OCEAN DRILLING PROGRAM

LEG 130 PRELIMINARY REPORT

ONTONG JAVA PLATEAU

Dr. Loren Kroenke
Co-Chief Scientist, Leg 130
University of Hawaii
Hawaii Institute of Geophysics
2525 Correa Road
Honolulu, HI 96822

Dr. Wolfgang Berger
Co-Chief Scientist, Leg 130
Universität Bremen
Fachbereich Geowissenschaften
Postfach 3329
D-2800 Bremen 33
Federal Republic of Germany

Dr. Tom Janecek
Staff Scientist, Leg 130
Ocean Drilling Program
Texas A&M University
College Station, Texas 77845-9547

Philip D. Rabinowitz
Director
ODP/TAMU

Audrey W. Meyer
Manager
Science Operations
ODP/TAMU

Louis E. Garrison
Deputy Director
ODP/TAMU

May 1990

This informal report was prepared from the shipboard files by the scientists who participated in the cruise. The report was assembled under time constraints and is not considered to be a formal publication which incorporates final works or conclusions of the participating scientists. The material contained herein is privileged proprietary information and cannot be used for publication or quotation.

Preliminary Report No.30

First Printing 1990

Distribution

Copies of this publication may be obtained from the Director, Ocean Drilling Program, Texas A&M University Research Park, 1000 Discovery Drive, College Station, Texas 77845-9547. In some cases, orders for copies may require payment for postage and handling.

DISCLAIMER

This publication was prepared by the Ocean Drilling Program, Texas A&M University, as an account of work performed under the international Ocean Drilling Program, which is managed by Joint Oceanographic Institutions, Inc., under contract with the National Science Foundation. Funding for the program is provided by the following agencies:

Canada/Australia Consortium for the Ocean Drilling Program
Deutsche Forschungsgemeinschaft (Federal Republic of Germany)
Institut Français de Recherche pour l'Exploitation de la Mer (France)
Ocean Research Institute of the University of Tokyo (Japan)
National Science Foundation (United States)
Natural Environment Research Council (United Kingdom)
European Science Foundation Consortium for the Ocean Drilling Program
(Belgium, Denmark, Finland, Iceland, Italy, Greece, the Netherlands, Norway, Spain, Sweden, Switzerland, and Turkey)

SCIENTIFIC REPORT

The scientific party aboard JOIDES Resolution for Leg 130 of the Ocean Drilling Program consisted of:

Loren Kroenke, Co-Chief Scientist (Hawaii Institute of Geophysics, University of Hawaii, 2525 Correa Road, Honolulu, Hawaii 96822)
Wolfgang Berger, Co-Chief Scientist (Universität Bremen, Fachbereich Geowissenschaften, Postfach 3329, D-2800 Bremen 33, Federal Republic of Germany)
Thomas Janecek, ODP Staff Scientist (Ocean Drilling Program, 1000 Discovery Drive, College Station, Texas 77845-9547)
Jan Backman (Department of Geology, University of Stockholm, S-10691, Stockholm, Sweden)
Franck Bassinot (Département de Géologie Dynamique, Université Pierre et Marie Curie, 4 Place Jussieu, 75252 Paris Cedex 05, France)
Richard Corfield (Department of Earth Sciences, Oxford University, Park's Road, Oxford OX1 3PR, United Kingdom)
Margaret L. Delaney (Institute of Marine Sciences, University of California, Santa Cruz, California 95064)
Rick Hagen (Hawaii Institute of Geophysics, University of Hawaii, 2525 Correa Road, Honolulu, Hawaii 96822)
Eystein Jansen (Department of Geology, Sect B, University of Bergen, Allegaten 41, N-5007 Bergen, Norway)
Lawrence Krissek (Department of Geology and Mineralogy, Ohio State University, 107 Mendenhall Laboratory, 125 South Oval Mall, Columbus, Ohio 43210-1298)
Carina Lange (Geological Research Division, Scripps Institution of Oceanography, La Jolla, California 92093)
Mark Leckie (Department of Geology and Geography, Morrill Science Center, University of Massachusetts, Amherst, Massachusetts 01003)
Ida Lykke Lind (Instituttet for Teknisk Geologi, DTH, Bygning 204, Denmark)
Mitchell Lyle (Borehole Research Group, Lamont-Doherty Geological Observatory, Palisades, New York 10964)
John J. Mahoney (Hawaii Institute of Geophysics, University of Hawaii, 2525 Correa Road, Honolulu, Hawaii 96822-4567)
Janice Marsters (Hawaii Institute of Geophysics, University of Hawaii, 2525 Correa Road, Honolulu, Hawaii 96822-4567)
Larry Mayer (Department of Oceanography, Dalhousie University, Halifax, Nova Scotia B3H 4J1, Canada)
David C. Mosher (Department of Oceanography, Dalhousie University, Halifax, Nova Scotia B3H 4J1, Canada)
Robert Musgrave (Geology Department, University of Tasmania, GPO Box 252C, Hobart, Tasmania 7001, Australia)
Michael Prentice (Geology Department, University of Maine, Orono, Maine 04469)
Johanna M. Resig (Department of Geology and Geophysics, University of Hawaii, 2525 Correa Road, Honolulu, Hawaii 96822)
Heike Schmidt (Fachbereich Geowissenschaften, Universität Bremen, Klagenfurter Strasse, D-2800 Bremen 33, Federal Republic of Germany)
Rainer Stax (Institut für Geowissenschaften und Lithosphärenforschung, Universität Giessen, Senckenbergstrasse 3, Giessen, Federal Republic of Germany)
Michael Storey (Department of Geology, University of Keele, Keele, Staffordshire ST5 5BG, United Kingdom)

Toshiaki Takayama (Department of Geology, College of Liberal Arts, Kanazawa University, 1-1 Marunouchi, Kanazawa 920, Japan)
Kozo Takahashi (Woods Hole Oceanographic Institution, Woods Hole, Massachusetts 02543)
John A. Tarduno (Geological Research Division, Scripps Institution of Oceanography, La Jolla, California 92093)
Roy Wilkens (Hawaii Institute of Geophysics, University of Hawaii, 2525 Correa Road, Honolulu, Hawaii 96822-4567)
Guoping Wu (Scripps Institution of Oceanography, La Jolla, California 92093)

ABSTRACT

Over 4800 m of core were recovered from 16 holes drilled along a depth transect on the Ontong Java Plateau that was designed to gain new insight into the evolution of global ocean dynamics and climate during the past 25 million years, and the origin and tectonic history of the world's largest oceanic plateau.

The overall sedimentation rate pattern for the last 25 million years is dominated by a distinct low in the late early Miocene to early middle Miocene (20 to 15 Ma) and a prominent peak in the late Miocene to earliest Pliocene, which is characterized by some of the highest rates recorded in open-ocean pelagic sediments. The major patterns of carbonate accumulation suggest that global ocean changes in the carbon cycle take precedence over changes in bottom water activity by itself.

A large number of acoustic reflectors are synchronous and are associated in time with important paleoceanographic events. Many reflectors line up with sudden changes in carbonate accumulation. Some reflectors are strongly related to diagenesis, or are enhanced by diagenesis. Others mark the position of hiatuses, which in turn line up with condensed sections, emphasizing the importance of carbonate dissolution pulses.

Two apparently complete Cretaceous/Tertiary boundary sections (one calcareous, the other non-calcareous) were recovered. The shallower K/T boundary has one volcanic ash layer immediately proceeding the boundary, while the deeper site has evidence of volcanic activity throughout the transition.

Basement was penetrated twice, once to 26 meters and a second time to 149 meters. The recovery of massive tholeiitic basalt flows (one at least 28 m thick) indicates that the Ontong Java Plateau apparently formed, for the most part, by deep-water widespread effusion of flood basalts during Aptian time.

INTRODUCTION

The area drilled on the northeastern margin of the Ontong Java Plateau during Leg 130 (Fig. 1), was chosen to provide a depth transect of carbonate deposition in the western equatorial Pacific. Along this transect our intent was to recover a complete record of Neogene, Paleogene, and Late Cretaceous ocean history, with the goal of achieving a detailed reconstruction of paleoceanography and paleoclimate, in a well-constrained time frame. The unique geological setting of the plateau has led to the accumulation and preservation of a thick cover of pelagic sediments, apparently undisturbed in many areas. Thus, this region is eminently suited for high-resolution studies of globally significant paleoceanographic signals. In addition, there was the expectation that paleoceanographic events could be traced in the physical properties of the sediment, and that a link to the seismic record would allow both three-dimensional regional mapping, and long-distance correlation. Last, but not least, the origin and tectonic history of the Ontong Java Plateau itself constituted an important objective of our studies.

Ontong Java Plateau

The Ontong Java Plateau, straddling the equator in the western equatorial Pacific, is a broad mid-oceanic submarine plateau striking northwest-noutheast, parallel to the Solomon Islands to the south (Fig. 1). The plateau occupies an extensive area (1000 km x 1500 km) and rises to unusually shallow depths in its central region (around 1700 m). It has a complex margin physiography, with atolls or seamounts located near the western and southwestern edges (Kroenke, 1972).

Based on previous drilling results and on tectonic reconstructions of the region (e.g., Kroenke, 1984; Kroenke et al., 1986), a provisional history of the plateau can be compiled. The Ontong Java Plateau apparently began to form prior to 113 Ma, probably along a west-northwest-aligned spreading ridge. Pelagic sediments were deposited on the plateau as it formed; a shift from Austral to Tethyan assemblages at about 100 Ma (Site 289) reflects the northward movement of the plateau. During its journey, the plateau accumulated over 1000 m of Mesozoic and Cenozoic pelagic sediment, much of which is ooze and chalk. Although there is considerable evidence for disturbance, and even mass wasting (Berger and Johnson, 1976), there are many places with virtually undisturbed sections showing a layer-cake seismic stratigraphy. The age and origin of these layers have long been a matter of investigation; the suggestion is that they reflect distinct paleoceanographic events (Mayer et al., 1986). The bathymetric relationships extant today appear to have remained constant throughout the history of the plateau (Resig et al., 1976).

In late Oligocene time, the southwestern part of the plateau encountered the Outer Melanesian (North Solomon) subduction zone, resulting in the intrusion of dikes and sills along the outer trench rise (Fig. 1b). Collision of the plateau with the Outer Melanesian Arc ended subduction of the Pacific plate beneath the arc. Subduction ceased in the early Miocene (about 25 Ma) when the convergent boundary shifted. Subduction resumed south of the Solomon Islands region in the late Miocene (about 10 Ma), forming the New Britain-San Cristobal Trench. Eastward subduction of the Indo-Australia plate beneath the Pacific plate brought about the subsequent collision of the Woodlark Spreading Ridge with the Solomon Islands Arc (about 4 Ma). That collision led to the elevation and folding of the southwestern margin of the Ontong Java Plateau, culminating in the formation of the Malaita Anticlinorium, the overthrusting of the Solomon Islands Arc by plateau oceanic crust, and the emplacement of ophiolites on the islands of Malaita and Santa Isabel (Fig. 1). This overthrusting probably is still occurring.

Neogene Objectives

A major goal of Leg 130 was to drill four sites down the northeastern flank of the plateau (Sites 803-806; Fig. 2), to collect a series of continuous sedimentary sequences that would provide a Neogene depth transect. These four equatorial drill sites from the top of the Ontong Java Plateau to near its base span a depth range of nearly 2000 m within a short distance (Fig 3). Most of the sediments sampled were produced in the same surface-water conditions, having been derived from the same pelagic rain. The depth interval bracketed by our sites (2600 to 3900 m) contains the depth range in which changes in dissolution gradients are most pronounced, with considerable effects on physical properties and seismic reflectors (Berger and Johnson, 1976; Berger and Mayer, 1978; Mayer et al., 1986).

Regarding the Neogene objectives, the study of sediments drilled and cored along the depth transect are expected to yield the following: (1) High-resolution stratigraphic records across intervals of major paleoceanographic changes by evaluating variations of primary paleoceanographic indicators (isotopes, carbonate, biota); (2) A detailed sedimentary record to better understand the nature and role of carbonate dissolution in the deep sea and to attempt to quantify amounts of dissolution (necessary for attack on the CO_2 problem and related questions); (3) A high-resolution sedimentary record completing a global network of equatorial depth transects in order to better understand basin-basin fractionation and biotic evolution and provide a pelagic standard for comparison with marginal transects to elucidate basin-shelf fractionation; and (4) A sedimentary record to aid in understanding the origin of seismic events on oceanic plateaus and to compare them with seismic horizons in oceanic basins.

Pre-Neogene Objectives

The Cretaceous-Paleogene section also was important to us, because of the intrinsic interest of unfamiliar ocean conditions outside of the range of the Neogene, and also because this record provides a reference for southern hemisphere paleoceanography and bears on the early history of the plateau itself. Major hiatuses were encountered earlier in Upper Cretaceous-Paleogene sediments at DSDP Sites 288 and 289, which made it unlikely that complete sequences were to be found readily. However, many of the unconformities at Site 288 do not correlate with those at Site 289 (or the shallower, spot-cored Site 64), implying that they represent local events of limited areal extent (Andrews, Packham, et al., 1975). We drilled at other locations atop the plateau to recover key sections missed earlier.

Regarding objectives for Cretaceous and Paleogene sediments on the Ontong Java Plateau our goals were to (1) fill critical gaps in Cretaceous biostratigraphy and paleobiogeography; (2) estimate the original basement depth of the plateau and subsequent bathymetric change from benthic foraminifers and possibly from the dissolution history; (3) investigate the record of Cretaceous anoxic events in the South Pacific to increase understanding of mechanisms leading to the ocean-wide deposition of carbon-rich sediments; and (4) recover a well-preserved Cretaceous/Tertiary boundary in order to gain insight into the causes of mass extinctions.

Basement Objectives

Drilling into basement rocks and recovering a substantial amount of basalt was the final item on our list of objectives. The origin of the old, oceanic Pacific plateaus (Ontong Java, Manihiki, Shatsky, Hess, Magellan) is poorly understood, and progress in this regard on Ontong Java would be crucial. The Ontong Java Plateau has an unusually thick crust of truly continental proportions (~40 km thick on the main high plateau; e.g., Hussong et al., 1979). Even on the edges of the plateau the crust is still well within the continental range (~30 km, for instance, near the island of Malaita; e.g., Nixon and Boyd, 1979; Kroenke, 1972, and unpub. data). If there is continental crust on any of the large Pacific intraoceanic plateaus (as has been surmised by some) the Ontong Java Plateau, with by far the thickest crust, would seem one of the most favorable places to find it. A deep basement hole on the main high plateau would go far toward settling this issue. We drilled into basement on the Ontong Java Plateau in order to (1) determine the nature of the crust on the Ontong Java Plateau, that is, to establish the lithology, petrogenesis and sources of Ontong Java Plateau crustal material; (2) determine basement age and paleolatitudes of the Ontong Java Plateau to better understand the origin and movement of the plateau; and (3) compare the basement composition of the Ontong Java Plateau to that of the extensive "mid-Cretaceous" volcanic events of the Pacific to gain insight into the origin of both features.

DRILLING RESULTS

Leg 130 sailed from Guam on 23 January 1990 and drilled five sites on the Ontong Java Plateau to address these objectives (Fig. 2 and Tables 1 and 2). During the 62.7 days of Leg 130 operations, 51.2 days were spent on site while underway time added up to 11.5 days. Part of the underway time included seismic surveys over the drillsite locations.

Site 803

Location and Objectives

Site 803 is situated on the equatorial northeastern margin of the Ontong Java Plateau in 3415 m of water at latitude 2°26.0'N and longitude 160°32.5'E (Fig. 2). It was drilled as part of the Neogene depth transect to serve as a deep-water anchor site. The primary objective was to sample a section affected by substantial carbonate dissolution, yet sufficiently complete to provide a record of dissolution gradients, events, and cycles, which could be tied into a biostratigraphic framework. Other objectives were to provide Paleogene and Cretaceous sediments for paleoceanographic studies and to obtain basement rock in order to shed light on the origin of the Ontong Java Plateau. The site was located on an R/V *Thomas Washington* single-channel seismic (SCS) line acquired during the ROUNDABOUT cruise 11 "DANCER" survey between proposed sites OJP-4 and OJP-4B, upslope from a mid-section reflector (MSR).

Coring Results

Site 803 was occupied for 9.7 days. We cored a total of 991.3 m at four holes, 552.4 m by APC (103% recovery), 394.9 m by XCB (63% recovery), and 44 m by RCB (33% recovery). Total core recovery was 837.4 m. The four holes drilled were cored as follows: Hole 803A, APC 0 to 55.5 mbsf; Hole 803B, APC 0 to 61.3 mbsf; Hole 803C, APC 19 to 237.5 mbsf; Hole 803D, APC 0 to 217.1 mbsf, XCB 217.1 to 612.0 mbsf, RCB 612.0 to 656.0 mbsf.

The recovered sediments range in age from Pleistocene to early Late Cretaceous; they were divided into three units (Fig 4). The uppermost unit, Unit I, takes up most of the section (0-563.7 mbsf); it ranges from upper Eocene to Pleistocene and consists of nannofossil ooze and chalk to foraminifer nannofossil ooze and chalk. Unit II (563.7-621.8 mbsf) ranges from middle to upper Eocene and consists of approximately 58 m of nannofossil chalk with radiolarians, radiolarian nannofossil chalk, nannofossil radiolarite, and minor amounts of chert. Unit III (621.8-626.3 mbsf) ranges from lower Upper Cretaceous to middle Eocene and is composed of claystone and clayey siltstone, with minor radiolarian-rich intervals. Resistivity logs suggest that this lithology continues from 621.8 mbsf to basement at 630.4 mbsf.

The record is continuous from the Pleistocene to the lower Miocene where there is a significant stratigraphic break at 245.9 mbsf (15.9-21.3 Ma), the first of three major stratigraphic breaks encountered above the Cretaceous/Tertiary (K/T) boundary. The other two occur across the Paleocene/Eocene boundary (~45-~58 Ma), at 621.8 mbsf, and in the Paleocene (~58-~66 Ma) immediately below. The section below the K/T boundary, which was penetrated at 622.25 mbsf, is condensed and presumably also contains several substantial hiatuses.

In Unit I, the ooze/chalk transition occurs between 210 and 220 mbsf and provides the basis for division into Subunits IA and IB (Figs. 4 and 5). The logging data suggest that this transition extends over 60 m in the sedimentary column.

Subunit IA (0-217 mbsf) consists of nannofossil ooze, nannofossil ooze with foraminifers, and foraminifer nannofossil ooze. The foraminifer content is high in the Pleistocene and adjacent upper Pliocene ooze and decreases downhole through the first 30 to 60 mbsf, so that most of the subunit is nannofossil ooze. There is a slight increase in foraminifer content within upper Miocene sediments, somewhat below the middle of the section. Bioturbation is ubiquitous. Colors are dominantly various types of white and light gray; the Pleistocene section also exhibits colors with a yellowish hue. Faint green, purple, and red color bands are common, except in the upper middle Miocene nannofossil ooze (ca. 14 Ma to 10 Ma). These appear to have an origin analogous to "Liesegang" rings, which arise through diffusion along redox gradients surrounding objects containing reducing matter.

Sediment instability is indicated by microfaulted and discordant color banding at several levels in the section, especially in the lower Pliocene and uppermost Miocene ooze, but also within the upper and middle Miocene portions. One thin discrete ash layer is present in Unit I (at 181.2 mbsf in Hole 803D) that clearly ties the recovered section to the logging data.

Subunit IB (217-563.7 mbsf) consists of nannofossil chalk and nannofossil chalk with foraminifers. Its upper boundary is marked by a shift to higher velocity in the log data, with only one more low-velocity layer downhole, between 240 and 250 mbsf. Subunit IB is much like the younger Subunit IA, except for lithification. Colors are similar, as is intensity of bioturbation. Color banding appears in lower Oligocene sediments (ca. 420-520 mbsf). The bands become more abundant, more intense, and more distinct downhole in this interval. They are continuous across and through burrows.

Radiolarians are present in low proportions throughout the section, but their abundance never exceeds 7% in smear slides. Minor amounts of chert were recovered at 546.15 mbsf, in lowermost Oligocene sediments. A marked decrease in pore-water silica in the vicinity of this level indicates the onset of silica precipitation. Chert formation and enhanced grain cementation in the upper Eocene chalk is probably responsible for the local high-velocity layers detected in the logs at 521-541 mbsf, 546-558 mbsf, and below 564 mbsf.

Unit II (564-621.8 mbsf) consists of interbedded upper to middle Eocene nannofossil chalk with radiolarians, radiolarian nannofossil chalk, and nannofossil radiolarite. Drilling disturbance was significant in this unit. Minor amounts of chert were recovered. These lithologies produce distinctive records in physical properties, logging data, and seismic reflection profiles. Chert presumably is more abundant than the coring reveals: it may appear as a thin bed with high values in the resistivity log, with high sonic velocities, and may be responsible for a major reflector on seismic profiles at that depth.

Unit III (622-626.3 mbsf) is surprisingly thin for the age range (middle Eocene-early Late Cretaceous). It is composed of dark claystone and siltstone, predominatly by deep-sea siliciclastic sediments. Unit III also contains a complete Cretaceous/Tertiary boundary sequence as well as several major unconformities.

In Unit IV (630.4 - 656.0 mbsf), nine basalt subunits were recognized on the basis of intercalated limestones or breccias. Their age is Albian or older. The basalts are predominantly aphyric, fine-grained, and nonvesicular tholeiites. On-board XRF measurements indicate that the basalts are fairly well evolved and, in terms of their Zr/Nb ratio (14-17), distinct from both normal mid-ocean-ridge basalt (Zr/Nb > 30) and typical ocean island tholeiites (Zr/Nb commonly < 12) (Fig. 6). Slight compositional variations within the basalts suggest that they may have been derived from more than one parental magma.

Seismic Stratigraphy

Site 803 is characterized by a layer-cake seismic stratigraphy. The 14 reflectors (Fig. 7) that have been identified in the synthetic seismograms, generated from Site 803 physical property and logging data, almost exactly match those in the SCS survey profiles. While the regional and global significance of most of these reflectors must await more detailed shore-based study, it is possible to speculate on the paleoceanographic significance of some of the reflectors. Reflectors 3-1 and 3-2 (at 2.6 and 3.3-3.4 Ma, respectively) appear to be related to increases in carbonate preservation in the western equatorial Pacific and possibly linked to initiation of northern hemisphere glaciation and the increased activity of North Atlantic Deep Water (NADW) (cf. Mayer et al., 1986). In contrast, reflectors 3-a and 3-b (at 4.3 and 5.0 Ma, respectively) are believed to be indicative of dissolution events.

The winnowing suggested to be the possible cause for reflector 3-3 (at 8-8.1 Ma), as indicated by the high sand content at about 146 mbsf at Site 803, may be a regional phenomenon unrelated to a major paleoceanographic change. However, a similar winnowing event is indicated at DSDP Site 586 at about that time. Reflector 3-c (9.7 Ma) apparently coincides with a central-Pacific-wide reflector that has been linked to global oceanographic events, in particular major changes in NADW production. The same is true for reflector 3-4 (at 12.3-12.5 Ma; Mayer et al., 1986). Reflector 3-5 (at 15.1-15.5 Ma) coincides with a major hiatus. Reflector packages 3-6 and 3-7 are associated with generally high carbonate values characteristic of the deep carbonate compensation depth CCD in the Oligocene. The deepest reflectors, including 3-8 at the Eocene/Oligocene boundary, clearly represent major changes in productivity and dissolution at Site 803.

Sequence of Events

Widespread volcanism occurred in the region of the Ontong Java Plateau in Aptian-Albian time. At Site 803 on the flank of the plateau the relatively thin, pillowed nature of the flows suggests that their feeder vents were not very distant and that eruption rates were low. The severe alteration of the uppermost lava flow of Unit IV coupled with the absence of metalliferous sediments directly overlying the basalt indicates the presence of a hiatus of unknown origin and duration.

The depositional history at Site 803 began in the early Late Cretaceous with slow and/or discontinuous siliciclastic sedimentation below the CCD. Sedimentation apparently was continuous across the K/T boundary. The fact that these sediments are preserved is remarkable and calls for an explanation. We suggest early lithification. The presence of a major hiatus, occupying most of the Paleocene to early Eocene time, suggests erosional activity within or at the end of this period. The hiatus ended with the onset of pelagic sedimentation in the middle Eocene, suggesting a deepening of the CCD as well as the return of conditions favorable for the production and preservation of biogenic silica (cf. Berger and Winterer, 1974; van Andel et al., 1975). Since the late Eocene, carbonate deposition has dominated in this location. Sedimentation rates, about 7 m/m.y. during the middle Eocene, doubled in the late Eocene, to 15 m/m.y. at 40 Ma (Fig. 8).

Sedimentation at Site 803 increased across the Eocene/Oligocene boundary to over 25 m/m.y. into the early Miocene. Paleomagnetic analyses of the Oligocene sediments have resulted in a tentative magnetostratigraphy spanning Chrons 11 through 7. Preliminary analyses indicate a paleolatitude of 4.5°S for Site 803 during the Oligocene, which, in turn, suggests that the Ontong Java Plateau has been part of the Pacific plate for the last 30 m.y. In the early Miocene, another significant hiatus occurred that, based on extrapolation of sedimentation rates before and after the hiatus, extended from 20 to 15.5 Ma (NH2 of Keller and Barron, 1983). The sediments above the hiatus, of middle Miocene age, were deposited at rates between 10 and 15 m/m.y. The hiatus also may be partly related to a resurgence of transcurrent motion along nearby fracture zones caused by a change in Indo-Australia plate motion. This event, occurring roughly about 16 Ma, also resulted in renewed convergence along the Melanesian subduction zone (Manus-North Solomon-Uitiaz trenches) and a rejuvenation of volcanism along the Melanesian Arc (Kroenke, 1984).

In the late middle Miocene, ash erupted from a not-too-distant source, a source that also may have been responsible for the emplacement of a nearby mid-section reflector. Although possibly related to incipient Solomon Islands Arc volcanism, the ash more likely is the product of nearby tectonic volcanism, resulting from transtensive stress release, linked again to a resurgence of transcurrent motion along nearby fracture zones that was caused by still another change in Indo-Australia plate motion. The latter event, which occurred roughly about 10-12 Ma, also probably coincided with the formation of the new Solomon Islands subduction zone (along the New Britain-San Cristobal trenches; Fig. 1). In the late Miocene, sedimentation rates abruptly increased to between 20 and 25 m/m.y., with peak rates centered on ca. 7 Ma. In the Pliocene sedimentation rates decreased to 15 m/m.y., and in the Pleistocene they decreased still further to about 10 m/m.y. The magnetic stratigraphy shows that the decrease takes place at the base of the Olduvai Subchron (1.88 Ma).

Comparison of Site 803 with Sites 288, 289/586, and 462

Of the previously drilled sites on the Ontong Java Plateau, Site 289/586 is the nearest to Site 803 and contains the most complete and well-studied section. In comparing the sites, a few notable similarities were observed. The basement basalts at Site 803 are compositionally quite similar (at least in terms of Zr and Nb) to the basalt drilled at Site 289, as well as to the few analyzed basement lavas of Malaita (eastern Solomon Islands) and the basalt flows and sills drilled at Site 462 in the Nauru Basin northeast of the Ontong

Java Plateau. Numerous hiatuses were encountered in the lower Paleogene and Upper Cretaceous sections drilled at DSDP Sites 288 and 289 on the Ontong Java Plateau, which may well correlate with missing intervals at Site 803. These hiatuses may be associated with tectonic events that occurred around the region during Late Cretaceous and early Paleogene time. For example, hiatuses that occur deep in the section at Sites 288 and 289 may be related to the Campanian volcanic events recorded at Site 462 in the Nauru Basin (Moberly, Schlanger, et al., 1986). Early Paleogene hiatuses at all three sites may be related, in part, to the initiation of subduction along the Papuan-New Caledonia trenches and the end of seafloor spreading in Tasman and Coral Sea basins (Kroenke, 1984).

