LATE OLIGOCENE TO PLIOCENE SEA-LEVEL CYCLE EVENTS IN THE BALTIMORE CANYON TROUGH AND WESTERN NORTH ATLANTIC BASIN

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A dissertation submitted to the

Graduate School-New Brunswick

Rutgers, The State University of New Jersey

in partial fulfillment of the requirements

for the degree of

Doctor of Philosophy

Graduate Program in Geological Sciences

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October 1985

ABSTRACT OF THE THESIS

Late Oligocene to Pliocene Sea-Level Cycle Events in the Baltimore Canyon Trough and Western North Atlantic Basin

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Biostratigraphic and lithostratigraphic analyses of seven wells in the Baltimore Canyon Trough off New Jersey and two DSDP sites in the Western North Atlantic Basin are used to construct a record of late Oligocene to Pliocene sea-level cycle events and to determine the relationship between these events and $\delta^{18}O$ inferred paleotemperature changes.

Upper Oligocene to lower Miocene marine sediments in the Baltimore Canyon Trough off New Jersey are overlain by a middle(?) Miocene to upper Pliocene deltaic complex. Deltaic deposition did not commence prior to the late early Miocene and ceased by the late Pliocene in the region of the present-day continental shelf. By the late Miocene, possibly by the middle Miocene, deltaic deposition extended to the region of the present-day middle continental slope.

A late Oligocene decrease in paleobathymetry in the Baltimore Canyon Trough may correspond to a glacial ice-volume inferred $\delta^{18}O$ increase in planktic and benthic foraminifera at DSDP Site 563. An early Miocene rise of sea-level in the Baltimore Canyon Trough is correlated with a decrease in foraminiferal $\delta^{18}O$ values at Site 563.

A sea-level fall follows this event in the Baltimore Canyon Trough during the late early Miocene. A hiatus corresponding to this interval is present at Site 563. A decrease in $\delta^{18}O$ values at Site 563 in the upper middle Miocene suggests a decrease in glacial ice-volume. A corresponding marine incursion in the upper middle Miocene interrupted deltaic deposition in the distal parts of the Baltimore Canyon Trough.

A gradual change in the benthic foraminiferal assemblage at Site 563 begins prior to, and continues after, a major increase in benthic $\delta^{18}O$ values in the early middle Miocene and, thus, does not appear to have been initiated by the shift.

Increases in the abundance of the mid-latitude planktic foraminifer Globorotalia miozea at Site 563 are inversely correlated with changes in surface water paleo-temperatures inferred from $\delta^{18}O$ data.

ACKNOWLEDGMENTS

I am deeply grateful to Dr. Richard K. Olsson for the guidance, support, and training he has given me during the course of my graduate studies. Thanks to Dr. Kenneth G. Miller and Dr. John J. Flynn who were kind enough to spend many hours discussing various aspects of this research with me. I appreciate the helpful comments and suggestions given by Dr. Gail M. Ashley and Dr. George R. McGhee. Thanks also to Dr. Mark Feigenson for his assistance.

I owe thanks to a number of people who have given their time to help in the preparation of the final manuscript. Among them are Cherlyn Skuba, Laura Brachfeld, Amy Von Schondorff, Ross Dimmick, Martha Hoffman, and especially Carol Vadnos. Dr. Robert Holtzer was kind enough to take the SEM micrographs.

I received samples from a number of sources and they are gratefully acknowledged. Dr. C. Wylie Poag and Dr. John Hathaway assisted in obtaining samples from the AMCOR wells from the United States Geological Survey. Dr. Jan Hardenbol of Exxon Production Research Company assisted in obtaining samples from the ASP wells from that organization. Samples from the C.O.S.T. B-3 well were provided by Shell Oil Company. The Deep Sea Drilling Project provided samples from Sites 334 and 563.

Very special thanks go to Leslie Fields for her support, understanding, and especially, her patience. My family has been a source of unwavering support and encouragement throughout my college career and for this I am very grateful.

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INTRODUCTION

A knowledge of the timing, magnitude, and causes of eustatic cycles is helpful in understanding the depositional history of basins and in making correlations within and between them. Vail and others (1977) constructed a coastal onlap-offlap curve for the Cenozoic based on sequences which were identified on seismic reflection sections. Biostratigraphic data from wells were integrated into the seismic sections in order to place a geologic age on each sequence. Subsequently, Vail and Hardenbol (1979) and Vail and others (1980) revised the seismic sequence curve and correlated it with a curve of eustatic changes in the Tertiary. They identified three Pliocene sequences, eight Miocene sequences, and a latest Oligocene sequence in the upper part of the Tertiary. Most of the data used in constructing the curves have not been published because it is held as proprietary data. Hence, the validity of the curve has not been tested rigorously.

The coastal plain of New Jersey and Maryland and the offshore Baltimore Canyon Trough are ideally suited for study of stratigraphic sequences and sea-level changes because of their location on a mature passive continental margin where tectonic effects are generally small. Studies in the coastal plain by Melillo and Olsson (1981), Melillo (1982), Bam (1982), Olsson and others (1983) and Schreiber (1984) have produced a record of Miocene-Pliocene sea-level cycles and their contained benthic foraminiferal biofacies. Poag (1978, 1979), Hathaway and others (1979), Abbott (1978), and Olsson and others (1980) conducted studies of the biostratigraphy and paleoecology of late Oligocene to Pliocene units in the continental shelf off New Jersey using data from AMCOR (Atlantic Margin Coring Project) and other wells. Studies of late Oligocene to Pliocene units off New Jersey on the continental slope include a generalized discussion of the biostratigraphy and paleoecology of the ASP (Atlantic Slope Project) 14 and 15 wells (Poag, 1978, 1979) and more detailed studies of the COST (Continental Offshore Stratigraphic Test) B-3 well (Poag, 1980; Valentine, 1980). Miller and others (1985A) examine the distribution of Oligocene hiatuses in the New Jersey margin with respect to the deep-sea benthic foraminiferal $\delta^{18}O$ record. Based upon theoretical considerations Tucholke (1981) suggested that there is no direct relationship between eustatically-controlled margin hiatuses and oceanographically-controlled deep-sea hiatuses.

The deep-sea manifestation of sea-level cycles identified in continental margins is not well established. Studies by Barron and Keller (1982) and Keller and Barron (1983) support a very close relationship between eustatic falls identified by Vail and others (1977, 1979, 1980) and deep-sea hiatuses, whereas the work of Moore and others (1978) does not. In this study, the distribution of deep-sea hiatuses at DSDP Sites 334 and 563 is compared with the record of stratigraphic sequences in the Baltimore Canyon Trough and coastal plain of New Jersey and Maryland in order to determine the nature of this relationship in the late Oligocene to Pliocene of the Western North Atlantic.

Although other mechanisms have been proposed as initiators of eustatic changes (Pitman, 1978; Cloetingh and Wortel, 1985; and others), Pitman (1978) believes that only changes in glacial ice-volume can explain the rapid fluctuations in Neogene sea levels observed in the stratigraphic record. In this study, the planktic and benthic foraminiferal $\delta^{18}O$ curves and abundances of Globorotalia miozea and other selected planktic foraminifera at Site 563 are used to establish a record of late Oligocene-Miocene paleotemperatures and glacial ice-volume changes which can be compared with the sea-level cycles identified in the Western North Atlantic Margin.

This is the first study to examine the manifestation of late Oligocene to Pliocene sea-level cycles from a basin margin setting to a deep-sea setting. The study has four goals: 1) to use lithologic and planktic and benthic foraminiferal data to determine the late Oligocene to Pliocene sea level history of the Maryland-New Jersey coastal plain, the Baltimore Canyon Trough, and Western North Atlantic Basin; 2) to compare the distribution of deep-sea hiatuses at DSDP Sites 334 and 563 in the Western North Atlantic Basin with the sea-level history of the Western North Atlantic Margin; 3) to document the relationship between late Oligocene-Miocene sea-level cycles in the margin and the $\delta^{18}O$ paleotemperature record at DSDP Site 563; 4) to determine the usefulness of Globorotalia miozea as an indicator of surface-water paleotemperatures.

METHODS

Samples used in this study from the Baltimore Canyon Trough are from cores taken from three Atlantic Margin Coring Project (AMCOR) wells, three Atlantic Slope Project (ASP) wells, and cuttings from the Continental Offshore Stratigraphic Test (COST) B-3 well (Fig. 1). The AMCOR 6009B, 6010 and 6011 wells are located on the present day continental shelf. The ASP 13, 14, and 15 wells, and the COST B-3 well are located on the present day continental slope. Samples from the Western North Atlantic Basin are from Deep Sea Drilling Sites 334 and 563 (Fig. 2). Sample depths are given as depth below sea level, except for the DSDP sites where they are given as depth below the sediment surface. A listing of the samples examined from each well is given in Appendix 1.

Samples from the COST B-3 well, and, to a lesser extent, from Site 334, contain evidence of large amounts of caving of material from higher stratigraphic levels. For this reason, emphasis is placed on the first downwell occurrence of a species since this marks the highest stratigraphic position of the species. Only rarely were samples from the remaining cored wells contaminated with younger species. The contaminating species were usually Pleistocene species which were easily distinguished from the in-place fauna.

Absolute abundance counts were made and used in numerical analysis and diversity measurements. Relative abundance counts were made of planktic species at Sites 334 and 563.

Approximate grain-size distributions were determined by hand sieving of the samples and using the classification system

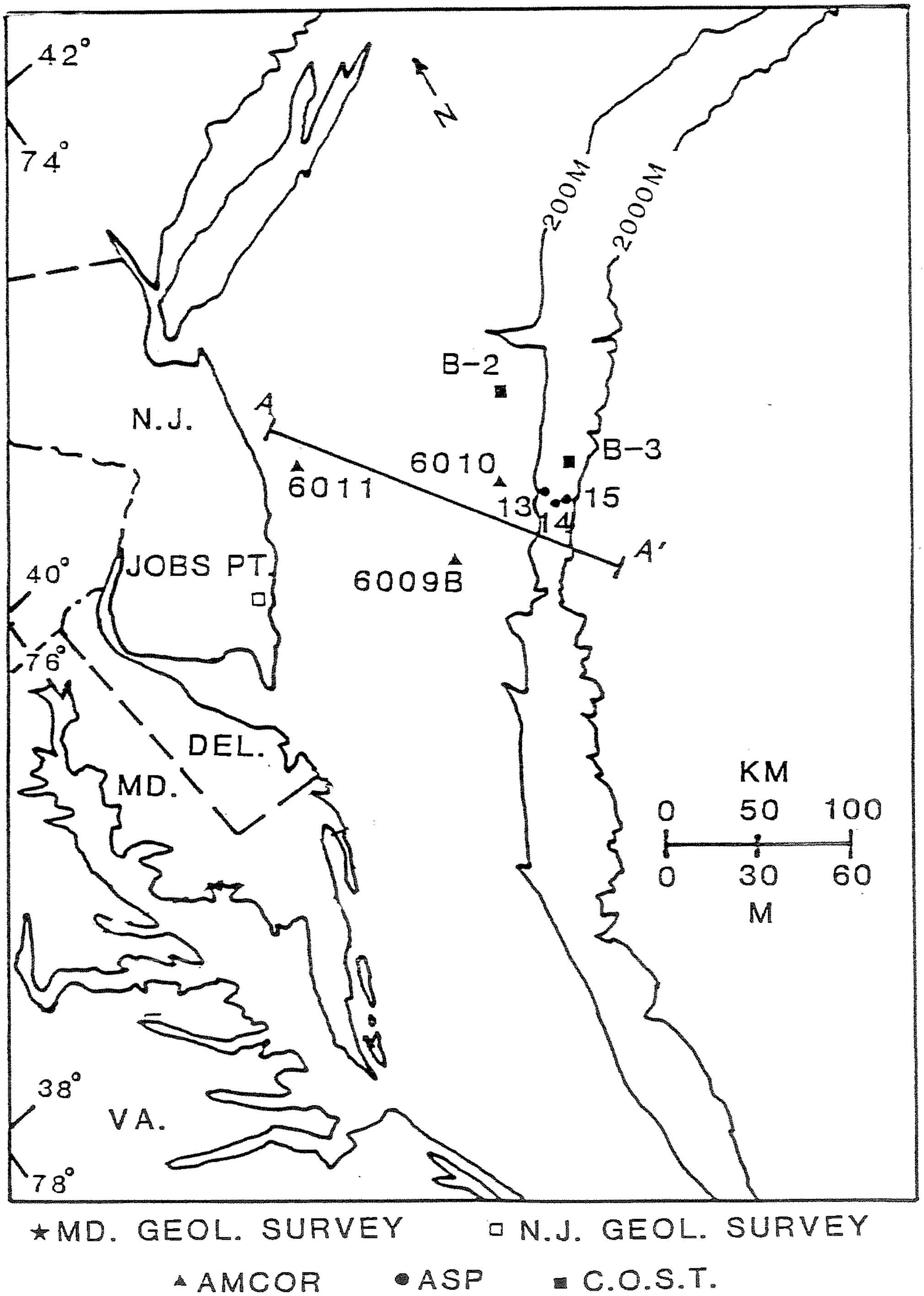


Figure 1 Location of wells in Baltimore Canyon Trough used in this study. Well data were projected onto dip-section A-A'.

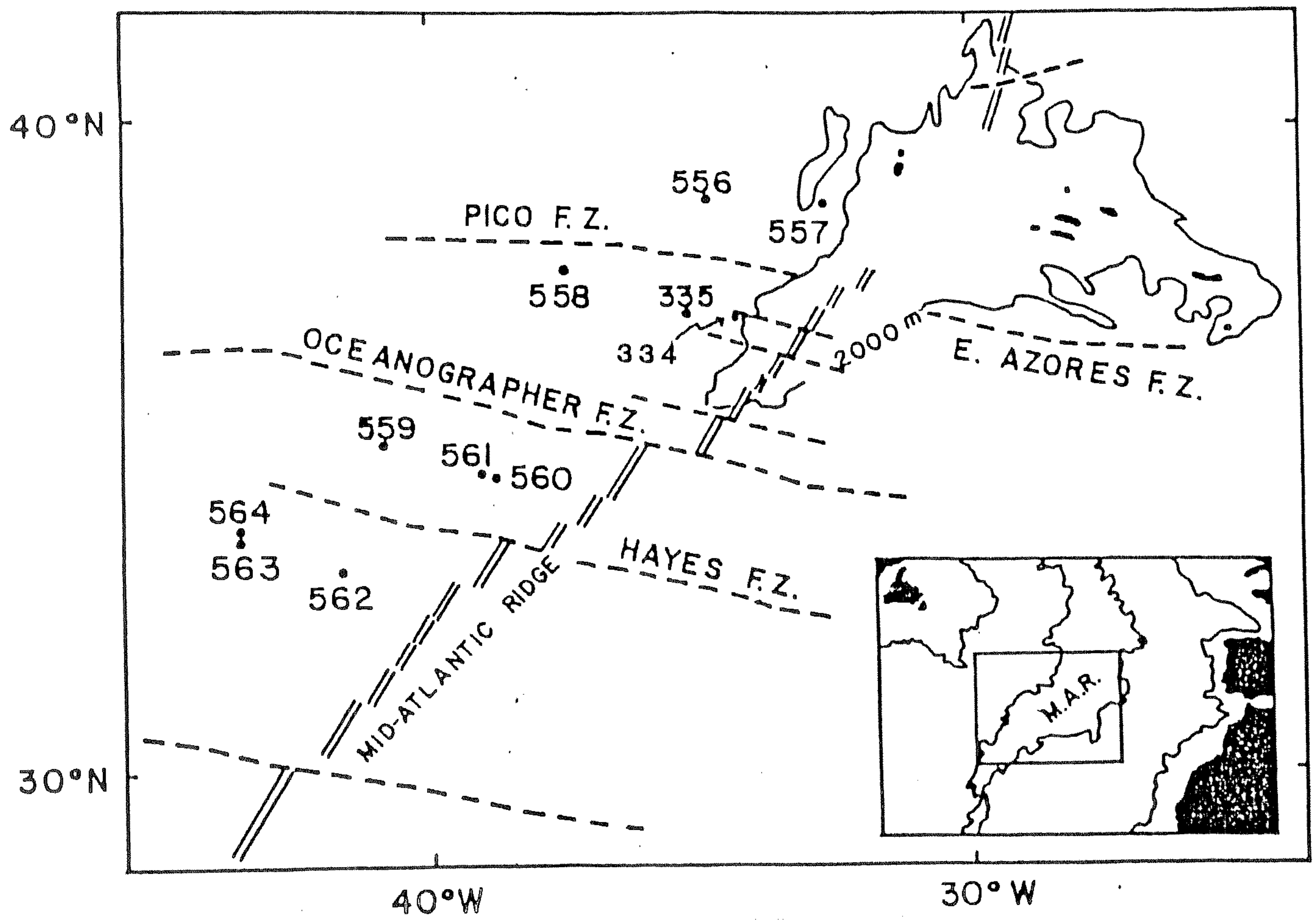


Figure 2 Location of DSDP Sites in the Western North Atlantic Basin used in this study.

of Folk (1974). Samples were wetted for color determinations which were made using the Munsell color chart. The percentage of foraminiferal test fragments in a sample was estimated using the percentage estimation charts of Terry and Chilingar (1955).

Gamma-ray, neutron porosity, electrical resistivity, and spontaneous potential logs were used with lithologic and faunal data to correlate units between the AMCOR, ASP and COST B-3 wells. The DSDP wells were correlated only on biostratigraphic data.

Specimens of Globoquadrina altispira altispira used in oxygen isotope analyses were picked from the greater than 63 micron size fraction. Analyses were performed at Lamont-Doherty Geological Observatory courtesy of K.G. Miller and R.G. Fairbanks.

Identification of benthic foraminiferal species was made using Cushman (1920-1931, parts 2-8), Cushman and Cahill (1933), Barker (1960), Murray (1971), Pflum (1971), Poag (1981), Tjalsma and Lohman (1983) and others. Identification of planktic foraminiferal species was made using Bolli (1957), Blow (1969), Jenkins (1971), Kennett (1973), Stainforth and others (1975), Kennett and Srinivasan (1983) and others. Important planktic and benthic species are illustrated by scanning electron micrographs.

STRUCTURAL SETTING

Baltimore Canyon Trough

The Baltimore Canyon Trough is one of five basins along the eastern continental margin of North America (Fig. 3) which formed during the opening of the North Alantic in middle Jurassic time (Grow and Sheridan, 1981). It extends from Virginia to New Jersey, where it attains its maximum width (100 km) and thickness.

Up to five kilometers of syn-rift and thirteen kilometers of post-rift deposits, mainly Mesozoic, are present off New Jersey (Grow and Sheridan, 1981; Schlee and Jansa, 1981). Neogene sediments consist of sands, silts, and clays (Libby-French, 1983). Miocene deposits account for most of this sequence (Poag, 1978). In contrast, less than two kilometers of sediments are present in the New Jersey coastal plain (Olsson, 1980). A westward extension is present beneath the coastal plain of New Jersey, Maryland, Delaware, and part of Virginia which forms the Salisbury Embayment (Fig. 4) (Olsson, 1980).

The main post-rifting tectonic process has been subsidence resulting from crustal cooling, sediment loading, and eustatic sea-level changes (Pitman, 1978; Watts and Steckler, 1981).

Western North Atlantic Basin

The Western North Atlantic Basin is a large bathymetric depression which has developed as a result of sea-floor spreading since the middle Jurassic (Gradstein and others, 1981). It is bounded to the east by the Mid-Atlantic Ridge, to the west by the coastal plain of eastern North America, by the Newfoundland Ridge to the

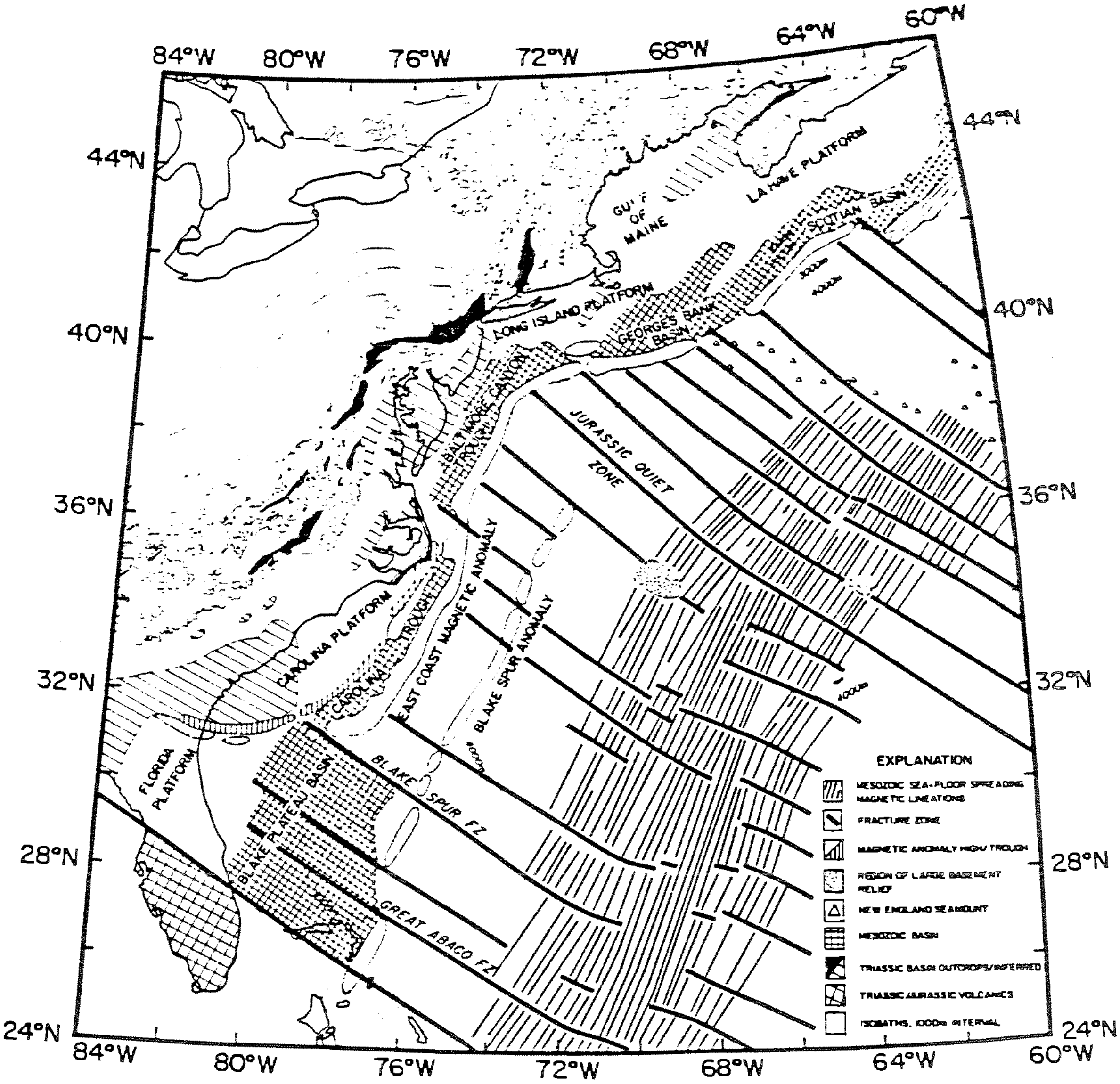
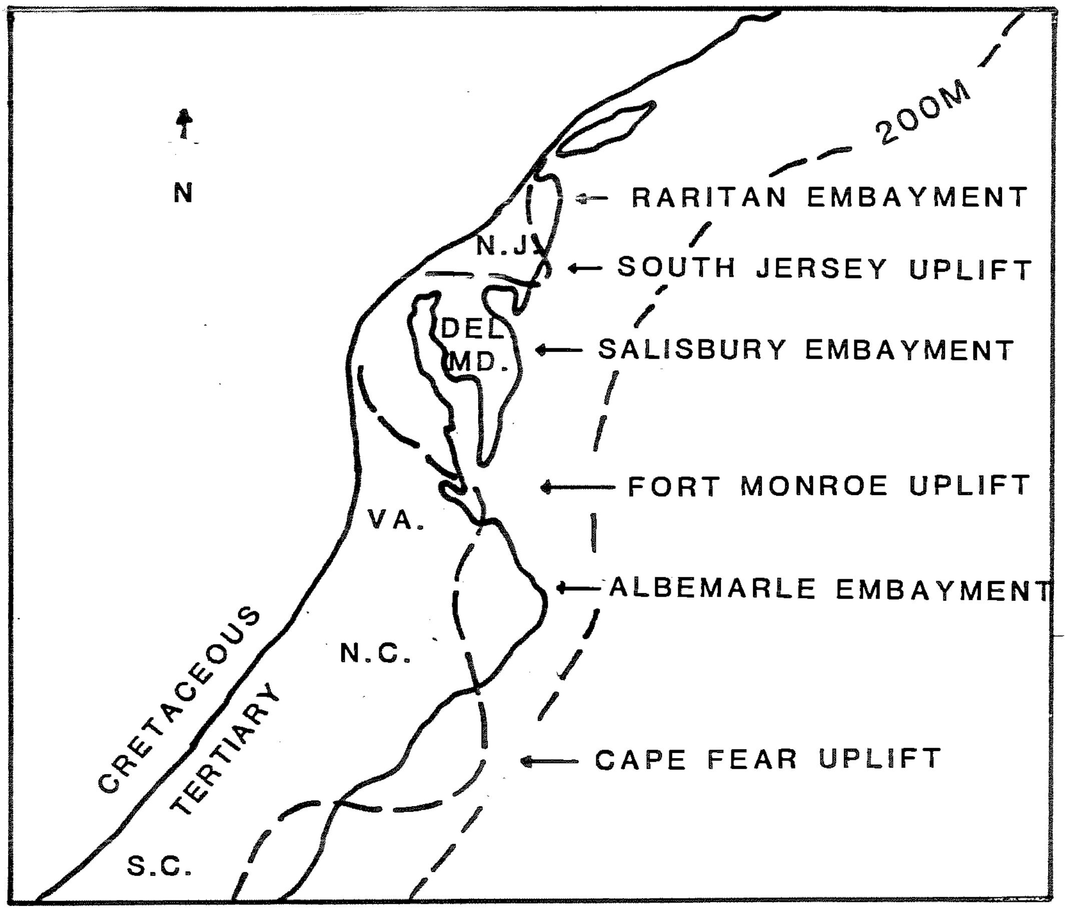


Figure 3 Major structural features of Eastern North America (from Grow and Sheridan, 1981).



(FROM OLSSON, 1978)

Figure 4 Location of South Jersey Uplift and Salisbury Embayment.

north, and by the Antilles and Barracuda Fracture Zone to the south (Jansa and others, 1980).

With the exception of the Mid-Atlantic Ridge and Puerto Rico Trench the basin is a tectonically stable region dominated by thermal subsidence of oceanic crust.

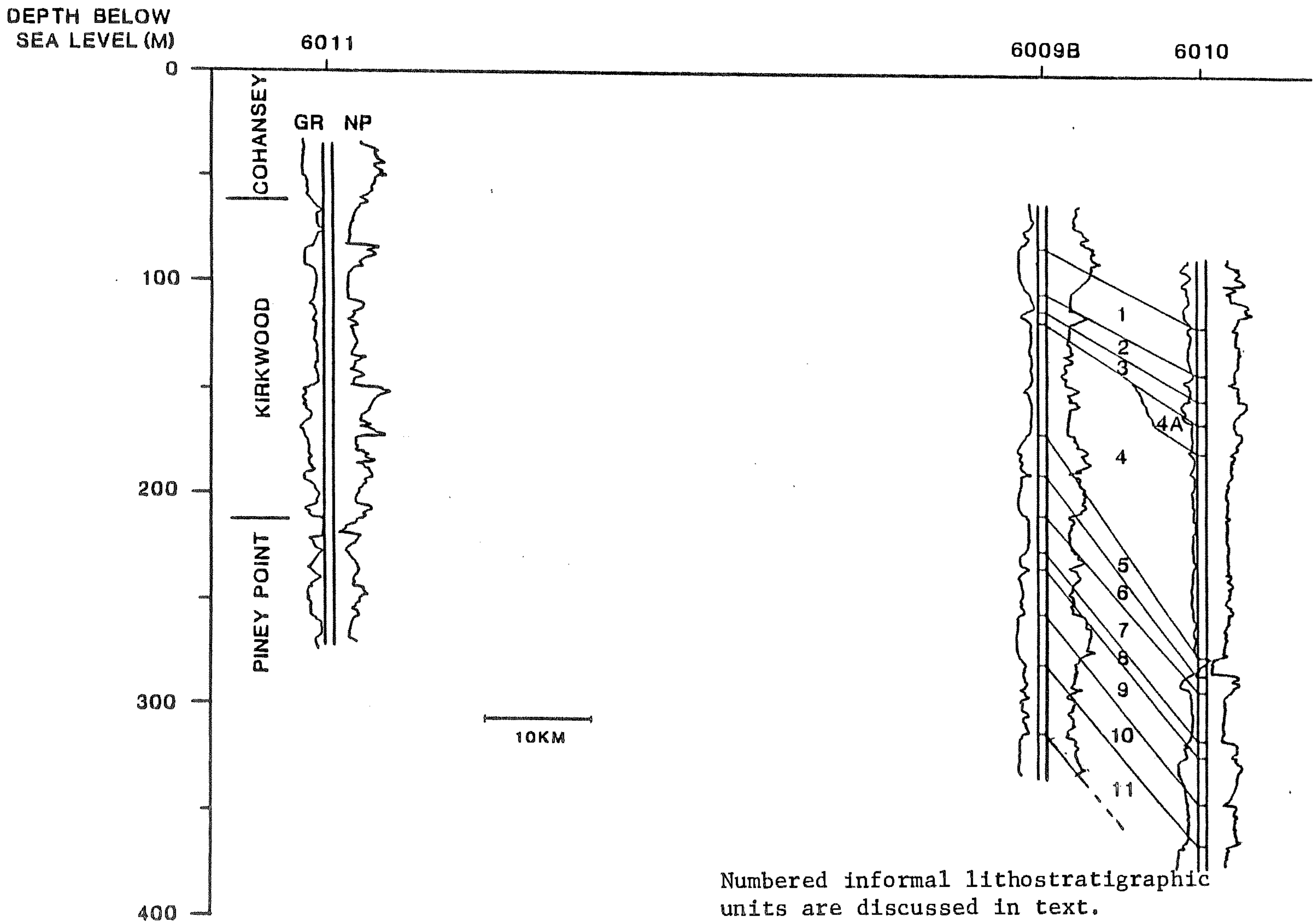
LITHOLOGIC AND PHYSICAL CHARACTERISTICS

Sedimentation in the Baltimore Canyon Trough off New Jersey was predominantly terrigenous during the Neogene. During much of the middle(?) Miocene through late Miocene-early Pliocene(?) deltaic conditions existed in the present-day continental shelf and upper continental slope areas, reaching a maximum thickness of approximately 1km in the vicinity of the present day continental slope (Grow, 1980). A series of alternating silts, sands and occasional gravels characterize these deposits. Prior to the development of the delta, sedimentation in the New Jersey coastal plain and nearshore region consisted mainly of sands and deep-water silts containing common siliceous microfossils while glauconitic, slightly sandy, silts containing abundant siliceous microfossils were deposited in the area of the present-day continental slope. Following the cessation of deltaic conditions, alternating marine silts, sands, and, in the Pleistocene, gravels were deposited on the continental shelf while mainly silts were deposited on the continental slope.

Upper Oligocene to lower Pliocene sediments of the Western North Atlantic Basin are nannofossil-foraminiferal oozes which display varying amounts of carbonate dissolution.

The AMCOR 6011 well (Figs. 1,5) is the only well in this study where formations of the coastal plain of New Jersey can be recognized. Three formations occur, the Piney Point, Kirkwood and Cohansey. The Piney Point Formation is a subsurface unit in New Jersey (Richards, 1967; Nemickas and Carswell, 1971; Olsson and

Figure 5. GAMMA RAY AND NEUTRON POROSITY LOGS - AMCOR WELLS



Numbered informal lithostratigraphic units are discussed in text.

others, 1980). The base of the Piney Point was not reached in the AMCOR 6011 well (Olsson and others, 1980). Sediments of the upper portion of this formation in the 6011 well consist of clayey, glauconitic, coarse to medium sands. Glauconite is present as rounded, weathered detrital grains and unrounded grains. A decrease in grain size occurs in the uppermost portions of the Piney Point. A clayey, slightly glauconitic, fine sand, which corresponds to a sharp increase in the gamma-ray log is present at the top of the unit (Fig. 5).

The overlying Kirkwood Formation is distinguished from the Piney Point by a lack of glauconite (Olsson and others, 1980). Basal sediments of the Kirkwood consist of brown silts and clays with abundant gypsum. Above this is a coarsening upward sequence of sands (Fig. 5). Diatomaceous clays and silts are present above and, in turn, are overlain by sand (Fig. 5). Abruptly above the sand is a series of silts and clays capped by a sand which marks the top of the Kirkwood (Fig. 5). The overlying Cohansey Formation is distinguished by a marked increase in quartz grain size (Isphording and Lodding, 1969).

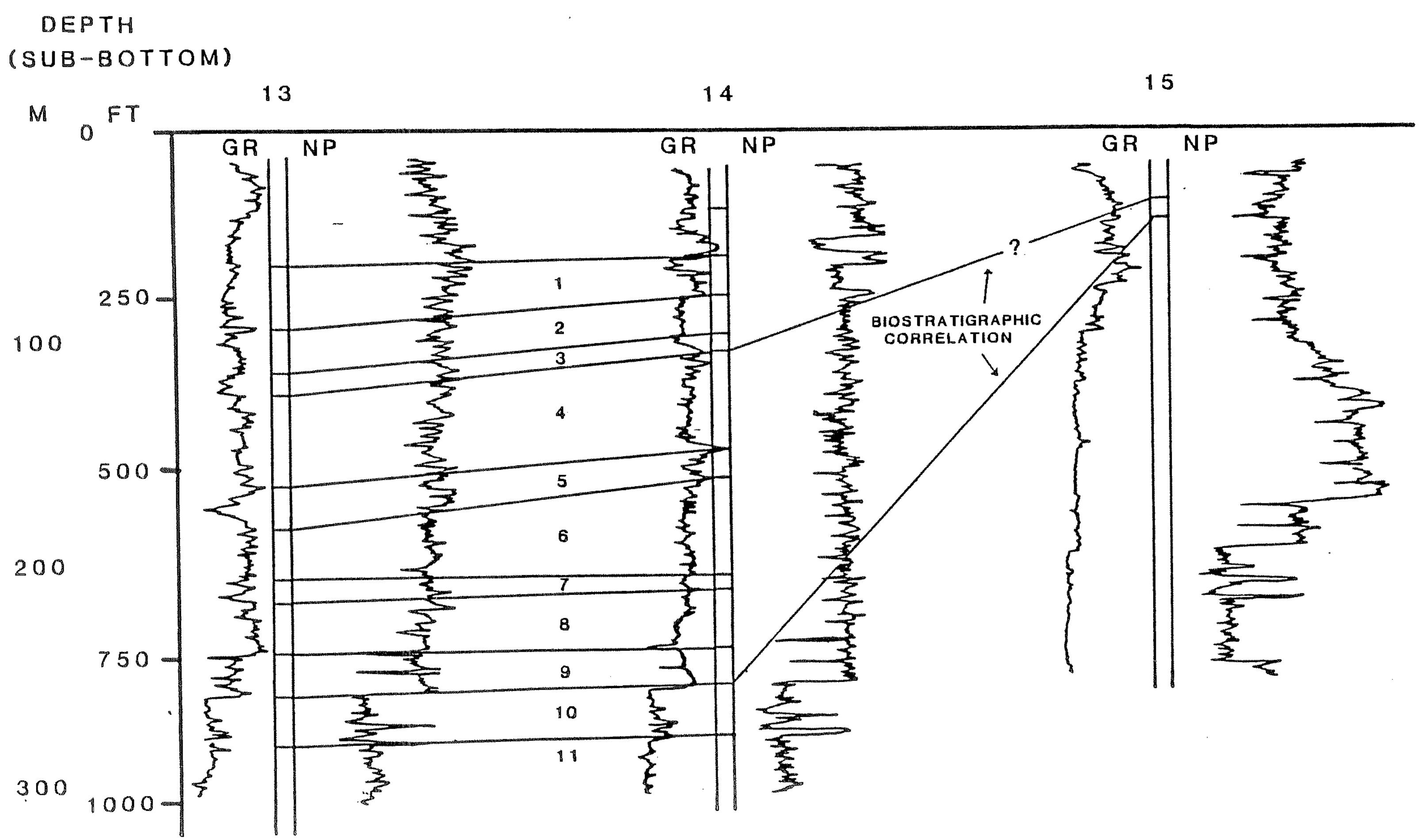
Gamma-ray and neutron porosity logs are most useful in correlating between wells in the Baltimore Canyon Trough. Correlations are made between the AMCOR 6009B and 6010 wells and between the ASP 13, 14 and the B-3 wells on the basis of well-log signatures, lithologic, and biostratigraphic data (Fig. 6). Correlation with the AMCOR 6011 and ASP 15 wells is accomplished using biostratigraphic data.

Lithostratigraphic units present in the New Jersey coastal plain and adjacent offshore region cannot be recognized in the AMCOR 6009B and 6010 wells (Fig. 1). Eleven informal lithostratigraphic units are identified in this study in these wells (Fig. 5). The AMCOR 6010 is less sandy. Units 6 through 11 are characterized by alternating olive-gray to dark olive-gray sands and silts. Glauconite is abundant at the base of Unit 9 in the 6010 well. Gypsum is common in Unit 7 in the 6009B well. Unit 5 in the 6009B well is a gray sandy silt which grades upward into a gray clayey silt with fine gravel. The same apparent stratigraphic level in the 6010 well contains silty sands with abundant gypsum and glauconite. The overlying sediments of Unit 4 are dark gray, micaceous, iron-stained, silts and occasional sands. Siliceous microfossils are absent from this unit and all sediments examined in these wells. A dark green, silty, medium grained sand which is identified as Unit 4A is present above this unit in the 6010 well.

Unit 3 is composed of a series of dark olive-gray, micaceous, silty fine sands with rare to common shell fragments. These grade into dark gray silts, clays and occasional sands of Units 2 and 1 (Fig. 5).

In the ASP 13 well the dominant lithology is an olive-gray, micaceous, sandy silt. A region of reduced gamma-ray and neutron porosity values is present from 997.0m to 935.7m which appears to correspond to a relatively low mica content (Fig. 6). In the remainder of the section above this interval gamma-ray and neutron porosity values are generally higher and appear to correspond to an increased mica content (Fig. 6). Occasional sands and sandy silts are present throughout the section. Small quantities of glauconite also are occasionally

Figure 6. GAMMA-RAY AND NEUTRON POROSITY LOGS - ASP WELLS



present, especially in the lower portions of the section. Very small amounts of gypsum are present in a few samples. Most silts have a reddish iron stain. Diatoms are present from approximately 905.3m and below. Plant fragments are common to absent.

Dark-green, highly glauconitic, sandy silts with abundant diatoms, radiolarians, and foraminifera are present in the lower portions of the ASP 14 well from 1475.8m to 1470.2m. The presence of reworked Eocene planktic foraminifera at 1470.9m indicates a probable sediment gravity flow origin. Diagenetic gypsum in association with dolomite is common here and rare at 1471.6m. Glauconite content is generally approximately 20%, but increases to 50% at 1470.2m. Dark-green, glauconitic, slightly sandy, silts are present from 1448.9m to 1446.8m. Glauconite is present as rounded, weathered detrital grains and unrounded grains. Most silt is iron-stained. Diatoms are common, radiolarians are rare and foraminifera are absent. A series of dark olive-gray, micaceous, sandy silts and clays and sands is present from 1426.5m to 1228.3m. Gypsum and glauconite are common in places. Diatoms are generally very abundant, radiolarians are rare and foraminifera are absent. Plant fragments are common. A similar, less micaceous, lithology is present from 1228.3m to 1212.2m. Gypsum is present in the uppermost portion of this interval. A dark olive-gray clay is present at the top of the sequence from 1212.2m to 1188.2m.

The lowermost sample examined in the ASP 15 well is from 1553.6m and consists of a pale yellow-brown, slightly marly, glauconitic clay with abundant radiolarians. From 1532.2m to

1514.6m a green-gray to olive-gray, highly glauconitic, sandy silt and clay is present. Radiolarians are very abundant. Above this, an olive-gray, micaceous, silty clay is present from 1513.4m to 1507.9m. Rounded glauconite is present from 1510.0m to 1508.8m and at 1512.1m. Reddish iron staining is present in small amounts in some samples from 1515.4m to 1508.8m. Plant fragments are common to absent in that interval.

White nannofossil-foraminiferal oozes are present at Site 334. Dissolution ranges from eolytic (signs of initial dissolution) to oligolytic (signs of slight dissolution) according to the dissolution facies scheme of Hsu and Andrews (1970). The percentage of foraminiferal test fragments in each sample, an important measure of dissolution (Thunell, 1976) is given in Figure 7. Fragments of basalt and brown vesicular volcanic glass are occasionally present. At Site 563, white pelagic oozes are present from 157.0m to 241.20m. Dissolution is generally eolytic to mesolytic (signs of considerable dissolution). Below this, cream colored pelagic oozes are present from 242.05m to 304.54m. Dissolution is generally eolytic to oligolytic. The percentage of foraminiferal test fragments in each sample is given in Figure 8.

Figure 7. CARBONATE DISSOLUTION AT DSDP SITE 334

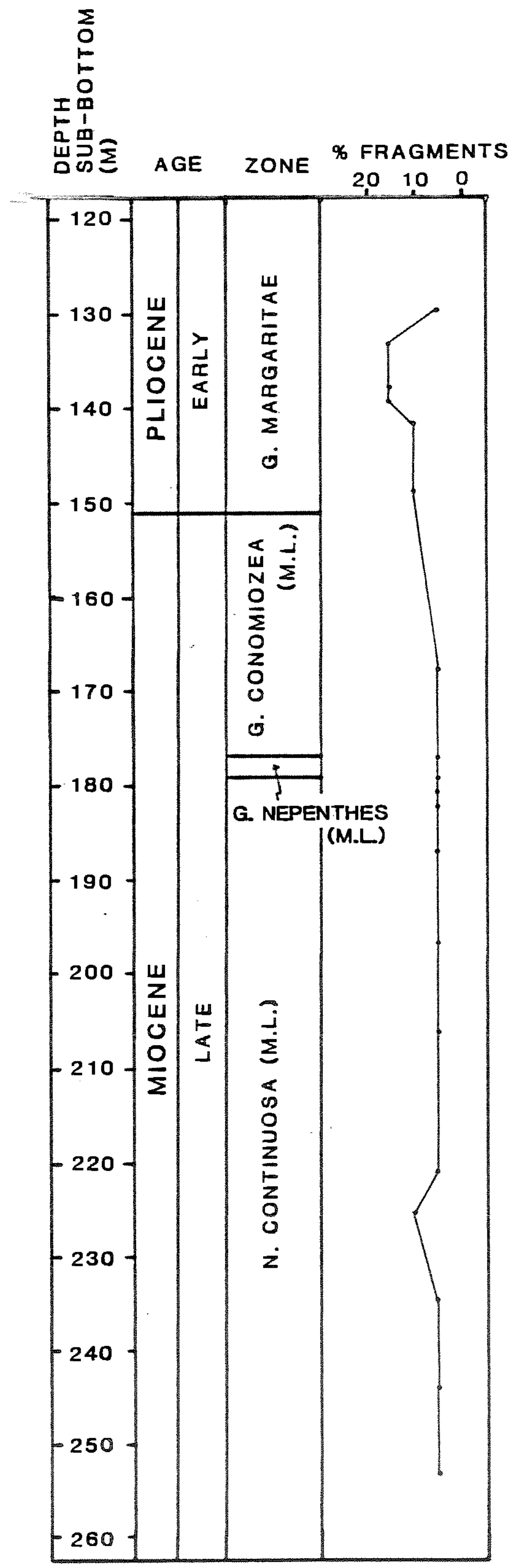
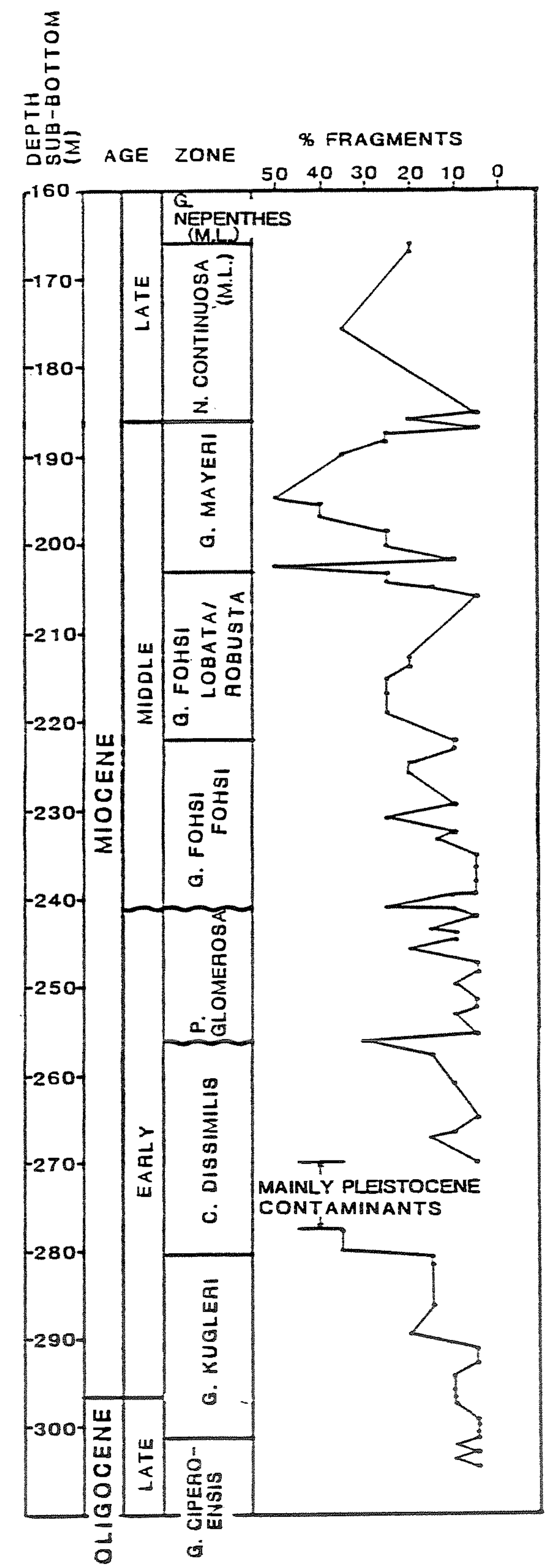


Figure 8

CARBONATE DISSOLUTION AT DSDP SITE 563



BIOSTRATIGRAPHY

The distribution of modern planktic foraminifera is greatly influenced by surface-water temperatures (Be and Tolderlund, 1971; Be, 1977). Five latitudinally-dependent planktic foraminiferal biogeographic provinces are recognized: Polar, Sub-Polar, Transitional, Sub-Tropical, (each of which is bipolar) and Tropical. A number of studies suggest that Neogene planktic foraminifera were similarly influenced by latitudinal changes in surface water temperatures (Jenkins, 1966A, 1966B, 1967; Kennett, 1973; Berggren, 1972; and others). Changes in global climate and circulation patterns resulted in the migration, or introduction by currents, of middle latitude species into low latitudes, and vice-versa. The study area is a region in which both middle and low latitude planktic foraminifera are present in the Miocene/Pliocene. As a result, the biostratigraphic zonation used during a given period must be indicative of the dominant faunal component present at that time. In this study, a middle latitude (m.l.) zonation is used during the late Pliocene and late Miocene (Fig. 9) (Kennett, 1973; Srinivasan and Kennett, 1981; Kennett and Srinivasan, 1983). A low latitude (l.l.) zonation is used during the middle Miocene and early Pliocene (Figs. 10,11) (Bolli, 1957; Bolli and Premoli-Silva, 1973; Stainforth and others, 1975). In the early Miocene a l.l. zonation is used for the Western North Atlantic Basin, while a m.l. zonation is used for the Baltimore Canyon Trough where upwelling currents appear to be responsible for the introduction of a largely cooler-water planktic foraminiferal assemblage. Planktic foraminiferal datums at DSDP Site

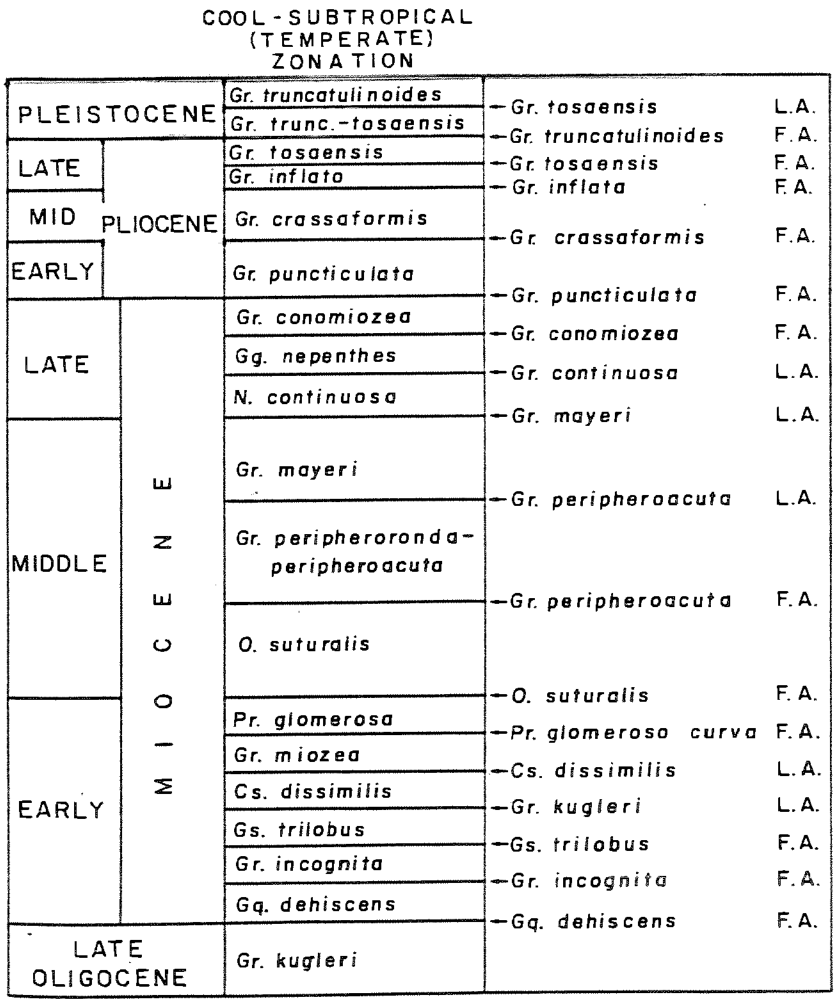


Figure 9 Temperate (m.l.) planktonic foraminiferal zonation of Kennett (1973) and Kennett and Srinivasan (1981). (From Kennett and Srinivasan, 1983)

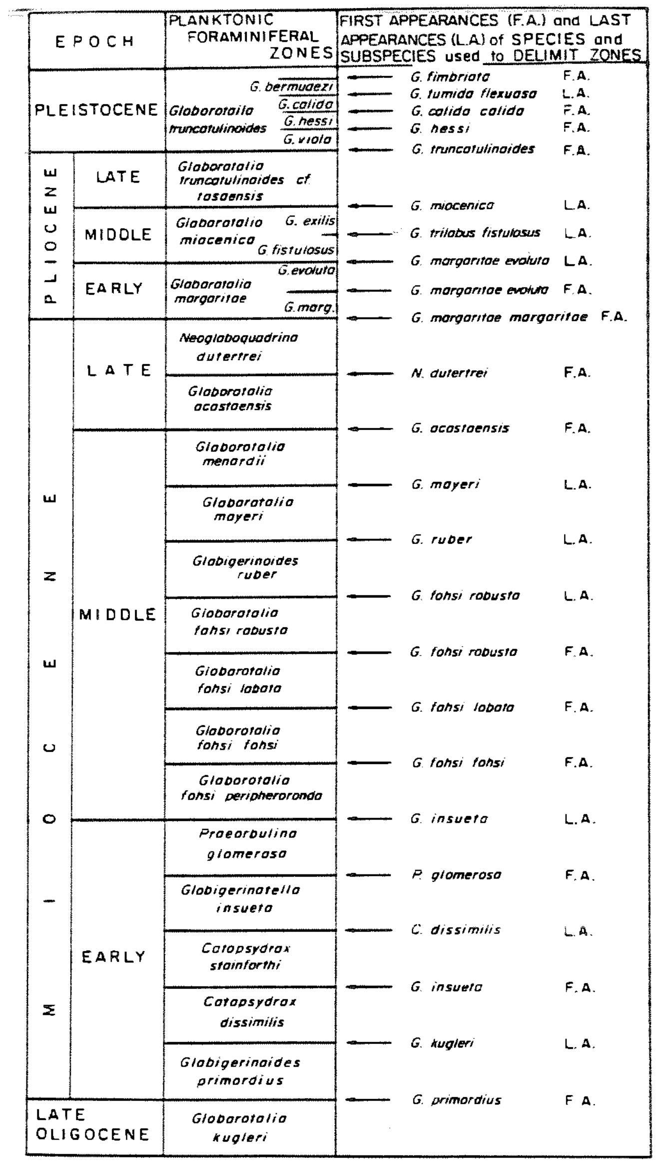


Figure 10 Tropical (1.1.) planktonic foraminiferal zonation of Bolli (1957) and Bolli and Premoli-Silva (1973). (From Kennett and Srinivasan, 1983)

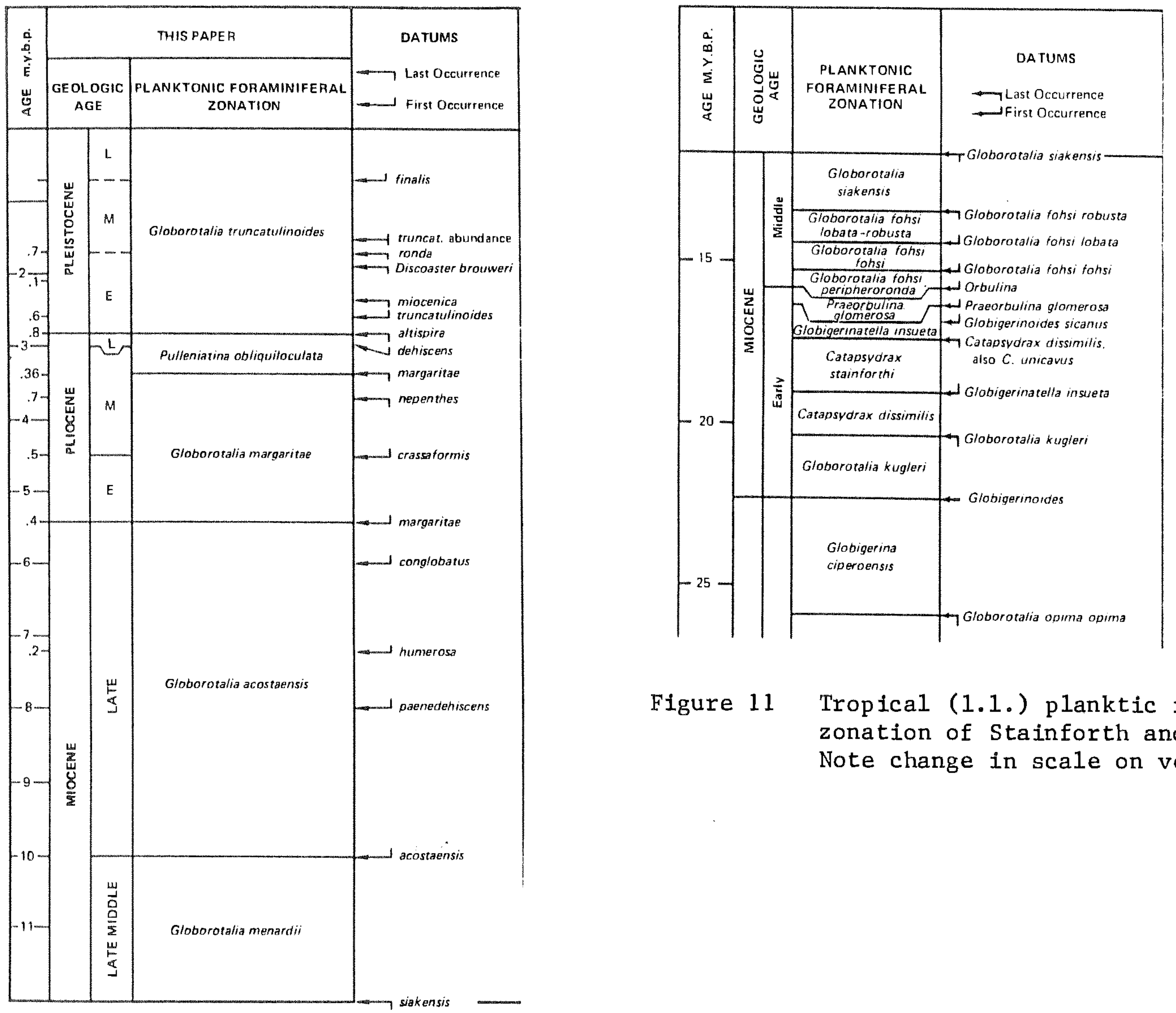


Figure 11 Tropical (1.1.) planktic foraminiferal zonation of Stainforth and others (1975). Note change in scale on vertical axis.

563 are correlated with the standard paleomagnetic time scale using the paleomagnetic stratigraphy of Miller and others (1985).

Baltimore Canyon Trough

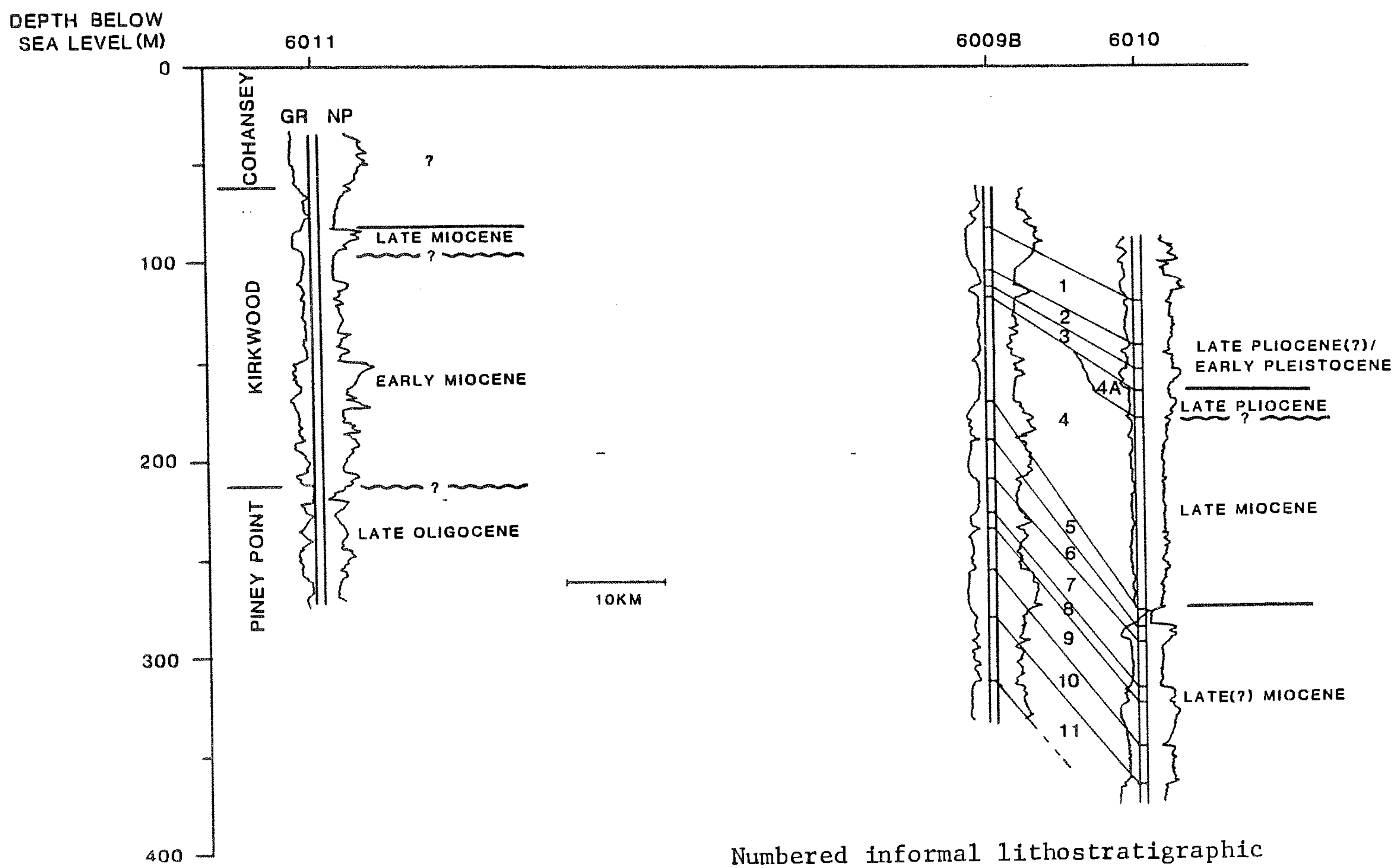
AMCOR 6011

Planktic foraminifera are absent from the Cohansey Formation and are very rare in the underlying Kirkwood Formation (Appendix 2). As a result, most age determinations are based on the biostratigraphy from the nearby Jobs Point well in the New Jersey coastal plain (Fig. 1) using data from Olsson and others (1980), Melillo and Olsson (1981), Palmer (1981), and Melillo (1982).

The late Miocene m.l. *Neogloboquadrina continuosa* Zone which is present in the Jobs Point well from 93.9m to 102.4m (Melillo and Olsson, 1982; Melillo, 1982) is correlated with the interval from 92.7 to 103.7m in the 6011 well (Fig. 12). Palmer (1981) assigns a lower Miocene radiolarian *Calocycletta costata* Zone (=l.l. *Globigerinatella insueta* Zone) in the 6011 well to the siliceous interval from 103.6m to 150.3m and in the Jobs Point well to the siliceous interval from 115.2m to 172.5m. The interval from 172.5m to 178.6m in the Jobs Point well which is contained within the early Miocene l.l. *Globigerinatella insueta* Zone (Olsson and others, 1980; Melillo, 1982) is correlated with the interval from 158.6m to 172.6m in the 6011 well (Fig. 12).

The base of the Kirkwood Formation is placed at 222.6m in the 6011 well immediately above the glauconitic sands of the Piney Point Formation (Fig. 12). Olsson and others (1980) assign a late Oligocene age (*Globigerina ciperoensis* Zone) to the upper portions of Piney Point Formation in the 6011 and Jobs Point well. The *G. opima*

Figure 12. BIOSTRATIGRAPHY AND LITHOSTRATIGRAPHY - AMCOR WELLS



Numbered informal lithostratigraphic units are discussed in text.

opima Zone is present from 244.5m to TD (282.3m) in the 6011 well (Olsson and others, 1980; Miller, pers. comm.). Specimens of *Chiloguembelina cubensis* (Palmer) present in the lower portions of this well are considered reworked and thus cannot be used to support the assignment of a Eocene age by Abbott (1978) and Hathaway and others (1979) to this interval (Fig. 13).

AMCOR 6009B

Members of the *Globorotalia tosaensis* Takayanagi and Saito-*Globorotalia truncatulinoides* (d'Orbigny) lineage are absent from the AMCOR wells, probably as a result of the relatively shallow paleobathymetry. Because the first evolutionary appearance of *G. truncatulinoides* is considered to mark the base of the Pleistocene it was not possible to firmly establish the position of the Pliocene/Pleistocene boundary in these wells.

Neogloboquadrina dutertrei (d'Orbigny) first occurs at 88.43m in a sparse fauna which includes *Globorotalia inflata* (d'Orbigny) and *Neogloboquadrina blowi* Rogl and Bolli (Fig. 14). According to Kennett (1973) the first appearance of *N. dutertrei* in middle latitudes occurs very near the first appearance of *Globorotalia truncatulinoides* whereas it occurs slightly before the first occurrence of *G. truncatulinoides* in low latitudes. The dominantly cooler-water, higher latitude, nature of the fauna suggests, but does not confirm, a Pleistocene age. At 93.2m the presence of *Globorotalia inflata* and *G. crassaformis* (Galloway and Wissler) suggests a late Pliocene age (m.l. *Globorotalia inflata* Zone to m.l. *Globorotalia tosaensis* Zone) (Figs. 12,14). Hathaway and others (1979) place the Pliocene/Pleistocene boundary at approximately 191.5m (Fig. 13).

Figure 13. PREVIOUS STUDIES OF AMCOR WELLS

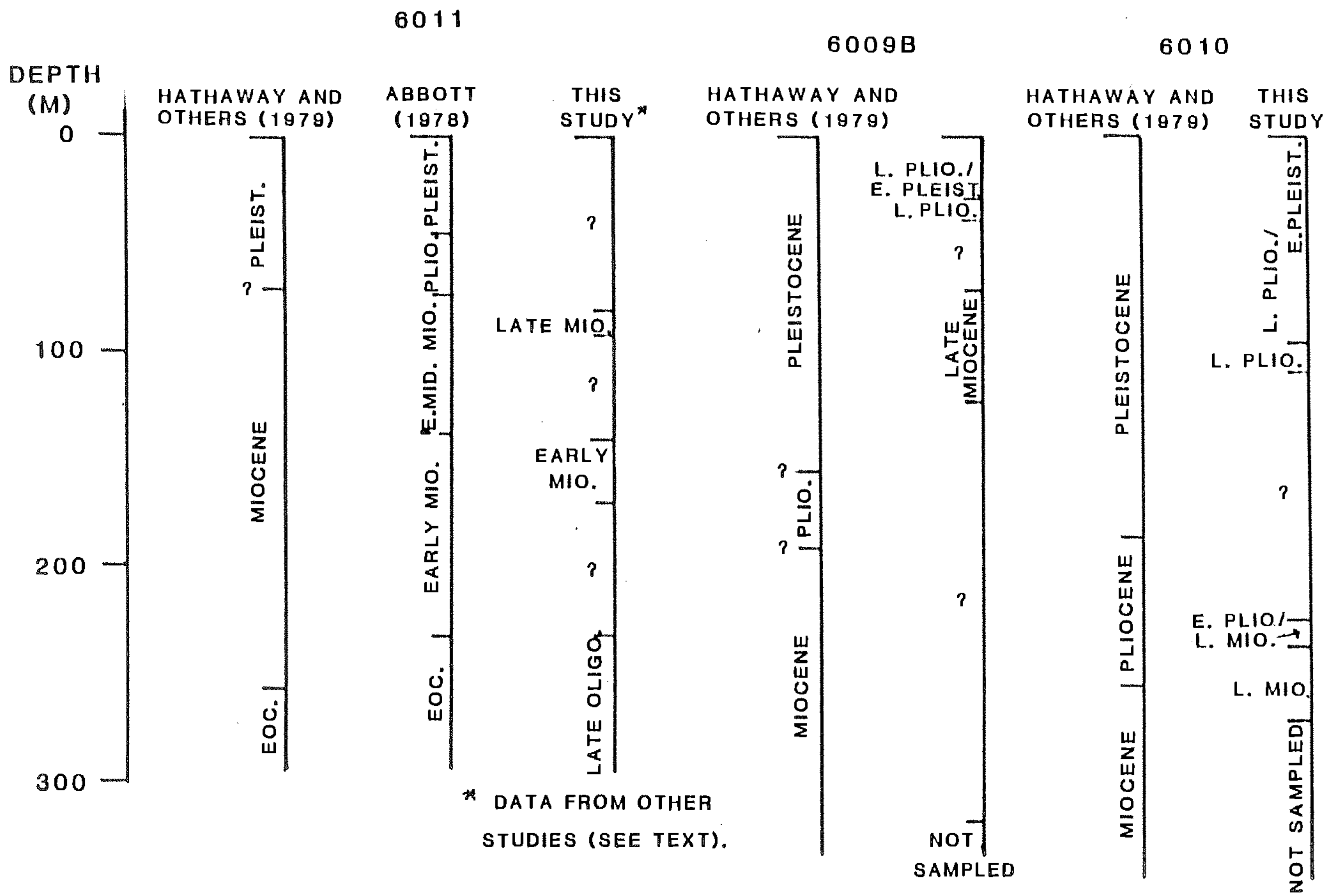
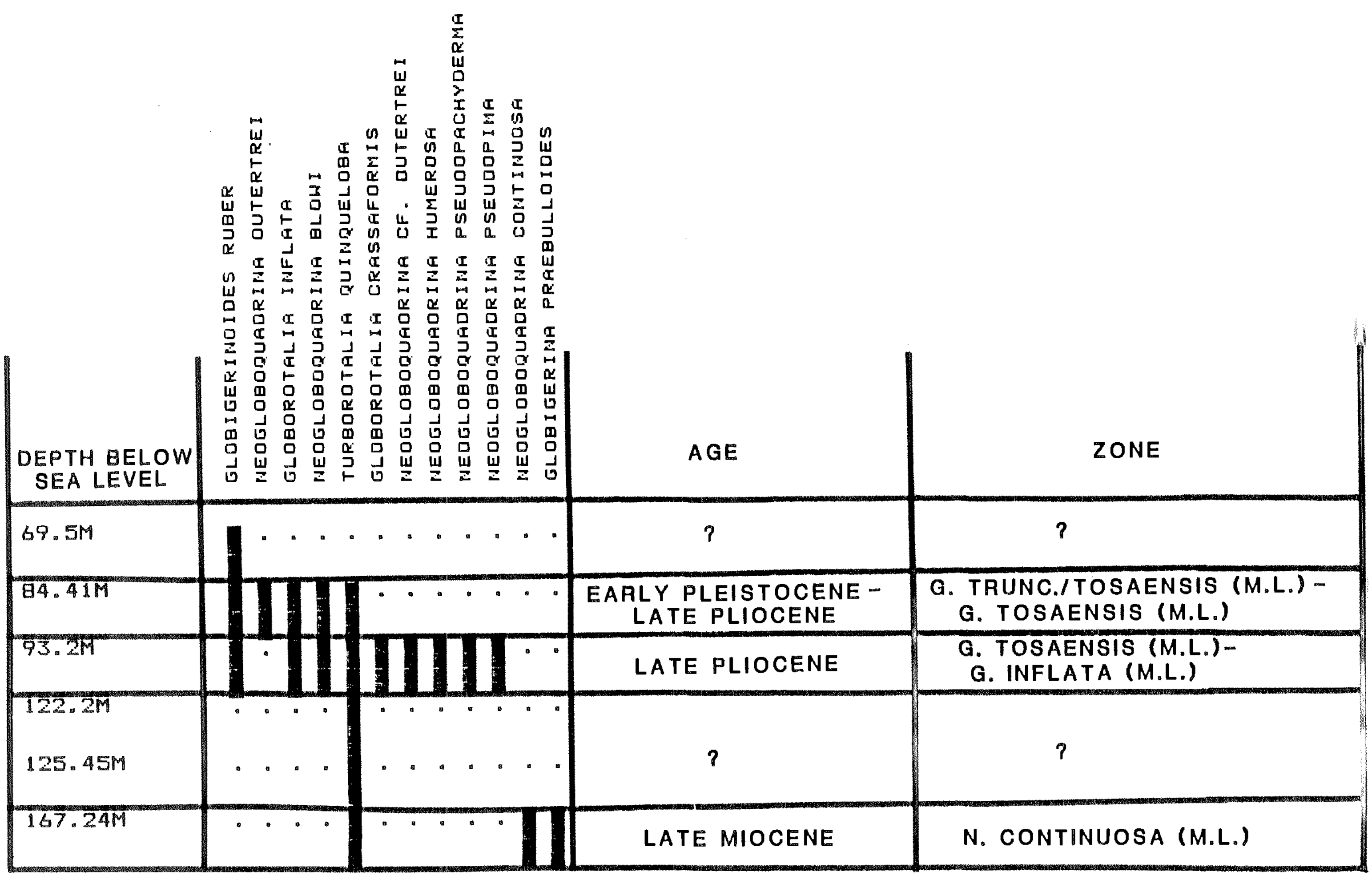


Figure 14 BIOSTRATIGRAPHY OF AMCOR 6009B WELL



The co-occurrence of N. continuosa (Blow) and Globigerina praebulloides Blow at 167.26m suggests the presence of the upper Miocene m.l. N. continuosa Zone (Figs. 12,14). Hathaway and others (1979) assigned the interval from approximately 191.5m to 222.5m a Pliocene(?) age (Fig. 13).

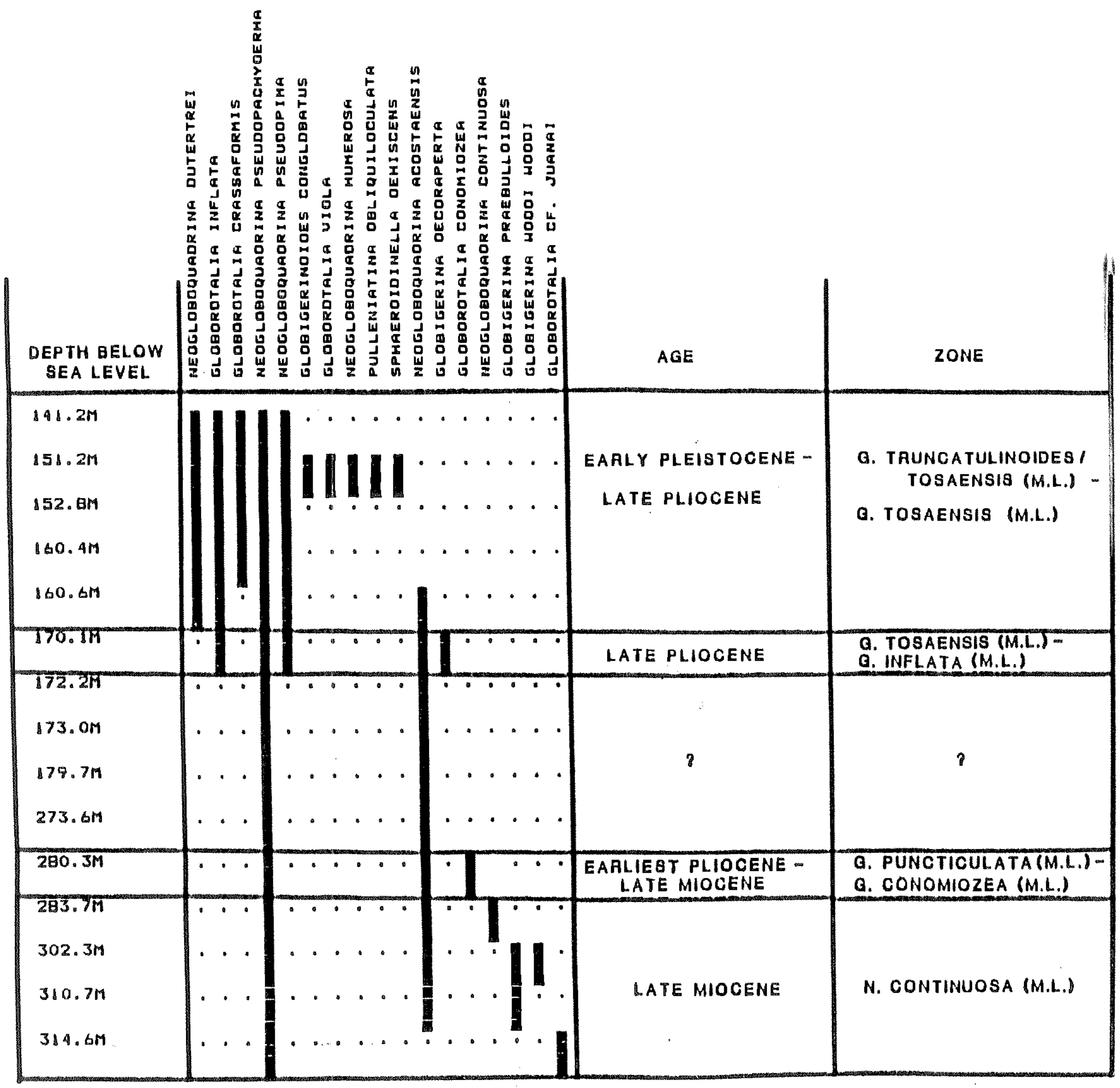
The presence of Ammonia beccarrii (Linnaeus) at 301.2m may be significant. Loeblich and Tappan (1964) give the range of Ammonia as Neogene, while Hardenbol (pers. comm.) believes that A. beccarrii is restricted to upper Miocene, or younger, deposits. Thus, it may be that this level is of late Miocene age (Figs. 12,14).

AMCOR 6010

Globorotalia inflata, G.menardii (Parker, Jones and Brady), Neogloboquadrina dutertrei, N. pseudopachyderma (Cita, Premoli-Silva, and Rossi), and N. acostaensis (Blow) are present in the interval from 141.2m to 160.6m (Fig. 15). The occurrence of N. pseudopachyderma indicates an age no younger than early Pleistocene (Saito and others, 1981) and the association of this species with N. dutertrei suggests the uppermost Pliocene m.l. Globorotalia tosaensis Zone to lower Pleistocene m.l. Globorotalia truncatulinoides-tosaensis Zone (Figs. 12,15).

The occurrence of G. inflata, G. crassaformis, Neogloboquadrina pseudopachyderma, and N. humerosa (Takayanagi and Saito) at 170.1m identifies the late Pliocene m.l. Globorotalia inflata Zone to Globorotalia tosaensis Zone (Figs. 12,15). Thus, the Pliocene/ Pleistocene boundary appears to lie between 160.6m and 170.1m (Figs. 12,15). Hathaway and others (1979) place the boundary at

Figure 15 BIOSTRATIGRAPHY OF AMCOR 6010 WELL



approximately 270.9m (Fig. 13).

The presence of Globorotalia conomiozea Kennett at 280.3m indicates a latest Miocene to earliest Pliocene age (m.l. Globorotalia conomiozea Zone to m.l. lower Globorotalia puncticulata Zone (Figs. 12,15). The occurrence of Neogloboquadrina acostaensis and N. pseudopachyderma at 314.6m identifies this level as late Miocene in age (m.l. Neogloboquadrina continuosa Zone) (Figs. 12,15).

ASP 13

The upper Miocene m.l. Neogloboquadrina continuosa Zone is identified from 867.5m to 966.8m (Figs. 16,17). Species which characterize this interval include N. continuosa, N. acostaensis, and N. pseudopachyderma. Rare specimens of Globoquadrina dehiscens (Chapman, Parr, and Collins) occur in the lower portions of this interval (Fig. 16).

ASP 14

At 1214.2m in the ASP 14 well a cooler-water fauna which includes Globorotalia truncatulinoides truncatulinoides, G. inflata, Neogloboquadrina dutertrei, right coiling N. pachyderma (Ehrenberg), and Globigerina bulloides d'Orbigny indicates a Pleistocene age (Figs. 17,18).

The late Miocene m.l. Neogloboquadrina continuosa Zone is present at 1305.4m (Fig. 17). Diagnostic species include N. continuosa, N. acostaensis, and N. pseudopachyderma (Fig. 18).