Concerning Paleogene sediments, it appears that similar conditions, favorable for the supply and preservation of silica, existed during the Eocene at Sites 803 and 289. Such conditions are typical of the entire Central Pacific (Berger, 1973; van Andel et al., 1975). Likewise, the Eocene record at both sites was interrupted by several intervals of erosion and/or nondeposition. The descriptions of the Neogene nannofossil oozes and chalks with their various subordinate components also are quite similar for these two sites. However, there are substantial differences in detail, especially with regard to sedimentation rates.

Differences may be summarized as follows. The basalts at Site 803 are pillow basalts that comprise many thin flows in contrast to the single massive flow drilled at Site 289. In the sediments, no chert was observed in the Miocene at Site 803, and the amount of chert encountered deep in the hole was minor in contrast to the massive cherts encountered at Site 289 in the middle Eocene-Upper Cretaceous section. A complete K/T transition sequence was found at Site 803 (albeit within a claystone-siltstone sequence) as opposed to the hiatus encountered at Site 289. Significantly, and in contrast to Site 289, no stratigraphic break was observed at the Eocene/Oligocene boundary at Site 803. On the other hand, sedimentation rates were higher at Site 289/586 than at Site 803, because of the shallower depth of the former (2200 m vs. 3400 m), and no Miocene hiatus was observed at Site 289/586.

When comparing overall sedimentation-rate patterns of Site 803 with those of Site 289/586, one notes striking changes in ratios for the Neogene sediments. This ratio ranges between 0.32 (for the lower Pliocene) and 0.77 (for the upper Miocene). Expressed inversely, the rates at Site 289 are higher by a factor of 3 and 1.3. Some of this variation is probably due to changing intensity of winnowing on the top of the plateau, but most of it must be ascribed to changing intensity of dissolution below 3000 m. If account is taken of the presence of hiatuses at Site 803, in the middle and lower Miocene, the overall ratio in sedimentation rate is approximately 60%. From this we estimate that more than one-half of the calcite which was supplied to the seafloor in the Neogene to Site 803 has been redissolved.

Site 804

Location and Objectives

Site 804 is located in the western-equatorial Pacific, on the northeastern margin of the Ontong Java Plateau (latitude 1°00.3'N, longitude 161°35.6'E, Fig. 2) in 3870 m of water 375 km east-northeast of DSDP Site 289/586. The objective in drilling this site was to obtain a continuous sedimentary record to serve as the deep-water end member on the Neogene depth transect, designed to recover depth-related paleoceanographic signals. It was anticipated that we would encounter a high-resolution carbonate record in a sub-lysoclinal setting for studies of dissolution and biostratigraphy.

We positioned the site using an R/V *Thomas Washington* single channel seismic (SCS) line acquired during the ROUNDABOUT Cruise 11, on the crossing SCS line of D/V *JOIDES Resolution*. The site is near the center of a slight depression about 4.5 km wide. The location is close to a significant offset in basement levels between the plateau and the deep ocean floor (Fig. 9). Episodic shaking from earthquakes, basement relief, and perhaps the presence of clay-rich layers at this water depth apparently create conditions favorable for large-scale slumping and debris flow on the flanks of the plateau. Removal of support at greater water depths, by carbonate dissolution, also may play a role in fostering mass movement (Berger and Johnson, 1976). Selection of a suitable site to drill was difficult under these conditions, and the site chosen was less than ideal for the purposes of the transect.

Coring Results

We spent 3.15 days on this site, coring 498.9 m of sediment, and recovering 465.9 m. Three holes were drilled. Hole 804A, a dedicated hole, was APC cored to 48.7 mbsf into upper Miocene sediments with 104% recovery. Hole 804B was APC cored to 137.7 mbsf into middle Miocene sediments with 103% recovery. It was abandoned when the core barrel became stuck in the hole. Hole 804C was APC cored to 120.3 mbsf, with a recovery of 100% on average. Below this depth coring by XCB proceeded to 312.5 mbsf where it terminated in lower Oligocene sediments. Average recovery for the XCB section was 80%. There was no logging.

The sediment retrieved is Neogene in age, except for the five deepest cores in Hole 804C, which recovered upper Oligocene chalk (Cores 130-804C-29X to 130-804C-33X). The entire column, from the earliest deposits to the seafloor, was classified as nannofossil ooze and chalk and is considered as one lithologic unit (Fig. 10). Major breaks are in the upper Oligocene (hiatus at 270 mbsf, 28.2-25.2 Ma) and at the lower to middle Miocene transition (hiatus at 197 mbsf, 18.6-14.6 Ma).

There is a condensed section or hiatus in the lower Pliocene, between 5 and 4 Ma (46 to 43 mbsf), and possibly within the middle Miocene, between 13 and 11 Ma (near 160 mbsf). Disturbance of layers (other than from coring) is evident in the section spanning the major hiatus from the lower to middle Miocene (210 to 187 mbsf) and between 42 and 110 mbsf (most of the upper Miocene). It is especially prominent between 70 and 80 mbsf (7-8 Ma).

Two subunits were recognized in this rather uniform section of bioturbated ooze and chalk. They are separated by the ooze/chalk transition at 181 mbsf (middle Miocene, ca. 13 Ma; Figs. 5 and 10).

The younger section of the unit (Subunit IA, 0-181 mbsf) comprises Pleistocene to middle Miocene nannofossil ooze with foraminifers, nannofossil ooze, and nannofossil ooze with radiolarians. The oozes are light brown in the top 20 to 40 mbsf, grading into white ooze, with color banding (related to "Liesegang" diffusion rings) down to 100 mbsf. The banding (green and reddish hues) is best expressed between 44 and 59 mbsf (uppermost Miocene and lowermost Pliocene) and is well developed between 71 and 90 mbsf. Banding is disrupted and distorted in the disturbed layers mentioned, within sediments of latest Miocene age (ca. 7 to 8 Ma). Two turbidites near 93 mbsf attest to redeposition within the middle upper Miocene (ca. 11 Ma).

The older portion of the unit (Subunit IB, 181-312.5 mbsf) consists of middle Miocene to upper lower Oligocene nannofossil chalk and nannofossil chalk with radiolarians. Colors are yellowish white, pale brown, and white. Radiolarian-bearing sediments are common in this subunit, with a strong radiolarian maximum in the lower Miocene (near 200 mbsf), just below the lower/middle Miocene hiatus. Also at this depth are indications of ooze/chalk clasts and distorted bioturbation features, as mentioned.

Seismic Stratigraphy

Seismic profiles across the site show the effects of mass movement. These profiles exhibit incoherent crenulate reflections at several levels, as well as evidence for wedging along the basin margins (Fig.9). Disturbance is first clearly noticeable at 0.05 seconds two-way traveltime (sbsf; ca. 40 mbsf) from the seafloor, where part of the section seems to be condensed or missing. At that level, or slightly below, is an unconformity which is expressed as a termination of tilted deeper reflectors against the overlying section (upper conformity; Fig 9). Disturbance continues down to 0.1 sbsf (ca. 80 mbsf) but may include the next deeper interval (to 0.12 sbsf) as well. This would correspond to the disruptions seen in the cores, especially at 70 to 80 mbsf (7 to 8 Ma), in the upper portion of the tilted block comprising the upper and middle Miocene section.

Disturbance is again seen in the lower part of the block, near 0.21 sbsf (ca. 170 mbsf). At 0.22 sbsf is a strong reflector, which is weakly developed outside the depression. Here within the graben it is bowl shaped and concentrates energy. This reflector coincides with, or is situated immediately above, the ooze/chalk transition as located in the cores. The lower boundary of the tilted block is probably a slip plane at 0.23 sbsf (lower unconformity; Fig. 9). In the cored sediments there is a major hiatus at this level (197 mbsf, 18.6 to 14.6 Ma). On either side, groups of reflectors are disrupted, presumably from mass movement. This series of strong reflectors probably represents ooze/chalk alternations in the lower Miocene.

The Miocene/Oligocene hiatus is well expressed as a strong double reflector, with the first return at 0.30 to 0.31 sbsf (ca. 270 mbsf). Judging from the lack of strong reflectors below, a section of more than 100 m of lower Oligocene sediments might be expected here, with the (unconformable) Eocene/Oligocene boundary appearing near 0.42 sbsf. If so, another 200 m or perhaps 250 m of sediment (depending on the basement pick) would be expected in this graben above basement. The first strong deep reflector (at 0.48 sbsf) presumably would mark the location of Eocene limestone and chert. Outside of the basin the apparent paucity of pre-Oligocene deposits would suggest widespread erosion early in the Cenozoic, and in the Late Cretaceous, as was the case at Site 803.

There is some indication that disturbance is associated preferentially with certain layers. This gives rise to a hypothesis that such layers may be predisposed, through conditioning during deposition, to serve as slip planes later. Inasmuch as hiatus formation is contingent on paleoceanographic events, the tracing of these features by seismic profiling should yield valuable information on the nature of such events (Mayer et al., 1986).

Special Studies

Physical properties, including wet-bulk density and sound velocity, show greater variability at this site than at Site 803. Distinct minima in density occur near or within the intervals identified to have hiatuses.

Chemical gradients in interstitial waters at this site are generally similar to those at Site 803, reflecting the calcareous/siliceous nature of the sediments and the paucity of organic material. Calcium and magnesium gradients are influenced by basalt-alteration reactions at depth and show the usual negative correlation ($R^2 = 0.97$). Strontium concentrations are lower than at Site 803, presumably reflecting diminished recrystallization intensity at Site 804. Dissolved silica increases with depth, indicating continuing dissolution of siliceous fossils. Near-maximum levels are reached at 100 mbsf, suggesting that below that level dissolution is reduced or balanced by precipitation.

Comparison of detailed paleomagnetic stratigraphic profiles for Pliocene-Pleistocene sediments in the three holes allows detection of small changes in sedimentation rates and of between-hole variation. There appears to be a small decrease in rate at the Pliocene/Pleistocene boundary, from 11.6 m/m.y. to 9.8 m/m.y. (Figure 11).

Sequence of Events

Faulting presumably started during initial cooling and sinking of the newly formed crust, early in the history of the plateau. This faulting initiated the basin within which lower Cenozoic (and perhaps upper Cretaceous) sediments are preserved, as seen on the seismic profiles. Elsewhere in the area erosion prevented deposition, or removed much sediment, in pre-Oligocene time. With the downward excursion of the CCD in the latest Eocene (Berger and Winterer, 1974), conditions became favorable for accumulation of calcareous sediments so that a continuous record could be generated in principle, albeit at moderately low sedimentation rates (ca. 10 m/m.y. overall).

At some time in the earliest Miocene, upper Oligocene sediments were removed. Low carbonate values near the Oligocene/Miocene boundary suggest that chemical erosion played a role in this process. Despite the high carbonate values in the lower Miocene sediments (commonly >85%), dissolution apparently was important in keeping sedimentation rates low: there are zones with greatly reduced foraminifer content. Radiolarian abundances became quite high at times. In the latest early Miocene (just below the hiatus at 197 mbsf in cores from the site) foraminifer-poor and radiolarian-rich ooze was deposited. After that time on silica deposition seems to have waned, as silica is sequestered into the margins and into high-latitude sinks, which become active owing to the general cooling since 16 Ma. At this point foraminifers also begin to become more abundant, with a peak near 10 Ma, and a sustained increase since the end of the Miocene.

The increase in foraminifers, and hence the possibility of fluctuations in sand content, has important implications for the development of certain physical properties in the uppermost Cenozoic sediments, which in turn control acoustic stratigraphy. There is little doubt that the increase in sand content parallels an increase in upwelling and hence foraminifer productivity. The question is why nannofossil supply does not keep pace. Increased winnowing and improved carbonate preservation must be considered also when trying to explain these patterns (Johnson et al., 1977; Wu and Berger, 1989).

Comparison with Sites 803 and 289

The lithology of Site 804 is the same as that of Site 803, where it prevails down into the upper Eocene. The carbonate content at Site 803 is somewhat higher on average. From the base of the upper Miocene upward, both sites show roughly the same pattern regarding trends in foraminiferal and radiolarian abundance. However, the high radiolarian abundances in the middle and lower Miocene of Site 804 do not seem to have a counterpart at Site 803. Thus, considering the distinctly lower carbonate values at Site 804 in the radiolarian-rich zones, it appears that the difference is due mainly to enhanced carbonate dissolution at Site 804 at those periods.

At DSDP Site 289 the equivalent section to that cored at Site 804 is nannofossil-foraminifer ooze and interbedded nannofossil-foraminifer ooze and nannofossil-foraminifer chalk. The facies (Unit 1) extends down into the lower Oligocene, where it terminates at a hiatus with upper Eocene limestone and chalk (Andrews, Packham, et al., 1975). Foraminifers are much more abundant at Site 289 than at Site 804. Two processes must be considered: increased winnowing at the depth of Site 289 (2200 m) and the destruction of tests at the depth of Site 804 (3870 m). Radiolarian content is low throughout Unit 1 of Site 289. However, in lower Miocene sediments, radiolarian concentrations are somewhat increased, just as they are at Site 804.

The ooze/chalk transition was located at 181 mbsf at Site 804 (Fig. 5). It is shallower here than at Site 803 (217 mbsf) but has about the same age (13-14 Ma), supporting the hypothesis of Schlanger and Douglas (1974) that age (that is, conditioning during deposition) is an important parameter in the rate of lithification. At Site 289, the transition was found near 350 mbsf in sediments that are somewhat younger (12-11 Ma). Thus, a distinctly increased overburden may accelerate the process of lithification, but not all that much.

Sediments from Site 804 exhibit a number of breaks in the stratigraphic record (near 4.5 Ma, possibly near 12 Ma, between 18.6 and 14.6 Ma, and between 28.2 and 25.2 Ma; Fig. 11), one of which is close to a hiatus at Site 803 (21.3-15.5 Ma). This hiatus apparently is correlative with NH2 of Keller and Barron (1983). There may be a condensed section in the uppermost lower Miocene of Site 289, which overlaps somewhat with the hiatus seen at Site 804. Rates of accumulation are about 10% lower at Site 804 than at Site 803 on the whole, in keeping with the greater depth of Site 804. In addition, about 10% of the sediment column is missing at Site 804, compared with Site 803, above the early to middle Miocene hiatus. Compared with those of Site 289, sedimentation rates of Site 804 are lower by a factor of 2 to 3, not counting the effect of hiatuses. This would suggest that more than one-half of the carbonate at Site 804 has been removed by dissolution on average. Thus, the high carbonate values here are not due to the lack of dissolution but to the lack of dilution by non-calcareous particles.

Site 805

Location and Objectives

Site 805 is located in the western-equatorial Pacific, on the northeastern margin of the Ontong Java Plateau (latitude 1°13.7'N, longitude 160°31.8'E; Fig. 2) in 3188 m of water. The objective in drilling this site was to obtain a continuous record to serve as the intermediate member of a depth transect of Neogene sediments, designed to recover depth-related paleoceanographic signals. It was anticipated that we would encounter a high-resolution carbonate record in a near-lysoclinal setting for studies of dissolution history and biostratigraphy.

Positioning was based on two crossing single-channel seismic (SCS) lines acquired by the R/V *Thomas Washington* during the ROUNDABOUT Cruise 11 (2130 UTC 24 December 1989 and 1700 UTC 25 December 1989; see Fig. 12 for D/V JOIDES Resolution seismic line of this area). The site lies within a gently sloping valley about 3.5 km wide, and flanked by low ridges along either side. The seismic profiles show continuous reflectors, with little or no disturbance.

Coring Results

We spent 6.17 days on this site, drilling three holes and coring 1134.8 m of sediment, of which 992.6 m was recovered. Hole 805A, a dedicated hole, was APC cored to 50.5 mbsf into upper Pliocene sediments, with 103% recovery. Hole 805B was APC cored to 263.2 mbsf, where refusal occurred at the boundary between upper and middle Miocene sediments; recovery was 103%. The hole was continued by XCB coring to 473.3 mbsf, with 210.1 m of sediment cored and 173.6 m recovered (83% recovery). Coring was terminated about halfway through a thick section of lower Miocene sediments. Hole 805C was APC cored to 235.8 mbsf (100% recovery), at which point XCB coring was initiated. Drilling terminated in upper Oligocene sediments at 611.0 mbsf, with 80% recovery in the XCB-cored interval. The hole then was logged.

The sediment retrieved is Neogene in age except for the nine deepest cores in Hole 805C, which recovered Oligocene chalk. The entire column, from the earliest deposits to the seafloor, is considered one lithologic unit (Fig. 13) and was classified as nannofossil and foraminifer-nannofossil ooze and chalk. The average sedimentation rate over the entire interval is estimated at 21.5 m/m.y. No stratigraphic breaks were detected. However, sedimentation rates fall to rather low values (below 10 m/m.y.) between 10 and 18 Ma (Figure 14).

Two subunits were recognized in this quite uniform section of bioturbated ooze and chalk. They are separated by the ooze/chalk (Figs. 5 and 13) transition at 282.5 mbsf in Hole 805B (base of Core 130-805B-30X) and at 293.7 mbsf in Hole 805C (base of Core 130-805C-31X) (upper middle Miocene, ca. 11.4 Ma). The transition is gradational and shows alternating layers with varying degrees of lithification.

The younger section of the unit (Subunit IA, 0-290 mbsf) comprises Pleistocene to middle Miocene nannofossil ooze, nannofossil ooze with foraminifers, and foraminifer-nannofossil ooze. Radiolarian content is low on the whole. The oozes are light gray in the top 30 mbsf, grading into white. Color banding is common throughout the unit and is especially well expressed in the uppermost Miocene. For the most part, color bands are coarse and irregular in Subunit IA. Some large burrows have well-developed concentric color rings ("Liesegang" rings), indicating redox gradients as the cause for color banding. Microfaulting was observed in Core 130-805B-18H at 166 mbsf (middle upper Miocene), and tilting of color bands is seen at the middle/upper Miocene boundary.

Sediments are generally soft, but in the lowermost part of Subunit IA (283-293 mbsf) more lithified intervals appear. A shift toward higher velocities occurs near the top of that zone, and another at the ooze/chalk transition at about 294 mbsf.

The older section of the unit, Subunit IB (290-611 mbsf), consists of 317 m of nannofossil chalk, nannofossil chalk with foraminifers and foraminifer-nannofossil chalk, of middle Miocene to late Oligocene age. The color is dominantly white. Color banding occurs throughout but becomes rare below 504 mbsf, in the lowermost Miocene. It includes bundles of pseudo-laminae, that is, fine-scale "Liesegang" banding showing sharp individual boundaries. Microfaulting is generally absent except near 310 mbsf (ca. 12 Ma), near the top of the subunit.

Recovery in the chalk subunit was good down into lower Miocene sediments. Here it dropped noticeably below 450 mbsf (Core 130-805C-47X) and became quite poor below 520 mbsf (Core 130-805C-55X), near the Oligocene/Miocene boundary. Even where recovery was very good, core contents are largely disjointed chunks and chips, with evidence for grinding of chalk on chalk. This type of recovery is typical for the material below 370 mbsf. The Oligocene/Miocene boundary is located near 525 mbsf and apparently is without hiatus. Sedimentation rates for the deep chalk section are typically between 10 and 20 m/m.y.

Special Studies

Paleomagnetic stratigraphies were produced for the uppermost section of Holes 805B and 805C. Only the Brunhes Chron and part of the Matuyama could be identified. The sedimentation rate since 1.7 Ma was determined to be 17.1 m/m.y. (Figure 14).

Chemical gradients in interstitial waters at this site are generally similar to those at Sites 803 and 804, reflecting the calcareous/siliceous nature of the sediments and the paucity of organic material. A somewhat higher supply of organic matter at this shallower site, perhaps because of the shallower depth, tends to produce slightly stronger gradients. Calcium and magnesium gradients are influenced by basalt-alteration reactions at depth and show the usual negative correlation. Strontium concentrations reflect recrystallization processes, that took place in younger sediments at this site than at the other two, owing to the higher sedimentation rates. Dissolved silica shows a steady increase with depth, except for a minor reversal of this trend just above the ooze/chalk transition.

Seismic Stratigraphy

Site 805 was the first of the Leg 130 sites to deliver a complete record without hiatuses. It is therefore of great interest with respect to a central objective of the leg: to determine the nature of the acoustic reflectors seen on seismic profiles. Guidance in attempting this is provided by the velocity and density profiles recovered during logging, and by the age control provided by biostratigraphy.

A great number of reflectors are observed in the profile taken by the R/V *Thomas Washington* during the ROUNDABOUT pre-site survey (Fig. 15). Depth assignment and dating show that at least some reflectors are associated with paleoceanographic events, as suggested by Mayer et al. (1986) for the central equatorial Pacific. They proposed the closing of the Panama Isthmus, reorganization of deep circulation in the Atlantic, climatic events surrounding the Antarctic, and the opening of Drake Passage as important paleoceanographic themes reflected in the acoustic properties of Pacific pelagic sediments. Accordingly (but without prejudging the question about origins) we refer to reflectors of age 2 to 4 Ma as "Panama series," to those of age 10 to 19 Ma as "Antarctic series," and to those of age 19 to 23 Ma as "Drake series." These ages are approximate: the criterion is grouping, not dating. The advantage of considering groups of reflectors rather than single members is that the variability of properties within a given section is being addressed rather than an individual excursion of velocity and/or density within the sediment profile.

The interval between the Panama reflectors and the Drake reflectors is the "Tethys interval," containing sediments deposited during mountain building in the closing Tethys belt. Below the Drake series is an acoustically quiet zone, the "Texas interval", named in appreciation of Texan know-how in deep-sea drilling, which saved enough time to allow entering this zone on several occasions during Leg 130. Below that is the "Ontong Java series", a group of strong reflectors, ubiquitous on the plateau, which derives from impedance change owing to limestone and chert formation.

The Panama series contains reflectors dated near 2, 2.4, and 3.7 Ma. The age of 2.4 Ma corresponds to a deep-water cooling event and the onset of North Atlantic ice buildup (Backman, 1979; Shackleton et al., 1984). The reflectors dated at 2.4 Ma and at 3.7 Ma can be identified in the seismic record across DSDP Site 586 (near Site 289) using the velocity profile provided by the logging of DSDP Site 586 (Moberly, Schlanger, et al., 1986). The Tethys interval (Fig. 15) contains a number of lesser reflectors, one of which apparently corresponds to lithification (near 210 mbsf, age 7 Ma). The presumed condensed section near 10 Ma has a less than prominent group of reflectors at the base of the Tethys interval (270 to 290 mbsf). Also, the ooze/chalk transition does not seem to be strongly expressed, although it is possible to find reflecting horizons in the vicinity of 290 mbsf.

The next group of strong reflectors, going downsection in Figure 15, is the upper part of the Antarctic series, centered on the middle Miocene (13 Ma). It starts with a distinct reflector between 310 and 320 mbsf (dated 12.5-13 Ma). The lower part of this series is somewhat weaker and belongs to the lowermost middle Miocene and uppermost lower Miocene (360 to 385 mbsf; 15-18 Ma). This entire zone is characterized by major climatic change and associated excursions in carbonate content and other sediment properties (Barron et al., 1985). These changes presumably are associated with the onset of Antarctic Bottom Water production at that time. The group of reflectors immediately below the Antarctic series, the Drake series, has the strongest reflector members. Ages range from about 18.5 Ma for the uppermost of the group (390 mbsf) to 22 Ma for the deepest (460 mbsf).

Below this group there is a thick section, the Texas interval (up to 180 m thick), which is more or less transparent acoustically. The reason for this is the absence of rapid change in sediment properties within the lower-most Miocene and upper Oligocene sediments. This zone is also noted by the biostratigraphers for the paucity of evolutionary events. One lone reflector (Fig. 15; 520-530 mbsf, ca. 23.6 Ma) appears to mark the Oligocene/Miocene boundary. Below this interval, there is a group of strong reflectors, the Ontong Java series, which is thought to represent the change from chalk to limestone in the lowermost Oligocene, and--somewhat deeper in the section--the occurrence of chert. The thickness of this acoustic unit is on the order of 100 m. Another 50 m or so down, acoustic basement is reached, probably consisting of basalt, but perhaps of chert and limestone.

In summary, the results of Site 805 support, in a general way, the hypothesis that many reflectors represent the effects of global paleoceanographic events and can be correlated across the tropical Pacific. Other reflectors, however, may be regionally strong expressions of minor events or may be related to diagenetic processes which are not synchronous.

Rates of Sedimentation

The oldest sediments cored, at 611 mbsf in Hole 805C, were of latest early Oligocene age (Zone NP23). The distance to acoustic basement below this level may be estimated as approximately 0.15 s two-way traveltime, which corresponds to roughly 190 m of sediment at that depth. If this is all the sediment there is, considerable hiatus formation in the early Paleogene and Cretaceous would seem to be indicated, assuming that the uncored section represents at least 80 m.y.of time.

Since early Oligocene time, Site 805 has received nannofossil ooze, with rather minor admixtures of siliceous fossils. Sedimentation rates typically varied between 15 m/m.y. (late Oligocene) and 40 m/m.y.(late Pliocene/late Miocene), with the overall average being near 20 m/m.y. A spike in sedimentation rate apparently occurs between 8 and 5 Ma (uppermost Pliocene) and coincides with the site crossing of the equator (Fig. 14).

Comparisons with Sites 803, 804, and 289

The lithology of Site 805 is the same as that of the comparison sites. The carbonate content at Site 805 typically reaches values above 90% throughout the section except in the Pleistocene portion and at the upper and lower boundaries of the middle Miocene. In the Pliocene values hover about 90%. The carbonate stratigraphy of Site 803 is quite similar in long-term trends as well as in some of the detail. Site 804 also has similar trends, although they are disturbed there by hiatus formation. On the whole, percentages are between 5% and 10% lower and fluctuate more strongly than in Site 805.

Mean grain size is typically between 12 and 25 µm at Site 805, with maxima near the Pleistocene/Pliocene boundary and in the uppermost and lowermost upper Miocene. Minima occur in the middle of the lower Pliocene and in the upper half of the upper Miocene. No measurements are available for pre-mid-Miocene sediments. Patterns are quite different for Sites 803 and 804. Site 803 had distinctly higher values in post-Miocene time despite its greater depth and lower sedimentation rate. Dissolution should decrease sand content there (Johnson et al., 1977), so differences in local winnowing, or in the rate of receiving fines from upslope areas, may be indicated. In the upper Miocene the situation is reversed: Site 805 has the coarser sediments. This is as expected if dissolution effects dominate. Site 804 has mean grain sizes which are quite comparable to those of Site 805 except for a pronounced coarsening in the section surrounding the hiatus in the lower Pliocene.

Smear-slide abundance patterns of the major fossil groups--nannofossils, foraminifers, radiolarians--are quite similar between Sites 803 and 805. To establish differences, a more quantitative analysis than was done on board will be necessary. Site 804 patterns are quite different, presumably owing to dissolution of carbonate and hiatus formation there. At DSDP Site 289, foraminifers are much more abundant than at Site 805 (Andrews, Packham, et al., 1975). Several processes must be considered: increased winnowing at Site 289 (2200 m), and the destruction of tests and delivery of upslope fines at the depth of Site 805 (3200 m). Radiolarian content is low throughout in Unit 1 of Site 289.