Middle Miocene sediments are present from 1345.8m to 1470.2m and lower Miocene sediments from 1471.6m to 1475.8m (Figs. 17,18). Globorotalia mayeri Cushman and Ellisor first occurs at 1345.8m and in the interval from 1419.1m to 1420.2m the zonal species Globorotalia

Figure 16

BIOSTRATIGRAPHY OF ASP 13 WELL

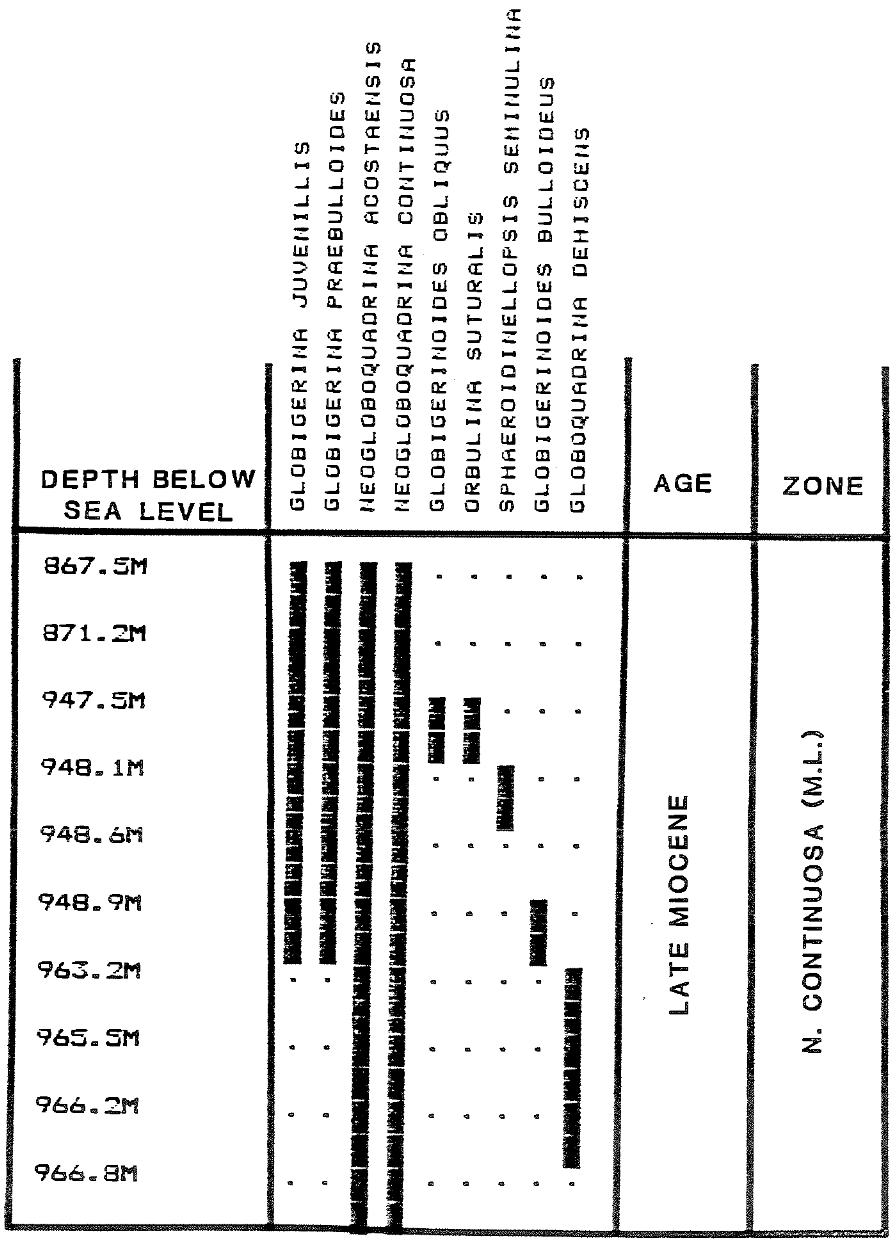


Figure 17. BIOSTRATIGRAPHY AND LITHOSTRATIGRAPHY - ASP WELLS

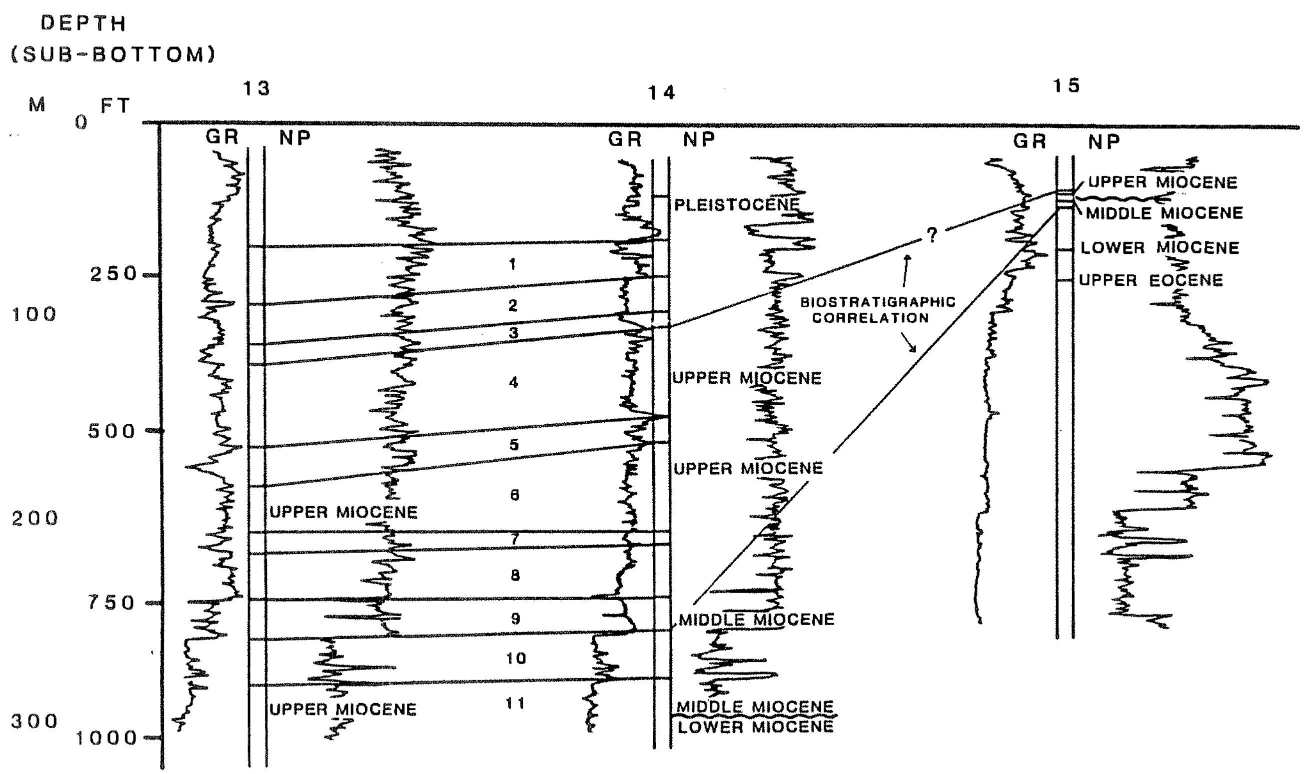
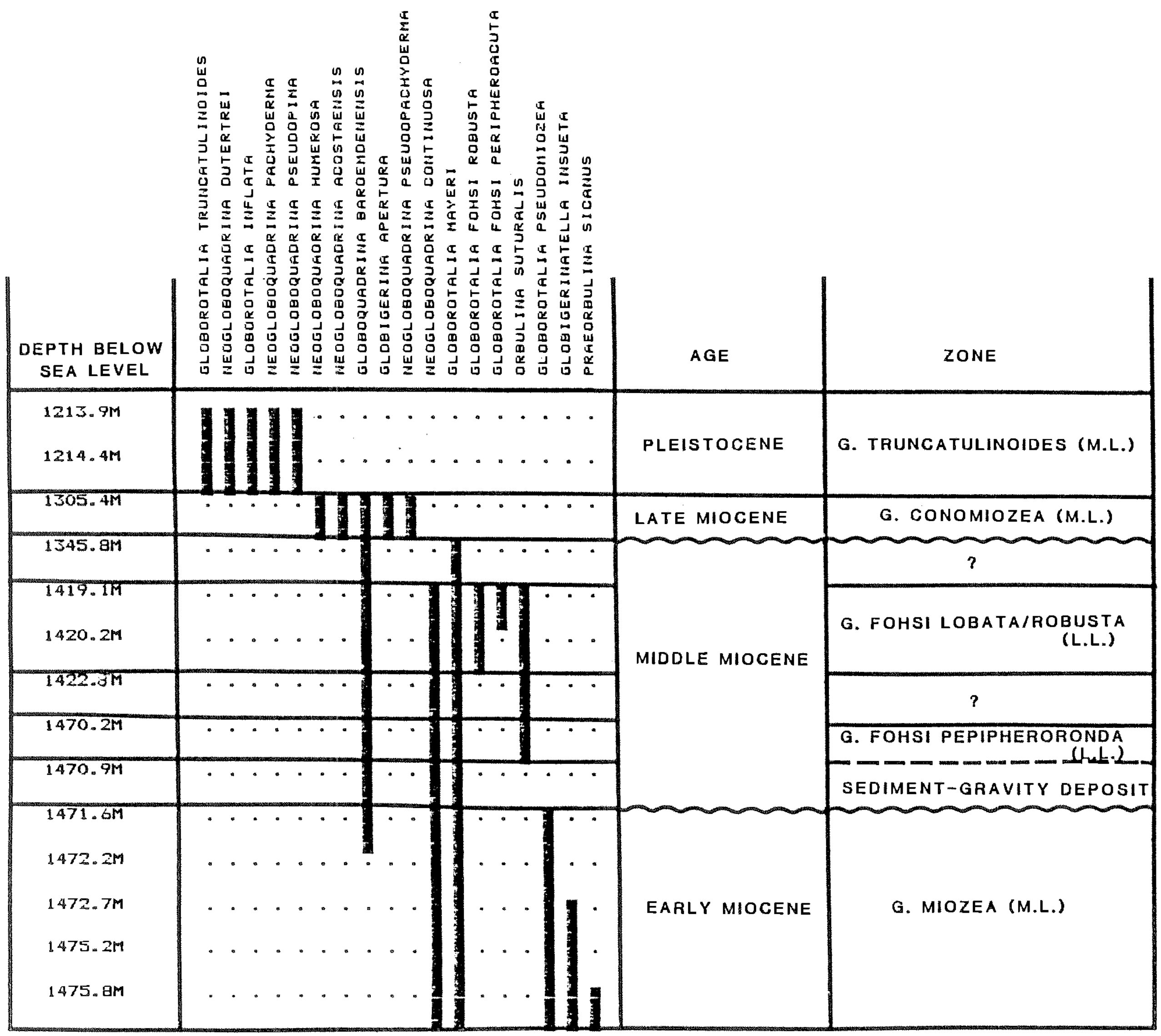


Figure 18. BIOSTRATIGRAPHY OF ASP 14 WELL



fohsi robusta Bolli is present (Figs. 17,18). A very sparse planktic foraminiferal assemblage is present at 1422.8m which is assigned a middle Miocene age based on superposition.

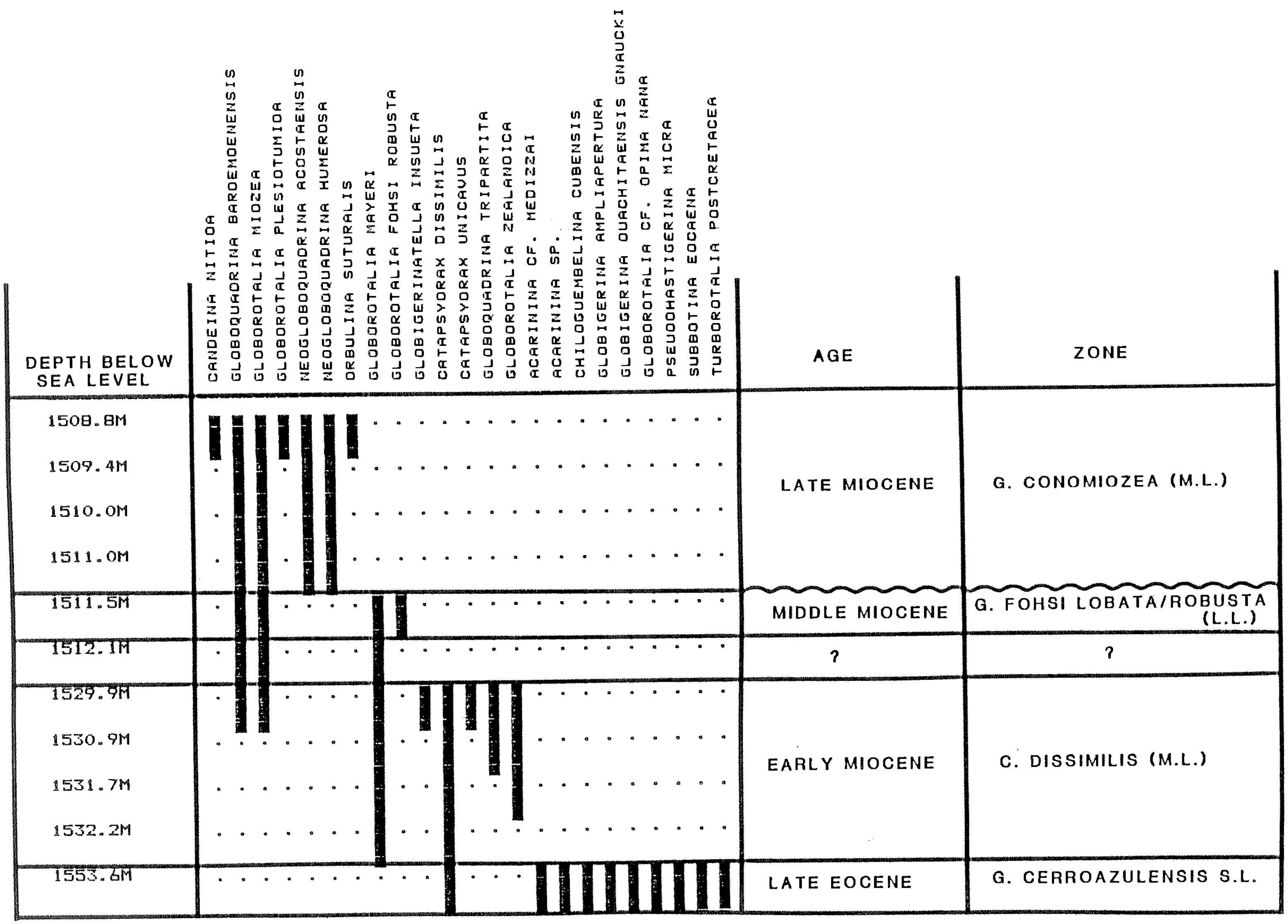
The FO of Orbulina at 1470.2m corroborates both the middle Miocene m.l. Orbulina suturalis Zone and the middle Miocene l.l. Globorotalia fohsi peripheroronda Zone (Figs. 17,18). As stated in the Lithology and Physical Characteristics section, the sample from 1470.9m appears to be part of a sediment-gravity flow deposit. If so, this suggests an lower-middle Miocene unconformity. The interval from 1471.6m to 1475.8m contains Globorotalia miozea Finlay, G. pseudomiozea Walters, Globigerinatella insueta Cushman and Stainforth, and Globigerinoides sicanus De Stefani without Praeorbulina glomerosa Blow, thus identifying the early Miocene m.l. Globorotalia miozea Zone and the early Miocene l.l. upper Globigerinatella insueta Zone and confirming the presence of a hiatus (Figs. 17,18).

ASP 15

The planktic foraminiferal zonation of the ASP 15 well is shown in Figures 17 and 19. It can be observed that lower, middle, and upper Miocene zones are identified in this well. A hiatus probably separates the middle and upper Miocene, with the l.l. Globorotalia fohsi lobata/robusta Zone being overlain by the m.l. Globorotalia conomiozea Zone.

At 1529.9m the appearance of Catapsydrax dissimilis Cushman and Bermudez and Globigerinatella insueta indicates the l.l. Catapsydrax stainforthi Zone (Figs. 17,19). The absence of Globigerinatella insueta from 1530.9m to 1531.7m indicates the l.l. Catapsydrax dissimilis Zone (Figs. 17,19). The occurrence of Globorotalia

Figure 19. BIOSTRATIGRAPHY OF ASP 15 WELL



zealandica Hornibrook from 1529.9m to 1531.7m is consistent with the range given by Kennett and Srinivasan (1983) and identifies the m.l. Catapsydrax dissimilis Zone. A relatively sparse planktic foraminiferal fauna at 1532.2m including C. dissimilis, but not Globorotalia zealandica, is also placed in the l.l. and m.l. Catapsydrax dissimilis Zones (Figs. 17,19).

An assemblage which includes Pseudohastigerina micra (Cole), Chilogumbelina cubensis (Palmer), Globigerina ampliapertura Bolli, Subbotina eocaena (Gumbel), Turborotalia postcretacea (Myatliuk), and Globorotalia cf. opima nana Bolli is present at 1553.6m (Fig. 19). Globorotalia cf. opima nana differs from typical specimens of G. opima nana by being more lobate in equatorial view and less quadrangular, and by the presence of a delicate apertural lip. It resembles G. bolivariana (Petters) with its more lobate chambers but differs from that species in that it is less involute, having all the chambers of the pentultimate whorl visible. Toumarkine and Bolli (1975) reported a similar form, which they also identified as G. cf. opima nana, from the upper Eocene of Possagno, Italy. Also present are forms similar to Acarinina medizzai (Toumarkine and Bolli) which has a reported range of middle to the lower part of the upper Eocene (Toumarkine and Bolli, 1975), and rare, very small, highly spinose specimens of the genus Acarinina, which generally does not range above the middle Eocene. In addition, the large size of the specimens of Chiloguembelina cubensis may indicate an Eocene age. Thus, this interval is placed in the upper Eocene Globorotalia cerroazulensis s.l. Zone (Figs. 17,19).

COST B-3

The topmost sample recovered from the COST B-3 well was taken at 1158.2m and it contains middle and upper Miocene species, including Globorotalia acrostoma Wezel, Globorotalia mayeri, G. fohsi robusta, and Neogloboquadrina pseudopachyderma (Figs. 20,21). The presence of G. acrostoma suggests that this stratigraphic level is not older than the middle Miocene l.l. middle Globorotalia fohsi fohsi Zone (Fig. 21). The co-occurrence in this sample of G. fohsi robusta and Neogloboquadrina pseudopachyderma, species whose ranges do not overlap, indicates that caving of material from higher stratigraphic levels has occurred. It appears that Globorotalia fohsi robusta is also from a higher stratigraphic level and is caved.

The top of the lower Miocene m.l. Globorotalia miozea Zone is placed at 1204.0m where Globorotalia zealandica has its first occurrence downhole (Figs. 20,21). The presence of a lower-middle Miocene hiatus in the nearby ASP 14 well suggests that one is also present in the COST B-3 well (Figs. 18,20,21). The placement of this boundary is contrary to the work of Valentine (1980) who placed it at 1405.1m on the basis of calcareous nannofossils and of Poag (1980) who placed the boundary at 1359.4m based on radiolarian data and the highest occurrence of Globigerinoides sicanus (Fig. 21). Stainforth and others (1975) question the biostratigrapic validity of this "datum" noting that forms seemingly identical to G. sicanus range to higher stratigraphical levels.

The top of the m.l. Catapsydrax dissimilis Zone is placed at 1368.6m where C. unicavus Bolli, Loeblich, and Tappan has its highest stratigraphic appearance (Figs. 20,21). The presence of a single

Figure 20. BIOSTRATIGRAPHY OF COST B-3 WELL

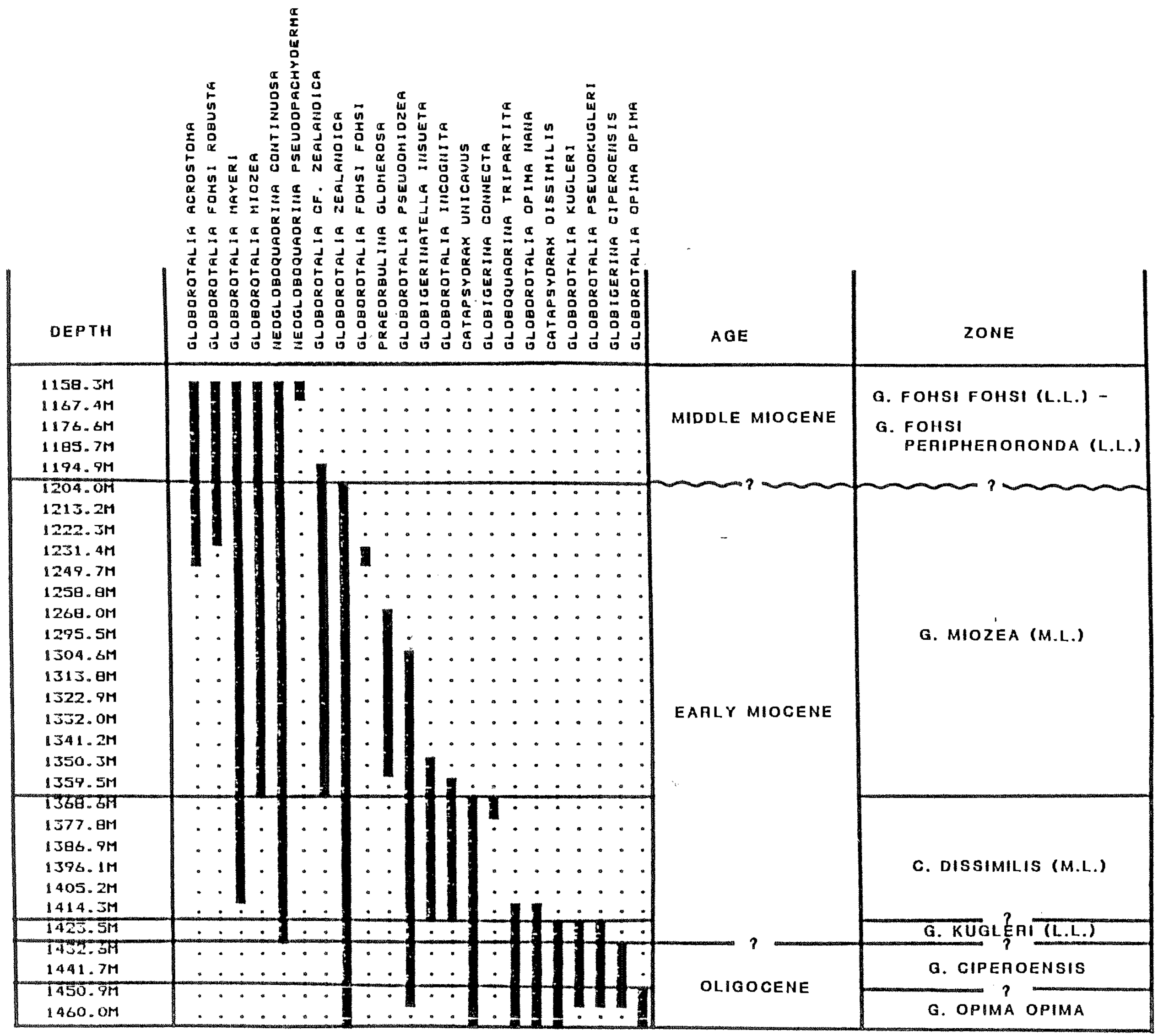
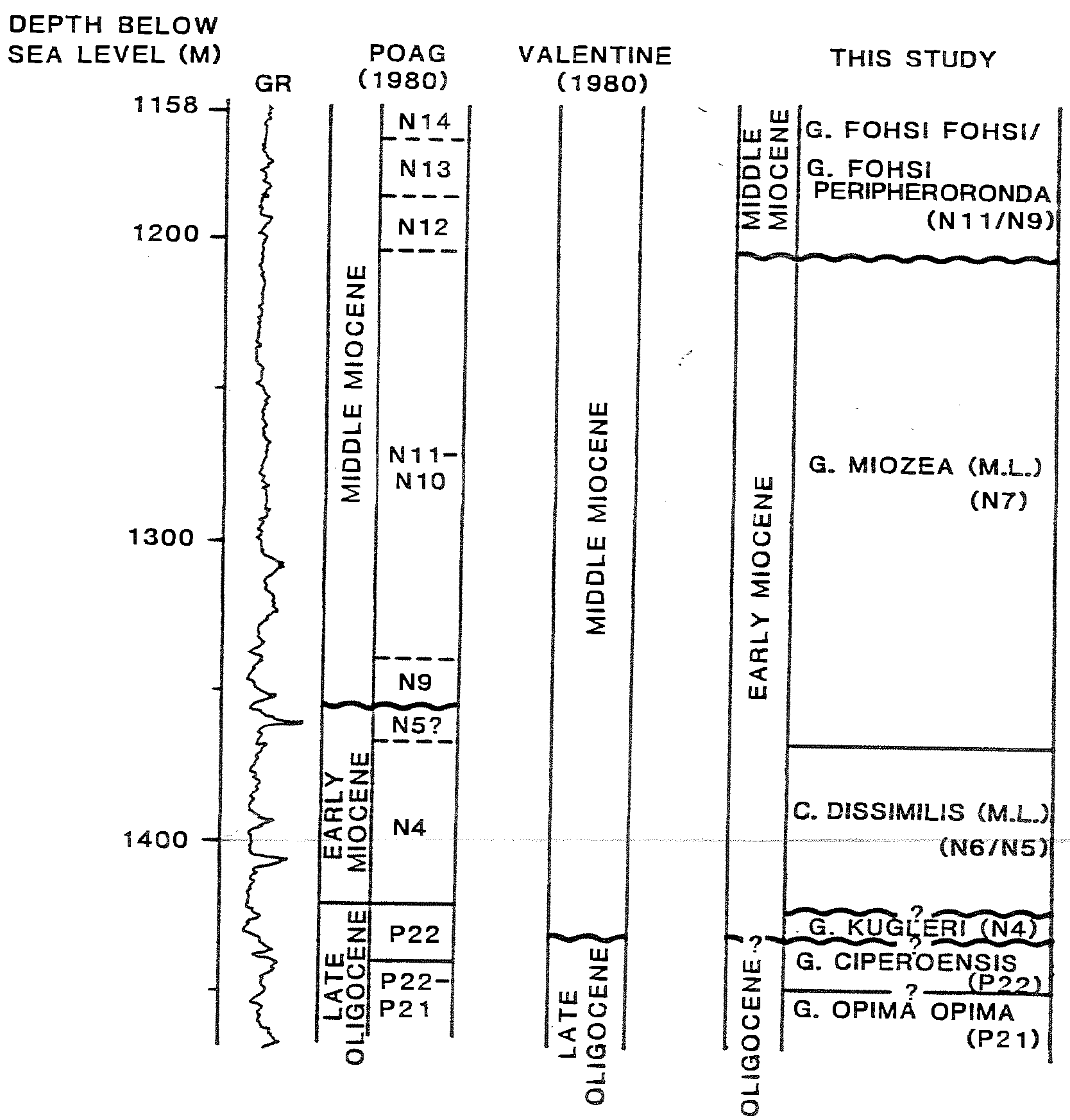


Figure 21 Previous studies of the Biostratigraphy of COST B-3 well



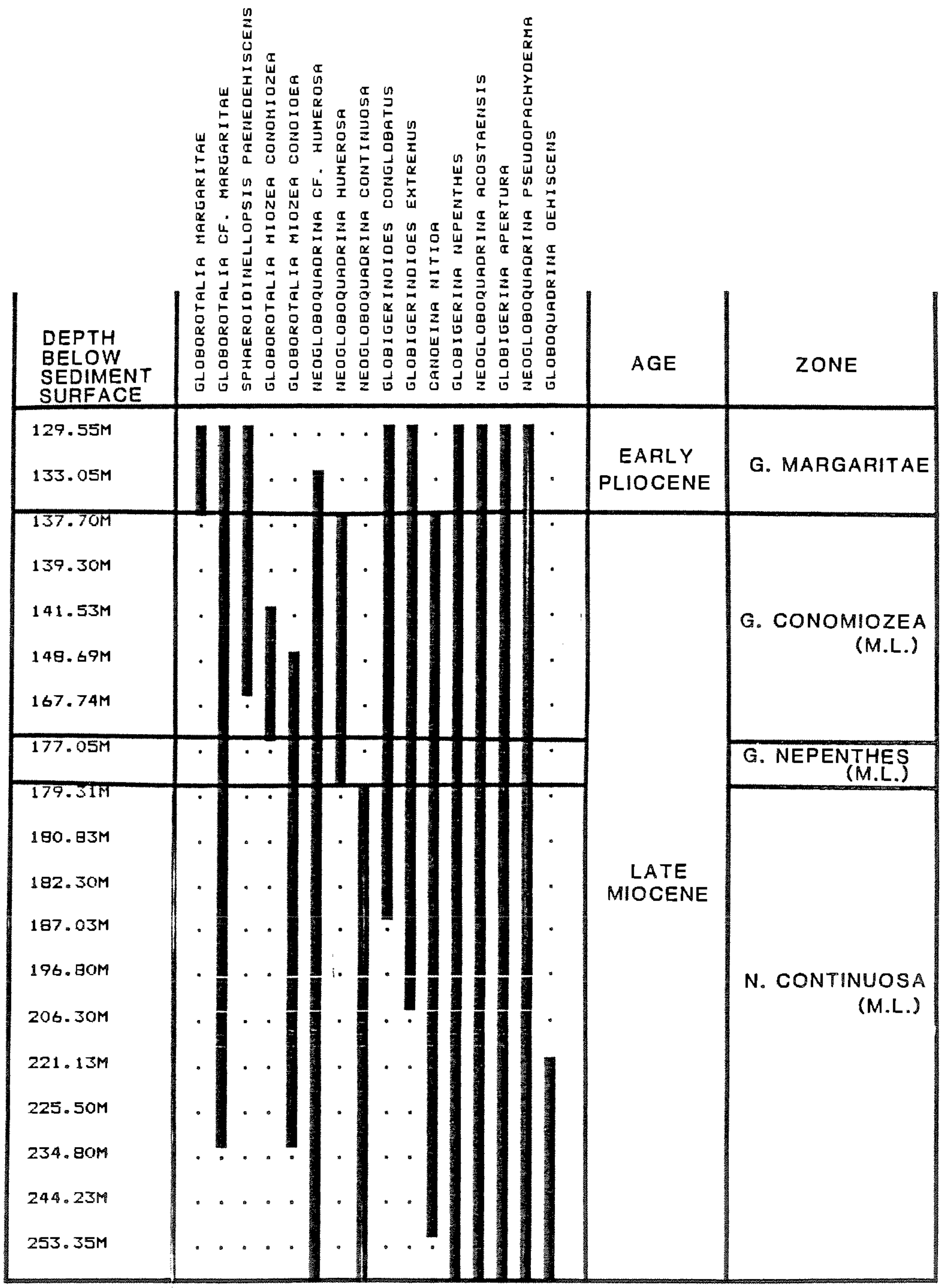
specimen of Globorotalia opima nana Bolli, possibly reworked, in samples from 1414.3m to 1441.7m is anomalous (Fig. 20). This zone is present to 1423.4m where Globorotalia kugleri Bolli first occurs and marks the top of the l.l. and m.l. Globorotalia kugleri Zones (Figs. 20,21). The first appearances of G. kugleri and G. pseudokugleri Blow at 1423.4m may indicate that the top of the zone is missing. The Oligocene/Miocene boundary is placed at 1432.6m where Globigerina ciperoensis Bolli, a species often used to approximate the Oligocene/Miocene boundary, first occurs (Figs. 20,21). The top of the late Oligocene Globorotalia opima opima Zone is placed at 1450.9m where Globorotalia opima opima Bolli first occurs in abundance (Figs. 20,21).

Western North Atlantic Basin

DSDP Site 334

The interval from 129.55m to 133.05m falls within the lower Pliocene l.l. Globorotalia margaritae Zone (Fig. 22). Sphaeroidinellopsis subdehiscens (Blow), Globorotalia conoidea Walters, and G. conomiozea have their LO within this zone (Fig. 22). Specimens of G. conomiozea are first found at 167.74m and indicate that the uppermost Miocene m.l. Globorotalia conomiozea Zone is present from 137.70m to 167.74m (Fig. 22). Sphaeroidinellopsis paenedehiscens Blow first appears within this zone (Fig. 22). The FO of Neogloboquadrina humerosa at 177.05m indicates the earliest Messinian. Thus, at Site 334 the m.l. Globorotalia conomiozea Zone is contained within the Messinian. The m.l. Globigerina nepenthes Zone is present from 167.74m to 179.31m where Neogloboquadrina continuosa last occurs (Fig. 22). Neogloboquadrina acostaensis ranges

Figure 22. BIOSTRATIGRAPHY OF DSDP SITE 334



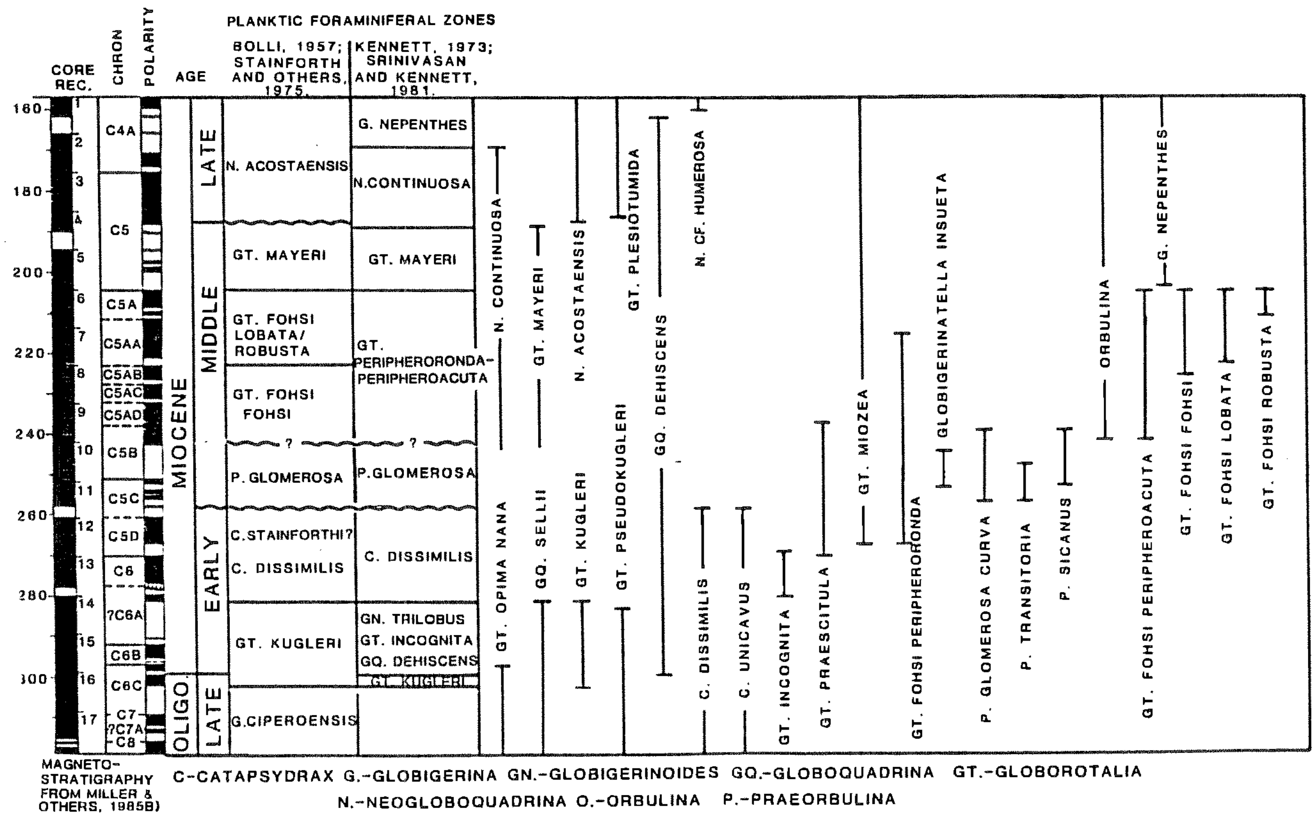
throughout this well and the co-occurrence of this species and N. continuosa identifies the m.l. Neogloboquadrina continuosa Zone in the interval from 179.31m to 253.39m (Fig. 22). The LO of Globoquadrina dehiscens falls within this zone (Fig. 22). Globigerinoides conglobatus (Brady) and G. extremus Bolli first appear within this zone (Fig. 22).

Throughout the late Miocene of Sites 334 and 563 and the Pliocene of Site 334 forms are present which are gradational between Globorotalia menardii, G. mediterranea Catalano and Sprovieri, G. dalii Perconig, and G. miozea. Miles (1977) and Poore (1981) report similar findings at Site 334. In a biometric study of late Miocene keeled globorotaliids of the Mediterranean, Zachariasse (1979) concluded that these taxa, and G. conomiozea, were part of an evolving cline and that the biostratigraphic utility of the group is questionable. Although close morphologic relationships are observed within this group at Sites 334 and 563, G. conomiozea can be easily distinguished and is therefore considered to have biostratigraphic utility in the Western North Atlantic.

DSDP Site 563

The highest level examined contains Neogloboquadrina cf. humerosa. This suggests that the upper portion of the m.l. Globigerina nepenthes Zone is present in the interval from 156.5m to 157.69m (Fig. 23). The co-occurrence of N. acostaensis and N. continuosa from 166.05m to 186.63m identifies the m.l. Neogloboquadrina continuosa Zone (Fig. 23). The first appearance of N. acostaensis is at the base of the uppermost normal event of magnetozone C5 (Fig. 23).

Figure 23. **PLANKTIC FORAMINIFERAL BIOSTRATIGRAPHY - DSDP SITE 563**



The upper middle Miocene m.l. Globorotalia mayeri Zone is placed from the LO of Globorotalia cf. mayeri at 188.21m to the disappearance of G. fohsi peripheroacuta Blow and Banner at 204.05m (Fig. 23). The lowermost occurrence of G. fohsi peripheroacuta is at 241.20m, at the base of Core 9 and indicates the presence of the m.l. Globorotalia peripheroronda-peripheroacuta Zone (Fig. 23). Orbulina suturalis Bronniman also first appears at this level (Fig. 23). Thus, the m.l. Orbulina suturalis Zone is probably missing.

The use of a low-latitude zonation for the middle Miocene permits more detailed division of this interval than is possible using a middle-latitude zonation. However, the presence of the cool water species Globorotalia miozea throughout much of this interval indicates that a low latitude zonation is not entirely applicable at this site.

The interval from 156.5m to 186.63m is contained within the l.l. Neogloboquadrina acostaensis Zone (Fig. 23). Neogloboquadrina cf. humerosa is present at 157.69m, possibly indicating a latest Miocene, Messinian, age (Fig. 23). Globorotalia plesiotumida Blow and Banner first occurs within this zone in association with the uppermost normal event of magnetozone C5 (Fig. 23).

The last occurrence of G. mayeri is at 188.21m (Fig. 23). Forms assigned to G. cf. mayeri are present in the sample at 187.38m, approximately 0.75m below the first occurrence of Neogloboquadrina acostaensis in the next higher sample at 186.63m (Fig. 23). Thus, the ranges of these taxa at Site 563 are contiguous, which indicates an apparent middle-late Miocene hiatus when using a low latitude zonation. However, Kennett and Srinivasan (1983) show that the ranges of these taxa are contiguous at middle latitudes so that no hiatus may be present. The probable completeness of the magnetostratigraphic record appears to support a conformable sequence (Miller and others, 1985B).

The lowermost occurrence of Globigerina nepenthes Todd at the bottom of core 5 indicates the presence of the 1.1. Globorotalia mayeri (=siakensis) Zone from 188.21m to 203.20m (Fig. 23). This FO datum is correlated with the lowermost reversed event of magnetozone C5 (Fig. 23).

All members of the Globorotalia fohsi lineage are present at Site 563. Globorotalia fohsi robusta, G. fohsi lobata Bermudez, G. fohsi fohsi Cushman and Ellisor, and G. fohsi peripheroacuta all disappear at the top of Core 6 near the uppermost normal event of magnetozone C5A, where the top of the 1.1. Globorotalia fohsi lobata/robusta Zone is placed (Fig. 23). This may indicate that a hiatus exists between Cores 5 and 6 in which part of the 1.1. Globorotalia mayeri Zone and the uppermost portion of the Globorotalia fohsi lobata/robusta Zones are missing (Fig. 23). However, this is not considered probable (see section on Deep-Sea Hiatuses). The base of the 1.1. Globorotalia fohsi lobata/robusta Zone at 222.20m is correlated with the base of the reversed event of magnetozone C5AA (Fig. 23).

The 1.1. Globorotalia fohsi fohsi Zone extends to the base of core 10 (241.20m) where G. fohsi peripheroacuta and Orbulina suturalis are first present (Fig. 23). The simultaneous FO of these species indicates that the 1.1. Globorotalia fohsi peripheroronda Zone is missing (Fig. 23).

Praeorbulina glomerosa curva (Blow) and P. transitoria (Blow) first occur at 255.46m, apparently correlative with the normal event of magnetozone C5B, and indicate the presence of the l.l. Praeorbulina glomerosa curva Zone (Fig. 23). The simultaneous occurrences of these species may indicate that the lower portion of the zone is missing.

Catapsydrax dissimilis and C. unicavus disappear at 256.29m, slightly below the FO of Praeorbulina near the third oldest reversed event of magnetozone C5C (Fig. 23). The FO of Praeorbulina immediately above the LO of Catapsydrax dissimilis and C. unicavus indicates the presence of a hiatus (Fig. 23). Because these events occur within Core 11 and not between cores it appears that a hiatus is present in which the l.l. Catapsydrax stainforthi and Globigerinatella insueta Zones are missing. Species having their FO within the l.l. Catapsydrax dissimilis Zone include Globigerinoides quadrilobatus (d'Orbigny), G. subquadratus Bronnimann, Globorotalia miozea (normal event of magnetozone C5D), G. praescitula Blow (normal event of C6), and Sphaeroidinellopsis disjuncta (Finlay)(normal event of C5D) (Fig. 23). The LO of Globoquadrina tripartita Koch and Globigerinoides primordius Blow and Banner are within this zone (Fig. 23). Globorotalia zealandica and G. incognita Walters are present in very small numbers (Fig. 23).

The LO of Globorotalia kugleri at 280.5m (apparently correlative with the reversed(?) event of magnetozone C6A(?)) marks base of the l.l. and m.l. Catapsydrax dissimilis Zones (Fig. 23). Because this event occurs at the top of Core 14 the upper range of G. kugleri may be truncated and thus the true magnetostratigraphic correlation of this event may be slightly younger (Fig. 23).

The FO of G. kugleri at 302.21m marks the base of the l.l

Globorotalia kugleri Zone (Fig. 23). The lower portion of this zone, prior to the first occurrence of Globoquadrina dehiscens, is placed in the upper Oligocene by Srinivasan and Kennett (1983) (Figs. 9,23). Berggren and others, in press, place the Oligocene/Miocene boundary at the FO of G. kugleri. The base of this zone is correlated with the uppermost portion of the lower reversed event of magnetozone C6C (Fig. 23). Globigerina sellii (Borsetti) and Globorotalia pseudokugleri last occur in this zone (Fig. 23). Globorotalia opima nana last occurs just above the FO of Neogloboquadrina continuosa (Fig. 23). Both LO datums are correlated and magnetozone C6B. Globoquadrina baroemoenensis (Leroy) and G. altispira altispira Cushman and Jarvis first occur near the top of the zone and Globigerina woodi Jenkins first occurs near the base of the zone.

The FO of Globoquadrina dehiscens at 296.62m marks the base of the Miocene (Fig. 23) (Srinivasan and Kennett, 1983). Thus, the Oligocene/Miocene boundary as used above is correlated with the reversed event of magnetozone C6B (Fig. 23).

DEEP-SEA HIATUSES

The production and preservation of carbonate deposits in the pelagic realm is largely a function of the fertility of near-surface waters and the corrosiveness of bottom waters (Berger, 1979). Deep-sea hiatuses result from periods of non-deposition, erosion, and dissolution, the most important factor being dissolution (Moore and others, 1978). The degree of corrosiveness of bottom water masses is variable. "Younger" water masses, which have only recently descended from the surface, are well oxygenated, have a low carbon dioxide content, and thus are less corrosive to calcium carbonate. The opposite is true for "older" waters which have lost much of their oxygen through oxidation of organic material and as a result have a greater carbon dioxide content. Also, water masses with high carbonate ion concentrations are less corrosive, and vice-versa. In general, Antartic Bottom Water (AABW) tends to be "older" and more corrosive than other bottom-water masses (Berger, 1979).

Kennett and Shackleton (1976) and Kennett (1977) recognize climatic deterioration in the earliest Oligocene which they interpret to have resulted in the formation of AABW. According to Keller and Barron (1983) subsequent periods of climatic deterioration should result in an increase in the production, circulation, and corrosiveness of AABW. Keller and Barron (1983) believe that an increase in the distribution of Neogene deep-sea hiatuses should correspond to periods of refrigeration inferred from oxygen isotope data and to periods of eustatic sea-level falls predicted from models in which increases in glacial ice-volume are primary causal mechanisms (e.g. Vail and others, 1977, 1980). However, Berger (1973, 1979) using data from Arrenhius (1952), has shown that there is an increase in the preservation of calcium carbonate in the equatorial Pacific during Pleistocene glacial intervals thus indicating no evidence for increased acitivity of AABW.

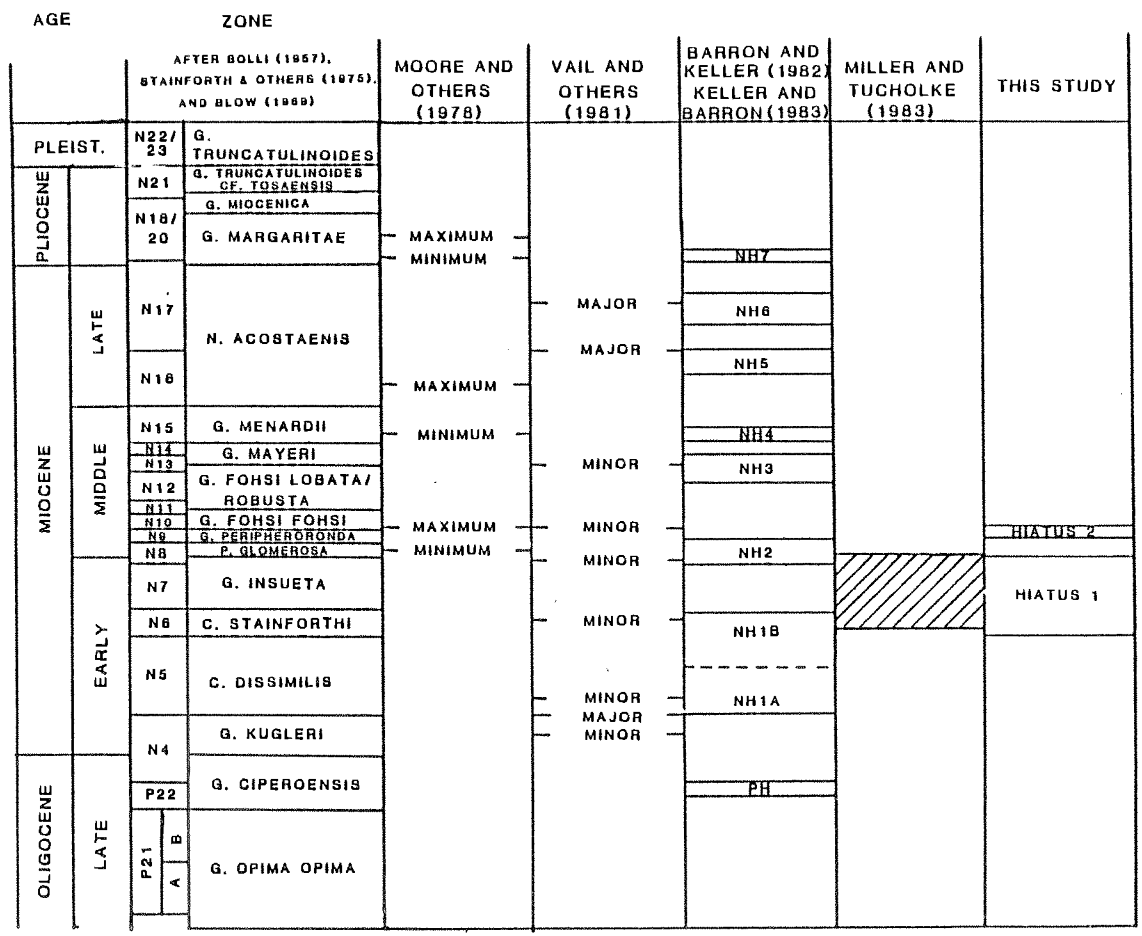
Studies of deep-sea hiatuses in the North Atlantic have been conducted by Moore and others (1978), Vail and others (1980), Barron and Keller (1982), Keller and Barron (1983), and Miller and Tucholke (1983) (Fig. 24).

Moore and others (1978) using a broad data base consisting of reports from DSDP Legs 1 through 31 in the Pacific, North and South Atlantic, and Indian oceans, as well as from the Carribbean and Gulf of Mexico identify hiatuses by the absence of one or more biostratigraphic zones. Previously, Moore (1972) noted an unusually large proportion of hiatuses reported from between cores recovered by the DSDP and estimated that an average of 35% (=6.3m of the 18m length of two consecutive cores) of the sediments in a given section may not be recovered as a result of "vagaries of the drilling process". As a result, Moore and others (1978) employ a cautious approach in the study of the distribution of deep-sea hiatuses whereby stratigraphic gaps occurring between cores are not considered real unless the duration of the gap is greater than 6.3m divided by the average sedimentation rate above and below the gap.

Using this technique Moore and others (1978) recognize three maxima and three minima in hiatus distribution in the Miocene-early Pliocene of the North Atlantic (Fig. 24).

Vail and others (1980) recognize hiatuses off the Blake

Figure 24. HIATUSES AND EROSIONAL EVENTS OF THE NORTH ATLANTIC



Escarpment and off the northwest coast of Africa through an analysis of seismic stratigraphic events dated by correlation with biostratigraphic determinations in nearby wells. Nine hiatuses in the Miocene-early Pliocene of the North Atlantic were reported, four of which were not biostratigraphically documented (Vail and others, 1980, Text Table 1) (Fig. 24).

Barron and Keller (1982) and Keller and Barron (1983) recognize eight widespread deep-sea hiatuses in the latest Oligocene to Pliocene (Fig. 24). They note that many of them fall between cores but reject the reasoning of Moore (1972) and Moore and others (1978) on the basis that: 1)the sampling interval they have used, approximately one sample per core section, is greater than that used by Moore and others (1978) and affords them greater biostratigraphic control; 2)well sites located in high productivity regions have expanded sections which allows recognition of hiatuses from sedimentation rate curves; 3)"the eight hiatuses identified can be recognized in numerous deep-sea sections where they fall between cores as well as within cores"; 4) recent advances in stratigraphic techniques, including the integration of various microfossil zonations, provide a purported 100,000 year age control for low-latitude Miocene sections.

The primary data base used by Barron and Keller (1982) and Keller and Barron (1983) consists of sixteen DSDP sites in the Pacific, only six of which are located in high productivity equatorial regions. Hiatuses recognized at these locations were then searched for at other sites where they fell "between cores as well as within cores". No data on the statistical significance of the frequency of these occurrences are given. A great deal of reliance is placed on the accuracy of the correlation of calcareous and siliceous microfossil zonations. Because these groups are often mutually exclusive in occurrence it is difficult to correlate the datums of one group with those of the other. Furthermore, they do not address the question of drilling losses and appear to assume that little or no loss occurs. Thus, they do not show data substantiating greater biostratigraphic precision and have not fully considered the problem of drilling losses. For these reasons, the approach of Moore (1972) and Moore and others (1978) is used to recognize hiatuses in this study.

Site 334

No hiatuses appear to be present in the late Miocene-early Pliocene at this site (Fig. 22).

Site 563

A hiatus (Hiatus 1) occurs within Core 11 in which the lower Miocene l.l. Catapsydrax stainforthi and Globigerinatella insueta Zones are missing (Fig. 23). This is approximately equivalent to the m.l. Globorotalia miozea and upper Catapsydrax dissimilis Zones. Hiatus 1 coincides with two minor unconformites noted by Vail and others (1980), and to a hiatus maximum in the Pacific noted by Loutit and Kennett (1981). The lower portion of the hiatus overlaps with the upper portion of hiatus NH1b of Barron and Keller (1982) and Keller and Barron (1983) (Fig. 24). Miller and Tucholke (1983) and Miller (pers. comm.) note that seismic reflector R2 in the northern North Atlantic dates to the late early Miocene and is often accompanied by a hiatus in which the lower Catapsydrax stainforthi to lower Praeorbulina glomerosa l.l. Zones are missing (Fig. 24). Thus, it may be that the late early Miocene hiatus at Site 563 can be correlated to this reflector.

It can be seen in Figure 8 that samples below the hiatus exhibit upsection increases in dissolution whereas samples above it display very little evidence of dissolution suggesting that the hiatus may be the result of erosion and/or non-deposition during a period of increased carbonate dissolution.

A possible hiatus is present at Site 563 between Cores 10 and 11 in which the l.l. Globorotalia peripheroronda Zone, equivalent to the m.l. Orbulina suturalis Zone, is missing (Fig. 23). It may be that the upper portion of the l.l. Praeorbulina glomerosa Zone is also missing (Fig. 23). Using the techniques of Moore (1972) and Moore and others (1978) calculations indicate that average sedimentation rates above and below the gap are only slightly less than those required to consider this gap a hiatus (Table 1). Furthermore, since the rates were of necessity calculated using species with truncated ranges the rates given are minimum values. Thus, it appears that it represents a hiatus which is designated Hiatus 2.

Hiatus 2 occurs during a maximum in hiatus distribution reported by Moore and others (1978) and may overlap slightly with the uppermost portion of hiatus NH2 of Barron and Keller (1982) and Keller and Barron (1983) (Fig. 24). It does correspond to a major erosional event noted by Van Andel and others (1977) in the South Atlantic and to a minor event noted by Vail and others (1980) (Fig. 24). It also correlates with a sea-level drop identified by Schreiber (1984) in the Maryland coastal plain.

Another possible hiatus occurs between the top of Core 6, where the last appearance of Globorotalia fohsi lobata occurs, and the base

Table 1

Minimum average sediment accumulation rate from FO *Praeorbulina* to FO *G. fohsi lobata* - 16.2 m/Ma

			Hiatus resulting from average drilling losses
At 35% drilling loss	$\frac{6.3\text{m}}{16.2\text{m/Ma}}$	=	0.38 Ma

Duration of stratigraphic break is 0.5 Ma. Thus, it appears to represent a hiatus.

Berggren and Van Couvering (1978) believe that no time interval is present between these datums in contrast to the previous works of Bolli (1957), Blow (1969), and Stainforth and others (1975) and others. Table 2 shows that a hiatus is not likely present when an average drilling loss of 35% is used (Table 2). Thus, this apparent stratigraphic break probably does not represent a hiatus. It does not correspond to any hiatus noted by Van Andel and others (1977) or Moore and others (1978), but does correspond to hiatus NH3 of Barron and Keller (1982), and Keller and Barron (1983). It also correspond to a minor hiatus noted by Vail and others (1980) (Fig. 24).

In summary, fewer hiatuses have been noted at Site 563 than have been proposed for other locations in the North Atlantic by other workers. In some cases, this reflects the use of more rigorous criteria in this study to document hiatuses. It may also be due to the use of only two well sites. Using planktic foraminifera, only one biostratigraphically well-documented hiatus occured in the early Miocene. It corresponds to two minor unconformites noted by Vail and others (1980) and to a hiatus maximum noted in the Pacific by Loutit and Kennett (1981). It may also be correlative with seismic reflector R2. Another probable hiatus occurs in the early middle Miocene and corresponds to a maximum in hiatus distribution noted by Moore and others (1978) and to a minor unconformity noted by Vail and others (1980). It also corresponds to a major erosional event in the South Atlantic recognized by Van Andel and others (1977). Miller and others (1985B), using nannofossil data, recognize an early Miocene hiatus at Site 563 between Cores 12 and 13 in which nannofossil zone NN3 is missing.

Table 2

Minimum average sediment accumulation rate from FO *G. fohsi lobata* to FO *N. acostaensis* - 13.5m/Ma

			Hiatus resulting from average drilling losses
At 35% drilling loss	$\frac{6.3m}{13.5m/Ma}$	=	0.47 Ma

Duration of stratigraphic break is 0.4 Ma. Thus, it does not appear to represent a hiatus.

NUMERICAL ANALYSIS

Counts of 200-300 individuals caught on a 63 micron mesh screen were made when possible and used in factor and cluster analysis. Species present in less than 20% of the samples or samples containing fewer than 50 individuals were not used in the numerical analyses, except for samples from the DSDP sites, which had generally low benthic foraminiferal abundances (Appendices 3,4).

Factor analysis was performed using the Biomedical Program Series (BMDP, 1983). Cluster analysis was performed using the Numerical Taxonomy System of Multivariate Statistical Programs (NT-SYS, 1974).

Checks are made of the accuracy with which an analysis reflects the original data matrix by using the cophenetic correlation coefficient (r_c) in the cluster analysis and by using the Eigenvalues in factor analysis. Values of r_c between 0.700 and 0.950 are considered usable. The greater the amount of variance explained by the number of factor axes used, the more accurately the analysis reflects the data matrix.

Cluster analysis is a method designed to search for discrete groupings within the data. However, it will often produce groupings whether or not natural groupings exist in the data. On the other hand, factor analysis is a multidimensional gradient technique and is not designed to produce groupings, as such. In addition, it is a mathematically more flexible technique. In most cases, the results of the two analyses are identical or very similar. Discrepancies usually occur as a result of groups being formed in the cluster analysis on the basis of similarities in the abundances, not the distribution, of species, and, or, from the unavailability of a variable for consideration with respect to the other variables once it has been clustered. In these cases, the groupings produced by factor analysis are used to delineate biofacies. Results of the cluster analyses are given in Figures 25-32.

Analyses were performed on matrices combining data from the AMCOR 6011, 6009B, and 6010 wells, the ASP 13, 14, and 15 wells, and individually from DSDP sites 334 and 563. This was done because few of the species from each grouping of wells are present in any other group (Appendix 4). Species and sample identifications are given in Tables 3-8. Factor analysis of the AMCOR wells reveals that the faunas present in the 6011 well are distinct from those of the 6009B and 6010 wells which have grouped closely together (Figs. 33,34). A similar situation exists in the analysis of the ASP wells. In this case, the faunas present in the ASP 13 well are distinct from those present in the ASP 14 and 15 wells which group closely together (Figs. 35,36). Analysis of the data from the AMCOR 6009B and 6010, ASP 14, and 15 wells indicate that each grouping contains more than one fauna (Figs. 37-40). In factor analysis, the first factor axes account for the greatest source of variance within the data. This variance appears to be caused by the use of the AMCOR 6011 and ASP 13 wells with their relatively distinctive faunas. As a result, differences between, and within, the faunas of the remaining wells are ignored until higher order factor axes are considered. In order to reduce the number of axes needed to reveal these differences the AMCOR 6011 and ASP 13 wells were considered separately (Figs. 41-44). The DSDP

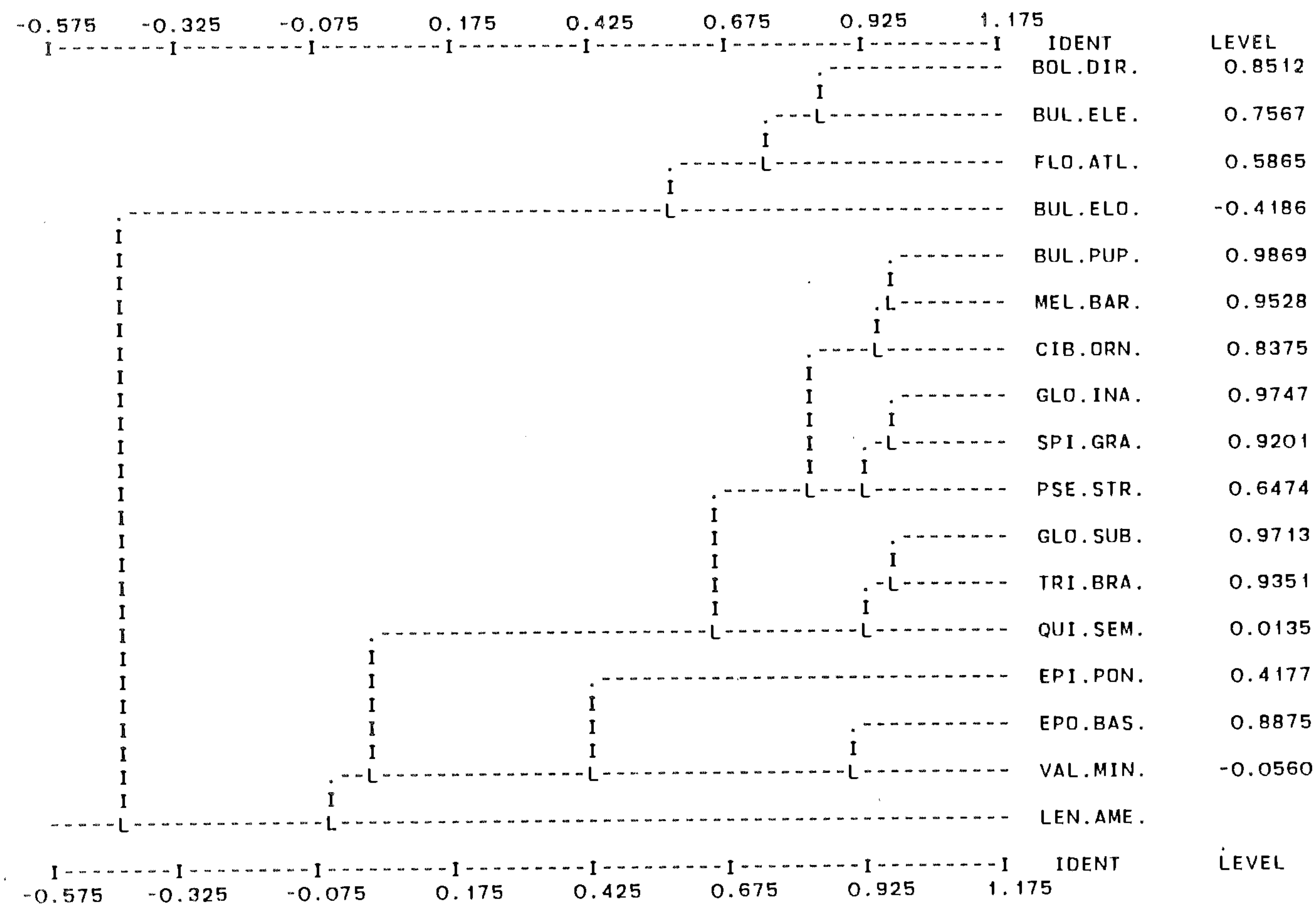


Figure 25 AMCOR 6011 R-Mode Cluster Analysis,

$r_c = 0.919$

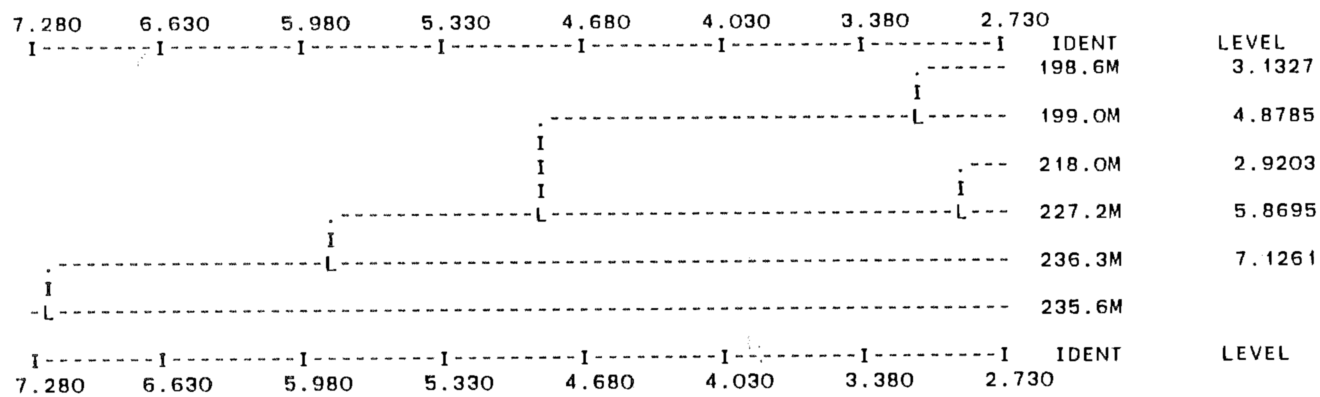


Figure 26 AMCOR 6011 Q-Mode Cluster Analysis,

$r_c = 0.923$

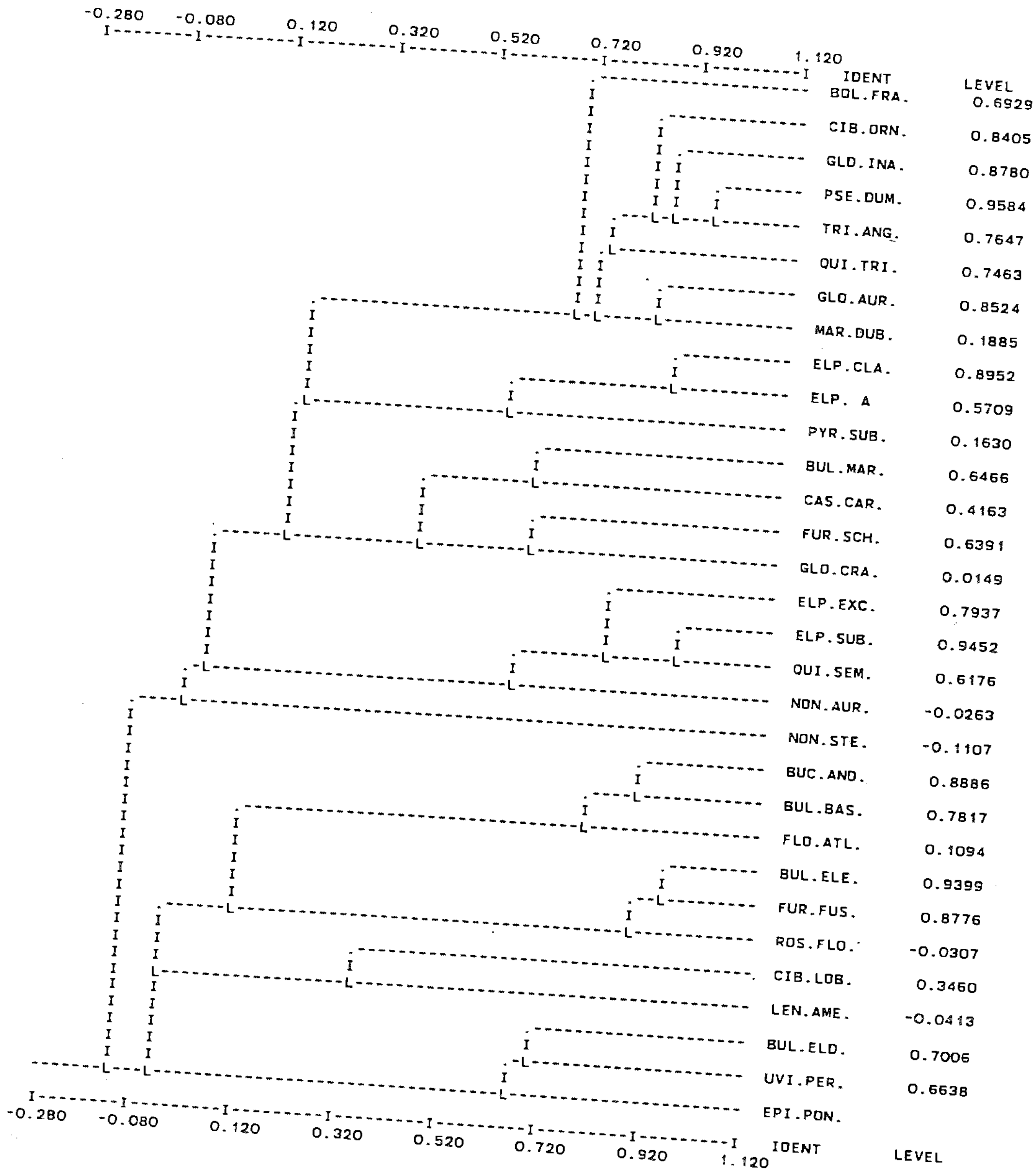


Figure 27 AMCOR 6009B and 6010 R-Mode Cluster Analysis, $r_c = 0.859$

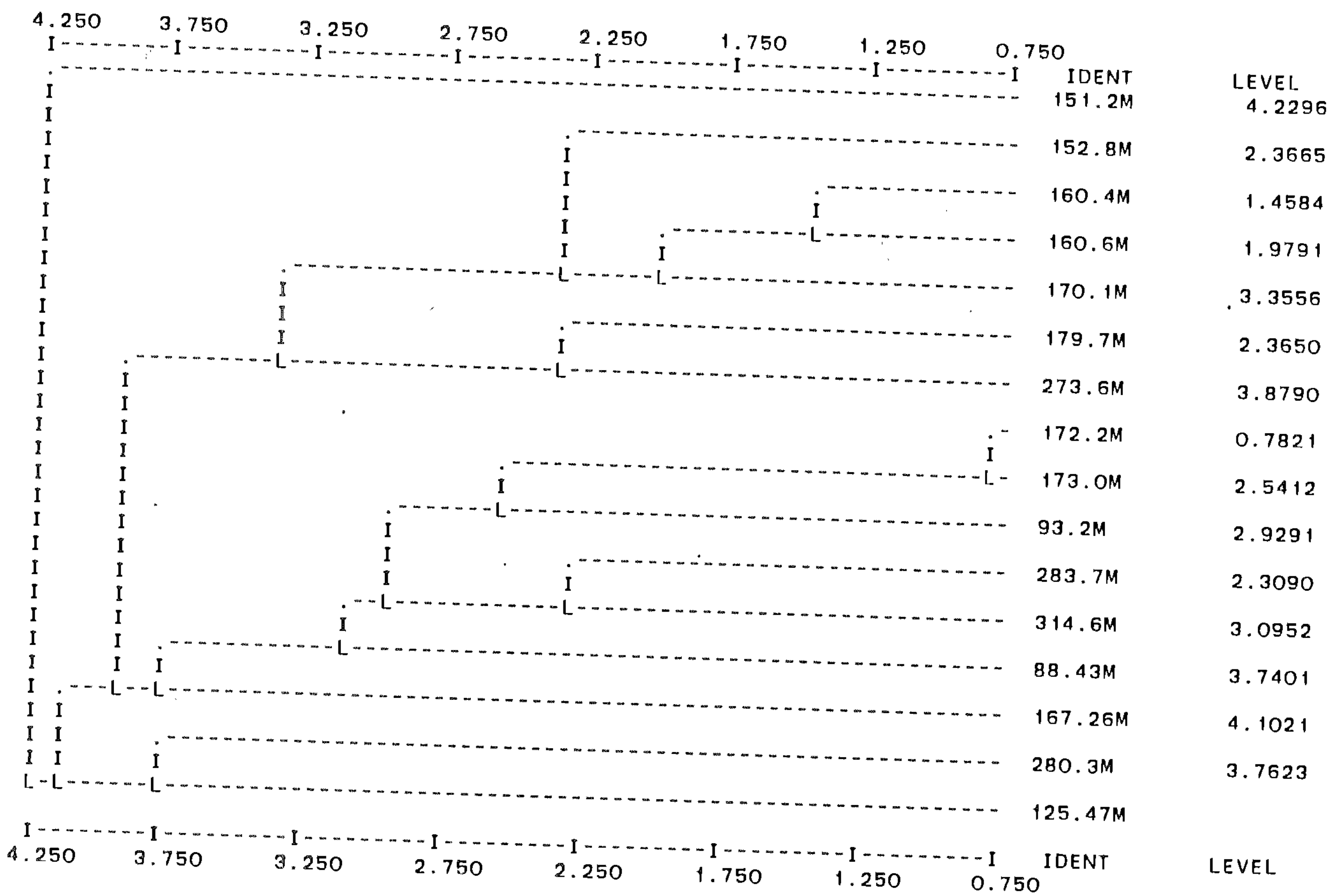


Figure 28 AMCOR 6009B and 6010 Q-Mode Cluster Analysis,

$r_c = 0.807$

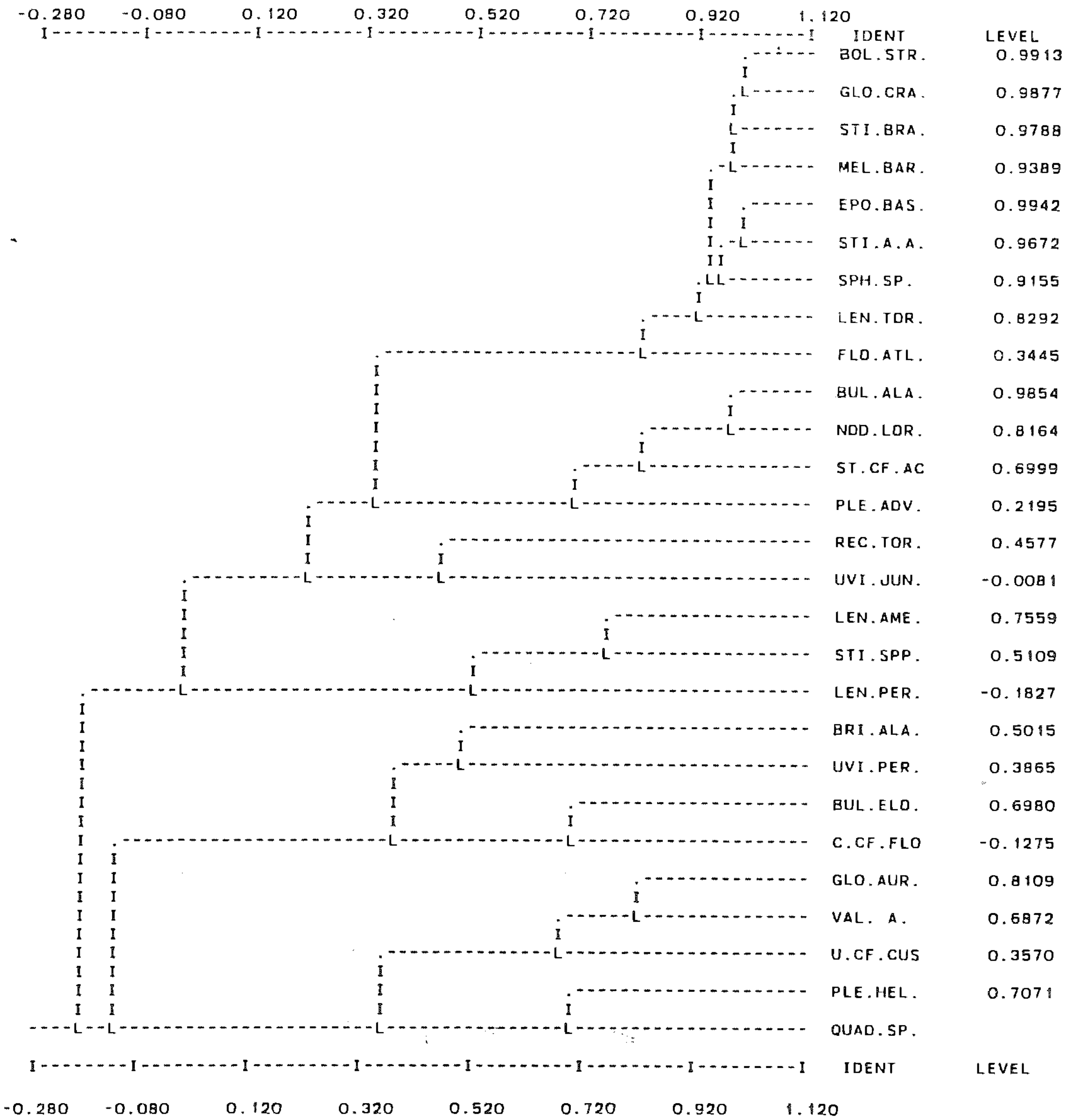


Figure 29 ASP 13 R-Mode Cluster Analysis,

$r_c = 0.830$

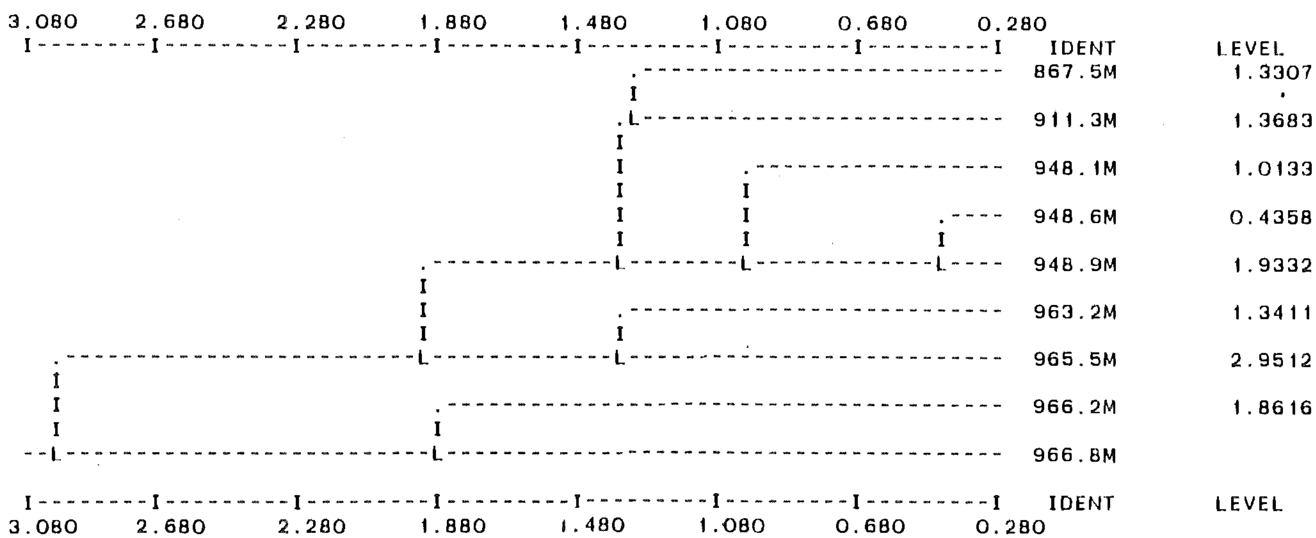


Figure 30 ASP B Q-Mode Cluster Analysis

$r_c = 0.938$

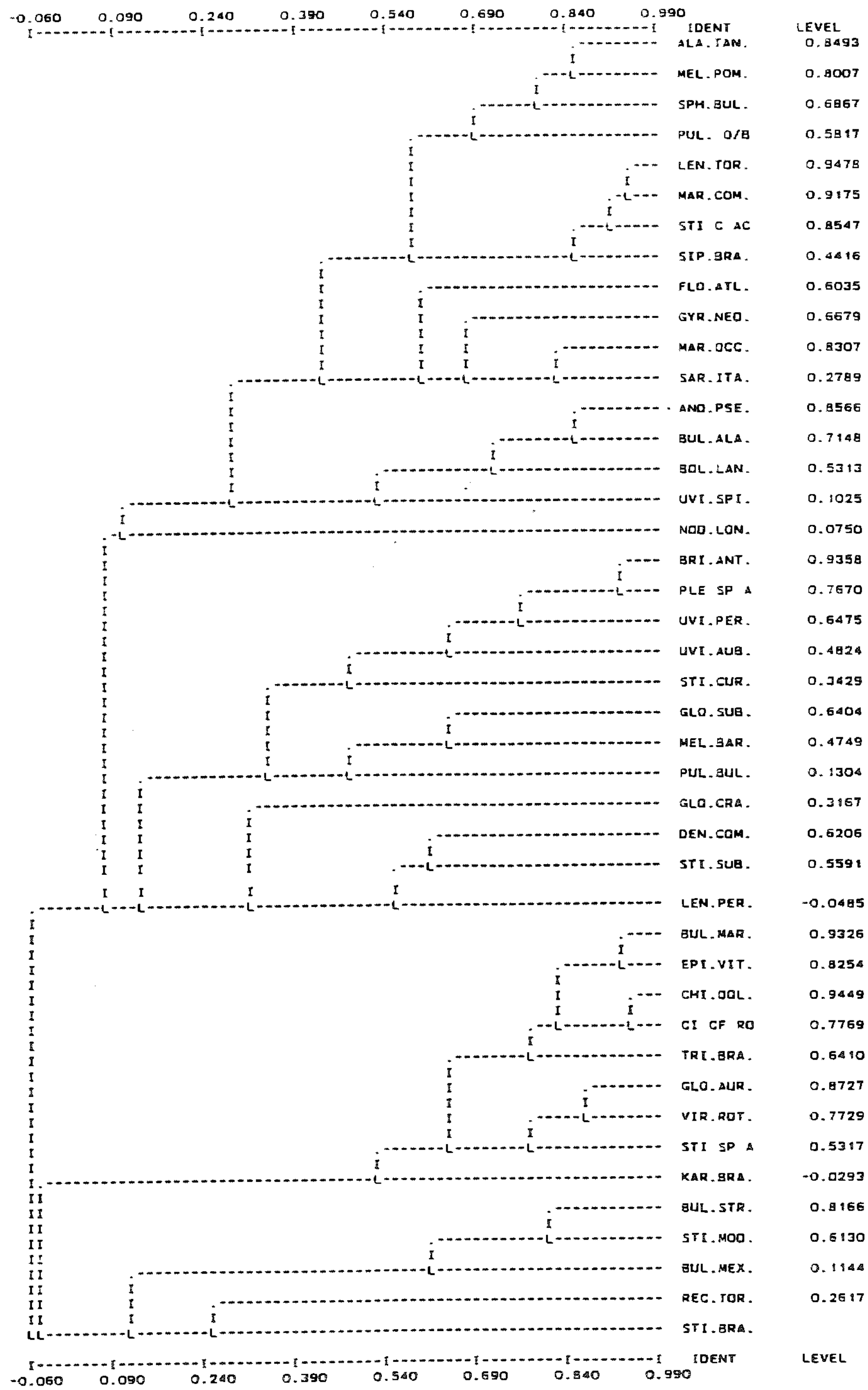


Figure 31 ASP 14 and 15 R-Mode Cluster Analysis,

$r_c = 0.774$

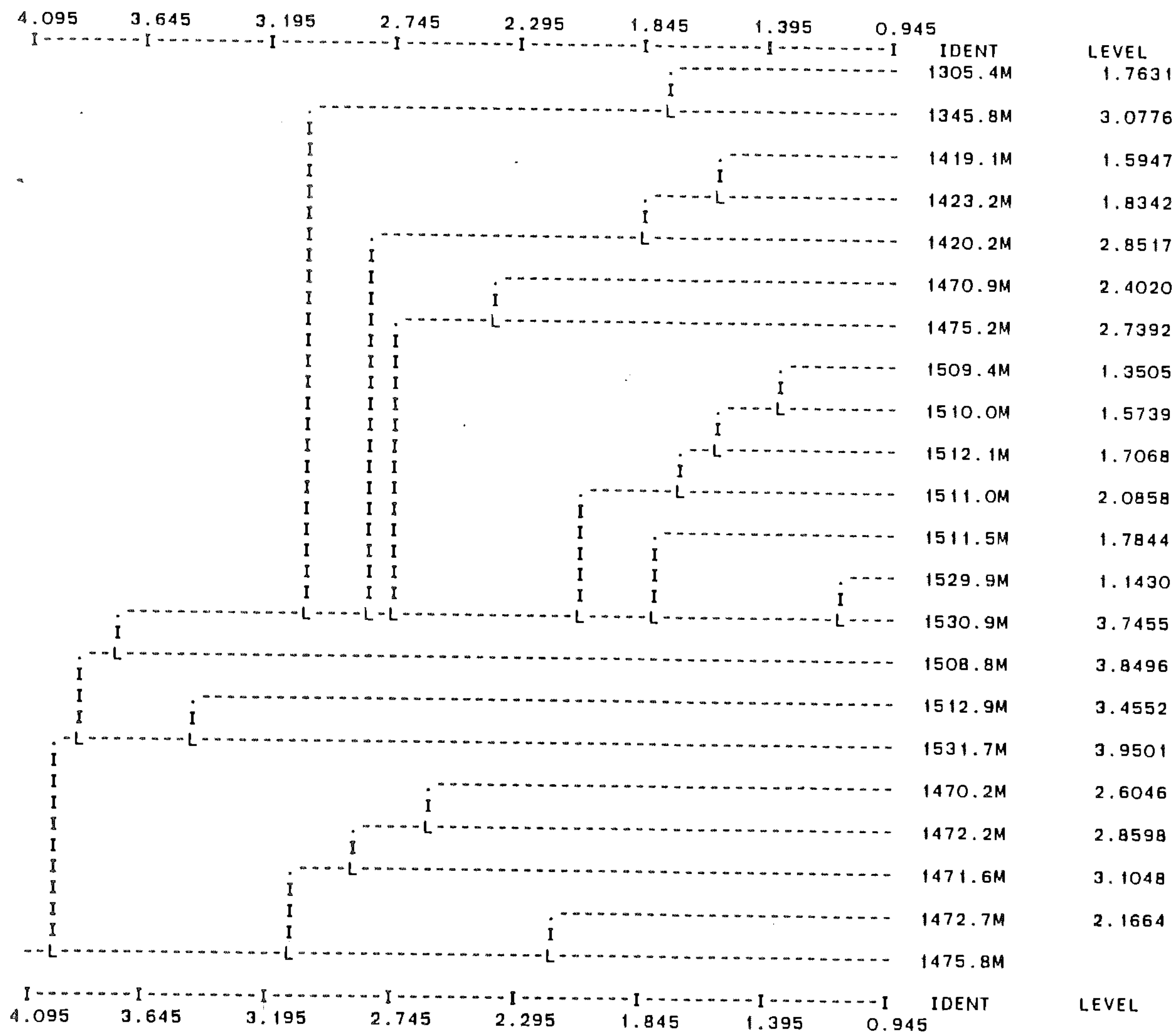


Figure 32 ASP 14 and 15 Q-Mode Cluster Analysis,

$r_c = 0.868$

TABLE 3

LIST OF SPECIES USED IN NUMERICAL ANALYSIS - AMCOR WELLS

Number	Abbreviation	Species
1	Bol.fra.	Bolivina fragilis
2	Buc.and.	Buccella anderseni
3	Bul.bas.	Buliminella bassendorfensis
4	Bul.mar.	Bulimina marginata
5	Bul.ele.	Buliminella elegantissima
6	Bul.elo.	B. elongata
7	Cas.car.	Cassidulina carinata
8	Cib.lob.	Cibicides lobatulus
9	Cib.orn.	C. ornatus
10	Elp.cla.	Elphidium clavatum
11	Elp sp A	Elphidium sp. A
12	Elp.exc.	E. excavatum
13	Elp.sub.	E. subarticum
14	Epi.pon.	Epistominella pontoni
15	Flo.atl.	Florilus atlantica
16	Fur.fus.	Fursenkoina fusiformis
17	Fur.sch.	F. schreibersiana
18	Glo.aur.	Globobulimina auriculata
19	Glo.cra.	Globocassidulina crassa
20	Glo.ina.	Globulina inaequalis
21	Len.ame.	Lenticulina americana
22	Mar.dub.	Marginulina dubia
23	Non.aur.	Nonionella auris
24	Non.ste.	N. miocenica stella
25	Pse.dum.	Pseudopolymorphina dumblei
26	Pyr.sub.	Pyrgo subsphaerica
27	Qui.tri.	Quinqueloculina triloculiniformis
28	Qui.sem.	Q. seminula
29	Ros.flo.	Rosalina floridana
30	Tri.ang.	Trifarina angulosa
31	Uvi.per.	Uvigerina peregrina
32	Bol.dir.	Bolivina directa
33	Bul.pup.	Bulimina pupoides
34	Epo.bas.	Eponides bassleri
35	Mel.bar.	Melonis barleeanus
36	Pse.str.	Pseudopolymorphina striata
37	Spi.gra.	Spiroplectammina gracilis
38	Tri.bra.	Trifarina bradyi
39	Val.min.	Valvulineria minuta

TABLE 4

LIST OF SAMPLES USED IN NUMERICAL ANALYSIS - AMCOR WELLS

WELL	SAMPLE #	DEPTH BELOW SEA LEVEL (M)
6010	1	151.2
	2	152.8
	3	160.4
	4	160.6
	5	170.1
	6	172.2
	7	173.0
	8	179.7
	9	273.6
	10	280.3
	11	283.7
	12	314.6
6009B	13	84.41
	14	93.2
	15	125.45
	16	167.24
6011	17	198.6
	18	199.0
	19	218.0
	20	227.2
	21	235.6
	22	236.3

TABLE 5

LIST OF SPECIES USED IN NUMERICAL ANALYSIS - ASP WELLS

NUMBER	ABBREVIATION	SPECIES NAME
1	Bol.str.	Bolivina striatula
2	Bri.ala.	Brizalina alata
3	Bul.ala.	Bulimina alazanensis
4	Bul.elo.	Buliminella elongata
5	Cib.flo.	Cibicides cf. floridana
6	Epo.bas.	Eponides bassleri
7	Flo.atl.	Florilus atlantica
8	Glo.aur.	Globobulimina auriculata
9	Glo.cra.	Globocassidulina crassa
10	Len.ame.	Lenticulina americana
11	Len.tor.	L. torrida
12	Len.per.	L. peregrina
13	Mel.bar.	Melonis barleeanus
14	Nod.lon.	Nodosaria longiscata
15	Ple.adv.	Plectofrondicularia advena
16	Ple.hel.	P. helenae
17	Quad sp.	Quadrimorphina sp.
18	Pse.tor.	Pseudonodosaria torrida
19	Sph.bul.	Sphaeroidina bulloides
20	Sti.sp A	Stilostomella sp. A
21	Sti.bra.	S. bradyi
22	S c acu.	S. cf. aculeata
23	U cf cus	Uvigerina cf. cushmani
24	Uvi.jun.	U. juncea
25	Uvi.per.	U. peregrina
26	Val.sp A	Valvulineria sp. A
27	Ala.tan.	Alabamina tangentenialis
28	Ano.pse.	Anomalinoides pseudogrosserugosa
29	Bol.lan.	Bolivina lanceolata
30	Bri.ant.	Brizalina antiqua
31	Bul.mar.	Bulimina marginata
32	Bul.str.	B. striata
33	Bul.mex.	B. striata mexicana
34	Chi.ool.	Chilostomella oolina
35	Ci cf ro	Cibicides cf. robertsonianus
36	Den.com.	Dentalina communis
37	Epi.vit.	Epistominella vitrea
38	Glo.sub.	Globocassidulina subglobosa
39	Gyr.neo.	Gyroidinoides neosoldanii
40	Kar.bra.	Karreriella bradyi
41	Mar.com.	Martinotiella communis
42	Mar.occ.	M. communis occidentalis
43	Mel.pom.	Melonis pompilioides
44	Ple.sp A	Pleurostomella sp. A
45	Pul.bul.	Pullenia bulloides
46	Pul.q/b	P. quinqueloba/bulloides
47	Sar.ita.	Saracenaria italica
48	Sip.bra.	Siphonina bradyana

TABLE 5 (continued)

LIST OF SPECIES USED IN NUMERICAL ANALYSIS - ASP WELLS

NUMBER	ABBREVIATION	SPECIES NAME
49	Sti.cur.	Stilostomella curvatura
50	Sti.mod.	S. modesta
51	Sti.sub.	S. subspinosa
52	Tri.bra.	Trifarina bradyi
53	Uvi.aub.	Uvigerina auberiana
54	Uvi.spi.	Uvigerina spinicostata
55	Vir.rot.	Virgulina rotundata
56	Uvi.med.	Uvigerina peregrina mediterranea
57	Ori.ten.	Oridorsalis tener tener
58	Len.cal.	Lenticulina calcar

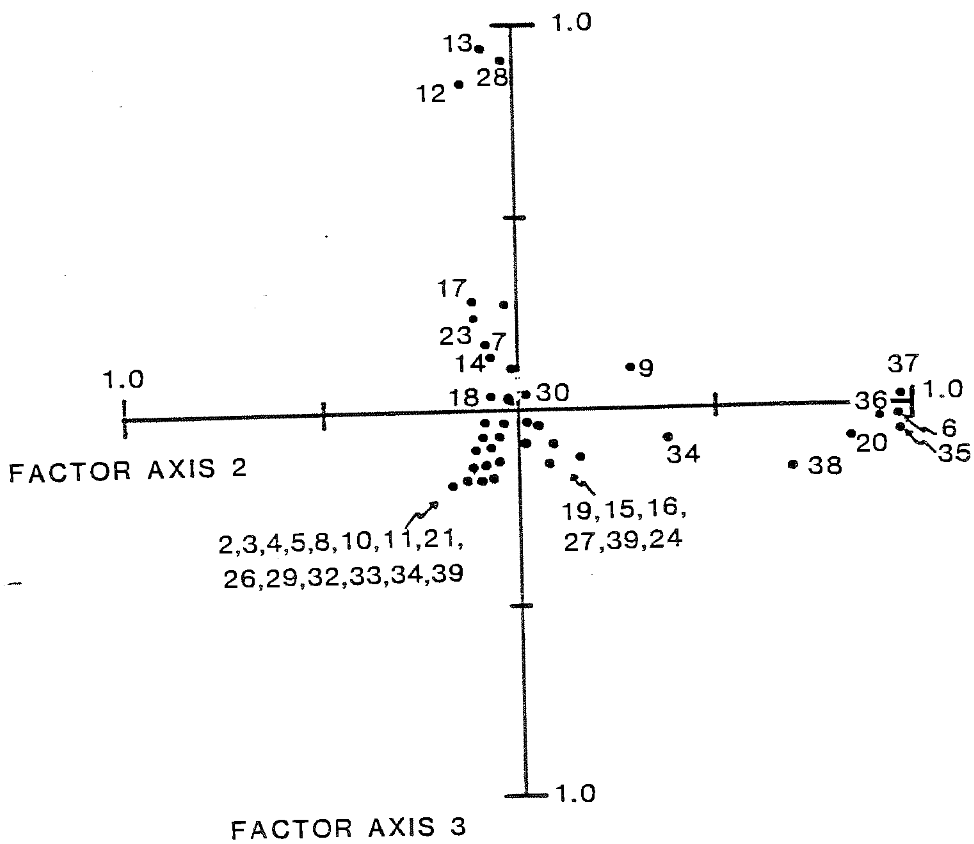
TABLE 6

LIST OF SAMPLES USED IN NUMERICAL ANALYSIS - ASP WELLS

WELL	SAMPLE #	DEPTH BELOW SEA LEVEL (M)
13	1	867.5
	2	911.3
	3	948.1
	4	948.6
	5	948.9
	6	963.2
	7	965.5
	8	966.2
	9	966.8
14	10	1305.4
	11	1345.8
	12	1419.1
	13	1420.2
	14	1423.2
	15	1470.2
	16	1470.9
	17	1471.6
	18	1472.2
	19	1472.7
	20	1475.2
	21	1475.8
15	22	1508.8
	23	1509.4
	24	1510.0
	25	1511.0
	26	1511.5
	27	1512.1
	28	1529.9
	29	1530.9
	30	1531.7
	31	1532.2

Figure 33

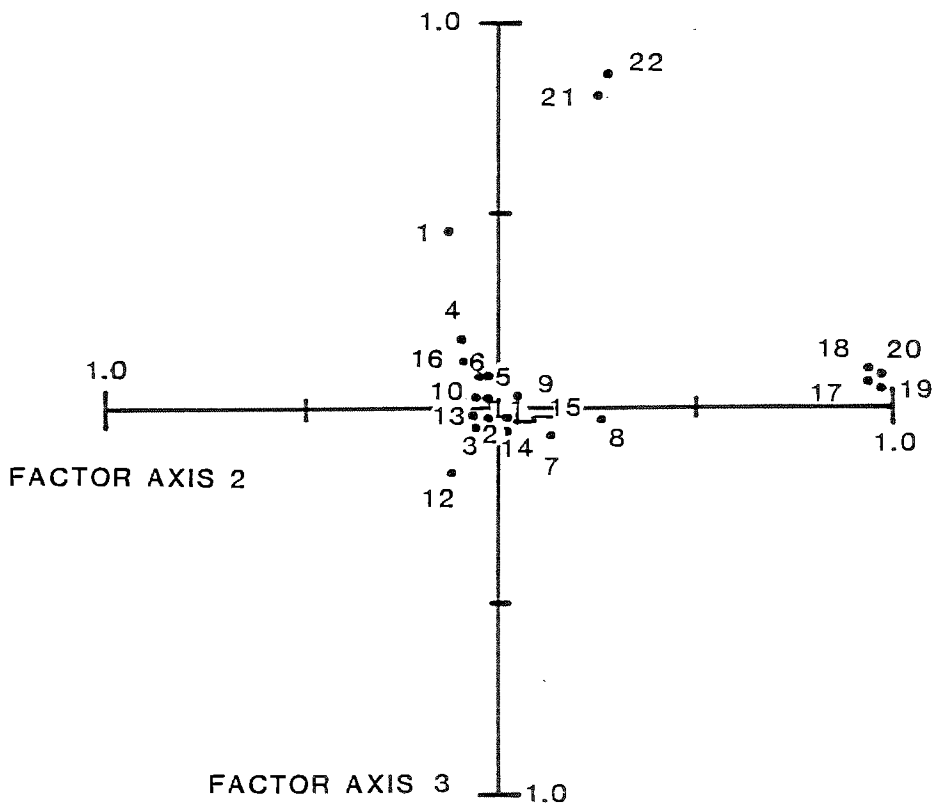
AMCOR 6009B, 6010, 6011 WELLS
R-MODE FACTOR ANALYSIS



Six axes explain 67% of the variance in the data.
Three axes explain 44% of the variance in the data.

Figure 34

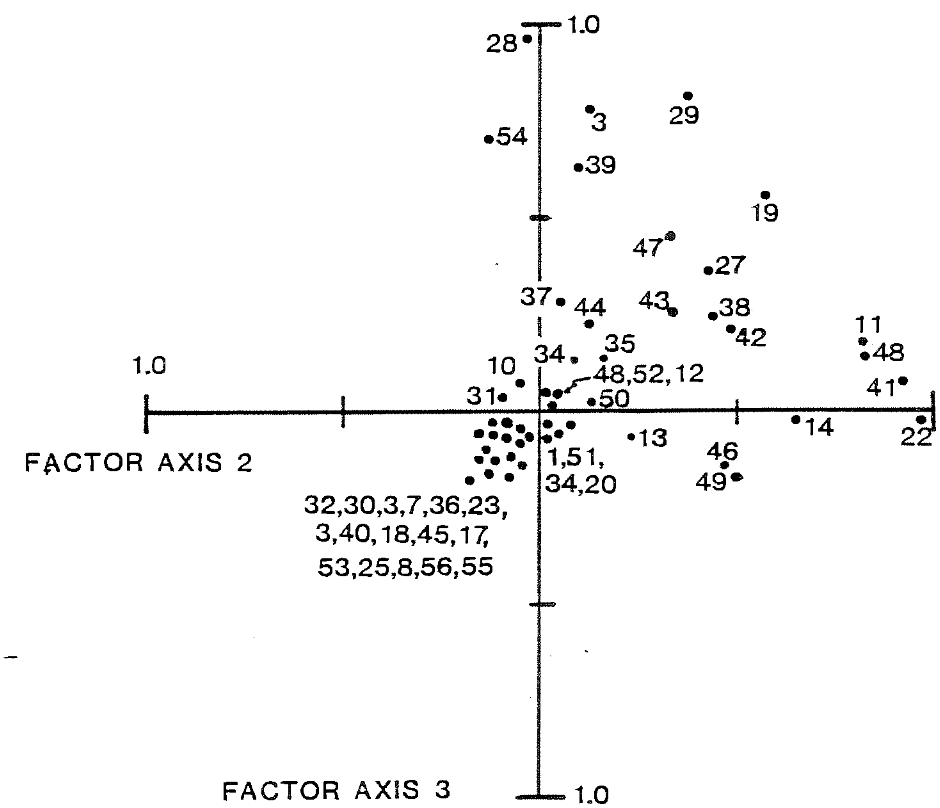
AMCOR 6009B, 6010, 6011 WELLS
Q-MODE FACTOR ANALYSIS



Six axes explain 71% of the variance in the data.
Three axes explain 59% of the variance in the data.

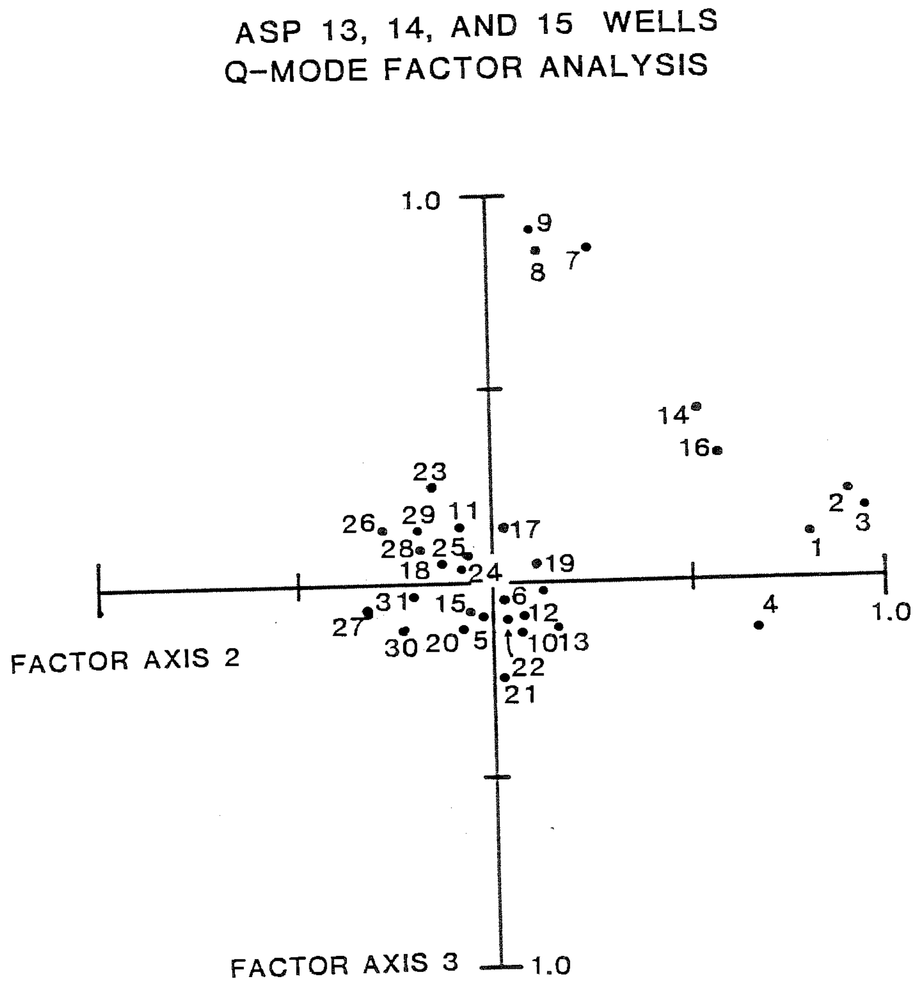
Figure 35

ASP 13, 14, 15 WELLS
R-MODE FACTOR ANALYSIS



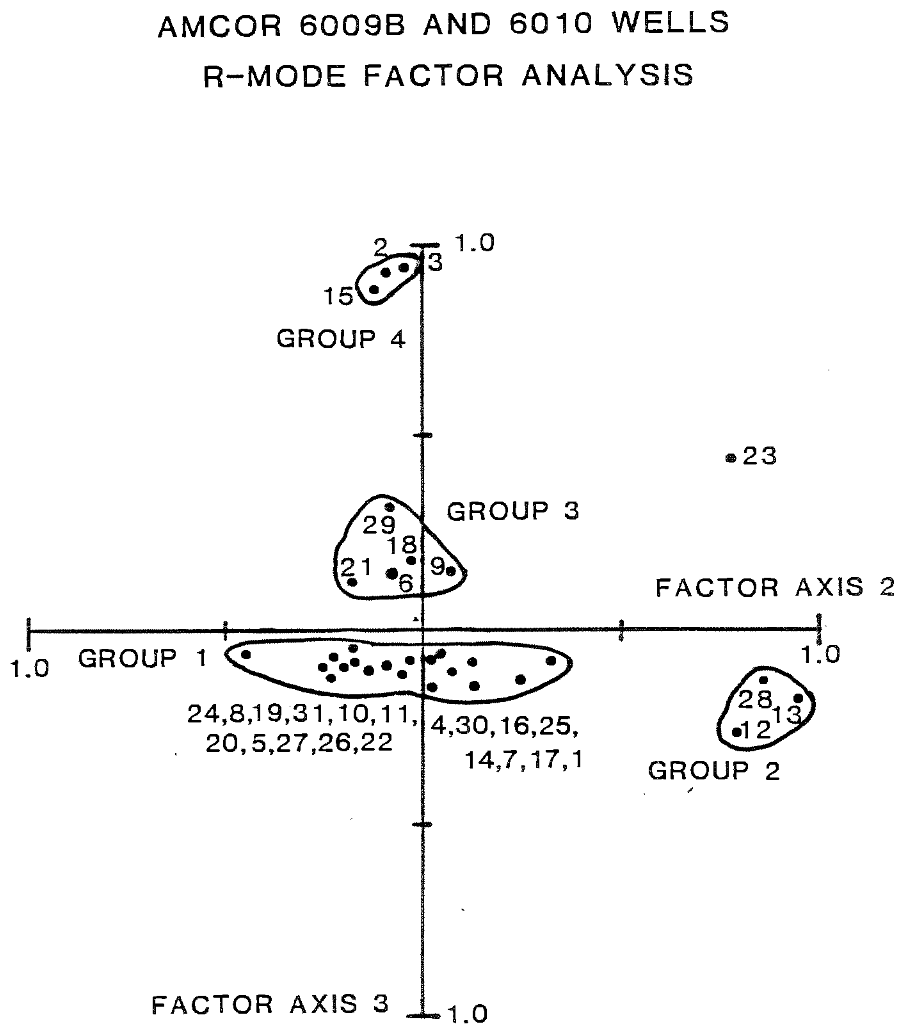
Six axes explain 60% of the variance in the data.
Three axes explain 45% of the variance in the data.

Figure 36



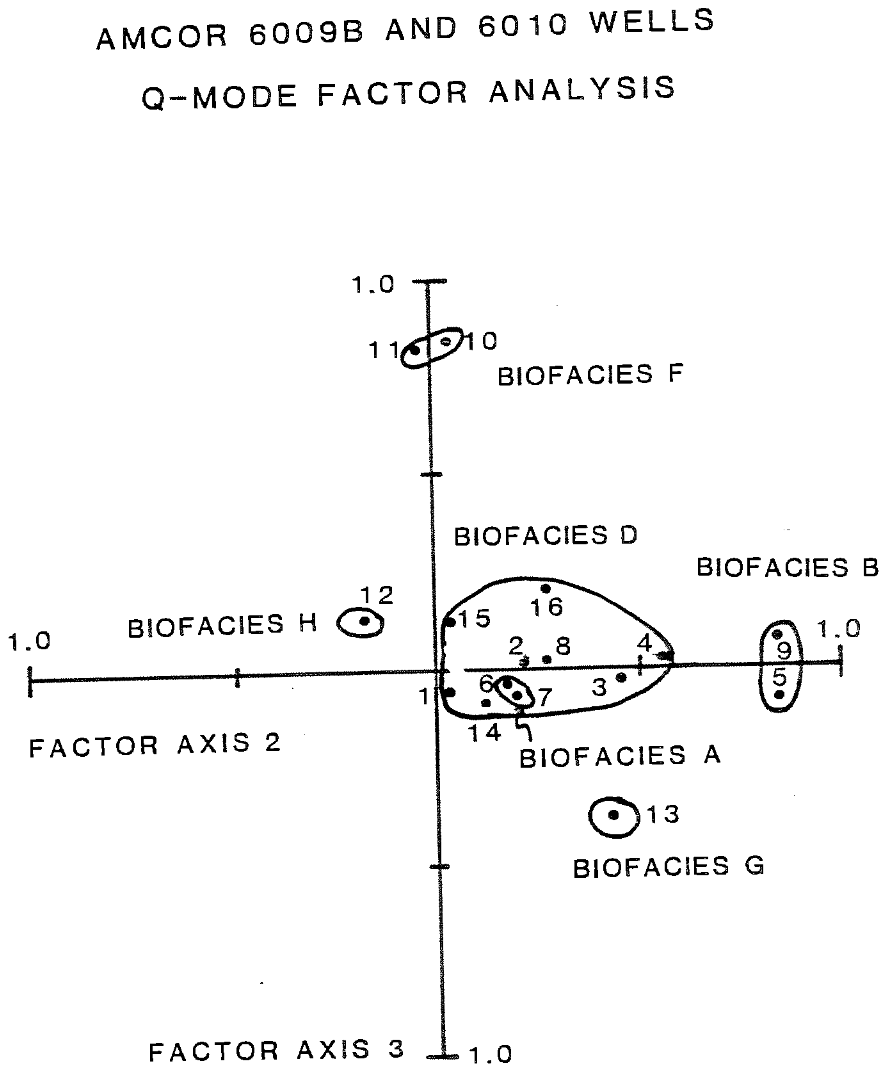
Six axes explain 74% of the variance in the data.
Three axes explain 57% of the variance in the data.

Figure 37



Six axes explain 77% of the variance in the data.
Three axes explain 62% of the variance in the data.

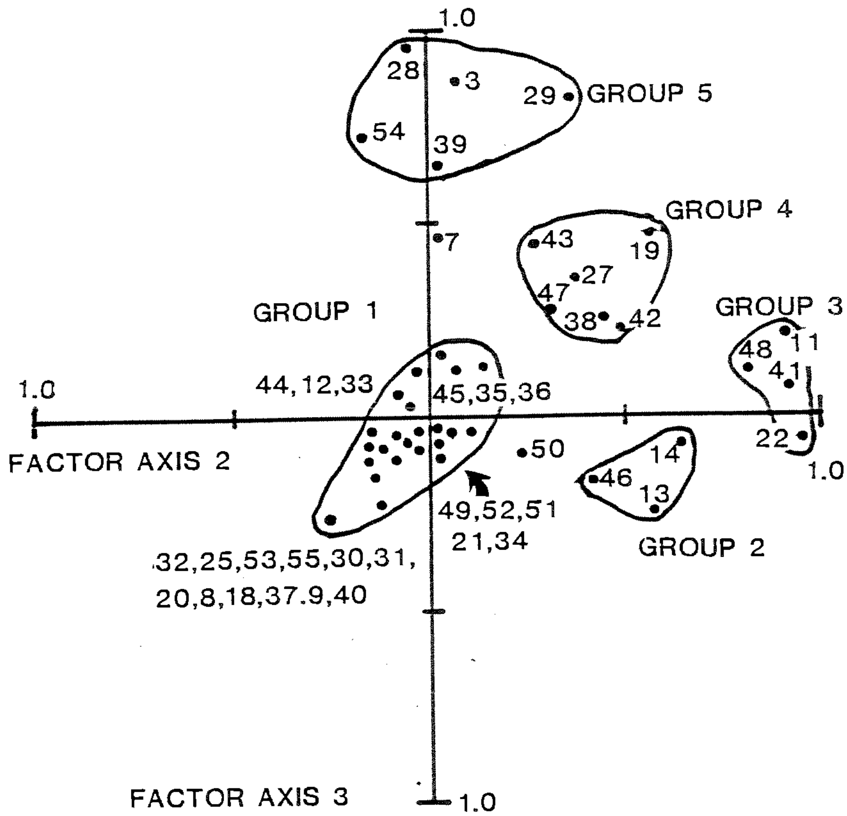
Figure 38



Six axes explain 91% of the variance in the data.
Three axes explain 75% of the variance in the data.

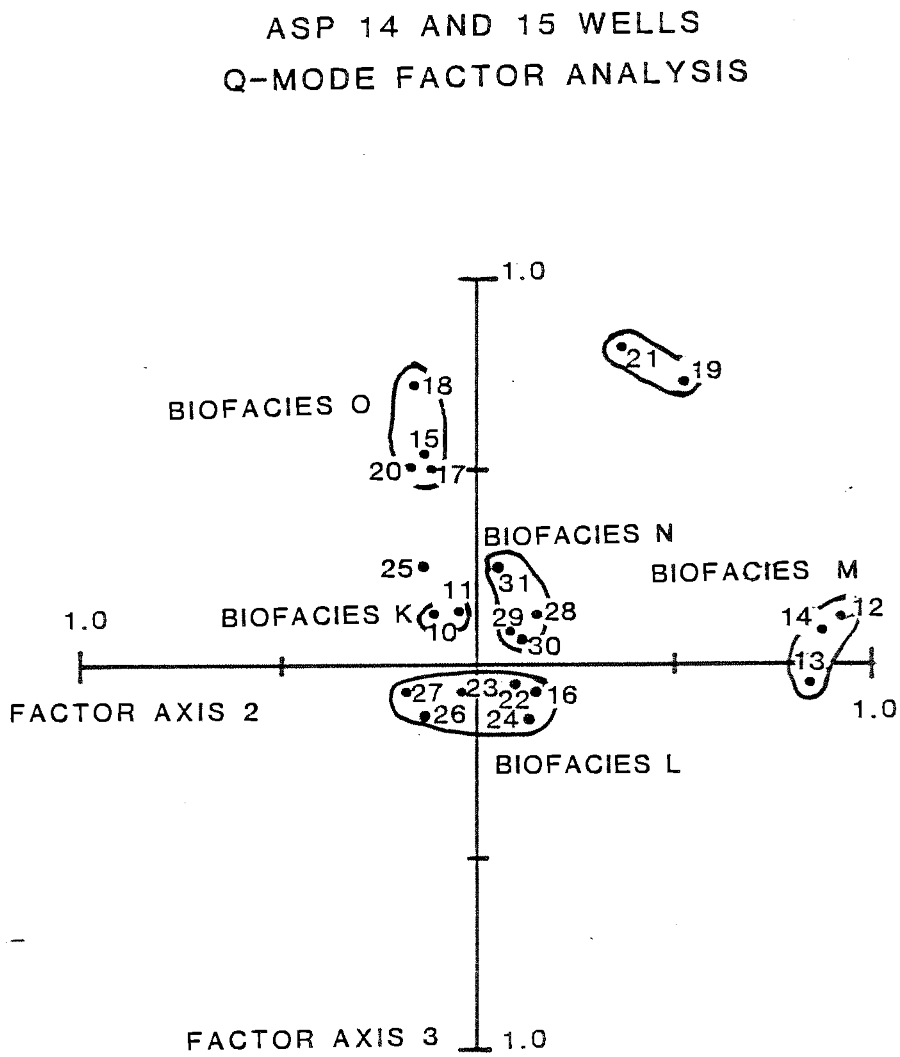
Figure 39

ASP 14 AND 15 WELLS
R-MODE FACTOR ANALYSIS



Six axes explain 76% of the variance in the data.
Three axes explain 52% of the variance in the data.

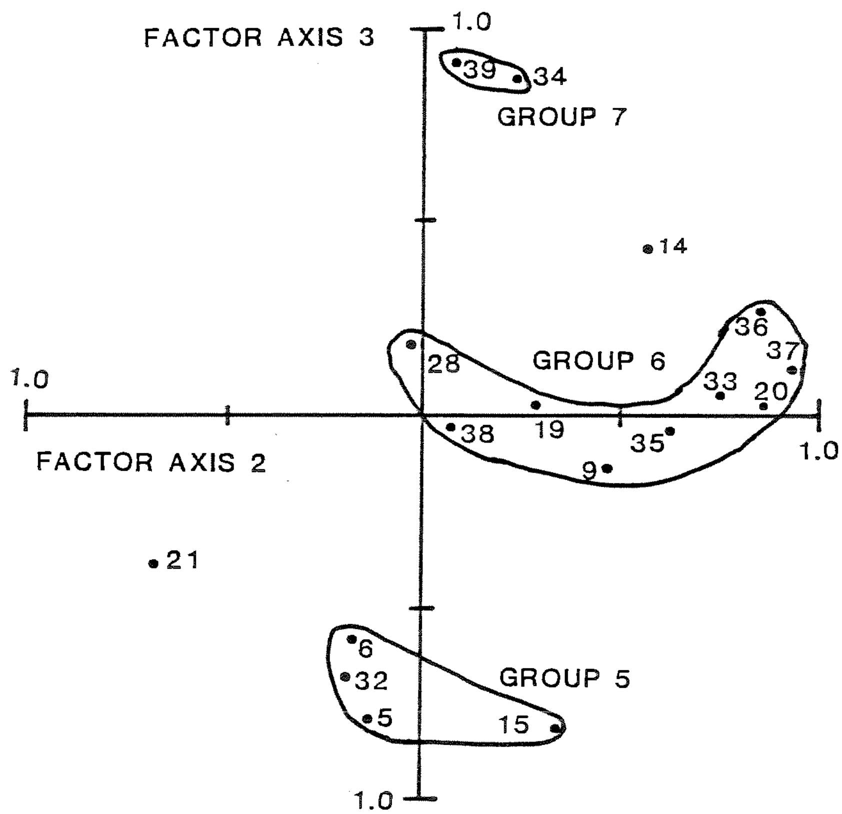
Figure 40



Three axes explain 95% of the variance in the data.

Figure 41

AMCOR 6011 WELL
R-MODE FACTOR ANALYSIS

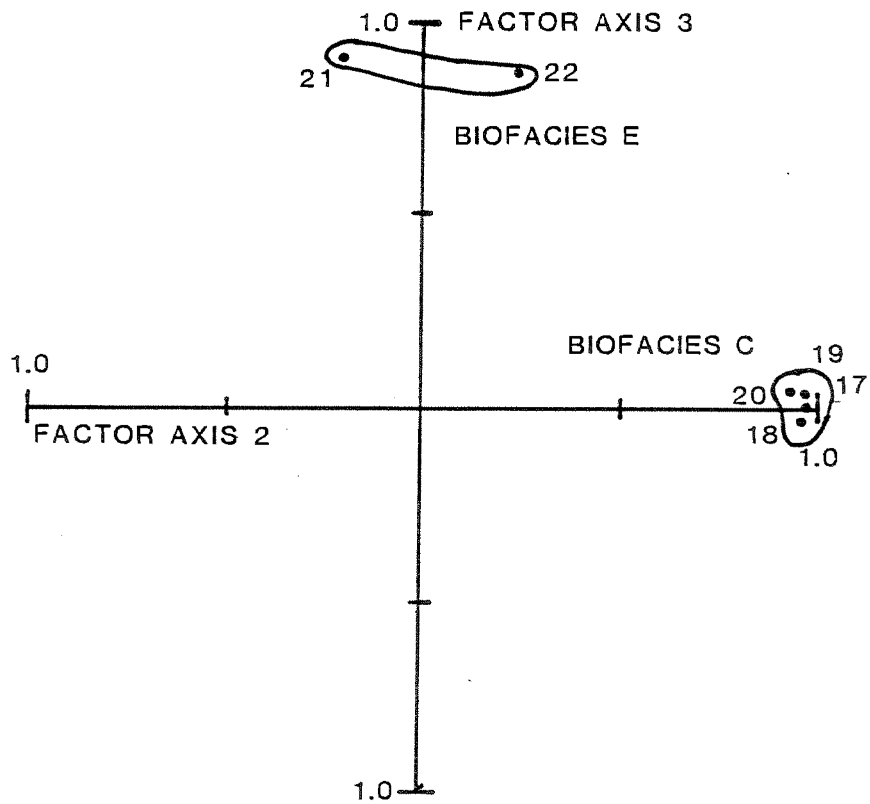


Three axes explain 91% of the variance in the data.

Figure 42

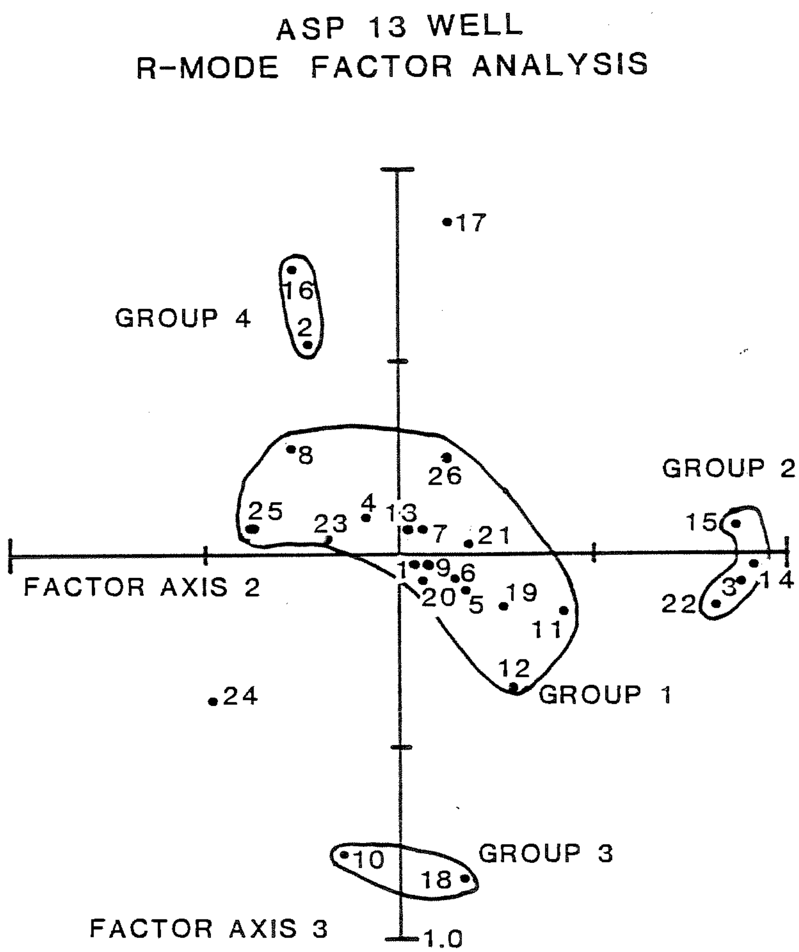
AMCOR 6011 WELL

Q-MODE FACTOR ANALYSIS



Three axes explain 99% of the variance in the data.

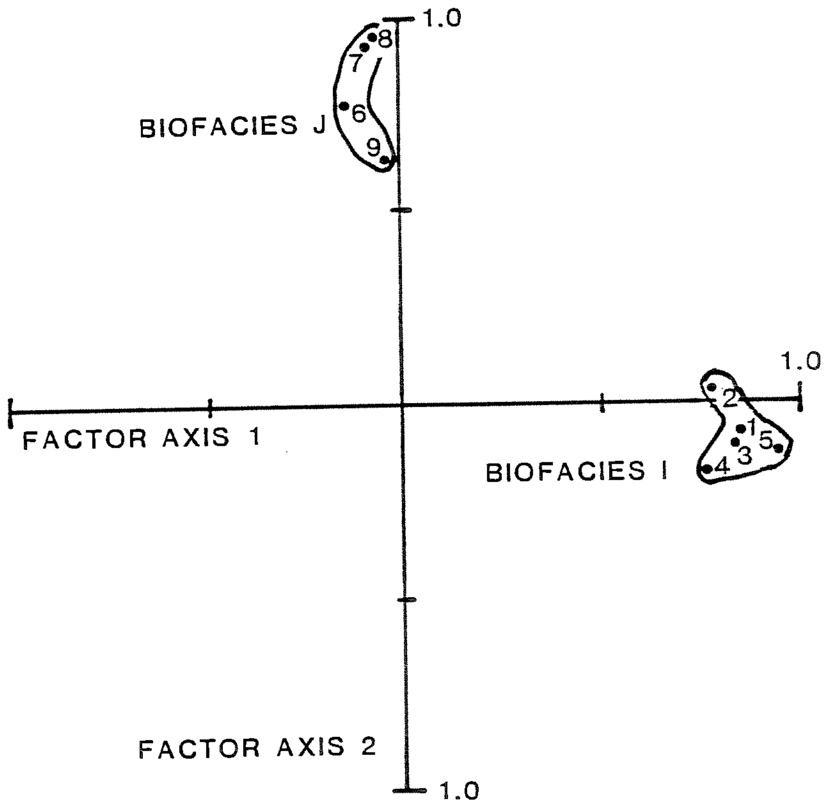
Figure 43



Five axes explain 91% of the variance in the data.
Three axes explain 72% of the variance in the data.

Figure 44

ASP 13 WELL Q-MODE FACTOR ANALYSIS



Five axes explain 93% of the variance in the data.
Three axes explain 82% of the variance in the data.

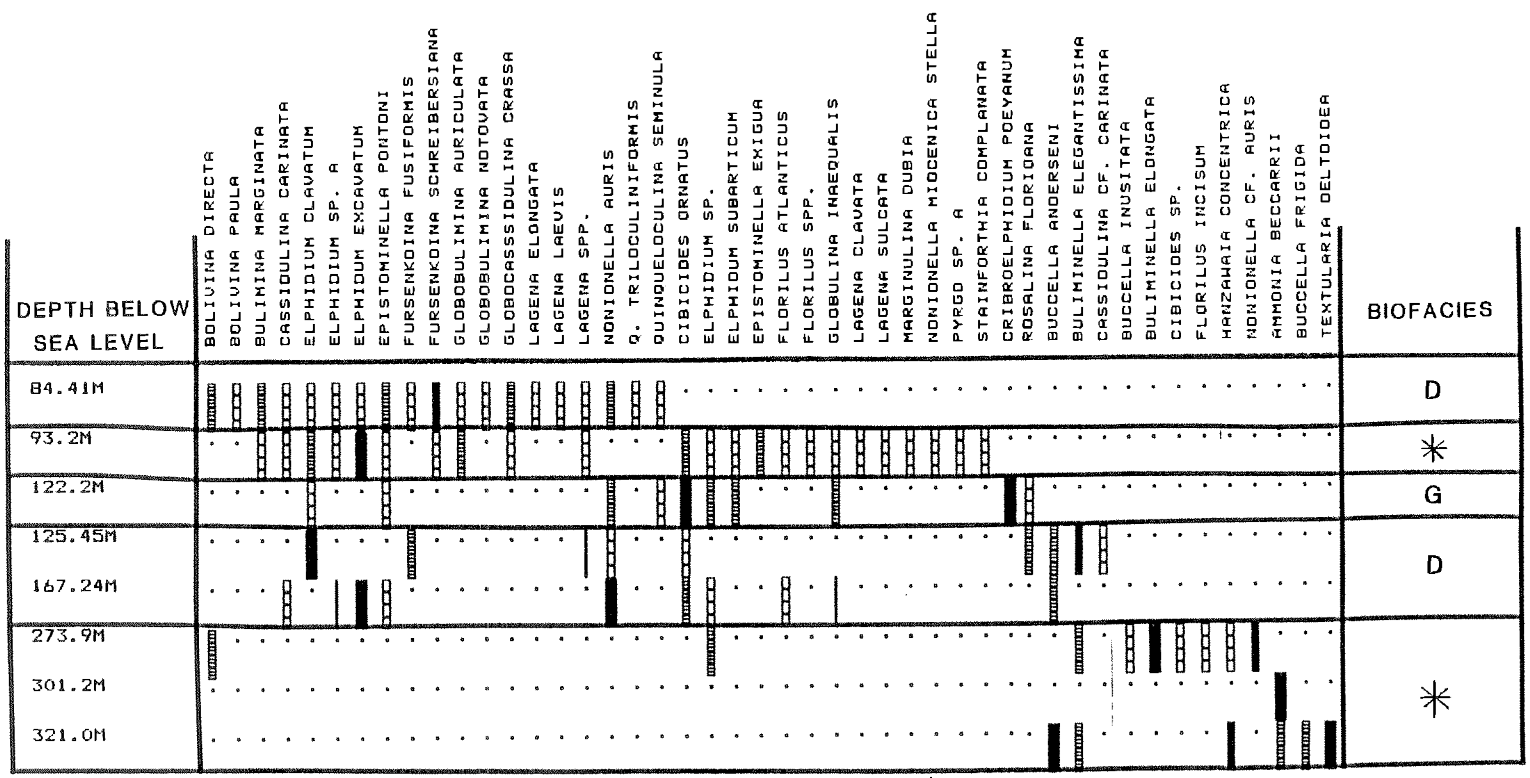
sites were considered separately mainly because Site 334 appears to contain considerable contamination of planktic, and presumably, benthic, species. Due to this, meaningful results could not be obtained. On the other hand, little contamination appears to be present at Site 563 and the use of data from Site 334 would most likely cause a deterioration in the quality of the results obtained at Site 563.

Numerical analysis of the data from the B-3 well did not produce meaningful results. This is probably due to the effects of the downhole displacement noted in the planktic fauna. More meaningful results were obtained by noting the first downhole occurrence of species since this marks the highest stratigraphic position of the species. Large, sudden, downhole decreases in the abundance of a species are considered to be due to caving from higher levels. In this manner assemblages were delineated which were then compared with those identified from core samples.

Visual inspection of the data reveals that many species are commonly occurring forms which are present in many samples and it is the proportion of the fauna that they comprise that varies. Groupings produced by numerical analysis usually contain species which are present in many samples. As a result, in some instances more than one group of species represents a biofacies. The relative importance of each group is a function of the proportion of the fauna which it represents. Diagrams of relative species abundances are helpful in visualizing this and are given in Figures 45-50,55,58. In this study, the groups of species which define a biofacies are given in order of decreasing importance.

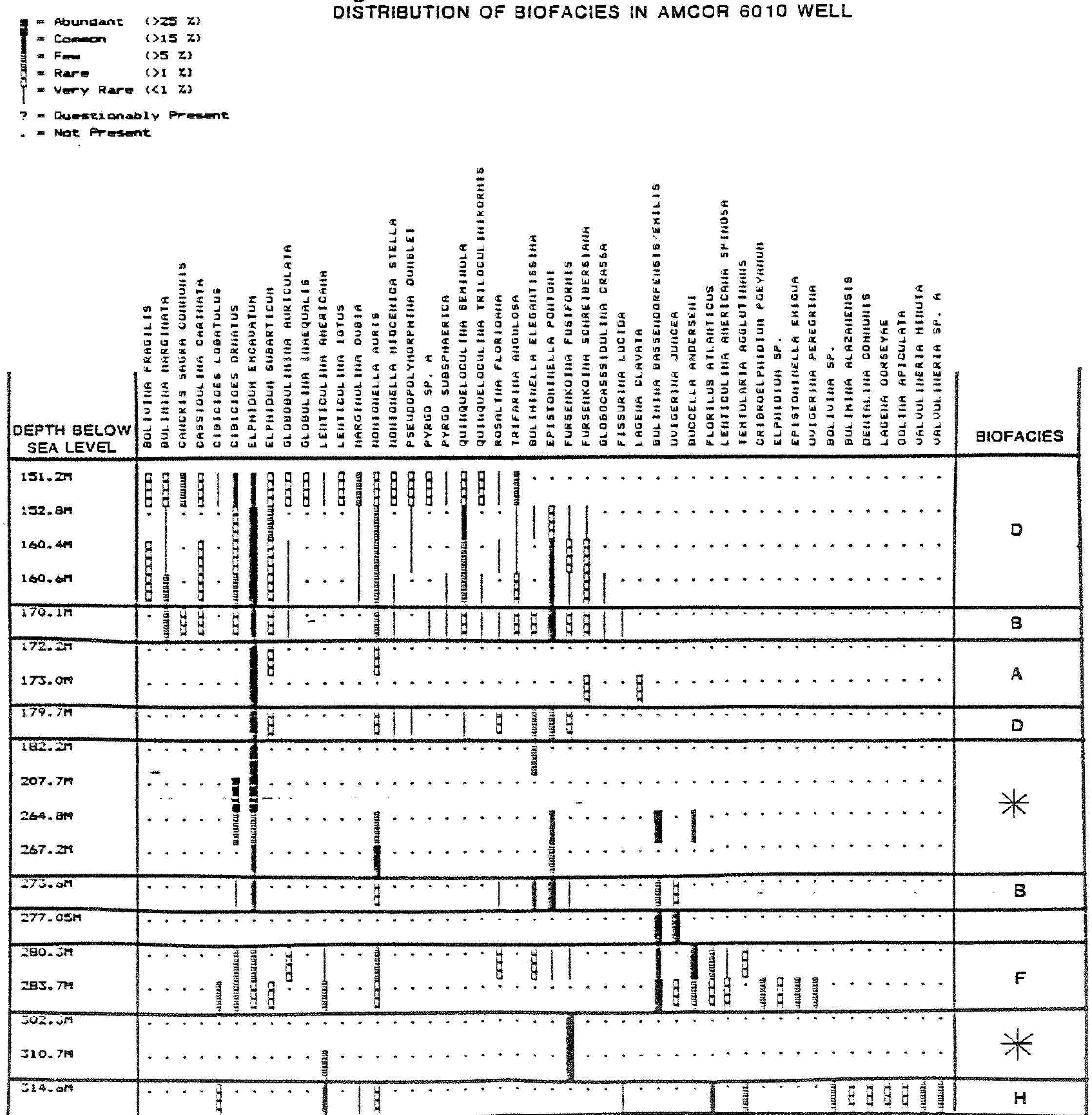
Figure 45. **DISTRIBUTION OF BIOFACIES IN AMCOR 6009B WELL**

= Abundant (>25 %)
= Common (>15 %)
= Few (>5 %)
= Rare (>1 %)
= Very Rare (<1 %)
? = Questionably Present
. = Not Present



SPECIES COMPRISING <1% OF ONLY ONE SAMPLE ARE NOT SHOWN. * CONTAINS TOO FEW SPECIMENS FOR NUMERICAL ANALYSIS.

Figure 46.
DISTRIBUTION OF BIOFACIES IN AMCOR 6010 WELL



SPECIES COMPRISING < 1% OF ONLY ONE SAMPLE ARE NOT SHOWN. ✳ CONTAINS TOO FEW SPECIMENS FOR NUMERICAL ANALYSIS.

Figure 47. DISTRIBUTION OF BIOFACIES IN AMCOR 6011 WELL

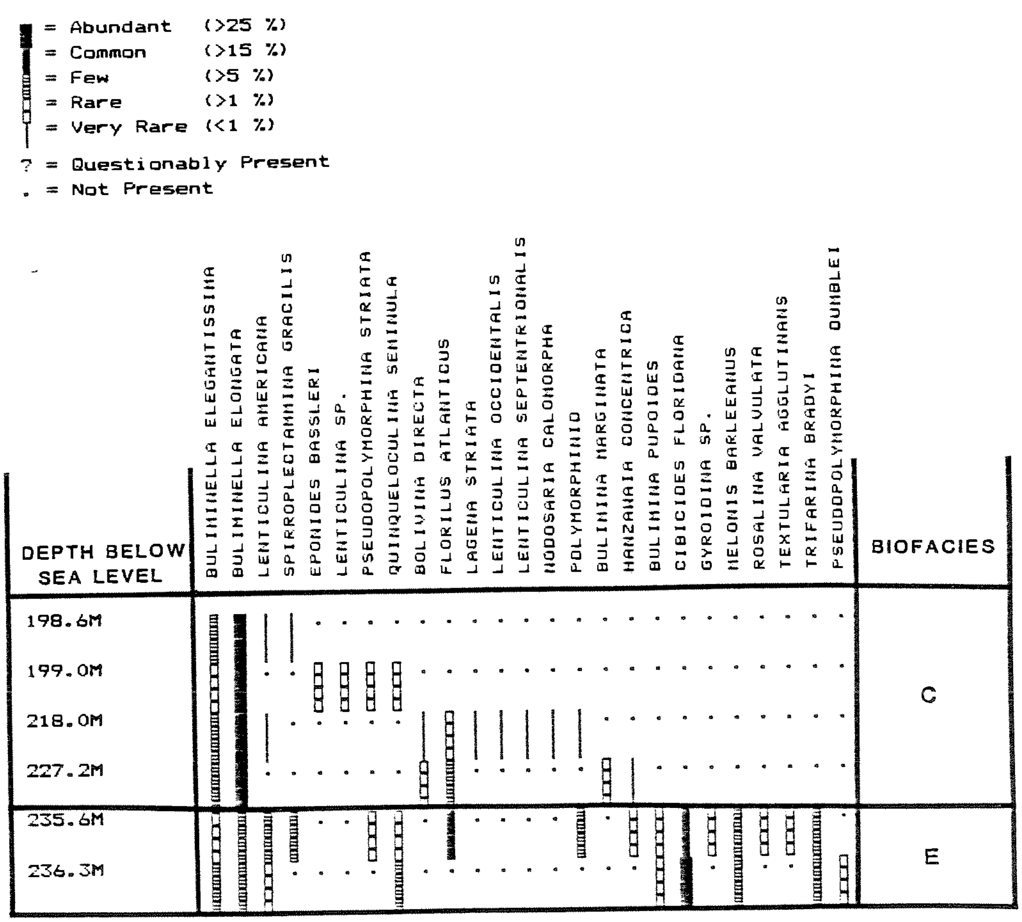
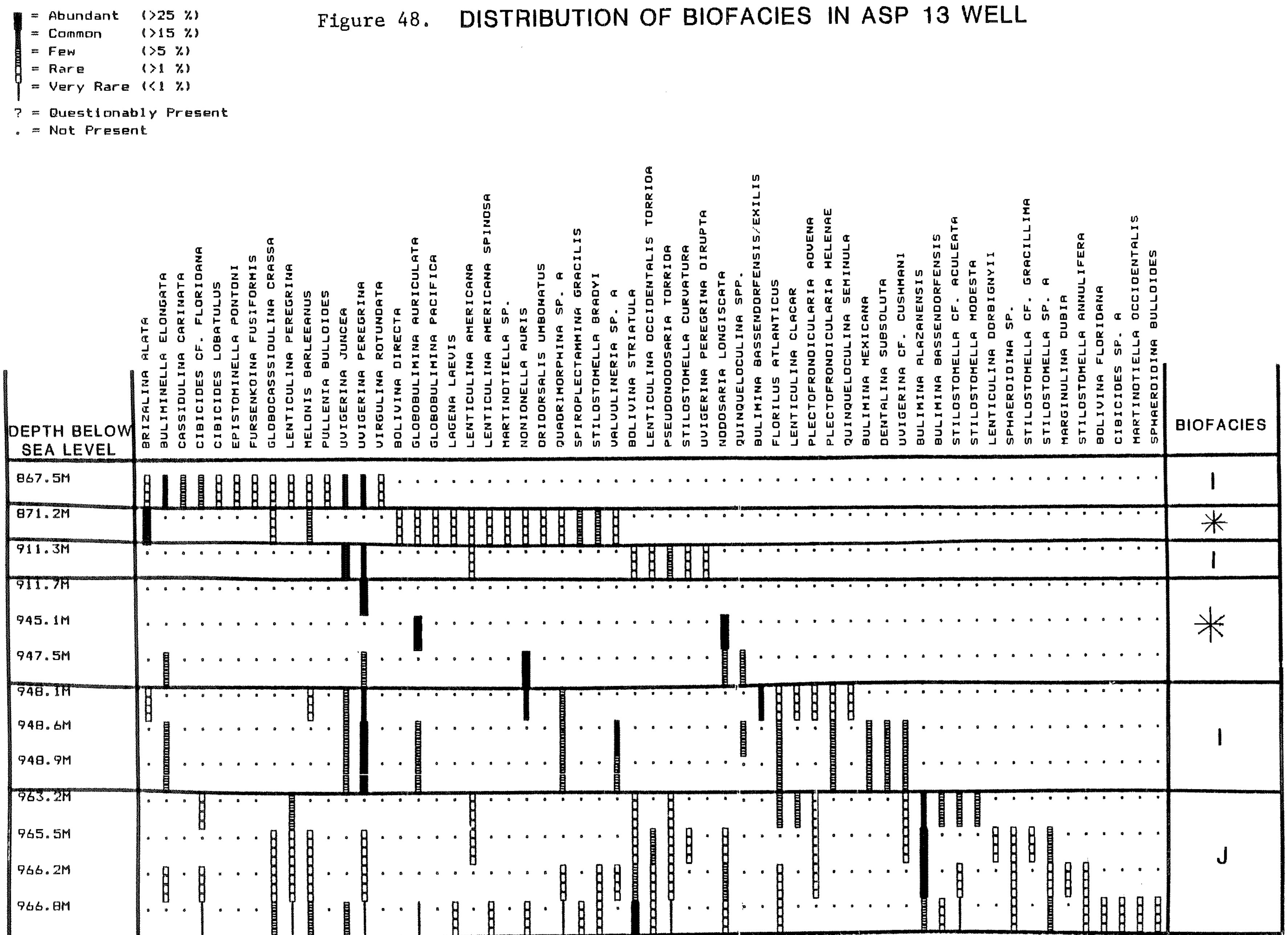


Figure 48. DISTRIBUTION OF BIOFACIES IN ASP 13 WELL



SPECIES COMPRISING < 1% OF ONLY ONE SAMPLE ARE NOT SHOWN. * CONTAINS TOO FEW SPECIMENS FOR NUMERICAL ANALYSIS.

= Abundant
= Common
= Few
= Rare
= Very Rar
?= Questiona
. = Not Pres

DEPTH BELOW SEA LEVEL
1305.4M
1345.8M
1419.1M
1420.2M
142 .2M
1448.9M
1470.2M
1470.9M
1471.5M
1472.2M
1472.7M
1473.2M
1473.8M

= Abundant (>
= Common (>
= Few (>
= Rare (>
= Very Rare (<

? = Questionably
. = Not Present

DEPTH BELOW SEA LEVEL	ASTROHONION FIJIENSIS
1508.8M	
1509.4M	.
1510.0M	.
1511.0M	.
1511.5M	.
1512.1M	.
1513.4M	.
1515.1M	.
1515.4M	.
1529.9M	.
1530.9M	.
1531.7M	.
1532.2M	.

Baltimore Canyon Trough

Biofacies A is comprised almost entirely (95-96%) of Elphidium excavatum (Terquem) (Fig. 46). Associated species include E. subarticum Cushman and rare juvenille forms of Nonionella auris (d'Orbigny) and Fursenkoina schreibersiana (Czjzek) (Fig. 46). This biofacies is present at 172.2m and 173.0m in the 6010 well (Figs. 38,46). and is represented by the species in Group 2 in Figure 37.

Biofacies B is characterized by a dominance of Epistominella pontoni (Cushman) (Fig. 46). Elphidium excavatum and Trifarina angulosa (Williamson) are also characteristic (Fig. 46). Nonionella auris, Cibicides ornatus (Cushman), and Fursenkoina fusiformis (Cushman) are associated species (Fig. 46). Uvigerina peregrina Cushman and Buliminella bassendorfensis Cushman and Parker are sometimes present (Fig. 46). Species in Groups 1 and 2 in Figure 37 represent this biofacies which is present in samples from 170.1m and 273.6m in the 6010 well (Figs. 38,46).

Biofacies C is characterized by a high dominance of Buliminella elongata (d'Orbigny) and lesser numbers of B. elegantissima (d'Orbigny) and Bolivina directa (Cushman) (Fig. 47). Associated species include juvenile Lenticulina americana (Cushman), Cibicides ornatus, and Florilus atlantica (Cushman) (Fig. 47). Samples from 198.6m, 199.0m, 218.0m, and 227.2m in the 6011 well contain this assemblage (Figs. 42,47). Species in Group 1 in Figure 41 represent this biofacies.

Biofacies D is characterized by a dominance of Elphidium excavatum with lesser numbers of Quinqueloculina seminulina (Linnaeus) and Nonionella auris (Figs. 45,46). Associated species include

Cibicides ornatus, Fursenkoina schreibersiana, Epistominella pontoni, Buccella anderseni McLean, and Globobulimina auriculata Cushman (Figs. 45,46). Samples from 151.2m, 152.8m, 160.4m, 160.6m, and 179.7m in the 6010 well and from 93.2m, 125.45m, and 167.26m in the 6009B well contain this biofacies (Figs. 38,45). This biofacies is represented by the species in Groups 2, 1, and 3 in Figure 37.

Biofacies E is characterized by Cibicides ornatus, Trifarina bradyi Cushman, Melonis barleeanus (Williamson), and Buliminella elongata (Fig. 47). Associated species include Globulina inaequalis Reuss, Globocassidulina crassa (d'Orbigny), Quinqueloculina seminulina, and Buliminella elegantissima (Fig. 47). This biofacies is present in samples from 235.6m and 236.3m in the 6011 well (Figs. 42,47). Species in Group 2 in Figure 41 represent this biofacies.

Buliminella bassendorfensis, Florilus atlantica, and Buccella anderseni characterize Biofacies F (Fig. 38). Associated species include Cibicides ornatus Lenticulina americana, and Elphidium excavatum (Fig. 38). Species in Group 4 in Figure 37 represent this biofacies. It is present in samples from 280.3m and 283.7m in the 6010 well (Figs. 38,46).

Fursenkoina schreibersiana, Bulimina marginata d'Orbigny, and Globocassidulina crassa characterize Biofacies G (Fig. 45). Associated species include Bolivina directa, Nonionella auris, and Epistominella pontoni (Fig. 45). Species in Group 1 in Figure 37 represent this biofacies. It is present in a sample from 84.41m in the 6009B well (Figs. 38,45).

Lenticulina americana, Florilus atlantica, and two species not used in the numerical analyses, Textularia agglutinans d'Orbigny, and

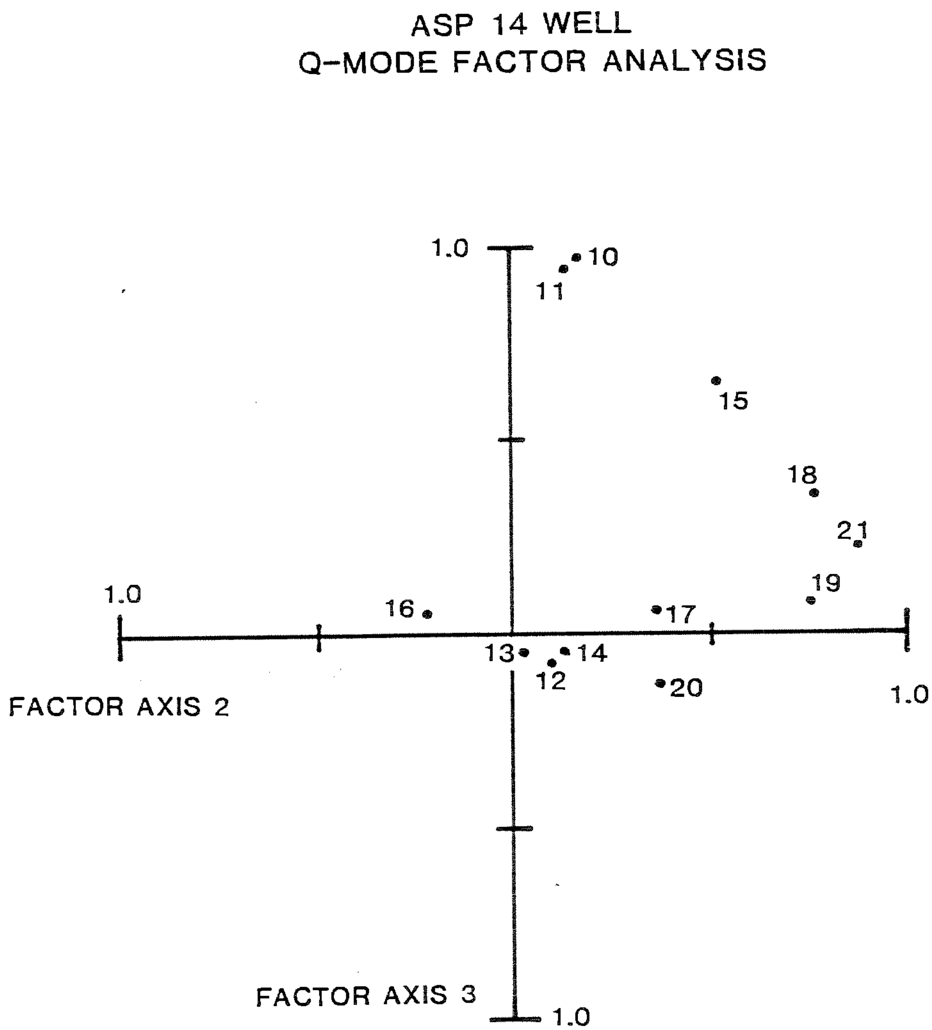
Bolivina sp. 1. characterize Biofacies H (Fig. 46). Valvulineria minuta (Schubert) and Lagena dorseyae McLean, also not used in the analyses, and Nonionella auris are associated species (Fig. 46). Species in Group 3 in Figure 37 represent this biofacies. It is present in a sample from 314.6m in the 6010 well (Figs. 38,46).

Uvigerina juncea Cushman and Todd and U. peregrina characterize Biofacies I (Fig. 48). Associated species include Quadrimorphina sp., Melonis barleeanus, Florilus atlantica, and Buliminella elongata (Fig. 48). Species number 17 and 24 and species in Group 1 in Figure 43 represent this biofacies. Samples from 867.5m, 911.3m, 948.1m, 948.6m, and 948.9m in the ASP 13 well contain this biofacies (Figs. 44,48).

Biofacies J is characterized by Bulimina alazanensis Cushman, Bolivina striatula Cushman, and Pseudonodosaria torrida (Cushman) (Fig. 48). Associated species include Globocassidulina crassa, Nodosaria longiscata d'Orbigny, Lenticulina torrida (Cushman), Melonis barleeanus, and Stilostomella sp. 1 (Fig. 48). Species in Groups 2, 1, and 3 in Figure 43 represent this biofacies. It is present in samples from 963.2m, 965.5m, 966.2m, and 966.8m in the ASP 13 well (Figs. 44,48).

A high dominance of Uvigerina auberiana d'Orbigny, and moderate numbers of Stilostomella bradyi (Cushman) and Buliminella bassendorfensis characterize Biofacies K (Fig. 49). Buliminella elongata, Bolivina directa, Bulimina alazanensis, and Bulimina striata mexicana Cushman are associated species (Fig. 49). Group 1 in Figure 39 contains the species which represent this biofacies. It is present in samples from 1305.4m and 1345.8m in the ASP 14 well (Figs. 40,49).

Figure 51



Five axes explain 91% of the variance in the data.
Three axes explain 77% of the variance in the data.

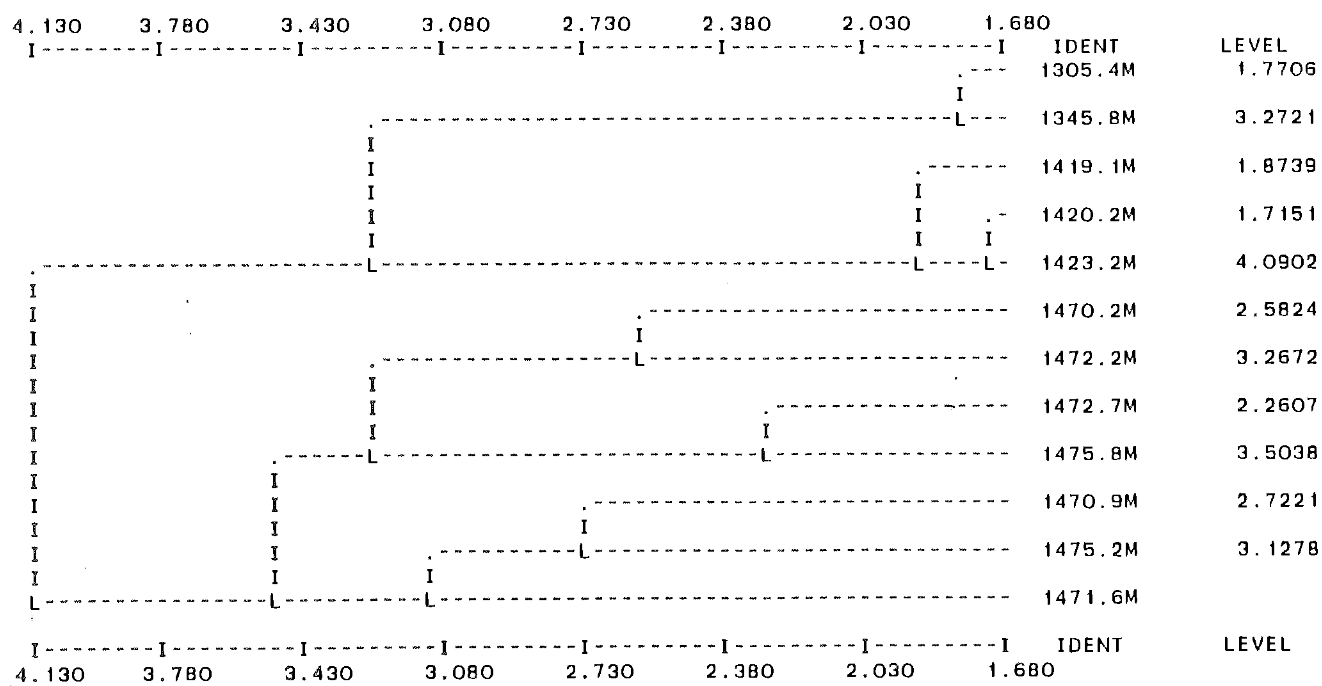


Figure 52 ASP 14 O-Mode Cluster Analysis,

$r_c = 0.822$

Analysis of the ASP 14 well by itself indicates that the sample from 1470.2m (sample 15) has affinities to Biofacies K (samples 10,11) (Figs. 51,52). It is also dominated by Uvigerina auberiana, but to a lesser extent (Fig. 49). Other important species include Stilostomella curvatura (Cushman) and Sphaeroidina bulloides d'Orbigny (Fig. 49).

Biofacies L is characterized by malformed specimens of Karrerriella bradyi (Cushman) as well as Melonis barleeanus, and Trifarina bradyi (Fig. 50). Associated speces include Nodosaria longiscata, Sphaeroidina bulloides, Stilostomella sp. A, Globobulimina auriculata, Epistominella vitrea Parker, Chilostomella oolina Schwager, Uvigerina auberiana and U. peregrina (Fig. 50). Species in Groups 1 and 2 in Figure 39 represent this biofacies. It is present in samples from 1508.8m, 1509.4m, 1510.0m, 1511.0m, 1511.5m, and 1512.1m in the ASP 15 well (Figs. 40,50). A sample from 1470.9m in the ASP 14 well appears to be associated with this biofacies (Fig. 40). However, based on lithologic and paleontologic characteristics the sample appears to represent a mass flow deposit and may contain a displaced shallow water fauna. Thus, its placement may not be significant.

Well developed specimens of Uvigerina spinicostata Cushman and Jarvis, Bulimina alazanensis, B. striata mexicana, B. striata d'Orbigny, and Pseudonodosaria torrida characterize Biofacies M (Fig. 49). Associated species include Stilostomella sp. 1, Stilostomella curvatura, and Nodosaria longiscata (Fig. 49). Species in Groups 5 and 1 in Figure 39 represent this biofacies. It is present in samples from 1419.1m, 1420.2m, and 1423.2m in the ASP 14 well (Figs. 40,49).

69

Uvigerina auberiana, Stilostomella curvatura, and Melonis barleeanus characterize Biofacies N (Fig. 50). Associated species include Uvigerina spinicostata, Trifarina bradyi, Nodosaria longiscata, and Pullenia bulloides (d'Orbigny) (Fig. 50). Species in Groups 1 and 2 in Figure 39 represent this biofacies. It is present in samples from 1529.9m, 1530.9m, 1531.7m, and 1532.2m in the ASP 15 well (Figs. 40,50).

Sphaeroidina bulloides, Uvigerina auberiana and Bulimina alazanensis characterize Biofacies O (Fig. 49). Associated species include Stilostomella curvatura, S. sp. cf. S. aculeata Cushman and Jarvis, and Anomalinoides pseudogrosserugosa Tjalsma, Martinotiella communis (d'Orbigny), Melonis pompilioides (Fitchel and Moll), and Stilostomella subspinosa (Cushman) (Fig. 49). Species in Groups 4, 5, 3, and 1 in Figure 39 represent this biofacies. Samples from 1471.6m, 1472.2m, 1472.7m, 1475.2m, and 1475.8m in the ASP 14 well contain this biofacies (Figs. 40,49). The samples from 1472.7m and 1475.8m contain greater numbers of Bulimina alazanensis and Uvigerina spinicostata than do the remaining samples and appear to have somewhat distinct groups for this reason (Figs. 40,49). However, overall faunal similarities between all these samples indicate that they comprise one biofacies (Fig. 49, Appendices 3,4).

Western North Atlantic Basin

At DSDP Site 563 numerical analysis reveals the presence of a gradient between the assemblage present in the lower portion of the well and that present in the upper portion (Figs. 53,54,56,57). Visual analysis of the data reveals that many of the commonly occurring species range throughout the well while a smaller number

TABLE 7

LIST OF SPECIES USED IN NUMERICAL ANALYSIS - DSDP SITE 563

#	SPECIES	ABBREVIATION
1	Anomalinoides pseudogrosserugosa	Ano.pse.
2	Bolivina huneri	Bol.hun.
3	Bolivina tectiformis	Bol.tec.
4	Buliminella grata	Bul.gra.
5	Bulimina alazanensis	Bul.ala.
6	Cibicides bradyi	Cib.bra.
7	Cibicidoides havanensis	Cib.hav.
8	C. mundulus	Cib.mun.
9	C. tuxpamensis	Cib.tux.
10	Dentalina sp. A	Den.sp A
11	Eggerella bradyi	Egg.bra.
12	Ehrenbergina trigona	Ehr.tri.
13	Epistominella exigua	Epi.exi.
14	Fissurina cf. radiata	Fis c ra
15	F. wiesneri	Fis.wie.
16	Gavelinella semicribrata	Gav.sem.
17	G. micra	Gav.mic.
18	Globocassidulina subglobosa	Glo.sub.
19	Gyroidinoides neosoldanii	Gyr.neo.
20	G. sp. A	Gyr sp A
21	G. sp. B	Gyr sp B
22	Karreriella bradyi	Kar.bra.
23	K. monumentensis	Kar.mon.
24	Latacarinina pauperata	Lat.pau.
25	Melonis barleeanus	Mel.bar.
26	M. pompilioides	Mel.pom.
27	Nuttalides umbonifera	Nut.umb.
28	Oridorsalis tener tener	Ori.ten.
29	O. tener umbonatus	Ori.umb.
30	Planulina wuellerstorfi	Pla.wue.
31	Pleurostomella sp. A	Ple sp A
32	P. tenuis	Ple.ten.
33	Pullenia bulloides	Pul.bul.
34	P. quinqueloba/bulloides	Pul.q/b.
35	P. quinqueloba	Pul.qui.
36	Stilostomella aculeata	Sti.acu.
37	S. antillea	Sti.ant.
38	S. curvatura	Sti.cur.
39	S. gracillima	Sti.gra.
40	S. subspinosa	Sti.sub.
41	Vulvulina spinosa	Vul.spi.