The ooze/chalk transition (Figs. 5 and 13) lies at 290 mbsf (ca. 11-11.5 Ma) at Site 805. It is deeper and younger here than at Site 803 (217 mbsf, ca. 14-14.5 Ma) but shallower than at Site 289 while being roughly synchronous with it (350 mbsf, ca. 11.5 Ma). Thus, the comparison of Site 805 with Site 289 supports the hypothesis of Schlanger and Douglas (1974) that age (that is, conditioning during deposition) is an important parameter in the rate of lithification; the comparison with Site 803 does not. It appears that a distinctly increased overburden may accelerate the process of lithification, but not all that much.

Rates of accumulation were about 10% to 30% lower at Site 805 than at Site 289, on the whole, in keeping with the greater depth of Site 805. The rates were distinctly higher than at Site 803 by a factor of between 1.2 (upper Miocene) and 1.9 (early Pliocene, middle and early Miocene). For Pleistocene sediments, rates are unusually low at all three sites (805, 803, 289). Also for this period, the sedimentation rate of Site 805 actually exceeded that of Site 289. This suggests strong winnowing during this period, with downslope transport of fine material presumably mitigating the winnowing effect at Site 805.

Site 806

Location and Objectives

Site 806 is located on the northeastern margin of the Ontong Java Plateau, close to the equator (latitude 0°19.1'N, longitude 159°21.7'E; Fig. 2) in 2523 m of water. The site represents the shallow end member on a transect which was designed to detect depth-related paleoceanographic signals in Neogene sediments. The objective in drilling at this location was to obtain a continuous record in an undisturbed setting, with maximum sedimentation rates, which could serve as a standard section against which all others could be measured. The setting was considered ideal for high-resolution studies of ocean history, including biostratigraphy, chemo-stratigraphy, and acoustic stratigraphy. This expectation proved well founded.

Positioning was based on a single-channel seismic (SCS) line acquired by the R/V *Thomas Washington* during the ROUNDABOUT Cruise 11 (0600 UTC 21 December; see

Fig. 16 for D/V JOIDES Resolution seismic line of this area). The site is at the proposed location OJP-1 on a 2-km-wide terrace interrupting a gentle incline sloping to the northeast. The sedimentary sequence apparently is complete and undisturbed, with the seismic profile showing a full set of reflectors which are readily correlated with those at Site 289/586.

Coring Results

We spent 7.9 days on this site, drilling three holes, and coring 1414.4 m of sediment of which 1275.9 m was recovered. Hole 806A, a dedicated hole, was APC cored to 83.7 mbsf into upper Pliocene sediments with 103% recovery. Hole 806B was APC cored to 320.0 mbsf, where refusal occurred, within the lower upper Miocene; recovery was 105%. The hole was continued by XCB coring, to 743.1 mbsf, with 423.1 m of sediment cored and 331.2 m recovered (78.3% recovery). Coring was terminated within lowermost Miocene sediments, when the objective (recovery of the Neogene section) was judged to have been reached. The hole was then logged, with the pipe pulled to 92 mbsf. Hole 806C was APC cored to 309.6 mbsf (103.6% recovery), at which point XCB coring was initiated. Cores were taken from 309.6 to 541.7 mbsf; from that point, we drilled ahead with a center bit to 599.0 mbsf, where a spot core was taken to obtain sediments from an interval with poor recovery in Hole 806B. A full core was obtained. Drilling then was then with a center bit, to 740 mbsf, at which point four cores were taken (740.0 to 776.4 mbsf), spanning the Oligocene/Miocene boundary. The XCB coring operation drilled 278 m and recovered 203 m of sediment (73% recovery) at this hole.

The sediment retrieved is Neogene in age, except for the four deepest cores in Hole 806C, which recovered Oligocene chalk (Cores 130-806C-59X to 130-806C-62X). The entire column, from the earliest deposits to the seafloor is considered as one lithologic unit (Fig. 17) and was classified as foraminifer nannofossil ooze and chalk to nannofossil ooze and chalk with foraminifers. No stratigraphic breaks were detected; apparently depositional history was continuous from the late Oligocene (ca. 27 Ma) to the present. The average sedimentation rate over the entire Neogene may be estimated at 31.6 m/m.y, the highest of any site drilled on Leg 130. Depending on assumptions made about the age of biostratigraphic tie points, the range of fluctuation lies between 15 and 55 m/m.y., or between 20 and 45 m/m.y. (Fig. 18).

Two subunits were recognized in this rather uniform section of bioturbated ooze and chalk, on the basis of degree of consolidation. They are separated by the ooze/chalk transition, placed at 339.4 mbsf in Hole 806B (Core 130-806B-37X), and at 338.5 mbsf in Hole 806C (Core 130-806C-37X) (lowermost upper Miocene, ca. 10 Ma). The transition is gradational and shows alternating layers of varying degree of lithification, beginning at about 200 mbsf in both holes, looking downhole.

The younger section of the unit (Subunit IA, 0-339 mbsf) comprises Pleistocene to upper middle Miocene foraminifer nannofossil ooze to nannofossil ooze with foraminifers. Foraminifer content is significantly higher than at previous Leg 130 sites (Sites 803-805) and is estimated as between 15% and 30%, on average. Radiolarian content is low. Bioturbation is common throughout; it appears to be more strongly expressed than at the previous sites. "Liesegang" banding is common throughout the subunit, although it appears to be fainter and more diffuse in appearance than at Sites 803 to 805. The best examples are near the bottom of the subunit. Authigenic pyrite was found associated with burrows, and a slight odor of H_2S was noted on occasion upon opening the cores. Microfaulting was rare. Sediments are generally soft, but in the lowermost part of Subunit IA more lithified intervals appear (below 200 mbsf). Coring was impeded in one instance owing to porcellanite nodules (310 mbsf, ca. 8.2 Ma, Core 130-806C-34X) near the level of APC refusal. The shallowest porcellanite nodules were found at 240 mbsf (ca. 6.7 Ma). A marked change in the velocity depth gradient (associated with a brief reversal) occurs just above this depth level (at 220 mbsf). At the ooze/chalk transition (339 mbsf), the character of the velocity profile changes: above this level high-frequency variations are pronounced; below it, they are indistinct.

The older section of the unit, Subunit IB (339-776.4 mbsf), consists of 436 m of foraminifer nannofossil chalk to nannofossil chalk with foraminifers, with a few intervals of nannofossil chalk, ranging from the lower upper Miocene to the upper Oligocene. Foraminifer content is high down to about 600 mbsf (ca. 20 Ma) and decreases below that level. Radiolarian content is low throughout. The color is predominantly white. Color banding occurs throughout; bands become thinner and more distinct with depth in the subunit. Small-scale flaser bedding is present. Bioturbation is ubiquitous. Rare, centimeter-size porcellanite nodules were observed at several levels (350 mbsf, 510 mbsf). The depth gradient of dissolved silica is reduced at 350 mbsf and between 450 and 550 mbsf, possibly in response to precipitation.

The sediments in the chalk section posed no problem for XCB coring down to the Oligocene/Miocene boundary zone, where recovery decreased. However, even where recovery was very good the chalk was broken up by drilling, with evidence for grinding of chalk on chalk. This type of recovery is typical for the material below 320 mbsf, that is, the XCB-cored section. The Oligocene/Miocene boundary lies between 740 and 750 mbsf and apparently is without hiatus (although recovery is poor at this level). Sedimentation rates for the deep chalk section vary between 20 and 30 m/m.y., the same as for the upper portion of the chalk subunit.

Special Studies

Paleomagnetic stratigraphic determinations were attempted for the uppermost section of Holes 806B and 806C. The Brunhes/Matuyama boundary could not be identified. However, magnetic susceptibility seems to be measurable well into the Pliocene, opening the possibility for the study of Milankovitch-type cycles using magnetic properties.

Chemical gradients in interstitial waters at this site are generally similar to those at Sites 803 to 805, reflecting the calcareous/siliceous nature of the sediments and the paucity of organic material. A somewhat higher supply of organic matter at this site, presumably owing to the shallower depth, tends to produce slightly stronger gradients. Sulfate concentrations especially show this influence of organic supply and decrease by almost 50% over the length of Hole 806C, with most of the decrease occurring by 222 mbsf. Alkalinity increases correspondingly in the upper section but decreases below 250 mbsf presumably in response to precipitation of carbonate. Calcium and magnesium gradients are influenced by basalt-alteration reactions at depth and show the usual negative correlation. Strontium concentrations reflect recrystallization processes, which apparently are more vigorous here than at the previous sites, owing to the higher sedimentation rates. Dissolved silica shows a steady increase with depth except for a minor reversal of this trend near the ooze/chalk transition (350-360 mbsf).

Excellent logs were obtained for sound velocity and density at Site 806. The fact that this site is characterized by continuous sedimentation makes these logs especially valuable. Laboratory velocities and bulk densities provide control for the upper part of the record, which could not be logged. Bulk density and sound velocity increase with depth more or less as expected. Bulk-density values are near 1.6 g/cm^3 at 100 mbsf and increase to 1.9 g/cm^3 by 700 mbsf. If expressed as average density increase per age interval (0.15 g/cm^3 per 10 Ma), the overall gradient is exactly identical to that of Site 586. It is noticeably higher than that of Site 805, which has a distinctly lower sedimentation rate. Thus, both depth of burial and age govern this parameter. Sound velocity is 1.65 km/s at 100 mbsf, and increases by 0.13 km/s per 100 m down to 250 mbsf, where the gradient changes to 0.18 km/s per 100 m. The stronger gradient presumably shows the effects of carbonate precipitation below 250 mbsf, as seen in the interstitial water measurements.

Seismic stratigraphy

Site 806 is the site with the highest sedimentation rate of Leg 130 sites and has a complete record, without hiatuses. As is true for Site 805, this site is therefore of great interest with respect to a central objective of the leg: to determine the nature of the acoustic reflectors seen on seismic profiles. Guidance in attempting this is provided by the velocity profile recovered during logging and by the age control provided by biostratigraphy.

The reflector groups identified at Site 805 can also be recognized at Site 806, in the seismic profiles taken by R/V *Thomas Washington* during the ROUNDABOUT pre-site survey (Fig. 19). In addition, there are others not seen at Site 805. Dating shows that at least some reflectors are associated with paleoceanographic events, as suggested by Mayer et al. (1986) for the central equatorial Pacific. They proposed the closing of the Panama Isthmus, reorganization of deep circulation in the Atlantic, climatic events surrounding the Antarctic, and the opening of Drake Passage as important paleoceanographic themes reflected in the acoustic properties of Pacific pelagic sediments. The names for three reflector groups were chosen for these propositions (without necessarily implying endorsement). The advantage of considering groups of reflectors rather than single members is obvious: it is the variability of sediment properties within a given section that is being addressed rather than an individual excursion of velocity and/or density. For an explanation of the names "Tethys interval" and "Texas interval," see Site 805 earlier in this report.

The match of reflectors shown in Figure 19 is readily obtained by assuming that the traveltime to equivalent reflectors of Site 806 is 1.37 times that in Site 805. The success of the match allows dating by correlation and also allows the statement that sedimentation rates between these two sites are likely to differ by a certain factor for the entire Neogene and Oligocene. This result is quite surprising, considering that the effects of dissolution are thought to be responsible for the difference in overall sedimentation rate and that dissolution intensity might be expected to have a long-term trend, producing a corresponding trend in differences in sedimentation rates.

The general match proposed in Figure 19 predicts that the age of 22.0 Ma found at

0.50 sbsf at Site 805 should appear at 0.685 sbsf at Site 806 (0.5•1.37), which corresponds to 676 mbsf, using a generalized velocity profile for Site 806 (based on logging). In fact, the biostratigraphic age of 22.0 Ma at Site 806 appears at 665 mbsf (with an uncertainty of 5 m). At 676 mbsf (the guess) the age is 22.3 Ma according to shipboard biostratigraphy. The result of the exercise suggests that the matching of reflectors on the Ontong Java Plateau produces correlations that are comparable in quality to those from biostratigraphic control. To check this proposition additional matches were picked as follows (each comparison shows Site 805 first, then Site 806): (1) 0.044 sbsf, 35 mbsf, 1.95 Ma; 0.061 sbsf, 48 mbsf, 2.05 Ma; (2) 0.128 sbsf, 103 mbsf, 4.44 Ma; 0.170 sbsf, 139 mbsf, 4.49 Ma; (3) 0.258 sbsf, 216 mbsf, 7.17 Ma; 0.332 sbsf, 285 mbsf, 7.64 Ma; (4) 0.363 sbsf, 315 mbsf, 12.70 Ma; 0.480 sbsf, 435 mbsf, 12.34 Ma. The average difference between the age estimates is 0.23 m.y. for the five determinations. Repeating the exercise using a continuous velocity profile, and picking different levels independently, gave virtually identical results. An error of between 0.2 and 0.3 m.y. is within the interpolation errors of the biostratigraphic age: it is the uncertainty found if one hole of Site 806 is used to predict the age at the same depth in the other hole. Thus, as far as we can tell, the correlative reflectors of Sites 805 and 806 are identical in age. The demonstration of this synchroneity is an important result; it is greatly simplified by the fact that near-equivalent levels at the two sites are readily found, owing to the similarity of sedimentation-rate patterns.

The Panama series contains reflectors which we dated near 2, 2.4, and 3.7 Ma. The age of 2.4 Ma corresponds to a deep-water cooling event and the onset of North Atlantic ice buildup (Backman, 1979; Shackleton et al., 1984). The reflectors dated at 2.4 Ma and at 3.7 Ma can be identified in the seismic record from DSDP Site 586 using the velocity profile provided by the logging of DSDP Site 586 (Moberly, Schlanger, et al., 1986). The Tethys interval contains a number of lesser reflectors, two of which (just above and below 0.4 sbsf) do not seem to have corresponding reflectors in Site 805 and may be related to lithification at that depth (near 350 mbsf).

The next group of strong reflectors, going downsection, is the upper bundle of the Antarctic series, centered on the middle Miocene (13 Ma 0.49 sbsf, ca. 450 mbsf). The lower group of this series is somewhat less prominent and belongs to the uppermost lower Miocene and lowermost middle Miocene (560 to 500 mbsf; 18-15 Ma). This entire zone is characterized by major climatic change, and associated excursions in carbonate content and other sediment properties (Barron et al., 1985). These changes presumably are associated with the onset of Antarctic Bottom Water production at that time. The group of reflectors immediately below the Antarctic series, the Drake series, has the strongest reflector members. Dates range from about 22.5 Ma for the deepest of the group (680 mbsf) to 18.5 for the uppermost (570 mbsf).

Below this group there is a thick section, the Texas interval (250 to 270 m thick), which shows another series of reflectors almost as strong as the Drake series. In Site 805 these reflectors are much less pronounced. The reason for the difference is not known; it may be related to the higher diagenetic potential at Site 806, stemming from better preservation of carbonate or from a greater supply of organic matter or both. Below this interval is the Ontong Java series, which is thought to represent the change from chalk to limestone in the lowermost Oligocene, and--somewhat deeper in the section--the occurrence of chert. As at Site 805, acoustic basement is reached shortly below this sequence.

In summary, there is good correlation between Sites 805 and 806 and good agreement in biostratigraphic dates for equivalent reflectors or reflector groups, regardless of the overall difference in sedimentation rates. This observation provides strong support for the hypothesis that many reflectors represent the effects of paleoceanographic events which are felt over a wide depth range and hence are of global significance. Other reflectors may be regionally strong expressions of minor events or may be related to diagenetic processes which are not synchronous.

Rates of Sedimentation

The oldest sediments cored, at 776 mbsf in Hole 806C, were of latest Oligocene age (Zones NP25, P22). The distance to acoustic basement below this level (0.75 sbsf) may be estimated as approximately 0.23 s two-way traveltime, which corresponds to roughly 340 m of sediment at that depth. Assuming that the uncored section represents at least 80 m.y. of time, the presence of condensed intervals or hiatuses, or both, would seem to be indicated for the lower Paleocene and Upper Cretaceous.

Since late Oligocene time, Site 806 has received nannofossil ooze, with rather minor admixtures of siliceous fossils on the whole . Sedimentation rates typically varied between 20 m/m.y. (early Miocene) and 46 m/m.y. (late Miocene), the overall average being near 30 m/m.y. (Fig. 18). These numbers are somewhat misleading, inasmuch as they are not corrected for mass flux and contain the trend of decreasing porosity with depth. If one corrects for this trend, it is found that the mass flux for the late Oligocene is of the same magnitude as for the late Neogene. Spikes in sedimentation rate may pertain to 8 to 6 Ma (latest Miocene) and to 14 to 13 Ma (middle Miocene), but they cannot be fully substantiated at this time because of uncertainties in absolute ages for biostratigraphic tie points. The two intervals in question are characterized by maximum carbonate values. There seem to be no condensed sections at Site 806 (whereas thinning of the upper lower Miocene was observed at Site 805).

Site 807

Locations and Objectives

Site 807, located on the northern margin of the Ontong Java Plateau (latitude 3°36.4'N, longitude 156°37.5'E, 2810 m water depth; Fig. 2) was drilled to answer questions regarding the origin and tectonic development of oceanic plateaus in general and the geologic history and paleoceanography of the Ontong Java Plateau in particular. Drilling objectives were to (1) provide Paleogene and Cretaceous sediments for studies of pre-Neogene paleoceanography; (2) obtain basement rock for studies of the origin of the Ontong Java Plateau; and (3) provide a second shallow-water site off the equator for comparison with Sites 806 and 803 on the Neogene equatorial depth transect. Criteria used to select Site 807 included (1) a position on the northern rim of the high plateau as far from Site 289 as feasible; (2) a location in relatively shallow water to obtain a well-preserved carbonate section; (3) the presence of a thick section showing thinning in the upper layers and thickening in the lower layers in the seismic reflection profiles; and (4) the presence of an undeformed sedimentary and basement section at a location protected from bottom-current activity.

The site was positioned using an R/V *Thomas Washington* single-channel seismic (SCS) line acquired during the EURYDICE cruise 9 survey at 0255 UTC on 11 April 1975; it was resurveyed during Leg 130. Site 807 is located on the northern rim of the high plateau, roughly 475 km northwest of DSDP Site 289/586, within a shallow basement graben about 0.5 km from the footwall of the northern side of the graben (Figure 20). The sedimentary section is thick, about 1.13 s of two-way traveltime in the SCS profile, and shows well-behaved layering, disturbed by only minor thickening along the graben walls in the lower portion of the section, and sheltered by its location from the ubiquitous bottom currents of the plateau. Thus this site appeared to offer the best opportunity for recovering one of the most complete depositional sequences present on the plateau as well as representative basement samples.

Coring Result

Site 807 was occupied for 24.3 days. We cored 1701.2 m of Neogene, Paleogene, and Upper Cretaceous sediments, 533.0 m by APC (101.9% recovery), 568.5 m by XCB (79.8% recovery), and 599.7 m by RCB (27.4% recovery). We also cored 148.7 m of basement (dated as Early Cretaceous), representing the deepest basement penetration yet achieved on a Pacific oceanic plateau (Figure 21), and recovered 87.6 m of basalt and 0.6 m of interbedded sediment. Three holes were drilled as follows: Hole 807A was APC cored to 254.4 mbsf and XCB cored to 822.9 mbsf, Hole 807B was APC cored to 278.6 mbsf, and Hole 807C was RCB cored from 780.0 to 1528.4 mbsf. Holes 807A and 807C also were successfully logged to total depth, and a complete set of geophysical measurements was obtained (including FMS data from Hole 807C).

The recovered sediments range in age from Pleistocene to Lower Cretaceous; they were divided into three lithologic units (Fig. 22). Unit I (0-968.0 mbsf) is composed mainly of Pleistocene to upper/middle Eocene nannofossil ooze and chalk with foraminifers, with lesser amounts of foraminifer nannofossil ooze and chalk as well as nannofossil ooze and chalk. Unit II (968.0-1351.4 mbsf) is composed of upper/middle Eocene to upper Campanian limestone, chert, nannofossil chalk and nannofossil chalk with foraminifers. Unit III (1351.4-1379.7 mbsf) is composed of lower Cenomanian to upper Albian-Aptian claystone and siltstone with varying amounts of radiolarians and limestone. Igneous basement at Site 807 is represented by one lithologic unit, Unit IV (1379.7-1528.4 mbsf), which is predominantly composed of Albian-Aptian basalt.

The record is continuous from the Pleistocene to the upper Oligocene where a stratigraphic break occurs at 702.4 mbsf (ca. 28-30 Ma), the first of four stratigraphic breaks encountered above the Cretaceous/Tertiary boundary. Other breaks occur in the middle Eocene at 996.8 mbsf, at 1073.0 mbsf, and at 1094.8 mbsf (ca. 40-43 Ma, 45-46 Ma, and 47-50 Ma respectively). Much of the Paleocene to middle Eocene section is condensed, except for part of the upper Paleocene. The K/T boundary was crossed at 1193.2 mbsf, with an apparently complete boundary sequence recovered. The section below the K/T boundary also probably includes one or more stratigraphic breaks, in particular between the upper Campanian limestone and the lower Cenomanian claystone-siltstone sequences at 1351.4 mbsf and near the Aptian-Albian limestone basalt contact at 1379.7 mbsf in Core 130-807C-74R.

Stratigraphy of the Sediments

Unit I is divided into two subunits, IA and IB, based on the depth of the ooze/chalk transition at 293 mbsf (ca. 10.4 Ma; Figs. 5 and 22). The boundary is transitional, as the lower 30 m of Subunit IA contains a significant percentage of chalk in isolated nodules and layers and the upper 20 m of Subunit IB contains numerous thin intervals of ooze.

Subunit IA (0-293 mbsf) consists of Pleistocene to upper/middle Miocene foraminifer nannofossil ooze, nannofossil ooze with foraminifers, and minor amounts of nannofossil ooze, mostly ranging from sandy silt to silt and only rarely to silty clay. Foraminifer abundances vary between 4% to 40%, averaging about 23%. Significant maxima in both mean grain size and foraminifer abundance were noted in both Holes 807A and 807B at 25 mbsf (ca. 2 Ma), from 80-90 mbsf (ca. 4 Ma), at 160 mbsf (ca. 6 Ma), and between 220 and 250 (ca. 7-8 Ma). Significant minima were observed at 50 mbsf (2.5-3 Ma), at 135 mbsf (ca. 5 Ma), and between 200 and 210 mbsf (ca. 6.5 Ma). Carbonate content increases downhole from 88% in the Pleistocene section to an average of 92% in the Miocene section. Other constituents such as radiolarians and diatoms are present in trace amounts. Colors range from white (in the top 3 m) through pale brown to light gray. Horizontal color bands are pervasive, occurring in various shades of green or purple. Up to 2 cm thick and commonly in green and purple pairs, the bands first appear at 9 mbsf and increase in frequency downhole to a maximum in the upper Miocene, between 90 and 200 mbsf, below which they decrease in frequency. Bioturbation is extensive, as indicated by burrow structures, authigenic pyrite pellets, and trace fossils. The odor of H_2S also was detected upon splitting of some of the cores. Burrows are commonly surrounded by discrete purple halos that cross-cut and overprint color bands, suggesting the presence of redox gradients emanating from the burrows. Minor microfaulting also is present.

Subunit IB (293-968.0 mbsf) consists of upper/middle Miocene to upper/middle Eocene nannofossil chalk with foraminifers, foraminifer nannofossil chalk, and nannofossil chalk. Foraminifer abundances are high, about 20%, from 350 to 500 mbsf (ca. 13-21 Ma) and from 680 to 740 mbsf (ca. 27-31 Ma). Foraminifer abundances are low at the top of the subunit from 300 to 350 mbsf (ca. 11-13 Ma) and from 525 to 675 mbsf (ca. 22-27 Ma). Mean carbonate content for the subunit is about 93%. Carbonate maxima occur from 450 to 575 mbsf; minima occur from 325 to 425 mbsf and below 575 mbsf. Nine separate ash layers are present between 639 and 759 mbsf (ca. 26-32 Ma). The ash layers are dark gray and show well the effects of bioturbation. Other components such as radiolarians and diatoms are present in trace quantities. The chalk is predominantly white. Faint to distinct green color bands are common at the top of the subunit but are rare below 300 mbsf. Purple bands fluctuate in abundance throughout the subunit but are more frequent between 700 and 760 mbsf. The bands thin with depth to less than 1 mm. Swarms of thin bands exhibiting wavy, braided, flaser-like patterns are common. Bioturbation is common as indicated by burrow-mottles, trace fossils, and pyritized burrow linings, which become flattened with depth.

Unit II is divided into two subunits, IIA and IIB, based on the transition from chalk to limestone. The boundary between the two subunits is placed at 1098.0 mbsf, where a limestone lithology is indicated by the presence of over 50% nonbiogenic carbonate in smear slides. The transition is also reflected in a substantial increase in average core recovery, from about 7% in Subunit IIA to about 44% in Subunit IIB.

Subunit IIA (968.0-1098.0 mbsf) consists of upper/middle Eocene to middle Eocene nannofossil chalk, nannofossil chalk with foraminifers, limestone, silicified limestone, and chert. The chalk is white and moderately bioturbated. Burrows are commonly flattened and predominantly horizontal. Isolated occurrences of gray anastomosing color bands or flaser bedding are observed. Both the limestone and the silicified limestone are white. The chert is gray, apparently nodular, and commonly occurs with chalk coatings and millimeter to centimeter-size chalk inclusions.

Subunit IIB (1098.0-1351.4 mbsf) consists of middle Eocene to upper Campanian limestone and chert. The limestone is predominantly white and moderately to highly bioturbated, as evidenced by weak mottling, finely disseminated pyrite, and flattened horizontal burrows. Stylolites occur throughout the subunit. Gray and red chert nodules and minor chert layers are present in all cores. At least 15 ash layers were found between 1140 and 1200 mbsf (ca. 56-67 Ma). The thickest is a 3 cm layer, encountered at 1156.6 mbsf (ca. 57 Ma), whereas the remaining layers are about 1 cm thick. At least 10 dark gray to brown clay layers were found between 1300 and 1351 mbsf (ca. 74-76) that also may represent altered volcanic ash (the upper two layers contain volcanic glass). Evidence for redeposition is ubiquitous below 1116 mbsf. Clasts of white limestone, about 5 mm in diameter, are dispersed throughout a slightly grayer matrix from 1116 to 1197 mbsf, indicating a steady input of debris from the flanks of the graben. Nannofossils from a clast at 1127 mbsf are of Late Cretaceous age, while nannofossils in the matrix are of mixed Paleocene and Cretaceous age. Evidence for mass transport is pervasive below 1197 mbsf. Laminae or beds of well-sorted carbonate grains 5 mm to 5 cm thick are observed between 1197 and 1232 mbsf. Low-angle truncation surfaces and the well-sorted nature of the grains suggest that some of the parallel laminae are primary, possibly formed by winnowing. Clast-bearing intervals alternating with clast-free intervals over thicknesses of 1 to 5 m are common below 1232 mbsf. Most of the clasts, ranging from 1 to 5 cm in diameter, are white limestone, but gray clasts are more abundant below 1271 mbsf, and green clasts are present below 1290 mbsf. The green clasts may be altered basaltic glass. Dark brown claystone clasts are common below 1321 mbsf. The clast-bearing intervals probably represent debris-flow deposits. A fold at 1264 mbsf, underlying a 1-m-thick, graded, clast-bearing interval, supports the debris-flow interpretation.

Unit III is divided into two subunits, IIIA and IIIB, on the basis of the relative abundances of claystone and limestone.

Subunit IIIA (1351.4-1369.7 mbsf) consists of lower Cenomanian to upper Albian claystone interbedded with siltstone with radiolarians, radiolarian siltstone, and radiolarian sandy siltstone. The claystone is very dark grayish brown. Bioturbated intervals are indicated by the mottling and burrows about 1 cm long. The siltstone interbeds, which are generally gray, are relatively rare at the top of the subunit but become more abundant and increase in radiolarian content downhole. The contacts between the claystone and the siltstone interbeds are predominantly gradational, but sharp contacts and graded bedding are also present. Although few scour marks or load structures were observed, the overall interbedded pattern emphasizes the importance of episodic deposition at Site 807.

Subunit IIIB (1369.7-1379.7 mbsf) consists of upper Albian-Aptian limestone and chert. Although the limestone was recovered from the interval 1369.7 to 1375.6 mbsf, as measured from the cores, a distinct decrease in the drilling rate at 1379.7 mbsf suggests that this depth is the contact between the limestone and the underlying basalt. The recovered limestone is generally gray and bioturbated. The upper part contains very fine, vertical, anastomosing fractures. The lower part contains wavy, lenticular beds about 0.5-3 cm thick as well as microfaults and abundant healed tensional cracks. The chert, found in both intervals, is black to dark gray and nodular in origin.

Basement Stratigraphy

Unit IV (1379.7-1528.4 mbsf) is composed of Albian-Aptian tholeiitic basalt and interbedded limestone and is divided into seven subunits, IVA through IVG, five of which are igneous (IVA, C, E, F, and G) and two of which are sedimentary (IVB and D) (Fig. 23).

Subunit IVA (1379.7-1424.6 mbsf): aphyric pillow lavas and thin (<2 m thick) massive flows with rare plagioclase phenocrysts up to 3 mm long, superficially similar to lavas at Site 803.

Subunit IVB (1424.6-1425.1 mbsf): Albian-Aptian limestone interbedded with vitric tuff. The limestone is white and contains numerous healed fractures. The tuff is dark reddish brown to reddish brown.

Subunit IVC (1425.1-1441.9 mbsf): aphyric pillow lavas and thin (<3 m thick) massive flows with sparse, euhedral to subhedral olivine microphenocrysts (<1 mm long), largely replaced by green and black clays.

Subunit IVD (1441.9-1442.0 mbsf): Albian-Aptian limestone. The limestone is olive brown and contains quartz and illite/glauconite.

Subunit IVE (1442.0-1447.0 mbsf): aphyric pillow lavas and thin (<3 m thick) massive flows with sparse, euhedral to subhedral olivine microphenocrysts (<1 mm long), largely replaced by green and black clays.

Subunit IVF (1447.0-1475.0 mbsf): aphyric massive flow with sparse, euhedral to subhedral olivine microphenocrysts (<1 mm long), largely replaced by green and black clays.

Subunit IVG (1475.0-1528.4 mbsf): aphyric pillow lavas and thin (<3 m thick) massive flows with sparse, euhedral to subhedral olivine microphenocrysts (<1 mm long), largely replaced by green and black clays.

Flecks of native copper were observed in several of the basalt cores below the sedimentary interbeds of Subunit IVB, particularly in vein material in Section 130-807C-82R-2 at 40 and 58 cm. Disseminated pyrite also was observed in glassy pillow rims and fractures. Another sedimentary interbed, unsampled in the coring but detected during logging, occurs within Subunit IVC at 1434 mbsf. All of the igneous subunits of Unit IV are composed of tholeiitic basalt, generally only slightly altered. Subunits IVA, C, E, and G are successions of pillow and thin (<3 m thick) massive flows. Subunit IVF, however, consists of a single massive flow approximately 28 m thick. This flow documents the presence of thick flood basalt lavas on the Ontong Java Plateau. The general paucity of phenocrysts is reminiscent of some continental flood basalts, notably the Grande Ronde Formation of the Columbia River Basalt Group.

Special Studies

Paleomagnetic measurements were made on all APC and XCB cores from Hole 807A, Cores 130-807B-1H through -10H from Hole 807B, and all RCB cores from Hole 807C. The Pleistocene sediments of Holes 807A and 807B contain a well-defined record of the Brunhes/Matuyama boundary as Jaramillo and Olduvai Subchrons. These polarity boundaries enable a precise determination of Pleistocene sedimentation rates. Parts of the Miocene section, as well as parts of the Oligocene, Eocene, and Paleocene, also look promising for paleolatitude determinations. At the base of the sedimentary section in Hole 807C, the brown claystone/siltstone sequence has natural remanent magnetizations (NRMs) dominated by a viscous present-day overprint which may permit determination of a Cenomanian-Campanian paleodeclination. The age of the sediments overlying the basalt, Albian-Aptian, suggests that we have recovered a volcanic sequence that is especially promising for refining the Pacific plate apparent polar-wander path. The NRM of the basalts are dominantly steeper than -20° in inclination. If the NRM is dominated by a primary remanence, a suggestion in accordance with the freshness of the rocks, the entire basalt sequence is of normal polarity.

Magnetic-susceptibility measurements gave good results well into Pliocene sediments. These data will be useful for fine-scale correlation and for studies of Milankovitch-type cycles.

Results from interstitial-water geochemistry at Site 807 are similar to those of Sites 803 and 804. The conservative gradients (Ca, Mg) compare favorably to those of Sites 288 and 289, suggesting similar rates for basalt alteration and diffusion. These and other gradients reflect the dominance of biogenic sediments and the paucity of organic carbon. Ca- and Mg- depth gradients are the least pronounced at Site 807, however, and the Mg profile at Site 807 is anomalous in the lower part of the section, where Mg concentrations remain constant with increasing depth. Dissolved silica concentrations generally increase with depth down to 900 mbsf (ca. 36 Ma), then decrease and level off at 1000 mbsf (ca. 42 Ma) in the silicified sediments of Unit II.

The combined carbonate-content curve for Holes 807A and 807C closely reflects the lithostratigraphic units described at Site 807. The nannofossil oozes and chalks of Unit I are characterized by very high carbonate contents ranging from 85% to 95%. The chert-rich limestones in Subunit IIA and the upper part of Subunit IIB show wide variations in carbonate content, ranging from 51% to 97%, whereas the chert-poor limestones of Unit

IIB are characterized by consistently high values ranging from 95% to almost 99%. In contrast, the claystones/siltstones of Subunit IIIA have carbonate contents less than 0.3% and are similar to equivalent intervals recovered above basement at Site 803.

Excellent well-log data were obtained from Holes 807A and 807C. The logs from both holes correlate well over scales of decimeters, instilling confidence in the measurements and hence in the interpretation of cyclicity at Milankovitch time scales. The logging data from Hole 807A, in conjunction with a detailed suite of physical-property measurements obtained from the split cores, confirm the depth of the ooze/chalk transition based upon sediment descriptions. The logging data from Hole 807C likewise confirm the depth of the chalk/limestone transition and reveal the presence of local maxima and minima in velocity that correlate with chert/silicified chalk zones and the claystone/siltstone beds deep in the section. Velocity, density, and resistivity all increase across the Unit I/II boundary owing to lower porosity of the chert and the effect of increased cementation by silica of the calcareous sediment. The Subunit IIA/IIB boundary, owing to the transformation of chalk and silicified chalk to limestone, is clearly seen in the logging data as an increase in velocity, density and electrical resistivity. The logs allow an estimate of the amount of chert present in the section, which varies between 20% and 70%; the higher values signify the presence of massive cherts or beds of highly silicified limestone. The claystone, siltstone, and limestone of lithostratigraphic Unit III appear in the logs as an interval of reduced velocity, resistivity, and density. Basement is clearly defined as an increase in density, resistivity, and velocity. Gamma-ray, density, and resistivity logs, together with the FMS data, confirm the presence of a single massive flow in Subunit IVF and help identify the presence of sedimentary interbeds in the overlying pillowed flow subunits, including the one unsampled by the coring operation. Resistivity logs, moreover, suggest that another massive flow might be present at the bottom of the hole. The logs also provide important constraints on the generation of synthetic seismograms. Duplication of logging runs in the paired Holes 807B and 807C allows assessment of the precision of the logging data.

A reasonably complete section for determination of seismic stratigraphy is present at Site 807. Comparison of the synthetic seismogram with the field profile produces a good match implying that the traveltime-to-depth conversion was acceptable. Evidence for small-scale mass movement is observed at 0.14-0.24 sbsf and at 0.28-0.41 sbsf (4.7-6.7 Ma and 7.5-12.5 Ma, respectively; Fig. 20). Thickened wedges of sediment occur between 0.44-0.53 sbsf (14.5-20.5 Ma) and around 1.00-1.02 sbsf (about 50.4 Ma). Basement occurs at approximately 1.13 sbsf (1379.7 mbsf based on the drilling).

Sequence of Events

The sequence of events as deduced from the drilling at Site 807 portrays the final stage of development of the world's largest submarine flood basalt plateau. The Ontong Java Plateau evidently formed for the most part by widespread effusion of massive flood basalts into deep water during Aptian time. The sequence of eruptive events that occurred toward the end of the formation of the plateau, as recorded at Sites 803 and 807, are as follows.

The final phase of flood basalt effusion was characterized by the eruption of a massive flow, which was closely followed by the eruption of a series of thin pillowed flows. This sequence was followed in turn by the eruption of another massive flow, again closely followed by the eruption of another series of thin pillowed flows. After an interval of time (of uncertain duration), represented by the deposition of a limestone-claystone facies at Site 807, the eruption of a late-stage sequence of pillowed flows occurred. Based on phenocryst assemblages, these probably are of a more evolved composition and represent the waning phase of volcanism at the site.

The first sediments to accumulate at the thermally elevated site were limestones and vitric tuffs, deposited above, but probably close to, the Early Cretaceous CCD (ca. 2000 mbsl?). As the plateau cooled and contracted, the seafloor subsided and, as the site rapidly sank below the CCD, a radiolarian ooze-clay facies began to accumulate. The graben that probably developed around the site during plateau subsidence apparently provided a sediment trap and sheltered accumulating sediment at the site from bottom-current activity, thus preserving the early depositional history of the Ontong Java Plateau.

Following deposition of the upper Albian-lower Cenomanian claystone-siltstone facies, the upper Campanian-Maestrichtian limestones were laid down, perhaps in response to a rapidly falling Cretaceous CCD. Sedimentation rates decreased from 20 m/m.y. in the late Maestrichtian to about 3 m/m.y. in the early Paleocene (Fig. 24). Mid-ocean volcanism, probably of hot-spot origin, apparently was initiated on or near the Ontong Java Plateau in latest Maestrichtian time, as evidenced by the ash layer deposited just below the K/T boundary at Site 807. The volcanism, increasing in intensity (or proximity to the site), peaked in the late Paleocene (ca. 57 Ma) and then receded, disappearing entirely by middle Eocene time (ca. 54 Ma). After an initial low of 2 m/my in the early/middle Eocene (ca. 54-51 Ma), sedimentation rates increased in the Paleogene peaking at 35 m/m.y. in the late middle Eocene (ca. 45-43 Ma) (Fig. 24). Hiatuses, however, also apparently occurred in the middle Eocene (ca. 50-47 Ma, 46-45 Ma, and 42-40 Ma).

Volcanism was initiated again in early-late Oligocene time (ca. 32-26 Ma), this time perhaps of tectonic origin as a result of flexure of thick plateau crust as the Ontong Java Plateau crossed the outer rise of the Melanesian Trench and docked against the Melanesian Arc. A jump in sedimentation rate to 38 m/m.y. occurred in the early Oligocene (ca. 32-30 Ma), followed by another hiatus (ca. 28-30 Ma). Deposition thereafter was uninterrupted. Sedimentation rates ranged from 30 m/m.y. across the Oligocene/Miocene boundary (ca. 28-22 Ma), through 16-18 m/m.y. in the early to early late Miocene and early Pliocene (ca. 22-4 Ma), to 44 m/m.y. in the late Miocene (ca. 8-5 Ma) before dropping to the Quaternary rate of about 15 m/m.y.

Comparison with Neogene Sections at Other Sites

Site 807 was the last site to be drilled on Leg 130, providing an opportunity for comparison with the results obtained previously.

The Neogene carbonate stratigraphy of Site 807 (above 600 mbsf) shows the same general pattern as the profiles of Sites 805 and 806 (Fig. 25). The major features are the broad maxima centered in the upper Miocene and in the lowermost Miocene, and the minima in the middle Miocene and the Quaternary. The upper lower Miocene minimum seen at Site 805, and represented by hiatus formation at Sites 803 and 804, is not well expressed at Site 807. Additional measurements are necessary to check whether this discrepancy is due to spotty sampling or to differences in carbonate patterns at different water depths during that time of the initiation of cold deep water formation.

The rather small depth difference between Sites 807 and 806 (300 m), at depths well above the present lysocline (3.3 km; Berger et al., 1982), results in very small absolute differences in carbonate percentages. The same is true for the comparison of carbonate values between Sites 807 and 805 (depth difference near 400 m). Averages for the last 15 million years are as follows (sequence is in the order of water depth, 806, 807, 805):

0-5 Ma	90.65 ± 2.22; 91.02 ± 1.76; 89.52 ± 2.34;
5-10 Ma	93.40 ± 1.26; 92.80 ± 1.10; 92.38 ± 2.04;
10-15 Ma	92.95 ± 1.68; 90.56 ± 1.85; 91.40 ± 2.10.

It is seen that the carbonate percentages change very little over the interval and that they overlap with their standard deviations. For the last 5 million years, Site 807 has the highest carbonate values, presumably because of having less dilutant material than the shallower, equatorial Site 806 (volcanic input, silica). Between 5 and 10 Ma, the sequence is as expected from the depth differences. However, between 10 and 15 Ma, Site 807 has the lowest carbonate values of the three sites, presumably because at that period it was the closest to the equator, having received an increased proportion of diatoms and radiolarians.

A comparison of sediment thicknesses of Site 807 with those of the other sites, for the major biostratigraphic subdivisions is shown in Figure 26. The sedimentation-rate trends are much clearer than the ones in the carbonate percentages. For the Neogene, Site 807 has 80% of the sediment accumulation of Site 806 and exceeds that of Site 805 by 11%. The proportional difference to Site 806 is greatest in the Pleistocene (70%) and is least in the late Pliocene and late Miocene (88% and 85%, respectively). The late Miocene "agreement" presumably is due to the positions of Sites 807 and 806 relative to the equator. The close agreement for the late Pliocene is surprising, especially as it is followed by the strong difference in sedimentation rates for the Pleistocene. Apparently the upwelling belt was much wider in the late Pliocene than in the Pleistocene.

A crude index of the Neogene dissolution gradient may be found by considering the ratios of the sediment thicknesses at Site 806, 807, and 805. The gradient is supposed to have increased over the last 25 million years (van Andel et al., 1975). No clear trend emerges from our data, however. The gradient appears to be greatest in the late early Miocene and early middle Miocene, at the time of hiatus formation in the deeper sites. This time corresponds to NH2 in the hiatus scheme of Keller and Barron (1983) and to the onset of major Antarctic cooling (Savin et al., 1985).

The question as to why the pre-Neogene section is so much more riddled with hiatuses than the Neogene one must remain open. Of course, age itself is correlated with probability of removal (Moore and Heath, 1977). However, the history of the plateau, and especially its tectonic history as reflected in earthquakes, will have to be considered when discussing the distribution of major hiatuses. Regional mapping of seismic reflectors should help in this endeavor.

HIGHLIGHTS AND SUMMARY OF EVENTS

Important first results of Leg 130 include new insights about the global ocean carbon cycle, about the significance of acoustic reflectors, and about the origin and early history of Ontong Java Plateau (and by analogy other oceanic plateaus). In addition, we twice recovered a complete Cretaceous/Tertiary (K/T) boundary transition, one calcareous and one non-calcareous. Drilling results indicate that global ocean changes in the carbon cycle take precedence over changes in bottom water activity by itself, in controlling major patterns of carbonate accumulation in the late Neogene. Sedimentation rates were found to vary over a factor of three during the Neogene, with a striking maximum (50 m/m.y.) in the latest Miocene to early Pliocene, throughout the depth transect sampled (2600-3920 meters below sealevel). Fluctuations in carbonate are highly coherent throughout the depth transect over the last 12 million years, but less so before that. A striking drop in sedimentation rate by a factor of 2 occurred at the end of the Pliocene, despite a (presumed) increase in trade wind intensity and associated equatorial upwelling: apparently the ocean was sufficiently stripped of nutrients by this time to reduce the effects of upwelling on productivity.

A large number of acoustic reflectors can be traced between sites at different depths, despite being produced by different mechanisms. They are synchronous and are associated in time with important paleoceanographic events. An extensive downhole logging program provided the control for calculating the exact depth of reflectors, so they can be tied to biostratigraphic and lithostratigraphic datum points. Some reflectors are related to diagenesis, or are enhanced by diagenesis, others mark the position of hiatuses, which in turn line up with condensed sections, emphasizing the importance of carbonate dissolution pulses. At shallower water depths the ooze/chalk transition occurs at a younger age in the thicker sediment stacks compared with the deeper sites. Overburden, initial condition of sediments at burial, and age, all are important in controlling the rates of diagenesis.

Recovery of the Cretaceous/Tertiary boundary, apparently in complete sections, at Sites 803 and 807, demonstrates the presence of a deep carbonate compensation depth CCD across the transition. The shallower one shows a volcanic ash layer immediately preceding the boundary, placed by microfossil content. The deeper site has evidence of volcanic activity throughout.

The basalts cored at Sites 803 and 807 (26 m and 149 m penetration) are predominantly olivine-bearing and appear to have been erupted from submarine vents over a considerable interval of time during the mid-Cretaceous. At Site 807 pillowed lava flows buried sediments at least twice, perhaps more often (recovery is spotty in parts). At least one thick flow was penetrated (ca. 28 m), indicating that flood basalts are important in building the plateau. Much of this basalt is very fine-grained, reminiscent of many continental flood basalts. Paleolatitudes from magnetic inclinations in the basalt suggest that Ontong Java Plateau moved coherently with the Pacific Plate since the Early Cretaceous.

Sequence of Events

The sequence of events as deduced from the drilling portrays the final stage of development of the world's largest submarine flood basalt plateau. The Ontong Java Plateau evidently formed, for the most part, by deep-water, widespread effusion of massive flood basalts during Aptian time. The final phase of flood basalt effusion was characterized by the eruption of massive flows which were closely followed, in turn, by the eruption of a series of thin-pillowed flows. After an interval of time (of uncertain duration), represented by the deposition of a limestone-claystone facies at Site 807, the eruption of another late stage sequence of pillowed flows occurred. Based on phenocryst assemblages, there probably are of a more evolved composition and represent the waning phase of volcanism at the site.

The first sediments to accumulate on top of the thermally elevated plateau were limestones and vitric tuffs, deposited above, but probably close to the Early Cretaceous CCD (2500 to 3000 mbsl). As the plateau cooled and contracted the seafloor subsided and, as the site rapidly sank below the CDD, a radiolarian ooze-clay facies began to accumulate. The graben that probably developed around Site 807 during plateau subsidence may have provided a sediment trap and sheltered accumulating sediment at the site from bottom current activity, thus preserving the early depositional history of the Ontong Java Plateau.

Following deposition of the upper Albian-lower Cenomanian claystone-siltstone facies, the upper Campanian-Maastrichtian limestones were laid down, perhaps in response to a rapidly falling Cretaceous CCD. Sedimentation rates decreased from 20 m/m.y. in the late Maastrichtian to about 3 m/m.y. in the early Paleocene. Mid-ocean volcanism, probably of hot spot origin, apparently was initiated on or near the Ontong Java Plateau in latest Maastrichtian time, as evidenced by the ash layer deposited just below the K/T boundary at Site 807. The volcanism, increasing in intensity (or proximity to the site), peaked in the late Paleocene (ca 57 Ma). After an initial low of 1 m/m.y. in the early-middle Eocene (ca 51 Ma), sedimentation rates increased in the Paleogene peaking at 35 m/m.y. in the late middle Eocene (ca 45-43 ma). Hiatuses, however, also apparently occurred in the middle Eocene (ca 50-47 Ma, 46-45 Ma, and 43-40 Ma).

Volcanism was initiated again in Oligocene time (ca 32-26 Ma), this time perhaps as a result of flexure of thick plateau crust as the Ontong Java Plateau crossed the outer rise of the Melanesian Trench and docked against the Melanesian Arc. A jump in sedimentation rate to 30-40 m/m.y. occurred in the early Oligocene (ca 32-30 Ma) and was followed by another hiatus on the top of the plateau (ca 28-30 Ma). Deposition thereafter, however, was uninterrupted and at the shallower sites provides for the unparalleled Neogene pelagic sequence which sets Ontong Java Plateau apart as a recording station for global ocean change. Sedimentation rates ranged from 20-30 m/m.y. across the Oligocene/Miocene boundary (ca 28-22 Ma) to 10-20 m/m.y. in the early to early late Miocene (ca 22-8 Ma) to as high as 50 m/m.y. in the late Miocene (ca 8-5 Ma) before dropping to the present day rates of about 15 m/m.y.

References

Andrews, J.E., Packham, G.H., et al., 1975. Init. Repts. DSDP, 30: Washington (U.S. Govt Printing Office).

Arrhenius, G., 1952. Sediment cores from the East Pacific. Swedish Deep-Sea Expedition 1947-1948, 5, Pts. 1-3.

Backman, J., 1979. Pliocene biostratigraphy of DSDP Sites 111 and 116 from the North Atlantic Ocean and the age of northern hemisphere glaciation. J. Stockh. Contrib. Geol., 32:115-137.

Barron, J.A., Keller, G. and Dunn, D.A., 1985. A multiple microfossil biochronology. In Kennett, J.P. (Ed.), The Miocene Ocean: Paleoceanography and Biogeography.

Geol. Soc. of Am. Mem., 163:21-36.

Berger, W.H., 1973. Cenozoic sedimentation in the eastern tropical Pacific. Geol. Soc. Am. Bull., 84:1941-1954.

Berger, W.H., Bonneau, M.-C., and Parker, F.L., 1982. Foraminifera on the deep-sea floor: lysocline and dissolution rate. Oceanologica Acta, 5:249-258.

Berger, W.H., and Johnson, T.C., 1976. Deep-sea carbonates: Dissolution and mass wasting on Ontong-Java Plateau. Science, 192:785-787.

Berger, W.H., and Mayer, L.A., 1978. Deep-sea carbonates: acoustic reflectors and lysocline fluctuations. Geology, 6:11-15.

Berger, W.H. and Winterer, E.L., 1974. Plate stratigraphy and the fluctuating carbonate line. In Hsü, K.J., and Jenkyns, H.C. (Eds.), Pelagic Sediments on Land and Under the Sea. Internat. Assoc. Sediment. Spec. Pub., 1:11-48

Floyd, P. A., 1986. Petrology and geochemistry of oceanic intraplate sheet-flow basalts, Nauru Basin, Deep Sea Drilling Project Leg 89. In Moberly, R., Schlanger, S. O., et al., Init. Repts. DSDP, 89: Washington (U.S. Govt. Printing Office, 471-497.

Humphries, S. E., Thompson, R. N., Gibson, I. L., and Marriner, G. F., 1980. Comparison of geochemistry of basalts from the East Pacific Rise, OCP Ridge and Siqueiros Fracture Zone, Deep Sea Drilling Project, Leg 54. In Rosendahl, B. R., Hekinian, R., et al., Init. Repts. DSDP, 54: Washington (U. S. Govt. Printing Office), 635-649.

Hussong, D.M., Wipperman, L.K., and Kroenke, L.W., 1979. The crustal structure of the Ontong Java and Manahiki oceanic plateaus. J. Geophys. Res., 84:6003-6010.
Jackson, E. D., Bargar, K. E., Fabbi, B. P., and Heropoulos, C., 1976. Petrology of the basaltic rocks drilled on Leg 33 of the Deep Sea Drilling Project. In Schlanger, S. O., Jackson, E. D., et al., Init. Repts. DSDP, 33: Washington (U. S. Govt. Printing Office), 571-630.

Johnson, T.C., Hamilton, E.L., and Berger, W.H., 1977. Physical properties of calcareous ooze: control by dissolution at depth. Marine Geol., 24:259-277.

Keller, G. and Barron, J.A. 1983. Paleoceanographic implications of Miocene deep-sea hiatuses. Geol. Soc. Am. Bull., 94:590-613.

Kempton, P. D., Autio, L. K., Rhodes, J. M., Holdaway, M. J., Dungan, M. A. and Johnson, P., 1985. Petroloty of basalts from Hole 504B, Deep Sea Drilling Project, Leg 83. In Anderson, R. N., Honnorez, J., et al., Init. Repts. DSDP, 83: Washington (U.S. Govt. Printing Office), 129-164.

Kroenke, L.W., 1972. Geology of the Ontong Java Plateau. Ph.D. dissert., Univ. Hawaii, HIG-725. 119 p.

Kroenke, L. W., Jovannk, C., and Woodward, P., 1983. Bathymetry of the Southwest Pacific. Chart 1 of the Geohysical Atlas of the Southwest Pacific. 2 sheets CCOP/SOPAC.

_______, 1984. Cenozoic Tectonic Development of the Southwest Pacific. U.N. ESCAP, COOP/SOPAC, Tech. Bull., 6.

Kroenke, L.W., Resig, J., and Cooper, P.A., 1986. Tectonics of the southeastern Solomon Islands: Formation of the Malaita Anticlinorium. *In* Vedder, J.J.,Tiffin D.L. (Eds.), Geology and Offshore Resources of Pacific Island Arcs, Solomon Islands Region. Circum-Pacific Council for Energy and Mineral Resources, Earth Science Ser., 4:109-116.

Mammerickx, J., and Smith, S.M., 1985. Bathymetry of the North Central Pacific: Boulder CO. Geol. Soc. of Am.

Mayer, L.A., Shipley, T.H. and Winterer, E.L., 1986. Equatorial Pacific seismic reflectors as indicators of global oceanographic events. Science 233:761-764.

Moberly, R., Schlanger, S.O., et al., 1986. Site 586. In Moberly, R., Schlanger, S.O., et al., Init. Repts. DSDP, 89: Washington (U.S. Govt. Printing Office), 213-235.

Moore, T.C., and Heath, G.R. 1977. Survival of deep-sea sedimentary sections. Earth Planet. Sci Lett., 37:71-80.

Nixon, P.H., and Boyd, F.R., 1979. Garnet bearing lherzolites and discrete nodule suites from the Malaita alnoite, Solomon Islands, S.W. Pacific, and their bearing on oceanic mantle composition and geotherm. In Boyd, F.R. (Ed.), The Mantle Sample, Inclusions in Kimberlite, and Other Volcanics. Proc. 2nd Int'l Kimberlite Conf., AGU, 2:400-423.

Resig, J., Buyannanonth, V., and Roy, K., 1976. Foraminiferal stratigraphy and depositional history of the Ontong Java Plateau. Deep Sea Res., 23:441-456.

Saunders, A. D., 1986. Geochemistry of basalts from the Nauru Basin, Deep Sea Drilling Project Legs 61 and 89: implications for the origin of oceanic flood basalts. In Moberly, R., Schlanger, S. O., et al., Init. Repts. DSDP, 89: Washington (U.S. Govt. Printing Office), 499-517.