TABLE 8

LIST OF SAMPLES USED IN NUMERICAL ANALYSIS - DSDP SITE 563

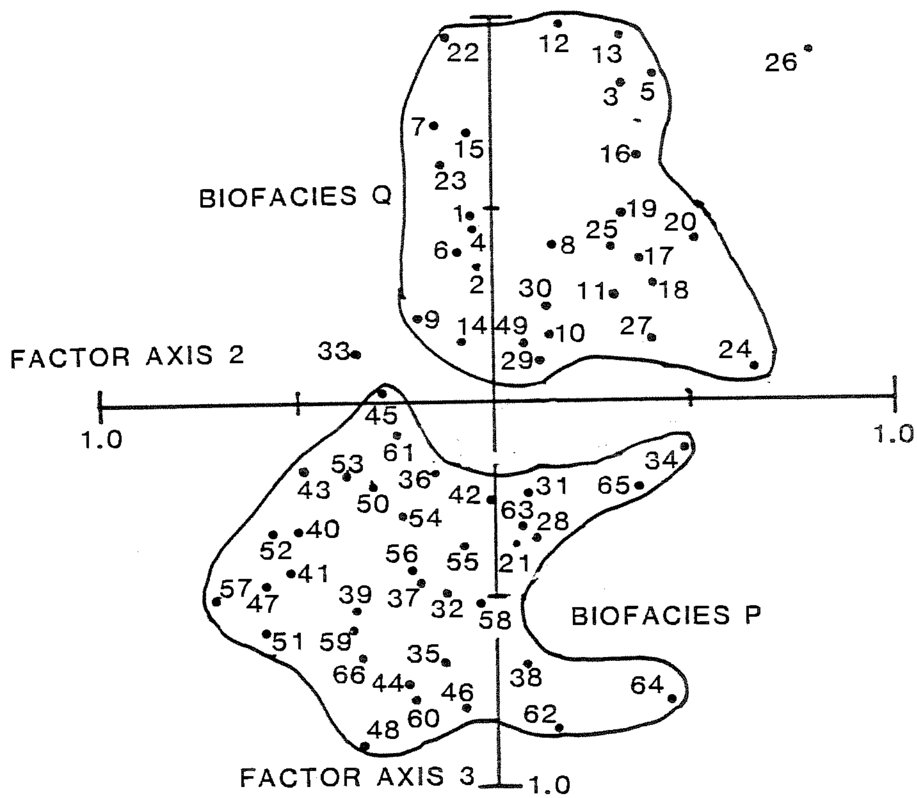
SAMPLE #	DEPTH (METERS SUB-BOTTOM)
1	166.05
2	166.80
3	175.55
4	185.05
5	185.80
6	186.63
7	187.38
8	188.21
9	189.79
10	194.55
11	195.30
12	196.88
13	198.46
14	200.04
15	201.62
16	202.45
17	203.20
18	204.05
19	204.80
20	205.63
21	210.37
22	213.55
23	216.71
24	219.04
25	222.20
26	223.05
27	224.63
28	229.37
29	230.95
30	232.55
31	236.46
32	238.04
33	239.62
34	241.20
35	242.05
36	244.38
37	245.96
38	248.37
39	249.95
40	251.55
41	252.30
42	255.46
43	256.29
44	257.87
45	261.05
46	266.54
47	267.37
48	270.00

TABLE 8 (continued)

LIST OF SAMPLES USED IN NUMERICAL ANALYSIS - DSDP SITE 563

SAMPLE #	DEPTH (METERS SUB-BOTTOM)
49	277.92
50	280.05
51	280.80
52	281.63
53	283.21
54	286.37
55	289.55
56	291.13
57	292.71
58	294.29
59	295.87
60	296.62
61	297.45
62	299.05
63	302.21
64	302.96
65	303.79
66	304.54

Figure 53. DSDP SITE 563
Q-MODE FACTOR ANALYSIS



Six axes explain 73% of the variance in the data.
Three axes explain 60% of the variance in the data.

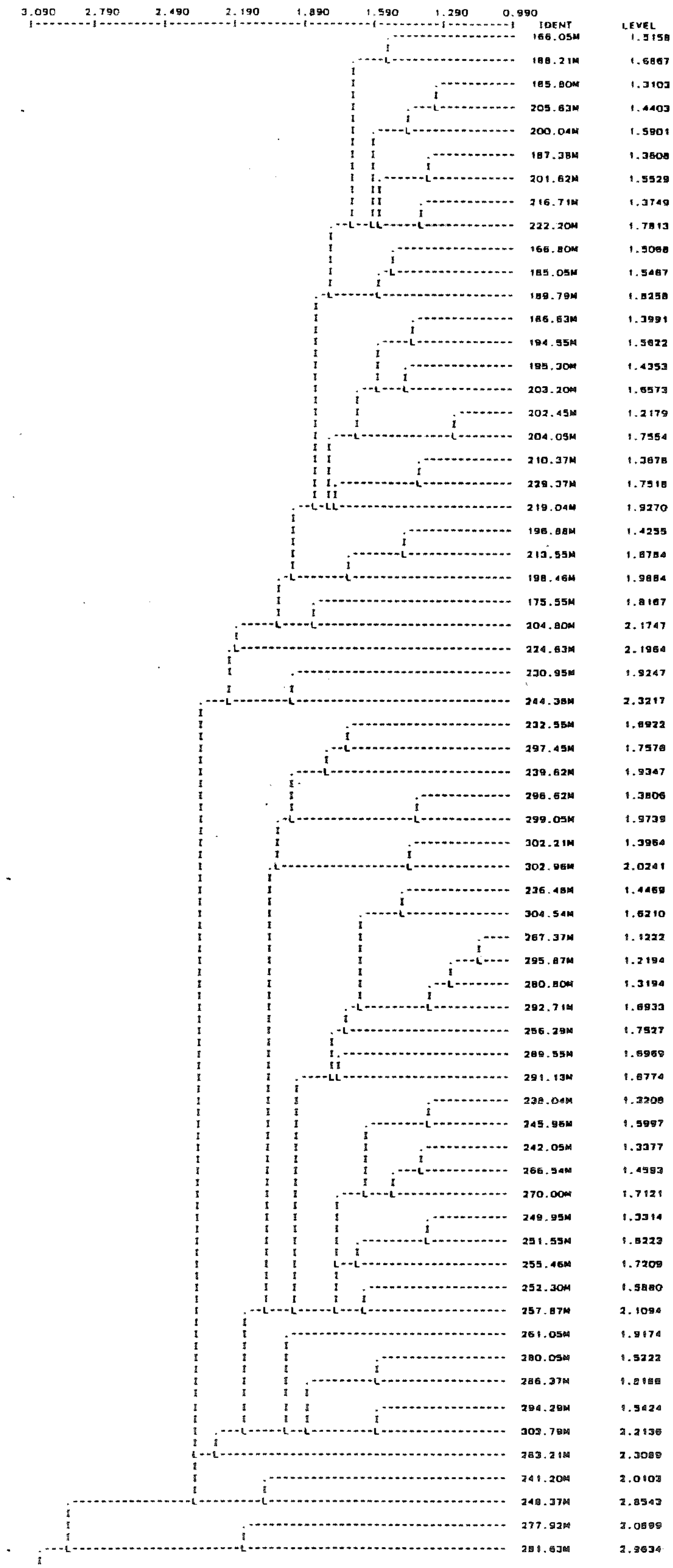


Figure 54 DSDP Site 563 Q-Mode Cluster Analysis
$r_c = 0.763$

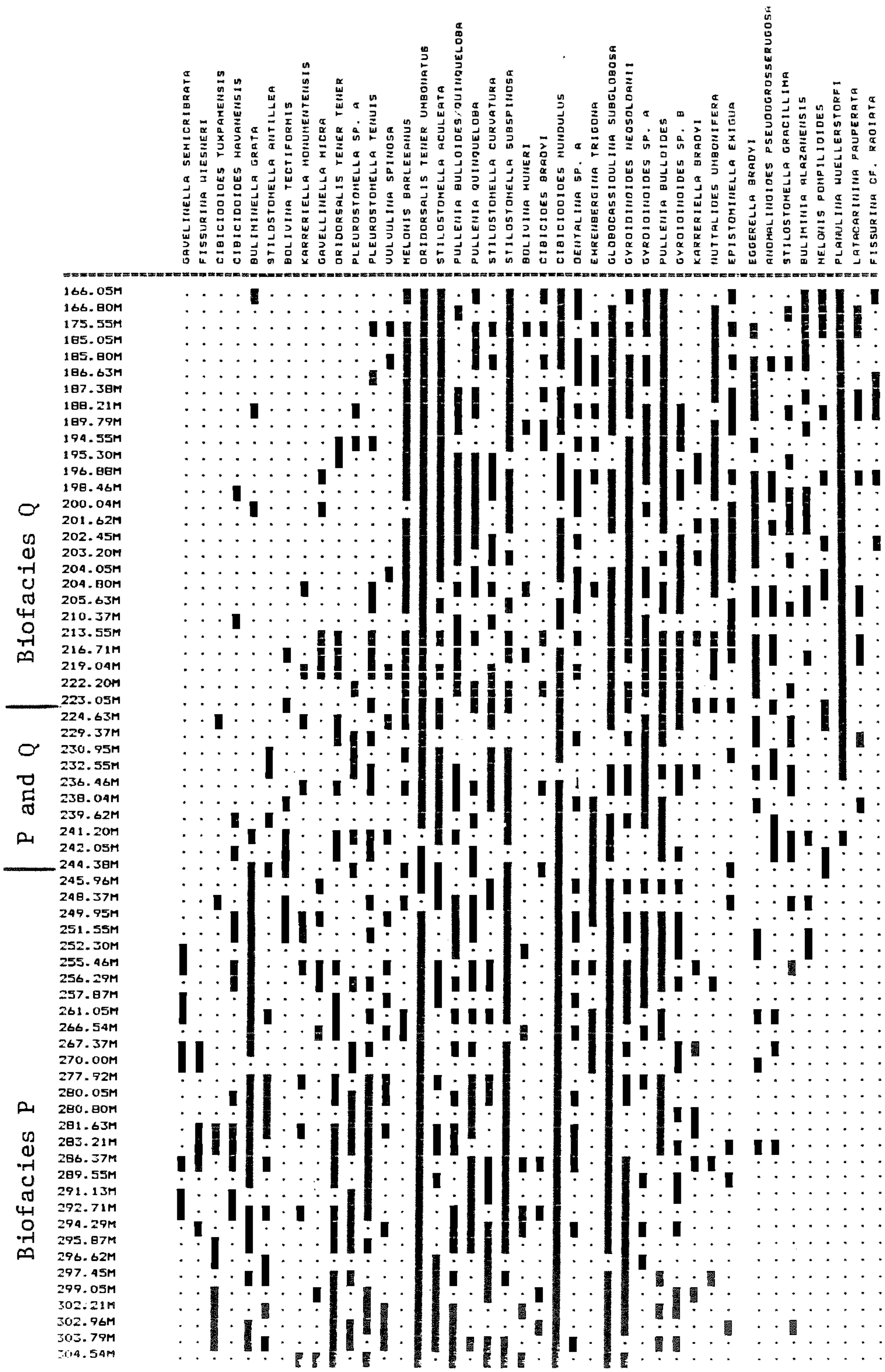


Figure 55. Distribution of commonly occurring benthic foraminifera at DSDP Site 563.

characterize either the upper or lower portion of the well (Fig. 55). This change appears to occur over an interval of approximately twenty to twentyfive meters (Fig. 55).

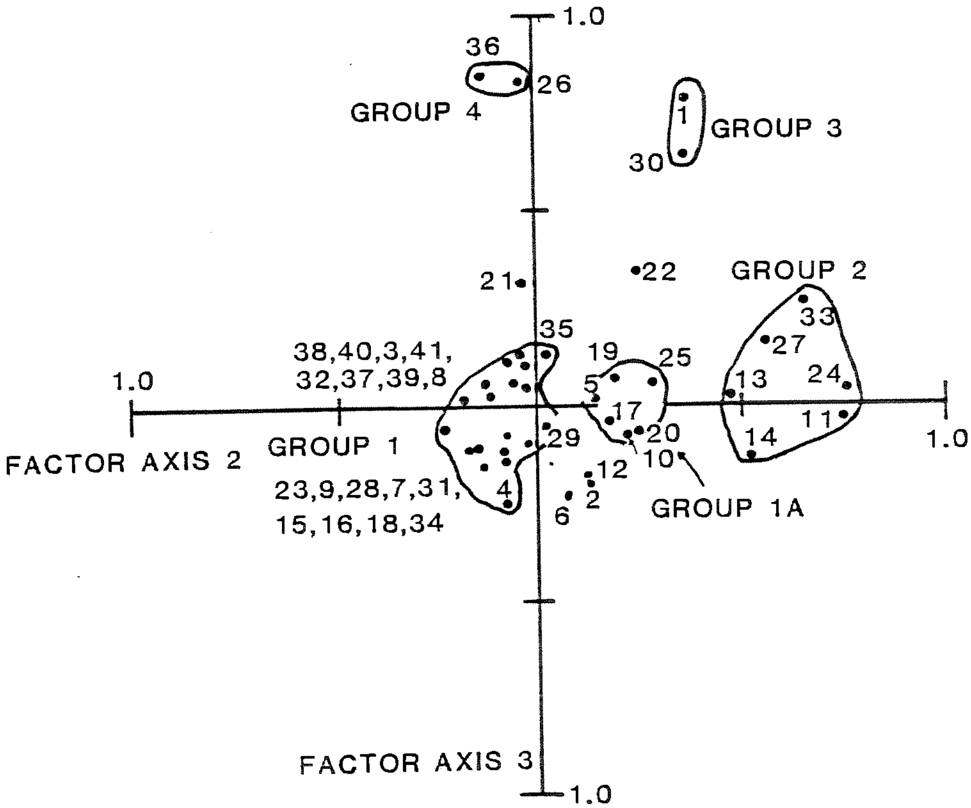
Biofacies P is characterized by Buliminella grata Parker and Bermudez, Oridorsalis tener tener (Brady), Pleurostomella tenuis Hankten, and Pleurostomella sp. A (Fig. 55). Associated species include Cibicidoides havanensis (Cushman and Bermudez), Gavelinella semicribrata (Beckmann), Bolivina tectiformis, and Karrerriella chapapotensis monumentensis Mallory (Fig. 55). Species in Groups 1A, 2, 3, and 4 in Figure 56 represent this biofacies. It is present in samples from 304.54m to 245.96m (Figs. 53,55).

Biofacies Q is characterized by Planulina wuellerstorfi (Schwager), Eggerella bradyi (Cushman), Nuttalides umbonifera (Cushman), and Epistominella exigua (Brady) (Fig. 55). Associated species include Laticarinina pauperata (Parker and Jones), Anomalinoides pseudogrosserugosa, Melonis pompilioides, and Fissurina sp. cf. F. radiata Seguenza (Fig. 55). Species in Group 1 in Figure 56 represent this biofacies. It is present from 222.20m to 166.05m (Figs. 53,55).

An assemblage comprised of components of Biofacies Q and P is present between 244.38m and 223.05m (Figs. 53,55). This represents the upper l.l. Praeorbulina glomerosa Zone through l.l. Globorotalia fohsi fohsi Zone.

Numerical analysis of benthic foraminiferal population data from Site 334 did not produce meaningful results. Apparently, the contamination noted in the planktic assemblages is also present in the benthic assemblages. This interpretation is supported by the findings

Figure 56. R-MODE FACTOR ANALYSIS DSDP SITE 563



Six axes explain 47% of the variance in the data.
Three axes explain 32% of the variance in the data.

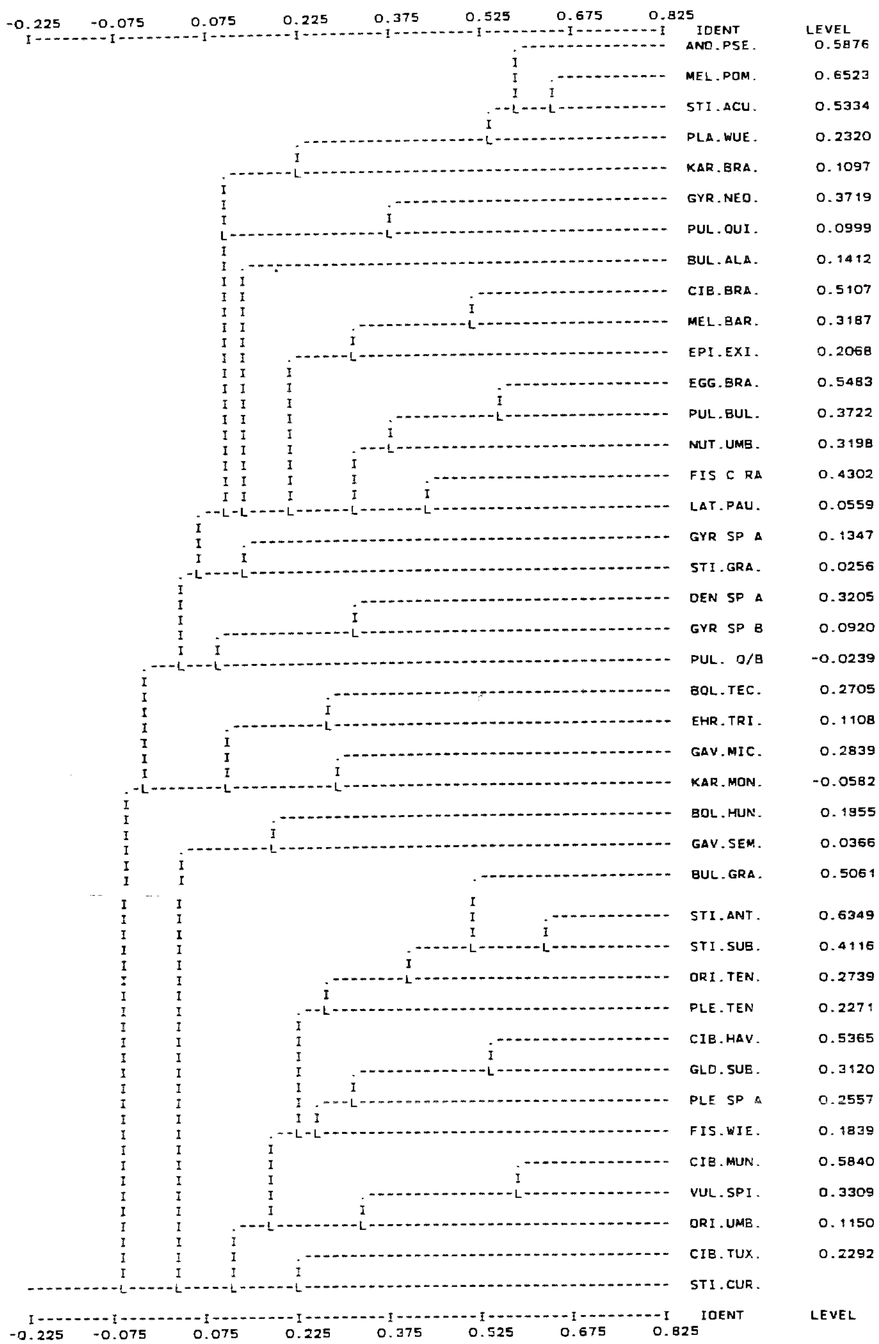


Figure 57 DSDP Site 563 R-Mode Cluster Analysis
r_c=0.625

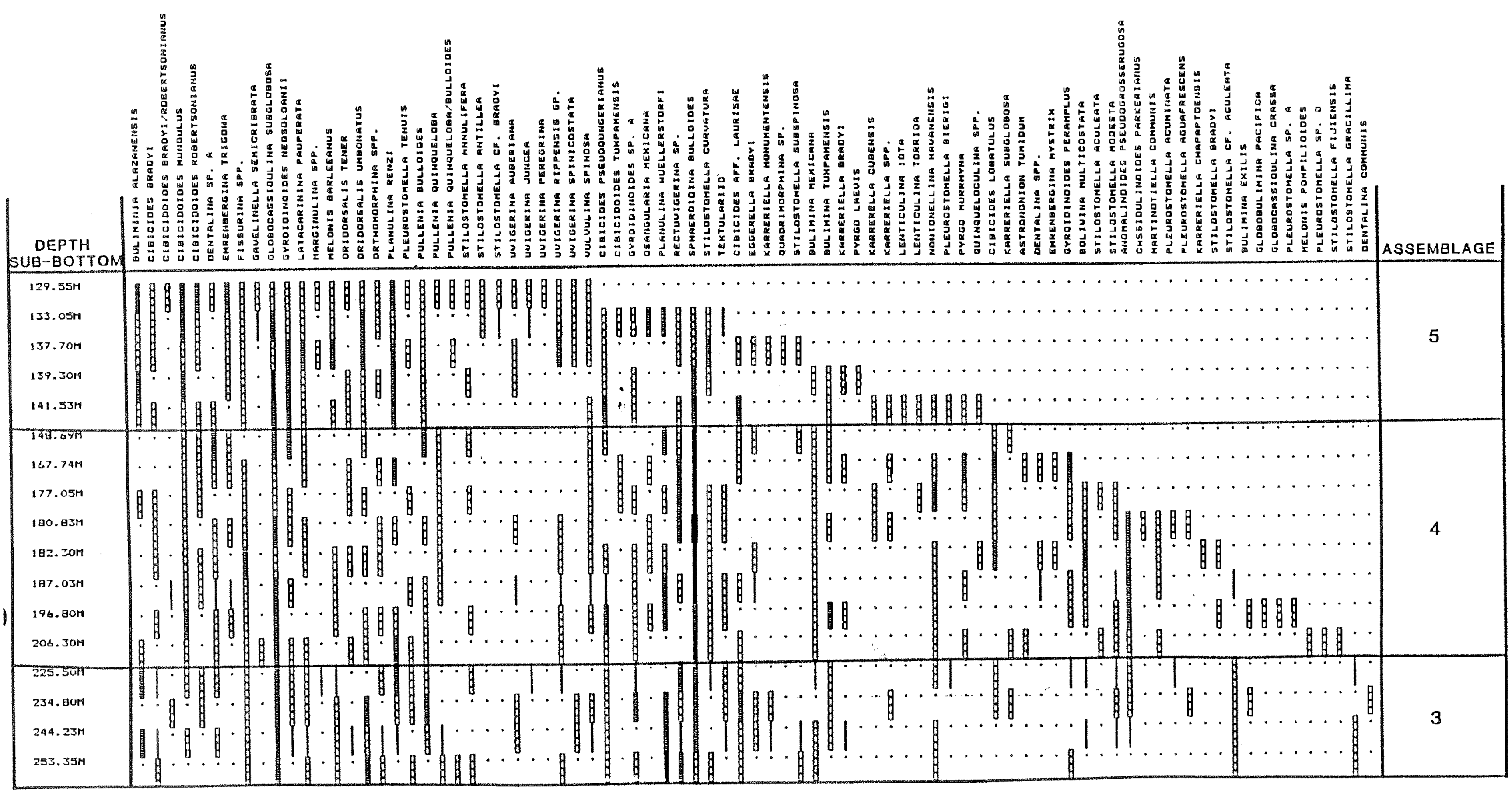
of Poore (1981) who also noted that the planktic foraminiferal data at Site 334 contained much noise. In addition, the benthic isotope record of Keigwin and others (in press) shows little change which may be due to mixing of the section. This contrasts with the late Miocene isotopic record at Site 563 of Miller and others (1985B) which shows distinct, correlatable patterns.

A generalized interpretation of the assemblages present at Site 334 can be obtained by noting the first downhole occurrence of a species and the range in which it is common using charts such as that shown in Figure 58. The interval from 129.55m to 141.53m is characterized by Globocassidulina subglobosa (Brady), Planulina renzi (Cushman), Bulimina alazanensis, and Cibicidoides mundulus (Brady, Parker and Jones) (Fig. 58). Associated species include Sphaeroidina bulloides, Oridorsalis tener umbonatus (Reuss), and Laticarinina pauperata (Fig. 58). From 148.69m to 206.30m the species grouping is dominated by Sphaeroidina bulloides, Globocassidulina subglobosa, Planulina wuellerstorfi and Cibicidoides mundulus (Fig. 58). Associated species include Cibicides pseudoungerianus (Cushman), Planulina renzi, Pullenia bulloides (d'Orbigny), and Oridorsalis tener umbonatus (Fig. 58).

From 225.50m to 253.35m a species grouping similar to that above is present (Fig. 58). However, Sphaeroidina bulloides is of reduced importance (Fig. 58).

= Abundant (>25 %)
= Common (>15 %)
= Few (>5 %)
= Rare (>1 %)
= Very Rare (<1 %)
? = Questionably Present
. = Not Present

Figure 64. DISTRIBUTION OF ASSEMBLAGES AT DSDP SITE 334



SPECIES COMPRISING < 1% OF ONLY TWO SAMPLES ARE NOT SHOWN.

PALEOBATHYMETRY AND PALEOECOLOGY

Studies of foraminiferal paleoecology are based on the concept that the depth distributions of fossil benthic species were controlled by the same parameters that govern the distribution of Recent benthic species. Studies have shown that properties of the water mass (oxygen content, pH, salinity, temperature, turbidity and others) and substrate (carbonate, clastic, grain size, light, and others) are the most important factors controlling the distribution of extant species, factors which in general vary as a function of depth (Douglas, 1979). Many of the important species identified in this study are extant species whose environmental preferences are known. By comparing the relative abundances of a group of species in a fossil assemblage with their known occurrences in Recent sediments the paleobathymetric distribution of the fossil assemblage can be estimated. In addition, data from previous studies of Miocene benthic foraminifera in the Maryland and New Jersey coastal plains by Melillo (1982), Bam (1982), and Schreiber (1984) have been integrated into a paleoslope model which is used to estimate the preferred paleobathymetric ranges of these species (Olsson and others, 1983).

Another approach to the determination of paleobathymetries and paleoenvironments is to calculate the diversity of an assemblage. The most commonly used measures are the number of species (S), the Shannon-Weiner information function (H(S)) where

$$H(S) = -\Sigma p_i \ln p_i$$

when p is the proportion of the ith species, and equitability (E) where

$$E = \frac{e^{H(S)}}{S}$$

(Gibson and Buzas, 1973). In this study diversity refers to values of S and H(S) and equitability refers to values of E.

In a study of Recent foraminiferal diversity patterns Gibson and Buzas (1973) calculated values of S, H(S), and E for a number of locations along the Atlantic coast including areas off southern New Jersey and Maryland. In Figure 59 it can be observed that H(S) provides the most unambiguous indication of diversity changes with depth. This view has also been taken by Sanders (1968) in a study of benthic invertebrates and by Balsam and others (1980) in a study of Pleistocene glacial and interglacial planktic foraminiferal assemblages of the North Atlantic.

A summary of the mean values of S, H(S), and E for each biofacies is given in Tables 9 and 10. Diversity values for individual samples are given in Appendix 5.

Baltimore Canyon Trough

The sediments associated with Biofacies A are iron-stained silts and clays with abundant mica and chlorite. Quartz sand is present in small quantities. Diversity and equitability are extremely low (Table 9) and planktonic foraminifera are absent. A low energy, protected, paleoenvironment, possibly tidal marsh or lagoonal, is interpreted for Biofacies A (Fig. 60).

Biofacies B contains a low diversity assemblage which exhibits moderate equitability (Table 9). The lithology associated with this

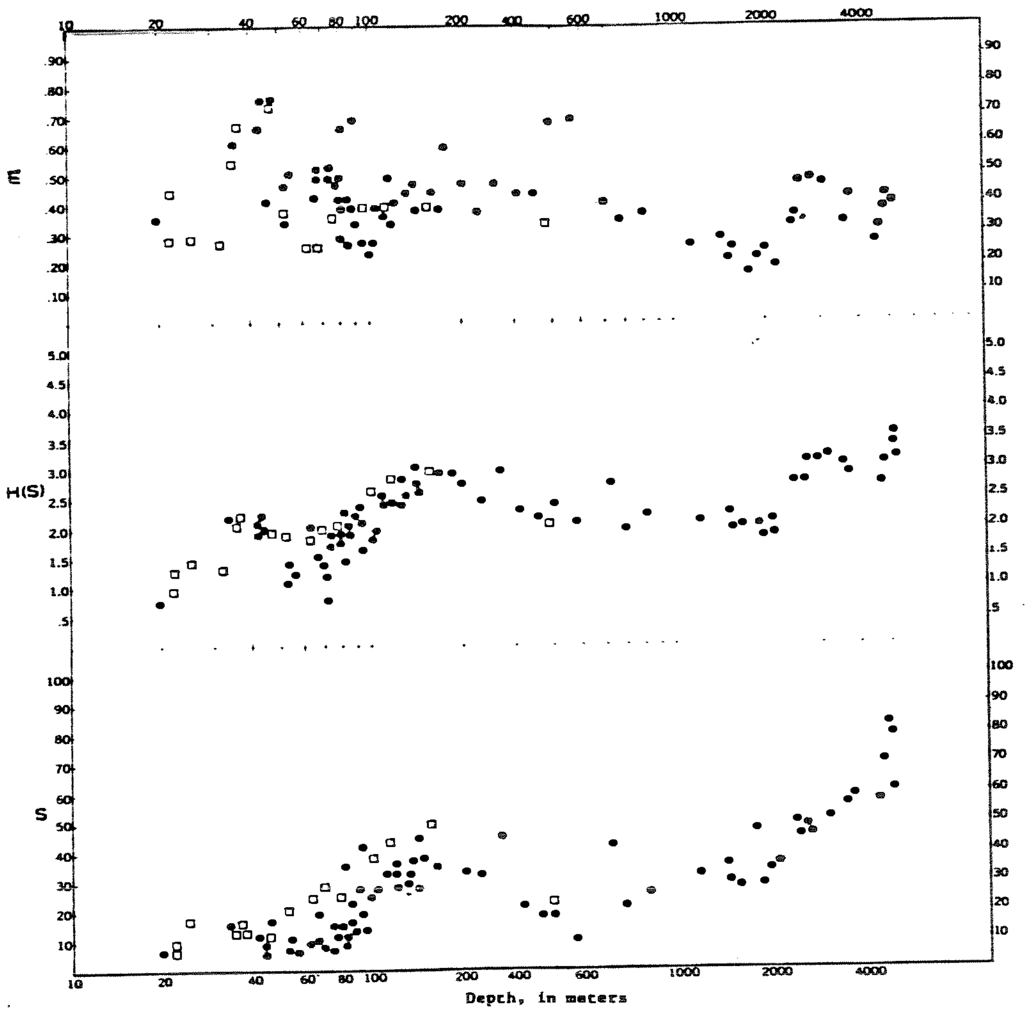


Figure 59 Diversity value off eastern United States. Circles are Cape Cod to Maryland average values. Boxes are from Maryland traverse. (From Gibson and Buzas, 1973)

Table 9

Mean Values of S, H(S), & E for Biofacies from the Baltimore Canyon Trough

Biofacies	Mean S	Mean H(S)	Mean E
A	3	0.22	0.41
B	15	1.84	0.46
C	10	0.71	0.24
D	11.25	1.76	0.38
E	17.5	2.37	0.64
F	14.5	2.12	0.58
G	19	2.62	0.73
H	16	2.20	0.56
I	23.6	2.18	0.76
J	23.8	2.55	0.59
K	15.5	1.37	0.26
L	24.8	2.83	0.74
M	19.3	2.53	0.66
N	25	2.47	0.58
O	47.4	3.09	0.47

Figure 60

MIOCENE-PLIOCENE BIOFACIES OF THE WESTERN NORTH ATLANTIC MARGIN

BIOFACIES	CHARACTERISTIC SPECIES	PALEOENVIRONMENT AND PALEOBATHYMETRY
A	ELPHIDIUM EXCAVATUM	LAGOONAL
B	EPISTOMINELLA PONTONI ELPHIDIUM EXCAVATUM. TRIFARINA ANGULOSA	PRODELTA 25-50 METERS
C	BULIMINELLA ELONGATA B. ELEGANTISSIMA BOLIVINA DIRECTA	NEARSHORE, 25 METERS,OR LESS
D	ELPHIDIUM EXCAVATUM QUINQUELOCULINA SEMINULINA NONIONELLA AURIS	INNER TO MID-NERITIC, 30-90 METERS
E	CIBICIDES ORNATUS TRIFARINA BRADYI MELONIS BARLEEANUS BULIMINELLA ELONGATA	MID-NERITIC, 60-90 METERS
F	BULIMINELLA BASSENDORFENSIS FLORILUS ATLANTICA BUCCELLA ANDERSENI	MID-NERITIC, 50-100 METERS
G	FURSENKOINA SCHREIBERSIANA BULIMINA MARGINATA CASSIDULINA CRASSA	MID-NERITIC, 50-120 METERS
H	LENTICULINA AMERICANA FLORILUS ATLANTICA TEXTULARIA AGGLUTINANS	MID-NERITIC, 60-110 METERS
I	UVIGERINA JUNCEA U. PEREGRINA	MID- TO OUTER NERITIC, 75-150 METERS
J	BULIMINA ALAZANENSIS BOLIVINA STRIATULA PSEUDONODOSARIA TORRIDA	OUTER NERITIC, 100-200 METERS
K	UVIGERINA AUBERIANA STILOSTOMELLA BRADYI BULIMINELLA BASSENDORFENSIS	OUTER NERITIC, DELTA ASSOCIATED, 100-200 METERS
L	KARRERRIELLA BRADYI MELONIS BARLEEANUS TRIFARINA BRADYI	UPPER TO MIDDLE BATHYAL 300-500 METERS
M	UVIGERINA SPINICOSTATA BULIMINA ALAZANENSIS B. STRIATA MEXICANA B. STRIATA PSEUDONODOSARIA TORRIDA	UPPER TO MIDDLE BATHYAL, 500-700 METERS
N	UVIGERINA AUBERIANA STILOSTOMELLA CURVATURA MELONIS BARLEEANUS	UPPER TO MIDDLE BATHYAL, 600-800 METERS
O	SPHAEROIDINA BULLOIDES UVIGERIANA AUBERIANA BULIMINA ALAZANENSIS	MIDDLE BATHYAL, 700-900 METERS

biofacies is an iron-stained silt with abundant mica and chlorite. Small specimens of globigerine planktic foraminifera comprise less than 1% of the assemblage. Most foraminifers exhibit a moderate iron stain. Similar staining is observed on foraminifera found in the vicinity of the present-day Mississippi delta (C. Pflum, pers. comm.). A prodelta paleoenvironment of 25m to 50m is interpreted for Biofacies B (Fig. 60).

Biofacies C is present in medium to fine grained sands with common to abundant detrital glauconite and shell fragments. Diversity and equitability are low (Table 9). Planktic foraminfera are absent. A nearshore inner-neritic paleoenvironment of 25m, or less, is interpreted for Biofacies C (Fig. 60).

Biofacies D is present in silts and silty fine grained quartz sands. Diversity and equitability are moderate (Table 9). Planktic foraminifera, mainly juveniles, comprise 2% to 30% of the assemblage. An inner to mid-neritic paleoenvironment of 30m to 90m is interpreted for Biofacies D (Fig. 60).

Biofacies E is present in silty, fine grained sand, containing abundant detrital glauconite and occasional shell fragments. Diversity and equitability are moderate (Table 9). Planktonic foraminifera constitute 5%, or less, of the assemblage. A mid-neritic paleoenvironment of 60m to 90m is interpreted for Biofacies E (Fig. 60).

Biofacies F contains a moderately diverse and equitable assemblage (Table 9). Planktic species comprise 3% to 11% of the assemblage. This biofacies is present in fine to medium quartz sands with common to abundant detrital glauconite. A mid-neritic paleoenvironment of 50m to 100m is interpreted for Biofacies F (Fig. 60).

Biofacies G contains an assemblage with moderate to high diversity and equitability (Table 9). Planktic foraminifera comprise 26% of the assemblage. This biofacies is present in a lithology of slightly sandy clays. A mid-neritic paleoenvironment of 50m to 120m is interpreted for Biofacies G (Fig. 60).

Biofacies H is present in sandy silts that contain small amounts of detrital glauconite. The assemblage has moderate diversity and equitability (Table 9). Planktic foraminifera comprise 8% of the assemblage. A mid-neritic paleoenvironment of 60m to 110m is interpreted for Biofacies H (Fig. 60).

Biofacies I is present in a lithology of sandy silts and silty sands. Most foraminifers have an iron staining. Diversity is low to moderate, equitability is relatively high (Table 9). Planktic foraminifera comprise 31% of the assemblage. A middle to outer neritic paleoenvironment of 75m to 150m is interpreted for Biofacies I (Fig. 60).

Biofacies J is present in a lithology of sandy silts. Most foraminifers have a light to moderate iron staining. Diversity and equitability are moderate to high (Table 9). Planktic foraminfera comprise 10% of the assemblage. An outer neritic paleoenvironment of 100m to 200m is interpreted for Biofacies J (Fig. 60).

Biofacies K is present in unstained silts intercalated with iron stained silts which contain abundant mica and chlorite. Many foraminfers have a light iron stain, especially in the sample from 1305.4m in the ASP 14 well. Diversity and equitability are low (Table

9). Planktic foraminifera comprise 30% of the assemblage. Radiolarians and diatoms are common. An outer neritic, delta associated, paleoenvironment of 100m to 200m is interpreted for Biofacies K (Fig. 60). The sample from 1470.2m in the ASP 14 well is present in a glauconitic silt. Diversity and equitability are high (Table 9). Planktic foraminifera comprise 63% of the assemblage, and diatoms and radiolarians are abundant. It is interpreted to represent deposition in a non-deltaic, upper bathyal paleoenvironment of 200m to 500m.

Biofacies L is present in slightly sandy silts and clays. Diversity and equitability are moderate to high (Table 9). Planktic foraminifera comprise 47% of the assemblage. Most foraminifera are unstained. Radiolarians and diatoms are common to very abundant. A delta associated, upper to middle bathyal paleoenvironment of 300m to 500m is interpreted for Biofacies L (Fig. 60). The sample from 1508.8m in the ASP 15 well contains the costate uvigerinids Uvigerina mediterranea and U. dirupta and may represent deposition in a slightly shallower, upper bathyal, paleoenvironment of 200m to 300m.

Biofacies M is present in unstained silts. Diversity and equitability are moderate (Table 9). Planktic foraminifera comprise 40% of the assemblage. Many foraminifers have an iron stain. Radiolarians and diatoms are abundant. A delta associated upper to middle bathyal paleoenvironment of 500m to 700m is interpreted for for Biofacies M (Fig. 60).

Biofacies N is present in glaucontic silts. Diversity and equitability are moderate (Table 9). Planktic foraminifera comprise 60% of the assemblage. Diatoms and radiolarians are abundant. An upper middle bathyal paleoenvironment of 600m to 800m is interpreted for Biofacies N (Fig. 60).

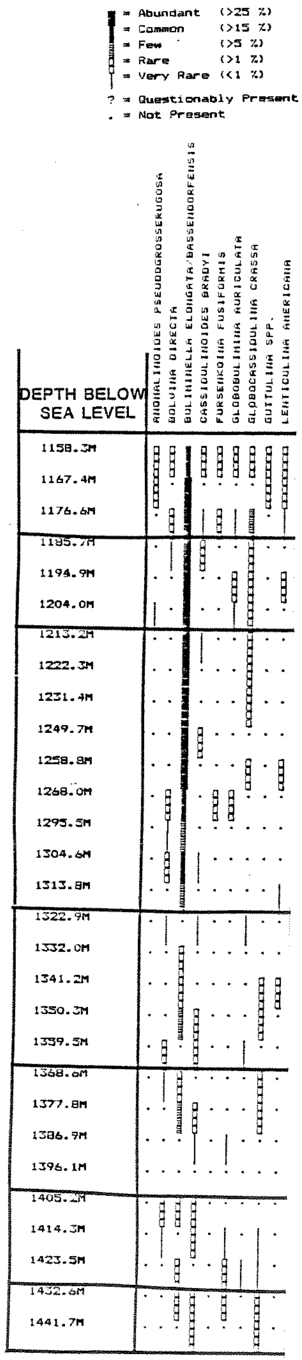
Biofacies O is present in glauconitic silts. Diversity and equitability are moderate to high (Table 9). Planktic foraminifera comprise 53% of the assemblage. Radiolarians and diatoms are very abundant. A lower to middle bathyal paleoenvironment of 700m to 900m is interpreted for Biofacies O (Fig. 60).

In the B-3 well seven species groupings are identified using the technique described above, five of which have affinities to biofacies identified from core samples in the ASP and AMCOR wells. The remaining two are designated Assemblages 1 and 2, not Biofacies, since they are not identified using numerical analysis.

A species grouping characterized by *Uvigerina auberiana*, *Lenticulina americana*, *L. americana spinosa* (Cushman), and rare specimens of *Bulimina alazanensis* is present from 1158.3m to 1176.6m. This species grouping is similar to Biofacies I which is considered to represent an outer neritic paleoenvironment of 120m to 150m (Fig. 61).

From 1176.6m to 1204.0m a species grouping dominated by *Buliminella elongata* is present. Specimens of this taxon from 1213.2m to 1258.8m are probably caved (Fig. 61). Other characteristic species include *Melonis barleeanus* and *Cibicides* sp. cf. *C. pseudoungerianus* (Fig. 61). This species grouping has affinities to Biofacies E and is also interpreted to represent a mid-neritic paleoenvironment of 60m to 90m (Fig. 61).

Rare, well developed, specimens of *Uvigerina spinicostata* are first present at 1213.2m (Fig. 61). *Bulimina alazanensis* is the dominant species from 1268.0m to 1322.9m and is an important component of the


= Abundant (>25 %)
= Common (>15 %)
= Few (>5 %)
= Rare (>1 %)
= Very Rare (<1 %)
? = Questionably Present
. = Not Present
DEPTH BELOW SEA LEVEL
ANOMALINOIDES PSEUDOGROSSERUGOSA
BOLVINA DIRECTA
BULIMINELLA ELONGATA/BASSENDORFENSIS
CASSIDULINOIDES BRADYI
FURSENKOINA FUSIFORMIS
GLOBOBULIMINA AURICULATA
GLOBOCASSIDULINA CRASSA
GUTTULINA SPP.
LENTICULINA AMERICANA
1158.3M
1167.4M
1176.6M
1185.7M
1194.9M
1204.0M
1213.2M
1222.3M
1231.4M
1249.7M
1258.8M
1268.0M
1295.5M
1304.6M
1313.8M
1322.9M
1332.0M
1341.2M
1350.3M
1359.5M
1368.6M
1377.8M
1386.9M
1396.1M
1405.2M
1414.3M
1423.5M
1432.6M
1441.7M

assemblage to 1396.1m (Fig. 61). Other important species include Melonis barleeanus, Cibicides sp. cf. C. pseudoungerianus, Stilostomella sp. A, Nodosaria longiscata, Martinotiella communis, and Buliminella elongata (probably caved) (Fig. 61). This species grouping is similar to Biofacies N and appears to represent deposition in a slightly shallower, middle bathyal, paleoenvironment of 400m to 700m (Fig. 61).

Very rare specimens of Melonis pompilioides and Karrerriella bradyi first occur at 1322.9m (Fig. 61). Stilostomella aculeata and S. subspinosa are first present at 1341.2m (Fig. 61). This species grouping is similar to Biofacies N and O and is interpreted to represent a middle to lower bathyal paleoenvironment of 600m to 900m.

Martinotiella communis is the dominant species at 1368.6m, while M. occidentalis (Cushman) first appears at this level (Fig. 61). At 1386.8m a species grouping which includes Bolivina antiqua, B. spathulata (Williamson), and a group of polymorphinids first appears (Fig. 61). Lenticulina rotulata (Lamarck)? and L. peregrina (Schwager) reappear at this level (Fig. 61). Most of the deeper water species of the grouping above are absent, or, are present in reduced numbers, suggesting caving (Fig. 61). This species grouping is present to 1396.1m and does not have an obvious relationship to any of the biofacies delineated above. An outer neritic to upper bathyal paleoenvironment of 200m to 400m is interpreted for Assemblage 1 (Figs. 61,62).

Globulina inaequalis Reuss and Lenticulina torrida (Cushman) are first present at 1405.1m (Fig. 61). Uvigerina auberiana and U. flintii Cushman are important members of the assemblage (Fig. 61).

Figure 62

Benthic Foraminiferal Assemblages at COST B-3 Well

Assemblage	Characteristic Species	Paleoenvironment
1	*Martinotiella communis* *M. occidentalis* *Bolivina antiqua* *B. spathulata* Polymorphinids	Outer neritic– Upper bathyal 200–400m
2	*Bulimina marginata* *B. notovata* *Sphaeroidina bulloides* *Melonis barleeanus* *Uvigerina auberiana*	Outer neritic 100–200m

Bolivina alata Seguenza first appears at 1414.3m (Fig. 61). This species grouping appears to be related to Biofacies K and represents an outer neritic to upper bathyal paleoenvironment of 150m to 250m (Fig. 61).

At 1432.6m Bulimina marginata and B. notovata (Chapman) appear for the first time (Fig. 61). Sphaeroidina bulloides, Melonis barleeanus, and Uvigerina auberiana increase in abundance (Fig. 61). An outer neritic paleoenvironment of 100m to 200m is interpreted for Assemblage 2 which is present from 1432.6m to 1453.9m (Figs. 61,62).

Western North Atlantic Basin

Biofacies P is present in a pelagic carbonate ooze in which dissolution ranges from eolytic to oligolytic. Diversity is moderate and equitability is high (Table 10). Planktic foraminifera comprise approximately 99% of the foraminiferal assemblage. The backtracking technique of Berger (1973) indicates that Biofacies P represents deposition in an abyssal paleoenvironment of approximately 3100m to 3550m (Fig. 63). Buliminella grata, Oridorsalis tener tener, Pleurostomella tenuis, and Pleurostomella sp. A are the dominant species (Fig. 56). Oridorsalis tener umbonatus and Globocassidulina subglobosa are also important members of this assemblage (Fig. 56).

Biofacies Q is also present in a pelagic calcareous ooze. However, dissolution is greater, ranging from occasionaly eolytic to mesolytic. Planktic foraminifera comprise 98-99% of the foraminiferal assemblage. Diversity and equitability are moderate to high (Table 10). Backtracking indicates deposition in an abyssal paleoenvironment of approximately 3550m to 3750m for Biofacies Q (Fig. 63). The dominant species are Planulina wuellerstorfi, Eggerella bradyi,

Table 10

Mean Values of S, H(S), and E for Biofacies of the Western North Atlantic Basin

Biofacies	Mean S	Mean H(S)	Mean E
P	22.8	2.77	0.73
Q	25.3	2.85	0.72

Figure 63

Biofacies of the Western North Atlantic Basin

Biofacies	Characteristic Species	Paleobathymetry
P	*Buliminella grata* *Orisodorsalis tener tener* *Pleurostomella tenuis* *Pleurostomella sp. A*	Abyssal 3100—3500m
Q	*Planulina wuellerstorfi* *Eggerella bradyi* *Nuttallides umbonifera* *Epistominella exigua*	Abyssal 3550—3750m

Nuttalides umbonifera, and Epistominella exigua (Fig. 56). Globocassidulina subglobosa and Cridorsalis tener umbonatus are less abundant (Fig. 56).

The species groupings noted at Site 334 are present in nannofossil-foraminiferal oozes (Aumento and others, 1977). Planktic foraminifera comprise approximately 98-99% of the foraminiferal assemblage. Diversity and equitability are high in Assemblage 3 (Table 11). Dissolution ranges from eolytic to oligolytic. Backtracking yields lower bathyal to abyssal paleodepths of approximately 1850m to 2000m (Fig. 64).

Assemblage 4 has high diversity and equitability (Table 11). Dissolution ranges from occasionally eolytic to oligolytic. Backtracking indicates that it was deposited in an abyssal paleoenvironment of 2000m to 2400m (Fig. 64).

Assemblage 5 contains high diversity and equitability (Table 11). Dissolution ranges from oligolytic to mesolytic. Backtracking indicates that deposition occurred in an abyssal paleoenvironment of 2400m to 2650m (Fig. 64).

Table 11

Mean Values of S, H(S), and E of benthic foraminiferal assemblages at DSDP Site 334

Assemblage	S	H(S)	E
3	39.75	3.29	0.69
4	34.38	3.12	0.67
5	36.60	3.23	0.71

Figure 64

Benthic Foraminiferal Assemblages at DSDP Site 334

Assemblage	Characteristic Species	Paleoenvironment
3	*Globocassidulina subglobosa* *Planulina renzi* *Bulimina alazanensis* *Cibicidoides mundulus*	Lower bathyal—abyssal 1850—2000m
4	*Sphaeroidina bulloides* (abundant) *Globocassidulina subglobosa* *Planulina wuellerstorfi* *Cibicidoides pseudoungerianus*	Abyssal 2000—2400m
5	*Sphaeroidina bulloides* *Globocassidulina subglobosa* *Planulina wuellerstorfi* *Cibicidoides pseudoungerianus*	Abyssal 2400—2650m

DEPOSITIONAL ENVIRONMENTS AND SEA-LEVEL HISTORY

Neogene sediments in the Baltimore Canyon Trough off New Jersey consist primarily of terrigenous sands, silts, and clays (Poag, 1979). A major deltaic complex underlies the present-day continental shelf and upper-middle continental slope (Hathaway and others, 1979; Poag, 1979, 1980; Schlee, 1981; Greenlee, 1981). Deltaic conditions appear to have begun after the late early Miocene and to have ceased by the late Pliocene. In the Western North Atlantic Basin at Site 563 the main factors causing changes in depositional conditions are changes in the makeup of bottom water in the middle and late Miocene and changes in the intensity of carbonate dissolution, which is often related to bottom-water changes. Increases in paleo-water depth due to thermal subsidence do not appear to be an important initiator of paleoenvironmental change during the Late Oligocene to Pliocene at Sites 563 and 334.

The foraminiferal oxygen isotopic record at Site 563 can be used to document periods of climatic change which can be compared with the stratigraphic and paleoenvironmental record of the Baltimore Canyon Trough and coastal plain of Maryland and New Jersey. The $\delta^{18}O$ content of foraminiferal tests is related to temperature and seawater $\delta^{18}O$ content (Epstein and others, 1951, 1953; Emiliani, 1955; and others). Covariance between the planktic and benthic foraminiferal $\delta^{18}O$ record has been shown by Shackleton and Opdyke (1973) to be an indicator of Quaternary glacial ice-volume. Miller and others (1985A) believe that $\delta^{18}O$ values in Cibicidoides greater than 1.9 per mil indicate the presence of glacial ice. Pitman (1978) has shown that, except for catastrophic flooding or draining of small basins, only the buildup and melting of glacial ice occurs on a sufficiently rapid scale to account for the rapid changes of sea-level in the Neogene observed in the stratigraphic record. Thus, covariant planktic and benthic $\delta^{18}O$ increases, coincident with $\delta^{18}O$ values in Cibicidoides greater than 1.9 per mil, should be associated with eustatic sea-level falls.

An upper Oligocene (Globigerina ciperoensis Zone) decrease in paleobathymetry is recorded in the AMCOR 6011 well where a change from middle neritic to nearshore conditions is evident (Fig. 65). The curve of Vail and others (1980) shows a coastal offlap event and sea-level fall corresponding to the upper portion of the zone (Fig. 66). This interval is conformable at Site 563 where a pronounced increase in $\delta^{18}O$ values occurs in the planktic and benthic foraminiferal records (Fig. 67; Miller and others, 1985B). The covariance is 0.4-0.9 per mil and Cibicidoides values are 1.9-2.0 per mil (Miller and Fairbanks, 1985). This represents a sea-level drop of 40-90m (Fairbanks and Matthews, 1978). Miller and others (1985A) believe that an increase in glacial ice volume at this time was responsible for a low stand of sea-level which resulted in erosion on the continental margins of New Jersey and Ireland (Goban Spur). The upper Oligocene decrease in paleobathmetry present in the AMCOR 6011 well in the Baltimore Canyon Trough possibly supports this hypothesis.

A hiatus, which may be related to a sea-level fall, also appears to be present at the top of the Globorotalia kugleri Zone in the COST B-3. However, the thinness of this zone in the COST B-3 well does not allow recognition of paleobathymetric changes.

Figure 65
DEPOSITIONAL ENVIRONMENTS IN THE BALTIMORE CANYON TROUGH

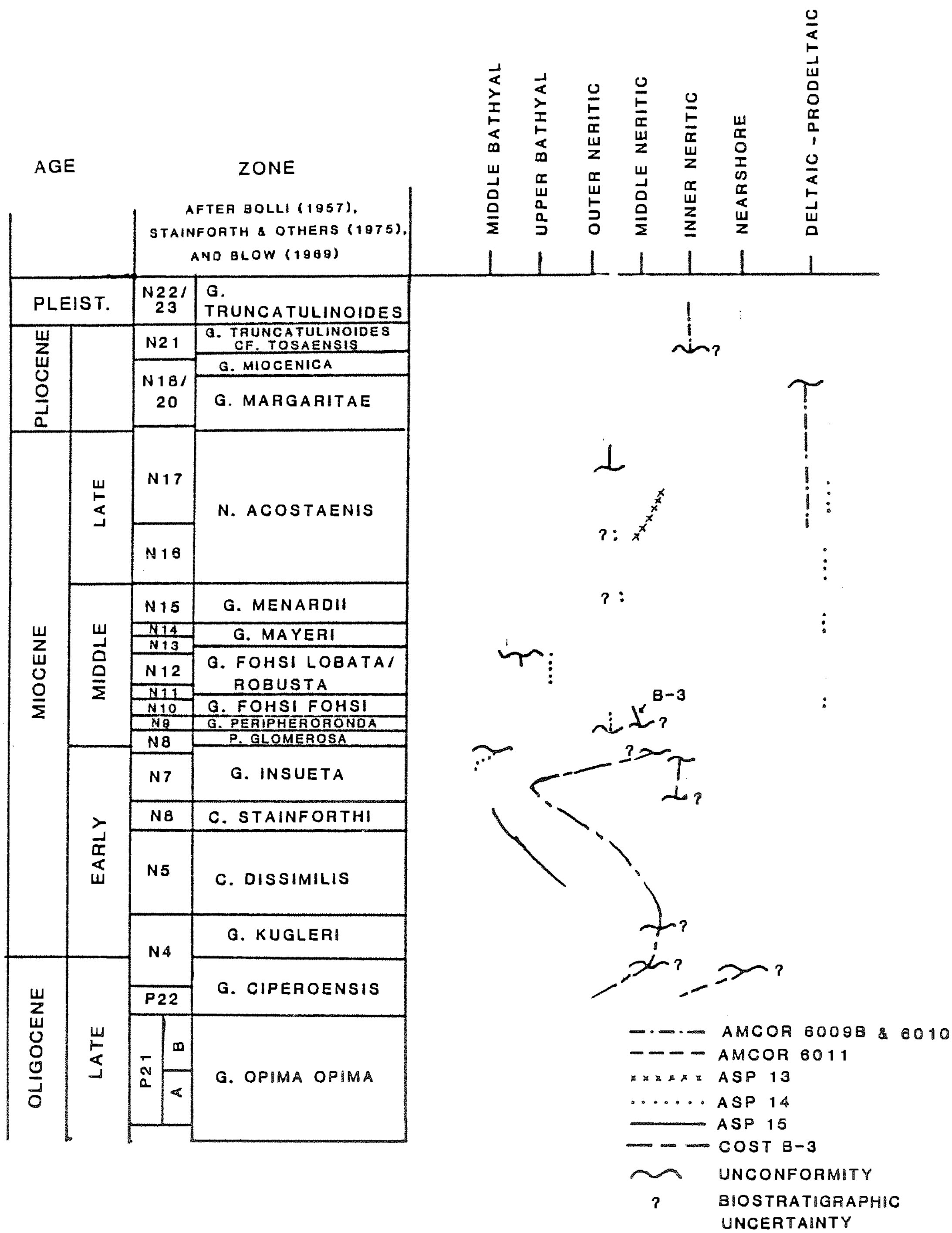


Figure 66.
SEA-LEVEL CYCLE CHART OF VAIL AND OTHERS (1980)

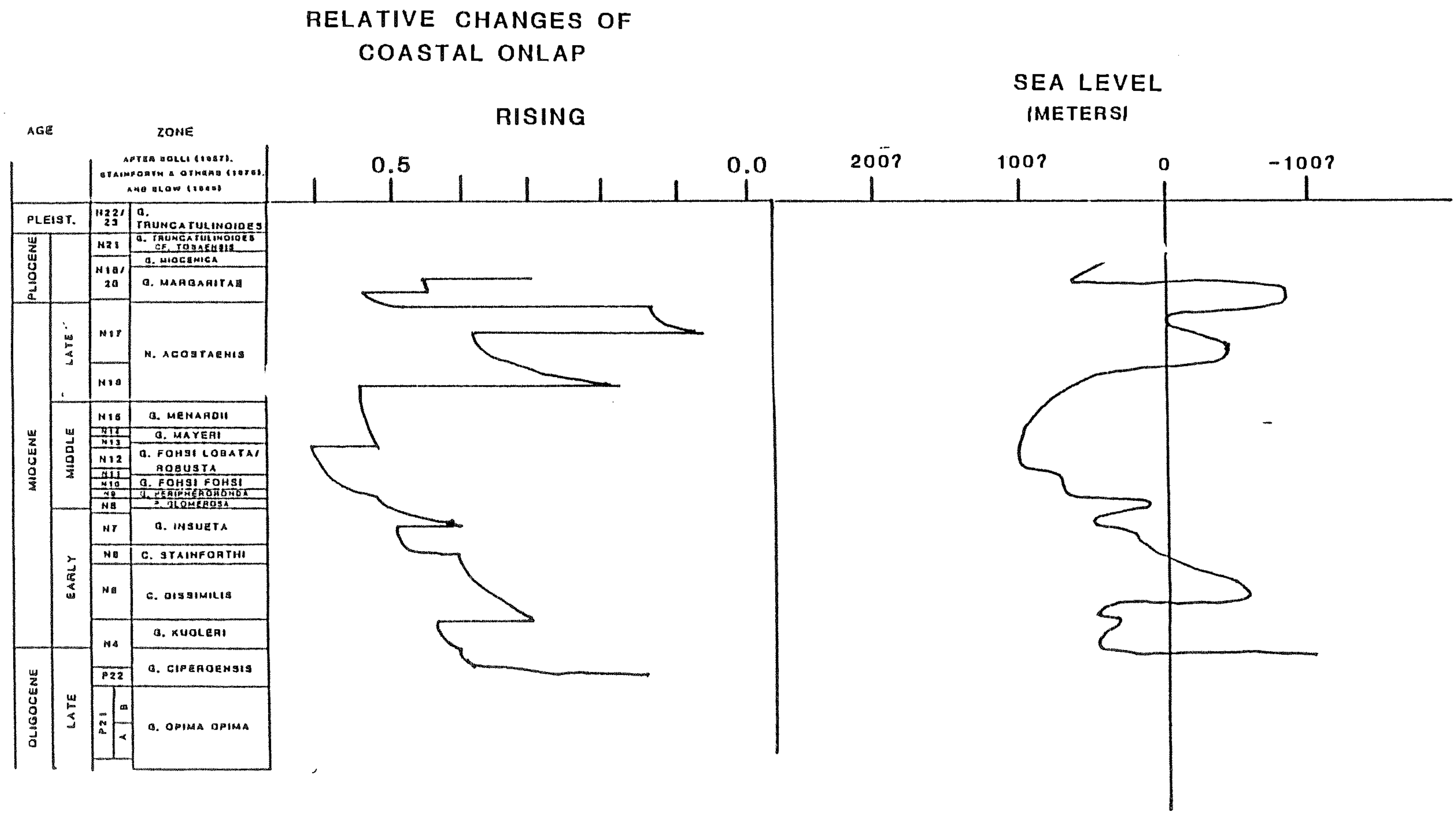
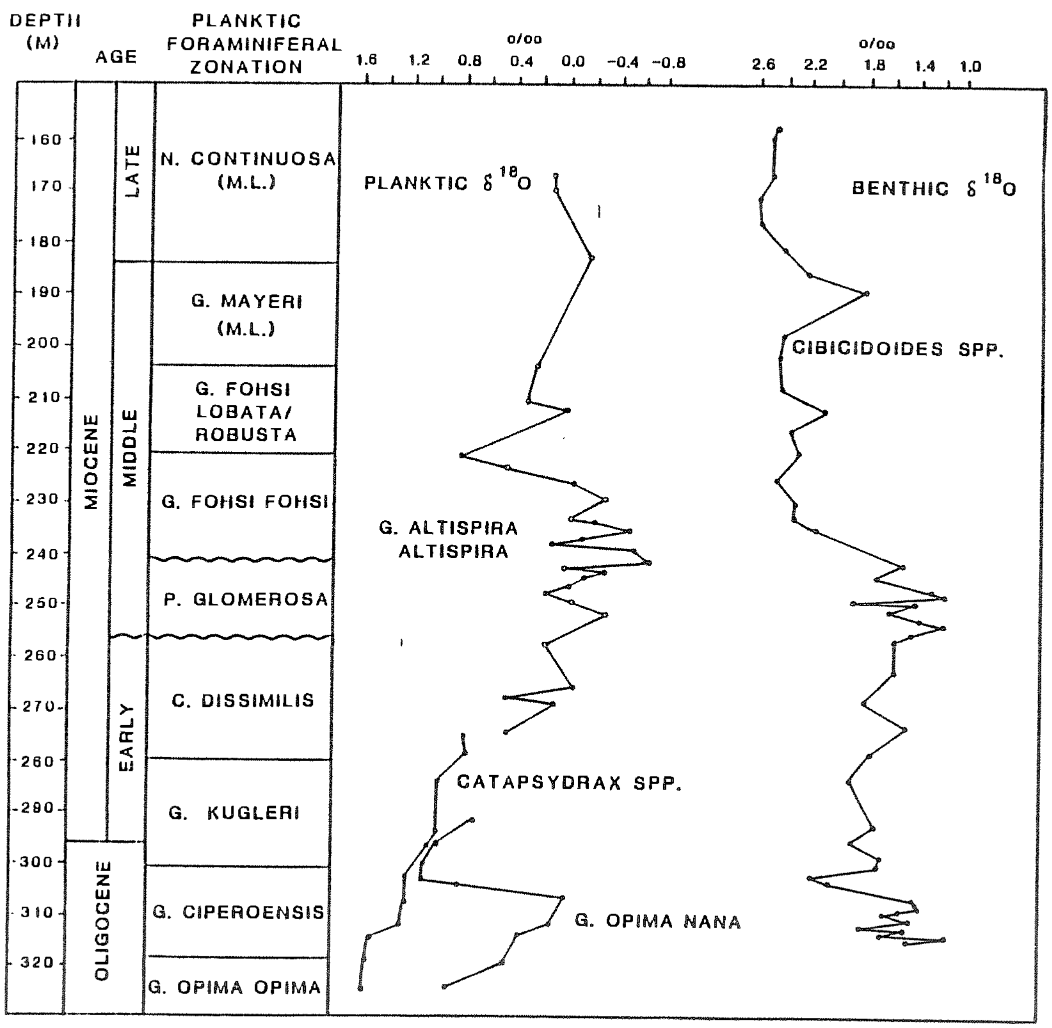


Figure 67. OXYGEN ISOTOPE RECORD AT DSDP SITE 563



Open circles indicate samples which were heated during initial processing.

In the m.l. <u>Catapsydrax dissimilis</u> Zone middle neritic foraminiferal assemblages in the COST B-3 well give way rapidly to outer neritic and upper bathyal assemblages (Fig. 65). In the ASP 15 well, upper bathyal assemblages gave way to middle bathyal assemblages (Fig. 65).

A sharp decrease in $\delta^{18}O$ values, which may be associated with the rapid increase in paleobathymetry seen in the COST B-3, well occurs in the planktic and benthic records in the lower portion of the m.l. <u>Catapsydrax dissimilis</u> Zone at Site 563 (Figs. 65,67). Following this an overall decrease in $\delta^{18}O$ values occurs in the planktic foraminiferal records which corresponds to a rise in sea-level proposed by Vail and others (1980) and is noted in the Baltimore Canyon Trough in this study and in the Maryland coastal plain by Schreiber (1984) (Figs. 65-67). The presence of abundant glauconite in the ASP 15 and COST B-3 wells suggests transgressive conditions (Arthur and Jenkyns, 1981) and may indicate that this interval is a condensed interval (Vail and Todd, 1981), thus supporting the interpretation of a highstand of sea-level at this time. The abundance of the cooler-water species <u>Globorotalia incognita</u> and <u>G. zealandica</u> as well as siliceous microfossils in these wells suggest the upwelling of cold, nutrient rich bottom waters, which Arthur and Jenkyns (1981) associate with highstands of sea-level. In addition, the presence of the abyssal benthic foraminifer <u>Melonis pompilioides</u> may be due to the raising of isotherms as a result of such upwelling. The paucity of <u>G. incognita</u> and <u>G. zealandica</u> at Site 563, which is located only 5.5 to 6 south of the Maryland-New Jersey area, suggests that the introduction of these predominantly middle latitude taxa into the latter area may have been the result of current activity, not a basin-wide cooling event.

Sea-level continued to rise, reaching a maximum during deposition of the lower portion of the l.l. _Globigerinatella insueta_ Zone (approximately equal to the m.l. _Globorotalia miozea_ Zone) when middle-lower bathyal conditions existed at the COST B-3 well (Fig. 65). In the AMCOR 6011 well a change from sands to deep-water silts occurs in this zone, in agreement with the record of the continental slope (Fig. 65). The presence of deep-water silts suggests that deltaic deposition did not commence in present-day nearshore areas until after the late early Miocene (Fig. 65). A decrease in paleobathymetry occurs in the COST B-3 well in the upper portion of the _Globigerinatella insueta_ Zone with middle bathyal conditions changing to upper-middle bathyal conditions (Fig. 65). In the ASP 14 well sediments of upper _Globigerinatella insueta_ Zone were deposited in a middle bathyal paleoenvironment of decreasing water depth. They are unconformably overlain by outer neritic-upper bathyal sediments in the _Globorotalia peripheroronda_ Zone (Fig. 65). This hiatus is also inferred to be present in the nearby COST B-3 well where it is marked by an abrupt decrease in paleobathymetry from upper-middle bathyal to middle-outer neritic conditions (Fig. 65). The record in the COST B-3 well differs slightly from that of the Maryland coastal plain where Schreiber (1984) reports a sea-level fall commencing at the boundary between the l.l. _Globigerinatella insueta_ Zone and l.l. _Praeorbulina glomerosa_ Zone. Based on the more complete biostratigraphic data in the COST B-3 well it appears that the sea-level fall occurred earlier, in the upper _Globigerinatella insueta_

Zone (Fig. 65).

The *Catapsydrax stainforthi* and *Globigerinatella insueta* Zones are absent at Site 563, due to a hiatus possibly caused by increased corrosiveness of bottom waters. Savin and others (1981) in a review of benthic foraminiferal $\delta^{18}O$ studies in the Pacific noted what they termed "regionwide, possibly worldwide" peak $\delta^{18}O$ values which they correlated with the upper *G. insueta* Zone. The curve of Vail and others (1980) shows a stillstand of sea-level corresponding to this interval (Fig. 66). However, the paleobathymetric record in the COST B-3 well in the Baltimore Canyon Trough suggests a fall of sea-level (Fig. 65).

The lower Miocene *Praeorbulina glomerosa* Zone is absent from the ASP 14 well, and, presumably, from the COST B-3 well (Figs. 18,21,65). Sediments within this zone in the Maryland coastal plain are regressive (Schreiber, 1984). The curve of Vail and others (1980) shows a sea-level fall corresponding to the *Praeorbulina glomerosa* Zone (Fig. 66).

The lower middle Miocene (1.1. *Globorotalia peripheroronda* Zone) sediments in the COST B-3 and ASP 14 wells were deposited in a shallower paleoenvironment than those of the lower Miocene (*Globigerinatella insueta* Zone, Fig. 65). This is in agreement with the record of the coastal plain of Maryland (Schreiber, 1984). Paleobathymetry increases from middle neritic to outer neritic in the undifferentiated *G. peripheroronda*-middle *G. fohsi fohsi* Zone (Fig. 65). The curve of Vail and others (1980) shows that a rapid sea-level rise which is they correlate with the lower *G. peripheroronda* Zone is followed by a slower rise which they correlate with the upper *G.*

peripheroronda Zone/lower _G. fohsi fohsi_ Zone (Fig. 66). The curve also shows a rapid rise of sea-level which they correlate with the upper _G. fohsi fohsi_ Zone (Fig. 66).

Savin and others (1975), Shackleton and Kennett (1975), and Woodruff and others (1981) noted a major increase in $\delta^{18}O$ values in the middle Miocene which they interpreted to have resulted from the initiation of major glaciation in Antarctica. Woodruff and others show that the $\delta^{18}O$ enrichment occurs in the lower to middle part of the _G. fohsi fohsi_ Zone. At Site 563 a major increase in $\delta^{18}O$ values in both the planktic and benthic foraminiferal records also occurs in the _G. fohsi fohsi_ Zone (Fig. 67). _Cibicidoides_ $\delta^{18}O$ values are generally 1.9-2.4 per mil during the remainder of the Miocene (Miller and others, 1985B), suggesting the presence of glacial ice. In the Maryland coastal plain the _G. fohsi fohsi_ Zone is only partially developed and is unconformably overlain by the upper Miocene Choptank Formation (Melillo and Olsson, 1981; Melillo, 1982; Bam, 1982; Schreiber, 1984).

At Site 563 the _G. fohsi fohsi_ Zone $\delta^{18}O$ enrichment shift occurs during a change in the benthic foraminiferal fauna. This is in agreement with studies by Thomas (in press) and Woodruff (in press). Biofacies P, which is characterized by _Buliminella grata_, _Oridorsalis tener tener_, _Pleurostomella tenuis_, and _P._ sp. A, is replaced by Biofacies Q, which is characterized by _Planulina wuellerstorfi_, _Eggerella bradyi_, _Nuttalides umbonifera_, and _Epistominella exigua_. The cause of this apparently gradual replacement of Biofacies P by Biofacies Q is unclear, but Miller (pers. comm.) believes that it is associated with the introduction of younger, non-corrosive, bottom waters into the Eastern North Atlantic and an increase in carbonate sedimentation in the North Atlantic in the early middle Miocene (Praeorbulina glomerosa Zone).

The middle Miocene dark olive-gray, micaceous, clayey, iron-stained silts in the ASP 14 well above 1466.2m suggest the presence of deltaic conditions, thus, indicating that deltaic conditions did not reach the present-day continental slope until after the early middle Miocene (Fig. 65).

A middle Miocene (G. fohsi lobata/robusta Zone) sea-level highstand is evident by the presence of bathyal deposits in the ASP 14 and ASP 15 wells (Fig. 65). This highstand is also evident in the COST B-3 well and, thus, this middle Miocene sea-level event would appear well documented in the Western North Atlantic margin (Fig. 65).

At Site 563 a decrease in planktic and benthic $\delta^{18}O$ values occurs in the middle part of the G. fohsi lobata/robusta Zone, although it is not well constrained (Fig. 67). This may indicate a global warming event and a decrease in ice volume, which would result in a rise of sea-level. The curve of Vail and others (1980) shows that the greatest highstand of sea-level in the Miocene occurred at the end of the zone (Fig. 66). However, the $\delta^{18}O$ enrichment peak at Site 563 occurs near the middle of this zone which suggests that the culmination of the highstand may have been an earlier event (Fig. 67).

In the ASP 14 well in the middle Miocene (above the G. fohsi lobata/robusta Zone) the section is dominantly deltaic or pro-deltaic suggesting the cessation of the marine incursion correlated with the

G. fohsi lobata/robusta Zone (Fig. 65).

Benthic $\delta^{18}O$ values drop to 1.6 per mil in the G. mayeri Zone (Miller and others, 1985B, Fig. 67) suggesting decreased amounts of glacial ice. This event appears to correspond to a decrease in benthic foraminiferal $\delta^{18}O$ values in the Pacific noted by Savin and others (1981) and by Burckle (1982) and to a highstand of sea-level shown in the curve of Vail and others (1980) (Fig. 66). Sediments of this zone and of the latest Middle Miocene G. menardii Zone are absent from the Maryland-New Jersey coastal plain. In the Baltimore Canyon Trough off New Jersey these sediments are either absent, not recovered, or are deltaic in nature and thus cannot be age dated using planktic foraminifera.

Deltaic conditions existed during deposition of most of the late Miocene at the ASP 14 well (Fig. 65). An increase in the thickness of the late Miocene section in the ASP 13 well reflects an increase upslope in the thickness of the delta which was also noted from geophysical data by Greenlee (1981). Marine deposits in the ASP 13 and ASP 14 wells which are contained within the Neogloboquadrina continuosa Zone (Tortonian) may correspond to a marine sand in the Jobs Point well and to the Tortonian Choptank and St. Marys Formations of Maryland. The presence of bathyal deposits in the uppermost Miocene (Globorotalia conomiozea Zone) in the ASP 15 well suggest that deltaic conditions had come to an end at this well site (Fig. 65). Data from the AMCOR 6009B and AMCOR 6010 wells suggest that deltaic conditions lasted here until the late Pliocene (Globorotalia inflata Zone to G. tosaensis Zone) (Fig. 65). Hathaway and others (1979) believe that deltaic conditions persisted off New Jersey, Delaware, and Maryland well into the Pleistocene.

The late Miocene at Site 563 is characterized by a return to bottom water conditions which were present prior to the latest middle Miocene warming (Fig. 67). This is corroborated by the benthic foraminiferal $\delta^{13}C$ record (Miller and others, in press).

At Site 334 only relatively minor changes in the composition of the benthic foraminiferal fauna occur in the upper Miocene-lower Pliocene (Fig. 58). In the *Neogloboquadrina continuosa* Zone through the *Globigerina nepenthes* Zone the co-dominant species are *Sphaeroidina bulloides* and *Globocassidulina subglobosa* (Fig. 58). *Sphaeroidina bulloides* decreases sharply in abundance in the uppermost Miocene (Messinian) and the lower Pliocene where *Globocassidulina subglobosa* becomes the dominant species (Fig. 58). The faunal change noted may be correlated with the well-known Messinian climatic deterioration.

PLANKTIC FORAMINIFERAL PALEOBIOGEOGRAPHY

Patterns in the temporal distribution of species of planktic foraminifera which characterize distinct climatic conditions should reflect changes in the paleoceanographic conditions in a given area. Olsson (1982) in a review of published and unpublished data on the paleobiogeographic distribution of Cenozoic planktic foraminifera recognizes a number of species which are indicators of specific climatic conditions (Figs. 68-70). In this study, paleoclimatic interpretations based on changes in the abundance of key indicator species, particularly Globorotalia miozea, are compared with the $\delta^{18}O$ record of Site 563. Globorotalia miozea was chosen for closer study because it is a member of the subgenus Globoconella, which has been shown by Kennett and Srinivasan (1981) and Kennett (1982) to have evolved in middle latitude regions in the Neogene. Thus, its presence in lower latitudes should indicate the incursion of cooler surface waters. This is the first study in which the abundances of G. miozea are compared with the $\delta^{18}O$ record in the Western North Atlantic Basin.