Savin, S.M., Abel, L., Barrera, E., Hodell, D., Kennett, J.P., Murphy, M., Keller, G., Killingley J. and Vincent, E., 1985. The evolution of Miocene surface and near-surface marine temperatures: oxygen isotopic evidence. In Kennett, J.P. (Ed.), The Miocene Ocean: Paleoceanography and Biogeography. Geol. Soc. Am. Mem., 163:49-82.

Schlanger, S.O., and Douglas, R.G., 1974. The pelagic ooze-chalk-limestone transition and its implications for marine stratigraphy. In Hsü, K.J., and Jenkyns, H.C., Pelagic Sediments: on Land and under the Sea. Spec. Publs. Int. Assoc. Sediment., 1:117-148.

Seifert, K. E., Vallier, T. L., Windom, K. E., and Morgan, S. R., 1981. Geochemistry and petrology of igneous rocks, Deep Sea Drilling Project Leg 62. In Thiede, J., Vallier, T. L., et al., Init. Repts. DSDP, 62: Washington (U. S. Govt. Printing Office), 945-954.

Shackleton, N.J., Backman, R. J., Zimmerman, H., Kent, D.V., Hall, M.A., Roberts, D.G, Schnitker, D., Baldauf, J.G., Desprairies, A., Homrighausen, R., Huddlestun, P., Keene, J.B., Kaltenback, A.J., Krumsiek, K.A.O., Morton, A.C., Murray, J.W. and Westburg-Smith, J., 1984. Oxygen isotope calibration of the onset of ice-rafting and history of glaciation in the North Atlantic region. Nature, 307:620-623.

Stoeser, D. B., 1975. Igneous rocks from Leg 30 of the Deep Sea Drilling Project. In Andrews, J. E., Packham, G., et al., Init. Repts. DSDP, 30: Washington (U.S. Govt. Printing Office), 401-444.

van Andel, T.H., Heath, G.R., and Moore, T.C., 1975. Cenozoic history and paleoceanography of the central equatorial Pacific Ocean. Mem. Geol. Soc. Am., 145.

Winterer, E.L., Riedel, W.R., et al., 1971. Init. Repts. DSDP, 7, Washington (U.S. Govt. Printing Office, 473-606.

Wu, G., and , W.H., 1989. Planktonic foraminifera: differential dissolution and the Quaternary stable isotope record in the west-equatorial Pacific. Paleoceanography, 4:181-198.

OCEAN DRILLING PROGRAM
SITE SUMMARY
LEG 130

HOLE	LATITUDE	LONGITUDE	TOTAL DEPTH (meters)	NUMBER OF CORES	INTERVAL CORED (meters)	CORE RECOVERED (meters)	PERCENT RECOVERED (percent)	DRILLED (meters)	TOTAL PENETRATION (meters)	TIME ON HOLE (hours)	TIME ON SITE (hours)
803A	02 26.011N	160 32.480E	3477.0	6	55.50	57.99	104.49%	0.00	55.50	18.17	18.17
803B	02 26.011N	160 32.480E	3483.5	7	61.30	58.18	94.91%	0.00	61.30	10.00	28.17
803C	02 25.993N	160 32.452E	3669.2	23	218.50	226.31	103.57%	19.00	237.50	33.25	61.42
803D	02 25.993N	160 32.452E	4080.0	71	656.00	494.96	75.45%	0.00	656.00	170.75	232.17
		SITE OJP-4 TOTALS:		107	991.30	837.44	84.48%	19.00	1010.30	232.17	
804A	01 00.278N	161 35.621E	3921.5	6	48.70	50.52	103.74%	0.00	48.70	15.25	15.25
804B	01 00.278N	161 35.621E	4009.5	15	137.70	141.61	102.84%	0.00	137.70	16.50	31.75
804C	01 00.281N	161 35.623E	4184.7	33	312.50	273.78	87.61%	0.00	312.50	43.00	74.75
		SITE OJP-6 TOTALS:		54	498.90	465.91	93.39%	0.00	498.90	74.75	
805A	01 13.68N	160 31.76E	3250.0	6	50.50	52.22	103.41%	0.00	50.50	11.50	11.50
805B	01 13.68N	160 31.76E	3671.1	50	473.30	444.89	94.00%	0.00	473.30	45.75	57.25
805C	01 13.69N	160 31.77E	3809.7	64	611.00	495.46	81.09%	0.00	611.00	90.75	148.00
		SITE OJP-2 TOTALS:		120	1134.80	992.57	87.47%	0.00	1134.80	148.00	
806A	00 19.11N	159 21.68E	2615.5	9	83.70	85.95	102.69%	0.00	83.70	24.25	24.25
806B	00 19.11N	159 21.69E	3264.4	78	743.10	666.36	89.67%	0.00	743.10	100.50	124.75
806C	00 19.11N	159 21.70E	3308.3	62	587.60	523.62	89.11%	188.80	776.40	65.50	190.25
		SITE OJP-1 TOTALS:		149	1414.40	1275.93	90.21%	188.80	1603.20	190.25	
807A	03 36.42N	156 37.49E	3638.0	86	822.90	716.74	87.10%	0.00	822.90	100.87	100.87
807B	03 36.39N	156 37.49E	2817.4	30	278.60	280.18	100.57%	0.00	278.60	29.00	129.87
807C	03 36.37N	156 37.48E	4345.4	93	748.40	252.84	33.78%	780.00	1528.40	454.00	583.87
		SITE OJP-5 TOTALS:		209	1849.90	1249.76	67.56%	780.00	2629.90	583.87	
		LEG 130 TOTALS:		639	5889.30	4821.61	81.87%	987.80	6877.10	1229.04	

Table 2

OCEAN DRILLING PROGRAM
OPERATIONS RESUME
LEG 130

Total Days (19 January - 27 March, 1990)		66.9
Total Days in Port		4.2
Total Days Under Way		11.5
Total Days on Site		51.2
Trip Time	7.7	
Coring Time	32.1	
Drilling Time	1.0	
Logging/Downhole Science Time	5.6	
Reentry Time	1.1	
Casing and Cementing Time	1.6	
ODP Breakdown Time	1.1	
Other	1.1	

Total Distance Traveled (nautical miles)	2405
Average Speed (knots)	8.7
Number of Sites	5
Number of Holes	16
Total Interval Cored (m)	5889.3
Total Core Recovery (m)	4821.6
Percent Core Recovered	81.9
Total Interval Drilled (m)	987.8
Total Penetration (m)	6877.1
Maximum Penetration (m)	1528.4
Maximum Water Depth (m from drilling datum)	3872.7
Minimum Water Depth (m from drilling datum)	2531.0

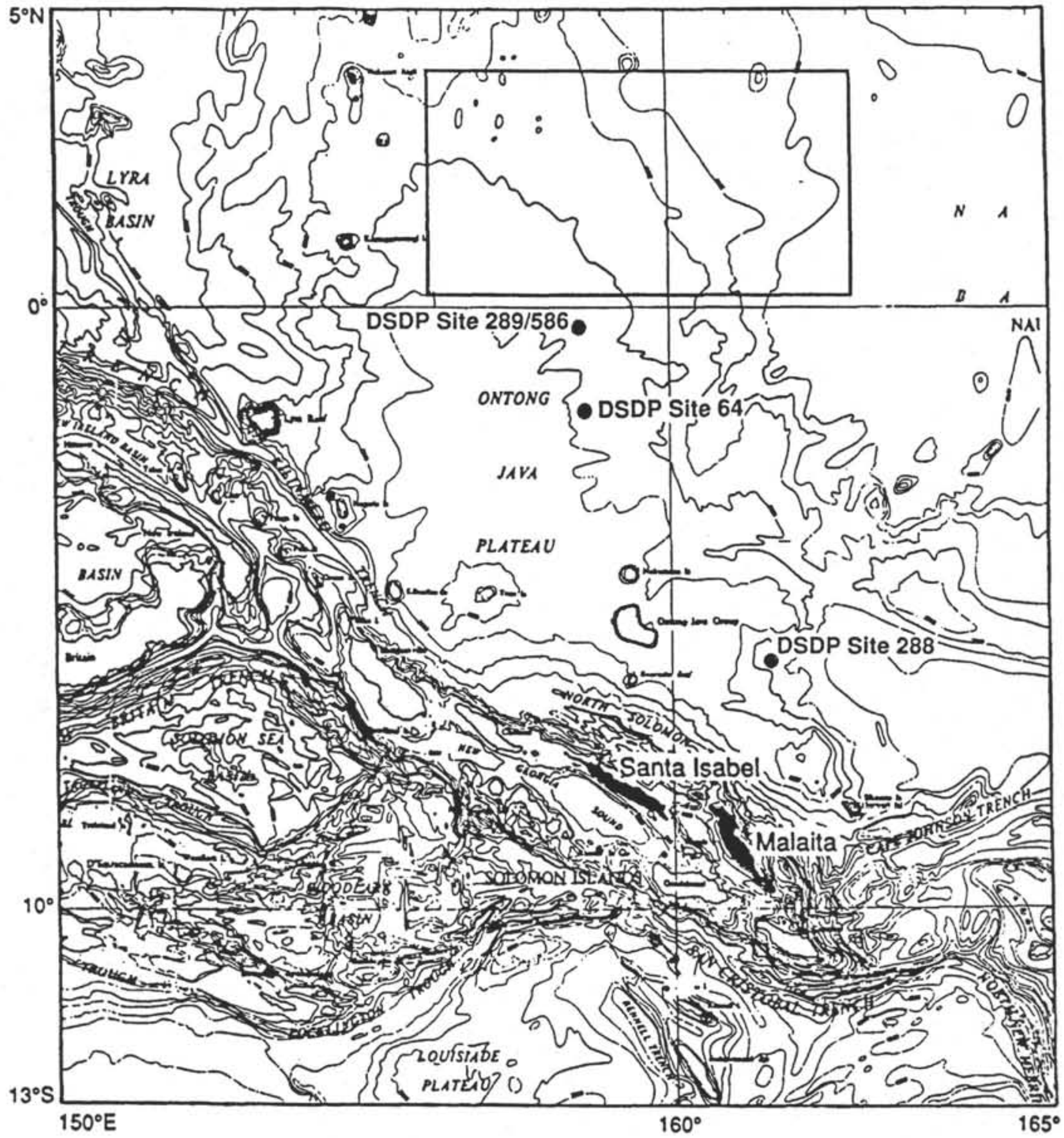

Figure 1 a). Bathymetry of the Ontong Java Plateau (after Kroenke et al., 1983), showing the location of DSDP Sites 64, 288, and 289/586. Box shows location of Leg 130 drilling. Contour interval is 500 m.

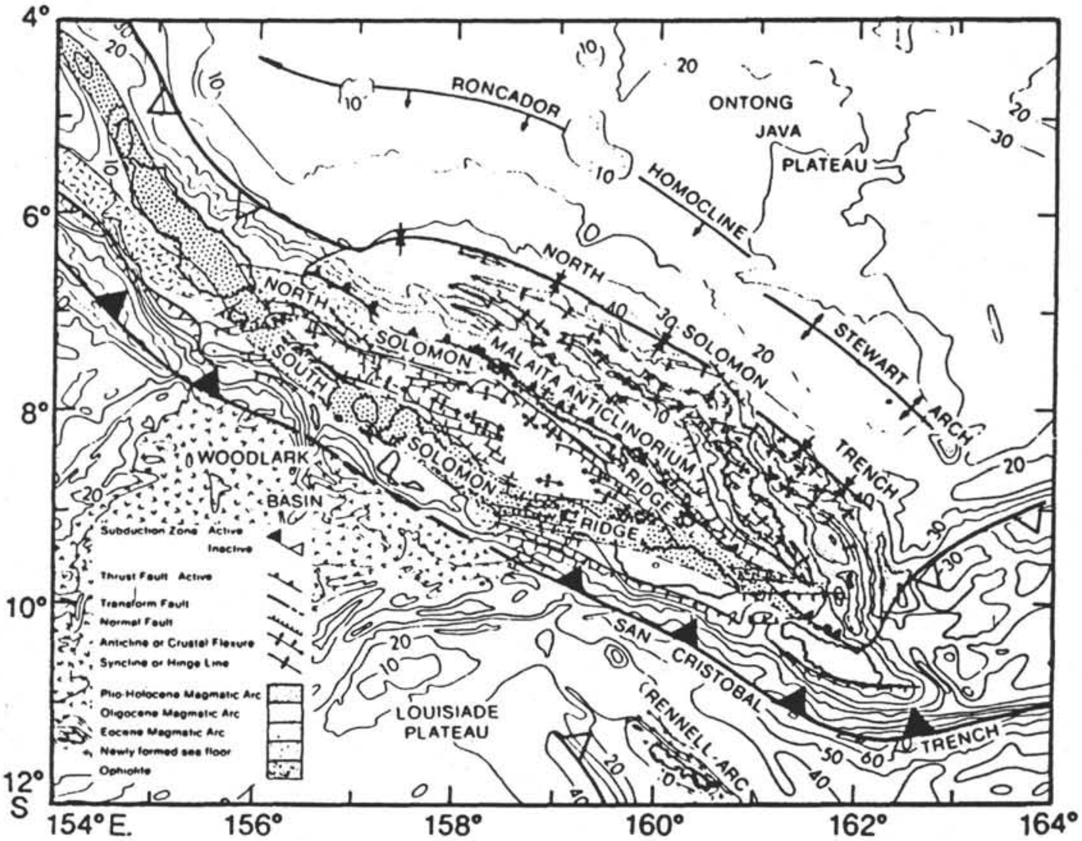

Figure 1 b). Structural elements of the Solomon Islands and the southwestern Ontong Java Plateau (after Kroenke, 1984; Kroenke, et al., 1986).

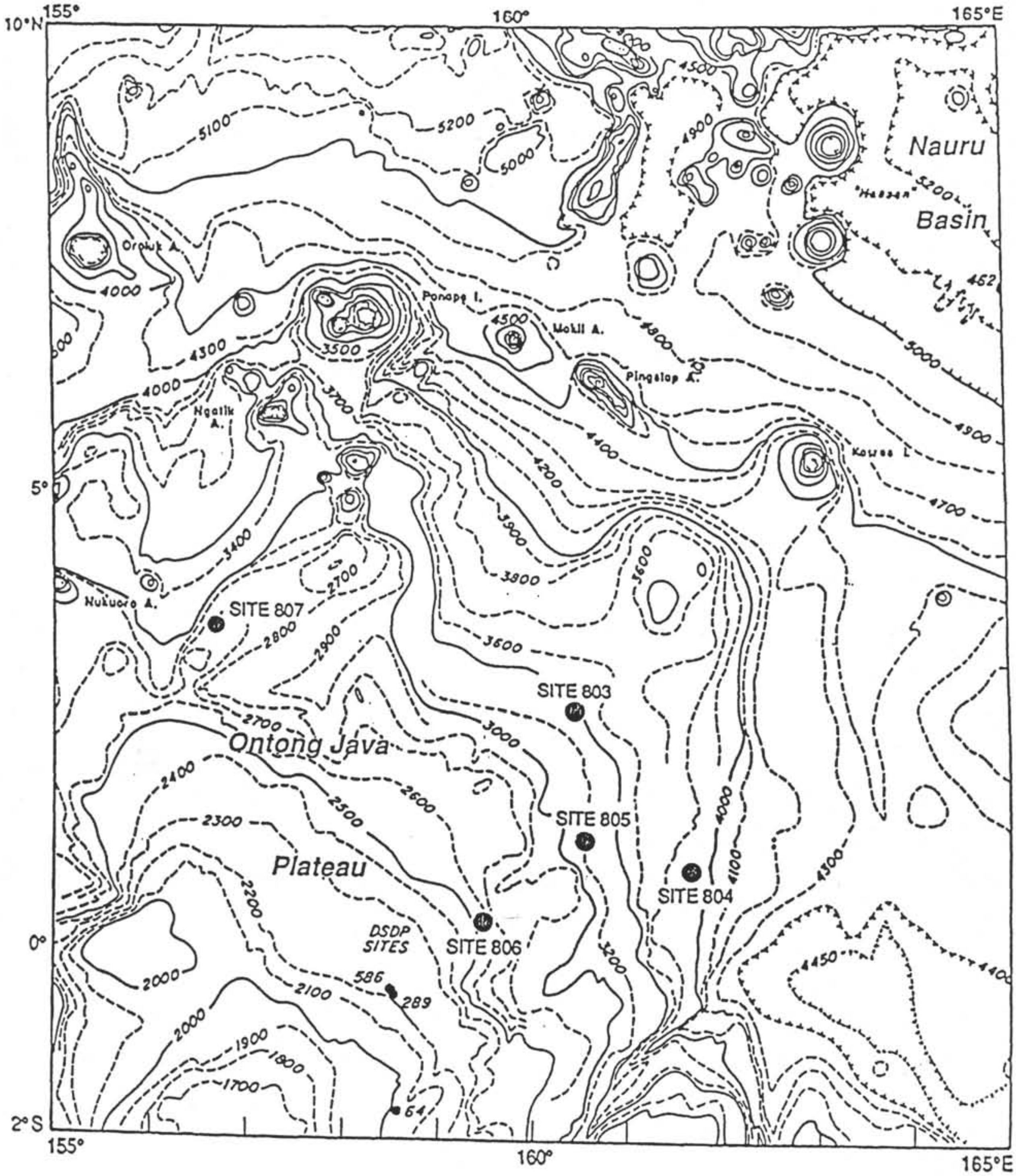

Figure 2. Bathymetry, in meters, of the northwestern part of the Ontong Java Plateau (after Mammerickx and Smith, 1985). The location of the Leg 130 sites (Sites 803-807) together with those from DSDP Leg 7 (Site 64), Leg 30 (Site 289), and Leg 89 (Site 586) are shown for reference.

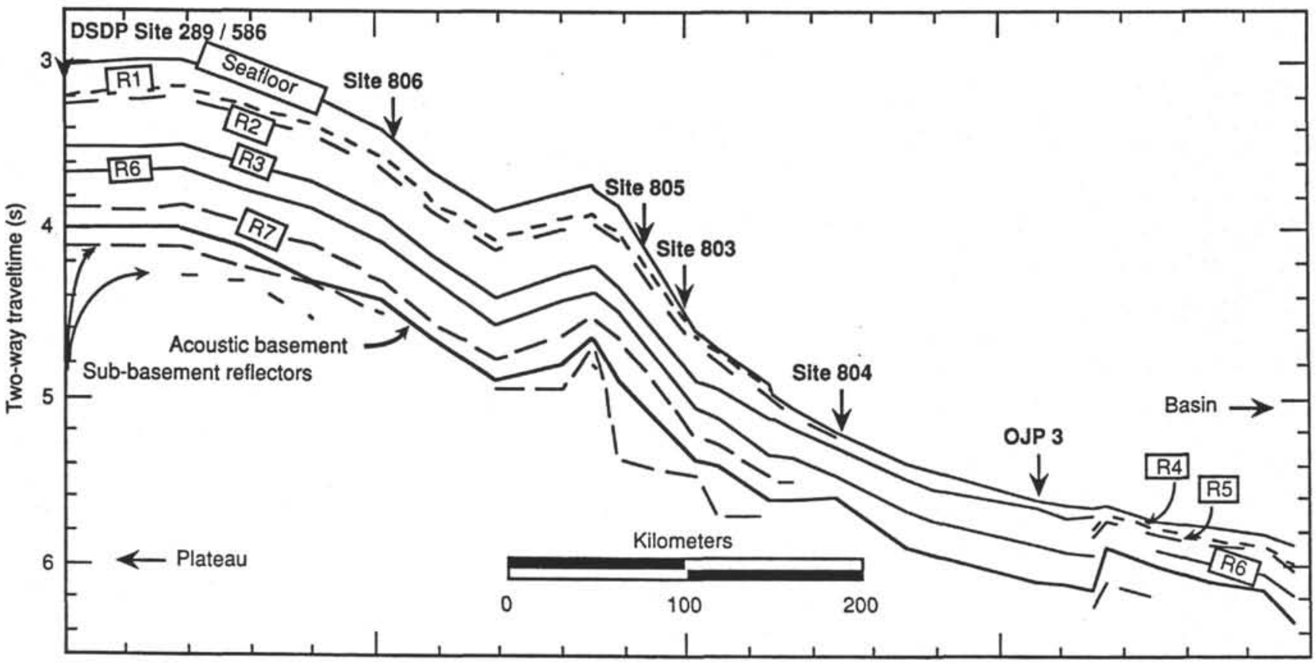

Figure 3. Simplified acoustic stratigraphy for the flank of the Ontong Java Plateau, and approximate locations of Sites 803 to 806 (the Neogene depth transect). OJP-3 is a proposed site which was not drilled. See text for discussion of reflectors. Figure courtesy of David Mosher, Dalhousie University.

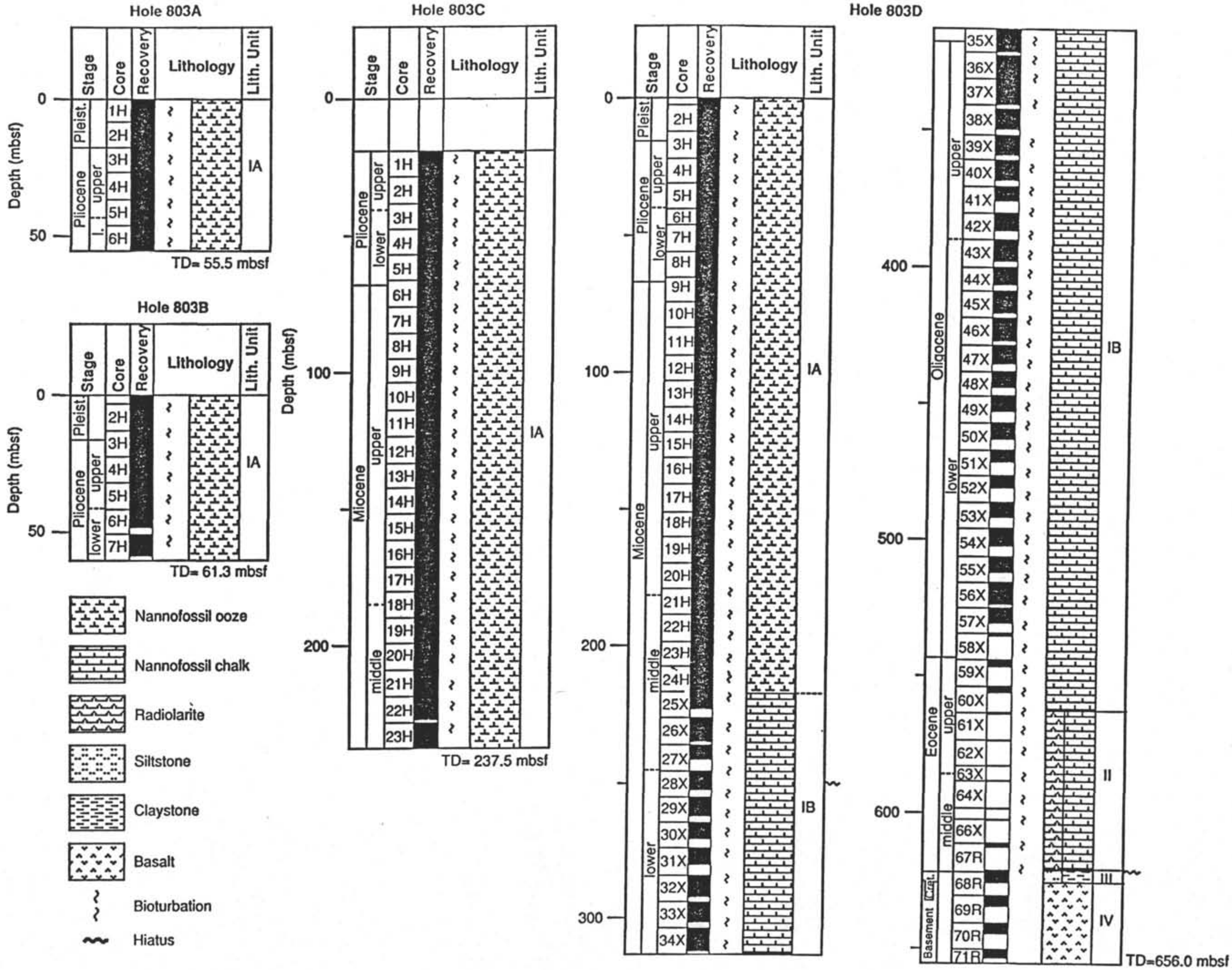

Figure 4. Summary lithologic columns for Site 803.

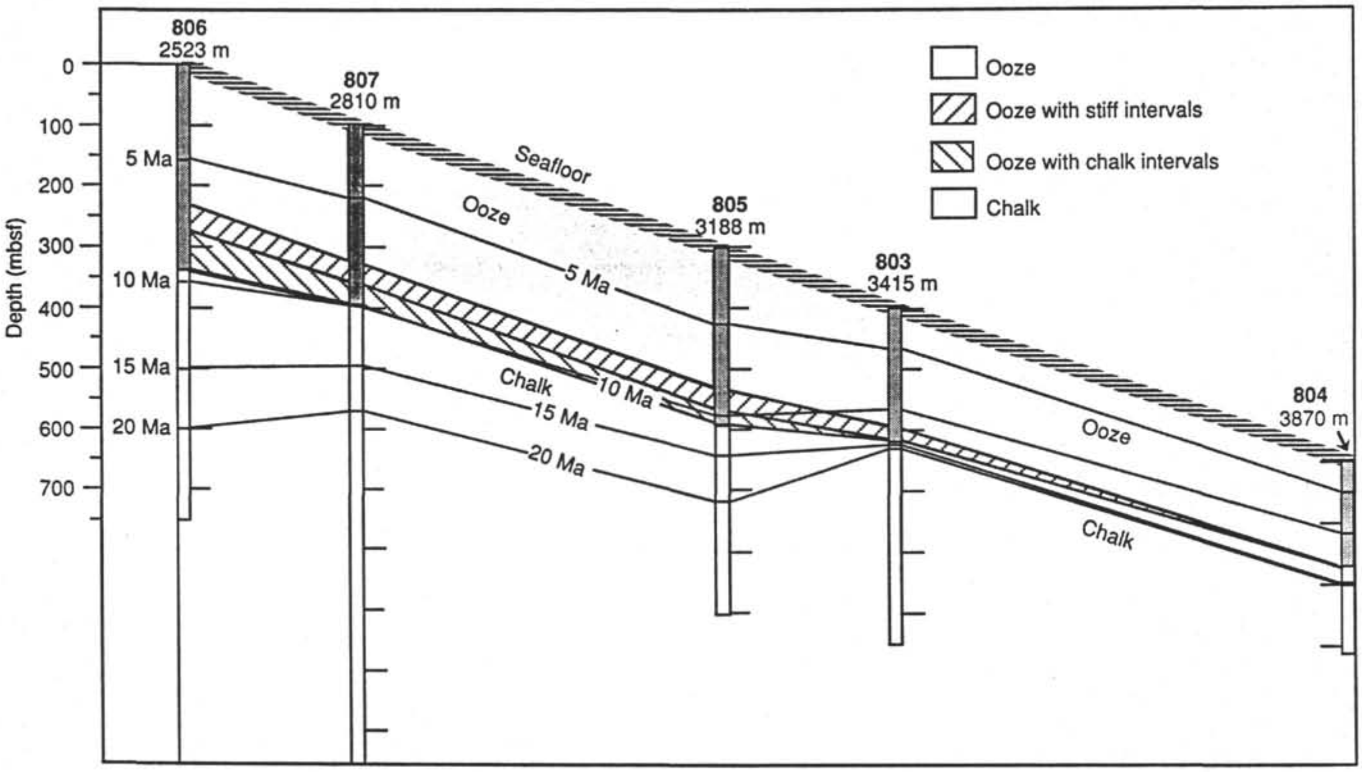

Figure 5. Location of ooze/chalk boundary at Leg 130 sites.