The planktic foraminiferal oxygen isotope record of Site 563 (Fig. 57) is sparse in the upper middle to upper Miocene due to carbonate dissolution of the species Globoquadrina altispira altispira used in the analyses. Globoquadrina altispira altispira was chosen for isotopic analyses because its $\delta^{18}O$ composition is approximately the same as that of Globigerinoides sacculifer (Brady) (Vincent and others, in press), a species known to live in the upper portion of the water column (Be and Tolderlund, 1971; Be, 1977). In addition, it is

Figure 68

Paleobiogeographic distribution of species

Paleobiogeographic distribution of species	LOWER MIOCENE				
	TROPICAL	WARM SUB-TROPICAL	COOL SUB-TROPICAL	SUBPOLAR	POLAR
GLOBOROTALIA					
mendacis	X				
mayeri	X	X			
continuosa	X	X	X		
kugleri	X	X	X		
peripheroronda	X	X	X		
praescitula	X	X	X	X	
acrostoma		X			
zealandica incognita		X	X		
zealandica zealandica		X	X	X	X
pseudocontinuosa			X		
conica			X	X	
GLOBIGERINA					
drury	X	X			
angustiumbilicata	X	X	X		
bradyi	X	X	X		
falconensis	X	X	X		
juvenilis	X	X	X		
praebulloides	X	X	X		
woodi	X	X	X	X	X
quinqueloba			X		
bulloides			X	X	
woodi connecta			X	X	
GLOBIGERINOIDES					
subquadratus	X	X			
obliquus	X				
sacculifer	X				
primordius	X	X			
altiaperturus	X	X	X		
bisphaericus	X	X	X		
trilobus	X	X	X		
GLOBOQUADRINA					
tripartita	X				
venezuelana	X	X			
altispira	X	X			
dehiscens	X	X	X	X	
binaiensis		X			
CATAPSYDRAX					
stainforthi	X				
dissimilis	X	X	X	X	X
unicavus	X	X	X	X	X
GLOBIGERINATELLA					
insueta	X	X	X		
GLOBOROTALOIDES					
suteri	X	X	X	X	X
SPHAEROIDINELLA					
disjuncta			X		
CASSIGERINELLA					
chipolensis	X	X	X		

Figure 69

Paleobiogeographic distribution of species

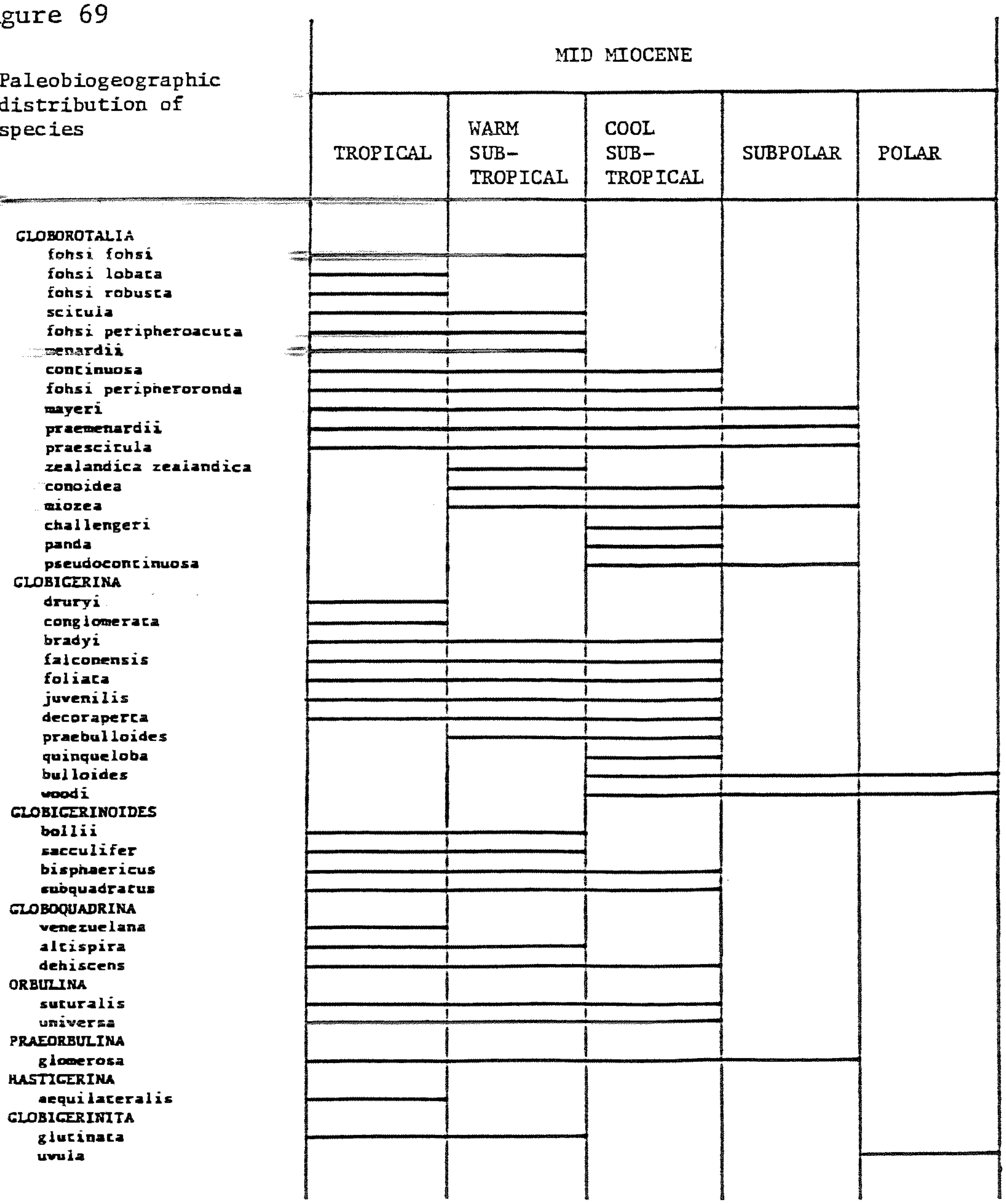
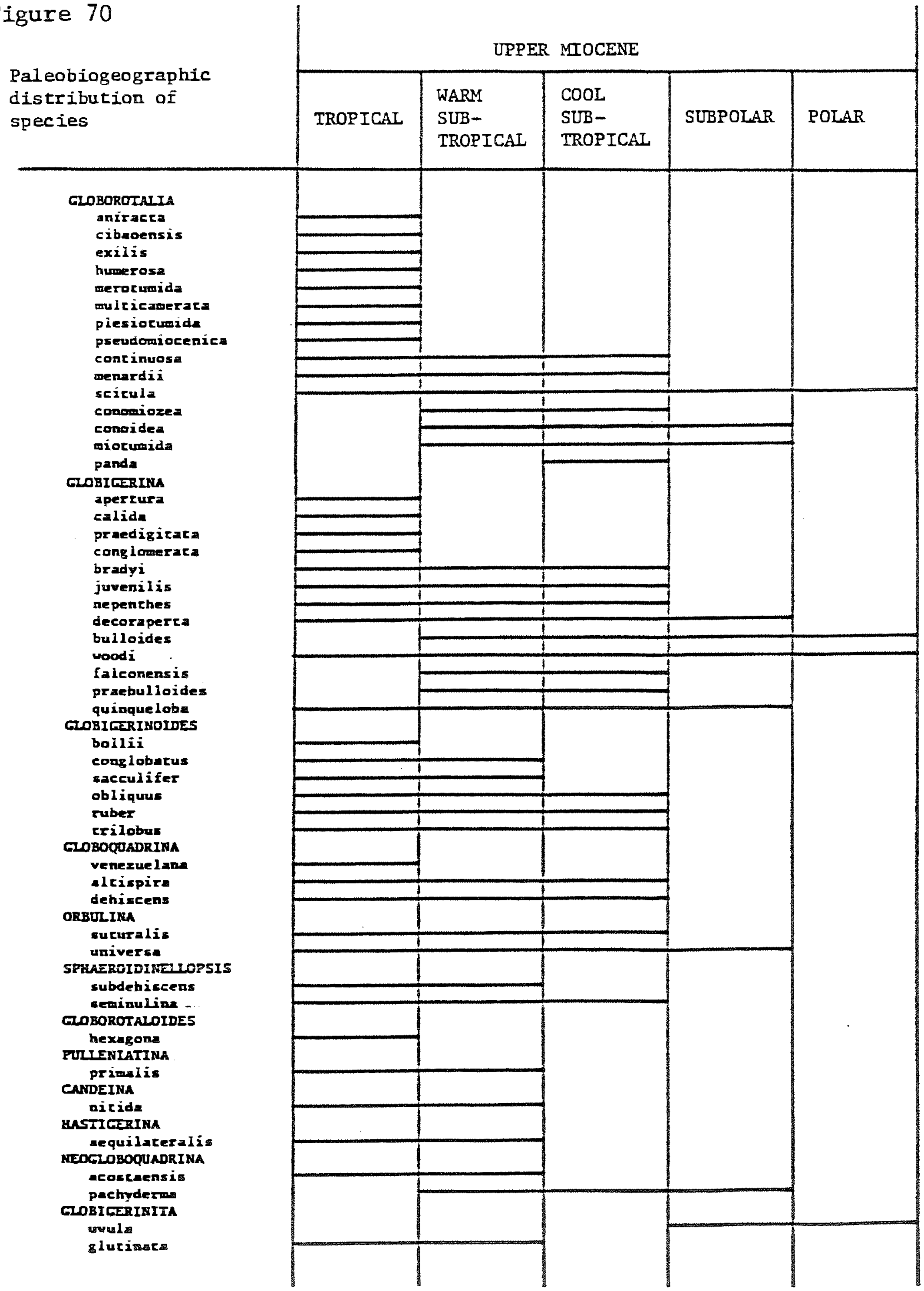


Figure 70

Paleobiogeographic distribution of species



often present in samples which lack G. sacculifer as a result of carbonate dissolution.

In the upper Oligocene-lower Miocene at Site 563 prior to the appearance of G. miozea an overall warming trend is inferred from the $\delta^{18}O$ data (Fig. 67). Within this interval tropical to warm sub-tropical species such as Globoquadrina venezuelana, Globorotalia mayeri, and Globigerinoides subquadratus are common (Appendix 2). The largely tropical species Globoquadrina tripartita is also present, except in the uppermost Oligocene where the $\delta^{18}O$ data suggest cooler conditions (Fig. 67; Appendix 2). It is also absent in the upper Globorotalia kugleri Zone where a poorly constrained cooling event may be present (Fig. 67; Appendix 2).

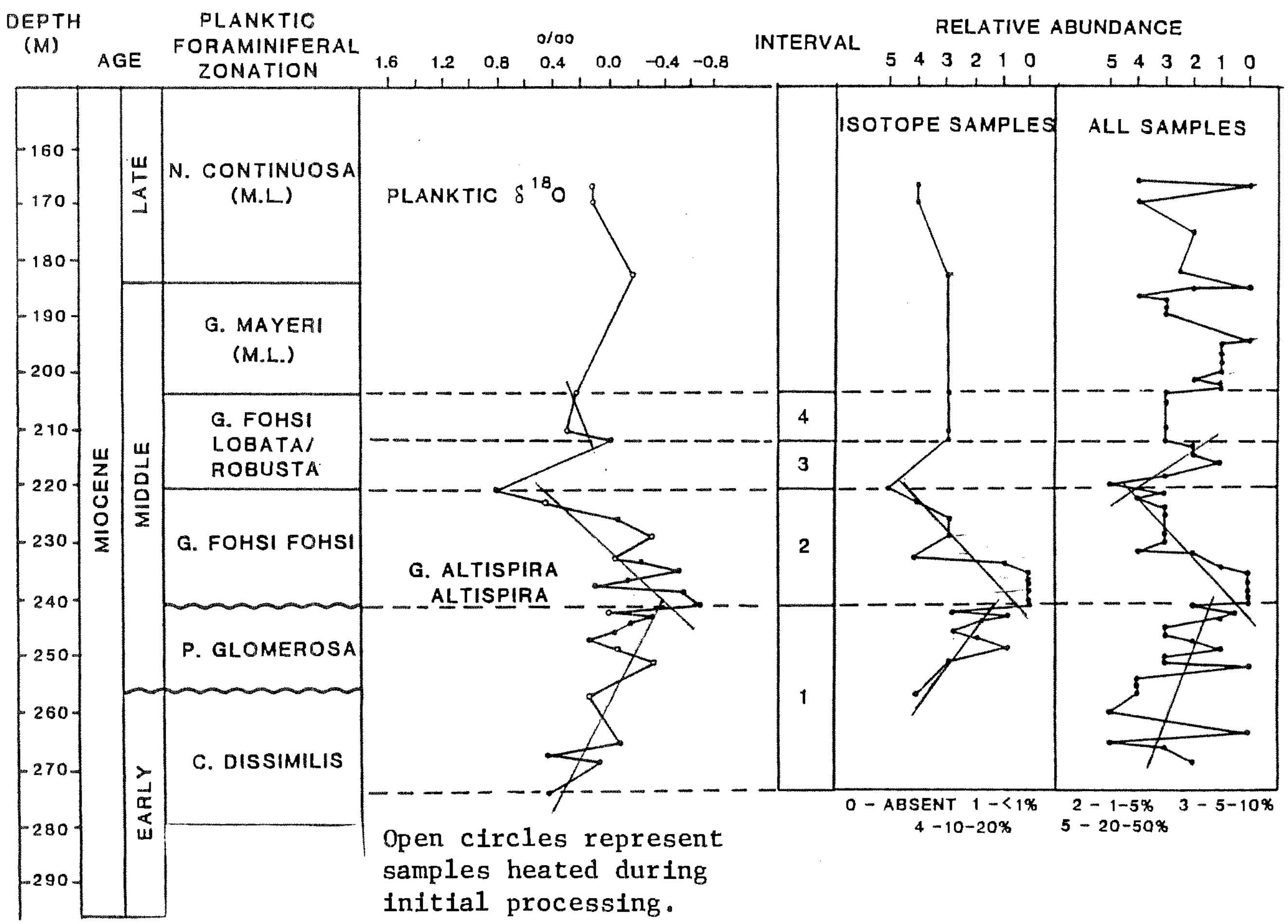
The Miocene interval at Site 563 where G. miozea is present is divided into four "intervals", based on changes in overall $\delta^{18}O$ trends, through which least-squares-fit regression lines are plotted (Fig. 71). Regression lines are also plotted for the abundances of G. miozea (Fig. 71).

Portions of the $\delta^{18}O$ curve in Figure 71 which indicate overall cooling and portions of the G. miozea curve which indicate overall increases in abundance are expressed by a least-squares-fit line with a negative slope. Similarly, least-squares-fit lines with positive slopes indicate overall warming and a decrease in the abundance of G. miozea.

It can be observed that there is a good correlation between planktic foraminiferal $\delta^{18}O$ values and abundances of G. miozea (Fig. 71). In general, increases in $\delta^{18}O$ are matched by increases in the abundance of G. miozea.

Figure 71

PLANKTIC OXYGEN ISOTOPE RECORD AND ABUNDANCE OF G. MIOZEA AT SITE 563



Open circles represent samples heated during initial processing.

During interval 1 the $\delta^{18}O$ record of planktic foraminifera has a positive slope, while benthic values change little (Fig. 71, Table 12; Miller and others, 1985B). Using Pleistocene convention (Shackleton and Opdyke, 1973) this indicates a general surface-water warming trend (Fig. 71; Table 12). The G. miozea record also has a positive slope, indicating a decrease in abundance (Fig. 71; Table 12). Thus, the $\delta^{18}O$ record and the abundances of G. miozea, as well as other selected planktic foraminifera, suggest that following a latest Oligocene cooling, Site 563 experienced a general increase of surface temperatures during the early Miocene. A slight cooling may be present in the earliest Miocene upper G. kugleri Zone (Fig. 67).

All records have negative slopes during interval 2, indicating a general cooling trend (Fig. 71; Table 12). Covariance of benthic and planktic $\delta^{18}O$ values is less than 0.4 per mil, while G. altispira altispira shows an increase of approximately 1.0 per mil (Fig. 71). Using the Pleistocene convention, this indicates approximately 0.6 per mil of surface water cooling (approximately 3 C). Although the records of $\delta^{18}O$ values and the abundance of G. miozea are poorly constrained in intervals 3 and 4 the matchup is still good (Fig. 71; Table 12). In interval 3 all records have a positive slope, suggesting an overall warming trend (Fig. 71; Table 12). The $\delta^{18}O$ record in interval 4 has a negative slope, suggesting an overall cooling, although no change occurs in the abundance of G. miozea (Fig. 71; Table 12).

Above interval 4 dissolution is too great in most samples to allow overall paleoclimatic interpretations to be made based on the abundances of G. miozea. However, dissolution is low enough in three

Table 12
Slope of least-squares-fit lines through O-18 and *G. miozea* abundance records

Interval	Planktic O-18	% *G. miozea* in O-18 samples	% *G. miozea* in all samples
4	−0.37	infinite	infinite
3	+0.46	+2.20	+0.20
2	−0.52	−1.29	−0.71
1	+0.40	+1.17	+0.44

samples to permit paleoclimatic interpretations to be made of the planktic foraminferal fauna of each. At 201.62m in the lower part of the G. mayeri Zone the abundance of G. miozea is low, suggesting warm conditions (Appendix 2). In the lower part of the N. continuosa Zone at 186.63m an abundance of G. miozea suggests much cooler conditions (Appendix 2). Decreased numbers of this species slightly higher in the zone, at 185.05m, suggest warmer conditions (Appendix 2). However, many of the late Miocene forms referred to G. miozea appear to be gradational with G. menardii and, thus, may not have the same paleoceanographic significance as earlier forms of G. miozea.

CONCLUSIONS

1) A decrease in paleobathymetry in the upper Oligocene (Globigerina ciperoensis Zone) in the AMCOR 6011 well may be associated with an uppermost Oligocene (upper Globigerina ciperoensis Zone) increase in planktic and benthic $\delta^{18}O$ values at Site 563. The $\delta^{18}O$ shift coincides with an uppermost Oligocene coastal offlap event and sea-level fall shown in the curve of Vail and others (1980).

2) Sea-level rose in the ASP 15 and B-3 wells in the early Miocene (Catapsydrax dissimilis Zone through Globigerinatella insueta Zone). This agrees with the curve of Vail and others (1980) which shows a coastal onlap event and sea-level rise during this interval. At Site 563 this period is marked by an decrease in planktic and benthic $\delta^{18}O$ values.

3) An early Miocene (upper G. insueta Zone) sea-level fall is evident in the ASP 14 and COST B-3 wells. The curve of Vail and others (1980) shows a coastal offlap event and sea-level fall corresponding to the base of the Praeorbulina glomerosa Zone. The results of this study suggest that either an additional sequence is present in the early Miocene (upper G. insueta Zone) or that the sequence identified by Vail and others (1980) may have begun earlier, in the upper Globigerinatella insueta Zone. The G. insueta and Catapsydrax stainforthi Zones are missing at Site 563, probably due to increased corrosiveness of bottom-waters.

4) In the COST B-3 well the undifferentiated Globorotalia fohsi peripheroronda/ middle G. fohsi fohsi Zones lie unconformably above the Globigerinatella insueta Zone with the younger sediments having

been deposited in a shallower paleoenvironment, in agreement with the curve of Vail and others (1980). The general rise in sea-level in the Globorotalia fohsi peripheroronda Zone and lower Globorotalia fohsi fohsi Zone shown in the curve of Vail and others (1980) is in agreement with the record in the COST B-3 well.

5) Deltaic conditions do not appear to have commenced in the vicinity of the present-day inner to middle continental shelf prior to the early Miocene (Globigerinatella insueta Zone) and appear to have ended by the late Pliocene (Globorotalia inflata Zone to G. tosaensis Zone).

6) Deltaic conditions do not appear to have commenced in the vicinity of the present day mid-upper continental slope prior to the middle Miocene (Globorotalia fohsi peripheroronda Zone) and appear to have ended prior to the latest Miocene (Globorotalia conomiozea Zone). Deltaic deposition was interrupted in the upper middle Miocene (G. fohsi lobata/robusta Zone) in the ASP 14 and 15, and COST B-3 wells. At Site 563 an increase in planktic and benthic $\delta^{18}O$ values corresponding to the middle of this zone suggest a reduction in glacial ice and a rise of sea-level. This is in agreement with the curve of Vail and others (1980).

7) Miocene deep-sea hiatuses are present at Site 563 in the Catapsydrax stainforthi/Globigerinatella insueta Zones and Globorotalia fohsi peripheroronda Zone. No hiatuses appear to be present at Site 334.

8) Changes in the abundance of Globorotalia miozea are inversely related to changes in surface-water paleotemperatures inferred from planktic $\delta^{18}O$ data.

9) A major increase in benthic $\delta^{18}O$ values in the middle Miocene (Globorotalia fohsi fohsi Zone) does not appear to be the cause of a change in the benthic foraminiferal fauna which takes place prior to, and after, the increase.

APPENDIX 1

Samples examined

AMCOR wells (core/section/meters from top of section)

6009B

1/1/1.3	9/1/1.48	14/1/1.4	22/2/0.25
2/1/1.7	9/2/1.44	14/2/0.4	23/2/0.5
2/2/1.7	10/1/1.44	14/4/0.1	24/1/1.4
3/1/0.12	10/2/1.49	14/4/0.7	27/1/0.1
3/2/1.45	10/3/1.46	14/5/1.3	27/2/1.15
4/1/1.21	11/2/0.05	15/1/0.28	27/2/1.2
4/2/1	12/1/0.08	15/3/0.6	28/2/1
5/1/0.6	12/1/0.09	16/1/1	29/2/1
8/1/1.2	12/2/0.55	17/1/1.32	30/1/0.83
8/2/0.01	12/4/0.15	18/1/1	30/2/0.3
8/2/0.07	12/5/1.44	19/1/0.8	30/2/1.48
8/2/0.5	12/6/0.4	20/1/1.46	31/1/1.1
8/3/1.45	13/1/1.3	21/1/1.2	32/1/1.3
9/1/0.37	13/1/1.45	21/3/0.4	

6010

1/1/1.2	9/3/0.1	16/1/1	22/5/1
1/3/1	10/1/1.3	16/3/1	23/1/1.4
2/1/1.2	10/1/1.5	18/1/1.3	25/1/1.1
3/1/1	11/1/1.5	19/1/1	26/1/0.1
4/1/1.3	11/3/0.6	19/3/0.03	26/1/0.45
5/1/0.6	11/3/1.4	19/5/1	26/3/1
6/1/1.1	12/1/1.4	20/1/1.3	26/5/1
6/3/1.2	12/3/1	20/3/1	26/6/1.3
7/1/1	13/1/1	20/5/0.65	26/6/1.4
7/3/0.8	14/1/1.35	21/1/1.4	27/1/1.5
7/3/1.1	14/3/1	21/3/0.8	
8/1/1	14/5/1	22/1/0.8	
9/1/1.5	15/1/1	22/3/1.25	

6011

1/1/1.5	8/5/1	13/3/0.8	18/1/1
2/1/1	9/1/1	13/5/1	20/1/1
3/1/1.4	10/1/1.45	14/1/1.3	21/1/1.4
6/1/1.45	11/1/1	14/3/1	22/1/1.45
7/1/0.1	11/3/1	15/2/1	23/1/1.3
7/1/1.3	11/5/0.22	16/2/0.2	24/1/0.5
8/1/0.3	12/1/0.6	16/2/0.6	24/1/1.2
8/3/1	13/1/0.9	17/2/0.1	

APPENDIX 1 (continued)

ASP Wells (core/meters from top of core).

13

8/0.08	12/1.46	15/1.22	18/0.3
8/0.46	12/1.77	15/2.59	18/0.88
8/0.87	12/2.5	15/3.29	18/1.4
8/1.07	12/2.68	15/3.38	18/2.68
8/1.42	12/3.26	15/3.66	18/3.17
8/1.75	13/1.22	15/4.33	18/3.87
8/2.74	13/1.52	16/0.03	18/4.51
8/3.09	13/1.55	16/0.49	19/0.3
8/3.51	13/2.06	16/0.88	19/0.79
8/3.93	13/2.41	16/1.49	19/1.4
9/0.23	13/2.67	16/2.13	19/2.47
9/0.66	13/2.74	16/2.74	19/3.38
9/1.04	14/0.12	16/3.32	19/4.02
9/1.28	14/0.76	17/0.3	19/4.45
9/1.83	14/1.07	17/0.76	20/0.67
9/2.04	14/1.22	17/1.52	20/1.16
9/2.5	14/1.55	17/2.77	20/2.23
10/0.06	14/1.83	17/3.17	20/2.71
10/0.4	14/2.1	17/3.81	20/3.23
11/0.15	15/0.3	17/4.27	
12/0.85	15/0.91	17/4.57	

14

2/3.23	6/2.38	9/4.6	13/0.3
2/3.66	7/0.52	10/1.1	13/0.82
2/4.27	7/1.43	10/1.65	13/1.34
3/0.61	7/2.44	10/2.5	13/1.89
3/1.86	7/3.66	10/3.11	13/2.68
3/2.19	7/4.15	10/3.72	13/3.32
4/0.46	7/4.27	10/4.33	13/3.87
4/1.71	8/0.06	10/4.6	13/4.6
4/2.38	8/0.64	11/0.03	16/0.49
4/3.08	8/1.52	11/0.61	16/1.22
5/0.24	8/3.14	11/1.25	16/1.83
5/0.85	8/3.78	11/2.44	16/2.62
5/1.43	8/4.54	11/3.75	18/0.15
5/2.9	9/0.49	12/0.27	18/0.85
5/3.29	9/1.34	12/0.91	18/1.46
5/3.69	9/1.74	12/1.49	18/2.07
5/4.51	9/2.77	12/2.9	18/2.65
6/0.43	9/3.29	12/3.9	19/0.24
6/1.07	9/3.93	12/4.33	19/0.85
6/1.74	9/4.3	12/4.63	

APPENDIX 1 (continued)

15

3/0.06	4/0.09	4/3.72	5/1.07
3/0.91	4/0.58	4/4.21	5/1.89
3/1.52	4/1.22	4/4.51	5/2.44
3/2.13	4/2.53	5/0.09	7/0.3

DSDP Sites (core/section/centimeters from top of section)

563

2/1/5-9	6/5/5-9	10/4/80-84	14/1/80-84
2/1/80-84	6/6/80-84	10/5/5-9	14/2/5-9
3/1/5-9	7/1/5-9	10/6/5-9	14/3/5-9
4/1/5-9	7/2/5-9	11/1/5-9	14/6/5-9
4/1/80-84	7/3/5-9	11/1/80-84	15/1/5-9
4/2/5-9	7/4/80-84	11/2/5-9	15/2/5-9
4/2/80-84	7/6/80-84	11/3/80-84	15/3/5-9
4/3/5-9	8/1/5-9	11/4/5-9	15/4/5-9
4/4/5-9	8/2/5-9	11/5/5-9	15/5/5-9
5/1/5-9	8/3/80-84	12/1/5-9	15/5/80-84
5/1/80-84	8/5/5-9	12/3/80-84	15/6/5-9
5/2/80-84	8/6/5-9	12/4/80-84	15/6/80-84
5/3/80-84	9/1/5-9	12/5/5-9	16/1/5-9
5/4/80-84	9/3/80-84	12/6/110-114	16/1/80-84
5/5/80-84	9/4/80-84	13/1/5-9	16/2/5-9
5/6/5-9	9/5/80-84	13/1/60-64	16/2/80-84
5/6/80-84	9/6/80-84	13/1/110-114	16/3/5-9
6/1/5-9	10/1/5-9	13/5/60-64	16/3/80-84
6/1/80-84	10/2/80-84	13/5/110-114	16/4/5-9
6/2/5-9	10/3/80-84	14/1/5-9	16/4/80-84

334

2/1/5-9	6/1/20-24	8/1/53-57	11/4/88-92
2/3/5-7	6/2/140-144	9/1/80-84	12/1/100-104
2/6/70-74	7/1/5-9	9/4/90-94	13/1/80-84
3/1/30-32	7/2/81-85	10/1/80-87	14/1/73-77
3/2/78-82	7/3/83-89	10/4/93-97	15/1/35-39
4/1/19-23	7/4/5-9	10/6/140-150	

COST B-3 Well

(Meters below sea level/feet below Kelly Bushing)

1158.3/3810	1249.7/4110	1350.3/4440	1432.6/4710
1167.4/3840	1258.8/4140	1359.5/4470	1441.7/4740

APPENDIX 1 (continued)

COST B-3 Well

1176.6/3870	1268.0/4170	1368.6/4500	1450.9/4770
1185.7/3900	1295.5/4260	1377.8/4530	1460.0/4800
1194.9/3930	1304.6/4290	1386.9/4560	1469.1/4830
1204.0/3960	1313.8/4320	1396.1/4590	1478.2/4860
1213.2/3990	1322.9/4350	1405.2/4620	
1222.3/4020	1332.0/4380	1414.3/4650	
1231.4/4050	1341.2/4410	1423.5/4680	

APPENDIX 2

Distribution of planktic species

AMCOR 6011

	GLOBIGERINA PRAEBULLOIDES	GLOBOROTALIA CF. SEMIVERA	GLOBOROTALIA OBESA
218.0M	.	1	.
227.2M	.	1	.
235.6M	4	1	1

AMCOR 6009B

	GLOBIGERINA ANGUSTIUMBILICATA	GLOBIGERINA BULLOIDES	GLOBIGERINA SP.	GLOBIGERINOIDES RUBER	GLOBIGERINOIDES SACCULIFER	GLOBOROTALIA CRASSAFORMIS	GLOBOROTALIA INFLATA	GLOBOROTALIA OBESA	GLOBOROTALIA SP.	NEOGLOBOQUADRINA BLOWI	NEOGLOBOQUADRINA CF. DUTERTREI	NEOGLOBOQUADRINA DUTERTREI	NEOGLOBOQUADRINA HUMEROSA	NEOGLOBOQUADRINA PSEUDOPACHYDERMA	NEOGLOBOQUADRINA PSEUDOPIMA	TURBOROTALIA QUINQUELOBA
69.5M	..	..	..	.1	..	..	..	..	..	..	..	..	..	..	..	..
84.41M	.2	..	.8	..	..	..	.1	..	.1	13	..	.5	..	..	..	.1
93.2M	..	.1	.1	.3	.2	.1	.9	..	..	.2	.5	..	10	.2	.5	.3
122.2M	..	..	..	..	..	..	..	.1	..	..	..	..	..	..	..	.1
125.45M	..	..	.1	..	..	..	..	..	..	..	..	..	..	..	..	..
167.24M	..	..	.2	..	..	..	..	..	..	..	..	..	..	..	..	.2

APPENDIX 2 (Continued)

AMCOR 6010

	GLOBIGERINA BULLOIDES	GLOBIGERINA DECORAPERTA	GLOBIGERINA PRAEBULLOIDES	GLOBIGERINA SP.	GLOBIGERINA WOODI WOODI	GLOBIGERINITA INCRUSTA	GLOBIGERINOIDES BULLOIDEUS	GLOBIGERINOIDES CONGOBLATUS	GLOBIGERINOIDES EXTREMUS	GLOBIGERINOIDES IMMATURA	GLOBIGERINOIDES RUBER	GLOBIGERINOIDES SACCULIFER	GLOBIGERINOIDES SP.	GLOBIGERINOIDES TRILOBA TRILOBA	GLOBOROTALIA CF. JUANAI	GLOBOROTALIA CF. SCITULA	GLOBOROTALIA CRASSAFORMIS
141.2M	.4	..	..	.1	..	..	..	..	..	..	.2	..	..	.1	..	..	.1
151.2M	19	..	..	.1	..	..	..	.6	.1	..	15	.5	..	.7	..	..	21
152.8M	..	..	..	.1	..	..	..	..	..	..	.1	..	..	.1	..	..	..
160.4M	..	..	..	..	..	..	..	..	..	..	.2	..	..	..	..	..	.1
160.6M	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
170.1M	.2	.1	..	..	..	.1	..	..	..	..	.1	..	..	.1	..	..	..
172.2M	..	..	..	.1	..	..	..	..	..	..	..	..	..	..	..	..	..
173.0M	..	..	..	.3	..	..	..	..	..	..	..	..	..	..	..	..	..
179.7M	.2	..	..	.2	..	..	..	..	..	..	..	..	.1	..	..	..	..
273.6M	..	..	..	.2	..	..	..	..	..	..	..	..	..	..	..	..	..
280.3M	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
283.7M	.3	..	..	.1	..	.1	..	..	..	..	..	..	..	..	..	..	..
302.3M	..	..	.2	..	.1	..	..	..	..	..	..	..	..	..	..	.1	..
310.7M	.2	..	.9	31	..	..	..	..	..	..	..	..	..	..	..	.1	..
314.6M	..	..	..	.1	..	..	.1	..	..	.1	..	..	..	..	.1	..	..

	GLOBOROTALIA INFLATA	GLOBOROTALIA MENARDII	GLOBOROTALIA SP.	GLOBOROTALIA VIOLA	HASTIGERINA AEQUILATERALIS	NEOGLOBOQUADRINA ACOSTAENSIS	NEOGLOBOQUADRINA CF. ACOSTAENSIS	NEOGLOBOQUADRINA CF. PSEUDOPIMA	NEOGLOBOQUADRINA CONTINUOSA	NEOGLOBOQUADRINA DUTERTREI	NEOGLOBOQUADRINA HUMEROSA	NEOGLOBOQUADRINA PSEUDOPACHYDERMA	NEOGLOBOQUADRINA PSEUDOPIMA	NEOGLOBOQUADRINA SP.	PULLENIATINA OBLIQUILOCULATA	SPHAEROIDINELLA DEHISCENS	TURBOROTALIA QUINQUELOBA
141.2M	.1	..	..	..	..	..	..	..	..	.1	..	.9	14	..	..	..	13
151.2M	25	.4	..	.2	.1	..	.1	..	..	18	.4	15	.9	..	21	.1	.1
152.8M	..	..	..	..	.1	..	..	..	..	..	..	.3	.3	..	..	..	.1
160.4M	.1	..	..	..	..	..	..	..	..	..	..	.7	.4	..	..	..	.2
160.6M	.2	.1	..	..	..	.1	..	.2	..	.1	..	.4	..	.5	..	..	.2
170.1M	.4	..	..	..	..	..	.2	..	..	..	..	.3	10	..	..	..	12
172.2M	..	..	.3	..	..	..	..	.2	..	..	..	..	..	..	..	..	..
173.0M	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
179.7M	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
273.6M	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	.1
280.3M	..	..	..	..	..	..	..	..	.8	..	..	.5	..	..	..	..	..
283.7M	..	..	..	..	..	..	..	..	.1	..	..	.1	..	..	..	..	..
302.3M	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
310.7M	..	..	..	..	..	.2	..	..	..	..	..	..	..	..	..	..	.1
314.6M	..	..	..	..	..	..	..	..	..	..	..	.7	..	..	..	..	..

APPENDIX 2 (Continued)

ASP 13

	GLOBIGERINA CF. BULLOIDES	GLOBIGERINA FALCONENSIS	GLOBIGERINA JUVENELLIS	GLOBIGERINA PRAEBULLOIDES	GLOBIGERINA SPP.	GLOBIGERINITA INCRUSTA	GLOBIGERINOIDES BULLOIDEUS	GLOBIGERINOIDES OBLIQUUS	GLOBIGERINOIDES QUADRILOBATUS	GLOBIGERINOIDES SPP.	GLOBIGERINOIDES TRILOBA IMMATURA	GLOBIGERINOIDES TRILOBA TRILOBA	GLOBOQUADRINA DEHISCENS	GLOBOROTALIA AFF. MENARDII	GLOBOROTALIA SPP.	NEOGLOBOQUADRINA ACOSTAENSIS	NEOGLOBOQUADRINA CONTINUOSA	ORBULINA SUTURALIS	SPHAEROIDINELLOPSIS SEMINULINA
867.5M	..	..	.2	.1	.3	.1	..	..	..	..	..	.1	..	..	.1	.2	.2	..	..
871.2M	..	.1	..	..	.1	.1	..	..	..	..	..	..	..	..	..	..	..	..	..
947.5M	.1	..	.1	.1	.3	.2	..	.6	11	.2	..	..	..	..	..	..	.4	.1	..
948.1M	..	..	.6	.3	..	.6	..	..	..	.1	.1	..	..	.1	..	.3	.5	..	.3
948.6M	..	..	.1	..	..	..	..	..	.4	..	..	.1	..	..	..	.1	.1	..	..
948.9M	..	..	.1	.2	.1	.1	.1	..	.1	..	..	.1	..	..	..	.1	.3	..	..
963.2M	..	..	..	..	..	..	..	..	..	..	..	..	.2	..	..	..	..	..	..
965.5M	..	..	..	..	..	..	..	..	..	..	..	..	.1	..	..	..	..	..	..
966.2M	..	..	..	..	.6	..	..	..	..	..	.2	..	.1	..	..	.2	.6	..	..
966.9M	..	..	..	..	23	..	..	..	.1	.1	..	..	..	..	..	.2	.5	..	..

ASP 14

	CATAPSYDRAX CF. DISSIMILIS	GLOBIGERINA ANGUSTIUMBILICATA	GLOBIGERINA APERTURA	GLOBIGERINA BULLOIDES	GLOBIGERINA CF. EAMESI	GLOBIGERINA CF. FALCONENSIS	GLOBIGERINA CONCINNA	GLOBIGERINA DECORAPERTA	GLOBIGERINA FOLIATA	GLOBIGERINA JUVENILLIS	GLOBIGERINA LABIACRASSATA	GLOBIGERINA PRAEBULLOIDES	GLOBIGERINA SP.	GLOBIGERINA SP. A	GLOBIGERINA WOODI WOODI	GLOBIGERINATELLA INSUETA
1213.9M	...	...	...	..7	...	...	...	...	...	...	...	...	...	...	...	...
1214.4M	...	...	...	..7	...	...	...	...	...	...	...	...	...	...	...	...
1305.4M	...	...	..9	..3	...	..4	...	..1	...	..3	...	...	...	...	..4	...
1345.8M	...	...	...	..1	...	...	...	...	...	..2	...	...	..1	...	...	...
1419.1M	...	...	...	...	...	...	...	...	...	..2	...	...	..1	...	...	...
1420.2M	...	...	...	..2	...	...	...	...	...	..2	...	.12	..1	...	...	...
1422.2M	...	...	...	...	...	...	...	...	...	..1	...	...	...	...	...	...
1470.2M	...	...	...	.14	...	..3	..3	...	..5	..6	..1	.11	.26	...	...	...
1470.9M	...	..1	...	...	...	..7	...	...	..2	..1	..1	.12	..5	...	...	...
1471.6M	...	...	...	...	...	..1	...	...	..2	...	...	...	..1	..1	..1	...
1472.2M	...	..1	...	..1	...	..1	...	...	...	...	...	...	..2	...	...	...
1472.7M	...	..4	...	...	...	..6	...	...	..3	..2	...	.33	.45	..2	...	..1
1475.2M	...	...	...	..2	..1	...	...	...	..2	..1	.13	..3	..1	...	...	...
1475.8M	..1	.10	...	.12	...	...	..2	...	..6	..5	...	.32	...	...	...	..1

APPENDIX 2 (Continued)

ASP 14

	GLOBIGERINITA INCRUSTA	GLOBIGERINITA NAPARIMAENSIS	GLOBIGERINOIDES CF. SICANUS	GLOBIGERINOIDES MITRA	GLOBIGERINOIDES QUADRILOBATUS	GLOBIGERINOIDES RUBER	GLOBIGERINOIDES SACCULIFER	GLOBIGERINOIDES SP.	GLOBIGERINOIDES SUBQUADRATUS	GLOBIGERINOIDES TRILOBA IMMATURA	GLOBIGERINOIDES TRILOBA TRILOBA	GLOBOQUADRINA ALTISPIRA ALTISPIRA	GLOBOQUADRINA ALTISPIRA GLOBOSA	GLOBOQUADRINA BAROEMOENENSIS	GLOBOQUADRINA DEHISCENS ADVENA	GLOBOQUADRINA DEHISCENS DEHISCENS
1213.9M	..1	...	...	...	...	..7	...	...	...	...	..1	...	...	...	...	...
1214.4M	...	...	...	...	...	..7	...	...	...	...	..1	...	...	...	...	...
1305.4M	..6	...	...	...	..2	...	...	..1	...	...	..3	...	...	..2	...	...
1345.8M	...	...	...	...	...	..1	...	...	...	...	...	...	...	...	...	...
1419.1M	..1	...	...	...	[illegible]	...	...	...	..6	..7	..1	...	...	...	...	...
1420.2M	...	...	...	..2	..2	..6	...	...	...	..5	..5	...	...	..1	...	...
1422.2M	...	...	...	...	...	...	...	...	...	...	...	...	...	..1	...	...
1470.2M	.14	...	...	...	...	...	..2	..2	...	..4	..1	..1	..1	...	..6	..2
1470.9M	.10	...	..2	...	...	...	..2	..3	..3	..3	..2	...	..1	...	..8	..6
1471.6M	...	..1	...	...	...	...	..2	..1	..2	..2	..2	...	...	..1	...	..2
1472.2M	..1	...	...	...	...	...	...	..2	...	..3	..3	..2	..1	...	...	..2
1472.7M	.12	...	..1	...	...	...	..3	...	...	...	...	..2	...	...	..9	..7
1475.2M	..4	...	...	...	...	...	..6	..2	..3	.21	.15	...	...	...	..4	..6
1475.8M	.12	...	..1	...	...	...	..6	...	..2	..6	..8	..1	...	...	.33	.23

	GLOBOQUADRINA SP.	GLOBOQUADRINA TRIPARTITA	GLOBOQUADRINA VENEZUELANA	GLOBOROTALIA ACROSTOMA	GLOBOROTALIA CF. CIBAOENSIS	GLOBOROTALIA CF. CRASSAFORMIS	GLOBOROTALIA CF. MIOZEA	GLOBOROTALIA CF. SCITULA	GLOBOROTALIA FOHSI PERIPHEROACUTA	GLOBOROTALIA FOHSI ROBUSTA	GLOBOROTALIA INFLATA	GLOBOROTALIA MAYERI	GLOBOROTALIA MENARDII	GLOBOROTALIA MIOZEA	GLOBOROTALIA MIOZEA S.L.	GLOBOROTALIA PARALENGUAENSIS
1213.9M	...	...	...	...	...	..1	...	...	...	...	.12	...	...	...	...	...
1214.4M	...	...	...	...	...	...	...	...	...	...	.13	...	...	...	...	...
1305.4M	...	...	..1	...	..1	...	...	...	...	...	...	...	..2	...	..1	...
1345.8M	..1	...	...	...	...	...	...	...	...	...	...	.26	...	...	..3	...
1419.1M	...	...	...	...	...	...	...	...	..1	..1	...	.13	...	...	...	...
1420.2M	...	...	...	...	...	...	...	..4	...	..1	...	.66	..1	...	...	..1
1422.2M	...	...	...	...	...	...	...	..2	...	...	...	..3	...	...	..2	...
1470.2M	...	...	..5	..4	...	...	...	...	...	...	...	.37	...	.29	.31	...
1470.9M	...	...	..3	...	...	...	...	...	...	...	...	..3	...	..5	..5	...
1471.6M	...	...	...	...	...	...	...	...	...	...	...	.13	...	..1	...	...
1472.2M	...	..2	..2	..2	...	...	...	...	...	...	...	.29	...	...	..8	...
1472.7M	..3	..3	...	...	...	...	...	...	...	...	...	109	...	.28	.75	...
1475.2M	...	..1	..3	...	...	...	...	...	...	...	...	.91	...	...	..4	...
1475.8M	..2	..1	..5	...	...	...	.12	...	...	...	...	111	...	.80	.67	...

APPENDIX 2 (Continued)

ASP 14

	GLOBOROTALIA PERIPHERORONDA	GLOBOROTALIA PRAESCITULA	GLOBOROTALIA SCITULA	GLOBOROTALIA SP. A	GLOBOROTALIA SP. B	GLOBOROTALIA TRUNCATULINOIDES	GLOBOROTALIA ZEALANDICA	GLOBOROTALOIDES SUTERI	NEOGLOBOQUADRINA ACOSTAENSIS	NEOGLOBOQUADRINA CONTINUOSA	NEOGLOBOQUADRINA DUTERTREI	NEOGLOBOQUADRINA HUMEROSA	NEOGLOBOQUADRINA PACHYDERMA	NEOGLOBOQUADRINA PSEUDOPIMA	ORBULINA SUTURALIS	ORBULINA UNIVERSA
1213.9M	...	...	...	...	...	..3	...	...	...	...	.27	...	..1	..4	...	...
1214.4M	...	...	...	...	...	..3	...	...	...	...	.27	...	..1	..4	...	...
1305.4M	...	...	..2	...	...	...	...	...	.26	.32	...	..3	...	...	...	..3
1345.8M	...	...	..6	...	...	...	...	...	...	...	...	...	...	...	...	..4
1419.1M	...	...	..3	...	...	...	...	...	...	..1	...	...	...	...	..1	..2
1420.2M	...	...	..2	...	...	...	...	...	...	..1	...	...	...	...	...	..2
1422.2M	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
1470.2M	..1	...	...	..1	...	...	...	...	...	..1	...	...	...	...	..1	...
1470.9M	...	..5	...	...	...	...	...	...	...	...	...	...	...	...	...	...
1471.6M	...	..1	...	...	...	...	..4	...	...	..2	...	...	...	...	...	...
1472.2M	...	...	...	..1	..1	...	..2	..4	...	..4	...	...	...	...	...	...
1472.7M	...	...	...	...	...	...	..2	..1	...	.18	...	...	...	...	...	...
1475.2M	...	...	...	...	...	...	...	...	...	.12	...	...	...	...	...	...
1475.8M	..1	..3	...	...	...	...	..3	...	...	.28	...	...	...	...	...	...

	PRAEORBULINA GLOMEROSA CIRCULARIS ?	PRAEORBULINA SICANUS	PULLENIATINA PRIMALIS	SPHAEROIDINELLA DEHISCENS	SPHAEROIDINELLOPSIS DISJUNCTA	SPHAEROIDINELLOPSIS SEMINULINA	TURBOROTALIA QUINQUELOBA
1213.9M	...	...	..5	..7	...	...	..7
1214.4M	...	...	..3	...	...	...	...
1305.4M	...	...	...	...	...	...	...
1345.8M	...	...	...	...	...	...	...
1419.1M	...	...	...	...	...	..1	...
1420.2M	...	...	...	...	...	...	...
1422.2M	...	...	...	...	...	..2	...
1470.2M	..1	...	...	...	...	...	...
1470.9M	...	...	...	...	...	...	...
1471.6M	...	...	...	...	...	...	...
1472.2M	...	...	...	...	...	...	...
1472.7M	...	...	...	...	...	...	...
1475.2M	...	...	...	...	...	...	...
1475.8M	...	..1	...	...	..1	...	...

APPENDIX 2 (Continued)

ASP 15

	ACARININA CF. MEDIZZAI	ACARININA SP.	CANDEINA NITIDA	CATAPSYDRAX DISSIMILIS	CATAPSYDRAX UNICAVUS	CHILOGUEMBELINA CUBENSIS	GLOBIGERINA AMPLIAPERTURA	GLOBIGERINA ANGUSTIUMBILICATA	GLOBIGERINA BULLOIDES	GLOBIGERINA CF. EUAPERTURA	GLOBIGERINA CF. FALCONENSIS	GLOBIGERINA JUVENILIS	GLOBIGERINA OUACHITAENSIS GNAUCKI	GLOBIGERINA PRAEBULLOIDES	GLOBIGERINITA INCRUSTA	GLOBIGERINITA UNAPERTURENSIS
1508.8M	...	...	..1	...	...	...	...	..3	..2	...	...	..1	...	...	.16	...
1509.4M	...	...	...	...	...	...	...	...	...	...	...	...	...	...	..3	...
1510.0M	...	...	...	...	...	...	...	...	...	...	...	...	...	...	..1	...
1511.0M	...	...	...	...	...	...	...	...	...	...	...	...	...	...	..2	...
1511.5M	...	...	...	...	...	...	...	...	..1	...	...	...	...	..1	..1	...
1512.1M	...	...	...	...	...	...	...	...	...	...	...	...	...	..1	..2	...
1529.9M	...	...	...	..4	..1	...	...	...	...	...	..1	...	...	..1	..3	..1
1530.9M	...	...	...	..1	...	...	...	...	...	...	...	...	...	...	...	...
1531.7M	...	...	...	...	...	...	...	...	..4	...	..1	...	...	..1	...	...
1532.2M	...	...	...	..1	...	...	...	..1	..6	...	..2	...	...	..5	..4	...
1553.6M	..6	.12	...	..4	...	.10	..1	..2	...	..2	...	...	..2	...	...	...

	GLOBIGERINOIDES ALTIAPERTURA	GLOBIGERINOIDES RUBER	GLOBIGERINOIDES SACCULIFER	GLOBIGERINOIDES SUBQUADRATUS	GLOBIGERINOIDES TRILOBA IMMATURA	GLOBIGERINOIDES TRILOBA TRILOBA	GLOBOQUADRINA ALTISPIRA ALTISPIRA	GLOBOQUADRINA ALTISPIRA GLOBOSA	GLOBOQUADRINA BAROEMOENENSIS	GLOBOQUADRINA CF. TRIPARTITA	GLOBOQUADRINA DEHISCENS DEHISCENS	GLOBOQUADRINA TRIPARTITA	GLOBOQUADRINA VENEZUELANA	GLOBOROTALIA CF. MIOZEA	GLOBOROTALIA CF. MULTICAMERATA	GLOBOROTALIA CF. OPIMA NANA
1508.8M	...	..4	..6	...	...	..3	...	..2	..3	...	...	...	...	..8	..2	...
1509.4M	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
1510.0M	...	..2	...	...	...	...	...	...	..3	...	...	...	...	...	..1	...
1511.0M	...	..3	...	...	...	...	...	...	..4	...	...	...	...	...	...	...
1511.5M	...	..5	..5	...	...	...	..1	...	..8	...	...	...	...	...	...	...
1512.1M	...	...	..1	...	...	...	...	...	...	...	...	...	...	...	...	...
1529.9M	...	...	..5	..3	..8	.18	..1	..8	..2	...	.56	..3	..2	...	...	...
1530.9M	...	...	...	...	..1	..4	..1	..1	...	...	..6	..1	..1	...	...	...
1531.7M	..1	...	...	...	...	...	..1	..3	...	...	.16	...	..2	...	...	...
1532.2M	...	...	..2	...	..2	.16	...	...	...	..3	.17	...	..1	...	...	...
1553.6M	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	..9

APPENDIX 2 (Continued)

ASP 15

	GLOBOROTALIA FOHSI ROBUSTA	GLOBOROTALIA MAYERI	GLOBOROTALIA MIOZEA CF. CONOIDEA	GLOBOROTALIA MIOZEA S.L.	GLOBOROTALIA OBESA	GLOBOROTALIA PLESIOTUMIDA	GLOBOROTALIA PRAESCITULA	GLOBOROTALIA SCITULA	GLOBOROTALIA SCITULA GIGANTEA	GLOBOROTALIA ZEALANDICA	NEOGLOBOQUADRINA ACOSTAENSIS	NEOGLOBOQUADRINA CONTINUOSA	NEOGLOBOQUADRINA HUMEROSA	ORBULINA SUTURALIS	ORBULINA UNIVERSA	PSEUDOHASTIGERINA MICRA
1508.8M	...	...	..6	.19	...	..3	...	...	...	...	..9	...	120	..1	..1	...
1509.4M	...	...	..1	..6	...	...	...	..1	...	...	..1	...	.20	...	...	...
1510.0M	...	...	...	..3	...	...	...	...	...	...	..4	...	.22	...	...	...
1511.0M	...	...	...	...	..2	...	...	...	...	...	..5	...	.40	...	...	...
1511.5M	..3	.72	...	..3	..2	..1	...	...	..1	...	...	...	...	...	...	...
1512.1M	...	.13	...	..1	...	...	...	...	...	...	...	...	...	...	...	...
1529.9M	...	.41	...	.30	...	...	.31	...	...	..4	...	..1	...	...	...	...
1530.9M	...	.12	...	...	...	...	...	...	...	.15	...	...	...	...	...	...
1531.7M	...	..3	...	...	...	...	...	...	...	.10	...	...	...	...	...	...
1532.2M	...	.34	...	...	...	...	...	...	...	...	...	..6	...	...	...	...
1533.6M	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	..3

	SPHAEROIDINELLOPSIS SEMINULINA	SPHAEROIDINELLOPSIS SUBDEHISCENS	SUBBOTINA CF. EOCAENA	SUBBOTINA EOCAENA	SUBBOTINA LINAPERTA GP.	TURBOROTALIA POSTCRETACEA	TURBOROTALIA QUINQUELOBA
1508.8M	...	...	...	...	...	...	...
1509.4M	...	...	...	...	...	...	...
1510.0M	...	...	...	...	...	...	...
1511.0M	...	...	...	...	...	...	...
1511.5M	..4	..4	...	...	...	...	..1
1512.1M	...	...	...	...	...	...	...
1529.9M	...	...	...	...	...	...	...
1530.9M	...	...	...	...	...	...	...
1531.7M	...	...	...	...	...	...	...
1532.2M	...	...	...	...	...	...	...
1533.6M	...	...	..2	..1	.13	.25	...

APPENDIX 2 (Continued)

COST B-3

	1158.3M	1167.4M	1176.6M	1185.7M	1194.9M	1204.0M	1213.2M	1222.3M	1231.4M	1249.7M	1258.8M	1268.0M	1295.5M	1304.6M	1313.8M	1322.9M	1332.0M	1341.2M	1350.3M	1359.5M	1368.6M	1377.8M	1386.9M	1396.1M	1405.2M	1414.3M	1423.5M	1432.6M	1441.7M	1450.9M	1460.0M
GLOBOROTALIA ACROSTOMA	3	3		1		1			5																						
GLOBOQUADRINA VENEZUELANA							1										2			1	1				2	5	2		1	1	6
GLOBOQUADRINA TRIPARTITA																										4		1		3	1
GLOBOQUADRINA SP. (EARLY FORM)																														1	
GLOBOQUADRINA SP.						2																									
GLOBOQUADRINA PRAEDEHISCENS				1							1									1			1	1	1				1	2	
GLOBOQUADRINA DEHISCENS						3				3						1	3	3	2	3	1		1	1	2	1	4			1	
GLOBOQUADRINA CF. DEHISCENS																							1	1							9
GLOBOQUADRINA BAROEMOENENSIS			2		1		1												1		1										
GLOBOQUADRINA ALTISPIRA GLOBOSA		1							1									1													
GLOBOQUADRINA ALTISPIRA ALTISPIRA			1							2									1				1	1	1	2					
GLOBIGERINOIDES TRILOBA	1						1									2			1				3	3	2	4	2			1	4
GLOBIGERINOIDES SUBQUADRATUS	2	1		5	1	1		1	1		3	1							1	1	1		1	1	1		2				
GLOBIGERINOIDES SICANUS											1																				
GLOBIGERINOIDES QUADRILOBATUS			1	1		8	1			3		2	2		1	2			2	2	1				3	12	5			1	
GLOBIGERINOIDES PRIMORDIUS																										5		1	1	1	
GLOBIGERINOIDES IMMATURA					1	3		1						2			1														
GLOBIGERINOIDES CF. ALTIAPERTURA																	1														
GLOBIGERINOIDES BULLOIDEUS							1																								
GLOBIGERINOIDES ALTIAPERTURA																										1				1	
GLOBIGERINITA NAPARIMENSIS						1																								1	
GLOBIGERINITA INCRUSTA	2		1				1				2									1	10		2	2		2				1	
GLOBIGERINATELLA INSUETA																			1							2					
GLOBIGERINA WOODI					1	1													2							1					
GLOBIGERINA SP.	2															1			1	1						1					
GLOBIGERINA PRAEBULLOIDES			3	7		1	1	2		3	2	1		1	1				3							5				4	44
GLOBIGERINA LABIACRASSATA																														1	
GLOBIGERINA JUVENILIS										1								1													
GLOBIGERINA FOLIATA			1																		2										
GLOBIGERINA FALCONENSIS							1													1											
GLOBIGERINA EUAPERTURA																				1						1		1			
GLOBIGERINA DRURYI					1	1		1										1								1					
GLOBIGERINA CONNECTA																					1										
GLOBIGERINA CONCINNA																				1							1	3		1	
GLOBIGERINA CIPEROENSIS																												6		3	
GLOBIGERINA CF. MIOZEA																		1													
GLOBIGERINA CF. CONNECTA																				1											
GLOBIGERINA CF. BRAZIERI																														2	
GLOBIGERINA BULLOIDES			1		1	2	3		1		1	1		1							1										
GLOBIGERINA ANGUSTIUMBILICATA							1																		2		1				1
CATAPSYDRAX UNICAVUS																					1					1					7
CATAPSYDRAX DISSIMILIS																											1	3	1	3	7
CASSIGERINELLA UNICAVUS																											1				
CASSIGERINELLA CHIPOLENSIS																							1	1						2	

APPENDIX 2 (Continued)

COST B-3

	GLOBOROTALIA BELLA	GLOBOROTALIA CF. ACROSTOMA	GLOBOROTALIA CF. MAYERI	GLOBOROTALIA CF. MOIZEA	GLOBOROTALIA CF. PERIPHERORONDA	GLOBOROTALIA CF. PRAESCITULA	GLOBOROTALIA CF. ZEALANDICA	GLOBOROTALIA FOHSI FOHSI	GLOBOROTALIA FOHSI ROBUSTA	GLOBOROTALIA INCOGNITA	GLOBOROTALIA KUGLERI	GLOBOROTALIA MAYERI	GLOBOROTALIA MIOZEA	GLOBOROTALIA OBESA	GLOBOROTALIA OPIMA NANA	GLOBOROTALIA OPIMA OPIMA	GLOBOROTALIA PRAESCITULA	GLOBOROTALIA PSEUDOKUGLERI	GLOBOROTALIA PSEUDOMIOZEA	GLOBOROTALIA SCITULA	GLOBOROTALIA SEMIVERA	GLOBOROTALIA SP.	GLOBOROTALIA ZEALANDICA	NEOGLOBOQUADRINA ACOSTAENSIS	NEOGLOBOQUADRINA CONTINUOSA	NEOGLOBOQUADRINA PSEUDOPACHYDERMA	ORBULINA SUTURALIS	ORBULINA UNIVERSA	PRAEORBULINA GLOMEROSA	PRAEORBULINA GLOMEROSA CIRCULARIS	PRAEORBULINA GLOMEROSA CURVA	SPHAEROIDINELLOPSIS CF. DISJUNCTA	SPHAEROIDINELLOPSIS DISJUNCTA	SPHAEROIDINELLOPSIS SEMINULINA	SPHAEROIDINELLOPSIS SUBDEHISCENS
1158.3M									.1			16	.1				.8								.4	.2	.2								.1
1167.4M												14	.1															.1						.1	
1176.6M				.1								19	.1							.4		.1			.1										
1185.7M		.1										18	.2							.4				.2	.1		.3			.1					
1194.9M							.1					19								.6		.2			.1			.2							
1204.0M					.1							63								.2	.1	.1	.3											.1	
1213.2M					.1							18					.1			.2			.3				.2								.1
1222.3M									.4			15	.2										.3		.2		.2								
1231.4M	.1							.1				20	.2	.1																					
1249.7M										.8		10	.3								.5														
1258.8M												11																							
1268.0M	.3											11								.2	.2		.2						.1						
1295.5M					.1							12	.2								.3		.3					.1							
1304.6M												.4	.1				.1		.1				.1		.1										
1313.8M														.1			.2						.7												
1322.9M																	.1		.1						.1										.1
1332.0M												.1											.1					.1							
1341.2M							.6					.5																.2						.2	
1350.3M		.2		.8	.1							.2	.1				.1						.3		.1				.2			.1			
1359.5M							.1			.8			.2				.2						.8		.1								.1		
1368.6M			.2			.4				10							.9						15		.2										
1377.8M												.1																							
1386.9M				.4	.1					.8		.1											.4												
1396.1M				.4	.1					.7		.1									.1		.1												
1405.2M						.2						.2							.1				.3												
1414.3M				.5						.7					.1						.4		.2								.1				
1423.5M											.2				.1			.4	.3						.1										
1432.6M											.8				.2																				
1441.7M															.1																				
1450.9M											.3				.3	.5		.1	.2		.3														
1460.0M															.8	.6							.2												

APPENDIX 2 (Continued)

At DSDP sites the following scale of relative abundances is used:

0 - Absent
1 - Very rare (1%)
2 - Rare (1-5%)
3 - Few (5-10%)
4 - Common (10-20%)
5 - Abundant (20-50%)
6 - Very abundant (Greater than 50%)

DSDP SITE 334

	CANDEINA NITIDA	GLOBIGERINA APERTURA	GLOBIGERINA BULBOSA	GLOBIGERINA BULLOIDES	GLOBIGERINA CF. APERTURA	GLOBIGERINA CF. BULBOSA	GLOBIGERINA DECORAPERTA	GLOBIGERINA FALCONENSIS	GLOBIGERINA NEPENTHES	GLOBIGERINA QUINQUELOBA	GLOBIGERINA SP.	GLOBIGERINA WOODI WOODI	GLOBIGERINITA INCRUSTA	GLOBIGERINOIDES BOLLII	GLOBIGERINOIDES BULLOIDEUS	GLOBIGERINOIDES CF. CONGLOBATUS	GLOBIGERINOIDES CF. EXTREMUS	GLOBIGERINOIDES CF. KENNETTI	GLOBIGERINOIDES CF. SEIGILIEI	GLOBIGERINOIDES CONGLOBATUS	GLOBIGERINOIDES EXTREMUS	GLOBIGERINOIDES KENNETTI	GLOBIGERINOIDES OBLIQUUS	GLOBIGERINOIDES QUADRILOBATUS	GLOBIGERINOIDES RUBER	GLOBIGERINOIDES SACCULIFER	GLOBIGERINOIDES SIEGLIEI	GLOBIGERINOIDES TRILOBA IMMATURA	GLOBIGERINOIDES TRILOBA TRILOBA	GLOBOQUADRINA ALTISPIRA ALTISPIRA	GLOBOQUADRINA ALTISPIRA GLOBOSA	GLOBOQUADRINA BAROEMOENENSIS	GLOBOQUADRINA CF. DEHISCENS
129.55M	.	2	2	2	1	.	1	2	2	2	.	2	2	2	.	.	.	.	.	2	2	.	.	.	.	2	.	.	2	4	.	.	.
133.05M	.	2	.	2	.	2	2	2	2	.	.	2	2	.	.	.	.	.	.	1	2	.	.	.	.	.	.	.	.	1	.	.	.
137.70M	1	1	.	3	.	.	1	2	3	.	.	2	.	.	.	.	.	.	2	1	4	.	.	2	.	2	.	.	2	2	.	.	1
139.30M	.	2	.	2	.	.	2	2	2	.	.	1	.	.	.	.	.	.	.	2	.	.	3	2	.	2	.	.	3	2	.	.	.
141.53M	.	1	.	3	.	.	.	2	2	.	.	2	1	.	.	.	.	.	.	1	2	.	1	2	.	1	.	.	2	1	1	.	.
148.69M	.	2	.	2	.	.	.	2	2	.	.	2	.	.	2	.	.	.	.	.	2	.	.	.	.	1	.	.	2	1	.	.	.
167.74M	1	1	.	3	.	.	.	2	2	.	.	1	.	.	.	.	.	.	.	.	3	.	.	1	.	2	.	.	2	1	1	1	.
177.05M	.	2	1	3	.	.	1	2	2	.	.	.	1	2	2	1	.	.	.	.	1	2	.	.	.	1	.	.	2	2	1	.	.
179.31M	2	1	.	1	.	.	.	1	2	.	.	1	2	.	.	.	.	.	.	.	2	2	.	2	.	1	.	.	1	2	1	.	.
180.83M	2	.	.	1	.	.	.	2	2	.	.	1	2	.	.	.	.	.	.	1	2	2	.	2	.	1	.	.	.	2	1	.	.
182.30M	.	.	.	2	.	.	1	2	2	.	.	.	.	2	.	2	.	.	.	1	2	3	.	2	.	1	1	.	2	2	.	1	.
187.03M	.	2	.	3	.	.	2	2	2	.	.	1	1	.	2	.	.	.	.	.	2	.	.	.	1	2	.	.	2	.	1	.	.
196.80M	1	.	.	3	.	.	.	2	3	.	.	2	.	.	.	.	.	2	.	.	2	.	.	2	.	1	.	.	2	2	.	.	.
206.30M	1	.	.	3	.	.	.	2	1	.	.	1	1	2	2	.	2	1	.	.	.	.	.	1	1	2	.	.	2	1	1	.	.
221.13M	1	.	.	3	.	.	.	2	2	.	.	1	1	2	1	.	1	1	.	.	.	1	.	1	1	2	.	.	1	1	1	.	.
225.50M	1	.	.	3	.	.	.	2	2	.	.	.	.	2	.	.	.	.	.	.	.	1	2	.	1	2	.	.	2	1	1	.	.
234.80M	2	1	.	2	.	.	.	2	2	.	1	1	1	2	.	.	2	2	.	.	.	1	.	1	.	.	.	.	2	2	.	.	.
244.23M	1	2	.	3	.	.	1	2	2	.	.	2	1	.	2	.	.	1	.	.	.	.	.	1	.	1	.	1	1	1	1	.	.
253.35M	.	2	.	2	.	.	.	.	1	1	.	2	1	.	1	.	.	.	.	.	.	.	1	1	.	1	.	.	2	1	.	.	.

APPENDIX 2 (Continued)

DSDP SITE 334

	129.55M	133.05M	137.70M	139.30M	141.53M	148.69M	167.74M	177.05M	179.31M	180.83M	182.30M	187.03M	196.80M	206.30M	221.13M	225.50M	234.80M	244.23M	253.35M
SPHAEROIDINELLOPSIS SUBDEHISCENS	2	.	.	2	2	2	1	2	1	1	2	2	2	2	2	2	2	1	1
SPHAEROIDINELLOPSIS SEMINULINA	.	.	.	.	.	.	.	.	.	2	.	.	.	2	.	1	2	.	1
SPHAEROIDINELLOPSIS PRAENEDEHISCENS	1	2	2	.	1	2	.	.	.	.	.	.	.	.	.	.	.	.	.
SPHAEROIDINELLOPSIS CF. PRAENEDEHISCENS	.	.	.	.	.	.	.	1	.	.	.	1	.	.	.	.	.	.	.
SPHAEROIDINELLOPSIS CF. DISJUNCTA	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.
PULLENIATINA PRIMALIS	.	.	1	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.
ORBULINA UNIVERSA	2	1	2	2	3	1	2	3	2	2	2	3	1	2	1	1	2	1	1
ORBULINA BILOBATA	1	.	2	1	1	1	1	1	1	1	1	1	1	.	.	.	.	1	.
NEOGLOBOQUADRINA PSEUDOPACHYDERMA	1	.	.	2	1	.	.	.	.	.	.	1	.	.	1	1	1	1	1
NEOGLOBOQUADRINA HUMEROSA	.	.	1	.	.	1	.	1	.	.	.	.	.	.	.	.	.	.	.
NEOGLOBOQUADRINA CONTINUOSA	.	1	.	.	.	.	.	.	.	.	2	1	.	1	1	1	.	.	2
NEOGLOBOQUADRINA CF. HUMEROSA	.	1	1	.	.	2	2	1	1	1	1	.	1	.	1	1	1	1	1
NEOGLOBOQUADRINA CF. CONTINUOSA	.	.	.	.	1	.	.	1	.	.	.	.	.	.	.	.	.	.	.
NEOGLOBOQUADRINA CF. ATLANTICA	.	.	.	.	.	.	1	.	.	.	1	.	.	.	.	.	.	.	.
NEOGLOBOQUADRINA CF. ACOSTAENSIS	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
NEOGLOBODQUADRINA ATLANTICA	2	.	1	.	1	1	.	2	.	2	.	.	.	1	.	.	1	.	1
NEOGLOBOQUADRINA ACOSTAENSIS	2	2	1	2	1	1	2	2	2	2	2	.	2	1	1	2	2	1	3
HASTIGERINA AEQUILATERALIS	.	.	.	2	.	1	1	1	1	1	1	1	.	1	.	.	.	.	.
GLOBOROTALIA TUMIDA	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	1	.	.
GLOBOROTALIA SP.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.
GLOBOROTALIA SCITULA	2	2	2	2	1	2	2	.	.	1	1	1	2	.	2	3	1	.	1
GLOBOROTALIA PLESIOTUMIDA	.	.	.	.	.	.	2	2	3	3	2	2	2	2	2	1	.	1	1
GLOBOROTALIA PANDA	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	1	.
GLOBOROTALIA OBESA	1	.	1	2	2	.	.	.	2	2	.	1	.	.	1	1	1	1	.
GLOBOROTALIA MULTICAMERATA	.	.	1	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.
GLOBOROTALIA MIOZEA/MENARDII	3	3	3	.	3	3	2	.	3	3	.	.	.	1	1	3	1	4	3
GLOBOROTALIA MIOZEA CONOMIOZEA	.	.	.	.	1	4	3	.	.	.	.	.	.	.	.	.	.	.	.
GLOBOROTALIA MIOZEA CONOIDEA	.	.	.	.	.	3	4	.	.	.	.	.	.	4	.	1	.	.	.
GLOBOROTALIA MEROTUMIDA	.	.	.	.	.	.	.	1	.	.	.	2	2	2	.	2	.	.	2
GLOBOROTALIA MENARDII	1	.	1	3	1	.	1	1	2	2	.	2	1	2	.	1	1	1	1
GLOBOROTALIA MARGARITAE	3	3	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
GLOBOROTALIA JUANAI	.	.	2	3	1	.	.	.	.	.	1	2	1	2	.	2	.	.	.
GLOBOROTALIA DALLII	2	.	1	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.
GLOBOROTALIA CIBAOENSIS	.	2	1	.	.	1	.	2	2	2	2	1	.	1	.	.	2	2	2
GLOBOROTALIA CF. TUMIDA	.	.	.	1	1	.	.	.	.	.	.	1	.	.	.	.	.	1	.
GLOBOROTALIA CF. SCITULA	.	.	1	.	.	2	.	2	.	.	1	1	.	.	.	1	.	1	.
GLOBOROTALIA CF. PLESIOTUMIDA	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	1	1	.
GLOBOROTALIA CF. MULTICAMERATA	1	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
GLOBOROTALIA CF. MEDITERRANEA	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
GLOBOROTALIA CF. MARGARITAE	1	.	.	1	2	.	.	.	.	.	.	1	.	.	.	1	.	.	.
GLOBOROTALIA CF. JUANAI	1	2	.	.	.	.	.	.	1	1	.	.	.	.	.	.	.	1	.
GLOBOROTALIA CF. CONOMIOZEA	.	.	.	.	.	2	1	.	.	.	1	.	.	2	.	.	.	.	.
GLOBOROTALIA CF. CONOIDEA	.	.	.	.	.	3	.	.	.	1	.	.	.	.	.	.	.	.	.
GLOBOQUADRINA VENEZUELANA	.	.	.	.	1	.	.	.	1	1	1	1	1	1	1	1	1	.	1
GLOBOQUADRINA DEHISCENS	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	2	2	3	3

APPENDIX 2 (Continued)

DSDP SITE 563

	CASSIGERINELLA CHIPOLENSIS	CATAPSYDRAX DISSIMILIS	CATAPSYDRAX GORTANII	CATAPSYDRAX PARVULUS	CATAPSYDRAX UNICAVUS	CLAVATORELLA BERMUDEZI	GLOBIGERINA BRAZIERI	GLOBIGERINA BULLOIDES	GLOBIGERINA CONCINNA	GLOBIGERINA DECOAPERTA	GLOBIGERINA DRURYI	GLOBIGERINA FALCONENSIS	GLOBIGERINA FOLIATA	GLOBIGERINA JUVENILIS	GLOBIGERINA NEPENTHES	GLOBIGERINA PRAEBULLOIDES	GLOBIGERINA SP.	GLOBIGERINA WOODI CONNECTA	GLOBIGERINA WOODI WOODI	GLOBIGERINATELLA INSUETA	GLOBIGERINITA INCRUSTA	GLOBIGERINITA NAPARIMAENSIS	GLOBIGERINOIDES ALTIAPERTURA	GLOBIGERINOIDES BOLLII	GLOBIGERINOIDES BULLOIDEUS	GLOBIGERINOIDES DIMINUTUS	GLOBIGERINOIDES MITRA	GLOBIGERINOIDES OBLIQUUS	GLOBIGERINOIDES PARAWOODI	GLOBIGERINOIDES PRIMORDIUS	GLOBIGERINOIDES QUADRILOBATUS	GLOBIGERINOIDES RUBER	GLOBIGERINOIDES SACCULIFER
166.05M	.	.	.	.	.	.	.	.	.	1	.	1	.	1	2	.	.	.	1	.	1	.	.	.	1	.	.	.	.	.	.	.	.
166.30M	.	.	.	.	.	.	.	1	.	1	.	.	.	1	3	.	.	.	1	.	2	.	.	1	.	.	.	.	.	.	.	.	.
175.55M	.	.	.	.	.	.	.	.	.	.	.	.	.	.	3	.	.	.	1	.	2	.	.	.	.	.	.	.	.	.	.	.	1
185.05M	.	.	.	.	.	.	.	.	.	.	.	.	.	.	4	.	.	.	1	.	2	.	.	.	.	.	.	.	.	.	.	2	.
185.80M	.	.	.	.	.	.	.	1	.	.	.	1	.	1	2	.	.	.	.	.	2	.	.	.	.	.	.	.	.	.	.	.	.
186.63M	.	.	.	.	.	.	.	2	.	.	.	2	.	2	2	.	1	.	.	.	2	.	.	.	2	.	.	1	.	.	.	.	.
187.33M	.	.	.	.	.	.	.	1	.	.	.	.	.	.	3	.	.	.	2	.	2	.	.	.	.	.	.	1	.	.	.	.	.
188.21M	.	.	.	.	.	.	.	.	.	.	2	.	.	.	3	.	.	.	.	.	2	.	.	.	.	.	.	.	.	.	.	.	.
189.79M	.	.	.	.	.	.	.	.	.	.	.	1	.	.	2	1	1	.	2	.	2	.	.	.	.	.	.	.	.	.	.	.	.
194.55M	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
195.30M	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
196.88M	.	.	.	.	.	.	.	1	.	.	.	.	.	.	3	.	.	.	2	.	.	.	.	.	.	.	.	.	.	.	.	.	.
198.46M	.	.	.	.	.	.	.	1	.	.	.	.	.	.	3	.	.	.	2	.	.	.	.	.	.	.	.	.	.	.	.	.	.
200.04M	.	.	.	.	.	.	.	.	.	.	2	.	.	.	5	.	.	.	4	.	.	.	.	.	.	.	.	.	.	.	.	.	.
201.62M	.	.	.	.	.	.	.	1	.	.	1	1	.	.	4	1	.	.	2	.	2	.	.	.	.	.	.	.	.	.	.	.	.
202.45M	.	.	.	.	.	.	.	.	.	1	2	.	.	.	3	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
203.20M	.	.	.	.	.	.	.	1	.	.	1	.	.	1	1	.	.	.	.	.	2	.	.	.	.	.	.	.	.	.	.	.	.
204.05M	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	1	.	2	.	.	.	.	.	.	.	.	.	2	.	.
205.63M	.	.	.	.	.	.	.	.	.	.	.	.	1	1	.	1	.	.	.	.	2	.	.	.	.	.	.	.	.	.	2	2	.
210.37M	.	.	.	.	.	.	.	.	.	.	.	.	1	1	.	1	.	.	.	.	2	.	.	.	.	.	.	.	.	.	.	.	.
213.35M	.	.	.	.	.	.	.	2	.	.	.	2	.	.	.	1	.	.	1	.	1	.	.	.	.	.	.	.	.	.	.	.	1
215.17M	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
219.04M	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
222.20M	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
223.05M	.	.	.	.	.	.	.	.	.	.	.	.	.	2	.	1	1	.	1	.	2	.	.	.	.	.	.	.	.	.	2	.	.
224.63M	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	2	.	.	.	.	.	.	.	.	.	.	.	.
229.37M	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	2	.	.	.	.	.	.	.	.	.	.	.	1
230.95M	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	2	.	.	.	.	.	.	.	.	.	.	.	.
232.55M	.	.	.	.	.	.	.	1	.	1	1	.	.	2	.	.	1	.	1	.	2	.	.	.	.	.	2	.	.	.	.	.	.
236.46M	.	.	.	.	.	.	.	1	.	.	.	1	.	1	.	1	1	.	1	.	2	.	.	.	.	.	1	2	.	.	1	.	1
238.04M	.	.	.	.	.	.	.	.	.	.	2	1	.	1	.	1	.	.	.	.	2	.	.	.	.	.	1	.	.	.	.	.	1
241.20M	.	.	.	.	.	.	.	.	.	.	2	.	.	2	.	.	.	.	.	.	2	2	.	.	.	.	.	.	.	.	2	.	.
242.05M	.	.	.	.	.	.	.	.	.	1	1	1	.	.	.	.	.	.	.	.	2	.	.	.	.	.	1	.	.	.	2	.	.
244.38M	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	1	.	.	.	1	2	.	.	.	.	.	.	.	.	.	1	.	.
245.96M	.	.	.	.	.	.	.	.	.	.	2	1	.	2	.	2	.	.	1	.	2	.	.	.	.	.	.	.	.	.	.	.	.
247.54M	.	.	.	.	.	.	.	.	.	.	1	1	.	1	.	2	.	.	.	1	2	.	.	.	.	.	.	.	.	.	1	.	.
248.37M	.	.	.	.	.	.	.	.	.	.	2	.	.	1	.	1	1	.	.	1	2	.	.	.	.	.	1	.	.	.	1	.	.
249.95M	.	.	.	.	.	1	.	.	.	.	1	1	.	.	.	.	.	.	.	2	2	.	.	.	.	.	2	.	.	.	4	.	.
251.55M	.	.	.	1	.	.	.	1	.	.	2	.	.	1	.	2	1	.	.	1	2	.	.	.	.	2	.	.	.	.	.	.	.
252.30M	.	.	.	.	.	.	.	.	.	.	2	1	.	.	.	2	.	1	.	1	.	.	.	.	.	2	.	.	.	.	2	.	1
253.46M	.	.	.	1	.	.	.	.	.	.	1	.	.	1	.	.	1	.	.	.	2	.	.	.	.	1	.	.	1	.	1	.	1
256.29M	.	1	.	.	1	.	.	.	.	.	.	.	.	.	.	2	1	1	1	.	2	.	.	.	.	.	.	.	1	.	.	.	.
257.87M	.	2	.	.	2	.	.	.	.	.	.	.	.	.	.	.	.	.	2	.	2	.	.	.	.	.	.	.	.	.	2	.	1
261.05M	.	3	.	.	2	.	.	.	.	.	2	1	.	.	.	1	1	.	.	.	2	.	1	.	.	.	.	.	.	.	.	.	1
264.96M	.	3	.	.	2	.	.	.	.	.	2	1	.	.	.	1	1	.	.	.	2	.	1	.	.	.	.	.	.	1	.	.	1
266.54M	.	3	.	.	2	.	.	.	.	.	.	.	.	1	.	2	1	.	2	.	2	.	.	.	.	.	.	.	.	1	.	.	.
267.37M	.	3	.	.	1	.	.	.	.	.	1	.	.	2	.	2	.	.	.	.	2	.	.	.	.	.	1	.	.	1	2	.	.
270.00M	.	3	.	.	2	.	.	.	.	.	.	.	.	1	.	2	1	.	2	.	2	.	.	.	.	.	.	.	1	.	.	.	.
277.92M	.	5	.	.	2	.	.	.	.	.	.	.	.	1	.	2	.	.	2	.	2	.	.	.	.	.	.	.	.	.	.	.	.
280.05M	1	4	.	.	2	.	1	.	.	.	.	.	.	1	.	2	.	.	2	.	2	.	.	.	.	.	.	.	.	.	.	.	.
280.80M	1	3	.	.	2	.	.	.	.	.	.	.	.	2	.	2	.	1	1	.	2	.	.	.	.	.	.	.	.	.	.	.	.
281.63M	1	3	.	.	2	.	1	.	.	.	.	.	.	2	.	1	.	.	1	.	2	.	.	.	.	.	.	.	.	1	.	.	.
283.21M	1	4	.	.	2	.	.	.	.	.	.	.	.	.	.	2	1	.	.	.	2	.	.	.	.	.	.	.	.	.	.	.	.
286.37M	1	4	.	.	.	.	2	.	.	.	.	.	.	.	.	2	.	.	.	.	2	.	.	.	.	.	.	.	.	1	.	.	.
289.55M	.	4	.	.	1	.	.	.	.	.	.	.	.	.	.	1	.	.	2	.	2	.	.	.	.	.	.	.	.	.	.	.	.
291.13M	1	3	.	.	1	.	.	.	1	.	.	.	.	.	.	2	.	1	1	.	2	.	.	.	.	.	.	.	.	.	.	.	.
292.71M	.	2	.	.	2	.	.	.	1	.	.	.	.	.	.	2	1	.	1	.	2	.	1	.	.	.	.	.	1	1	.	.	.
294.29M	.	2	.	.	.	.	.	.	1	.	.	.	.	1	.	2	.	1	1	.	2	.	.	.	.	.	.	.	.	2	.	.	.
295.87M	.	2	.	.	2	.	.	.	.	.	.	.	.	.	.	2	.	1	1	.	2	.	.	.	.	.	.	.	.	1	.	.	.
296.62M	.	3	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	1	1	.	2	.	1	.	.	.	.	.	.	1	.	.	.
297.45M	.	3	.	.	.	.	.	.	1	.	.	.	.	.	.	2	.	1	.	.	2	.	.	.	.	.	.	.	.	1	.	.	.
298.20M	.	3	.	.	2	.	.	.	.	.	.	.	.	.	.	2	1	.	.	.	2	.	.	.	.	.	.	.	.	1	.	.	.
299.05M	.	3	.	.	.	.	.	.	.	.	.	.	.	.	.	2	.	.	.	.	2	.	.	.	.	.	.	.	.	2	.	.	.
299.80M	.	3	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	2	.	.	.	.	.	.	.	.	1	.	.	.
300.63M	.	3	3	.	1	.	.	.	.	.	.	.	.	.	.	1	1	.	.	.	2	.	.	.	.	.	.	.	.	.	.	.	.
301.38M	.	3	2	.	2	.	.	.	.	.	.	.	.	.	.	2	.	.	.	.	2	.	.	.	.	.	.	.	.	.	.	.	.
302.21M	.	3	.	.	.	.	.	.	1	.	.	.	.	2	.	2	.	.	1	.	2	.	.	.	.	.	.	.	.	1	.	.	.
302.96M	.	3	.	.	2	.	.	.	1	.	.	.	.	2	.	3	1	.	1	.	2	.	.	.	.	.	.	.	.	.	.	.	.

APPENDIX 2 (Continued)

DSDP SITE 563

	GLOBIGERINOIDES SICANUS	GLOBIGERINOIDES SP.	GLOBIGERINOIDES SUBQUADRATUS	GLOBIGERINOIDES TRILOBA IMMATURA	GLOBIGERINOIDES TRILOBA TRILOBA	GLOBOQUADRINA ALTISPIRA ALTISPIRA	GLOBOQUADRINA ALTISPIRA CF. ALTISPIRA	GLOBOQUADRINA ALTISPIRA CF. GLOBOSA	GLOBOQUADRINA ALTISPIRA GLOBOSA	GLOBOQUADRINA BAROEMOENENSIS	GLOBOQUADRINA DEHISCENS	GLOBOQUADRINA PRAEDEHISCENS	GLOBOQUADRINA SELLII	GLOBOQUADRINA SP.	GLOBOQUADRINA TRIPARTITA	GLOBOQUADRINA VENEZUELANA	GLOBOROTALIA ARCHEOMENARDII	GLOBOROTALIA CF. CONOIDEA	GLOBOROTALIA CF. MAYERI	GLOBOROTALIA CF. MIOZEA	GLOBOROTALIA CF. PRAESCITULA	GLOBOROTALIA CF. SCITULA	GLOBOROTALIA CIBAOENSIS	GLOBOROTALIA FOHSI FOHSI	GLOBOROTALIA FOHSI LOBATA	GLOBOROTALIA FOHSI PERIPHEROACUTA	GLOBOROTALIA FOHSI PERIPHERORONDA	GLOBOROTALIA FOHSI PRAEFOHSI	GLOBOROTALIA FOHSI ROBUSTA	GLOBOROTALIA INCOGNITA	GLOBOROTALIA JUANAI	GLOBOROTALIA KUGLERI	GLOBOROTALIA LENGUAENSIS
166.05M	.	.	.	.	2	.	.	.	2	.	5	.	.	.	.	1	.	.	.	.	.	1	1	.	.	.	.	.	.	.	.	.	.
166.80M	.	.	.	.	1	.	.	.	2	.	5	.	.	.	.	1	.	.	.	.	.	.	1	.	.	.	.	.	.	.	1	.	.
173.55M	.	.	.	.	1	.	.	.	.	.	4	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
185.05M	.	.	.	.	.	.	.	.	2	.	3	.	.	.	.	1	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.
185.80M	.	.	.	.	.	.	.	.	1	.	3	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
186.62M	.	1	.	1	.	.	.	.	2	.	5	.	.	.	.	1	.	1	.	.	.	2	.	.	.	.	.	.	.	.	.	.	.
187.38M	.	.	.	1	.	1	.	.	1	.	4	.	.	.	.	.	.	.	2	.	.	1	.	.	.	.	.	.	.	.	.	.	.
188.21M	.	.	.	.	.	.	.	.	.	.	4	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
189.79M	.	.	.	.	.	.	.	.	.	.	4	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
194.55M	.	.	.	.	.	.	.	.	.	.	6	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
195.30M	.	.	.	.	.	.	.	.	.	.	5	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
196.88M	.	.	.	.	.	.	.	.	.	.	5	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
198.46M	.	.	.	.	.	.	.	.	.	.	5	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.
200.04M	.	.	.	.	.	2	.	.	.	.	4	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.
201.62M	.	.	.	.	.	1	.	.	.	.	4	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
202.45M	.	.	.	.	.	.	.	.	.	.	4	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.
203.20M	.	.	.	.	.	1	.	.	.	.	4	.	.	.	.	.	.	.	3	1	.	.	.	.	.	.	.	.	.	.	.	.	2
204.05M	.	1	.	2	2	.	.	.	2	1	3	.	.	.	.	1	.	.	.	.	.	.	.	.	2	2	.	.	2	.	.	.	.
205.62M	.	1	.	2	.	2	.	.	1	1	3	.	.	1	.	2	.	.	1	.	.	1	.	.	3	2	.	.	3	.	.	.	.
210.37M	.	.	.	.	2	3	.	.	1	1	3	.	.	.	.	2	.	.	.	.	.	1	.	.	3	1	.	.	3	.	.	.	.
213.55M	.	.	.	2	.	.	.	.	.	1	3	.	.	.	.	.	.	.	1	.	.	.	.	.	1	1	4	.	.	.	.	.	.
215.17M	.	.	.	.	.	.	.	.	.	.	3	.	.	.	.	.	.	.	.	.	.	.	.	1	1	.	4	.	.	.	.	.	.
216.71M	.	.	.	.	.	.	.	1	.	.	4	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	3	.	.	.	.	.	.
219.04M	.	.	.	.	1	1	.	.	.	.	4	.	.	.	.	2	.	.	.	.	.	.	.	.	.	.	2	.	.	.	.	.	.
222.20M	.	.	.	.	.	.	1	.	.	.	4	.	.	.	.	1	.	.	.	1	.	1	.	.	1	.	.	.	.	.	.	.	.
223.05M	.	1	1	.	2	2	.	1	.	1	4	.	.	1	.	1	.	.	1	1	.	1	.	.	.	1	.	.	.	.	.	.	.
224.62M	.	1	2	2	.	1	.	.	.	.	5	.	.	1	.	.	.	.	.	.	.	.	.	1	.	2	.	.	.	.	.	.	.
229.37M	.	.	1	2	.	2	.	.	.	.	4	.	.	1	.	1	.	.	.	.	.	.	.	.	.	.	.	2	.	.	.	.	.
230.95M	.	.	.	.	.	.	.	.	.	.	4	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.
232.55M	.	1	.	2	.	2	.	1	.	2	5	.	.	.	.	.	.	.	.	.	.	.	.	.	.	3	.	.	.	.	.	.	.
236.46M	.	1	.	2	2	2	.	.	.	.	4	.	.	.	.	1	.	.	.	.	.	.	.	.	.	3	4	.	.	.	.	.	.
238.04M	1	.	2	2	.	2	.	.	.	.	5	.	.	1	.	2	1	.	.	.	.	.	.	.	.	.	4	.	.	.	.	.	.
241.20M	2	.	.	.	.	2	.	.	.	2	3	.	.	.	.	.	1	.	.	.	.	1	.	.	.	1	3	.	.	.	.	.	.
242.05M	1	.	3	.	.	2	.	.	.	.	3	.	.	.	.	2	.	.	1	.	.	2	.	.	.	.	.	.	.	.	.	.	.
244.33M	2	.	1	2	.	2	.	.	.	.	4	.	.	.	.	2	.	.	.	.	.	.	.	.	.	.	3	.	.	.	.	.	.
245.96M	2	.	2	2	.	2	.	.	.	.	5	.	.	.	.	2	.	.	.	1	.	.	.	.	.	.	1	.	.	.	.	.	.
247.54M	1	.	2	2	.	2	.	.	.	.	4	1	.	.	.	1	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.
248.37M	1	.	2	2	.	2	.	.	.	.	4	.	.	.	.	2	.	.	.	.	2	.	.	.	.	.	2	.	.	.	.	.	.
249.95M	3	.	3	3	2	2	.	.	.	.	4	.	.	.	.	1	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
251.55M	3	1	.	2	1	3	.	.	.	2	5	1	.	.	1	.	.	.	1	3	.	.	.	.	.	.	2	.	.	.	.	.	.
252.30M	.	.	.	2	3	2	.	.	.	2	5	.	.	.	.	2	.	.	.	3	.	.	.	.	.	.	2	.	.	.	.	.	.
253.46M	.	.	1	.	2	2	.	.	.	2	5	1	.	.	.	2	1	.	.	4	.	.	.	.	.	.	1	.	.	.	.	.	.
256.29M	.	.	.	.	1	2	.	.	.	2	4	.	.	.	.	2	.	.	.	3	.	.	.	.	.	.	.	.	.	.	.	.	.
257.37M	.	.	1	2	1	3	.	1	.	2	3	.	.	.	.	2	.	.	.	4	.	.	.	.	.	.	1	.	.	.	.	.	.
261.05M	.	.	.	1	2	2	.	.	2	.	2	.	.	.	1	2	.	.	.	5	.	.	.	.	.	.	.	.	.	.	.	.	.
264.96M	.	.	.	1	2	2	.	.	2	.	2	.	.	.	1	.	.	.	.	5	.	.	.	.	.	.	.	.	.	.	.	.	.
266.54M	.	.	1	1	1	2	.	.	.	.	1	.	.	.	.	1	.	.	.	5	1	.	.	.	.	.	1	.	.	1	.	.	.
267.57M	.	1	2	.	2	3	.	.	.	1	2	2	.	1	2	.	.	.	.	3	1	.	.	.	.	.	2	.	.	.	.	.	.
270.00M	.	1	2	2	.	3	.	.	.	.	3	3	.	1	.	.	.	.	.	2	.	.	.	.	.	.	2	.	.	.	.	.	.
277.72M	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	1	.	.	.
280.05M	.	.	.	.	1	.	.	.	.	.	3	3	.	1	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	1	.	2	.
280.80M	.	.	.	.	.	.	.	.	.	.	1	3	.	.	5	2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	2	.
281.62M	.	.	.	.	.	.	.	.	.	.	1	3	.	.	5	2	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	2	.
283.21M	.	.	.	.	.	.	.	.	.	.	2	4	.	.	.	3	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	2	.
286.37M	.	.	.	.	.	.	1	.	.	.	2	4	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.
289.55M	.	.	.	.	1	.	.	.	.	.	2	5	.	.	.	2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.
291.13M	.	1	.	.	2	.	.	.	.	.	2	4	.	.	2	2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.
292.71M	.	.	.	.	.	.	1	.	.	.	2	4	1	.	2	3	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	2	.
294.29M	.	.	.	.	2	.	.	.	.	.	2	4	.	.	2	2	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	2	.
295.87M	.	.	.	.	1	.	.	.	.	.	2	4	1	.	.	2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.
296.62M	.	.	.	.	.	.	.	.	.	.	2	4	.	.	.	2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.
297.45M	.	.	.	.	.	.	.	.	.	.	.	5	.	.	3	2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.
298.20M	.	.	.	.	.	.	.	.	.	.	.	3	.	.	1	2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.
299.05M	.	.	.	.	1	.	.	.	.	.	.	4	.	.	3	3	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	2	.
299.80M	.	1	.	.	.	.	.	.	.	.	.	4	.	.	.	3	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.
300.62M	.	.	.	.	.	.	.	.	.	.	.	5	.	.	.	3	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.
301.38M	.	.	.	.	.	.	1	.	.	.	.	5	.	.	.	3	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	2	.
302.21M	.	.	.	.	.	.	.	.	.	.	.	5	.	.	3	3	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
302.96M	.	.	.	.	.	.	.	.	.	.	.	3	.	.	3	3	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.

APPENDIX 2 (Continued)

DSDP SITE 563

	GLOBOROTALIA MAYERI	GLOBOROTALIA MENARDII	GLOBOROTALIA MIOTUMIDA MIOTUMIDA	GLOBOROTALIA MIOZEA	GLOBOROTALIA MIOZEA CF. MIOZEA	GLOBOROTALIA MIOZEA MIOZEA	GLOBOROTALIA MULTICAMERATA	GLOBOROTALIA OBESA	GLOBOROTALIA OPIMA NANA	GLOBOROTALIA PANDA	GLOBOROTALIA PLESIOTUMIDA	GLOBOROTALIA PRAEMENARDII	GLOBOROTALIA PRAESCITULA	GLOBOROTALIA PSEUDOKUGLERI	GLOBOROTALIA SCITULA	GLOBOROTALIA SCITULA VENTRIOSA	GLOBOROTALIA SEMIVERA	GLOBOROTALIA SP.	GLOBOROTALIA ZEALANDICA	GLOBOROTALOIDES HEXAGONA	GLOBOROTALOIDES SUTERI	HASTIGERINA AEQUILATERALIS	NEOGLOBOQUADRINA ACOSTAENSIS	NEOGLOBOQUADRINA CF. ACOSTAENSIS	NEOGLOBOQUADRINA CF. [illegible]	NEOGLOBOQUADRINA CONTINUOSA	NEOGLOBOQUADRINA PSEUDOPACHYDERMA	ORBULINA BILOBATA	ORBULINA SUTURALIS	ORBULINA UNIVERSA	PRAEORBULINA GLOMEROSA CURVA	PRAEORBULINA TRANSITORIA	SPHAEROIDINELLOPSIS CF. SUBDEHISCENS	SPHAEROIDINELLOPSIS DISJUNCTA	SPHAEROIDINELLOPSIS SEMINULINA	SPHAEROIDINELLOPSIS SUBDEHISCENS
166.05M	.	2	.	4	.	.	1	.	.	.	2	.	.	.	.	1	.	.	.	.	.	.	1	.	1	1	.	.	.	2	.	.	.	.	.	3
166.80M	.	3	.	.	.	.	1	1	.	.	2	.	.	.	.	.	.	1	.	.	.	.	1	.	1	1	.	.	.	2	.	.	.	.	.	4
173.55M	.	2	.	2	.	.	.	.	.	.	2	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	1	.	.	.	.	.	.	.	.	3
185.05M	.	4	2	.	.	.	.	1	.	.	3	.	.	.	.	.	.	.	.	.	.	.	1	1	1	2	.	.	.	2	.	.	.	.	.	2
185.80M	.	.	.	2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	2	.	.	2	.	.	.	1	.	.	2	.	.	3
186.63M	.	.	.	4	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	2	.	.	.	.	.	2	.	.	.	.	2	2
187.33M	.	3	.	3	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	2	.	.	.	1	.	.	.	.	3	3
188.21M	2	.	.	3	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	3	4
189.79M	2	.	.	3	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	3	2
194.55M	2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	5
195.30M	3	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	2	.	.	.	2	.	.	.	.	.	3
196.38M	3	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	3	3
198.46M	2	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	4
200.04M	3	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	2	.	.	.
201.62M	3	.	.	2	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	2	.	.	.	.	.	3
202.45M	2	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	2	3
203.20M	5	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	1	.	.	.	.	2	3
204.05M	3	.	.	3	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	2	.	2	2	3	.	.	.	.	3	3
205.63M	4	.	.	3	.	.	.	2	.	.	.	2	.	.	2	.	.	1	.	.	.	.	.	.	.	2	.	1	2	2	.	.	2	.	2	.
210.37M	3	.	.	2	.	.	.	1	.	.	.	2	.	.	1	.	.	.	.	.	.	.	.	.	.	2	.	.	2	2	.	.	.	.	2	2
213.55M	3	.	.	2	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	2	.	.	.	1	.	.	.	.	.	2
215.17M	3	.	.	2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	2	2
216.71M	3	.	.	1	.	.	.	.	.	.	.	1	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	2	2
219.04M	2	.	.	3	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	2	2
222.20M	3	.	.	3	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	2	.	1	.	2	.	.	.	.	2	2
223.05M	3	.	.	4	.	4	.	1	.	.	.	2	.	.	.	1	.	.	.	.	.	.	.	.	.	1	.	.	.	2	.	.	2	.	.	2
224.63M	3	.	.	3	.	.	.	.	.	.	.	1	.	.	.	1	.	.	.	.	.	.	.	.	.	1	.	.	1	2	.	.	1	.	1	.
229.37M	2	.	.	3	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	2	.	.	1	2	.	.	.	.	2	2
230.95M	3	.	.	3	.	.	.	.	.	.	.	2	.	.	.	.	.	.	.	.	.	.	.	.	.	2	.	.	.	2	.	.	.	.	2	2
232.55M	3	.	.	4	.	.	.	1	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	1	.	2	1
236.46M	2	.	.	1	.	.	.	2	.	1	.	1	1	.	1	.	.	1	.	.	.	.	.	.	.	.	.	1	2	2	.	.	.	1	2	.
238.04M	2	.	.	.	.	.	.	2	.	.	.	.	1	.	.	.	.	.	.	.	.	1	.	.	.	2	.	.	.	.	1	.	.	2	2	.
241.20M	2	.	.	.	.	.	.	2	.	.	.	1	2	.	.	2	.	.	.	.	.	.	.	.	.	.	.	.	2	2	.	.	.	2	2	.
242.05M	2	.	.	2	.	.	.	2	.	.	.	1	2	.	.	.	.	.	.	.	.	.	.	.	.	2	.	.	.	.	1	.	.	3	3	.
244.38M	2	.	.	1	.	.	.	.	.	.	.	.	2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	2	.	.
245.96M	2	.	.	2	.	.	.	2	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	1	.	.	2	.	.
247.54M	2	.	.	2	.	.	.	2	.	.	.	.	3	.	.	.	.	.	.	.	.	.	.	.	.	2	.	.	.	.	2	1	.	2	2	.
248.37M	2	.	.	2	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	2	1	.	2	2	.
249.95M	2	.	.	1	.	.	.	.	.	.	.	.	2	.	.	.	.	.	.	.	1	1	.	.	.	1	.	.	.	.	3	.	.	1	1	.
251.55M	1	.	.	3	.	.	.	.	.	.	.	.	2	.	.	.	.	.	.	1	.	.	.	.	.	1	.	.	.	.	2	1	.	1	.	.
252.30M	2	.	.	3	.	.	.	2	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	1	.	.	.	.	3	2	.	2	.	.
255.46M	2	.	.	4	.	.	.	.	.	.	.	.	2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	1	.	2	.	.
256.29M	2	.	.	4	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	2	.	.	.	.	.	.	.	1	.	.
257.87M	2	.	.	4	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	2	.	.	.	.	.	.	.	2	.	.
261.05M	2	.	.	5	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	2	.	.	.	.	.	.	.	2	.	.
264.96M	2	.	.	5	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	2	.	.	.	.	.	.	.	2	.	.
266.54M	2	.	.	5	.	.	.	1	.	.	.	.	.	.	.	.	.	1	1	.	.	.	.	.	.	1	.	.	.	.	.	.	.	1	.	.
267.37M	2	.	.	.	.	.	.	1	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	2	.	.	.	.	.	.	.	1	.	.
270.00M	.	.	.	.	.	.	.	1	.	.	.	.	2	.	.	.	.	.	.	.	.	.	.	.	.	2	.	.	.	.	.	.	.	.	.	.
277.92M	3	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	3	.	.	.	.	.	.	.	.	.	.
280.05M	3	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	2	.	.	.	.	.	.	.	.	.	.
280.80M	2	.	.	.	.	.	.	.	.	.	.	.	.	3	.	.	.	.	.	.	.	.	.	.	.	2	.	.	.	.	.	.	.	.	.	.
281.63M	2	.	.	.	.	.	.	1	.	.	.	.	.	3	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
283.21M	2	.	.	.	.	.	.	2	.	.	.	.	.	3	.	.	.	.	.	.	.	.	.	.	.	2	.	.	.	.	.	.	.	.	.	.
286.37M	2	.	.	.	.	.	.	2	.	.	.	.	.	3	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.
289.55M	1	.	.	.	.	.	.	.	.	.	.	.	.	3	.	.	.	.	.	.	.	.	.	.	.	2	.	.	.	.	.	.	.	.	.	.
291.13M	2	.	.	.	.	.	.	.	.	.	.	.	.	3	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.
292.71M	2	.	.	.	.	.	.	.	.	.	.	.	.	3	.	.	.	.	.	.	.	.	.	.	.	2	.	.	.	.	.	.	.	.	.	.
294.29M	2	.	.	.	.	.	.	.	1	.	.	.	.	2	.	.	1	.	.	.	.	.	.	.	.	2	.	.	.	.	.	.	.	.	.	.
295.87M	2	.	.	.	.	.	.	.	1	.	.	.	.	2	.	.	.	.	.	.	.	.	.	.	.	2	.	.	.	.	.	.	.	.	.	.
296.62M	2	.	.	.	.	.	.	2	1	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	2	.	.	.	.	.	.	.	.	.	.
297.45M	2	.	.	.	.	.	.	.	1	.	.	.	.	2	.	.	1	.	.	.	.	.	.	.	.	2	.	.	.	.	.	.	.	.	.	.
298.20M	2	.	.	.	.	.	.	2	2	.	.	.	.	3	.	.	.	.	.	.	.	.	.	.	.	2	.	.	.	.	.	.	.	.	.	.
299.05M	2	.	.	.	.	.	.	.	2	.	.	.	.	3	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
299.80M	2	.	.	.	.	.	.	2	2	.	.	.	.	3	.	.	1	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.
300.63M	.	.	.	.	.	.	.	.	2	.	.	.	.	2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
301.38M	.	.	.	.	.	.	.	.	2	.	.	.	.	2	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.
302.21M	3	.	.	.	.	.	.	2	2	.	.	.	.	3	.	.	.	.	.	.	.	.	.	.	.	2	.	.	.	.	.	.	.	.	.	.
302.76M	2	.	.	.	.	.	.	2	2	.	.	.	.	2	.	.	2	.	.	.	.	.	.	.	.	2	.	.	.	.	.	.	.	.	.	.

APPENDIX 3

Distribution of benthic species

AMCOR 6009B

	AMMONIA BECCARRII	BOLIVINA DIRECTA	BOLIVINA PAULA	BUCCELLA ANDERSENII	BUCCELLA FRIGIDA	BUCCELLA INUSITATA	BULIMINA MARGINATA	BULIMINELLA ELEGANTISSIMA	BULIMINELLA ELONGATA	CASSIDULINA CARINATA	CASSIDULINA CF. CARINATA	CIBICIDES ORNATUS	CIBICIDES SP.	CRIBROELPHIDIUM POEYANUM	ELPHIDIUM CLAVATUM	ELPHIDIUM SP.
84.41M	...	..8	..3	...	...	...	.12	...	...	..2	...	...	...	...	..4	...
93.2M	...	...	...	...	...	...	..4	...	...	..2	...	..6	...	...	..6	..2
122.2M	...	...	...	...	...	...	...	...	...	...	...	..8	...	.10	..1	..2
125.45M	...	...	...	.27	...	...	...	.49	...	...	..8	.10	...	...	.64	...
167.24M	...	...	...	.25	...	...	...	...	...	..8	...	.26	...	...	...	.10
273.9M	...	..2	...	...	...	..1	...	..2	..6	...	...	...	..1	...	...	..2
301.2M	..3	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
321.0M	..1	...	...	..3	..1	...	...	..1	...	...	...	...	...	...	...	...

	ELPHIDIUM SP. A	ELPHIDUM EXCAVATUM	ELPHIDUM SUBARTICUM	EPISTOMINELLA EXIGUA	EPISTOMINELLA PONTONI	FISSURINA LUCIDA	FLORILUS ATLANTICUS	FLORILUS INCISUM	FLORILUS SPP.	FURSENKOINA FUSIFORMIS	FURSENKOINA SCHREIBERSIANA	GLOBOBULIMINA AURICULATA	GLOBOBULIMINA NOTOVATA	GLOBOCASSSIDULINA CRASSA	GLOBULINA INAEQUALIS	GUTTULINA CF. YABEI
84.41M	..1	..3	...	...	..6	...	...	...	...	..3	.15	..2	..3	.10	...	...
93.2M	..5	.40	..1	.10	..1	...	..3	...	..2	...	..1	..6	...	..1	..1	...
122.2M	...	...	..3	...	..1	...	...	...	...	...	...	...	...	...	..2	...
125.45M	...	...	...	...	...	..1	...	...	...	.31	...	...	...	...	...	...
167.24M	..1	112	...	...	..6	...	..5	...	...	...	...	...	...	...	..2	..1
273.9M	...	...	...	...	...	...	...	..1	...	...	...	...	...	...	...	...
301.2M	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
321.0M	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...

	HANZAWAIA CONCENTRICA	LAGENA CLAVATA	LAGENA ELONGATA	LAGENA LAEVIS	LAGENA SPP.	LAGENA SULCATA	MARGINULINA DUBIA	NONIONELLA AURIS	NONIONELLA CF. AURIS	NONIONELLA MIOCENICA STELLA	PYRGO SP. A	Q. TRILOCULINIFORMIS	QUINQUELOCULINA SEMINULA	ROSALINA FLORIDANA	STAINFORTHIA COMPLANATA	TEXTULARIA DELTOIDEA
84.41M	...	...	..1	..1	..1	...	...	..5	...	...	...	..4	..2	...	...	...
93.2M	...	..2	...	...	..1	..1	..1	...	...	..3	..2	...	...	...	..1	...
122.2M	...	...	...	...	...	...	...	..2	...	...	...	...	..1	..1	...	...
125.45M	...	...	...	...	..1	...	...	..9	...	...	...	...	...	.14	...	...
167.24M	...	...	...	...	...	...	...	164	...	...	...	...	...	...	...	...
273.9M	..1	...	...	...	...	...	...	...	..5	...	...	...	...	...	...	...
301.2M	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
321.0M	..2	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	..4

APPENDIX 3 (Continued)

AMCOR 6010

	BOLIVINA DIRECTA	BOLIVINA FRAGILIS	BOLIVINA PAULA	BOLIVINA SP.	BRIZALINA BARBATA	BUCCELLA ANDERSENI	BULIMINA ALAZANENSIS	BULIMINA BASSENDORFENSIS/EXILIS	BULIMINA MARGINATA	BULIMINELLA ELEGANTISSIMA	CANCRIS SAGRA COMMUNIS	CASSIDULINA CARINATA	CIBICIDES LOBATULUS	CIBICIDES ORNATUS	CIBICIDES SP. A	CRIBROELPHIDIUM POEYANUM	DENTALINA COMMUNIS	ELPHIDIUM CLAVATUM	ELPHIDIUM SP.	ELPHIDUM EXCAVATUM	ELPHIDUM SUBARTICUM	EPISTOMINELLA EXIGUA	EPISTOMINELLA PONTONI	FISSURINA LUCIDA	FLORILUS ATLANTICUS	FURSENKOINA FUSIFORMIS	FURSENKOINA SCHREIBERSIANA	GLOBOBULIMINA AURICULATA	GLOBOCASSIDULINA CRASSA	GLOBULINA GIBBA	GLOBULINA INAEQUALIS	HANZAWAIA CONCENTRICA
151.2M	...	.11	..1	...	...	...	...	...	.14	...	.20	..4	..1	.62	..3	...	...	...	...	.71	..6	...	...	...	...	...	...	.11	...	..1	..5	..1
152.8M	...	...	...	...	...	...	...	...	..1	..1	...	...	...	.13	...	...	...	...	...	280	.26	...	..8	...	...	..2	..1	...	...	...	...	...
160.4M	...	..8	...	...	...	...	...	...	..2	...	...	..9	...	..9	...	...	...	...	...	214	.18	...	.66	...	...	.10	.16	..3	...	...	...	...
160.6M	...	..5	...	...	...	...	...	...	.12	...	...	..8	...	.25	...	...	...	...	...	.79	.10	...	.39	...	...	..2	..6	..2	..1	...	...	...
170.1M	...	...	...	...	...	...	...	...	.24	..9	..4	.11	...	..9	...	...	...	...	...	.66	..6	...	.90	..2	...	..5	.10	..1	..2	...	...	...
172.2M	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	.81	..3	...	...	...	...	...	...	...	...	...	...	...
173.0M	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	.44	...	...	...	...	...	...	..1	...	...	...	...	...
179.7M	...	...	...	...	...	...	...	...	...	.31	...	...	...	...	...	...	...	...	...	189	..5	...	.14	...	...	..3	...	...	...	...	...	...
182.2M	...	...	...	...	...	...	...	...	...	..1	...	...	...	...	...	...	...	...	...	..6	...	...	...	...	...	...	...	...	...	...	...	...
207.7M	...	...	...	...	...	...	...	...	...	...	...	...	...	..1	...	...	...	...	...	..2	...	...	...	...	...	...	...	...	...	...	...	...
264.8M	...	...	...	...	...	..3	...	..5	...	...	...	...	...	..1	...	...	...	...	...	..2	...	...	..3	...	...	...	...	...	...	...	...	...
267.2M	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	..4	...	...	..1	...	...	...	...	...	...	...	...	...
273.6M	...	...	...	...	...	...	...	.22	...	.48	...	...	...	..2	...	...	...	...	...	.75	...	...	145	...	...	..2	...	...	...	...	...	...
277.05M	...	...	...	...	...	...	...	..1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
280.3M	...	...	...	...	...	110	...	.85	...	.15	...	...	...	.20	...	...	...	...	...	.19	...	...	..3	...	.51	..3	...	..4	...	...	...	...
283.7M	...	...	...	...	...	..3	...	.19	...	...	...	...	..6	..3	...	..7	...	...	..2	..1	..1	..3	...	...	..1	...	...	...	...	...	...	...
302.3M	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	..2	...	...	...	...	...	...
310.7M	..1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	..1	...	...	...	...	...	...	...	..9	...	...	...	...	...	...
314.6M	...	...	...	.16	..1	...	..2	...	...	...	...	...	..2	...	...	...	..2	...	...	...	...	...	...	..1	.31	...	...	...	...	...	...	...

APPENDIX 3 (Continued)

AMCOR 6010

	LAGENA CLAVATA	LAGENA DORSEYAE	LENTICULINA AMERICANA	LENTICULINA AMERICANA SPINOSA	LENTICULINA IOTUS	MARGINULINA DUBIA	NONIONELLA AURIS	NONIONELLA MIOCENICA STELLA	OOLINA APICULATA	PSEUDOPOLYMORPHINA DUMBLEI	PSUEUDOPOLYMORPHINA STRIATA	PYRGO SP. A	PYRGO SUBSPHAERICA	QUINQUELOCULINA SEMINULA	QUINQUELOCULINA TRILOCULINIFORMIS	ROSALINA FLORIDANA	TEXTULARIA AGGLUTINANS	TEXTULARIA SP. C	TRIFARINA ANGULOSA	UVIGERINA JUNCEA	UVIGERINA PEREGRINA	VALVULINERIA MINUTA	VALVULINERIA SP. A	VIRGULINA ROTUNDATA
151.2M	...	...	..1	...	.15	.17	..7	..5	...	.12	..1	..9	..2	.14	..7	..1	...	..3	.31	...	...	...	...	...
152.8M	...	...	...	...	...	..1	.45	...	...	..1	...	...	...	.68	...	...	...	...	..1	...	...	...	...	...
160.4M	...	...	...	...	...	..1	.49	...	...	..1	...	...	...	.24	...	..2	...	...	..2	...	...	...	...	...
160.6M	...	...	...	...	...	..1	.19	..1	...	...	...	...	..1	.24	..2	...	...	...	..3	...	...	...	...	...
170.1M	...	...	...	...	...	...	.20	..1	...	...	...	..1	..2	..7	..1	..2	...	...	..6	...	...	...	...	...
172.2M	...	...	...	...	...	...	..1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
173.0M	..1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
179.7M	...	...	...	...	...	...	.13	..2	...	..2	...	...	...	..1	...	..3	...	...	...	...	...	...	...	...
182.2M	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
207.7M	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
264.8M	...	...	...	...	...	...	..1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
267.2M	...	...	...	...	...	...	.13	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
273.6M	...	...	...	...	...	...	.13	...	...	...	...	...	...	...	...	..1	...	...	...	.10	...	...	...	...
277.05M	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	..1	...	...	...	...
280.3M	...	...	..2	..3	...	...	.47	...	...	...	...	...	...	...	...	..7	..4	...	...	...	...	...	...	...
283.7M	...	...	..3	..2	...	...	..1	...	...	...	...	...	...	...	...	...	...	...	...	..1	..3	...	...	...
302.3M	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
310.7M	...	...	..1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
314.6M	...	..5	.28	...	...	..1	..4	...	..3	...	...	...	...	...	...	...	.16	...	...	...	...	..8	..7	..1

APPENDIX 3 (Continued)

AMCOR 6011

	TRIFARINA BRADYI	TEXTULARIA AGGLUTINANS	SPIRROPLECTAMMINA GRACILIS	ROSALINA VALVULATA	QUINQUELOCULINA SEMINULA	PSEUDOPOLYMORPHINA STRIATA	PSEUDOPOLYMORPHINA DUMBLEI	POLYMORPHINID	NODOSARIA CALOMORPHA	MELONIS BARLEEANUS	LENTICULINA SP.	LENTICULINA SEPTENTRIONALIS	LENTICULINA OCCIDENTALIS	LENTICULINA AMERICANA	LAGENA STRIATA	HANZAWAIA CONCENTRICA	GYROIDINA SP.	FLORILUS ATLANTICUS	EPONIDES BASSLERI	CIBICIDES FLORIDANA	BULIMINELLA ELONGATA	BULIMINELLA ELEGANTISSIMA	BULIMINA PUPOIDES	BULIMINA MARGINATA	BOLIVINA DIRECTA
198.6M	...	...	..1	...	...	...	...	...	...	...	...	...	...	..1	...	...	...	...	...	...	178	.15	...	...	...
199.0M	...	...	...	...	..1	..1	...	...	...	...	..1	...	...	...	...	...	...	...	..2	...	.50	..1	...	...	...
218.0M	...	...	...	...	...	...	...	..1	..1	...	...	..1	..1	..1	..2	...	...	.11	...	...	585	.35	...	...	..1
227.2M	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	..2	...	.25	...	...	300	.44	...	..6	..6
235.6M	..8	..1	..9	..1	..2	..3	...	..5	...	..6	...	...	...	..8	...	..1	..1	.13	...	.12	..6	..2	..2	...	...
236.3M	..5	...	...	...	..3	...	..1	...	...	..5	...	...	...	..1	...	...	...	...	...	.14	..3	..3	..1	...	...

APPENDIX 3 (Continued)

ASP 13

	BOLIVINA DIRECTA	BOLIVINA FLORIDANA	BOLIVINA SP.	BOLIVINA STRIATULA	BRIZALINA ALATA	BULIMINA ALAZANENSIS	BULIMINA BASSENDORFENSIS	BULIMINA BASSENDORFENSIS/EXILIS	BULIMINA MEXICANA	BULIMINELLA ELONGATA	CASSIDULINA CARINATA	CIBICIDES CF. FLORIDANA	CIBICIDES LOBATULUS	CIBICIDES SP.	CIBICIDES SP. A	DENTALINA SUBSOLUTA	EPISTOMINELLA PONTONI	EPONIDES BASSLERI	FISSURINA SPP.	FLORILUS ATLANTICUS	FURSENKOINA FUSIFORMIS	GLOBOBULIMINA AURICULATA
867.5M	..	..	..	..	.1	..	..	..	..	.5	.2	.2	.1	..	..	..	.1	..	..	..	.1	..
871.2M	.1	..	.1	..	22	..	..	..	..	..	..	..	..	..	..	..	..	..	.1	..	..	.1
911.3M	..	..	..	.1	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
911.7M	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
945.1M	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	.2
947.5M	..	..	..	..	..	..	..	..	..	.1	..	..	..	..	..	..	..	..	..	..	..	..
948.1M	..	..	..	..	.1	..	..	.4	..	..	..	..	..	..	..	..	..	..	..	.1	..	..
948.6M	..	..	..	..	..	..	..	..	.1	.1	..	..	..	..	..	.1	..	..	..	.1	..	.2
948.9M	..	..	..	..	..	..	..	..	.2	.1	..	..	..	..	..	.1	..	..	..	.1	..	.1
963.2M	..	..	..	.1	..	.6	.3	..	..	..	..	.1	..	..	..	..	..	..	..	.3	..	..
965.5M	..	..	..	.1	..	10	..	..	..	..	..	..	..	..	..	..	..	.1	..	..	..	..
966.2M	..	..	..	11	..	50	..	..	..	.1	..	.1	..	.1	..	..	..	.1	.1	.2	..	..
966.8M	..	.4	..	41	..	21	.4	..	..	..	..	.1	..	..	.2	..	..	.3	..	.7	..	.1

	GLOBOBULIMINA PACIFICA	GLOBOCASSIDULINA SP.	GLOBOCASSIDULINA CRASSA	GYROIDINOIDES SP.	LAGENA LAEVIS	LENTICULINA AMERICANA	LENTICULINA AMERICANA SPINOSA	LENTICULINA CLACAR	LENTICULINA DORBIGNYII	LENTICULINA OCCIDENTALIS TORRIDA	LENTICULINA PEREGRINA	LENTICULINA SPP.	MARGINULINA DUBIA	MARGINULINA OBESA	MARTINOTTIELLA OCCIDENTALIS	MARTINOTTIELLA SP.	MELONIS BARLEEANUS	NODOSARIA LONGISCATA	NODOSARIID	NONIONELLA AURIS	ORISODORSALIS CF. TENER	ORISODORSALIS CF. UMBONATUS
867.5M	..	..	.1	..	..	..	..	..	..	..	.1	..	..	..	..	..	.1	..	.1	..	..	..
871.2M	.1	..	.1	..	.1	.2	.1	..	..	..	..	..	..	..	..	.1	.3	..	..	.1	..	..
911.3M	..	..	..	..	..	.1	..	..	..	.1	..	..	..	..	..	..	..	..	..	..	..	..
911.7M	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
945.1M	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	.1	..	..	..	..
947.5M	..	.1	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	.1	..	.4	..	..
948.1M	..	..	..	..	..	..	..	.1	..	..	..	..	..	..	..	..	.1	..	..	.4	..	..
948.6M	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
948.9M	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
963.2M	..	..	..	..	..	.1	..	.3	..	..	.2	..	..	..	..	..	..	..	..	..	..	..
965.5M	..	..	.1	..	..	.1	..	..	.1	.2	.1	..	..	..	..	..	.1	.1	.1	..	..	..
966.2M	..	..	.3	..	..	..	..	..	..	.5	.1	..	.2	..	..	..	.2	10	..	..	.1	.1
966.8M	..	..	10	.1	.3	..	.2	..	..	.7	.1	.1	..	.1	.4	..	.8	.3	..	.4	..	..

APPENDIX 3 (Continued)

ASP 13

	ORISODORSALIS UMBONATUS	PLANULINA SP.	PLECTOFRONDICULARIA ADVENA	PLECTOFRONDICULARIA HELENAE	PULLENIA BULLOIDES	PYRGO MURRHINA	QUADRIMORPHINA SP. A	QUINQUELOCULINA SEMINULA	QUINQUELOCULINA SPP.	RECTOGLANDULINA TORRIDA	SPHAEROIDINA BULLOIDES	SPHAEROIDINA SP.	SPIROPLECTAMMINA GRACILIS	STILOSTOMELLA ANNULIFERA	STILOSTOMELLA BRADYI	STILOSTOMELLA CF. ACULEATA	STILOSTOMELLA CF. GRACILLIMA	STILOSTOMELLA CURVATURA	STILOSTOMELLA MODESTA	STILOSTOMELLA SP. A	STILOSTOMELLA SPP.	UVIGERINA CF. CUSHMANI
867.5M	..	..	..	..	.1	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	.1	..
871.2M	.1	.1	..	..	..	..	.1	..	..	..	..	..	.6	..	.3	..	..	..	..	..	..	..
911.3M	..	..	..	..	..	..	..	..	..	.2	..	..	..	..	..	..	..	.1	..	..	..	..
911.7M	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
945.1M	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
947.5M	..	..	..	..	..	..	..	..	.1	..	..	..	..	..	..	..	..	..	..	..	..	..
948.1M	..	..	.1	.1	..	..	.2	.1	..	..	..	..	..	..	..	..	..	..	..	..	.1	..
948.6M	..	..	..	.1	..	..	.1	..	.1	..	..	..	..	..	..	..	..	..	..	..	..	.2
948.9M	..	..	..	.1	..	..	.1	..	..	..	..	..	..	..	..	..	..	..	..	..	..	.1
963.2M	..	..	.1	..	..	..	..	..	..	.1	..	..	..	..	..	.2	..	..	.3	..	.1	.1
965.5M	..	..	.1	..	..	..	..	..	..	.1	..	.1	..	..	..	..	.1	.1	..	.2	.1	.1
966.2M	..	..	.2	..	..	..	.1	..	..	.1	..	.1	..	.1	.2	.3	..	..	..	.2	..	..
966.8M	..	..	..	..	..	.1	.1	..	..	.1	.2	.2	.2	.2	.5	.1	..	..	..	.8	..	..

	UVIGERINA DIRUPTA	UVIGERINA JUNCEA	UVIGERINA PEREGRINA	VALVULINERIA SP. A	VIRGULINA ROTUNDATA	VULVULINA (?) SPINOSA
867.5M	..	.6	.7	..	.1	..
871.2M	..	..	..	.1	..	..
911.3M	.1	12	.6	..	..	..
911.7M	..	..	.1	..	..	..
945.1M	..	..	..	..	..	..
947.5M	..	..	.1	..	..	..
948.1M	..	.2	.4	..	..	..
948.6M	..	.1	.5	.3	..	..
948.9M	..	.2	.4	.1	..	..
963.2M	..	..	..	..	..	..
965.5M	..	..	.1	..	..	..
966.2M	..	..	.2	.1	..	..
966.8M	..	11	.1	..	..	.1

APPENDIX 3 (Continued)

ASP 14

	AGGLUTINATED SP. A	AGGLUTINATED SP. B	AGGLUTINATED SP. C	ALABAMINA TANGENTIALIS	AMPHICORYNA SP. B	ANOMALINOIDES GLOBULOSA	BOLIVINA CF. DIRECTA	BOLIVINA LANCEOLATA	BOLIVINA SP. C	BOLIVINA SP. D	BOLIVINA SP. E	BOLVINA DIRECTA	BULIMINA ALAZANENSIS	BULIMINA GIBBA	BULIMINA NOTOVATA	BULIMINA STRIATA
1305.4M	...	...	...	...	...	...	...	...	...	...	...	..2	...	...	...	...
1345.8M	...	...	...	...	...	...	...	...	...	...	...	..3	..6	...	...	...
1419.1M	...	...	...	...	...	...	...	...	...	...	...	...	..4	...	...	..3
1420.2M	...	...	...	...	...	...	...	...	...	...	...	...	.11	...	...	.15
1422.2M	...	...	...	...	...	...	...	...	...	...	...	...	.10	...	...	.12
1448.9M	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
1470.2M	...	...	...	..2	...	..2	...	..1	..1	...	...	..1	.11	..4	..3	...
1470.9M	...	...	...	...	...	...	...	...	...	...	...	...	...	..1	...	...
1471.6M	...	...	...	...	...	...	..1	..3	...	...	...	...	..9	...	...	...
1472.2M	...	...	...	..8	...	...	...	...	...	...	...	...	.22	...	..1	..1
1472.7M	...	...	...	..2	..1	..8	..1	..2	..1	...	...	...	.42	...	..3	...
1475.2M	..2	...	..1	..1	...	..2	...	..3	...	...	...	...	..2	..8	..2	...
1475.8M	..2	..1	...	..4	...	.14	...	..5	...	..2	..1	...	.76	...	..8	..1

	BULIMINA STRIATA MEXICANA	BULIMINELLA BASSENDORFENSIS	BULIMINELLA ELONGATA	CASSIDULINOIDES BRADYI	CERATOBULIMINA PACIFICA	CHILOSTOMELLA OOLINA	CIBICIDES CF. FLORIDANA	CIBICIDES CF. PSEUDOUNGERIANUS	CIBICIDES CF. ROBERTSONIANUS	CIBICIDES SP.	DENTALINA AFF. ADOLPHINA	DENTALINA COMMUNIS	DENTALINA SP.	DENTALINA SUBSOLUTA	EGGERELLA BRADYI	EGGERELLA PROPINQUA
1305.4M	...	.53	..1	..1	...	...	..1	..1	...	...	...	...	...	..2	...	...
1345.8M	..2	..1	.11	...	...	...	...	...	...	...	...	...	...	...	...	...
1419.1M	..2	...	..1	...	...	...	...	...	...	...	...	...	...	...	...	...
1420.2M	..4	...	..8	...	...	...	...	..2	...	...	...	...	...	...	...	...
1422.2M	..8	...	..3	...	...	..1	...	..8	...	...	...	...	...	..1	...	...
1448.9M	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
1470.2M	..5	...	...	...	...	..2	...	..5	...	..3	..4	..1	...	...	..2	..1
1470.9M	...	...	...	...	...	..1	...	..1	...	..2	..2	...	...	...	..1	...
1471.6M	..1	...	...	...	...	...	...	...	...	..1	...	...	...	...	...	...
1472.2M	...	...	...	...	...	..2	...	..4	..1	..2	..2	..3	...	..1	...	...
1472.7M	..1	...	..1	...	...	...	...	..6	...	..2	..2	...	...	...	...	...
1475.2M	...	...	..1	...	..1	...	...	..5	...	...	...	..1	...	...	...	...
1475.8M	...	...	...	...	...	...	...	..4	..1	..1	...	..2	..3	..2	...	...

APPENDIX 3 (Continued)

ASP 14

	EPISTOMINELLA SP. A	EPONIDES BASSLERI	EPONIDES CF. TUMIDULUS	EPONIDES EXIGUA	FISSURINA CF. BRADYI	FISSURINA CF. LUCIDA	FISSURINA SPP.	FISSURINA SULCATA	FLORILUS ATLANTICUS	FRONDICULARIA SAGITTULA	FURSENKOINA CF. DAVISI	FURSENKOINA CF. FUSIFORMIS	GAUDRYINA SP. A	GLOBOBULIMINA AURICULATA	GLOBOBULIMINA SP. C	GLOBOCASSIDULINA SUBGLOBOSA
1305.4M	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	..1
1345.8M	...	...	...	...	...	...	...	...	..2	...	...	...	...	...	...	...
1419.1M	...	...	...	...	...	...	..1	...	...	...	...	...	...	...	...	...
1420.2M	...	..3	...	...	...	...	..2	...	..1	...	...	...	...	..5	...	...
1422.2M	...	..1	...	...	...	...	...	...	...	...	...	...	...	...	...	...
1448.9M	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
1470.2M	...	...	...	...	...	...	..1	...	..3	..4	...	..2	...	...	...	..6
1470.9M	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
1471.6M	...	...	...	..1	...	...	..1	...	...	..1	...	...	...	...	..1	..7
1472.2M	...	...	...	...	...	...	...	..2	..2	..3	...	...	...	...	...	..2
1472.7M	..1	...	...	..1	...	..2	...	...	..2	..3	...	...	...	...	...	..5
1475.2M	...	...	..1	...	..1	...	...	...	..3	..2	...	...	..3	...	...	..1
1475.8M	..1	...	...	...	...	...	..2	...	..3	...	..1	...	...	...	...	..2

	GLOBULINA INAEQUALIS	GLOBULINA SP.	GUTTULINA CF. HIPPONENSIS	GUTTULINA CF. YABEI	GYROIDINOIDES NEOSOLDANII	GYROIDINOIDES ORBICULARIS	HOGLUNDINA ELEGANS	KARRERIELLA BRADYI	LAGENA CF. SULCATA	LAGENA ELONGATA	LAGENA GRACILLIS	LAGENA LAEVIS	LAGENA SP.	LAGENA STRIATA	LAGENA SUBSTRIATA	LENTICULINA CF. ANTILLEA
1305.4M	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
1345.8M	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
1419.1M	...	...	...	...	..1	...	...	...	...	...	...	..1	...	...	...	...
1420.2M	...	...	...	...	..1	...	...	...	...	...	...	...	...	...	...	...
1422.2M	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
1448.9M	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
1470.2M	...	...	...	.10	..6	...	...	...	...	..1	...	...	...	...	...	...
1470.9M	...	...	...	...	..2	..3	...	...	...	...	...	...	...	...	...	...
1471.6M	...	...	...	..3	..1	...	...	...	...	...	...	...	...	...	...	..1
1472.2M	...	...	...	..6	..2	..2	...	..1	...	...	..1	..1	...	...	..2	...
1472.7M	..3	..1	...	...	..7	...	...	...	...	...	...	...	...	..1	...	...
1475.2M	...	...	..1	..1	..2	...	..1	...	..2	...	...	..1	...	...	...	...
1475.8M	...	...	...	...	..5	...	...	...	..4	...	...	...	..1	...	...	...

APPENDIX 3 (Continued)

ASP 14

	LENTICULINA OCCIDENTALIS	LENTICULINA OCCIDENTALIS GLABRATA	LENTICULINA OCCIDENTALIS NOVANGLIAE	LENTICULINA OCCIDENTALIS TORRIDA	LENTICULINA PEREGRINA	LENTICULINA ROTULATA	LENTICULINA SP. A	LENTICULINA SPINOSA	LINGULINA CF. SEMINUDA	MARGINULINA OBESA	MARGINULINOPSIS SP. A	MARTINOTTIELLA COMMUNIS	MARTINOTTIELLA COMMUNIS OCCIDENTALIS	MARTINOTTIELLA SP.	MELONIS BARLEEANUS	MELONIS POMPILIOIDES
1305.4M	...	...	1	3	...	...	...	...	...	...	...	...	1	...	...	...
1345.8M	...	...	...	...	...	...	...	2	...	...	...	...	1	...	...	...
1419.1M	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
1420.2M	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
1422.2M	...	...	...	2	...	...	...	...	...	...	...	...	1	...	1	...
1448.9M	...	...	...	...	...	...	...	...	...	...	...	...	2	...	...	...
1470.2M	...	...	2	...	3	3	...	...	...	...	1	6	8	...	6	5
1470.9M	...	...	2	...	...	...	1	...	...	...	3	3	...	...	...	3
1471.6M	...	6	...	5	...	...	...	...	1	1	1	14	4	...	7	...
1472.2M	8	9	...	...	1	1	...	...	...	2	1	14	4	2	4	7
1472.7M	5	...	...	1	1	...	...	...	...	...	...	1	1	2	1	4
1475.2M	...	...	...	...	1	4	...	...	...	...	2	1	3	1	3	1
1475.8M	...	5	...	...	1	1	...	...	2	1	...	4	3	3	...	5

	NODOSARIA LONGISCATA	NODOSARIA SOLUTA	NODOSARIA SUBSTRIGATA	ORISODORSALIS CF. TENER	OSANGULARIA MEXICANA	PLANULINA CF. WUELLERSTORFI	PLANULINA WUELLERSTORFI	PLECTOFRONDICULARIA ADVENA	PLEUROSTOMELLA BREVIS	PLEUROSTOMELLA CF. AGUAFRESCAENSIS	PLEUROSTOMELLA RAPA RECENS	PLEUROSTOMELLA SP. A	PRAEGLOBOBULIMINA SPINESCENS	PSEUDONODOSARIA GLANDULINIFORMIS	PSEUDONODOSARIA SP. A	PULLENIA BULLOIDES
1305.4M	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	1
1345.8M	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
1419.1M	3	...	...	...	...	...	...	...	...	...	...	...	...	...	...	1
1420.2M	2	...	...	...	...	...	...	1	...	...	...	...	...	...	...	4
1422.2M	1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
1448.9M	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
1470.2M	1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	3
1470.9M	20	...	1	...	1	...	...	1	1	...	...	...	...	...	...	...
1471.6M	34	5	...	...	...	6	...	...	...	...	1	...	1	...	...	2
1472.2M	...	...	...	...	...	...	...	...	...	...	...	1	1	1	...	3
1472.7M	4	...	...	1	...	...	2	...	2	...	...	2	...	...	1	8
1475.2M	19	...	...	...	...	...	...	...	...	1	...	1	...	...	...	6
1475.8M	...	...	...	...	...	...	1	...	2	...	...	...	...	...	...	...

APPENDIX 3 (Continued)

ASP 14

	PULLENIA QUINQUELOBA	PULLENIA QUINQUELOBA/BULLOIDES	RECTOBOLIVINA VIRGULA	RECTOGLANDULINA TORRIDA	SARACENARIA ITALICA	SIGMOILINA TENUIS	SIPHONINA BRADYANA	SIPHONODOSARIA CONSOBRINA EMACIATA	SPHAEROIDINA BULLOIDES	STILOSTOMELLA ANNULIFERA	STILOSTOMELLA BRADYI	STILOSTOMELLA CF. ACULEATA	STILOSTOMELLA CURVATURA	STILOSTOMELLA MODESTA	STILOSTOMELLA SP. A	STILOSTOMELLA SP. B
1305.4M	...	...	...	..2	...	...	...	...	..3	...	..9	..2	...	...	...	...
1345.8M	...	...	...	...	...	...	...	...	...	..1	.18	...	...	..1	..1	...
1419.1M	...	..1	...	..1	...	...	...	...	...	..1	..1	..1	..1	...	..1	...
1420.2M	..1	...	...	..1	...	...	...	...	...	...	..1	...	..1	..5	..6	...
1422.2M	...	...	...	...	...	...	...	...	...	...	..1	..1	..2	..3	..5	...
1448.9M	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
1470.2M	...	..3	...	..1	..4	...	.11	...	.23	...	...	...	.23	..1	...	..1
1470.9M	...	..2	...	...	...	...	..1	..2	..3	...	...	...	..7	...	...	...
1471.6M	...	...	..3	...	..1	...	.22	...	.27	...	..2	.34	..5	..1	...	..4
1472.2M	...	.10	...	...	..2	...	.27	...	.50	...	..2	.25	..2	..3	...	...
1472.7M	...	...	...	...	..2	...	.12	...	.14	...	...	..2	..7	...	...	..1
1475.2M	...	..1	...	...	..1	...	.11	...	.22	...	...	..1	..4	...	...	..1
1475.8M	...	..2	...	...	..1	..1	..4	...	.54	..1	..1	..1	..4	...	...	...

	STILOSTOMELLA SP. C	STILOSTOMELLA SUBSPINOSA	TEXTULARIA SP.	TRIFARINA ANGULOSA	TRIFARINA BRADYI	UVIGERINA AUBERIANA	UVIGERINA CF. SCHWAGERI	UVIGERINA SPINICOSTATA	VAGINULINA BERMUDENSIS	VAGINULINA SP. A	VAGULINOPSIS SUBALATA	VIRGULINA ROTUNDATA	VULVULINA SPINOSA
1305.4M	...	...	...	...	...	145	...	...	...	...	...	...	...
1345.8M	...	...	...	..1	...	.69	...	...	...	...	...	...	...
1419.1M	...	...	...	...	...	...	...	..6	...	...	...	..1	...
1420.2M	...	...	...	...	...	...	...	.12	...	...	...	.18	...
1422.2M	...	...	...	...	...	...	...	.27	...	...	...	..1	...
1448.9M	...	...	...	...	...	...	...	...	...	...	...	...	...
1470.2M	..3	...	...	...	..8	.37	...	...	...	...	...	...	..1
1470.9M	...	..7	...	...	...	..1	..1	..5	...	...	...	...	...
1471.6M	...	..3	...	...	..2	.11	...	...	...	...	..1	...	...
1472.2M	..1	..2	...	...	..4	.39	...	...	..4	...	...	...	...
1472.7M	...	..3	...	...	...	.13	..1	.21	...	...	...	...	...
1475.2M	..1	..5	..1	...	..1	..1	..3	...	...	...	..1	...	...
1475.8M	...	...	...	...	..3	.38	..1	.27	...	..1	...	...	...

APPENDIX 3 (Continued)

ASP 15

	ALABAMINA TANGENTIALIS	ANOMALINOIDES GLOBULOSUS	ASTRONONION FIJIENSIS	ASTRONONION TUMIDUM	BIGENERINA NODOSARIA	BOLIVINA BARBATA	BOLIVINA DIRECTA	BOLIVINA FLORIDANA	BOLIVINA PSEUDOPLICATA	BOLIVINA SP. B	BRIZALINA ANTIQUA	BULIMINA ALAZANENSIS	BULIMINA MARGINATA	BULIMINA STRIATA	BULIMINA STRIATA MEXICANA	BULIMINELLA CF. PUPOIDES
1508.8M	...	...	..7	...	..1	...	..5	..4	...	...	...	..8	.11	...	..4	...
1509.4M	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
1510.0M	...	...	...	...	...	...	...	...	...	...	...	..2	...	...	...	...
1511.0M	...	...	...	...	..2	...	...	...	...	..1	...	...	..2	...	...	...
1511.5M	...	...	...	...	...	...	...	...	...	..1	...	...	..4	...	...	...
1512.1M	...	...	...	...	...	...	...	...	...	...	...	...	..2	...	...	...
1513.4M	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
1515.1M	...	...	...	...	..1	...	...	...	...	...	...	...	...	...	...	...
1515.4M	...	...	...	...	..2	...	...	...	...	...	...	...	...	...	...	...
1529.9M	..2	...	...	...	...	..1	...	...	..1	...	.13	..2	...	..2	...	..2
1530.9M	...	...	...	...	...	...	...	...	...	...	..1	...	...	..3	...	...
1531.7M	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
1532.2M	...	..1	...	..1	...	...	...	...	...	...	.56	.46	...	...	...	...

	BULIMINELLA ELONGATA	BULIMINELLA MORGANI	CASSIDULINA CARINATA	CASSIDULINA OBTUSA	CHILOSTOMELLA OOLINA	CHILOSTOMELLINA FIMBRIATA	CIBICIDES CF. PSEUDOUNGERIANA	CIBICIDES CF. ROBERTSONIANUS	CIBICIDES LOBATULUS	CIBICIDOIDES SP. A	DENTALINA AFF. ADOLPHINA	DENTALINA COMMUNIS	DENTALINA SPINOSA	EGGERELLA BRADYI	EPISTOMINELLA VITREA	EPONIDES CF. REGULARIS
1508.8M	..8	...	...	...	.16	...	...	..5	...	...	...	..4	...	..6	..8	...
1509.4M	...	...	...	..1	..4	...	...	..1	...	...	...	...	...	...	..1	...
1510.0M	...	..5	...	...	..3	...	...	...	...	...	...	..1	...	...	..1	...
1511.0M	...	...	...	...	..1	...	...	...	...	...	...	...	...	...	..4	...
1511.5M	...	..3	...	..1	...	..1	..5	...	..1	...	...	...	...	...	..3	..1
1512.1M	...	...	..2	..1	..3	...	...	..1	...	...	...	...	...	...	...	...
1513.4M	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
1515.1M	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
1515.4M	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
1529.9M	...	...	...	..2	...	...	...	...	...	...	..9	..6	..4	...	...	...
1530.9M	...	...	...	..2	...	...	...	...	...	...	...	...	..2	...	...	...
1531.7M	...	...	...	...	...	...	..1	...	...	...	...	...	..2	...	...	...
1532.2M	...	...	...	...	..1	...	...	...	...	..1	...	...	..2	...	...	...

APPENDIX 3 (Continued)

ASP 15

	EPONIDES POLIUS	EPONIDES SP. B	EUUVIGERINA MIOZEA	FISSURINA AURICULATA LINEARITUBA	FISSURINA LUCIDA	FISSURINA ORBIGNYANA	FISSURINA SP. A	FISSURINA SP. B	FLORILUS ATLANTICUS	FRONDICULARIA SP. A	FURSENKOINA FUSIFORMIS	FURSENKOINA VICKSBURGENSIS	GLANDULINA SP. A	GLANDULINA SP. B	GLOBOBULIMINA AURICULATA	GLOBOBULIMINA SP. A
1508.8M	...	...	...	..4	..3	..4	..2	..1	..2	...	..2	...	..1	..1	.11	...
1509.4M	...	...	...	..1	...	...	...	...	..1	...	...	...	...	...	..6	...
1510.0M	...	...	...	...	...	...	...	...	..1	...	...	...	...	...	..2	...
1511.0M	...	...	...	...	...	...	...	...	...	...	...	...	...	...	..1	...
1511.5M	...	...	...	...	...	...	...	...	...	..1	...	...	...	...	...	..1
1512.1M	...	...	...	...	...	...	...	...	..2	...	...	...	...	...	..1	..1
1513.4M	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
1515.1M	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
1515.4M	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
1529.9M	..1	...	...	...	...	...	...	...	...	...	...	..1	...	...	...	...
1530.9M	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
1531.7M	..1	...	..6	...	...	...	...	...	...	...	...	...	..1	...	...	...
1532.2M	...	..1	...	...	...	...	...	...	...	...	...	...	...	..1	...	...

	GLOBOBULIMINA SP. B	GLOBOCASSIDULINA SUBGLOBOSA	GYROIDINOIDES NEOSOLDANII	KARRERIELLA BRADYI	LAGENA ELONGATA	LAGENA GRACILLIS	LAGENA LAEVIS	LAGENA SEMISTRIATA	LAGENA SP. A	LAGENA SP. B	LAGENA SUBSTRIATA	LAGENA SULCATA	LATICARININA PAUPERATA	LENTICULINA ATLANTICUS	LENTICULINA CALCAR	LENTICULINA PEREGRINA
1508.8M	...	..4	..1	..6	..2	...	...	..1	..1	..1	..1	...	...	...	..2	...
1509.4M	...	...	...	..2	...	...	...	...	...	...	...	...	...	...	...	...
1510.0M	...	...	...	..4	...	...	...	...	...	...	...	...	...	...	..1	...
1511.0M	...	...	..1	..7	..2	...	...	...	...	...	...	...	...	...	...	...
1511.5M	...	...	...	..6	...	...	...	...	...	...	...	...	...	...	...	...
1512.1M	...	...	...	..1	...	...	...	...	...	...	...	...	...	...	..1	...
1513.4M	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
1515.1M	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
1515.4M	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
1529.9M	..6	...	..1	...	...	..2	..7	...	...	...	...	..3	...	...	...	..5
1530.9M	...	...	..1	..1	...	..1	...	...	...	...	...	...	...	...	...	...
1531.7M	..2	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
1532.2M	...	..8	..2	...	...	...	...	...	...	...	...	...	..1	..1	...	...

APPENDIX 3 (Continued)

ASP 15

	LENTICULINA SP. A	LENTICULINA SP. B	LOXOSTOMUM SP.	MARTINOTIELLA COMMUNIS	MARTINOTIELLA COMMUNIS OCCIDENTALIS	MELONIS BARLEEANUS	MELONIS CF. POMPILIOIDES	NODOSARIA CALOMORPHA	NODOSARIA LONGISCATA	NODOSARIA RADICULA GLANDULIFORMIS	NONIONELLA TURGIDA	OOLINA HEXAGONA	ORISODORSALIS CF. UMBONATUS	ORISODORSALIS TENER	ORISODORSALIS UMBONATUS	PARAFISSURINA RADIATA
1508.8M	...	...	...	..2	..4	..4	...	...	..8	...	..1	...	...	..2	...	..2
1509.4M	...	...	...	...	...	..4	...	...	..3	...	...	...	...	...	...	..1
1510.0M	..1	...	...	..1	...	..3	...	...	.16	...	...	...	...	...	...	...
1511.0M	...	...	...	..1	...	..1	...	...	..6	...	...	...	..1	...	...	..2
1511.5M	..1	...	...	...	...	..2	...	..1	..1	...	...	...	...	...	...	...
1512.1M	...	...	...	...	...	..3	...	...	...	..1	...	...	...	...	...	...
1513.4M	...	...	...	...	..2	...	...	...	...	...	...	...	...	...	...	...
1515.1M	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
1515.4M	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
1529.9M	...	..6	..1	...	...	..2	...	...	..2	...	...	..1	...	..3	..1	...
1530.9M	...	...	...	...	...	..2	...	...	..1	...	...	...	...	...	...	...
1531.7M	...	...	...	...	...	..2	...	...	..1	...	...	...	...	...	...	...
1532.2M	...	...	...	...	...	..4	..1	...	...	...	...	...	...	...	...	...

	PARAFISSURINA VENTRICOSA	PARAFRONDICULARIA ADVENA	PLEUROSTOMELLA BREVIS	PLEUROSTOMELLA RAPA RECENS	PLEUROSTOMELLA SP. A	PSEUDONODOSARIA COMATULA	PULLENIA BULLOIDES	PULLENIA CF. QUINQUELOBA	QUINQUELOCULINA SP.	SIGMOIDINA PACIFICA	SIPHONINA BRADYANA	SPHAEROIDINA BULLOIDES	STILOSTOMELLA ANNULIFERA	STILOSTOMELLA CURVATURA	STILOSTOMELLA SP. A	STILOSTOMELLA SP. B
1508.8M	..1	...	...	...	...	...	..7	...	...	...	...	.13	...	..1	.14	...
1509.4M	...	...	...	...	..1	...	...	...	...	...	...	..7	...	...	..6	...
1510.0M	...	...	...	..1	...	...	..1	...	...	...	...	..2	...	...	..2	...
1511.0M	...	...	...	...	...	..1	...	..1	...	...	...	.11	...	..2	..2	...
1511.5M	...	...	...	...	...	...	..1	...	..5	...	...	...	...	...	...	...
1512.1M	...	...	...	...	...	...	..2	...	...	...	...	..3	...	...	..2	...
1513.4M	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
1515.1M	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
1515.4M	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
1529.9M	...	..1	..1	...	..2	...	..3	..2	...	...	..3	.10	..3	.14	.10	..2
1530.9M	...	...	...	..2	...	...	..1	..1	...	...	...	...	...	.14	...	...
1531.7M	...	..2	...	..1	...	...	...	...	...	...	...	...	...	..4	...	...
1532.2M	...	..3	...	...	..7	...	..7	...	...	..1	...	..7	...	.22	...	...

APPENDIX 3 (Continued)

ASP 15

	STILOSTOMELLA SUBSPINOSA	TEXTULARIA SP. A	TEXTULARIA SP.B	TRIFARINA BRADYI	UVIGERINA AUBERIANA	UVIGERINA PEREGRINA DIRUPTA	UVIGERINA PEREGRINA MEDITERRANEA	UVIGERINA SPINICOSTATA	VAGINULINA BERMUDENSIS	VALVULINERIA CF. BRADYI	VALVULINERIA RUGOSA MINUTA	VIRGULINA ROTUNDATA
1508.8M	...	...	...	.16	..3	..4	..2	...	...	..4	...	.20
1509.4M	...	...	...	..1	..2	...	..1	...	...	...	...	..3
1510.0M	...	...	...	..1	..1	...	...	...	...	...	...	..2
1511.0M	...	...	...	..7	..2	...	...	...	...	...	...	..3
1511.5M	...	...	...	..6	..1	...	...	...	...	..1	...	...
1512.1M	...	...	...	..3	...	...	..1	...	...	...	...	..1
1513.4M	...	...	...	...	...	...	...	...	...	...	...	...
1515.1M	...	...	...	...	...	...	...	...	...	...	...	...
1515.4M	...	...	...	...	...	...	...	...	...	...	...	...
1529.9M	.16	..1	..1	...	.25	...	..5	.15	...	...	...	..2
1530.9M	...	...	...	..3	..5	...	...	..1	...	...	...	...
1531.7M	...	...	...	..3	..6	...	...	..2	...	...	...	...
1532.2M	...	...	...	..6	196	...	..5	...	..1	...	..2	...

APPENDIX 3 (Continued)

COST B-3

	ALABAMINA TANGENTIALIS	AMPHICORYNA HIRSUTA	AMPHICORYNA SP.	ANOMALINOIDES PSEUDOGROSSERUGOSA	BATHYSIPHON SPP.	BOLIVINA ALATA	BOLIVINA ANTIQUA	BOLIVINA CF. DIRECTA	BOLIVINA CF. STRIATULA	BOLIVINA FLORIDANA	BOLIVINA PSEUDOPLICATA	BOLIVINA SP. C	BOLIVINA SPATHULATA	BOLIVINA SPISSA	BOLIVINA DIRECTA	BULIMINA ALAZANENSIS
1158.3M	...	...	...	..2	...	...	...	...	...	...	...	...	...	...	..4	...
1167.4M	...	...	...	..2	...	...	...	...	...	...	...	...	...	...	...	..1
1176.6M	...	...	...	...	...	...	...	...	...	...	...	...	...	...	..3	..1
1185.7M	...	...	...	...	...	...	...	...	...	...	...	...	...	...	..1	...
1194.9M	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
1204.0M	...	...	...	..1	...	...	...	...	...	...	...	...	...	...	...	...
1213.2M	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
1222.3M	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	..1
1231.4M	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	..8
1249.7M	...	...	...	...	...	...	...	..1	...	...	...	...	...	...	...	..8
1258.8M	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	.23
1268.0M	...	...	...	...	...	...	...	...	...	...	...	...	...	...	..3	.34
1295.5M	...	...	...	...	...	...	...	...	...	...	...	...	...	...	..2	226
1304.6M	...	...	...	...	..1	...	...	...	...	...	...	...	...	...	..3	.96
1313.8M	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	102
1322.9M	...	...	...	...	...	...	...	...	...	...	...	...	...	...	..2	.92
1332.0M	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	.26
1341.2M	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	.24
1350.3M	...	...	..2	...	...	...	...	...	...	...	...	...	...	...	...	.23
1359.5M	...	...	...	...	...	...	...	...	..1	...	...	...	...	...	..3	.31
1368.6M	...	..1	...	...	...	...	...	...	...	...	...	..1	...	...	..2	.38
1377.8M	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	.11
1386.9M	.10	...	...	...	...	...	..1	...	...	...	...	...	..4	...	...	.32
1396.1M	..6	...	...	...	...	...	...	...	...	...	...	...	.18	...	...	.37
1405.2M	..6	...	...	...	...	...	...	...	...	...	..1	...	..5	...	..2	..6
1414.3M	..8	..2	...	...	...	.12	...	...	..2	...	...	..1	...	...	..2	...
1423.5M	..5	..1	...	...	...	..7	..6	...	...	..1	...	...	...	..1	...	.31
1432.6M	.12	..1	...	...	...	..1	..5	...	...	...	...	...	..1	...	...	...
1441.7M	..2	...	...	...	...	..1	..2	...	...	..1	...	...	...	...	...	..4

APPENDIX 3. (Continued)

COST B-3

	BULIMINA CF. GRATA	BULIMINA COSTATA	BULIMINA DIFORMIS	BULIMINA GIBBA	BULIMINA MARGINATA	BULIMINA NOTOVATA	BULIMINA PUPOIDES	BULIMINA SPICATA	BULIMINA STRIATA	BULIMINA STRIATA MEXICANA	BULIMINELLA BASSENDORFENSIS	BULIMINELLA CF. ELONGATA	BULIMINELLA ELEGANTISSIMA	BULIMINELLA ELONGATA/BASSENDORFENSIS	CASSIDULINOIDES BRADYI	CHILOSTOMELLA OOLINA
1158.3M	...	...	...	...	...	...	...	...	...	...	...	...	...	.15	..3	...
1167.4M	...	...	...	...	...	...	...	...	...	...	...	...	...	.17	...	...
1176.6M	..1	...	..2	...	...	...	...	...	...	..1	...	...	..2	.46	..1	...
1185.7M	...	...	...	...	...	...	...	...	...	..1	...	...	...	.86	..3	...
1194.9M	...	...	...	...	...	...	...	...	...	...	...	...	...	.36	...	...
1204.0M	...	...	...	...	...	...	...	...	...	...	...	...	...	115	...	...
1213.2M	...	...	...	...	...	...	...	...	...	...	...	...	...	.56	..1	...
1222.3M	...	...	...	...	...	...	...	...	...	...	...	...	...	.38	...	...
1231.4M	...	...	...	...	...	...	...	...	...	...	...	...	...	.59	...	..1
1249.7M	...	...	...	...	...	...	...	...	...	..1	...	...	...	.39	..1	...
1258.8M	...	...	...	...	...	..7	...	...	...	...	...	...	...	.42	...	...
1268.0M	...	...	...	...	...	...	..4	...	...	...	...	..1	...	.22	...	...
1295.5M	...	...	...	...	...	...	..5	...	...	..1	...	...	...	.40	...	...
1304.6M	...	...	...	...	...	...	...	..2	...	...	...	...	...	.36	..1	...
1313.8M	...	...	...	...	...	...	...	...	...	..3	...	...	...	.28	...	...
1322.9M	...	...	...	...	...	...	..2	..1	...	..1	...	...	...	...	..1	..1
1332.0M	...	..1	...	...	...	...	...	...	...	..1	..2	...	...	..5	...	...
1341.2M	...	...	...	..1	...	...	...	...	...	..3	...	...	...	..8	...	...
1350.3M	...	...	...	...	...	...	...	...	...	..2	...	...	...	.10	..2	...
1359.5M	...	...	...	...	...	...	..1	...	...	..3	...	...	...	...	..3	...
1368.6M	...	...	...	...	...	...	...	...	...	..2	...	...	...	..3	...	...
1377.8M	...	...	...	...	...	...	...	...	...	..1	...	...	...	..7	..1	...
1386.9M	...	...	...	...	...	...	...	...	...	..3	..3	...	...	...	..1	...
1396.1M	...	...	...	..1	...	...	...	...	...	..8	.11	...	...	...	...	...
1405.2M	...	...	...	..2	...	...	...	...	...	..5	..1	...	...	..2	..3	...
1414.3M	...	...	...	...	...	...	..1	...	...	..3	...	...	...	...	..6	...
1423.5M	...	...	...	..1	...	...	..1	...	..1	..2	...	...	...	..3	...	...
1432.6M	...	..1	...	...	..1	..1	...	...	...	..2	..2	...	...	..7	..2	...
1441.7M	...	...	...	...	...	...	...	...	...	..2	...	...	...	...	..1	...

	CIBICIDES BRADYI	CIBICIDES CF. PSEUDOUNGERIANUS	CIBICIDES LOBATULUS	CIBICIDES SP.	CIBICIDOIDES(?) SP.	CLAVULINA NODOSARIA	CYCLAMMINA SP.?	DENTALINA COMMUNIS	DENTALINA SP.	DENTALINA SUBSOLUTA	EGGERELLA BRADYI	EGGERELLA SPP.	EPONIDES BASSLERI	FISSURINA CF. LUCIDA	FISSURINA SPP.	FLORILUS ATLANTICA
1158.3M	...	...	...	...	..1	...	...	...	...	...	...	...	...	...	...	...
1167.4M	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
1176.6M	...	..1	...	...	...	...	...	...	...	...	...	...	...	...	...	...
1185.7M	...	..6	...	...	...	...	...	...	...	...	...	...	...	...	...	...
1194.9M	...	..6	...	..1	...	...	...	...	...	...	...	...	...	...	..1	..1
1204.0M	...	..7	...	..1	...	...	...	...	...	...	...	...	...	...	..1	..1
1213.2M	...	..5	...	...	...	...	...	...	..1	...	...	...	...	...	..1	...
1222.3M	...	..7	...	...	...	...	...	...	...	...	...	...	...	...	..1	..1
1231.4M	...	..4	..3	...	...	...	...	...	...	...	...	...	..1	...	...	..1
1249.7M	...	...	..3	...	...	...	...	...	...	...	...	...	..1	...	...	..3
1258.8M	...	..2	..1	...	...	...	...	...	...	...	...	...	...	...	...	...
1268.0M	...	..2	...	...	...	...	...	...	...	...	...	...	...	...	..1	...
1295.5M	...	.11	...	..1	...	...	...	...	...	...	...	...	...	..1	...	..3
1304.6M	...	.10	...	..2	...	...	...	...	...	...	...	..2	...	..1	..1	..3
1313.8M	...	.11	...	..1	...	...	..1	...	...	...	...	...	...	...	...	...
1322.9M	...	.17	...	..2	...	...	...	...	...	...	..1	...	...	...	...	..1
1332.0M	..1	..9	...	..1	...	...	...	...	...	...	..1	...	...	...	..1	..1
1341.2M	...	.11	...	...	...	...	...	...	..1	...	...	...	...	...	...	...
1350.3M	...	.15	...	..2	...	...	...	...	..2	..2	...	...	...	...	..1	...
1359.5M	...	.11	...	..1	...	...	...	...	...	...	...	..1	...	...	..1	...
1368.6M	..1	..5	...	..8	...	...	...	...	...	...	...	...	...	...	...	..4
1377.8M	...	..6	..1	..3	...	...	...	...	..1	...	...	...	...	...	...	..1
1386.9M	...	..2	...	..7	...	..1	...	..1	...	...	..2	...	...	...	...	..5
1396.1M	...	.17	...	..3	...	..8	...	..1	...	..3	..1	...	...	...	..1	..6
1405.2M	...	..1	..2	..7	...	..2	...	...	...	...	...	...	...	...	..1	...
1414.3M	..1	..2	..3	.14	...	...	...	..1	...	...	..3	...	...	...	...	.21
1423.5M	...	...	..4	..8	...	...	...	...	...	...	...	...	...	...	...	..3
1432.6M	...	...	...	.13	...	..1	...	...	..2	...	...	...	...	...	...	...
1441.7M	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...