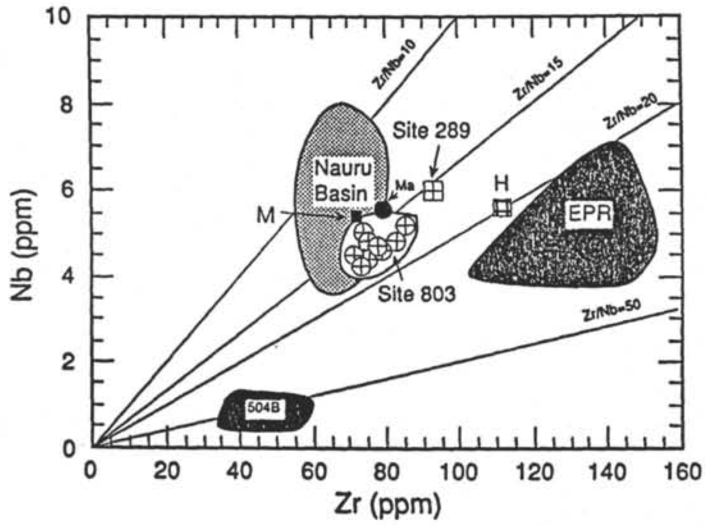

Figure 6. Plot of Zr versus Nb for Site 803 tholeiites. For comparison, fields are shown for the East Pacific Rise ("EPR"; Humphries et al., 1980), Hole 504B on the Costa Rica Rift (Kempton et al., 1985), and the Nauru Basin (Floyd, 1986; Saunders, 1986). Averages for Manihiki Plateau lavas ("M"; Jackson et al., 1976) and Malaita basement basalts ("Ma"; J. Mahoney, unpublished data) also are plotted, as are data for the single basalt flows recovered at Site 289 (Stoeser, 1975) and on Hess Rise ("H"; Seifert et al., 1981).

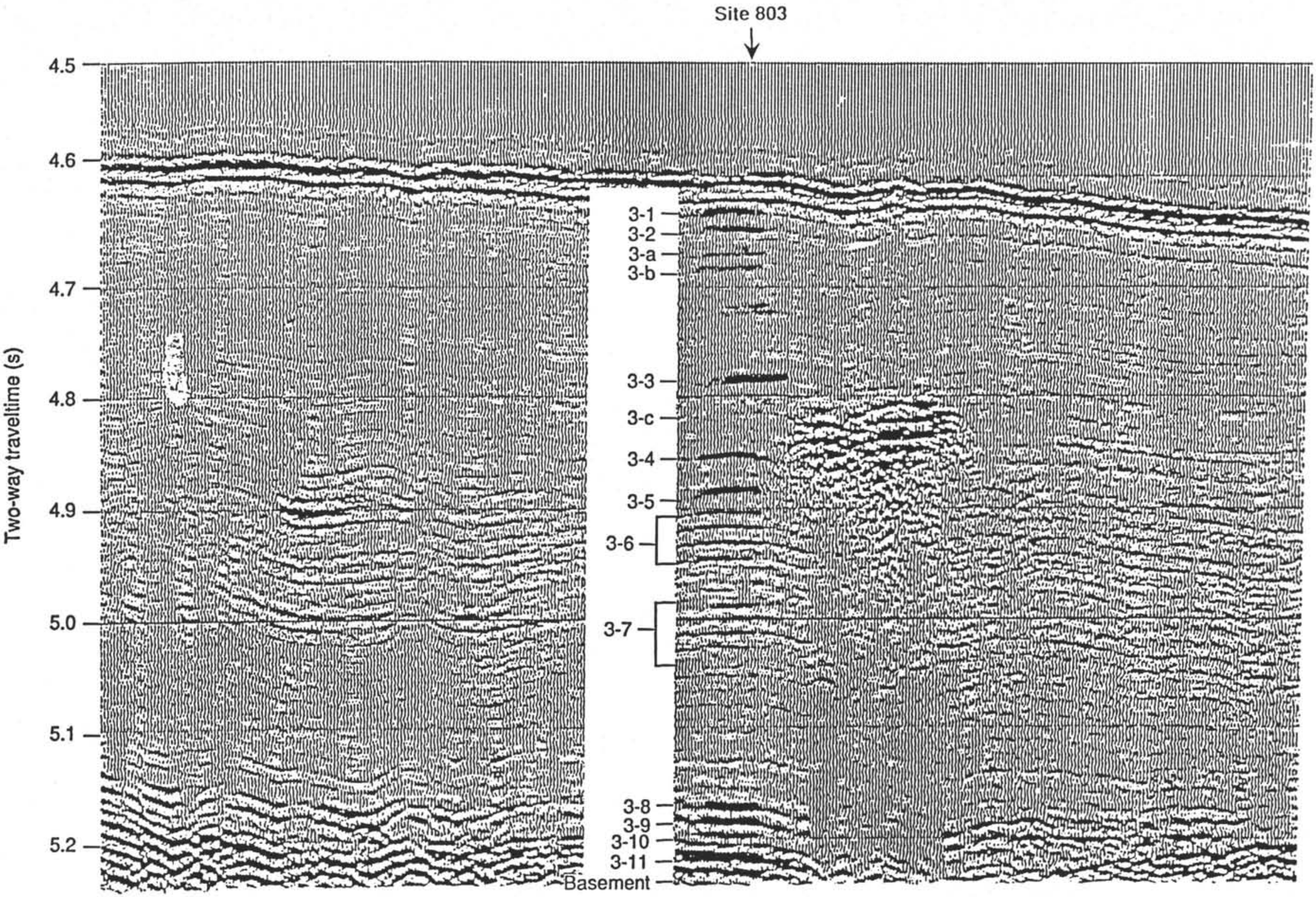

Figure 7. Seismic record collected on site survey ROUNDABOUT 11 (R/V *Thomas Washington* over Site 803 (80-in.^{3} water gun, 70-250-Hz bandpass filter). Location of Site 803 is indicated on the record. See text for discussion of reflector numbers 3-1 through 3-11.

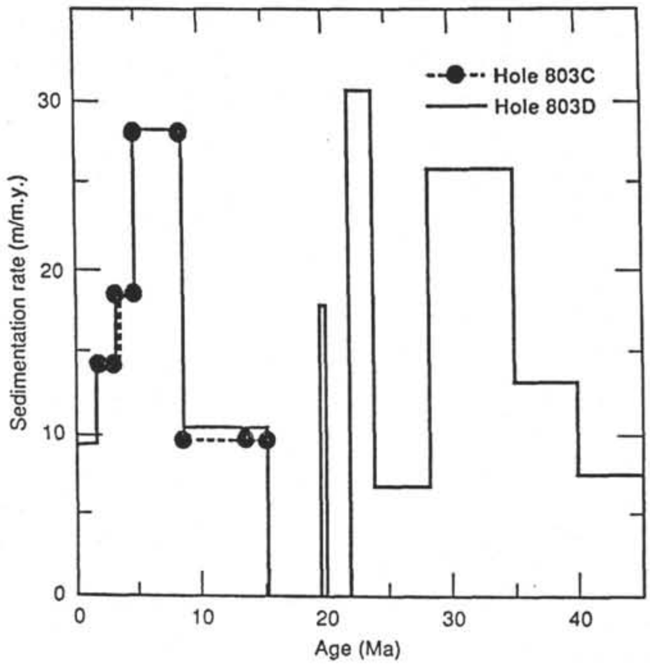

Figure 8. Sedimentation rates at Site 803.

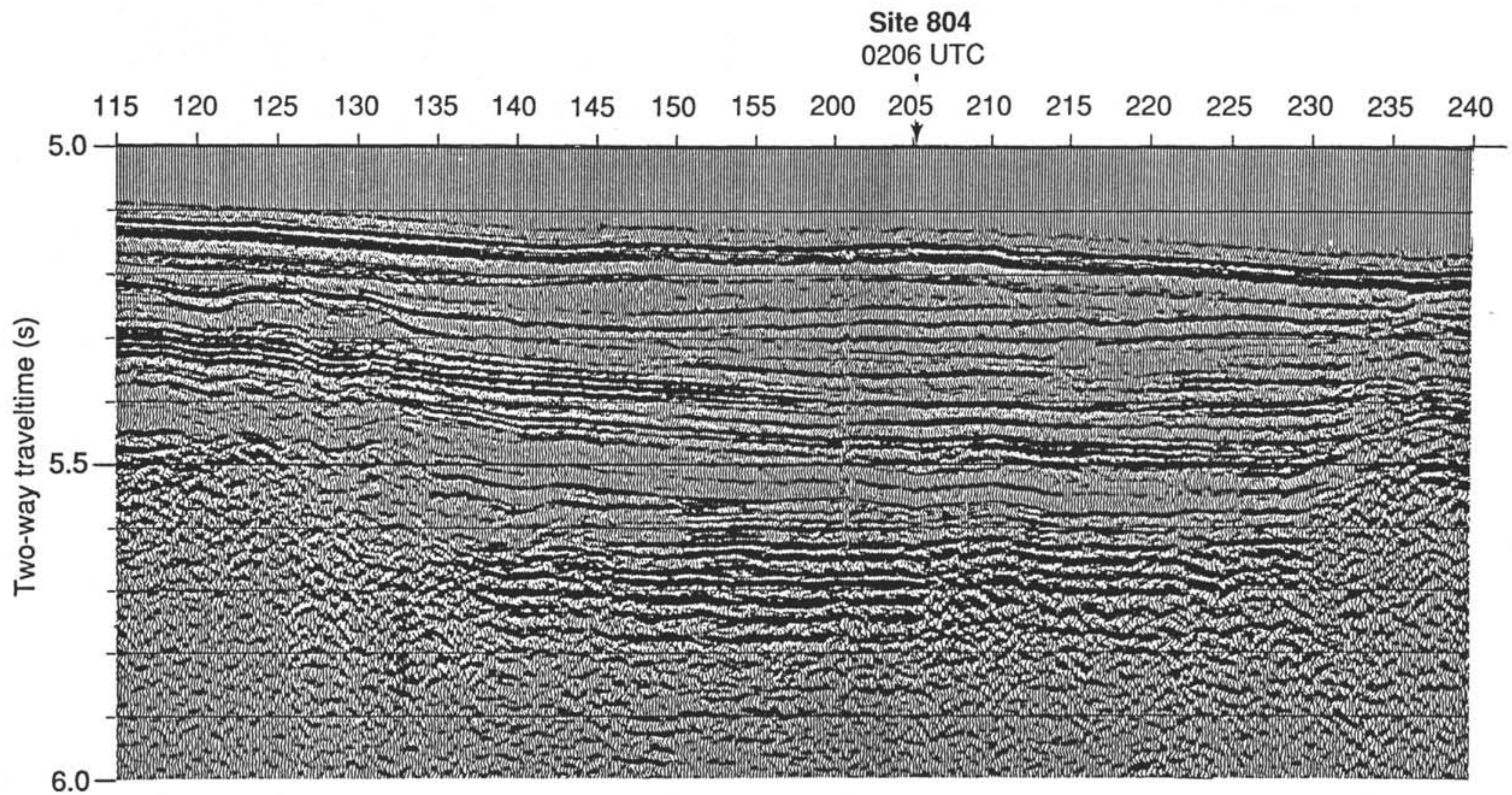

Figure 9. Seismic record collected during D/V *JOIDES Resolution* survey over Site 804 (80-in^3 water gun, 25-250-Hz bandpass filter).

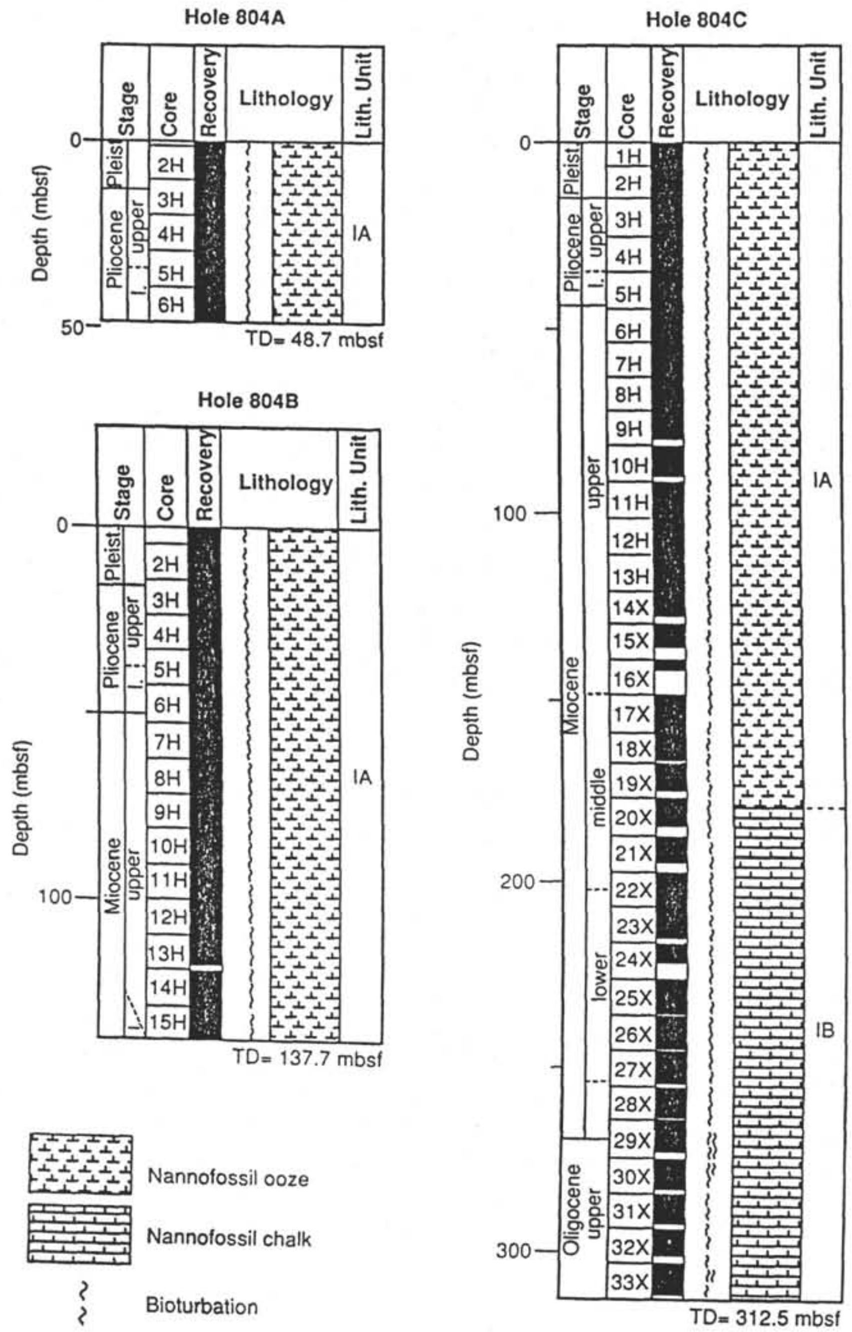

Figure 10. Summary lithologic columns for Site 804.

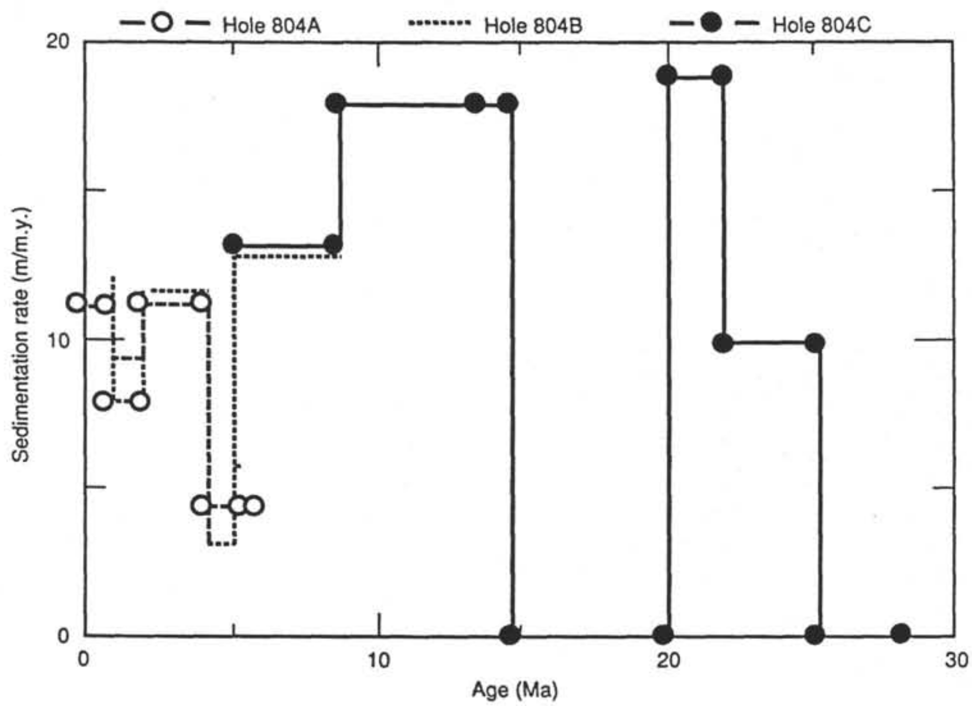

Figure 11. Sedimentation rates for Site 804.

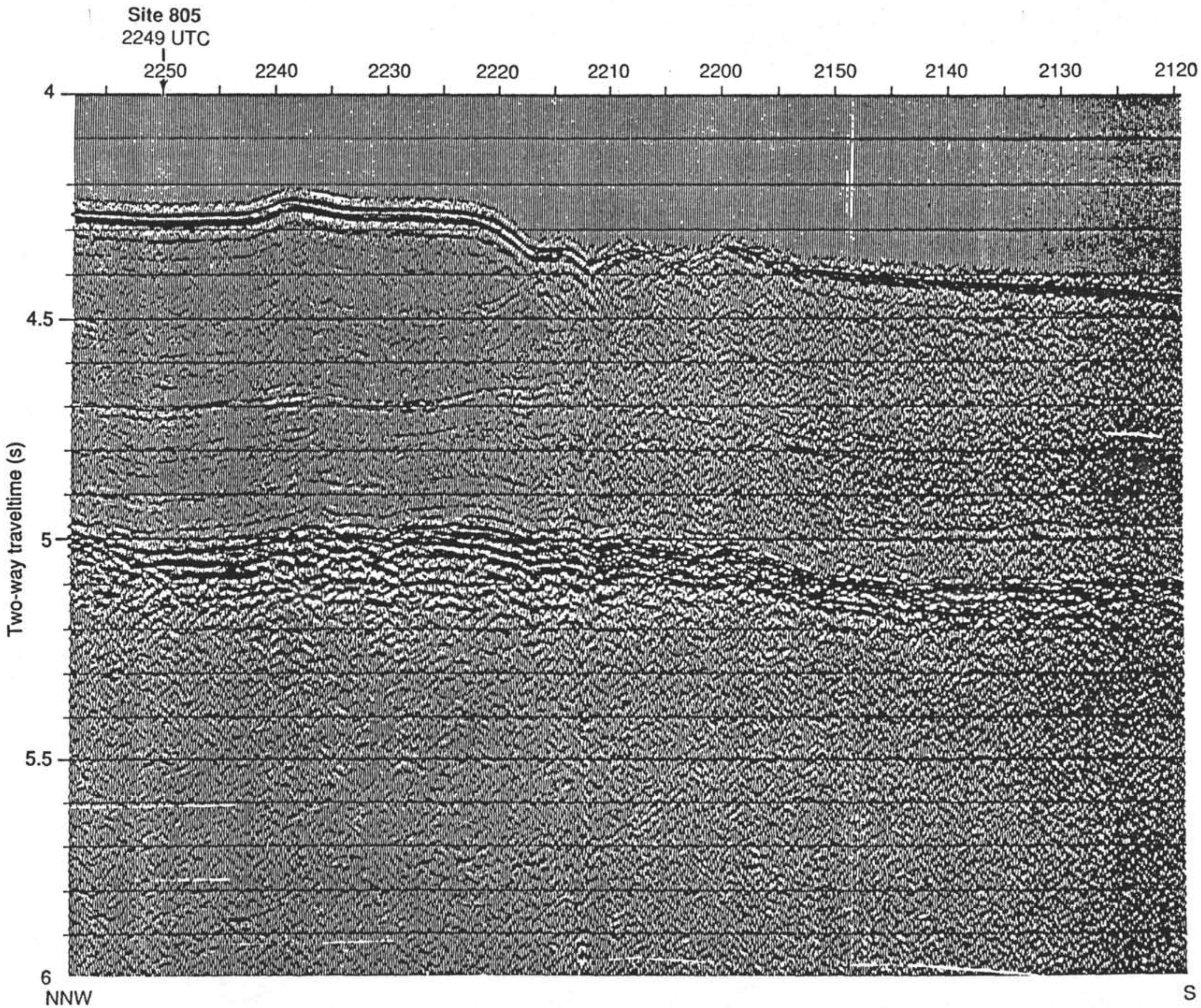

Figure 12. Seismic record collected during D/V *JOIDES Resolution* survey over Site 805 (80-in^3 water gun, 25-250-Hz bandpass filter).

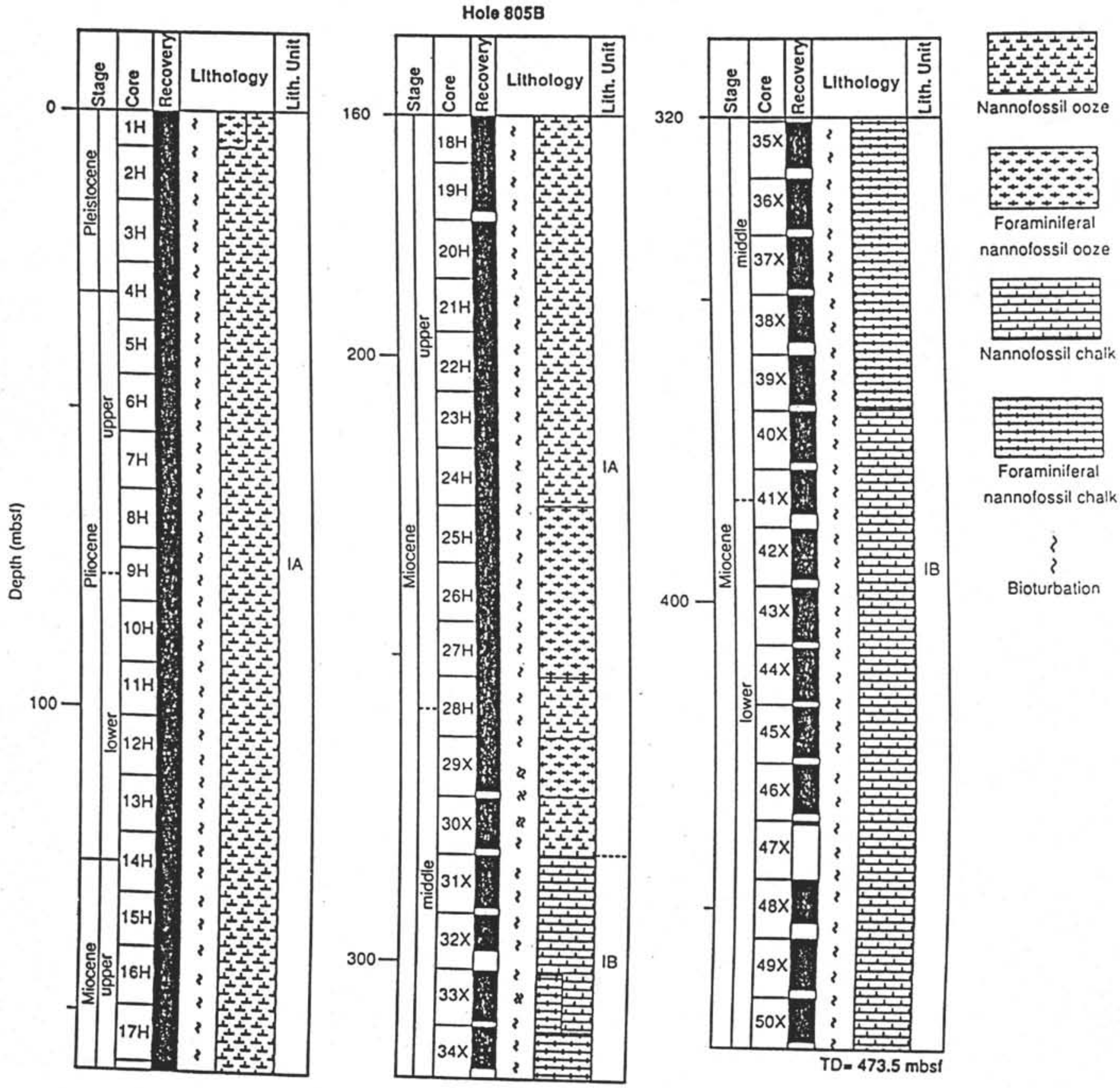

Figure 13. Summary lithologic columns for Site 805. Cores from Hole 805A were not split on board ship; therefore a lithologic column is not presently available for that hole.