APPENDIX 3 (Continued)

COST B-3

	FRONDICULARIA SAGGITULA	FURSENKOINA FUSIFORMIS	GAUDRYINA CURTA	GAUDRYINA SP. A	GLOBOBULIMINA AURICULATA	GLOBOCASSIDULINA CRASSA	GLOBOCASSIDULINA SUBGLOBOSA	GLOBULINA INAEQUALIS	GLOBULINA MINUTA	GLOBULINA SP.	GUTTULINA CF. YABEI	GUTTULINA SPP.	GYROIDINOIDES NEOSOLDANII	GYROIDINOIDES ORBICULARIS	HOGLUNDINA ELEGANS	KARRERIELLA BRADYI	LAGENA DORSEYAE	LAGENA GRACILLIMA	LAGENA LAEVIS	LAGENA SP.	LAGENA STRIATA	LAGENA SUBSTRIATA	LENTICULINA AMERICANA	LENTICULINA GIBBA	LENTICULINA OCCIDENTALIS	LENTICULINA OCCIDENTALIS GLABRATA	LENTICULINA OCCIDENTALIS NOVANGLIAE	LENTICULINA OCCIDENTALIS TORRIDA	LENTICULINA PEREGRINA	LENTICULINA ROTULATA	LENTICULINA SPINOSA	LENTICULINA SPP.
1158.3M	...	..1	...	...	..1	..3	...	...	..1	...	...	..1	...	...	...	...	..1	..1	...	...	...	...	..1	..1	...	...	...	...	...	...	..1	...
1167.4M	...	...	...	...	...	...	...	...	...	...	...	..1	...	...	...	...	...	...	...	...	...	...	..1	...	...	...	...	...	...	...	..1	...
1176.6M	...	..2	...	...	..1	..6	...	...	...	...	...	...	...	...	...	...	...	...	..1	...	..1	...	..1	...	...	...	...	...	...	...	..1	...
1185.7M	...	...	...	...	...	..3	...	...	...	...	...	...	...	...	...	...	...	...	..1	...	...	...	...	...	...	...	...	...	...	...	..2	..1
1194.9M	...	...	...	...	..1	..1	..3	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	..2	...	...	...	...	...	...	...	..1	..1
1204.0M	...	...	...	...	..1	..7	..1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	..1
1213.2M	...	...	...	...	...	..3	...	...	...	...	...	...	...	...	...	...	...	...	...	...	..1	...	...	...	...	...	...	...	...	...	..1	..1
1222.3M	...	...	...	...	...	..2	...	...	...	...	...	...	..1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
1231.4M	...	...	...	...	...	..2	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	..1	...
1249.7M	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
1258.8M	...	...	...	...	...	..3	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	..3	...	...	...	...	...	...	...	...	...
1268.0M	...	..3	...	...	..1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	..1
1295.5M	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
1304.6M	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	..1	..2	..2	...
1313.8M	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	..1	...	..1	..1	...	...	...	...	...	...	...	...	..1
1322.9M	...	...	...	...	...	..2	...	...	...	...	...	...	..1	...	...	..1	...	...	...	..1	...	...	...	...	...	...	...	...	..2	...	..3	...
1332.0M	...	...	...	...	...	...	...	...	...	...	...	...	..1	...	...	...	...	...	...	...	...	...	...	...	...	..2	...	...	..1	..1	..1	...
1341.2M	..1	...	...	...	...	...	...	...	...	..1	...	..3	..3	...	...	...	...	...	...	...	...	...	..3	...	...	...	...	...	...	...	...	..1
1350.3M	...	...	...	...	...	...	..2	...	...	...	..1	..9	..1	...	...	..3	...	...	...	...	...	...	...	..1	...	..1	..1	...	...	...	...	..1
1359.5M	...	...	...	...	...	..1	..2	...	...	..1	..4	...	..4	...	...	..1	...	...	...	...	...	...	...	...	...	...	...	...	..3	...	...	..2
1368.6M	...	...	...	..1	...	...	..1	...	...	...	...	..3	..2	...	...	..1	...	...	...	...	..1	...	...	...	..3	..1	...	...	..2	...	..1	...
1377.8M	...	...	...	...	...	...	...	...	...	...	...	..1	...	..1	...	..1	...	...	...	...	...	...	...	...	...	...	...	...	..1	...	...	...
1386.9M	...	...	..1	...	..1	...	..3	...	...	...	...	...	..5	...	...	...	...	...	...	...	...	...	...	...	...	..1	...	...	..1	..3	...	...
1396.1M	...	...	...	...	...	...	..9	...	...	...	...	...	..7	...	...	...	...	...	...	..1	...	...	...	...	...	..2	...	...	..1	...	..1	...
1405.2M	...	...	..1	..1	...	...	...	..1	..1	...	...	...	..1	...	...	...	...	...	...	...	...	...	...	...	...	..6	...	..6	...	...	...	..1
1414.3M	...	...	...	...	..2	...	..5	..4	...	...	...	..1	..7	..1	...	..1	...	...	...	..1	...	...	...	...	...	..3	..1	..1	..2	..5	..1	..3
1423.5M	...	...	..7	...	..7	..1	...	...	...	...	...	..1	..4	...	..3	...	...	...	...	...	...	...	...	...	...	...	...	..1	...	..1	...	..1
1432.6M	...	...	...	...	..3	...	..7	..3	...	...	...	..3	..6	...	..3	...	...	...	...	...	...	...	...	...	...	...	...	..2	..1	...	...	..2
1441.7M	...	...	...	...	...	...	..1	..1	...	...	...	..1	..1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	..1	...	...	...	...

APPENDIX 3 (Continued)

COST B-3

DEPTH	LOXOSTOMUM DIGITALE	MARGINULINA OBESA	MARGINULINOPSIS SP. A	MARTINOTIELLA COMMUNIS	MARTINOTIELLA COMMUNIS OCCIDENTALIS	MARTINOTIELLA SP.	MELONIS BARLEEANUS	MELONIS CF. POMPILIOIDES	MELONIS POMPILIOIDES	NODOSARIA LONGISCATA	NODOSARIA SPP.	NONIONELLA AURIS	OOLINA HEXAGONA	ORIDORSALIS TENER	ORIDORSALIS UMBONATUS	OSANGULARIA MEXICANA
1158.3M				1			9			1	2	1		1		
1167.4M							4					2		2		
1176.6M				1			5				2	2		1		
1185.7M				3			15							1		
1194.9M			1	3			7			1						
1204.0M				3			29			4				2		
1213.2M							5			4		1		1		
1222.3M				2			2			3		1				
1231.4M							1			6						
1249.7M				1						2				1		
1258.8M							4			3				1		
1268.0M				1			2			1				1		
1295.5M				2			7			3				1		
1304.6M				1		2	5			13						
1313.8M				4			21	1		12						1
1322.9M				6		1	24		2	11						1
1332.0M				5			9		1	7	1		1	1		
1341.2M			1	12		1	20		5	18						
1350.3M				11			9		4	8				1		
1359.5M				11			9		3	10	1					
1368.6M			1	112	8		4		3	9						
1377.8M					3		5		2	5	1					
1386.9M	4				7	3	6		6	10				2		
1396.1M	4				14		6		8					1		1
1405.2M	1				6		3		2	6					1	
1414.3M	2				5	3		5		11	11				3	
1423.5M		1	1	1	3		5		1	11	3			3	1	
1432.6M	1			5	2		6		2	7	1			1	2	
1441.7M	1						4				6				1	

DEPTH	OSANGULARIA SP.	PLECTOFRONDICULARIA ADVENA	PLEUROSTOMELLA RAPA RECENS	PLEUROSTOMELLA SP. A	PLEUROSTOMELLA TENUIS	POLYMORPHINID	PSEUDONODOSARIA TORRIDA	PULLENIA BULLOIDES	PULLENIA CF. BULLOIDES	PULLENIA QUINQUELOBA	QUADRIMORPHINA SP.	REOPHAX(?) SP.	SIGMOILINA SP.	SIGMOILINA TENUIS	SIPHOGENERINA SPINOSA	SIPHONINA BRADYANA
1158.3M																
1167.4M							1	1								
1176.6M								1								
1185.7M	1							7								
1194.9M							1	1		1						
1204.0M							2			1						
1213.2M								1								
1222.3M								2								
1231.4M																
1249.7M																
1258.8M									1							
1268.0M																
1295.5M								4		2	1		1			
1304.6M							1									
1313.8M																
1322.9M					1		1	4		1						
1332.0M								5								
1341.2M								4		2						
1350.3M								8		1						
1359.5M							1	8		4		1				1
1368.6M		1						7		2						
1377.8M		1	1					3								
1386.9M						5		17		2						1
1396.1M		2		3		5		16		4				1		
1405.2M		1			1			5		1						2
1414.3M		1				4		16		1				1		2
1423.5M		1				1		8							1	
1432.6M						8	3	9		5				1		
1441.7M						2				1						

APPENDIX 3 (Continued)

COST B-3

Depth	SPHAEROIDINA BULLOIDES	SPIROPLECTAMMINA GRACILIS	STILOSTOMELLA ACULEATA	STILOSTOMELLA ACULEATA/CURVATURA	STILOSTOMELLA ANNULIFERA	STILOSTOMELLA BRADYI	STILOSTOMELLA CF. ACULEATA	STILOSTOMELLA CF. SUBSPINOSA	STILOSTOMELLA CURVATURA	STILOSTOMELLA FISTUCA	STILOSTOMELLA MODESTA	STILOSTOMELLA SP. A	STILOSTOMELLA SUBSPINOSA	TEXTULARIA AGGLUTINANS	TEXTULARIA PSUEDOGRAMEN
1158.3M		1				6					6				
1167.4M						5									
1176.6M	1					19					4				
1185.7M	1					11					15	10			
1194.9M					1						7	1			
1204.0M						2						9			
1213.2M						6					5	5			
1222.3M									1		6	7			
1231.4M		1									8			2	
1249.7M											5			2	
1258.8M											6				
1268.0M	2					2					5	1		1	2
1295.5M	1	1			11						2	9			
1304.6M	5					1					2	8			
1313.8M	1					1			4		4	14			
1322.9M						11	7		3		12	10			
1332.0M	1	1					10	1	2		2	3			
1341.2M	6		20						6		13	5	1		
1350.3M	2		4						3			5			
1359.5M	3		2	1		1			8		7	1			
1368.6M	5		8			8			5		17	10			
1377.8M	2						1		2		8				
1386.9M	3					6	1		3		4	12			
1396.1M	6		6			8			12		6	8	3		
1405.2M					1	2	2		8	1	5	3	1		
1414.3M	7					2	5		14		16	10	5		
1423.5M	7						4		13		11	3	1		
1432.6M	7	1				7	5	4	6		18		1		
1441.7M	6			1		1	1		1		1		1		

Depth	TEXTULARIA SP.	TRIFARINA ANGULOSA	TRIFARINA BRADYI	TRIFARINA OCCIDENTALIS	UVIGERINA AUBERIANA	UVIGERINA CF. FLINTII	UVIGERINA CF. SENTICOSA	UVIGERINA CUSHMANI	UVIGERINA FLINTII	UVIGERINA JUNCEA	UVIGERINA PEREGRINA	UVIGERINA PEREGRINA DIRUPTA	UVIGERINA PEREGRINA/AUBERIANA	UVIGERINA SPINICOSTATA	VIRGULINA ROTUNDATA	VULVULINA SPINOSA
1158.3M								1			1		29		6	
1167.4M											1		11		2	
1176.6M													10		1	
1185.7M					2						1				4	
1194.9M					2											
1204.0M											1		8		6	
1213.2M		4			4								1	2	1	
1222.3M		3									1		1	2	4	2
1231.4M														39	1	
1249.7M		1			1									10	1	
1258.8M											1			25		
1268.0M														7		
1295.5M		1	2		1							3		8	4	
1304.6M	1		4			1					2		1	30	4	
1313.8M			1						13				4	10	1	
1322.9M			3					4	38				11	22		1
1332.0M			1						29			1		17		1
1341.2M			1		3			6	79					12	1	
1350.3M	1		6		6			3	24					17		
1359.5M			9		4			2	21			3		5		
1368.6M			5	4	2		3		15					8	1	
1377.8M			2		1				6		1			3		
1386.9M			8		7				2	1			2	6		
1396.1M			9					1	15				3	10		
1405.2M			8		11				5					3		
1414.3M			7		13	16			3					1		
1423.5M			5		9				2				1	3	1	
1432.6M	2				7	7		1	2					1	1	
1441.7M			1		4	3		1								

APPENDIX 3 (Continued)

DSDP SITE 334

	ANOMALINOIDES PSEUDOGROSSERUGOSA	ASTRONONION TUMIDUM	BOLIVINA MULTICOSTATA	BOLIVINA SPP.	BOLIVINA TECTIFORMIS	BOLIVINOPSIS SP.	BULIMINA CF. GRATA	BULIMINA CF. PUPOIDES	BULIMINA EXILIS	BULIMINA GIBBA	BULIMINA MEXICANA	BULIMINA TUXPAMENSIS	BULIMINELLA GRATA	BULIMINA ALAZANENSIS	CASSIDULINOIDES PARKERIANUS	CIBICIDES AFF. LAURISAE	CIBICIDES BRADYI	CIBICIDES CICATRICOSUS	CIBICIDES LOBATULUS	CIBICIDES PSEUDOUNGERIANUS	CIBICIDES SPP.	CIBICIDOIDES BRADYI/ROBERTSONIANUS
129.55M	..	..	..	..	..	..	..	..	..	..	..	..	..	13	..	..	.1	..	..	..	.1	.1
133.05M	..	..	..	.2	.1	..	..	..	..	..	..	..	..	.3	..	..	.3	..	..	.4	..	..
137.70M	..	..	..	..	.1	.1	..	..	..	..	..	..	.1	.1	..	.1	.1	..	..	.3	.1	..
139.30M	..	..	..	..	..	..	..	..	..	..	.1	.1	..	.4	..	..	..	..	..	.2	..	..
141.53M	..	..	..	..	..	..	..	..	..	..	..	.1	..	.1	..	.5	.2	..	..	.4	..	..
148.69M	..	..	..	..	..	..	..	..	..	..	.1	.1	..	..	..	.1	..	..	.1	.2	..	..
167.74M	..	.1	..	..	..	..	..	..	..	..	.3	.2	..	..	..	.2	..	..	.7	..	..	..
177.05M	..	..	.1	..	..	..	..	..	..	..	.1	..	..	.1	..	..	.1	..	.2	..	..	..
180.83M	.6	..	.2	..	..	..	.1	..	..	..	.2	.1	..	..	.1	..	.4	..	.2	..	..	..
182.30M	.5	..	.5	..	..	..	..	..	..	.1	.1	..	..	..	..	..	.2	..	.5	.1	..	..
187.03M	15	..	.2	..	..	..	..	..	..	..	.3	..	..	..	..	.2	..	..	..	.1	..	.1
196.80M	.6	..	.1	..	..	..	..	..	.1	..	.4	.5	..	..	..	..	.1	..	..	.5	..	..
206.30M	.3	.1	..	..	..	..	.1	..	..	..	.1	..	..	.2	..	.3	..	..	..	.3	.2	..
225.50M	.2	..	.1	.1	..	..	..	..	..	..	.1	.2	..	16	..	.6	.1	..	.2	.4	.1	..
234.80M	.2	..	..	..	..	..	..	.1	.1	..	..	.1	..	..	..	.6	..	..	.1	.3	..	.1
244.23M	.1	..	.1	.1	..	.1	..	..	..	..	.2	.4	..	.9	..	.3	.1	.3	..	.5	.3	..
253.35M	..	..	..	..	..	..	..	..	..	..	.2	..	..	..	..	.1	.2	.1	..	.1	..	..

	CIBICIDOIDES MUNDULUS	CIBICIDOIDES ROBERTSONIANUS	CIBICIDOIDES TUXPAMENSIS	DENTALINA COMMUNIS	DENTALINA SP. A	DENTALINA SPP.	EGGERELLA BRADYI	EGGERELLA SPP.	EHRENBERGINA HYSTRIX	EHRENBERGINA TRIGONA	EPISTOMINELLA EXIGUA	FISSURINA SPP.	FISSURINA WIESNERI	GAVELINELLA SEMICRIBRATA	GLOBOBULIMINA PACIFICA	GLOBOCASSIDULINA CRASSA	GLOBOCASSIDULINA SUBGLOBOSA	GYROIDINOIDES NEOSOLDANII	GYROIDINOIDES ORBICULARIS	GYROIDINOIDES PERAMPLUS	GYROIDINOIDES SP. A	GYROIDINOIDES SP. B
129.55M	.7	.5	..	..	.3	..	..	.1	..	.5	..	.1	..	.2	..	..	.3	.1	.2	..	..	.3
133.05M	.7	.3	.4	..	..	..	..	..	..	.2	..	.3	..	.1	..	..	14	.6	.1	..	.4	..
137.70M	.2	.1	..	..	..	..	.1	..	..	.1	..	.2	..	..	..	..	.2	.4	..	..	..	..
139.30M	.6	..	..	..	..	..	..	..	..	.1	..	.1	..	..	..	..	10	.6	..	..	.1	..
141.53M	.3	.1	..	..	.1	..	..	..	..	..	..	.2	..	..	..	..	10	.6	..	..	.1	..
148.69M	.1	.1	..	..	.4	..	.1	..	..	.1	..	..	..	..	..	..	.9	.5	..	..	..	..
167.74M	.3	.1	.2	..	.1	.1	..	..	.1	.1	..	.2	..	..	..	..	.2	..	..	.5	..	..
177.05M	.3	.1	.2	..	..	..	..	..	..	..	..	.4	..	..	..	..	.4	.1	..	.2	.1	..
180.83M	.4	..	..	..	.1	..	..	..	..	.1	..	.4	..	..	..	..	.5	.2	..	.1	..	..
182.30M	.4	.4	..	..	.1	.1	.1	..	.1	..	..	.5	..	..	..	..	.2	..	..	..	.2	..
187.03M	.3	.2	..	..	.1	.1	.1	..	..	.1	.1	.5	..	..	..	..	.6	.2	..	.2	.2	..
196.80M	.5	..	..	..	.2	..	..	.2	..	.1	..	.4	..	..	.1	.1	10	..	..	.3	.2	..
206.30M	.3	..	..	..	.3	..	..	..	..	..	..	.3	..	.1	..	..	.7	.2	..	..	.2	..
225.50M	.3	.2	..	..	.2	..	..	..	..	..	..	.2	..	..	..	..	.8	.4	..	.1	.1	..
234.80M	..	.2	..	.2	..	..	.2	..	..	..	..	.2	.1	..	..	..	10	.1	..	..	.5	..
244.23M	.2	..	..	..	.2	..	.2	..	..	..	..	.2	..	..	..	..	18	.1	..	..	..	..
253.35M	..	..	..	..	..	..	..	..	..	..	..	.2	..	..	..	..	.4	..	..	.2	.1	..

APPENDIX 3 (Continued)

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	KARRERELLA CUBENSIS	KARRERIELLA BRADYI	KARRERIELLA CHAPAPTOENSIS	KARRERIELLA MONUMENTENSIS	KARRERIELLA SPP.	KARRERIELLA SUBGLOBOSA	LAGENA GRACILIS	LAGENA SPP.	LATACARININA PAUPERATA	LENTICULINA IOTA	LENTICULINA SP.	LENTICULINA TORRIDA	MARGINULINA SPP.	MARTINOTIELLA COMMUNIS	MELONIS BARLEEANUS	MELONIS POMPILIOIDES	NODOSARELLA CF. DECURTA	NODOSARIID	NONIONELLINA HAVANENSIS	OOLINA LONGISPINA	ORISDOORSALIS TENER	ORISDOORSALIS UMBONATUS
129.55M	..	..	..	..	..	..	..	.1	.2	..	..	..	.1	..	.1	..	..	.1	..	..	.1	.2
133.05M	..	..	..	..	..	..	..	.2	.4	..	..	..	..	..	.4	..	..	..	..	..	..	.9
137.70M	..	..	..	.1	..	..	..	..	.4	..	..	..	.1	..	.5	..	..	..	..	..	..	.6
139.30M	..	.1	..	..	..	..	..	..	.1	..	.1	..	..	..	..	..	..	..	..	..	.1	.1
141.53M	.1	..	..	..	.1	..	..	.1	.3	.1	.1	.2	..	..	.2	..	..	..	.1	..	.1	.1
148.69M	..	..	..	..	..	.1	..	..	.1	..	..	..	..	..	..	..	..	..	..	.1	..	.2
167.74M	..	.2	..	..	.1	..	..	.1	.1	..	..	..	..	..	..	..	..	..	.2	..	.2	..
177.05M	.1	..	..	..	..	..	..	..	..	..	..	.1	..	..	..	..	..	..	.5	..	.1	.3
180.83M	.1	..	..	..	.1	..	..	..	.2	..	..	..	..	.2	..	..	..	..	..	..	..	..
182.30M	..	..	.2	..	..	..	..	.1	.1	..	..	..	..	.4	.2	..	..	.1	.2	..	.1	.3
187.03M	..	..	..	..	..	..	..	.3	..	..	..	..	..	.2	.2	..	..	..	.4	..	..	..
196.80M	..	.1	..	..	..	..	..	..	..	..	..	..	..	..	.4	..	..	..	.1	..	..	.1
206.30M	..	..	..	..	..	.1	..	..	.1	..	..	..	..	.1	..	.1	..	..	.1	..	.1	.2
225.50M	..	..	..	..	..	..	..	.2	.2	..	..	..	.1	..	.1	..	..	..	.3	..	..	..
234.80M	..	..	..	.2	.1	.1	..	..	.2	..	.1	..	..	..	.1	..	.1	..	..	..	..	.6
244.23M	..	.1	..	.1	..	..	..	..	.1	..	..	..	..	..	.2	..	..	..	.5	..	.1	.2
253.35M	..	..	..	..	..	..	.1	.1	.2	..	..	..	..	..	.2	..	..	..	.1	..	..	.7

	ORTHOMORPHINA HETEROSCULPTA	ORTHOMORPHINA JEDLITSCHKAI	ORTHOMORPHINA SPP.	OSANGULARIA MEXICANA	PLANULINA CF. ARIMINENSIS	PLANULINA GIGAS	PLANULINA WUELLERSTORFI	PLEUROSTOMELLA ACUMINATA	PLEUROSTOMELLA AGUAFRESCENS	PLEUROSTOMELLA BIERIGI	PLEUROSTOMELLA BREVIS	PLEUROSTOMELLA RAPA RECENS	PLEUROSTOMELLA SP. A	PLEUROSTOMELLA SP. D	PLEUROSTOMELLA TENUIS	PLEUROSTOMELLID	POLYMORPHINID	PULLENIA BULLOIDES	PULLENIA QUINQUELOBA	PULLENIA QUINQUELOBA BULLOIDES	PYRGO LAEVIS	PYRGO LUCERNULA
129.55M	..	..	.1	..	..	10	..	..	..	..	.1	..	..	..	.1	..	.1	.1	.1	.2	..	..
133.05M	..	..	.2	.9	..	.2	19	..	..	..	.1	..	..	..	..	..	..	.2	..	..	..	.2
137.70M	..	..	..	..	..	.9	..	..	..	..	..	..	..	..	.1	.1	.1	.3	..	.1	..	..
139.30M	..	..	.1	..	..	.8	..	..	..	..	..	..	..	..	..	..	.1	.1	..	..	.1	..
141.53M	..	..	..	..	.1	.5	..	..	..	.1	..	..	..	..	..	..	.1	.1	..	..	..	..
148.69M	.2	..	..	..	..	..	.7	..	..	..	..	..	..	..	..	.1	..	.5	.2	..	..	..
67.74M	..	..	.2	.3	..	.5	..	..	..	..	..	..	..	..	..	..	..	..	.1	..	..	..
177.05M	..	.1	..	..	..	..	.3	..	..	..	..	..	..	..	.2	..	.1	..	.1	..	..	..
180.83M	..	..	.1	.2	..	.1	..	.1	.1	..	..	..	..	..	..	..	..	.1	.1	..	..	..
182.30M	..	..	.1	.1	..	..	.4	..	..	..	..	..	..	..	..	.3	.3	..	.1	..	..	..
187.03M	..	..	..	..	..	..	.7	..	..	..	..	..	..	..	.4	..	..	.3	.3	..	..	..
196.80M	..	..	.2	.1	..	.2	.5	..	..	..	..	..	.1	..	..	.1	.1	.3	..	..	..	..
206.30M	..	..	..	..	..	.8	..	..	..	..	..	..	..	.1	.2	..	..	.1	..	..	..	..
225.50M	..	..	.2	..	..	12	..	.1	..	.1	..	..	..	..	.4	..	..	.6	..	..	..	..
234.80M	..	..	..	..	..	.2	.9	..	.1	..	..	.1	..	..	.3	.1	.1	.5	..	..	..	..
244.23M	..	..	.1	..	..	.1	12	..	..	..	..	..	..	..	..	..	..	.5	.1	..	..	..
253.35M	..	..	.2	..	..	..	11	..	..	..	..	..	..	..	.1	.1	..	..	.2	.2	..	..

APPENDIX 3 (Continued)

DSDP SITE 334

	PYRGO MURRHYNA	PYRULA EXTENSA	QUADRIMORPHINA SP.	QUINQUELOCULINA SPP.	RECTUVIGERINA SP.	SARACENARIA ITALICA	SPHAEROIDINA BULLOIDES	SPIRILLINA SPP.	STILOSTOMELLA ACULEATA	STILOSTOMELLA ANNULIFERA	STILOSTOMELLA ANTILLEA	STILOSTOMELLA BRADYI	STILOSTOMELLA CF. ACULEATA	STILOSTOMELLA CF. BRADYI	STILOSTOMELLA CF. CURVATURA	STILOSTOMELLA CURVATURA	STILOSTOMELLA FIJIENSIS	STILOSTOMELLA GRACILLIMA	STILOSTOMELLA MODESTA	STILOSTOMELLA SPP.	STILOSTOMELLA SUBSPINOSA	TEXTULARIID
129.55M	..	..	..	..	..	..	..	..	..	.1	.2	..	..	.2	..	..	..	..	..	.3	..	..
133.05M	..	..	..	..	.5	..	.5	..	..	..	.2	..	..	.1	..	.5	..	..	..	.1	..	.1
137.70M	..	..	.1	..	.2	..	.2	..	..	..	..	..	..	..	..	.5	..	..	..	.1	.2	..
139.30M	..	..	..	..	..	..	.5	..	..	.2	..	..	..	..	..	.1	..	..	..	..	..	..
141.53M	.1	..	..	.1	.3	..	10	..	..	..	..	..	..	..	.1	..	..	..	..	.3	..	..
148.69M	..	..	..	..	.1	.1	10	..	..	.1	..	..	..	..	..	..	..	..	..	..	.1	..
167.74M	.5	..	..	..	10	..	20	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
177.05M	.2	..	..	..	.9	..	20	..	.1	.1	..	..	..	..	..	.1	..	..	.2	.1	..	.3
180.83M	..	..	..	..	.6	..	24	..	..	..	..	..	..	..	..	.1	..	..	.1	.2	..	.3
182.30M	..	..	..	.1	..	..	15	..	..	..	..	.2	..	..	..	.3	..	..	..	..	..	..
187.03M	.2	..	..	..	.2	..	17	..	..	..	..	..	.1	..	..	.5	..	..	.1	.2	..	.2
196.80M	..	..	..	..	..	..	.7	..	..	.1	..	.1	..	..	..	.4	..	..	.1	.2	..	.2
206.30M	.1	..	..	..	..	..	19	..	.1	..	..	..	..	..	..	.1	.1	..	.1	..	..	..
225.50M	..	..	..	..	.9	..	17	..	..	.2	..	..	.3	..	..	.1	..	.1	.1	.6	..	.2
234.80M	..	.1	..	..	.4	..	12	.1	..	..	..	..	.1	..	..	..	..	..	.2	.3	..	.2
244.23M	..	..	..	..	.1	..	.7	..	..	..	..	..	.5	..	..	..	..	.2	.1	.1	.1	.1
253.35M	..	..	..	..	.5	..	.3	..	..	.2	..	..	.3	..	..	.1	..	.3	..	.2	.2	..

	TRILOCULARENA(?) SP.	UVIGERINA AUBERIANA	UVIGERINA JUNCEA	UVIGERINA PEREGRINA	UVIGERINA RIPPENSIS GP.	UVIGERINA SPINICOSTATA	VIRGULINA SP.	VULVULINA SPINOSA
129.55M	..	.2	.2	.4	.1	.1	.1	.4
133.05M	.3	..	.1	..	.3	.4	..	.4
137.70M	.3	.1	..	..	.5	.1	.1	.1
139.30M	..	.1	..	..	..	..	..	..
141.53M	..	..	..	..	..	..	.1	.1
148.69M	..	..	..	..	..	..	..	.2
167.74M	..	..	..	..	..	..	..	.1
177.05M	..	..	..	..	..	..	..	.2
180.83M	.3	.1	..	..	.1	..	..	.3
182.30M	..	..	..	..	.1	..	..	.2
187.03M	.2	.1	..	..	.1	..	..	.1
196.80M	.1	..	..	..	.1	..	.1	.1
206.30M	..	..	..	..	.1	..	..	..
225.50M	.2	..	.1	..	.1	..	..	..
234.80M	..	.1	..	..	..	.4	..	.1
244.23M	.1	.5	..	..	..	.2	.1	.1
253.35M	..	..	..	..	.1	..	.1	..

APPENDIX 3 (Continued)

DSDP SITE 563

	ABYSSINA POAGI	AMPHICORYNA CF. IGNOTA	AMPHICORYNA HIRSUTA	AMPHICORYNA IGNOTA	ANOMALINOIDES CF. SPISSOCOSTATA	ANOMALINOIDES PSEUDOGROSSERUGOSA	BOLIVINA HUNERI	BOLIVINA SPP.	BOLIVINA TECTIFORMIS	BOLIVINOPSIS SP.	BULIMINA JARVISI	BULIMINELLA GRATA	BULIMINIA ALAZANENSIS	BULIMINID	CASSIDULINA CARINATA	CASSIDULINA SPP.	CASSIDULINOIDES PARKERIANUS	CIBICIDES BRADYI	CIBICIDOIDES BRADYI/ROBERTSONIANUS	CIBICIDOIDES HAVANENSIS	CIBICIDOIDES MUNDULUS	CIBICIDOIDES PRAEMUNDULUS?
166.05M	..	..	..	..	..	..	..	..	..	..	..	.2	.4	.1	..	..	..	.1	..	..	.6	..
166.80M	..	..	..	..	..	..	..	..	..	..	..	..	.5	..	..	..	..	..	..	..	.2	..
175.55M	..	..	..	..	..	..	.2	..	..	..	..	..	.3	..	..	..	..	.1	..	..	12	..
185.05M	..	..	..	..	..	..	..	..	..	..	..	..	.5	..	..	..	..	..	.1	..	.1	..
185.80M	..	..	..	..	..	.1	..	..	..	..	..	..	.1	..	..	..	..	.1	..	..	.1	..
186.63M	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
187.38M	..	..	..	..	..	..	..	..	..	..	..	..	.1	..	..	..	..	.2	.2	..	.8	..
188.21M	..	..	..	..	..	..	..	..	..	..	..	.2	..	..	..	..	..	..	..	..	.6	..
189.79M	..	..	..	..	..	..	.1	..	..	..	..	..	.1	..	..	..	..	.1	..	..	.1	..
194.55M	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	.2	..	..	..	..
195.30M	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	.1	..
196.88M	..	..	..	..	..	.4	..	..	..	..	..	..	..	..	..	..	..	..	..	..	.4	..
198.46M	..	..	..	..	..	.1	..	..	..	..	..	..	.1	..	..	..	..	..	..	.1	.1	..
200.04M	..	..	..	..	..	..	..	..	..	..	..	.1	.1	..	..	..	..	..	..	..	..	..
201.62M	..	..	..	..	..	.1	..	..	..	..	..	..	.3	..	..	..	..	..	..	..	.3	..
202.45M	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	.2	..
203.20M	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	.1	..
204.05M	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	.1	..	.3	..
204.80M	..	..	..	..	..	.1	.1	..	..	..	..	..	.1	..	..	..	..	..	..	..	..	..
205.63M	..	..	..	..	..	.2	..	..	..	..	..	..	.1	..	..	..	..	..	..	..	.2	..
210.37M	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	.1	.5	..
213.55M	..	..	..	..	..	.2	..	..	..	..	..	..	..	..	..	..	..	.1	..	..	..	..
216.71M	..	..	..	..	..	.1	.1	..	.1	..	..	..	.1	..	..	..	..	..	..	..	.8	..
219.04M	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	.8	..
222.20M	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	.1	..	..	.7	..
223.05M	..	..	..	..	..	.5	..	..	.1	..	..	..	..	..	..	..	.2	..	..	..	.6	..
224.63M	.1	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	.1	..
229.37M	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	.4	..
230.95M	..	..	..	..	.1	.1	..	..	..	..	..	..	..	..	..	..	.1	..	..	..	.2	..
232.55M	..	..	..	..	.5	.1	..	..	..	..	..	..	..	.1	..	..	..	..	..	..	..	..
236.46M	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	.1	..	..	10	..
238.04M	..	..	.1	..	.1	..	..	..	.5	..	..	..	..	..	..	..	..	..	..	..	.6	..
239.62M	..	..	..	..	..	.1	..	..	..	..	..	..	..	..	..	..	.1	..	..	.1	.6	..
241.20M	..	..	..	..	..	.2	..	..	.1	..	..	.1	.2	..	..	..	.2	..	..	..	.4	..
242.05M	..	..	..	..	..	.1	..	..	.1	..	..	..	..	..	..	..	..	..	..	.1	.7	..
244.38M	..	.1	..	..	..	..	..	..	.3	..	.2	.1	..	..	.1	..	..	.4	..	..	11	..
245.96M	..	..	..	..	..	..	..	..	..	..	..	.1	..	..	..	..	..	..	..	..	.1	..
248.37M	..	.2	..	..	.3	..	..	..	.2	..	..	.3	.1	..	..	..	..	..	..	..	.9	..
249.95M	..	..	..	..	.1	..	..	..	.1	..	.1	.1	..	..	..	..	..	..	..	.1	.5	..
251.55M	..	..	..	..	..	..	..	..	.2	..	..	.2	.2	..	..	..	..	..	..	.1	.3	..
252.30M	..	..	..	..	..	..	.1	..	..	..	..	.1	.1	..	..	..	..	..	..	..	.3	.1
255.46M	..	..	..	..	..	..	..	..	..	..	..	.2	..	..	..	..	..	..	..	.5	.5	..
256.29M	..	..	..	..	.1	..	..	..	..	..	..	.3	..	..	..	..	..	..	..	.1	.5	..
257.87M	..	..	..	..	..	..	..	..	..	..	..	.2	..	..	..	..	..	..	..	..	.4	..
261.05M	..	..	..	..	..	.1	..	.1	..	..	..	.6	..	..	..	..	..	..	..	..	.6	..
266.54M	..	..	..	..	..	..	.1	..	..	..	..	.2	..	..	..	..	..	..	..	..	.7	..
267.37M	..	..	..	..	..	.1	..	..	..	..	..	.1	..	..	..	..	..	..	..	..	.4	..
270.00M	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	.2	..
277.92M	..	..	..	..	..	..	..	..	..	..	..	.2	..	..	..	..	..	..	..	..	16	..
280.05M	..	..	..	..	..	..	..	..	..	..	..	.1	..	.1	..	.1	..	..	..	.6	14	..
280.80M	..	..	..	..	..	..	..	..	..	..	..	.4	..	..	..	.1	..	..	..	..	.4	..
281.63M	..	..	..	..	..	..	..	..	..	..	..	.5	..	..	..	..	..	..	..	.3	11	..
283.21M	..	..	..	.1	..	.1	..	..	..	..	..	.1	..	..	..	.1	..	..	..	.7	.7	..
286.37M	..	..	..	..	..	..	.1	..	..	..	..	.1	..	..	..	..	..	.1	..	.4	.6	..
289.55M	..	..	..	..	..	..	..	..	..	..	..	.1	..	..	..	..	..	..	..	..	.6	..
291.13M	..	..	..	..	..	..	..	..	..	.1	..	..	..	..	..	..	..	..	..	.5	.3	..
292.71M	..	..	..	..	..	..	.2	..	..	..	..	.3	..	..	..	..	..	.1	..	.1	.5	..
294.29M	..	..	..	..	..	..	.1	..	..	..	..	.3	..	..	..	..	..	..	..	..	.9	..
295.87M	..	..	..	..	..	..	..	..	..	..	..	.1	..	..	..	..	..	..	..	..	.4	..
296.62M	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	.1	..
297.45M	..	..	..	..	..	..	..	..	..	..	..	.1	..	..	..	..	..	..	..	..	.1	..
299.05M	..	..	..	..	..	..	..	..	..	.3	..	..	..	..	..	..	..	.1	..	..	.1	..
302.21M	..	..	..	..	..	..	.1	..	..	..	..	..	..	..	..	..	..	..	..	..	10	..
302.96M	..	..	..	..	..	..	..	..	..	..	..	.1	..	..	..	..	.3	.1	..	..	16	..
303.79M	..	..	..	..	..	..	..	..	..	..	..	.2	..	..	..	..	..	..	..	..	10	..
304.54M	..	..	..	..	..	..	.1	..	..	..	..	..	..	..	..	..	..	..	..	..	.8	..

APPENDIX 3 (Continued)

DSDP SITE 563

	CIBICIDOIDES ROBERTSONIANUS	CIBICIDOIDES TUXPAMENSIS	CLINAPERTINA CF. COMPLANATA	CLINAPERTINA INFLATA	DENTALINA COMMUNIS	DENTALINA FILIFORMIS	DENTALINA INTORTA	DENTALINA SP. A	DENTALINA SP. B	DENTALINA SPP.	EGGERELLA BRADYI	EGGERELLA SPP.	EHRENBERGINA TRIGONA	EPISTOMINELLA EXIGUA	EUUVIGERINA SP.	FISSURINA CF. RADIATA	FISSURINA SPP.	FISSURINA WIESNERI	GAVELINELLA CAPITATA	GAVELINELLA SEMICRIBRATA	GAVELINELLA MICRA	GLOBOCASSIDULINA CRASSA
166.05M	..	..	..	..	..	..	..	.1	..	..	..	..	..	.1	..	.1	.4	..	..	..	..	..
166.80M	..	..	..	..	..	..	..	.1	.1	..	..	..	..	..	..	..	..	..	..	..	..	..
175.55M	..	..	..	..	..	..	..	..	..	..	.2	..	.1	.2	..	..	.1	..	..	..	..	..
185.05M	..	..	..	..	..	..	..	.1	..	..	..	..	..	..	..	..	.2	..	..	..	..	..
185.80M	..	..	..	..	..	..	..	.3	..	..	.3	..	.1	.1	..	..	..	..	..	..	..	..
186.63M	..	..	..	..	..	.3	..	.1	..	..	.4	..	.1	..	..	.1	.1	..	..	..	..	..
187.38M	..	..	..	..	..	..	..	..	..	.1	.1	..	..	.2	..	.1	.1	..	..	..	..	..
188.21M	..	..	..	..	..	..	..	.4	..	..	.1	..	.1	.2	..	.1	.3	..	..	..	..	..
189.79M	..	..	..	..	..	..	..	..	..	.1	..	..	..	.2	..	..	.1	..	..	..	..	..
194.55M	..	..	..	..	..	..	..	.1	..	..	.1	..	.1	..	..	..	.1	..	..	..	..	..
195.30M	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	.2	..	..	..	..	..
196.88M	..	..	..	..	..	.2	..	.2	..	..	.3	..	.1	.1	..	.1	.4	..	..	..	.1	..
198.46M	..	..	..	..	..	..	..	.5	..	..	.1	..	..	..	..	..	.2	..	..	..	..	..
200.04M	..	..	..	..	..	..	..	.1	..	.1	.2	..	..	.1	..	..	.1	..	..	..	.1	..
201.62M	..	..	..	..	..	..	..	..	..	..	.2	..	..	.1	..	..	.2	..	..	..	..	..
202.45M	..	..	..	.3	..	..	..	.2	..	.1	.1	..	..	.2	..	.1	.2	..	..	..	..	.1
203.20M	..	..	..	.2	..	..	..	..	..	.1	.4	..	..	.1	..	..	.1	..	..	..	..	..
204.05M	..	..	..	..	..	..	..	.1	..	..	..	..	..	.1	..	..	..	..	..	..	..	.1
204.80M	..	..	..	..	..	..	..	.1	..	..	.2	..	.1	..	..	..	..	..	..	..	..	..
205.63M	.1	..	..	..	..	..	..	.1	..	.3	.2	..	..	.1	..	..	..	..	..	..	..	..
210.37M	..	..	..	..	..	..	..	..	..	..	..	..	..	.1	..	..	..	..	..	..	..	..
213.55M	..	..	..	.1	..	..	..	.1	..	..	.4	..	..	.3	..	..	.2	..	..	..	.1	..
216.71M	..	..	..	..	..	..	..	..	..	.1	.2	..	..	.1	..	..	.2	..	..	..	.1	..
219.04M	..	..	..	..	..	..	..	.1	..	..	.1	..	..	..	..	..	.1	..	..	..	.1	..
222.20M	..	..	..	.1	..	..	..	..	..	..	.2	..	..	..	..	..	.1	..	..	..	..	..
223.05M	..	..	..	..	..	..	..	..	..	.1	..	..	..	.1	..	..	..	..	..	..	..	..
224.63M	..	.2	..	..	..	..	..	..	..	..	.1	..	..	..	..	..	.1	..	..	..	..	..
229.37M	..	..	..	..	..	..	..	.1	..	..	.1	..	..	..	..	..	.2	..	..	..	..	..
230.95M	..	..	..	.1	..	..	.1	..	..	..	..	..	..	.2	..	..	.1	..	..	..	..	..
232.55M	..	..	..	..	..	..	..	..	..	.4	.1	..	..	..	..	..	.3	..	..	..	..	..
236.46M	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
238.04M	.1	..	..	..	..	.1	.1	.1	..	..	.1	..	.1	..	..	..	..	..	..	..	..	..
239.62M	..	..	..	..	..	.1	..	..	..	..	..	..	.1	..	..	..	.1	..	..	..	..	..
241.20M	..	..	..	.1	..	..	..	..	..	..	..	..	.1	..	..	..	.2	..	..	..	..	..
242.05M	.1	..	..	..	..	..	..	..	..	..	..	..	.1	..	..	..	.1	..	..	..	..	..
244.38M	..	..	..	..	..	..	..	..	..	.1	..	..	.1	.2	..	..	..	..	..	..	..	..
245.96M	..	..	..	..	..	..	..	.2	..	.1	..	..	.1	..	..	..	.1	..	..	..	.1	..
248.37M	..	.3	..	..	..	.1	..	..	..	.1	..	..	.2	.2	..	..	..	..	..	..	..	..
249.95M	.1	..	..	..	..	..	..	.2	..	..	..	..	.2	..	..	..	.2	..	..	..	.1	..
251.55M	..	..	..	..	..	..	..	.1	..	.1	.1	..	..	..	..	..	.1	..	..	..	..	..
252.30M	..	..	..	..	..	..	..	..	..	..	.2	..	..	..	..	..	..	..	..	.7	..	..
255.46M	..	..	..	..	..	..	..	.1	..	.1	..	..	.2	..	..	..	..	..	..	.1	.2	..
256.29M	..	..	..	..	..	..	..	..	..	.1	..	.1	..	..	..	..	.1	..	..	..	.1	.2
257.87M	..	..	..	..	..	..	..	.2	..	.2	..	..	..	..	..	..	.3	..	..	.4	..	..
261.05M	..	..	..	..	..	.1	..	..	..	..	.1	..	.2	..	..	..	..	..	..	.1	..	.1
266.54M	..	..	..	..	..	..	..	.1	..	..	..	..	.1	..	..	..	.1	..	..	..	.1	..
267.37M	..	..	..	..	..	..	..	..	..	..	..	..	.2	..	..	..	.1	.1	..	.1	..	..
270.00M	..	..	..	..	..	..	..	..	..	.1	.2	..	.2	..	..	..	.1	.1	..	.1	..	..
277.92M	..	..	.1	..	..	..	..	..	..	..	..	..	..	..	..	..	.1	..	..	..	..	..
280.05M	..	..	..	..	..	..	..	.2	..	..	..	..	..	..	..	..	..	..	..	..	..	..
280.80M	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	.1	..	..	..	..	.1
281.63M	..	.2	..	..	..	..	..	.3	..	..	..	..	..	..	..	..	..	.1	..	..	..	.5
283.21M	..	.1	..	..	..	..	..	.5	..	..	.1	..	..	.1	..	..	..	.1	..	..	..	..
286.37M	..	..	..	..	..	..	..	.1	..	..	..	..	..	..	..	..	.1	.1	..	.1	..	..
289.55M	..	..	..	..	..	..	..	..	..	..	..	..	..	.3	.4	..	..	..	.2	..	..	..
291.13M	..	..	..	..	..	..	..	..	..	.3	..	..	..	..	..	..	..	..	..	.3	..	..
292.71M	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	.1	..	..
294.29M	..	..	..	..	..	..	..	.1	..	.1	..	..	..	..	..	..	.2	.1	..	..	..	..
295.87M	..	.1	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	.1
296.62M	..	.3	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
297.45M	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	.1	..	..	..	..	..
299.05M	..	.2	..	..	..	..	..	..	..	.1	..	..	..	..	..	..	..	..	..	..	.1	..
302.21M	..	.1	..	..	.1	..	..	..	..	..	..	.1	..	..	..	..	..	..	..	..	..	..
302.96M	..	.2	..	..	..	..	..	..	..	.2	..	..	..	.1	..	..	..	..	..	..	..	..
303.79M	..	.2	..	..	..	..	..	.3	..	..	..	..	..	..	..	..	..	..	..	..	..	..
304.54M	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	.1	..

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	GLOBOCASSIDULINA SUBGLOBOSA	GYROIDINOIDES CF. ORBICULARIS	GYROIDINOIDES NEOSOLDANII	GYROIDINOIDES ORBICULARIS	GYROIDINOIDES SP. A	GYROIDINOIDES SP. B	GYROIDINOIDES SP. C	HERRONALLIENINA SP.	KARRERELLA CUBENSIS	KARRERIELLA BRADYI	KARRERIELLA CHAPAPTOENSIS	KARRERIELLA MONUMENTENSIS	KARRERIELLA SP. 1	KARRERIELLA SPP.	KARRERIELLA SUBGLOBOSA	LAGENA GIBBERA	LAGENA GRACILIS	LAGENA HISPIDULA	LAGENA SPICATA	LAGENA SPP.	LATACARININA PAUPERATA	LENTICULINA SP.
166.05M	..	..	.2	..	.3	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
166.80M	.3	..	..	..	.1	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	.1	..
175.55M	.3	..	.2	..	.1	..	..	..	.1	..	..	..	..	..	..	..	..	..	..	.1	.1	..
185.05M	.6	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
185.80M	.2	..	.2	..	.1	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
186.63M	.2	..	.3	..	.1	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	.1
187.38M	.4	..	.4	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	.2	..
188.21M	.1	..	.3	..	.3	.2	..	..	..	..	..	..	..	..	..	..	..	..	..	.1	.1	..
189.79M	.2	..	..	..	.1	.3	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
194.55M	..	..	.1	..	.1	.3	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
195.30M	..	..	.2	..	.1	..	..	..	..	.1	..	..	..	..	..	..	..	..	..	..	..	..
196.88M	.4	..	.2	..	.1	.1	..	..	.1	.2	..	..	..	..	..	..	.1	..	..	..	.2	.1
198.46M	.4	..	.4	..	..	.6	..	..	..	..	..	..	..	..	..	..	.2	..	..	..	..	..
200.04M	.2	..	.1	..	.1	..	..	..	..	..	..	..	..	..	..	..	..	.2	..	..	..	..
201.62M	.2	..	.3	..	..	..	..	..	..	.1	..	..	..	..	..	..	..	..	..	..	..	..
202.45M	..	..	.3	..	..	.2	..	..	..	..	..	..	.1	..	..	..	..	..	.1	..	..	..
203.20M	..	..	.3	..	..	.1	..	..	..	.1	..	..	..	..	..	..	..	..	..	..	..	..
204.05M	.3	..	.1	..	.2	.1	..	..	..	..	..	..	..	..	.1	..	..	..	..	..	..	..
204.80M	.3	..	.2	..	.1	.1	..	..	..	..	..	.1	..	..	..	.1	..	..	..	..	.1	..
205.63M	.2	..	.2	..	..	.2	..	..	..	..	..	..	..	..	..	..	..	..	..	.2	.1	.1
210.37M	.1	..	.3	..	.1	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
213.55M	11	..	.5	..	.2	.1	..	..	..	.1	..	..	..	..	..	..	..	..	..	.2	.1	..
216.71M	.5	..	.1	..	.2	.1	.2	..	..	..	..	..	..	..	..	..	..	..	.1	.2	.1	..
219.04M	.2	..	..	..	.1	.3	..	..	..	..	..	.1	..	..	..	..	..	..	..	..	..	..
222.20M	.2	..	.2	..	.1	.2	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
223.05M	.2	..	.3	..	..	.3	..	..	..	.1	..	..	..	..	..	..	..	..	..	..	..	..
224.63M	.1	..	..	..	.2	.2	..	..	..	..	..	.1	..	..	.1	..	..	..	..	..	..	..
229.37M	..	..	.1	..	.2	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	.1	..
230.95M	..	..	..	..	.3	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	.1
232.55M	.5	..	.3	..	.1	.3	..	..	..	.2	..	..	..	..	.1	..	..	..	..	..	..	.1
236.46M	.6	..	.2	..	.3	.1	..	..	..	..	..	.2	..	..	.1	..	..	..	..	..	..	..
238.04M	..	..	..	..	.2	..	..	..	..	..	..	..	..	..	.2	..	..	..	..	..	.1	..
239.62M	.3	..	.4	..	.1	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
241.20M	.4	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
242.05M	.6	..	..	..	..	.1	..	..	..	..	..	..	..	..	.1	..	.1	..	..	..	..	..
244.38M	..	..	..	..	..	..	..	..	.1	..	..	..	..	..	..	..	..	..	..	..	..	..
245.96M	.1	..	.1	..	.1	.1	..	..	..	..	..	..	..	..	..	..	.1	..	..	..	..	..
248.37M	.1	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
249.95M	.5	..	.1	..	.1	.1	..	..	.1	..	..	.5	..	..	..	..	.1	.1	..	..	..	..
251.55M	10	..	.1	..	.3	.1	..	..	..	..	..	.1	.1	..	.1	..	..	..	..	.1	..	..
252.30M	.8	.1	..	..	.1	.2	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
255.46M	.8	..	.1	.3	.1	..	..	..	..	.1	..	.1	..	..	.2	..	..	..	..	.1	..	..
256.29M	.8	.2	.8	..	.1	.1	..	..	..	..	..	..	..	.1	..	..	..	.1	..	..	..	..
257.87M	.9	..	.1	.2	.1	..	..	..	..	..	.1	..	..	..	..	..	..	..	..	..	..	..
261.05M	10	.5	.4	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
266.54M	.7	..	..	..	.1	..	..	..	.1	..	..	..	..	.1	..	..	..	..	..	.1	..	..
267.37M	.4	..	.2	.1	..	.1	..	..	..	.1	..	..	..	..	..	..	..	..	..	..	..	..
270.00M	.3	..	..	..	..	.1	..	..	..	..	..	..	..	.1	..	..	..	..	..	..	..	..
277.92M	.5	..	.6	.3	.1	..	..	..	..	..	..	.1	..	..	.1	..	..	..	..	.1	..	.1
280.05M	10	..	.3	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	.1	..	..
280.80M	.3	..	..	..	..	.1	..	.1	..	.1	..	..	..	..	..	..	..	..	..	..	..	..
281.63M	.6	..	..	..	..	..	..	..	..	.1	..	.1	..	..	..	..	..	..	.1	..	..	..
283.21M	18	..	..	..	..	.2	..	..	..	..	..	..	..	..	..	..	..	.1	..	..	..	.1
286.37M	.8	..	.1	..	..	..	..	..	..	.1	..	..	..	..	..	..	..	..	..	..	..	..
289.55M	12	..	.6	..	.1	.2	..	..	.1	..	..	..	..	..	..	..	..	..	..	.2	..	..
291.13M	11	..	.3	..	..	.2	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
292.71M	.3	..	.1	..	..	..	..	.1	..	..	..	.1	..	..	..	..	..	.1	..	.2	..	..
294.29M	.4	..	.3	..	.1	.1	..	..	..	..	..	..	..	..	..	..	..	..	..	.3	..	.1
295.87M	.5	..	.1	..	..	..	..	..	..	..	..	..	..	..	..	..	..	.1	..	.1	..	..
296.62M	..	..	.2	.2	.1	..	..	..	..	..	..	..	..	..	.1	..	..	..	..	..	..	..
297.45M	.3	..	.1	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
299.05M	.3	..	.1	..	..	.2	..	..	..	.1	..	..	..	..	..	..	..	..	..	..	..	..
302.21M	.8	..	.1	..	..	.1	..	..	..	..	..	..	..	..	.1	..	..	..	..	..	..	..
302.96M	.4	..	.1	..	..	..	..	..	..	..	.2	..	..	..	..	..	..	..	..	..	..	..
303.79M	16	..	..	..	..	.2	..	..	..	..	.3	..	..	..	..	..	..	..	..	..	..	..
304.54M	.6	..	.3	..	..	..	..	..	..	..	..	.1	..	..	..	..	..	..	..	.1	..	..

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	MARTINOTIELLA SP.	MELONIS BARLEEANUS	MELONIS POMPILIOIDES	NODOSARELLA CF. DECURTA	NODOSARIID	NONIONELLINA HAVANENSIS	NONIONELLINA SP. A	NUTTALIDES UMBONIFERA	OOLINA GLOBOSA SETOSA	OOLINA HEXAGONA	OOLINA STRIATOPUNCTATA	ORIDORSALIS TENER	ORIDORSALIS UMBONATUS	ORTHOMORPHINA HAVANENSIS	ORTHOMORPHINA HETEROSCULPTA	ORTHOMORPHINA JEDLITSCHKAI	ORTHOMORPHINA SP. A	PLANULINA GIGAS	PLANULINA WUELLERSTORFI	PLEUROSTOMELLA BREVIS	PLEUROSTOMELLA RAPA RECENS	PLEUROSTOMELLA SP. A
166.05M	..	.5	.1	..	.2	..	..	..	..	..	..	..	.9	..	..	..	..	..	.6	..	..	..
166.80M	..	..	.1	..	..	..	.4	.3	..	..	..	..	.9	..	..	..	.1	.1	.3	..	..	..
175.55M	..	.3	.1	..	..	..	.2	.6	.1	..	..	..	.9	..	..	..	.4	..	.7	..	..	..
185.05M	..	.9	..	..	..	..	..	.2	..	..	..	..	.5	..	..	..	..	..	.4	..	..	..
185.80M	..	.3	..	..	..	..	..	.2	..	..	..	..	.7	..	..	.1	..	..	10	..	.1	..
186.63M	.1	.4	..	..	..	..	..	.3	..	..	..	..	.7	..	..	.1	..	..	.4	..	..	..
187.38M	..	.7	..	..	..	..	..	.1	..	..	..	..	.7	..	..	..	.1	..	.6	.1	..	..
188.21M	.1	.4	.1	..	..	..	..	..	..	..	..	..	.4	..	..	..	..	..	.3	..	..	.2
189.79M	..	.2	..	..	..	..	..	.2	..	..	..	..	.2	..	..	..	..	..	.1	..	..	..
194.55M	..	.7	..	..	..	..	..	.2	..	..	..	.2	.1	..	..	..	.1	..	.4	..	..	.1
195.30M	.1	.3	..	..	.2	..	..	.2	..	..	..	.1	.6	..	..	.1	..	..	.3	..	..	..
196.88M	.1	.3	.1	.1	..	..	..	.5	..	..	..	..	.8	..	..	.2	..	..	14	.1	..	..
198.46M	.3	.5	..	.1	..	..	..	.3	..	..	..	..	.3	..	..	..	..	..	13	..	..	..
200.04M	..	..	..	..	..	..	..	..	..	..	..	..	.4	..	..	..	..	..	.5	.2	..	..
201.62M	..	.2	..	..	..	..	..	.1	..	..	..	..	.7	..	..	..	..	..	.3	..	..	..
202.45M	..	.3	.1	..	..	..	..	.5	..	..	..	..	.7	..	..	..	..	..	10	..	..	..
203.20M	..	.4	..	..	.1	..	..	.1	..	..	..	..	.1	..	..	..	..	..	.5	.1	..	..
204.05M	..	.1	.2	.1	..	..	..	.2	..	..	..	..	10	..	.1	..	..	..	10	..	..	..
204.80M	..	.2	.4	..	..	..	..	.4	..	..	..	..	.3	..	..	..	..	..	.4	..	..	..
205.63M	.1	.2	..	..	..	..	..	..	..	..	..	..	.6	..	..	..	.1	..	.5	..	..	..
210.37M	..	..	..	..	.1	..	..	..	..	.1	..	..	.3	..	..	..	..	..	.6	..	..	..
213.55M	..	.3	..	..	.1	.1	.1	.4	..	..	..	.1	10	..	.1	..	..	..	.9	..	..	..
216.71M	..	.4	..	..	..	.1	..	.2	..	..	..	.1	11	..	..	..	..	..	10	..	..	..
219.04M	..	.3	..	..	..	..	..	.1	..	..	..	.2	.1	..	..	..	..	..	14	..	.2	..
222.20M	..	.3	..	..	..	..	..	..	..	..	..	..	.7	..	..	..	..	.1	17	..	..	.1
223.05M	..	.4	22	..	..	..	..	.2	..	..	..	..	.3	..	..	..	..	..	26	..	..	..
224.63M	..	.9	.5	..	..	..	..	..	..	..	..	.1	.5	..	..	..	.1	..	14	..	..	..
229.37M	..	..	..	.3	.1	..	..	..	..	..	..	.1	.2	..	..	..	..	..	.7	..	..	.3
230.95M	..	.2	..	..	..	..	..	..	..	..	..	..	13	..	..	..	..	..	.4	..	..	.4
232.55M	.1	..	..	..	..	.1	..	..	..	..	..	..	14	..	.1	..	.1	..	.1	..	..	.1
236.46M	..	.1	..	..	..	..	..	..	..	..	.1	.1	10	..	..	..	.1	..	..	..	..	..
238.04M	..	..	..	..	.2	..	..	..	..	..	..	..	.2	.1	.2	..	.1	..	..	..	..	..
239.62M	..	..	..	..	..	..	..	..	..	..	..	..	.6	..	..	..	..	..	..	.1	..	..
241.20M	..	..	..	..	..	..	..	..	..	..	..	.1	..	.1	..	..	..	..	.8	..	..	.1
242.05M	..	..	.1	.1	..	..	..	..	..	..	..	.1	.3	..	..	..	..	..	..	..	..	..
244.38M	..	10	.1	..	..	..	..	..	..	..	..	..	.5	..	..	..	..	..	..	.1	..	.1
245.96M	..	..	..	..	..	..	..	..	..	..	..	..	.3	..	..	..	..	..	..	..	..	..
248.37M	..	.1	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
249.95M	..	..	..	..	..	..	..	..	..	..	..	..	.6	..	..	..	..	..	..	..	..	..
251.55M	..	..	..	..	..	.1	..	..	..	..	..	..	.7	..	..	..	..	..	..	..	..	..
252.30M	..	..	..	.1	..	..	..	..	..	..	..	..	.6	..	..	..	..	..	..	..	..	..
255.46M	.3	..	..	.3	..	..	..	..	..	..	..	.1	.9	..	..	..	.2	..	..	.1	..	..
256.29M	..	..	..	.1	..	..	..	.2	..	..	..	..	.9	..	..	.1	..	..	..	..	..	.5
257.87M	..	..	..	.1	..	..	..	..	..	..	..	.5	.6	..	..	.1	..	..	..	..	..	..
261.05M	..	.2	..	..	..	..	..	..	..	..	..	.5	.7	..	..	..	.2	..	..	..	..	..
266.54M	..	.2	..	..	..	..	..	..	..	..	..	.2	.5	..	..	..	..	..	..	.1	..	..
267.37M	..	..	..	..	..	..	..	..	..	..	..	..	.5	..	..	..	..	..	..	..	..	.1
270.00M	..	..	..	..	..	..	..	..	..	..	..	..	.2	..	..	..	..	..	..	..	..	.1
277.92M	..	..	..	..	..	..	..	..	..	..	..	.7	15	..	..	..	..	..	..	.1	..	..
280.05M	..	..	..	..	..	.1	..	..	..	..	..	.1	19	..	..	.1	..	..	..	..	..	.5
280.80M	..	..	..	..	..	..	..	..	..	..	..	..	.4	..	.1	..	..	..	..	..	..	.2
281.63M	..	..	..	.2	..	..	..	..	..	..	..	.4	.2	..	..	..	..	..	..	..	..	.2
283.21M	..	..	..	..	..	..	..	..	..	..	..	.5	.8	..	..	..	..	..	..	..	..	.3
286.37M	..	..	..	..	..	..	..	.1	..	..	..	.3	.6	..	..	..	..	..	..	..	..	..
289.55M	..	..	..	..	..	..	..	..	..	..	..	.7	.2	..	..	..	..	..	..	..	..	..
291.13M	..	..	..	..	.1	..	..	..	..	..	..	..	.3	..	..	.1	..	..	..	..	..	.2
292.71M	..	..	..	..	.2	..	..	..	..	..	..	.2	.7	..	.1	..	..	..	..	..	..	.4
294.29M	..	..	..	..	..	..	..	..	..	..	..	.2	11	..	..	..	..	..	..	..	..	.1
295.87M	..	..	..	..	..	..	..	..	..	..	..	.1	.6	..	..	..	..	..	..	..	..	.1
296.62M	..	..	..	..	..	.1	..	..	..	..	..	..	.4	..	..	..	..	..	..	..	..	..
297.45M	..	..	..	..	..	..	..	.5	..	..	..	.1	.5	..	..	..	..	..	..	..	..	.1
299.05M	..	..	..	.1	..	..	..	..	..	..	..	.4	.3	..	..	..	..	..	..	..	..	..
302.21M	..	..	..	..	..	..	..	..	..	..	..	.1	10	..	.1	..	..	..	..	..	..	..
302.96M	..	..	..	..	..	..	..	..	..	..	..	.2	.6	..	.1	.2	..	..	..	..	..	.1
303.79M	..	..	..	.1	..	..	..	..	..	..	..	.2	21	..	.1	.3	..	..	..	..	..	.2
304.54M	..	..	..	..	.1	..	..	..	..	..	..	.1	.5	..	..	..	..	..	..	..	..	..

APPENDIX 3 (Continued)

DSDP SITE 563

	PLEUROSTOMELLA SP. B	PLEUROSTOMELLA SP. D	PLEUROSTOMELLA TENUIS	PLEUROSTOMELLID SP. A	PLEUROSTOMELLID SP. B	POLYMORPHINID	PULLENIA BULLOIDES	PULLENIA BULLOIDES/QUINQUELOBA	PULLENIA QUINQUELOBA	PYRGO MURRHYNA	PYRULA EXTENSA	QUADRIMORPHINA SP.	QUINQUELOCULINA SPP.	RECTUVIGERINA SP.	SARACENARIA SP.	SIGMOILINA TENUIS	SPHAEROIDINA BULLOIDES	STILOSTOMELLA ACULEATA	STILOSTOMELLA ANTILLEA	STILOSTOMELLA CF. ACULEATA	STILOSTOMELLA CF. BRADYI	STILOSTOMELLA CF. CURVATURA	STILOSTOMELLA CONSOBRINA	STILOSTOMELLA CURVATURA	STILOSTOMELLA GRACILLIMA	STILOSTOMELLA MODESTA	STILOSTOMELLA SPP.	STILOSTOMELLA SUBSPINOSA	TEXTULARIID	UVIGERINA AUBERIANA	UVIGERINA CHIRANA/ACULEATA	UVIGERINA RIPPENSIS GP.	VAGINULINA BERMUDENSIS	VAGINULINOPSIS SP.	VIRGULINA SP.	VIRGULINA TEXTURATA	VULVULINA SPINOSA
166.05M	.1	..	..	.2	..	..	.3	..	.1	..	..	..	..	..	.1	..	..	.1	..	..	.1	..	..	..	..	..	..	.3	..	..	..	..	..	..	..	..	..
166.80M	.3	.1	..	..	.1	..	.2	.4	..	..	..	..	..	..	..	..	..	.8	..	..	.3	..	..	..	.1	..	..	.4	..	..	..	..	..	..	..	..	..
175.55M	..	..	.3	..	..	.7	.5	..	.3	..	..	..	..	..	..	.2	..	.2	..	..	..	..	..	.4	..	..	..	.3	..	..	..	.1	..	..	..	..	.1
185.05M	..	..	..	.1	..	..	.1	..	.1	..	..	..	..	..	..	.1	..	.3	..	..	..	..	..	..	..	..	..	.3	..	..	..	.1	..	..	..	..	..
185.80M	..	..	..	.1	.1	..	.7	..	.1	..	..	..	..	..	..	..	..	.2	..	..	..	..	..	.1	.3	..	..	.4	.1	..	..	..	..	..	..	..	.1
186.63M	..	..	.1	..	..	..	.1	..	..	..	..	..	..	..	..	..	..	.1	..	..	..	..	..	..	..	..	..	.1	.1	..	..	..	..	..	..	..	..
187.38M	..	..	..	..	..	..	.4	.1	.2	..	..	..	..	..	..	..	..	.1	..	..	..	..	..	..	..	..	..	.1	..	..	..	..	..	..	..	..	..
188.21M	..	.1	..	..	..	..	.4	.1	.3	..	..	..	..	..	..	..	..	.2	..	..	..	..	..	..	.2	..	..	.1	..	..	..	..	..	..	..	..	..
189.79M	..	..	..	..	.1	.1	.6	.2	..	..	..	..	..	..	..	..	..	.3	..	..	..	..	..	..	..	.1	..	.4	..	..	..	..	..	..	..	..	..
194.55M	..	..	.1	.1	..	..	.2	..	..	..	..	..	..	..	..	..	..	.2	..	..	..	..	..	..	..	..	..	.1	..	..	..	.1	..	..	..	..	..
195.30M	..	..	..	.1	..	..	.2	.5	.2	..	..	..	..	..	..	.1	..	.4	..	..	..	..	..	.1	.1	.1	..	..	.2	..	..	.1	..	..	..	..	..
196.88M	..	.1	..	.1	..	..	.5	.1	.2	..	..	..	..	.1	..	..	.1	.6	..	..	..	..	..	.1	..	..	.1	.4	..	..	..	..	..	.1	.2	..	..
198.46M	..	..	..	.3	..	..	.4	.4	.2	..	..	..	..	..	..	..	..	.8	..	..	.1	..	..	.1	.1	..	.1	.4	.1	..	..	..	..	..	..	..	..
200.04M	..	..	..	.1	..	..	.3	.2	.1	..	..	..	..	..	..	..	..	.2	..	..	..	..	..	..	.1	..	..	.2	..	..	..	..	..	..	..	..	..
201.62M	..	..	..	.1	.3	..	.2	.1	.5	..	..	..	..	..	..	..	..	.5	..	..	.2	..	..	..	.1	..	..	.3	.1	..	..	..	..	..	..	..	..
202.45M	..	..	..	.1	.1	..	..	.1	.1	..	..	..	.1	..	..	..	..	.3	..	..	.1	..	..	.1	..	..	.5	..	..	..	..	.1	..	..	..	..	..
203.20M	..	..	..	..	..	..	.5	.1	..	..	..	..	..	..	..	..	..	.1	..	..	..	..	..	.2	.1	..	..	.1	.1	..	..	..	..	..	..	..	..
204.05M	..	..	..	.1	..	..	..	..	.1	..	..	..	..	..	..	..	..	.4	..	52	..	..	..	..	..	..	.1	..	..	..	..	..	..	..	..	..	.1
204.80M	..	..	.3	.1	..	..	.2	.1	.3	..	..	..	.1	..	..	..	..	..	..	93	..	..	..	.4	..	..	..	..	..	..	..	..	..	..	..	..	..
205.63M	..	.1	.2	.2	..	..	.3	..	..	..	..	..	..	..	..	..	..	.1	..	.2	..	..	..	..	.3	..	.1	.6	.3	..	..	..	..	..	..	..	..
210.37M	..	..	..	.2	..	..	..	.1	..	..	..	..	..	..	..	.1	.1	..	..	..	..	..	..	.1	..	..	..	..	.2	..	..	..	..	..	..	.1	..
213.55M	..	..	.1	.1	..	..	.5	.2	.1	..	.1	..	.1	..	..	..	..	.2	..	..	..	..	..	..	..	..	.3	.1	.1	..	..	..	..	..	..	..	..
216.71M	..	..	.1	.5	..	..	.4	.2	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	.3	..	..	..	..	..	..	..	..	..
219.04M	..	..	.3	.2	..	.1	.1	.1	..	..	..	..	.1	..	..	..	..	.4	..	..	..	..	..	.1	..	..	.1	..	..	..	..	..	..	..	..	..	.1
222.20M	..	..	..	.2	.1	..	.4	.1	.1	..	.1	..	..	..	..	..	..	..	..	..	..	..	..	.1	.1	..	..	.1	.1	..	..	..	..	..	..	..	..
223.05M	..	..	.1	..	.1	..	.5	..	.3	..	..	..	..	..	..	..	12	32	..	..	..	.4	..	.8	..	..	..	.7	..	..	..	..	..	..	..	..	..
224.63M	..	..	..	..	..	..	.1	..	..	.1	..	..	.1	..	..	..	..	11	..	..	..	15	..	.3	.4	..	..	..	.2	..	..	..	..	..	..	..	.1
229.37M	..	..	.2	.1	..	..	.2	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	.1	..	..	..	..	..	..	..	..	..	..	..	..
230.95M	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	.5	.1	..	..	..	..	.1	..	..	.2	.5	..	..	..	.1	..	..	..	..	..
232.55M	..	..	.2	..	.1	..	.1	.2	..	..	..	..	..	..	..	..	..	11	.1	..	..	..	..	.2	.1	..	.1	.4	..	..	..	..	..	..	..	..	..
236.46M	..	..	.2	.1	..	..	..	.2	.2	..	..	..	..	..	..	..	..	.5	..	..	.2	..	..	.1	.1	..	..	.2	..	..	..	.1	..	..	..	..	..
238.04M	..	..	..	.3	..	..	.4	.1	..	..	..	.2	..	..	..	..	.1	.2	..	..	..	..	..	.1	..	..	.1	.2	..	..	..	..	..	..	..	..	..
239.62M	..	..	..	..	..	..	.3	..	.1	..	..	..	..	..	..	..	..	13	.7	..	..	..	..	..	..	..	.1	.3	.3	..	..	..	..	..	..	..	..
241.20M	..	..	.6	..	..	..	.1	.1	..	..	..	..	..	..	..	..	..	18	..	..	..	..	..	..	.1	..	.2	.2	..	..	..	..	..	..	..	..	.3
242.05M	..	..	.1	.1	..	..	.3	..	.1	..	..	..	..	..	..	..	..	..	..	..	..	..	.1	..	.1	..	.1	..	.1	..	..	..	..	..	..	..	..
244.38M	..	..	..	.1	..	.1	..	..	.3	..	..	..	..	..	..	..	..	.2	.2	..	..	..	..	..	..	..	.1	.2	..	..	..	..	..	..	..	..	..
245.96M	..	.1	..	..	..	.1	.3	..	..	..	.1	..	..	..	..	..	.1	.1	..	..	..	..	..	.1	..	..	..	.2	..	..	..	..	..	..	..	..	..
248.37M	..	.1	.3	.1	..	..	..	.1	.1	..	..	..	..	..	..	..	..	.2	..	..	..	..	.1	.2	.1	..	..	.6	.1	..	.1	..	..	..	..	..	..
249.95M	..	..	..	.1	..	..	.1	.1	.1	..	..	..	..	..	..	..	.1	..	..	..	..	..	..	..	..	.1	..	.5	..	..	..	..	..	..	..	..	.1
251.55M	..	..	.1	..	.1	.1	.3	.3	.2	..	..	..	.1	..	..	..	..	..	..	..	..	..	..	..	..	..	..	.1	..	..	..	..	..	..	..	..	..
252.30M	..	.1	..	.2	.1	.2	.5	.1	..	..	..	..	..	..	..	..	..	..	..	..	..	..	.1	..	..	..	.4	.4	..	..	..	..	..	..	..	..	..
255.46M	..	.2	..	..	..	.1	.3	..	.1	..	..	..	..	..	..	..	..	.5	..	..	..	..	.1	.1	.1	..	.1	.5	.1	..	..	..	..	..	..	..	.1
256.29M	..	..	.2	..	..	.1	.3	.1	.2	..	..	..	..	..	..	..	..	.3	..	..	..	..	.1	.1	..	..	.1	.8	.1	..	..	..	..	..	..	..	..
257.87M	..	..	..	.1	..	.1	..	..	..	..	..	..	.1	..	..	..	..	.1	..	..	..	..	..	..	..	..	.1	.4	.2	.1	..	..	..	..	..	..	.1
261.05M	..	..	.2	.2	..	.3	.4	.5	.1	..	..	..	..	..	..	..	..	..	.8	..	..	..	..	.5	..	..	..	.5	.2	..	..	..	..	..	..	..	..
266.54M	..	..	..	.1	..	..	.1	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	.3	.2	..	..	..	..	..	..	.1
267.37M	..	..	.1	..	..	.1	..	.1	.3	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	.2	.5	..	.1	..	..	..	..	..	..	..
270.00M	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	.1	..	..	..	..	.1	..	.1	.1	.3	..	..	..	..	..	..	..
277.92M	..	..	.2	.1	..	.1	.1	..	.3	..	..	..	..	..	..	..	..	15	43	..	.2	..	..	.1	..	..	.1	11	11	..	..	..	.1	..	..	..	.6
280.05M	..	..	.2	.1	..	..	.1	.2	.3	..	..	..	..	..	.1	..	..	..	.6	..	..	..	..	.3	..	..	.1	.3	..	..	..	.2	..	..	..	..	.1
280.80M	..	..	.7	..	.2	..	.1	..	.1	..	..	..	..	..	..	..	..	..	.1	..	..	..	..	..	..	..	.1	.6	..	..	..	..	..	..	..	..	..
281.63M	..	..	.4	..	..	..	.2	.1	.1	..	..	..	..	..	..	..	..	.1	45	..	..	.1	..	..	..	..	.2	19	..	..	..	..	..	..	..	..	.1
283.21M	..	..	.3	.1	..	..	.3	.3	..	..	..	..	..	..	..	..	..	.5	..	..	..	..	..	..	..	..	.2	.4	..	..	..	..	..	..	..	..	..
286.37M	..	..	.3	..	..	..	..	..	.3	..	..	..	..	..	..	..	..	..	.7	..	..	..	..	.7	..	..	..	.7	..	..	..	..	..	..	..	..	..
289.55M	..	..	.2	.4	..	..	..	..	.2	..	..	..	..	..	..	..	..	.1	..	..	..	..	..	.3	..	..	.1	.4	.1	..	..	..	..	..	..	..	..
291.13M	..	..	.1	.1	..	.1	..	..	.3	..	..	..	..	..	..	..	..	..	..	..	..	..	..	.5	..	..	.1	.6	..	..	..	..	..	..	..	..	..
292.71M	..	..	.2	.1	..	..	..	.2	.2	..	..	..	.1	..	..	..	..	..	.1	..	.1	..	..	..	..	..	..	13	..	..	..	.1	..	..	..	..	..
294.29M	..	..	..	..	..	.1	..	.2	.1	..	..	..	.1	..	..	..	..	..	..	..	.5	..	..	.8	..	..	..	.5	..	..	..	..	..	..	..	..	.1
295.87M	..	..	.5	..	..	.1	..	.2	.3	..	..	..	..	..	..	..	..	..	..	..	..	..	..	.1	..	..	.1	.4	..	..	..	.1	..	..	..	..	..
296.62M	..	..	..	..	..	.1	..	..	..	..	..	..	..	..	..	..	..	.1	.2	..	..	..	..	.5	..	..	.1	..	..	..	..	..	..	..	..	..	..
297.45M	..	..	..	..	..	..	.1	.4	..	..	..	..	..	..	..	..	..	.3	.4	..	..	..	..	.2	..	..	..	.4	..	..	..	..	..	..	..	..	..
299.05M	..	..	.1	..	..	..	..	..	..	..	..	..	..	..	..	..	..	.1	..	..	..	..	..	.2	..	..	..	..	..	..	..	..	..	..	..	..	..
302.21M	..	..	.2	.1	..	..	.1	.2	..	..	..	..	..	..	..	..	..	15	.7	..	..	..	..	..	..	.1	.5	..	..	..	..	..	..	..	..	..	.2
302.96M	..	..	.1	.1	..	.3	..	.2	..	..	..	..	..	..	..	..	..	.9	..	..	..	..	..	..	.1	.2	.1	..	.2	..	..	..	..	..	..	..	.6
303.79M	..	..	..	..	..	.1	.1	.4	.2	..	..	..	..	..	..	..	..	.4	.2	.3	..	..	..	.9	..	.3	.3	.7	..	..	..	..	..	..	..	..	.3
304.54M	..	..	.4	.1	..	.2	..	.7	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	.1	..	..	.1	.2	..	..	..	..	..	..	..	..	..