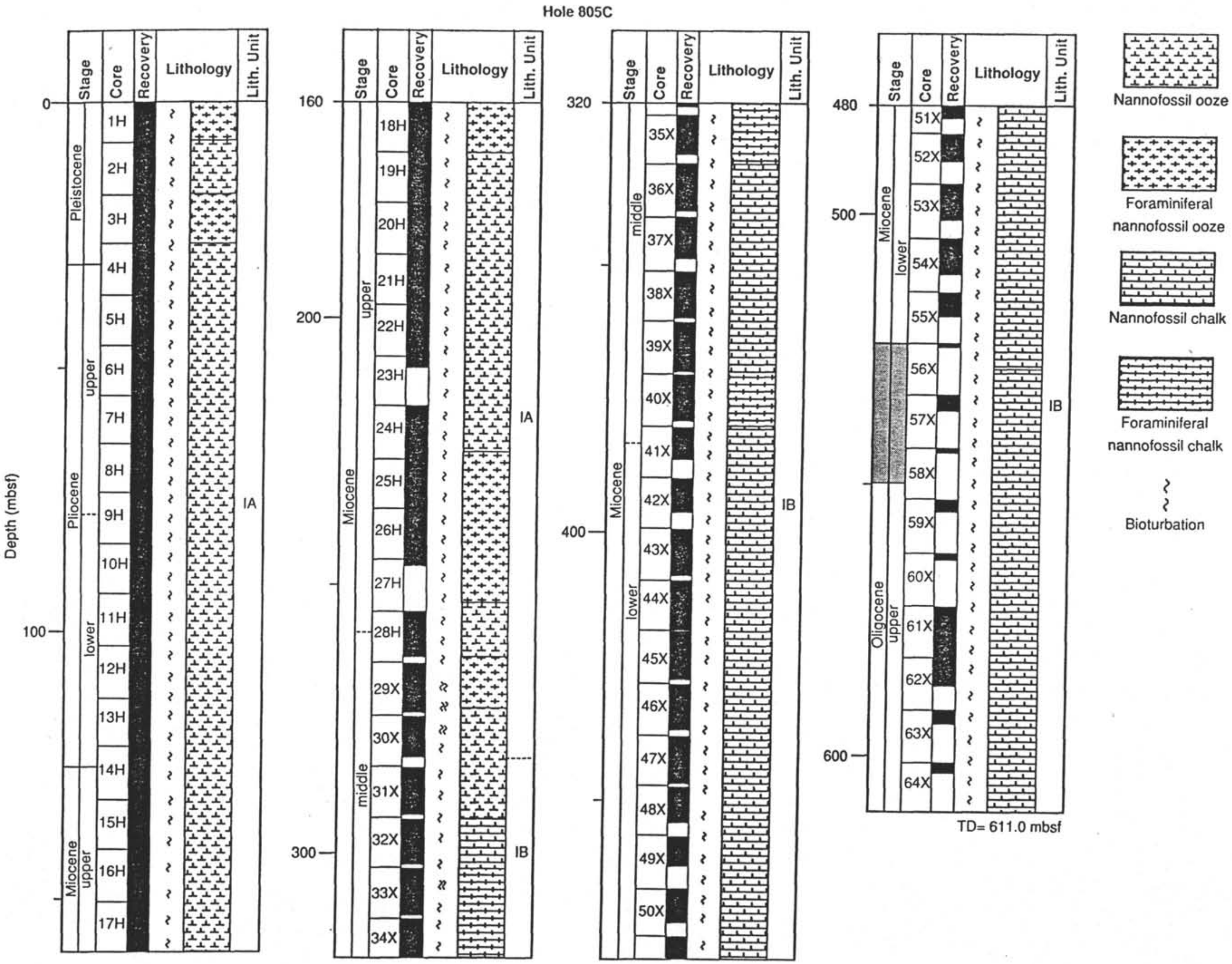

Figure 13 (cont'd.).

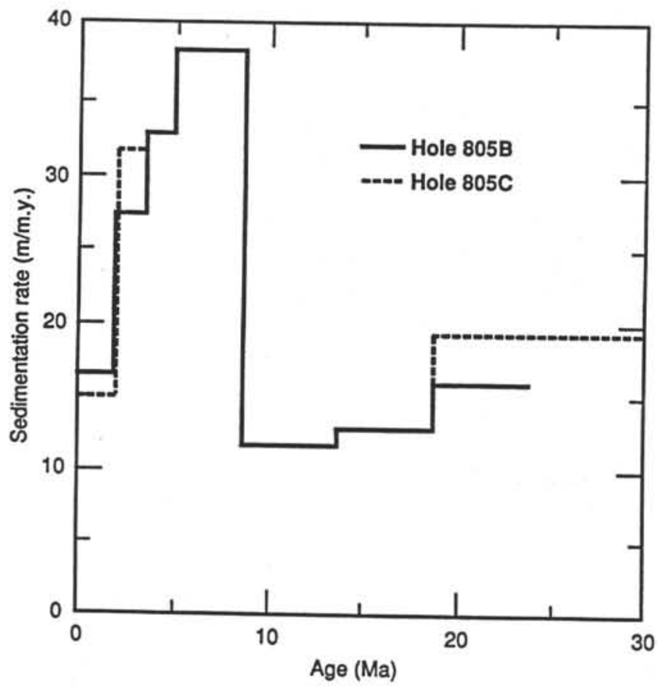

Figure 14. Sedimentation rates at Site 805.

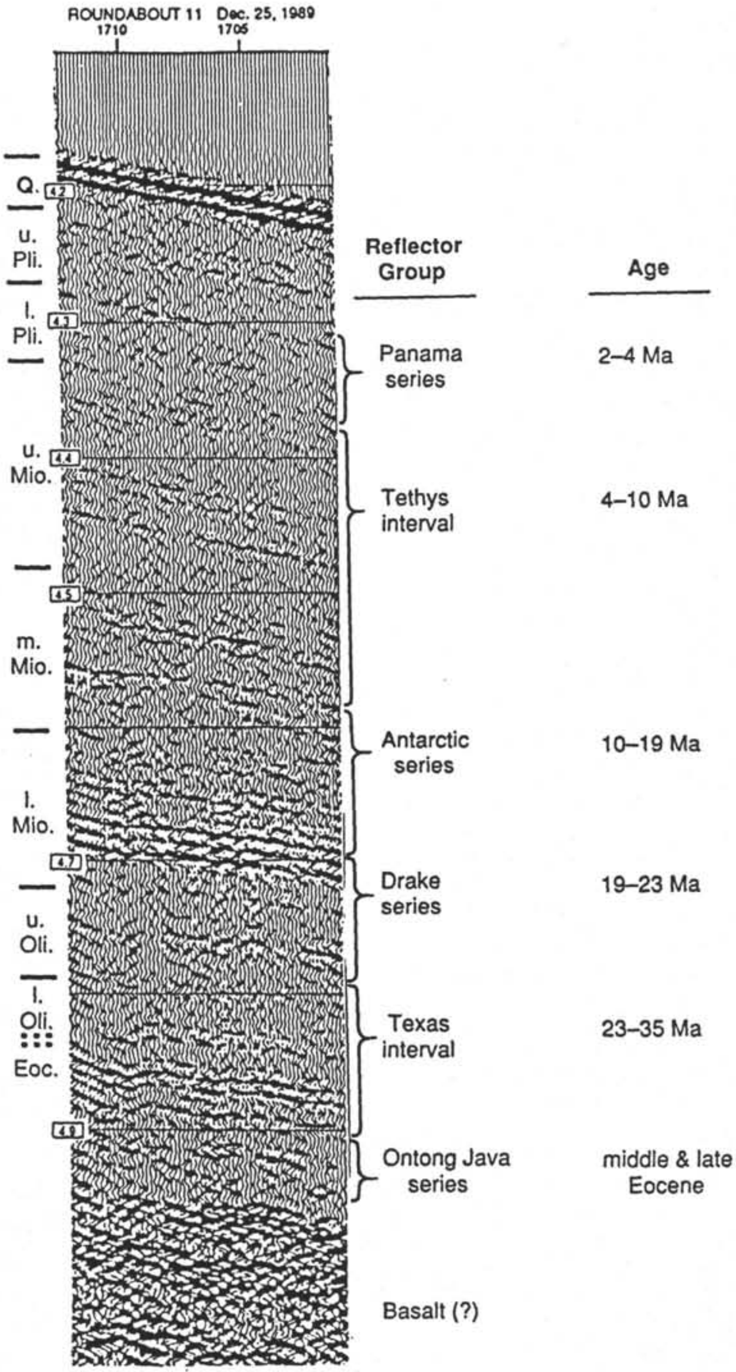

Figure 15. Seismic profile at Site 805, taken by R/V *Thomas Washington* on Cruise ROUNDABOUT 11, with time-scale assigned from drilling and logging results. Two-way travel time indicated on left-hand side of figure. Names to the right refer to distinct groups of reflectors ("series") and to zones with no distinct groups of reflectors ("intervals"). Three of the names are taken from suggestions by Mayer et al. (1986) regarding the origin of such reflectors (Panama, Antarctic, Drake Passage). While these hypotheses are appealing, our use of these names does not imply that we consider them approved. For "Tethys" and "Texas" intervals, see text.

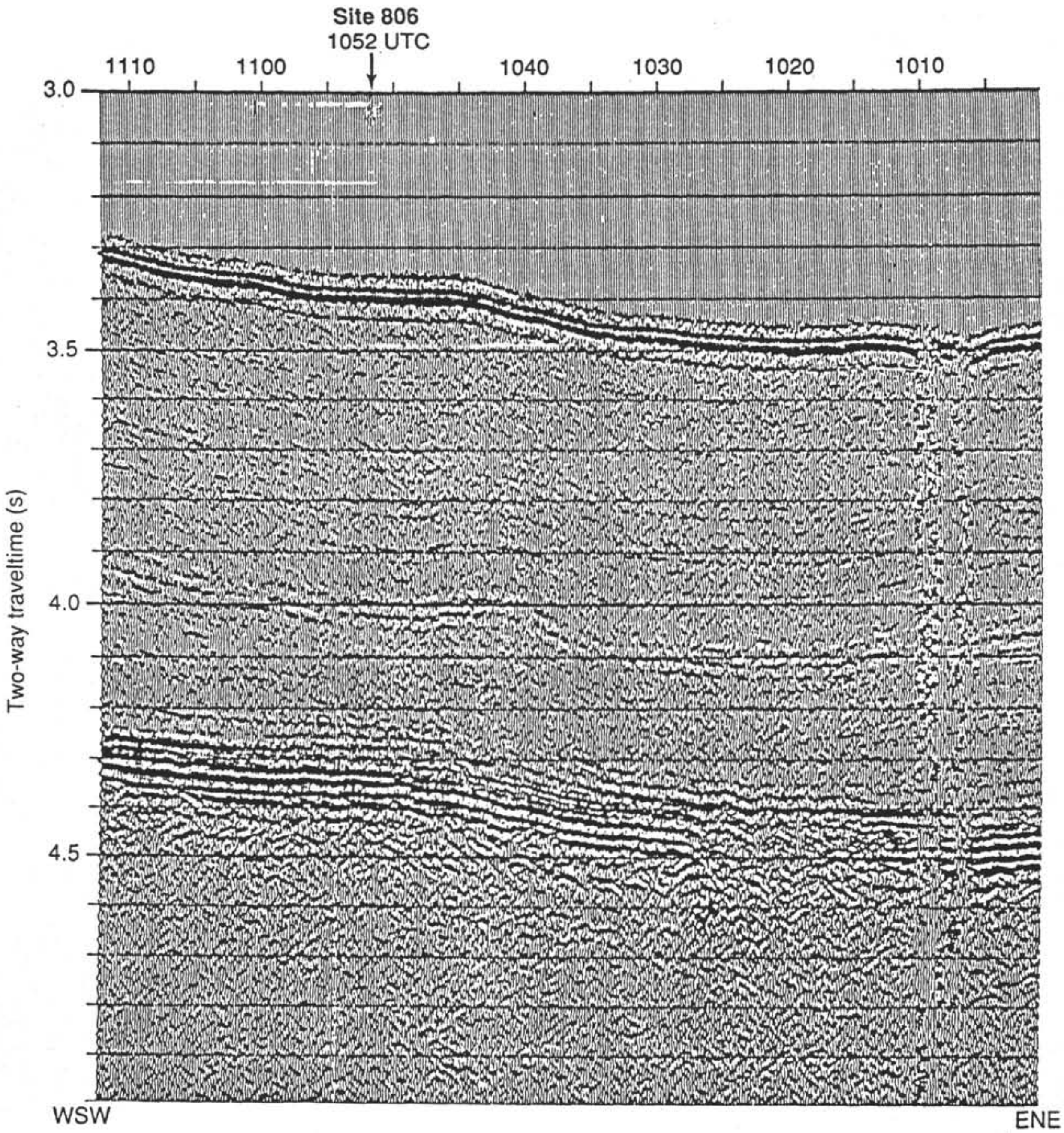

Figure 16. Seismic record collected during D/V *JOIDES Resolution* survey over Site 806 (80-in.^{3} water gun, 25-250-Hz bandpass filter).

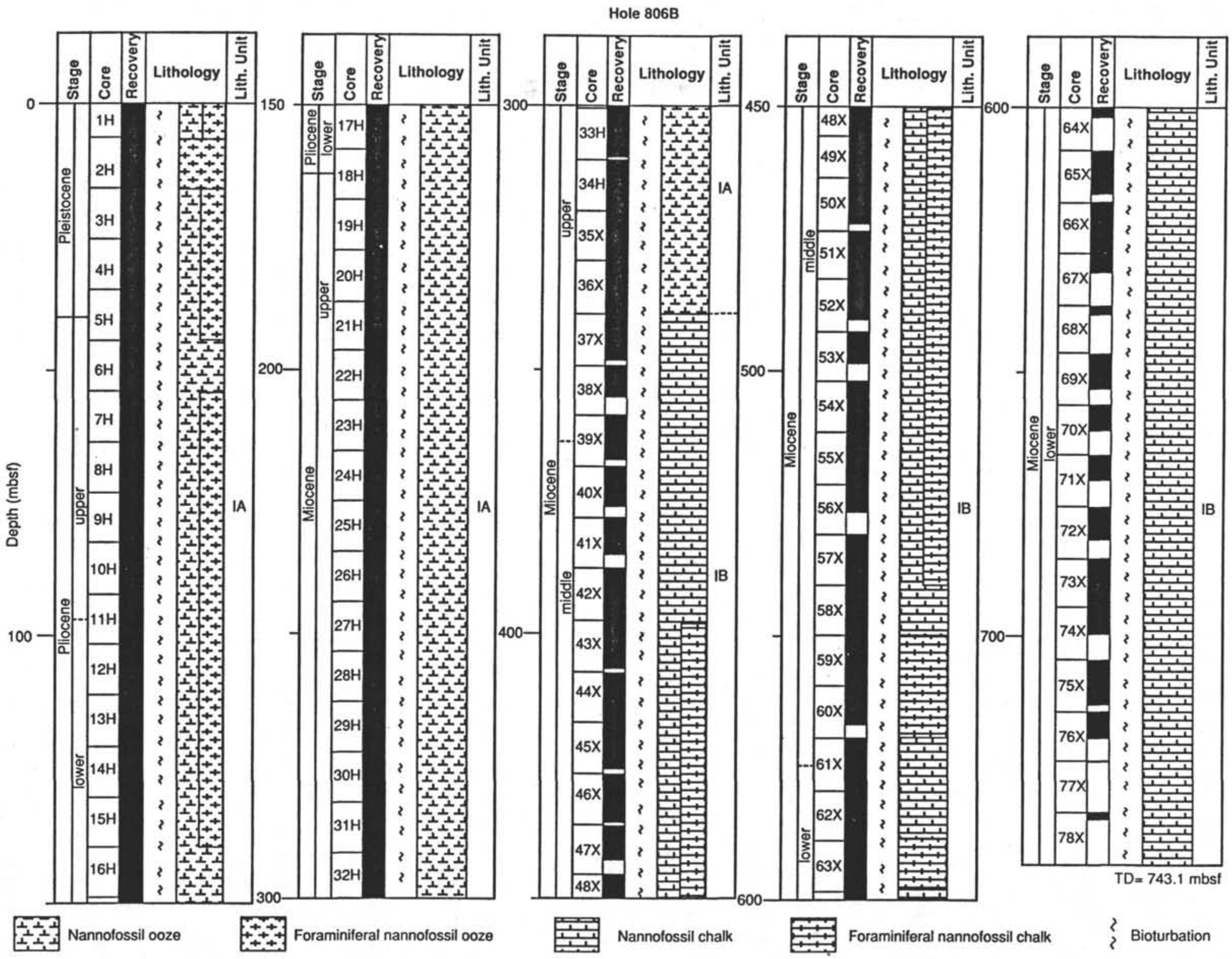

Figure 17. Summary lithologic columns for Site 806. Cores from Hole 806A were not opened on the ship; therefore a lithologic column is not presently available for that hole.

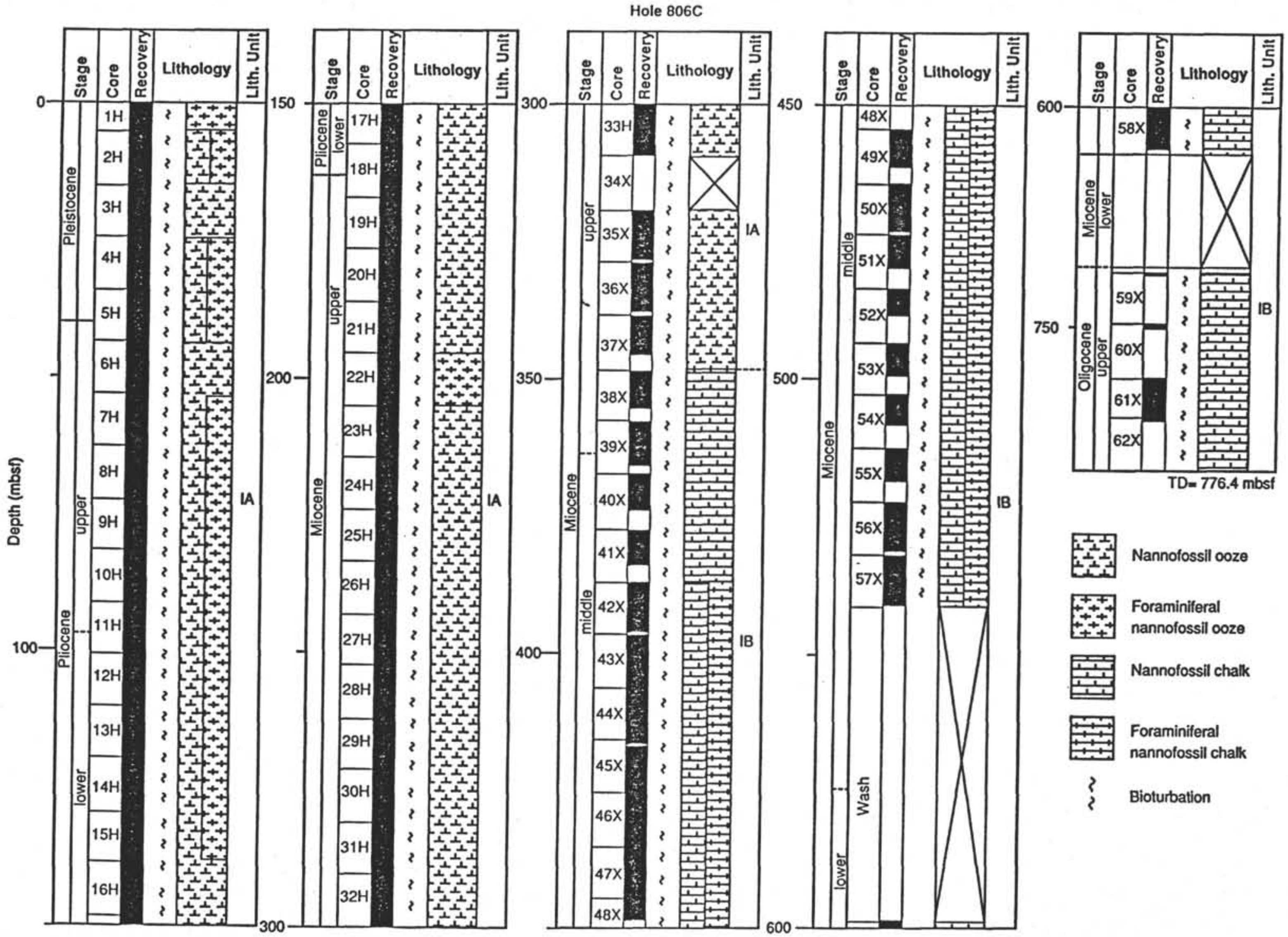

Figure 17 (cont'd).

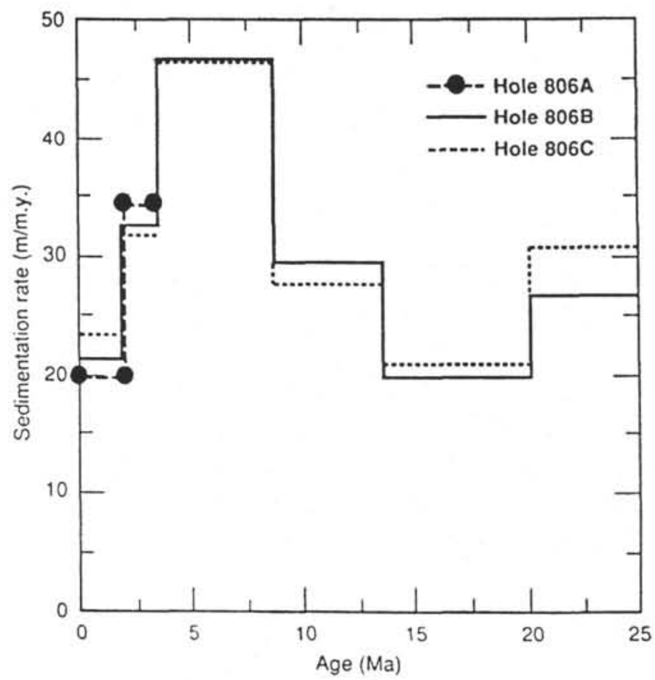

Figure 18. Sedimentation rates of Site 806.

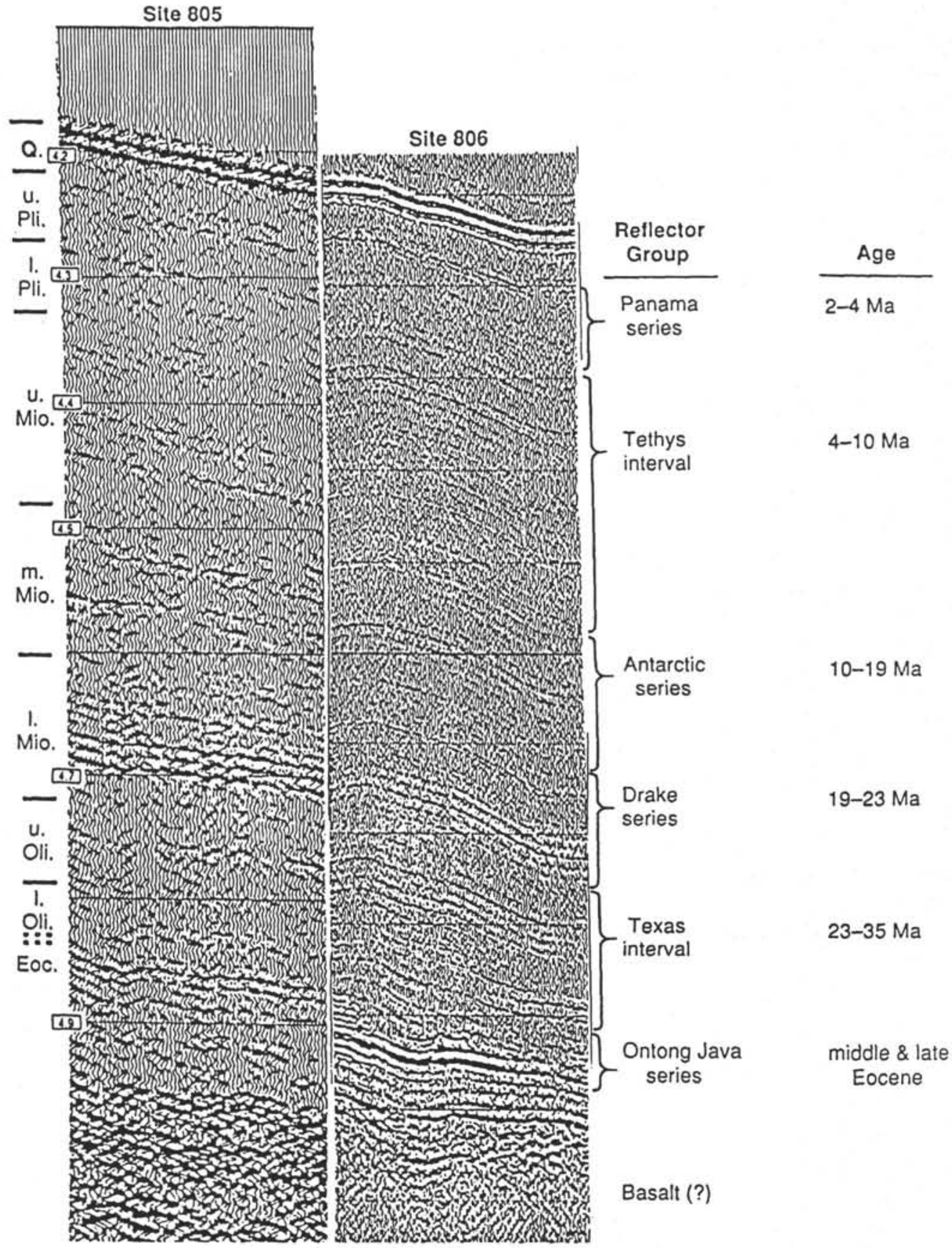

Figure 19. Comparison of seismic profiles at Sites 806 and 805. Profiles taken by R/V *Thomas Washington* on ROUNDABOUT Cruise 11, with the time scale assigned from drilling and logging results, and biostratigraphy. Names to the right refer to groups of reflectors ("series") and to zones with no distinct groups ("intervals"). The record of Site 806 is to the right; its traveltime scale was reduced by a factor of 0.73 in order to get a good match of reflectors.

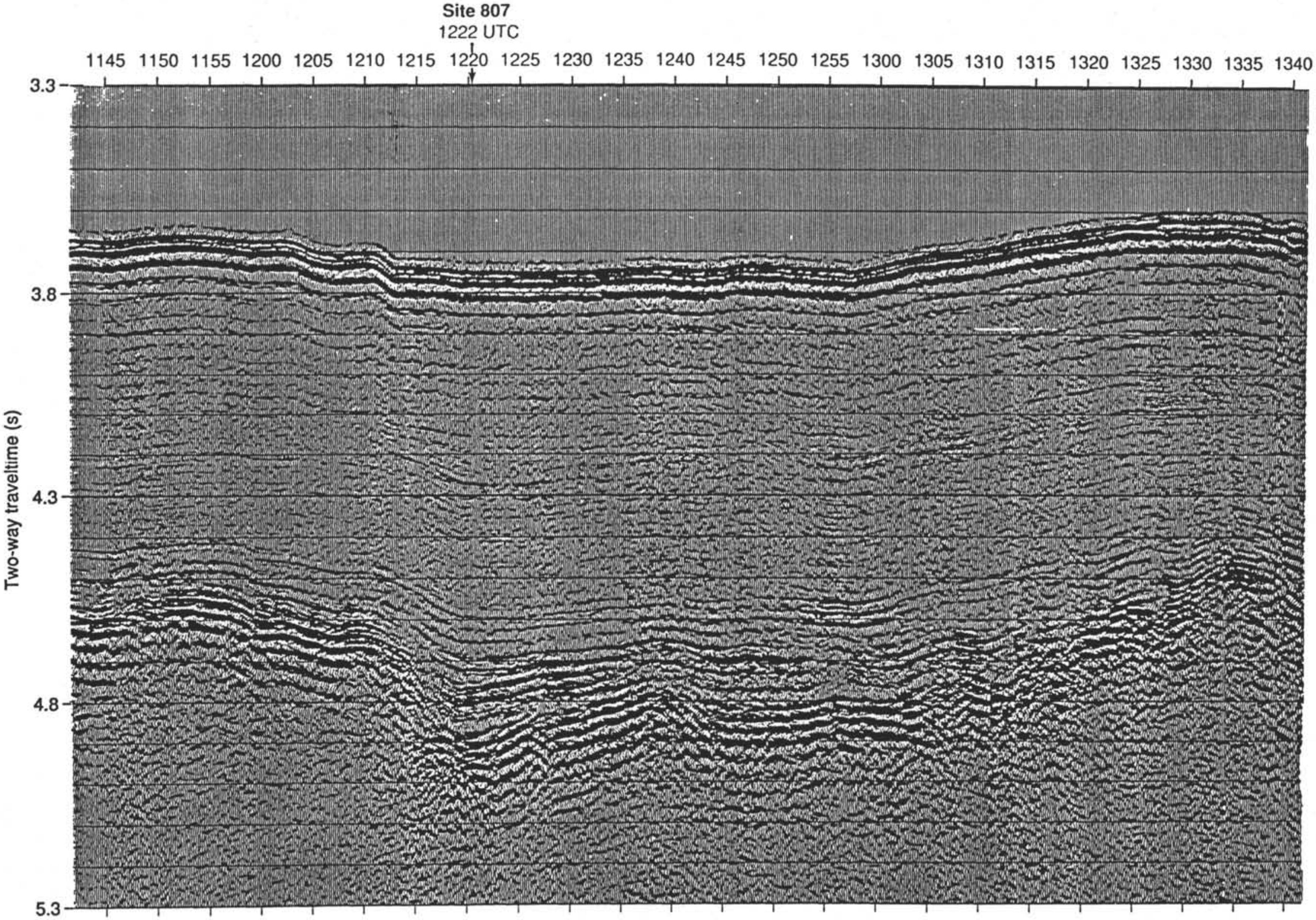

Figure 20. Seismic record collected during D/V *JOIDES Resolution* survey of Site 807 (80-in.^{3} water gun, 25-250-Hz bandpass filter).