APPENDIX 4

DATA MATRICES USED IN NUMERICAL ANALYSES

AMCOR 6009B and 6010

	BOL.FRA.	BUC.AND.	BUL.BAS.	BUL.MAR.	BUL.ELE.	BUL.ELO.	CAS.CAR.	CIB.LOB.	CIB.ORN.	ELP.CLA.
151.2M	11.000	0.0	0.0	14.000	0.0	0.0	4.000	1.000	62.000	0.0
152.8M	0.0	0.0	0.0	1.000	0.0	1.000	0.0	0.0	13.000	0.0
160.4M	8.000	0.0	0.0	2.000	0.0	0.0	9.000	0.0	9.000	0.0
160.6M	5.000	0.0	0.0	12.000	0.0	0.0	8.000	0.0	25.000	0.0
170.1M	0.0	0.0	0.0	24.000	0.0	9.000	11.000	0.0	9.000	0.0
172.2M	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
173.0M	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
179.7M	0.0	0.0	0.0	0.0	0.0	31.000	0.0	0.0	0.0	0.0
273.6M	0.0	0.0	22.000	0.0	0.0	48.000	0.0	0.0	2.000	0.0
280.3M	0.0	110.000	85.000	0.0	0.0	15.000	0.0	0.0	20.000	0.0
283.7M	0.0	3.000	19.000	0.0	0.0	0.0	0.0	6.000	3.000	0.0
314.6M	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.000	0.0	0.0
84.41M	0.0	0.0	0.0	12.000	0.0	0.0	2.000	0.0	0.0	4.000
93.2M	0.0	0.0	0.0	4.000	0.0	0.0	2.000	0.0	6.000	6.000
125.45M	0.0	27.000	0.0	0.0	49.000	0.0	0.0	0.0	10.000	0.0
167.24M	0.0	25.000	0.0	0.0	0.0	0.0	8.000	0.0	26.000	0.0

	ELP. A	ELP.EXC.	ELP.SUB.	EPI.PON.	FLO.ATL.	FUR.FUS.	FUR.SCH.	GLO.AUR.	GLO.CRA.	GLO.INA.
151.2M	0.0	71.000	6.000	0.0	0.0	0.0	0.0	11.000	0.0	5.000
152.8M	0.0	280.000	26.000	8.000	0.0	2.000	1.000	0.0	0.0	0.0
160.4M	0.0	214.000	18.000	66.000	0.0	10.000	16.000	3.000	0.0	0.0
160.6M	0.0	79.000	10.000	39.000	0.0	2.000	6.000	2.000	1.000	0.0
170.1M	0.0	66.000	6.000	90.000	0.0	5.000	10.000	1.000	2.000	0.0
172.2M	0.0	81.000	3.000	0.0	0.0	0.0	0.0	0.0	0.0	0.0
173.0M	0.0	44.000	0.0	0.0	0.0	0.0	1.000	0.0	0.0	0.0
179.7M	0.0	189.000	5.000	14.000	0.0	3.000	0.0	0.0	0.0	0.0
273.6M	0.0	75.000	0.0	145.000	0.0	2.000	0.0	0.0	0.0	0.0
280.3M	0.0	19.000	0.0	3.000	51.000	3.000	0.0	4.000	0.0	0.0
283.7M	0.0	1.000	1.000	0.0	1.000	0.0	0.0	0.0	0.0	0.0
314.6M	0.0	0.0	0.0	0.0	31.000	0.0	0.0	0.0	0.0	0.0
84.41M	1.000	3.000	0.0	6.000	5.000	3.000	15.000	5.000	10.000	0.0
93.2M	5.000	40.000	1.000	1.000	5.000	0.0	1.000	6.000	1.000	1.000
125.45M	0.0	64.000	0.0	0.0	0.0	31.000	0.0	0.0	0.0	0.0
167.24M	1.000	112.000	0.0	6.000	5.000	0.0	0.0	0.0	0.0	2.000

APPENDIX 4 (Continued)

AMCOR 6009B and 6010

	LEN.AME.	MAR.DUB.	NON.AUR.	NON.STE.	PSE.DUM.	PYR.SUB.	QUI.TRI.	QUI.SEM.	ROS.FLO.	TRI.ANG.	UVI.PER.
151.2M	1.000	17.000	7.000	5.000	12.000	2.000	7.000	14.000	1.000	31.000	0.0
152.8M	0.0	1.000	45.000	0.0	1.000	0.0	0.0	68.000	0.0	1.000	0.0
160.4M	0.0	1.000	49.000	0.0	1.000	0.0	0.0	24.000	2.000	2.000	0.0
160.6M	0.0	1.000	49.000	0.0	0.0	1.000	2.000	24.000	0.0	3.000	0.0
170.1M	0.0	0.0	20.000	1.000	0.0	2.000	1.000	7.000	2.000	6.000	0.0
172.2M	0.0	0.0	1.000	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
173.0M	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
179.7M	0.0	0.0	13.000	2.000	2.000	0.0	0.0	1.000	3.000	0.0	0.0
273.6M	0.0	0.0	13.000	0.0	0.0	0.0	0.0	0.0	1.000	0.0	10.000
280.3M	2.000	0.0	47.000	0.0	0.0	0.0	0.0	0.0	7.000	0.0	0.0
283.7M	3.000	0.0	1.000	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4.000
314.6M	28.000	1.000	4.000	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.000
84.41M	0.0	0.0	5.000	0.0	0.0	0.0	4.000	2.000	0.0	0.0	0.0
93.2M	0.0	11.000	0.0	3.000	0.0	3.000	0.0	0.0	0.0	0.0	0.0
125.45M	0.0	0.0	9.000	0.0	0.0	0.0	0.0	0.0	14.000	0.0	0.0
167.24M	0.0	0.0	0.0	164.000	0.0	0.0	0.0	0.0	0.0	0.0	0.0

AMCOR 6011

	BOL.DIR.	BUL.PUP.	BUL.ELE.	BUL.ELO.	CIB.ORN.	EPI.PON.	EPO.BAS.	FLO.ATL.	GLO.SUB.	GLO.INA.
198.6M	2.000	0.0	15.000	178.000	0.0	3.000	1.000	0.0	0.0	0.0
199.0M	1.000	0.0	1.000	50.000	0.0	0.0	2.000	0.0	0.0	0.0
218.0M	2.000	0.0	36.000	585.000	3.000	0.0	0.0	12.000	0.0	1.000
227.2M	6.000	0.0	44.000	301.000	3.000	0.0	0.0	30.000	0.0	0.0
235.6M	0.0	3.000	2.000	11.000	22.000	2.000	1.000	13.000	2.000	8.000
236.3M	1.000	1.000	3.000	8.000	16.000	0.0	0.0	0.0	2.000	1.000

	LEN.AME.	MEL.BAR.	PSE.STR.	QUI.SEM.	SPI.GRA.	TRI.BRA.	VAL.MIN.
198.6M	1.000	0.0	0.0	0.0	1.000	0.0	3.000
199.0M	2.000	0.0	1.000	1.000	0.0	0.0	3.000
218.0M	1.000	0.0	0.0	0.0	0.0	0.0	0.0
227.2M	0.0	0.0	0.0	0.0	0.0	0.0	0.0
235.6M	0.0	10.000	3.000	2.000	9.000	8.000	1.000
236.3M	3.000	5.000	0.0	3.000	0.0	12.000	0.0

APPENDIX 4 (Continued)

ASP 13

	BOL.STR.	BRI.ALA.	BUL.ALA.	BUL.ELO.	C.CF.FLO	EPO.BAS.	FLO.ATL.	GLO.AUR.	GLO.CRA.	LEN.AME.
867.5 M	0.0	1.000	0.0	5.000	2.000	0.0	0.0	0.0	1.000	0.0
911.3 M	1.000	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.000
948.1 M	0.0	1.000	0.0	0.0	0.0	0.0	1.000	0.0	0.0	0.0
948.6 M	0.0	0.0	0.0	1.000	0.0	0.0	1.000	2.000	0.0	0.0
948.9 M	0.0	0.0	0.0	1.000	0.0	0.0	1.000	1.000	0.0	0.0
963.2 M	1.000	0.0	6.000	0.0	1.000	0.0	3.000	0.0	0.0	1.000
965.5 M	1.000	0.0	10.000	0.0	0.0	1.000	0.0	0.0	1.000	1.000
966.2 M	11.000	0.0	50.000	1.000	1.000	1.000	2.000	0.0	3.000	0.0
966.8 M	41.000	0.0	21.000	0.0	1.000	3.000	7.000	1.000	10.000	0.0

	LEN.TOR.	LEN.PER.	MEL.BAR.	NOD.LOR.	PLE.ADV.	PLE.HEL.	QUAD.SP.	REC.TOR.	SPH.SP.	STI.A.A.
867.5 M	0.0	1.000	1.000	0.0	0.0	0.0	0.0	0.0	0.0	0.0
911.3 M	1.000	0.0	0.0	0.0	0.0	0.0	0.0	2.000	0.0	0.0
948.1 M	0.0	0.0	1.000	0.0	1.000	1.000	2.000	0.0	0.0	0.0
948.6 M	0.0	0.0	0.0	0.0	0.0	1.000	1.000	0.0	0.0	0.0
948.9 M	0.0	0.0	0.0	0.0	0.0	1.000	1.000	0.0	0.0	0.0
963.2 M	0.0	2.000	0.0	0.0	1.000	0.0	0.0	1.000	0.0	0.0
965.5 M	2.000	1.000	1.000	1.000	1.000	0.0	0.0	1.000	1.000	2.000
966.2 M	5.000	1.000	2.000	10.000	2.000	0.0	1.000	1.000	1.000	2.000
966.8 M	7.000	1.000	8.000	3.000	0.0	0.0	1.000	1.000	2.000	8.000

	STI.BRA.	ST.CF.AC	STI.SPP.	U.CF.CUS	UVI.JUN.	UVI.PER.	VAL. A.
867.5 M	0.0	0.0	1.000	0.0	6.000	7.000	0.0
911.3 M	0.0	0.0	1.000	0.0	12.000	6.000	0.0
948.1 M	0.0	0.0	1.000	0.0	2.000	4.000	0.0
948.6 M	0.0	0.0	0.0	2.000	1.000	5.000	3.000
948.9 M	0.0	0.0	0.0	1.000	2.000	4.000	1.000
963.2 M	0.0	2.000	4.000	1.000	0.0	0.0	0.0
965.5 M	0.0	0.0	2.000	1.000	0.0	1.000	0.0
966.2 M	2.000	3.000	0.0	0.0	0.0	2.000	1.000
966.8 M	5.000	1.000	0.0	0.0	11.000	1.000	0.0

APPENDIX 4 (Continued)

ASP 14 and 15

	ALA.TAN.	AND.PSE.	BOL.LAN.	BRI.ANT.	BUL.ALA.	BUL.MAR.	BUL.STR.	BUL.MEX.	GLO.CRA.	CHI.DOL.
1305.4M	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1345.8M	0.0	0.0	0.0	0.0	6.000	0.0	0.0	2.000	0.0	0.0
1419.1M	0.0	0.0	0.0	0.0	4.000	0.0	3.000	2.000	0.0	0.0
1420.2M	0.0	0.0	0.0	0.0	11.000	0.0	15.000	4.000	0.0	0.0
1423.2M	0.0	0.0	0.0	0.0	10.000	0.0	12.000	8.000	0.0	1.000
1470.2M	2.000	2.000	1.000	0.0	11.000	0.0	0.0	5.000	0.0	2.000
1470.9M	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.000
1471.6M	0.0	0.0	3.000	0.0	9.000	0.0	0.0	1.000	0.0	0.0
1472.2M	8.000	0.0	0.0	0.0	22.000	0.0	1.000	0.0	0.0	2.000
1472.7M	2.000	8.000	2.000	0.0	42.000	0.0	0.0	1.000	0.0	0.0
1475.2M	1.000	2.000	3.000	0.0	2.000	0.0	0.0	0.0	0.0	0.0
1475.8M	4.000	14.000	5.000	0.0	76.000	0.0	1.000	0.0	0.0	0.0
1508.8M	0.0	0.0	0.0	0.0	8.000	11.000	0.0	4.000	0.0	16.000
1509.4M	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.000	4.000
1510.0M	0.0	0.0	0.0	0.0	2.000	0.0	0.0	0.0	0.0	3.000
1511.0M	0.0	0.0	0.0	0.0	0.0	2.000	0.0	0.0	0.0	1.000
1511.5M	0.0	0.0	0.0	0.0	0.0	4.000	0.0	0.0	1.000	0.0
1512.1M	0.0	0.0	0.0	0.0	0.0	2.000	0.0	0.0	1.000	3.000
1512.9M	2.000	0.0	0.0	13.000	2.000	0.0	2.000	0.0	2.000	0.0
1529.9M	0.0	0.0	0.0	1.000	0.0	0.0	3.000	0.0	2.000	0.0
1530.9M	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1531.7M	0.0	1.000	0.0	56.000	46.000	0.0	0.0	0.0	0.0	1.000

	CI CF RO	OEN.COM.	EPI.VIT.	FLO.ATL.	GLO.AUR.	GLO.SUB.	GYR.NEO.	KAR.BRA.	LEN.PER.	LEN.TOR.
1305.4M	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4.000	0.0
1345.8M	0.0	0.0	0.0	2.000	0.0	0.0	0.0	0.0	0.0	0.0
1419.1M	0.0	0.0	0.0	0.0	0.0	0.0	1.000	0.0	0.0	0.0
1420.2M	0.0	0.0	0.0	1.000	5.000	0.0	1.000	0.0	0.0	0.0
1423.2M	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.000
1470.2M	0.0	1.000	0.0	3.000	0.0	6.000	6.000	0.0	3.000	2.000
1470.9M	0.0	0.0	0.0	0.0	0.0	0.0	2.000	0.0	0.0	2.000
1471.6M	0.0	0.0	0.0	0.0	0.0	7.000	1.000	0.0	0.0	11.000
1472.2M	1.000	3.000	0.0	2.000	0.0	2.000	2.000	1.000	1.000	9.000
1472.7M	0.0	0.0	0.0	2.000	0.0	5.000	7.000	0.0	1.000	1.000
1475.2M	0.0	1.000	0.0	3.000	0.0	1.000	2.000	0.0	1.000	0.0
1475.8M	1.000	2.000	0.0	3.000	0.0	2.000	5.000	0.0	1.000	5.000
1508.8M	5.000	4.000	8.000	2.000	11.000	4.000	1.000	6.000	0.0	0.0
1509.4M	1.000	0.0	1.000	1.000	6.000	0.0	0.0	2.000	0.0	0.0
1510.0M	0.0	1.000	1.000	1.000	2.000	0.0	0.0	4.000	0.0	0.0
1511.0M	0.0	0.0	4.000	0.0	1.000	0.0	1.000	7.000	0.0	0.0
1511.5M	0.0	0.0	3.000	0.0	0.0	0.0	0.0	6.000	0.0	0.0
1512.1M	1.000	0.0	0.0	2.000	1.000	0.0	0.0	1.000	0.0	0.0
1512.9M	0.0	6.000	0.0	0.0	0.0	0.0	1.000	0.0	5.000	0.0
1529.9M	0.0	0.0	0.0	0.0	0.0	0.0	1.000	1.000	0.0	0.0
1530.9M	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1531.7M	0.0	0.0	0.0	0.0	0.0	8.000	2.000	0.0	0.0	0.0

APPENDIX 4 (Continued)

ASP 14 and 15

	MAR.COM.	MAR.OCC.	MEL.BAR.	MEL.POM.	NOD.LON.	PLE SP A	PUL.BUL.	PUL. Q/B	REC.TOR.	SAR.ITA.
1305.4M	1.000	0.0	0.0	0.0	0.0	1.000	0.0	0.0	2.000	0.0
1345.8M	0.0	1.000	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1419.1M	0.0	0.0	0.0	0.0	3.000	0.0	1.000	1.000	1.000	0.0
1420.2M	0.0	0.0	0.0	0.0	2.000	0.0	4.000	0.0	1.000	0.0
1423.2M	0.0	1.000	1.000	0.0	1.000	0.0	0.0	0.0	0.0	0.0
1470.2M	6.000	8.000	6.000	5.000	4.000	0.0	3.000	3.000	1.000	4.000
1470.9M	3.000	0.0	0.0	3.000	20.000	0.0	0.0	2.000	0.0	0.0
1471.6M	14.000	4.000	7.000	0.0	34.000	0.0	2.000	0.0	0.0	1.000
1472.2M	14.000	4.000	4.000	7.000	0.0	1.000	3.000	10.000	0.0	2.000
1472.7M	1.000	1.000	1.000	4.000	4.000	2.000	8.000	0.0	0.0	2.000
1475.2M	1.000	3.000	3.000	1.000	19.000	1.000	6.000	1.000	0.0	1.000
1475.8M	4.000	3.000	0.0	5.000	0.0	0.0	0.0	0.0	0.0	1.000
1508.8M	2.000	4.000	4.000	0.0	8.000	0.0	7.000	0.0	0.0	0.0
1509.4M	0.0	0.0	4.000	0.0	3.000	1.000	0.0	0.0	0.0	0.0
1510.0M	1.000	0.0	3.000	0.0	16.000	0.0	1.000	0.0	0.0	0.0
1511.0M	1.000	0.0	1.000	0.0	6.000	0.0	0.0	1.000	0.0	0.0
1511.5M	0.0	0.0	2.000	0.0	1.000	0.0	1.000	0.0	0.0	0.0
1512.1M	0.0	0.0	3.000	0.0	0.0	0.0	2.000	0.0	0.0	0.0
1512.9M	0.0	0.0	2.000	0.0	2.000	2.000	3.000	2.000	0.0	0.0
1529.9M	0.0	0.0	2.000	0.0	1.000	0.0	1.000	1.000	0.0	0.0
1530.9M	0.0	0.0	2.000	0.0	1.000	0.0	0.0	0.0	0.0	0.0
1531.7M	0.0	0.0	4.000	1.000	0.0	7.000	7.000	0.0	0.0	0.0

	SIP.BRA.	SPH.BUL.	STI SP A	STI.BRA.	STI C AC	STI.CUR.	STI.MOD.	STI.SUB.	TRI.BRA.	UVI.AUB.	UVI.PER.	UVI.SPI.	VIR.ROT.
1305.4M	0.0	3.000	0.0	9.000	2.000	0.0	0.0	0.0	0.0	145.000	0.0	0.0	0.0
1345.8M	0.0	0.0	1.000	18.000	0.0	0.0	1.000	0.0	0.0	69.000	0.0	0.0	0.0
1419.1M	0.0	0.0	1.000	1.000	1.000	1.000	0.0	0.0	0.0	0.0	0.0	6.000	1.000
1420.2M	0.0	0.0	6.000	1.000	0.0	1.000	5.000	0.0	0.0	0.0	0.0	12.000	18.000
1423.2M	0.0	0.0	5.000	1.000	1.000	2.000	3.000	0.0	0.0	0.0	0.0	27.000	1.000
1470.2M	11.000	23.000	0.0	0.0	0.0	27.000	1.000	0.0	8.000	37.000	0.0	0.0	0.0
1470.9M	1.000	3.000	0.0	0.0	0.0	9.000	0.0	7.000	0.0	1.000	0.0	5.000	0.0
1471.6M	22.000	27.000	0.0	2.000	34.000	7.000	1.000	3.000	2.000	11.000	0.0	0.0	0.0
1472.2M	27.000	50.000	0.0	2.000	25.000	4.000	3.000	2.000	4.000	39.000	0.0	0.0	0.0
1472.7M	12.000	14.000	0.0	0.0	2.000	7.000	0.0	3.000	0.0	13.000	0.0	21.000	0.0
1475.2M	11.000	22.000	0.0	0.0	1.000	4.000	0.0	5.000	1.000	1.000	0.0	0.0	0.0
1475.8M	4.000	54.000	0.0	1.000	1.000	4.000	0.0	0.0	3.000	38.000	0.0	27.000	0.0
1508.8M	0.0	13.000	14.000	0.0	0.0	1.000	0.0	0.0	16.000	3.000	2.000	0.0	20.000
1509.4M	0.0	7.000	6.000	0.0	0.0	0.0	0.0	0.0	1.000	2.000	1.000	0.0	3.000
1510.0M	0.0	2.000	2.000	0.0	0.0	0.0	0.0	0.0	1.000	1.000	0.0	0.0	2.000
1511.0M	0.0	11.000	2.000	0.0	0.0	2.000	0.0	0.0	7.000	2.000	0.0	0.0	3.000
1511.5M	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	6.000	1.000	0.0	0.0	0.0
1512.1M	0.0	3.000	2.000	0.0	0.0	0.0	0.0	0.0	3.000	0.0	1.000	0.0	1.000
1512.9M	3.000	10.000	10.000	0.0	0.0	23.000	0.0	16.000	0.0	25.000	5.000	15.000	2.000
1529.9M	0.0	0.0	0.0	0.0	0.0	14.000	0.0	0.0	3.000	5.000	0.0	1.000	0.0
1530.9M	0.0	0.0	0.0	0.0	0.0	4.000	0.0	0.0	3.000	6.000	0.0	2.000	0.0
1531.7M	0.0	7.000	0.0	0.0	0.0	22.000	0.0	0.0	6.000	196.000	5.000	0.0	0.0

APPENDIX 4 (Continued)

DSDP SITE 563

	ANO.PSE.	BOL.HUN.	BOL.TEC.	BUL.GRA.	BUL.ALA.	CIB.BRA.	CIB.HAV.	CIB.MUN.	CIB.TUX.	DEN SP A
166.05M	0.0	0.0	0.0	2.000	4.000	1.000	0.0	6.000	0.0	1.000
166.80M	0.0	0.0	0.0	0.0	5.000	0.0	0.0	2.000	0.0	1.000
175.55M	0.0	2.000	0.0	0.0	3.000	1.000	0.0	12.000	0.0	0.0
185.05M	0.0	0.0	0.0	0.0	5.000	0.0	0.0	1.000	0.0	1.000
185.80M	1.000	0.0	0.0	0.0	1.000	1.000	0.0	1.000	0.0	3.000
186.63M	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.000
187.38M	0.0	0.0	0.0	0.0	1.000	2.000	0.0	8.000	0.0	0.0
188.21M	0.0	0.0	0.0	2.000	0.0	0.0	0.0	6.000	0.0	4.000
189.79M	0.0	1.000	0.0	0.0	1.000	1.000	0.0	1.000	0.0	0.0
194.55M	0.0	0.0	0.0	0.0	0.0	2.000	0.0	0.0	0.0	1.000
195.30M	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.000	0.0	0.0
196.88M	4.000	0.0	0.0	0.0	0.0	0.0	0.0	4.000	0.0	2.000
198.46M	1.000	0.0	0.0	0.0	1.000	0.0	1.000	1.000	0.0	5.000
200.04M	0.0	0.0	0.0	1.000	1.000	0.0	0.0	0.0	0.0	1.000
201.62M	1.000	0.0	0.0	0.0	3.000	0.0	0.0	3.000	0.0	0.0
202.45M	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.000	0.0	2.000
203.20M	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.000	0.0	0.0
204.05M	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.000	0.0	1.000
204.80M	1.000	1.000	0.0	0.0	1.000	0.0	0.0	0.0	0.0	1.000
205.63M	2.000	0.0	0.0	0.0	1.000	0.0	0.0	2.000	0.0	1.000
210.37M	0.0	0.0	0.0	0.0	0.0	0.0	1.000	5.000	0.0	0.0
213.55M	2.000	0.0	0.0	0.0	0.0	1.000	0.0	0.0	0.0	1.000
216.71M	1.000	1.000	1.000	0.0	1.000	0.0	0.0	8.000	0.0	0.0
219.04M	0.0	0.0	0.0	0.0	0.0	0.0	0.0	8.000	0.0	1.000
222.20M	0.0	0.0	0.0	0.0	0.0	1.000	0.0	7.000	0.0	0.0
223.05M	5.000	0.0	1.000	0.0	0.0	0.0	0.0	6.000	0.0	0.0
224.63M	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.000	2.000	0.0
229.37M	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4.000	0.0	1.000
230.95M	1.000	0.0	0.0	0.0	0.0	0.0	0.0	2.000	0.0	0.0
232.55M	1.000	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
236.46M	0.0	0.0	0.0	0.0	0.0	1.000	0.0	10.000	0.0	0.0
238.04M	0.0	0.0	5.000	0.0	0.0	0.0	0.0	6.000	0.0	1.000
239.62M	1.000	0.0	0.0	0.0	0.0	0.0	1.000	6.000	0.0	0.0
241.20M	2.000	0.0	1.000	1.000	2.000	0.0	0.0	4.000	0.0	0.0
242.05M	1.000	0.0	1.000	0.0	0.0	0.0	1.000	7.000	0.0	0.0
244.38M	0.0	0.0	3.000	1.000	0.0	4.000	0.0	11.000	0.0	0.0
245.96M	0.0	0.0	0.0	1.000	0.0	0.0	0.0	1.000	0.0	2.000
248.37M	0.0	0.0	2.000	3.000	1.000	0.0	0.0	9.000	3.000	0.0
249.95M	0.0	0.0	1.000	1.000	0.0	0.0	1.000	5.000	0.0	2.000
251.55M	0.0	0.0	2.000	2.000	2.000	0.0	1.000	3.000	0.0	1.000
252.30M	0.0	1.000	0.0	1.000	1.000	0.0	0.0	3.000	0.0	0.0
255.46M	0.0	0.0	0.0	2.000	0.0	0.0	5.000	5.000	0.0	1.000
256.29M	0.0	0.0	0.0	3.000	0.0	0.0	1.000	5.000	0.0	0.0
257.87M	0.0	0.0	0.0	2.000	0.0	0.0	0.0	4.000	0.0	2.000
261.05M	1.000	0.0	0.0	6.000	0.0	0.0	0.0	6.000	0.0	0.0
266.54M	0.0	1.000	0.0	2.000	0.0	0.0	0.0	7.000	0.0	1.000
267.37M	1.000	0.0	0.0	1.000	0.0	0.0	0.0	4.000	0.0	0.0
270.00M	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.000	0.0	0.0
277.92M	0.0	0.0	0.0	2.000	0.0	0.0	0.0	16.000	0.0	0.0
90.05M	0.0	0.0	0.0	1.000	0.0	0.0	6.000	14.000	0.0	2.000

APPENDIX 4 (Continued)

DSDP SITE 563

	AND.PSE.	BOL.HUN.	BOL.TEC.	BUL.GRA.	BUL.ALA.	CIB.BRA.	CIB.HAV.	CIB.MUN.	CIB.TUX.	DEN SP A
280.80M	0.0	0.0	0.0	4.000	0.0	0.0	0.0	4.000	0.0	0.0
281.63M	0.0	0.0	0.0	5.000	0.0	0.0	3.000	11.000	2.000	3.000
283.21M	1.000	0.0	0.0	1.000	0.0	0.0	7.000	7.000	1.000	5.000
286.37M	0.0	1.000	0.0	1.000	0.0	1.000	4.000	6.000	0.0	1.000
289.55M	0.0	0.0	0.0	1.000	0.0	0.0	0.0	6.000	0.0	0.0
291.13M	0.0	0.0	0.0	0.0	0.0	0.0	5.000	3.000	0.0	0.0
292.71M	0.0	2.000	0.0	3.000	0.0	1.000	1.000	5.000	0.0	0.0
294.29M	0.0	1.000	0.0	3.000	0.0	0.0	0.0	9.000	0.0	1.000
295.87M	0.0	0.0	0.0	1.000	0.0	0.0	0.0	4.000	1.000	0.0
296.62M	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.000	3.000	0.0
297.45M	0.0	0.0	0.0	1.000	0.0	0.0	0.0	1.000	0.0	0.0
299.05M	0.0	0.0	0.0	0.0	0.0	1.000	0.0	1.000	2.000	0.0
302.21M	0.0	1.000	0.0	0.0	0.0	0.0	0.0	10.000	1.000	0.0
302.96M	0.0	0.0	0.0	1.000	0.0	1.000	0.0	16.000	2.000	0.0
303.79M	0.0	0.0	0.0	2.000	0.0	0.0	0.0	10.000	2.000	3.000
304.54M	0.0	1.000	0.0	0.0	0.0	0.0	0.0	8.000	0.0	0.0

APPENDIX 4 (Continued)

DSDP SITE 563

	EGG.BRA.	EHR.TRI.	EPI.EXI.	FIS C RA	FIS.WIE.	GAV.SEM.	GAV.MIC.	GLO.SUB.	GYR.NEO.	GYR SP A
166.05M	0.0	0.0	1.000	1.000	0.0	0.0	0.0	0.0	2.000	3.000
166.80M	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.000	0.0	1.000
175.55M	2.000	1.000	2.000	0.0	0.0	0.0	0.0	3.000	2.000	1.000
185.05M	0.0	0.0	0.0	0.0	0.0	0.0	0.0	6.000	0.0	0.0
185.80M	3.000	1.000	1.000	0.0	0.0	0.0	0.0	2.000	2.000	1.000
186.63M	4.000	1.000	0.0	1.000	0.0	0.0	0.0	2.000	3.000	1.000
187.38M	1.000	0.0	2.000	1.000	0.0	0.0	0.0	4.000	4.000	0.0
188.21M	1.000	1.000	2.000	1.000	0.0	0.0	0.0	1.000	3.000	3.000
189.79M	0.0	0.0	2.000	0.0	0.0	0.0	0.0	2.000	0.0	1.000
194.55M	1.000	1.000	0.0	0.0	0.0	0.0	0.0	0.0	1.000	1.000
195.30M	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.000	1.000
196.88M	3.000	1.000	1.000	1.000	0.0	0.0	1.000	4.000	2.000	1.000
198.46M	1.000	0.0	0.0	0.0	0.0	0.0	0.0	4.000	4.000	0.0
200.04M	2.000	0.0	1.000	0.0	0.0	0.0	1.000	2.000	1.000	1.000
201.62M	2.000	0.0	1.000	0.0	0.0	0.0	0.0	2.000	3.000	0.0
202.45M	1.000	0.0	2.000	1.000	0.0	0.0	0.0	0.0	3.000	0.0
203.20M	4.000	0.0	1.000	0.0	0.0	0.0	0.0	0.0	3.000	0.0
204.05M	0.0	0.0	1.000	0.0	0.0	0.0	0.0	3.000	1.000	2.000
204.80M	2.000	1.000	0.0	0.0	0.0	0.0	0.0	3.000	2.000	1.000
205.63M	2.000	0.0	1.000	0.0	0.0	0.0	0.0	2.000	2.000	0.0
210.37M	0.0	0.0	1.000	0.0	0.0	0.0	0.0	1.000	3.000	1.000
213.55M	4.000	0.0	3.000	0.0	0.0	0.0	1.000	11.000	5.000	2.000
216.71M	2.000	0.0	1.000	0.0	0.0	0.0	1.000	5.000	1.000	2.000
219.04M	1.000	0.0	0.0	0.0	0.0	0.0	1.000	2.000	0.0	1.000
222.20M	2.000	0.0	0.0	0.0	0.0	0.0	0.0	2.000	2.000	1.000
223.05M	0.0	0.0	1.000	0.0	0.0	0.0	0.0	2.000	3.000	0.0
224.63M	1.000	0.0	0.0	0.0	0.0	0.0	0.0	1.000	0.0	2.000
229.37M	1.000	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.000	2.000
230.95M	0.0	0.0	2.000	0.0	0.0	0.0	0.0	0.0	0.0	3.000
232.55M	1.000	0.0	0.0	0.0	0.0	0.0	0.0	5.000	3.000	1.000
236.46M	0.0	0.0	0.0	0.0	0.0	0.0	0.0	6.000	2.000	3.000
238.04M	1.000	1.000	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.000
239.62M	0.0	1.000	0.0	0.0	0.0	0.0	0.0	3.000	4.000	1.000
241.20M	0.0	1.000	0.0	0.0	0.0	0.0	0.0	4.000	0.0	0.0
242.05M	0.0	1.000	0.0	0.0	0.0	0.0	0.0	6.000	0.0	0.0
244.38M	0.0	1.000	2.000	0.0	0.0	0.0	0.0	0.0	0.0	0.0
245.96M	0.0	1.000	0.0	0.0	0.0	0.0	1.000	1.000	1.000	1.000
248.37M	0.0	2.000	2.000	0.0	0.0	0.0	0.0	1.000	0.0	0.0
249.95M	0.0	2.000	0.0	0.0	0.0	0.0	1.000	5.000	1.000	1.000
251.55M	1.000	0.0	0.0	0.0	0.0	0.0	0.0	10.000	1.000	3.000
252.30M	2.000	0.0	0.0	0.0	0.0	7.000	0.0	8.000	0.0	1.000
255.46M	0.0	2.000	0.0	0.0	0.0	1.000	2.000	8.000	1.000	1.000
256.29M	0.0	0.0	0.0	0.0	0.0	0.0	1.000	8.000	8.000	1.000
257.87M	0.0	0.0	0.0	0.0	0.0	4.000	0.0	9.000	1.000	1.000
261.05M	1.000	2.000	0.0	0.0	0.0	1.000	0.0	10.000	4.000	0.0
266.54M	0.0	1.000	0.0	0.0	0.0	0.0	1.000	7.000	0.0	1.000
267.37M	0.0	2.000	0.0	0.0	1.000	1.000	0.0	4.000	2.000	0.0
270.00M	2.000	2.000	0.0	0.0	1.000	1.000	0.0	3.000	0.0	0.0
277.92M	0.0	0.0	0.0	0.0	0.0	0.0	0.0	5.000	6.000	1.000
280.05M	0.0	0.0	0.0	0.0	0.0	0.0	0.0	10.000	3.000	0.0

APPENDIX 4 (Continued)

DSDP SITE 563

	EGG.BRA.	EHR.TRI.	EPI.EXI.	FIS C RA	FIS.WIE.	GAV.SEM.	GAV.MIC.	GLO.SUB.	GYR.NEO.	GYR SP A
280.80M	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.000	0.0	0.0
281.63M	0.0	0.0	0.0	0.0	1.000	0.0	0.0	6.000	0.0	0.0
283.21M	1.000	0.0	1.000	0.0	1.000	0.0	0.0	18.000	0.0	0.0
286.37M	0.0	0.0	0.0	0.0	1.000	1.000	0.0	8.000	1.000	0.0
289.55M	0.0	0.0	3.000	0.0	0.0	0.0	0.0	12.000	6.000	1.000
291.13M	0.0	0.0	0.0	0.0	0.0	3.000	0.0	11.000	3.000	0.0
292.71M	0.0	0.0	0.0	0.0	0.0	1.000	0.0	3.000	1.000	0.0
294.29M	0.0	0.0	0.0	0.0	1.000	0.0	0.0	4.000	3.000	1.000
295.87M	0.0	0.0	0.0	0.0	0.0	0.0	0.0	5.000	1.000	0.0
296.62M	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.000	1.000
297.45M	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.000	1.000	0.0
299.05M	0.0	0.0	0.0	0.0	0.0	0.0	1.000	3.000	1.000	0.0
302.21M	0.0	0.0	0.0	0.0	0.0	0.0	0.0	8.000	1.000	0.0
302.96M	0.0	0.0	1.000	0.0	0.0	0.0	0.0	4.000	1.000	0.0
303.79M	0.0	0.0	0.0	0.0	0.0	0.0	0.0	16.000	0.0	0.0
304.54M	0.0	0.0	0.0	0.0	0.0	0.0	1.000	6.000	3.000	0.0

APPENDIX 4 (Continued)

DSDP SITE 563

	GYR SP B	KAR.BRA.	KAR.MON.	LAT.PAU.	MEL.BAR.	MEL.POM.	NUT.UMB.	ORI.TEN.	ORI.UMB.	PLA.WUE.
166.05M	0.0	0.0	0.0	0.0	5.000	1.000	0.0	0.0	9.000	6.000
166.80M	0.0	0.0	0.0	1.000	0.0	1.000	3.000	0.0	9.000	3.000
175.55M	0.0	0.0	0.0	1.000	3.000	1.000	6.000	0.0	9.000	7.000
185.05M	0.0	0.0	0.0	0.0	9.000	0.0	2.000	0.0	5.000	4.000
185.80M	0.0	0.0	0.0	0.0	3.000	0.0	2.000	0.0	7.000	10.000
186.63M	0.0	0.0	0.0	0.0	4.000	0.0	3.000	0.0	7.000	4.000
187.38M	0.0	0.0	0.0	2.000	7.000	0.0	1.000	0.0	7.000	6.000
188.21M	2.000	0.0	0.0	1.000	4.000	1.000	0.0	0.0	4.000	3.000
189.79M	3.000	0.0	0.0	0.0	2.000	0.0	2.000	0.0	2.000	1.000
194.55M	3.000	0.0	0.0	0.0	7.000	0.0	2.000	2.000	1.000	4.000
195.30M	0.0	1.000	0.0	0.0	3.000	0.0	2.000	1.000	6.000	3.000
196.88M	1.000	2.000	0.0	2.000	3.000	1.000	5.000	0.0	8.000	14.000
198.46M	6.000	0.0	0.0	0.0	5.000	0.0	3.000	0.0	3.000	13.000
200.04M	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4.000	5.000
201.62M	0.0	1.000	0.0	0.0	2.000	0.0	1.000	0.0	7.000	3.000
202.45M	2.000	0.0	0.0	0.0	3.000	1.000	5.000	0.0	7.000	10.000
203.20M	1.000	1.000	0.0	0.0	4.000	0.0	1.000	0.0	1.000	5.000
204.05M	1.000	0.0	0.0	0.0	1.000	2.000	2.000	0.0	10.000	10.000
204.80M	1.000	0.0	1.000	1.000	2.000	4.000	4.000	0.0	3.000	4.000
205.63M	2.000	0.0	0.0	1.000	2.000	0.0	0.0	0.0	6.000	5.000
210.37M	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.000	6.000
213.55M	1.000	1.000	0.0	1.000	3.000	0.0	4.000	1.000	10.000	9.000
216.71M	1.000	0.0	0.0	1.000	4.000	0.0	2.000	1.000	11.000	10.000
219.04M	3.000	0.0	1.000	0.0	3.000	0.0	1.000	2.000	1.000	14.000
222.20M	2.000	0.0	0.0	0.0	3.000	0.0	0.0	0.0	7.000	17.000
223.05M	3.000	1.000	0.0	0.0	4.000	22.000	2.000	0.0	3.000	26.000
224.63M	2.000	0.0	1.000	0.0	9.000	5.000	0.0	1.000	5.000	14.000
229.37M	0.0	0.0	0.0	1.000	0.0	0.0	0.0	1.000	2.000	7.000
230.95M	0.0	0.0	0.0	0.0	2.000	0.0	0.0	0.0	13.000	4.000
232.55M	3.000	2.000	0.0	0.0	0.0	0.0	0.0	0.0	14.000	1.000
236.46M	1.000	0.0	2.000	0.0	1.000	0.0	0.0	1.000	10.000	0.0
238.04M	0.0	0.0	0.0	1.000	0.0	0.0	0.0	0.0	2.000	0.0
239.62M	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	6.000	0.0
241.20M	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.000	0.0	8.000
242.05M	1.000	0.0	0.0	0.0	0.0	1.000	0.0	1.000	3.000	0.0
244.38M	0.0	0.0	0.0	0.0	10.000	1.000	0.0	0.0	5.000	0.0
245.96M	1.000	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.000	0.0
248.37M	0.0	0.0	0.0	0.0	1.000	0.0	0.0	0.0	0.0	0.0
249.95M	1.000	0.0	5.000	0.0	0.0	0.0	0.0	0.0	6.000	0.0
251.55M	1.000	0.0	1.000	0.0	0.0	0.0	0.0	0.0	7.000	0.0
252.30M	2.000	0.0	0.0	0.0	0.0	0.0	0.0	0.0	6.000	0.0
255.46M	0.0	1.000	1.000	0.0	0.0	0.0	0.0	1.000	9.000	0.0
256.29M	1.000	0.0	0.0	0.0	0.0	0.0	2.000	0.0	9.000	0.0
257.87M	0.0	0.0	0.0	0.0	0.0	0.0	0.0	5.000	6.000	0.0
261.05M	0.0	0.0	0.0	0.0	2.000	0.0	0.0	5.000	7.000	0.0
266.54M	0.0	0.0	0.0	0.0	2.000	0.0	0.0	2.000	5.000	0.0
267.37M	1.000	1.000	0.0	0.0	0.0	0.0	0.0	0.0	5.000	0.0
270.00M	1.000	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.000	0.0
277.92M	0.0	0.0	1.000	0.0	0.0	0.0	0.0	7.000	15.000	0.0
280.05M	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.000	19.000	0.0

APPENDIX 4 (Continued)

DSDP SITE 563

	GYR SP B	KAR.BRA.	KAR.MON.	LAT.PAU.	MEL.BAR.	MEL.POM.	NUT.UMB.	ORI.TEN.	ORI.UMB.	PLA.WUE.
280.80M	1.000	1.000	0.0	0.0	0.0	0.0	0.0	0.0	4.000	0.0
281.63M	0.0	1.000	1.000	0.0	0.0	0.0	0.0	4.000	2.000	0.0
283.21M	2.000	0.0	0.0	0.0	0.0	0.0	0.0	5.000	8.000	0.0
286.37M	0.0	1.000	0.0	0.0	0.0	0.0	1.000	3.000	6.000	0.0
289.55M	2.000	0.0	0.0	0.0	0.0	0.0	0.0	7.000	2.000	0.0
291.13M	2.000	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.000	0.0
292.71M	0.0	0.0	1.000	0.0	0.0	0.0	0.0	2.000	7.000	0.0
294.29M	1.000	0.0	0.0	0.0	0.0	0.0	0.0	2.000	11.000	0.0
295.87M	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.000	6.000	0.0
296.62M	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4.000	0.0
297.45M	0.0	0.0	0.0	0.0	0.0	0.0	5.000	1.000	5.000	0.0
299.05M	2.000	1.000	0.0	0.0	0.0	0.0	0.0	4.000	3.000	0.0
302.21M	1.000	0.0	0.0	0.0	0.0	0.0	0.0	1.000	10.000	0.0
302.96M	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.000	6.000	0.0
303.79M	2.000	0.0	0.0	0.0	0.0	0.0	0.0	2.000	21.000	0.0
304.54M	0.0	0.0	1.000	0.0	0.0	0.0	0.0	1.000	5.000	0.0

APPENDIX 4 (Continued)

DSDP SITE 563

	PLE SP A	PLE.TEN	PUL.BUL.	PUL. Q/B	PUL.QUI.	STI.ACU.	STI.ANT.	STI.CUR.	STI.GRA.	STI.SUB.	VUL.SPI
166.05M	0.0	0.0	3.000	0.0	1.000	1.000	0.0	0.0	0.0	3.000	0.0
166.80M	0.0	0.0	2.000	4.000	0.0	8.000	0.0	0.0	1.000	4.000	0.0
175.55M	0.0	3.000	5.000	0.0	3.000	2.000	0.0	4.000	0.0	3.000	1.000
185.05M	0.0	0.0	1.000	0.0	1.000	3.000	0.0	0.0	0.0	3.000	0.0
185.80M	0.0	0.0	7.000	0.0	1.000	2.000	0.0	1.000	3.000	4.000	1.000
186.63M	0.0	1.000	1.000	0.0	0.0	1.000	0.0	0.0	0.0	1.000	0.0
187.38M	0.0	0.0	4.000	1.000	2.000	1.000	0.0	0.0	0.0	1.000	0.0
188.21M	2.000	0.0	4.000	1.000	3.000	2.000	0.0	0.0	2.000	1.000	0.0
189.79M	0.0	0.0	6.000	2.000	0.0	3.000	0.0	0.0	0.0	4.000	0.0
194.55M	1.000	1.000	2.000	0.0	0.0	2.000	0.0	0.0	0.0	1.000	0.0
195.30M	0.0	0.0	2.000	5.000	2.000	4.000	0.0	1.000	1.000	0.0	0.0
196.88M	0.0	0.0	5.000	1.000	2.000	6.000	0.0	1.000	0.0	4.000	0.0
198.46M	0.0	0.0	4.000	4.000	2.000	8.000	0.0	1.000	1.000	4.000	0.0
200.04M	0.0	0.0	3.000	2.000	1.000	2.000	0.0	0.0	1.000	2.000	0.0
201.62M	0.0	0.0	2.000	1.000	5.000	5.000	0.0	0.0	1.000	3.000	0.0
202.45M	0.0	0.0	0.0	1.000	1.000	3.000	0.0	1.000	0.0	0.0	0.0
203.20M	0.0	0.0	5.000	1.000	0.0	1.000	0.0	2.000	1.000	1.000	0.0
204.05M	0.0	0.0	0.0	0.0	1.000	4.000	0.0	0.0	0.0	0.0	1.000
204.80M	0.0	3.000	2.000	1.000	3.000	0.0	0.0	4.000	0.0	0.0	0.0
205.63M	0.0	2.000	3.000	0.0	0.0	1.000	0.0	0.0	3.000	6.000	0.0
210.37M	0.0	0.0	0.0	1.000	0.0	0.0	0.0	1.000	0.0	0.0	0.0
213.55M	0.0	1.000	5.000	2.000	1.000	2.000	0.0	0.0	0.0	1.000	0.0
216.71M	0.0	1.000	4.000	2.000	0.0	0.0	0.0	0.0	0.0	3.000	0.0
219.04M	0.0	3.000	1.000	1.000	0.0	4.000	0.0	1.000	0.0	0.0	1.000
222.20M	1.000	0.0	4.000	1.000	1.000	0.0	0.0	1.000	1.000	1.000	0.0
223.05M	0.0	1.000	5.000	0.0	3.000	32.000	0.0	8.000	0.0	7.000	0.0
224.63M	0.0	0.0	1.000	0.0	0.0	11.000	0.0	3.000	4.000	0.0	1.000
229.37M	3.000	2.000	2.000	0.0	0.0	0.0	0.0	0.0	1.000	0.0	0.0
230.95M	4.000	0.0	0.0	0.0	0.0	5.000	1.000	1.000	0.0	5.000	0.0
232.55M	1.000	2.000	1.000	2.000	0.0	11.000	1.000	2.000	1.000	4.000	0.0
236.46M	0.0	2.000	0.0	2.000	2.000	5.000	0.0	1.000	1.000	2.000	0.0
238.04M	0.0	0.0	4.000	1.000	0.0	2.000	0.0	1.000	0.0	2.000	0.0
239.62M	0.0	0.0	3.000	0.0	1.000	13.000	7.000	0.0	0.0	3.000	0.0
241.20M	1.000	6.000	1.000	1.000	0.0	18.000	0.0	0.0	1.000	2.000	3.000
242.05M	0.0	1.000	3.000	0.0	1.000	0.0	0.0	0.0	1.000	0.0	0.0
244.38M	1.000	0.0	0.0	0.0	3.000	2.000	2.000	0.0	0.0	2.000	0.0
245.96M	0.0	0.0	3.000	0.0	0.0	1.000	0.0	1.000	0.0	2.000	0.0
248.37M	0.0	3.000	0.0	1.000	1.000	2.000	0.0	2.000	1.000	6.000	0.0
249.95M	0.0	0.0	1.000	1.000	1.000	0.0	0.0	0.0	0.0	5.000	1.000
251.55M	0.0	1.000	3.000	3.000	2.000	0.0	0.0	0.0	0.0	1.000	0.0
252.30M	0.0	0.0	5.000	1.000	0.0	0.0	0.0	0.0	0.0	4.000	0.0
255.46M	0.0	0.0	3.000	0.0	1.000	5.000	0.0	1.000	1.000	5.000	1.000
256.29M	5.000	2.000	3.000	1.000	2.000	3.000	0.0	1.000	0.0	8.000	0.0
257.87M	0.0	0.0	0.0	0.0	0.0	1.000	0.0	0.0	0.0	4.000	1.000
261.05M	0.0	2.000	4.000	5.000	1.000	0.0	8.000	5.000	0.0	5.000	0.0
266.54M	0.0	0.0	1.000	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.000
267.37M	1.000	1.000	0.0	1.000	3.000	0.0	0.0	0.0	0.0	5.000	0.0
270.00M	1.000	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.000	0.0
277.92M	0.0	2.000	1.000	0.0	3.000	15.000	43.000	1.000	0.0	11.000	6.000
280.05M	5.000	2.000	1.000	2.000	3.000	0.0	6.000	3.000	0.0	3.000	1.000

APPENDIX 4 (Continued)

DSDP SITE 563

	PLE SP A	PLE.TEN	PUL.BUL.	PUL. Q/B	PUL.OUI.	STI.ACU.	STI.ANT.	STI.CUR.	STI.GRA.	STI.SUB.	VUL.SPI.
280.80M	2.000	7.000	1.000	0.0	1.000	0.0	1.000	0.0	0.0	6.000	0.0
281.63M	2.000	4.000	2.000	1.000	1.000	1.000	45.000	0.0	0.0	19.000	1.000
283.21M	3.000	3.000	3.000	3.000	0.0	5.000	0.0	0.0	0.0	4.000	0.0
286.37M	0.0	3.000	0.0	0.0	3.000	0.0	7.000	7.000	0.0	7.000	0.0
289.55M	0.0	2.000	0.0	0.0	2.000	1.000	0.0	3.000	0.0	4.000	0.0
291.13M	2.000	1.000	0.0	0.0	3.000	0.0	0.0	5.000	0.0	6.000	0.0
292.71M	4.000	2.000	0.0	2.000	2.000	0.0	1.000	0.0	0.0	13.000	0.0
294.29M	1.000	0.0	0.0	2.000	1.000	0.0	0.0	8.000	0.0	5.000	1.000
295.87M	1.000	5.000	0.0	2.000	3.000	0.0	0.0	1.000	0.0	4.000	0.0
296.62M	0.0	0.0	0.0	0.0	0.0	1.000	2.000	5.000	0.0	0.0	0.0
297.45M	1.000	0.0	1.000	4.000	0.0	3.000	4.000	2.000	0.0	4.000	0.0
299.05M	0.0	1.000	0.0	0.0	0.0	1.000	0.0	2.000	0.0	0.0	0.0
302.21M	0.0	2.000	1.000	2.000	0.0	15.000	7.000	0.0	0.0	0.0	2.000
302.96M	1.000	1.000	0.0	2.000	0.0	9.000	0.0	0.0	1.000	0.0	6.000
303.79M	2.000	0.0	1.000	4.000	2.000	4.000	2.000	9.000	0.0	7.000	3.000
304.54M	0.0	4.000	0.0	7.000	0.0	0.0	0.0	1.000	0.0	2.000	0.0

APPENDIX 5

DIVERSITY VALUES OF INDIVIDUAL SAMPLES

AMCOR 6009B

Sample	Number Of Specimens N	Number Of Species S	Shannon-Weiner Diversity $\bar{H}$	Equitability E
84.41M	86	19	2.62	0.73
93.2M	102	23	2.37	0.47
122.2M	31	10	1.91	0.68
125.45M	214	10	1.87	0.65
167.24M	360	11	1.47	0.40
273.9M	21	9	1.95	0.78
301.2M	3	1	0.00	1.00
321.0M	12	6	1.63	0.85

AMCOR 6011

Sample	Number Of Specimens N	Number Of Species S	Shannon-Weiner Diversity $\bar{H}$	Equitability E
198.6M	195	4	0.33	0.35
199.0M	56	6	0.51	0.28
218.0M	639	10	0.39	0.15
227.2M	383	6	0.78	0.36
235.6M	80	16	2.47	0.74
236.3M	36	9	1.84	0.70

APPENDIX 5 (Continued)

AMCOR 6010

Sample	Number Of Specimens N	Number Of Species S	Shannon-Weiner Diversity $\bar{H}$	Equitability E
151.2M	336	28	2.67	0.52
152.8M	448	13	1.26	0.27
160.4M	434	16	1.75	0.36
160.6M	240	18	2.16	0.48
170.1M	279	21	2.19	0.42
172.2M	85	3	0.22	0.41
173.0M	46	3	0.21	0.41
179.7M	263	10	1.07	0.29
182.2M	7	2	0.41	0.75
207.7M	3	2	0.64	0.94
264.8M	15	6	1.64	0.86
267.2M	18	3	0.73	0.69
273.6M	318	9	1.49	0.49
277.05M	2	2	0.69	1.00
280.3M	373	14	1.98	0.52
283.7M	56	15	2.25	0.63
302.3M	2	1	0.00	1.00
310.7M	12	4	0.84	0.58
314.6M	128	16	2.20	0.56

APPENDIX 5 (Continued)

ASP 13

Sample	Number Of Specimens N	Number Of Species S	Shannon-Weiner Diversity $\bar{H}$	Equitability E
867.5M	33	16	2.43	0.71
871.2M	50	19	2.18	0.46
911.3M	25	8	1.54	0.58
911.7M	1	1	0.00	1.00
945.1M	3	2	0.64	0.94
947.5M	9	6	1.58	0.81
948.1M	24	13	2.37	0.82
948.6M	20	12	2.29	0.82
948.9M	16	11	2.25	0.86
963.2M	29	14	2.45	0.82
965.5M	31	20	2.60	0.67
966.2M	109	26	2.22	0.35
966.8M	167	34	2.88	0.52

APPENDIX 5 (Continued)

ASP 14

Sample	Number Of Specimens N	Number Of Species S	Shannon-Weiner Diversity $\bar{H}$	Equitability E
1305.4M	229	17	1.22	0.20
1345.8M	119	14	1.51	0.32
1419.1M	31	18	2.65	0.79
1420.2M	104	21	2.62	0.65
1422.2M	89	19	2.33	0.54
1448.9M	2	1	0.00	1.00
1470.2M	235	46	3.29	0.58
1470.9M	78	27	2.82	0.62
1471.6M	235	40	2.99	0.50
1472.2M	301	50	3.13	0.46
1472.7M	210	48	3.21	0.51
1475.2M	145	50	3.35	0.57
1475.8M	313	49	2.81	0.34

APPENDIX 5 (Continued)

ASP 15

Sample	Number Of Specimens N	Number Of Species S	Shannon-Weiner Diversity $\bar{H}$	Equitability E
1508.8M	245	50	3.55	0.70
1509.4M	46	18	2.62	0.76
1510.0M	51	20	2.53	0.63
1511.0M	61	22	2.75	0.71
1511.5M	47	21	2.76	0.75
1512.1M	31	18	2.79	0.90
1513.4M	2	1	0.00	1.00
1515.1M	1	1	0.00	1.00
1515.4M	2	1	0.00	1.00
1529.9M	202	44	3.32	0.63
1530.9M	41	16	2.32	0.64
1531.7M	34	14	2.43	0.81
1532.2M	384	26	1.80	0.23

APPENDIX 5 (Continued)

COST B-3

Sample	Number Of Specimens N	Number Of Species S	Shannon-Weiner Diversity $\bar{H}$	Equitability E
1158.3M	102	28	2.61	0.49
1167.4M	52	15	2.15	0.57
1176.6M	118	27	2.32	0.38
1185.7M	175	21	1.99	0.35
1194.9M	80	22	2.18	0.40
1204.0M	203	21	1.71	0.26
1213.2M	110	22	2.07	0.36
1222.3M	88	21	2.24	0.45
1231.4M	138	16	1.75	0.36
1249.7M	81	17	1.93	0.40
1258.8M	122	14	1.93	0.49
1268.0M	97	21	2.22	0.44
1295.5M	354	28	1.60	0.18
1304.6M	244	31	2.27	0.31
1313.8M	242	25	2.17	0.35
1322.9M	305	38	2.66	0.38
1332.0M	154	36	2.83	0.47
1341.2M	276	32	2.72	0.47
1350.3M	194	36	3.10	0.62
1359.5M	190	41	3.19	0.59
1368.6M	319	42	2.73	0.36
1377.8M	83	30	3.06	0.71
1386.9M	205	43	3.33	0.65
1396.1M	294	44	3.39	0.67
1405.2M	143	46	3.54	0.75
1414.3M	284	56	3.62	0.67
1423.5M	202	50	3.42	0.61
1432.6M	205	53	3.62	0.71
1441.7M	54	29	3.12	0.78

APPENDIX 5 (Continued)

DSDP SITE 334

Sample	Number Of Specimens N	Number Of Species S	Shannon-Weiner Diversity $\bar{H}$	Equitability E
129.55M	99	41	3.35	0.70
133.05M	151	40	3.36	0.72
137.70M	81	38	3.36	0.76
139.30M	60	25	2.80	0.66
141.53M	85	39	3.30	0.69
148.69M	69	28	2.95	0.69
167.74M	91	30	2.94	0.63
177.05M	85	33	3.01	0.62
180.83M	96	36	3.07	0.60
182.30M	95	37	3.30	0.73
187.03M	116	38	3.25	0.68
196.80M	99	40	3.40	0.75
225.50M	141	42	3.29	0.64
206.30M	82	33	3.01	0.62
234.80M	111	43	3.40	0.70
244.23M	123	43	3.32	0.64
253.35M	72	31	3.16	0.76

APPENDIX 5 (Continued)

DSDP SITE 563

Sample	Number Of Specimens N	Number Of Species S	Shannon-Weiner Diversity $\bar{H}$	Equitability E
289.55M	67	21	2.76	0.76
291.13M	57	20	2.71	0.75
292.71M	62	26	2.89	0.69
294.29M	69	24	2.81	0.69
295.87M	41	19	2.67	0.76
296.62M	25	13	2.38	0.83
297.45M	37	15	2.51	0.82
299.05M	28	16	2.63	0.87
302.21M	73	21	2.52	0.59
302.96M	73	25	2.80	0.66
303.79M	110	25	2.80	0.66
304.54M	46	17	2.51	0.72

APPENDIX 5 (Continued)

DSDP SITE 563

Sample	Number Of Specimens N	Number Of Species S	Shannon-Weiner Diversity $\bar{H}$	Equitability E
224.63M	88	26	2.73	0.59
229.37M	35	17	2.62	0.81
230.95M	52	20	2.62	0.68
230.95M	52	20	2.62	0.68
232.55M	77	30	2.97	0.65
238.04M	49	27	3.10	0.82
239.62M	58	19	2.56	0.68
241.20M	66	23	2.64	0.61
242.05M	38	23	2.82	0.73
244.38M	58	23	2.74	0.67
245.96M	27	21	2.95	0.91
248.37M	52	25	2.95	0.76
249.95M	52	28	3.05	0.75
251.55M	54	27	2.96	0.72
252.30M	56	22	2.79	0.74
255.46M	79	34	3.23	0.74
256.29M	80	32	3.10	0.69
257.87M	58	25	2.93	0.75
261.05M	92	26	3.02	0.79
266.54M	43	21	2.73	0.73
267.37M	40	21	2.82	0.80
270.00M	25	17	2.73	0.91
277.92M	161	29	2.63	0.48
280.05M	92	26	2.74	0.59
280.80M	43	19	2.67	0.76
281.63M	126	25	2.40	0.44
283.21M	86	25	2.81	0.66
286.37M	64	20	2.68	0.73

APPENDIX 5 (Continued)

DSDP SITE 563

Sample	Number Of Specimens N	Number Of Species S	Shannon-Weiner Diversity $\bar{H}$	Equitability E
166.05M	80	32	3.16	0.74
166.80M	63	23	2.87	0.77
175.55M	108	38	3.33	0.75
185.05M	143	21	1.58	0.23
185.80M	73	31	3.08	0.70
186.63M	60	29	3.17	0.82
187.38M	65	27	2.97	0.72
188.21M	60	27	3.13	0.85
189.79M	39	21	2.86	0.83
194.55M	37	21	2.82	0.80
195.30M	47	24	2.99	0.82
196.88M	102	42	3.39	0.71
198.46M	86	28	3.04	0.74
200.04M	38	22	2.94	0.86
201.62M	67	29	3.20	0.85
202.45M	67	31	3.12	0.73
203.20M	42	23	2.91	0.80
204.05M	102	23	2.00	0.32
204.80M	142	26	1.70	0.21
205.63M	62	29	3.19	0.84
210.37M	33	18	2.64	0.78
213.55M	97	38	3.25	0.68
216.71M	79	30	3.02	0.69
219.04M	58	25	2.77	0.64
222.20M	62	24	2.66	0.59
223.05M	159	27	2.68	0.54

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Explanation of Plate 1

Fig. 1 -- Elphidium excavatum (Terquem), AMCOR 6010 172.2m, side view, X81.

2 -- Epistominella pontoni (Cushman), AMCOR 6010 94.2m, Spiral view, X162.

3 -- Buliminella elongata (d'Orbigny), AMCOR 6011 218.0m, side view, X110.

4 -- Quinqueloculina seminulina (Linnaeus), AMCOR 6010 84.7m, side view, X130.

5 -- Buliminella elegantissima (d'Orbigny), AMCOR 6011 227.2m, side view, X130.

6 -- Cibicides ornatus (Cushman), AMCOR 6009B 93.2m, spiral view, X86.

7 -- Trifarina brady (Williamson), ASP 15 1508.8m, side view, X81.

8 -- Melonis barleeanus (Williamson), Site 563 236.46m, side view, X70.

9 -- Buliminella bassendorfensis (Cushman and Parker), AMCOR 6010 283.7m, side view, X108.

10 -- Florilus atlantica (Cushman), COST B-3 1368.6m, side view, X81.

11 -- Fursenkoina schreibersiana (Czjzek), AMCOR 6010 170.1m, side view, X108.

12 -- Bulimina marginata (d'Orbigny), AMCOR 6009B 84.41m, side view, X108.

13 -- Lenticulina americana (Cushman), COST B-3 1368.6m, side view, X54.

14 -- Uvigerina juncea (Cushman and Todd), AMCOR 6010 280.3m, side view, X70.

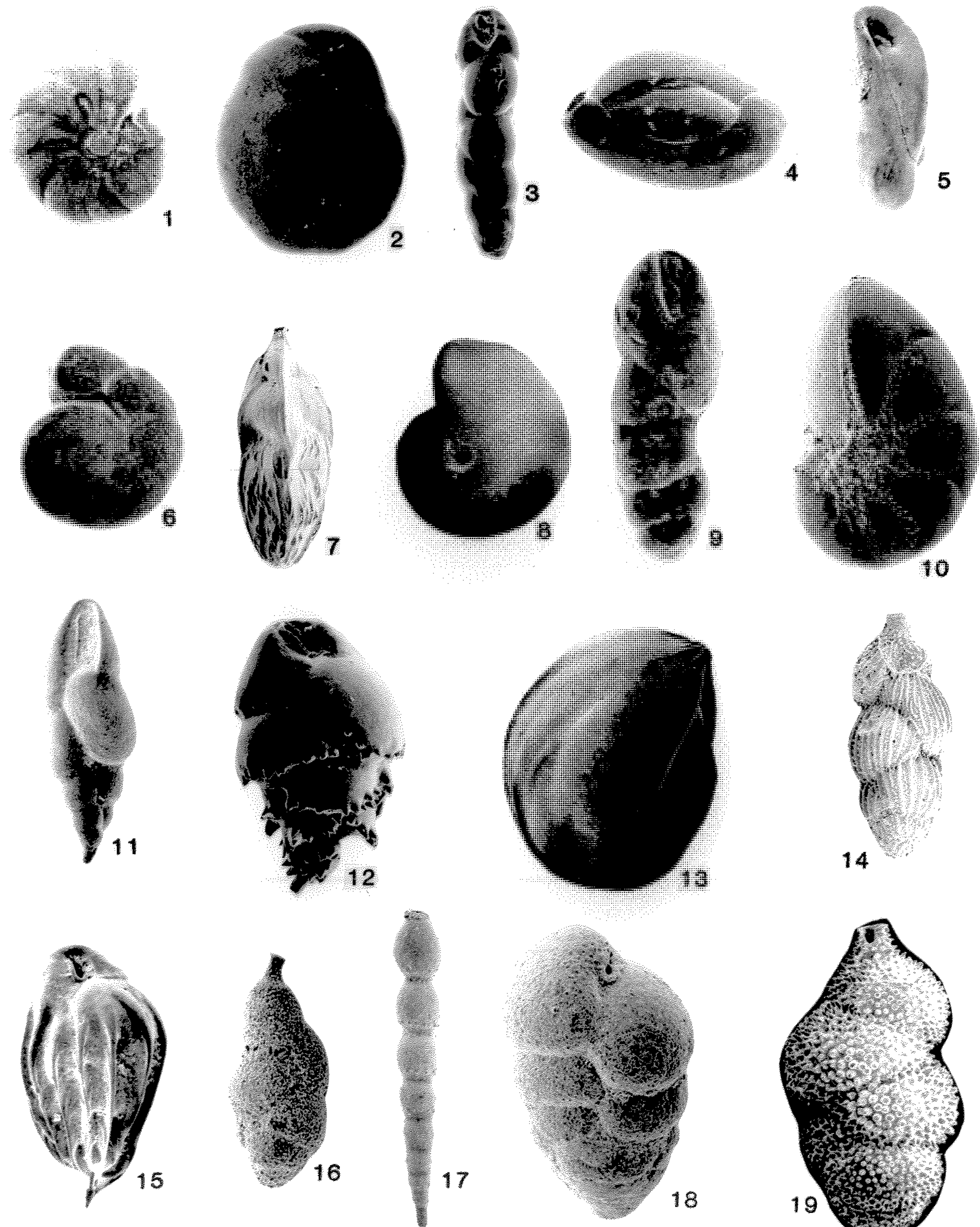
15 -- Bulimina alazanensis (Cushman), ASP 15 1531.7m, side view, X108.

16 -- Uvigerina auberiana (d'Orbigny), ASP 15 1531.7m, side view, X108.

17 -- Stilostomella bradyi (Cushman), COST B-3 1167.4m, side view, X70.

18 -- *Karreriella bradyi* (Cushman), ASP 15 1531.7m, side view, X81.

19 -- *Uvigerina spinicostata* (Cushman and Jarvis), Site 334 234.80m, side view, X43.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Explanation of Plate 2

Fig. 1 -- *Sphaeroidina bulloides* (d'Orbigny), Site 334 133.05m, umbilical view, X50.

2 -- *Buliminella grata* (Parker and Bermudez), Site 563 244.38m, side/top view, X90.

3 -- *Oridorsalis tener tener* (Brady), COST B-3 1405.2m, spiral view, X60.

4 -- *Pleurostomella brevis* (Hantken), Site 563 289.55m, side view, X75.

5 -- *Planulina wuellerstorfi* (Schwager), Site 334 148.69m, spiral view, X50.

6 -- *Eggerrella bradyi* (Cushman), Site 563 203.2m, side/top view, X50.

7 -- *Nuttalides umbonifera* (Cushman), Site 563 175.55m, spiral view, X65.

8 -- *Globocassidulina subglobosa* (Brady), Site 334 122.05m, side view, X50.

9 -- *Cibicidoides mundulus* (Brady, Parker and Jones), Site 563 204.05m, spiral view, X45.

10 -- *Planulina renzi* (Cushman), Site 334 141.53m, spiral view, X65.

11 -- *Pullenia bulloides* (d'Orbigny), Site 334 148.69m, edge view, X65.

12 -- *Gyroidinoides neosoldanii* (Brotzen), Site 334 148.69m, side view, X75.

13 -- *Sphaeroidinellopsis paenedehiscens* (Blow), Site 334 129.55m, side view, X50.

14 -- *Sphaeroidinellopsis subdehiscens* (Blow), Site 563 204.05m, side view, X50.

15 -- *Sphaeroidinellopsis seminulina* (Schwager), Site 563 187.38m, side view, X50.

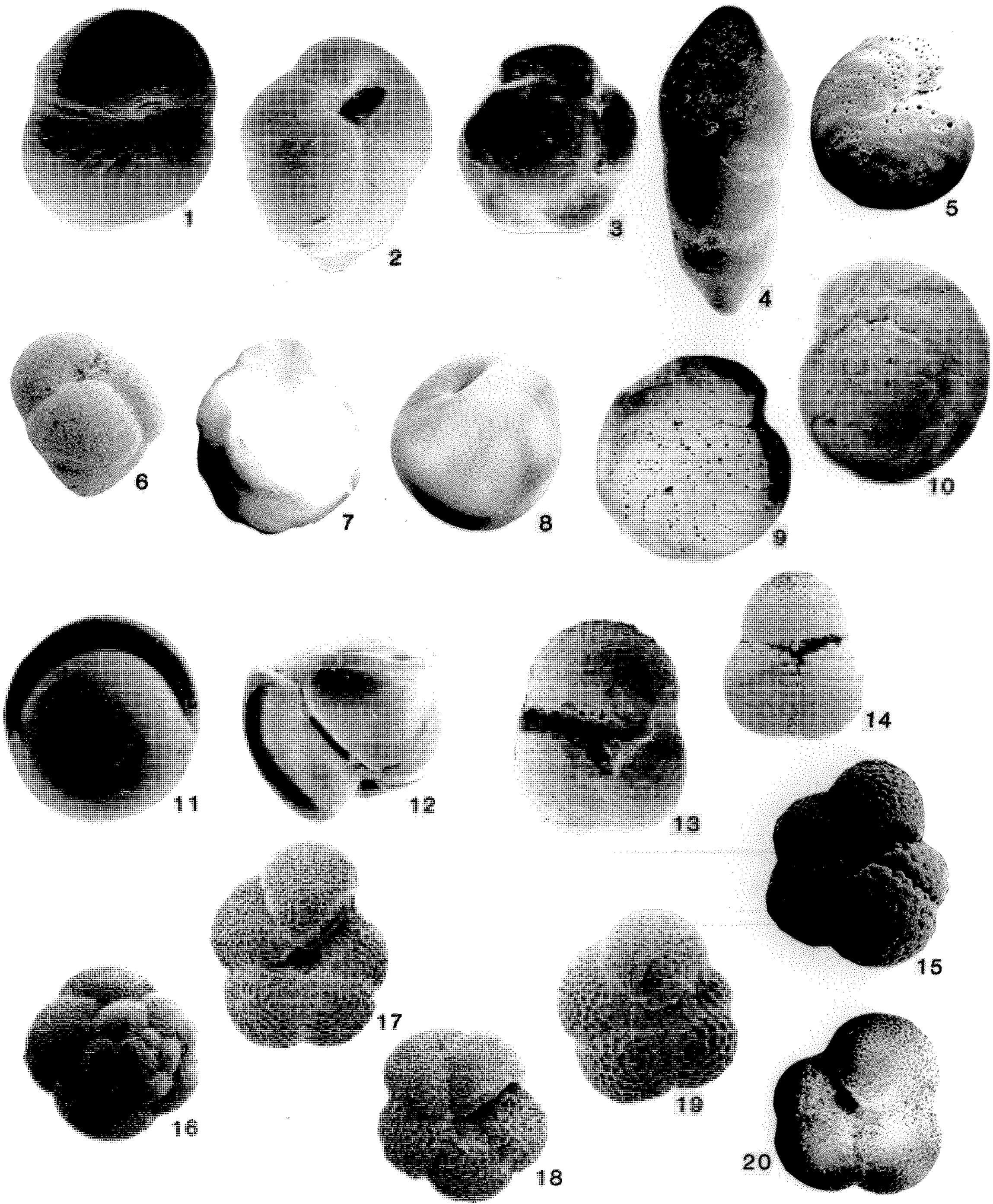
16 -- *Neogloboquadrina dutertrei* (d'Orbigny), AMCOR 6010 151.2m, spiral view, X50.

17 -- *Neogloboquadrina* sp. cf. *N. humerosa* (Takayanagi and Saito), Site 334 148.69m, umbilical view, X75.

18 -- *Neogloboquadrina acostaensis* (Blow), Site 334 167.74m, umbilical view, X75.

19 -- _Neogloboquadrina pseudopachyderma_ (Cita, Premoli-Silva and Rossi), Site 334 139.30m, umbilical view, X110.

20 -- _Neogloboquadrina continuosa_ (Blow), Site 563 188.21m, umbilical view, X75.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Explanation of Plate 3

Fig. 1 -- Globorotalia inflata (d'Orbigny), AMCOR 6010 151.2m, side view, X50.

2 -- Globorotalia conomiozea (Kennett), Site 334 148.69m, spiral view, X60.

3 -- Globorotalia conoidea (Walters), Site 334 167.74m, side view, X60.

4 -- Globorotalia miozea (Finlay), ASP 14 1470.2m, umbilical view, X85.

5 -- Globorotalia miozea, Site 563 252.30m, umbilical view, X65.

6 -- Globorotalia praescitula (Blow), COST B-3 1213.2m, umbilical view, X80.

7 -- Globorotalia zealandica (Hornibrook), COST B-3 1368.6m, side view, X120.

8 -- Globorotalia pseudomiozea (Walters), COST B-3 1368.6m, side view, X150.

9 -- Globorotalia fohsi robusta (Bolli), Site 563 205.63m, spiral view, X45.

10 -- Globorotalia fohsi lobata (Bermudez), Site 563 204.80m, spiral view, X50.

11 -- Globorotalia fohsi fohsi (Cushman and Ellisor), Site 563 215.17m, spiral view, X50.

12 -- Globorotalia fohsi peripheroacuta (Blow and Banner), Site 563 236.46m, side view, X75.

13 -- Glororotalia fohsi peripheroronda (Blow and Banner), Site 563 236.46m, spiral view, X75.

14 -- Globigerina nepenthes (Todd), Site 563 187.38m, umbilical view, X65.

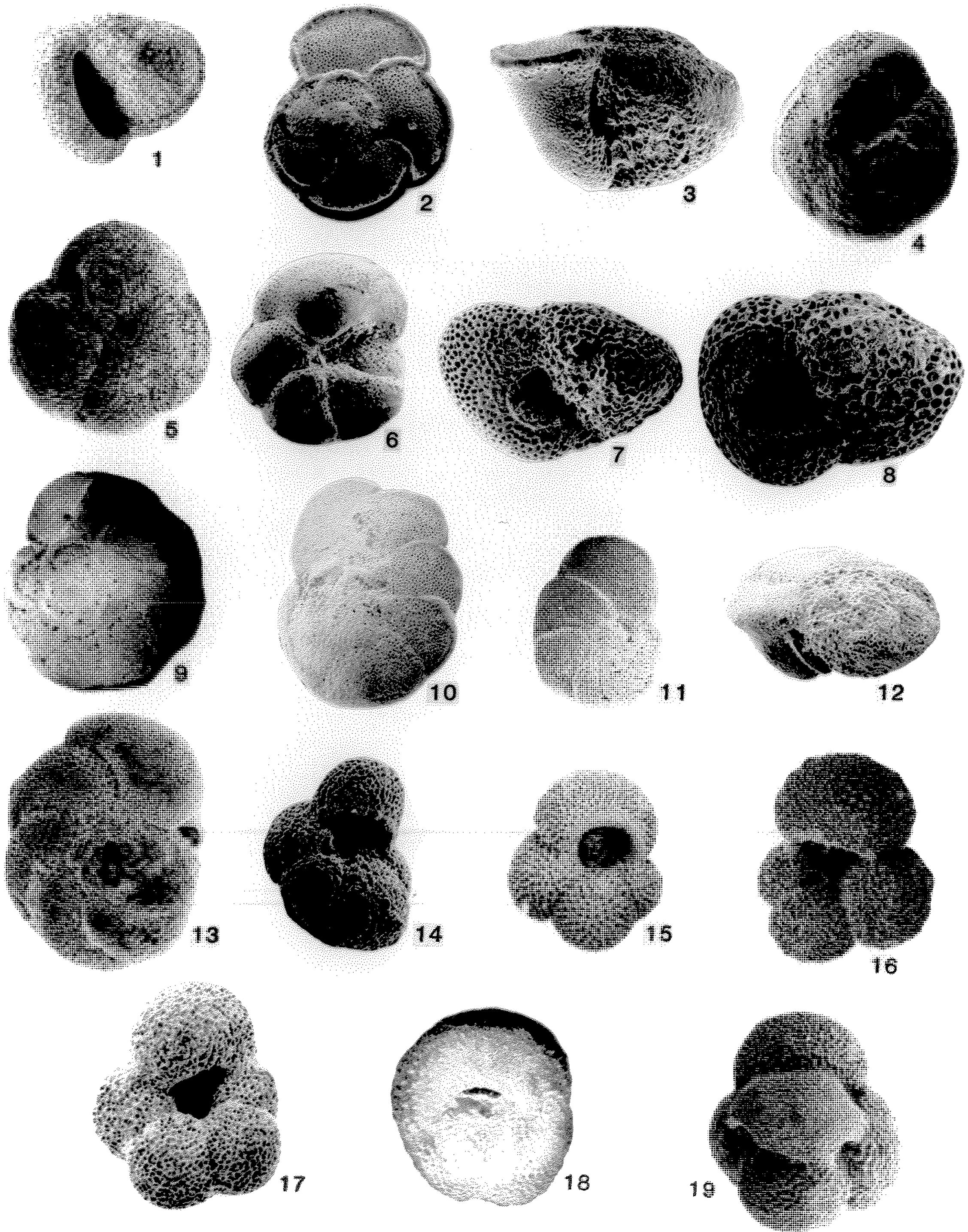
15 -- Globigerina woodi woodi (Jenkins), Site 563 185.05m, umbilical view, X75.

16 -- Globigerina praebulloides (Blow), Site 563 245.96m, umbilical view, X80.

17 -- Globigerina ciperoensis (Bolli), COST B-3 1432.6m, umbilical view, X120.

18 -- _Globigerina sellii_ (Borsetti), Site 563 292.71m, umbilical view, X60.

19 -- _Catapsydrax dissimilis_ (Cushman and Bermudez), COST B-3 1432.6m, umbilical view, X55.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Explanation of Plate 4

Fig. 1 -- Globigerinatella insueta (Cushman and Stainforth), ASP 14 1472.2m, side view, X75.

2 -- Globorotalia plesiotumida (Blow and Banner), Site 563 175.55m, umbilical view, X60.

3 -- Globorotalia praemenardii (Cushman and Stainforth), Site 563 226.96m, umbilical view, X50.

4 -- Globorotalia acrostoma (Wezel), ASP 14, 1472.2m, side view, X120.

5 -- Globorotalia mayeri (Cushman and Ellisor), Site 563 2040.05m, umbilical view, X75.

6 -- Globorotalia pseudokugleri (Blow), Site 563 292.71m, spiral view, X100.

7 -- Globorotalia kugleri (Bolli), SIte 563 289.55m, spiral view, X110.

8 -- Globoquadrina altispira altispira (Cushman and Jarvis), Site 563 236.46m, side view, X65.

9 -- Globorotalia margaritae (Cushman and Jarvis), Site 334 129.55m, umbilical view, X50.

10 -- Globoquadrina dehiscens (Chapman, Parr and Collins), Site 563 236.46m, spinal view, X75.

11 -- Globoquadrina dehiscens (Chapman, Parr and Collins), Site 563 234.46m, umbilical view, X55.

12 -- Globoquadrina venezuelana (Hedberg), Site 563 205.63m, umbilical view, X65.

13 -- Globoquadrina tripartita (Koch), Site 563 291.13m, umbilical view, X55.

14 -- Globigerinoides sacculifer (Brady) Site 334 129.55m, spiral view, X50.

15 -- Praeorbulina sicanus (DeStefani), Site 563 244.38m, side view, X55.

16 -- Praeorbulina glomerosa circularis (Blow), COST B-3 1350.3m, spinal view, X75.

17 -- Orbulina suturalis (Bronniman), Site 563 236.46m, spiral view, X80.

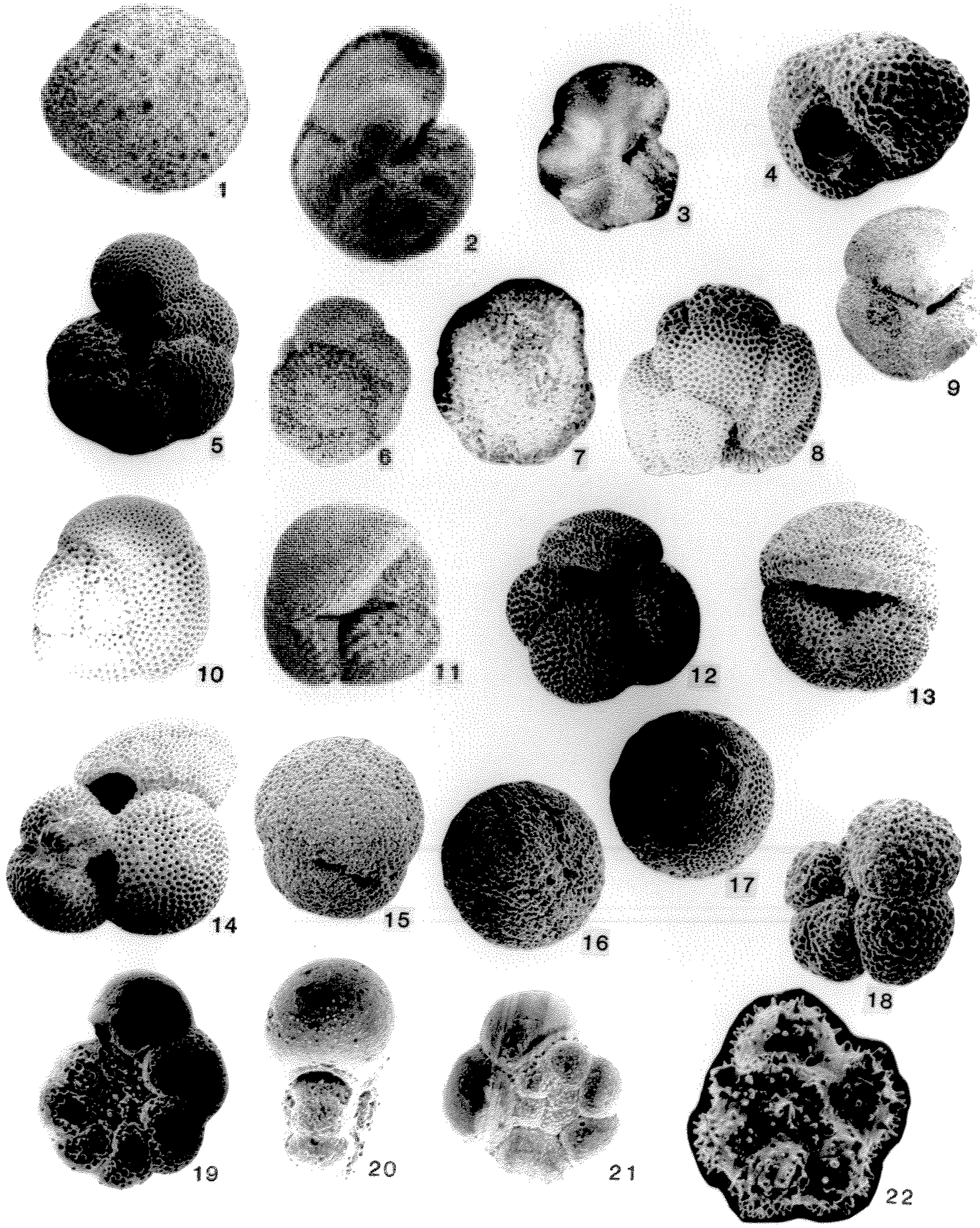
18 -- Globorotalia cf. G. opima nana (Bolli), ASP 15 1553.7m, umbilical view, X130.

19 -- Pseudohastigerina micra (Cole), ASP 15 1553.7m, side view, X165.

20 -- Pseudohastigerina micra (Cole), ASP 15 1553.7m, edge view, X235.

21 -- Turborotalia postcretacea (Myatliuk), ASP 15 1553.7m, spiral view, X150.

22 -- Acarinina cf. A. medizzai (Toumarkine and Bolli), ASP 15 1553.7m, spiral view, X235.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VITA

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1974	B.A. in Geology from Montclair State College, Montclair, New Jersey.
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1984	With Miller, K.G., M.P. Aubry, W.A. Berggren, D.V. Kent and M.J. Khan. Oligocene to Miocene Magnetobiostratigraphy and isotopic stratigraphy from Western North Atlantic DSDP Sites 563 and 558, North Atlantic Conference on Paleoceanography, London, England.
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