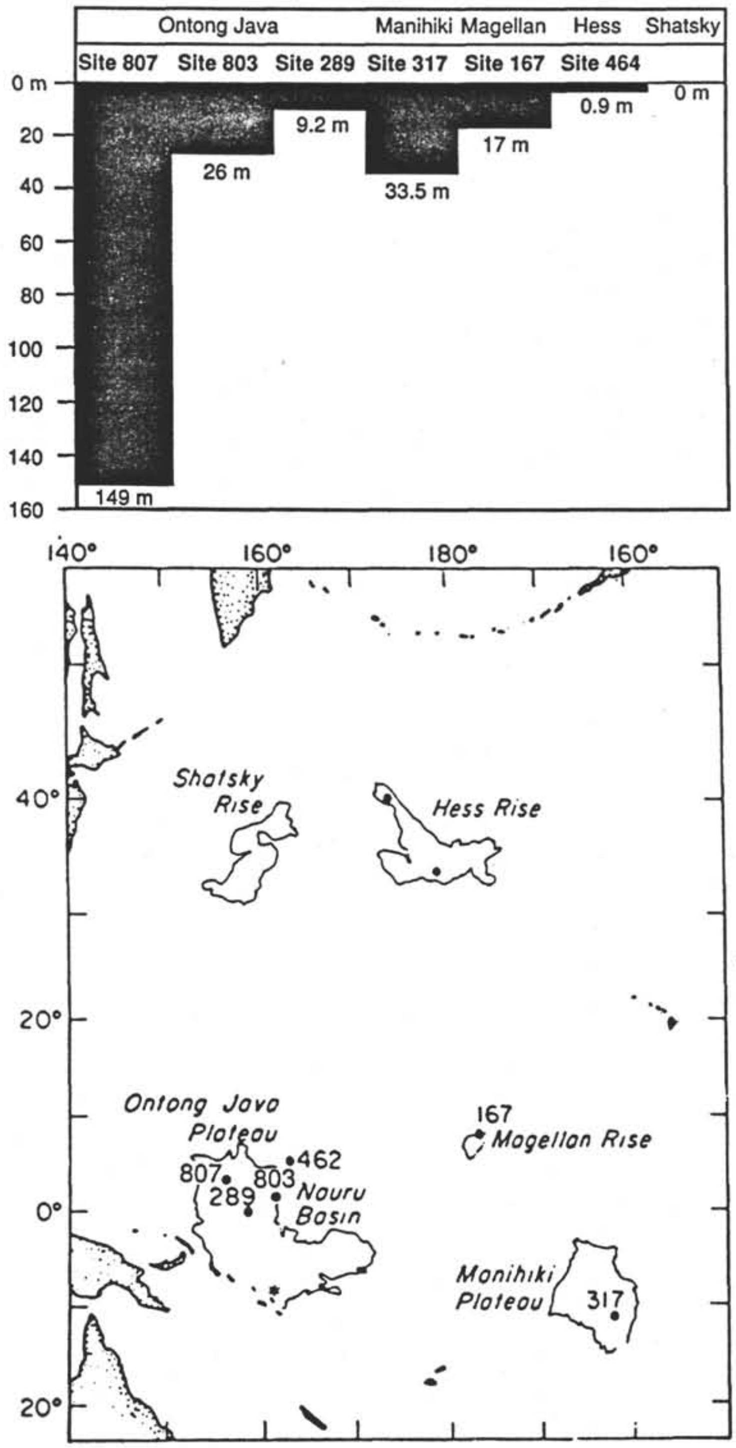

Figure 21. Basement penetration of oceanic flood basalt plateaus in the Pacific. Locations of drilling sites are shown on the map.

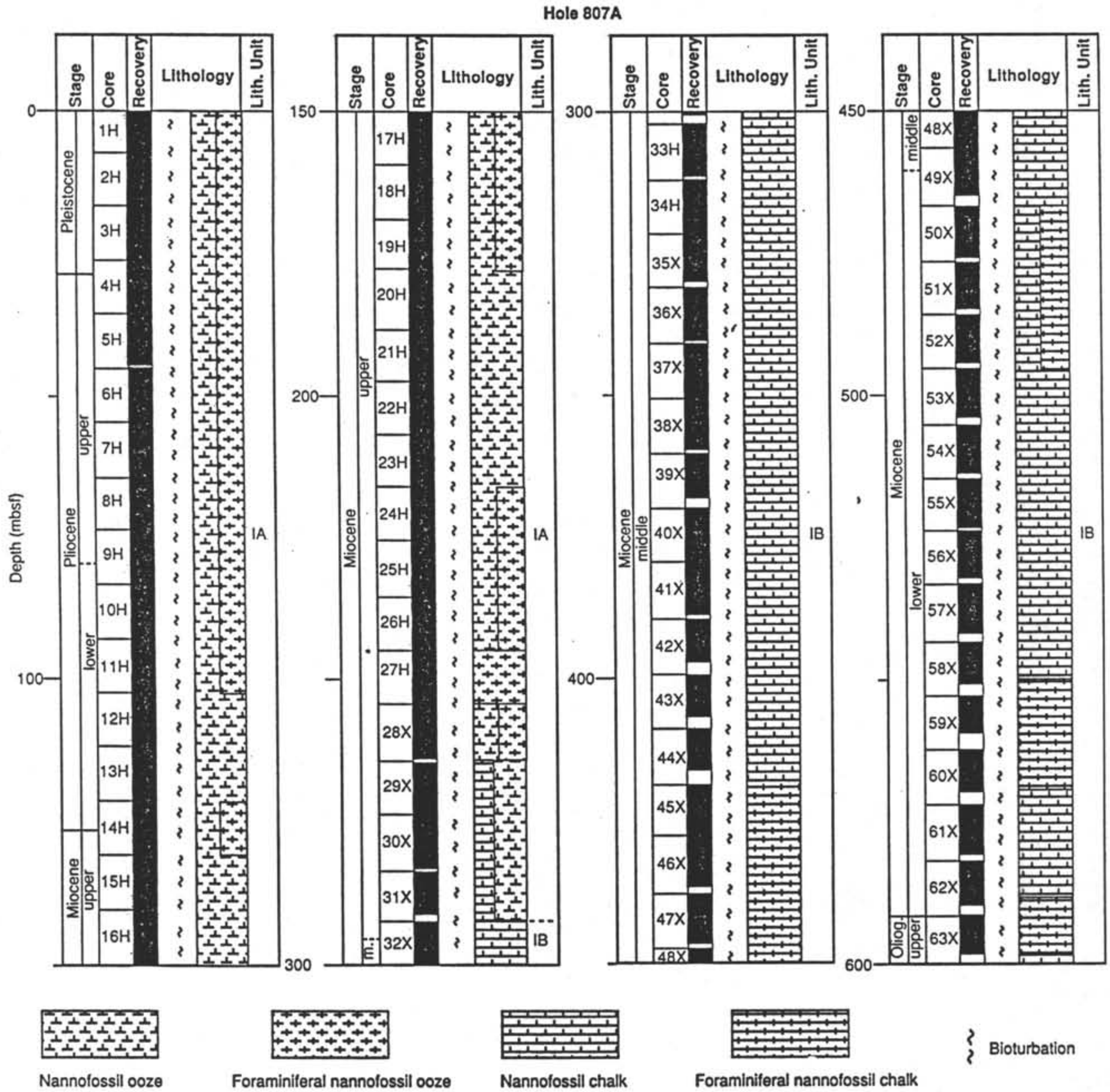

Figure 22. Summary lithologic columns for Site 807.

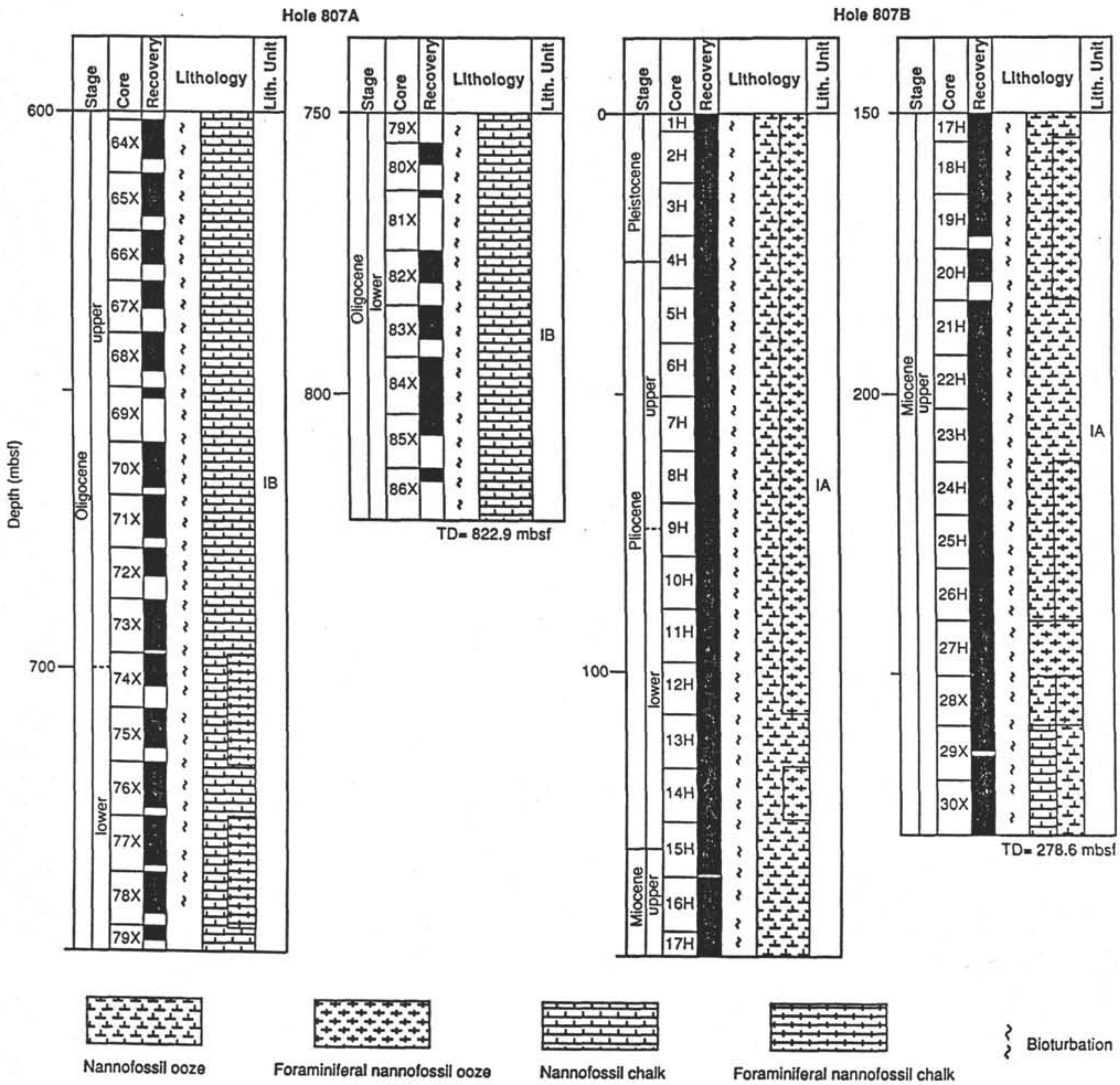

Figure 22 (cont'd).

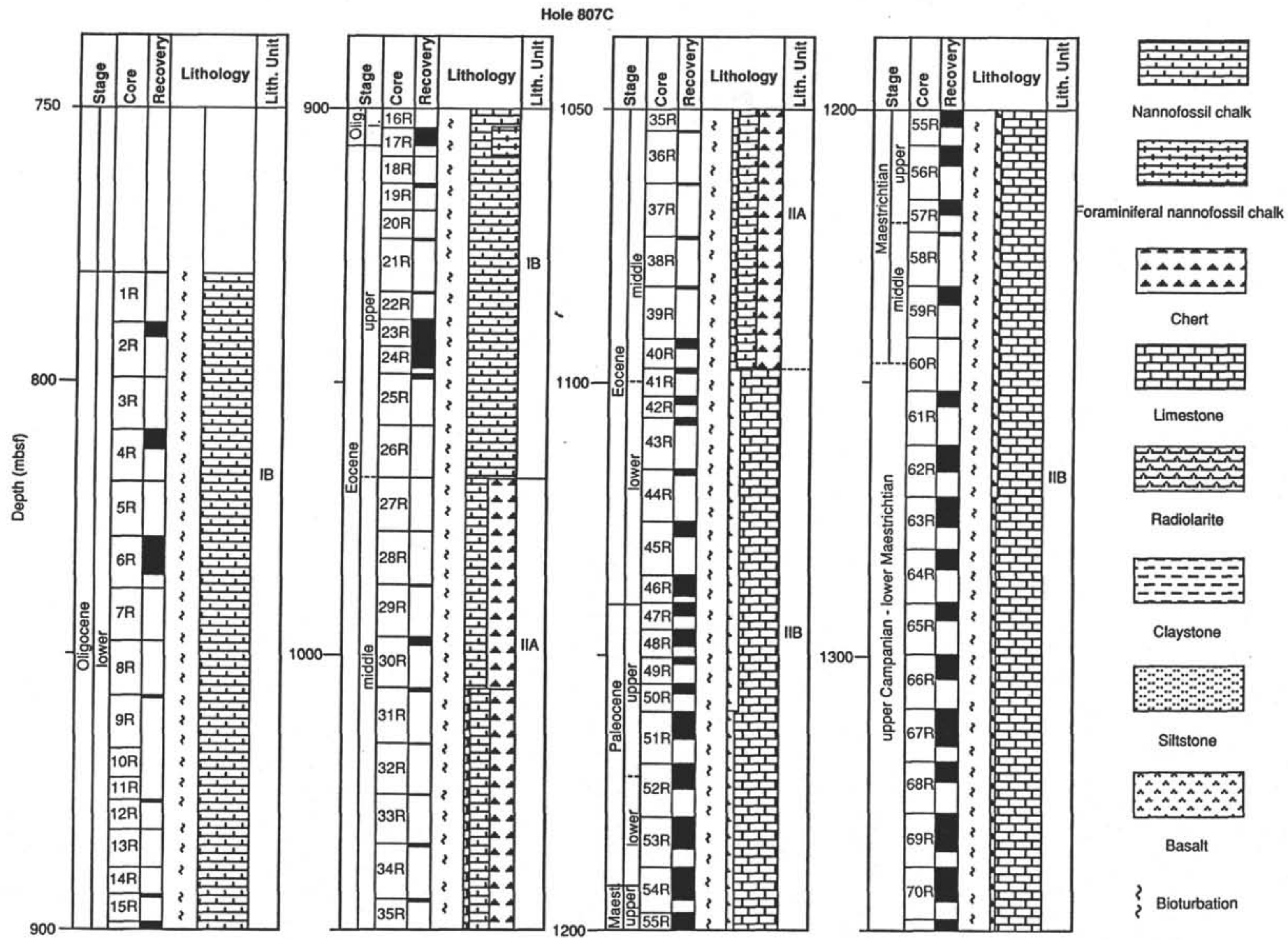

Figure 22 (cont'd).

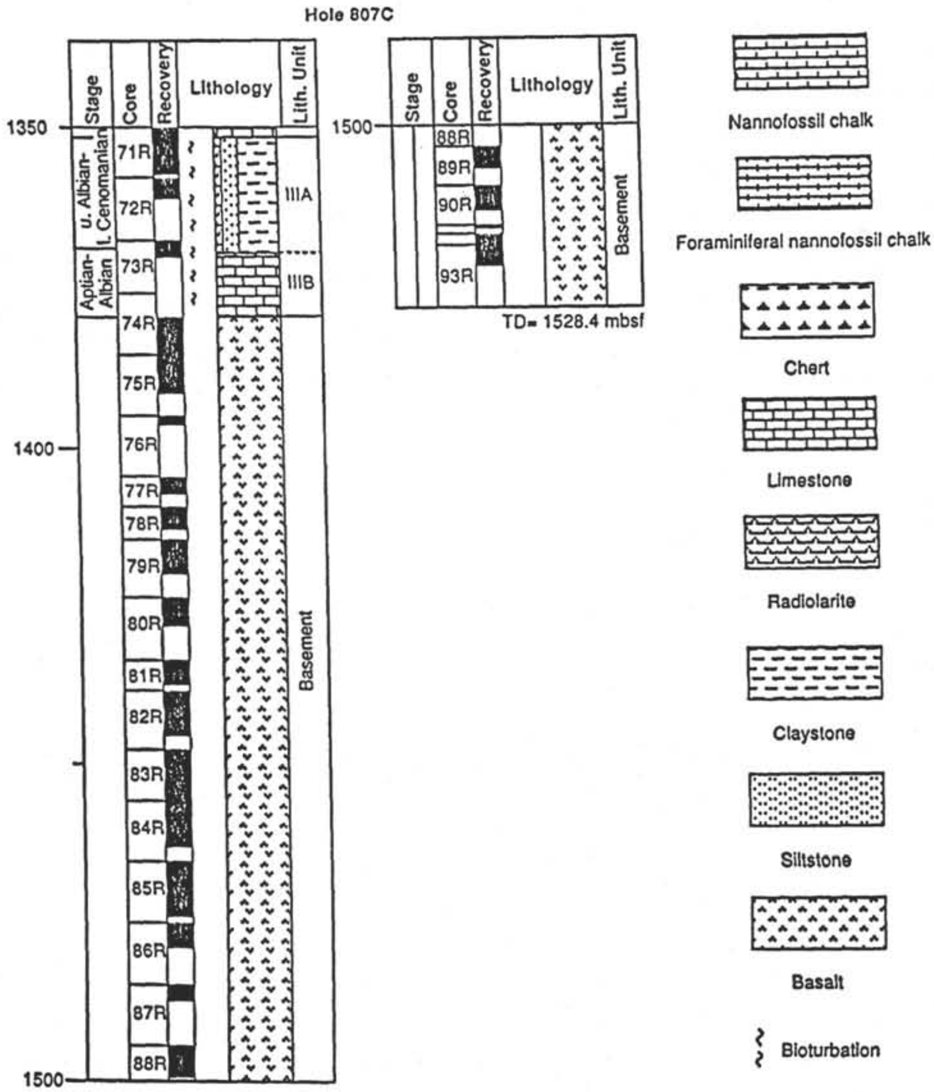

Figure 22 (cont'd).

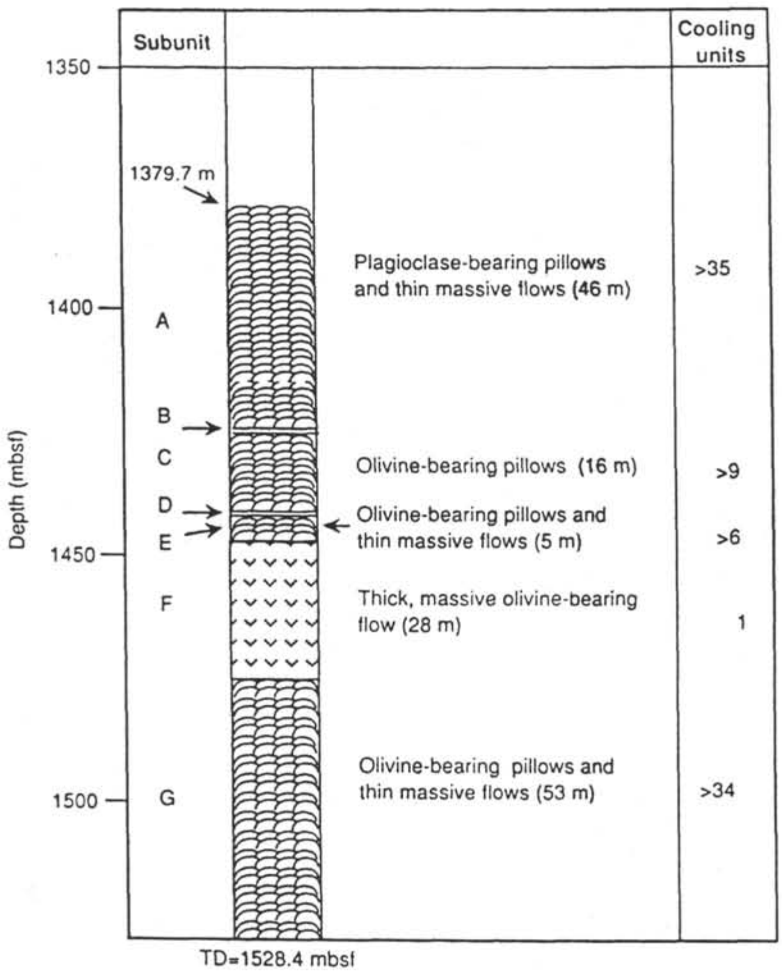

Figure 23. Summary lithologic column for basement rocks at Site 807.

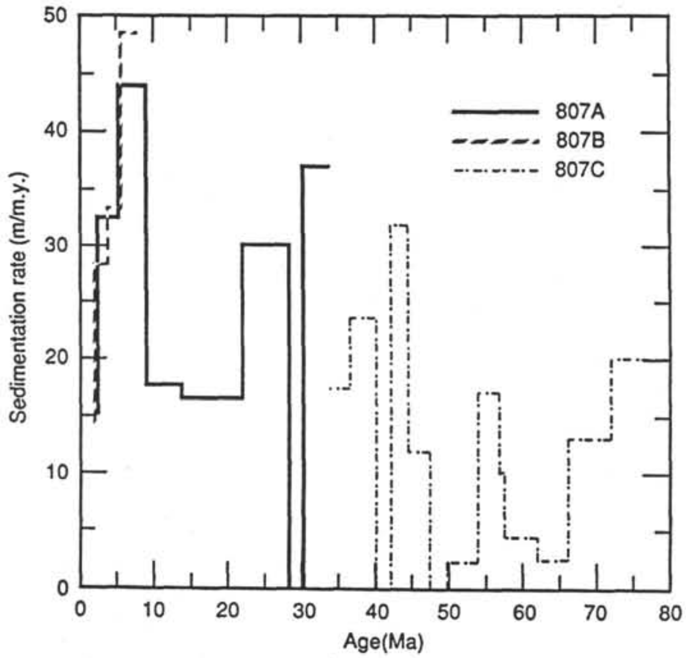

Figure 24. Sedimentation rates at Site 807.

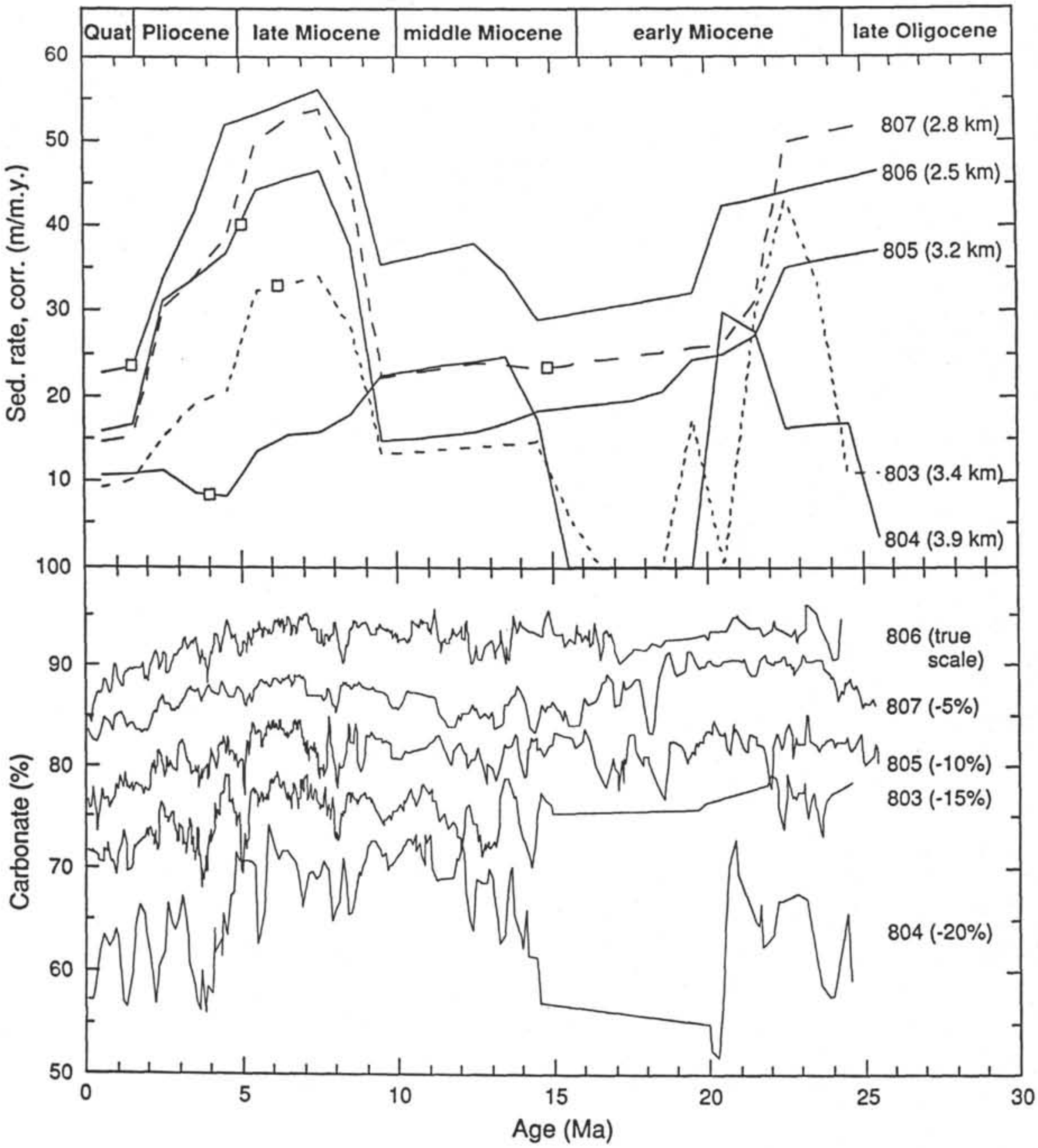

Figure 25. Sedimentation rates and carbonate percentages for the Leg 130 sites. Sedimentation rates have been corrected for compaction. Water depths for each site are listed on the right-hand side of the sedimentation rate figure. Boxes on sedimentation rate curves indicate the time when the site crossed the equator. Carbonate percentages have been adjusted, as noted on the figure, to facilitate graphical presentation.

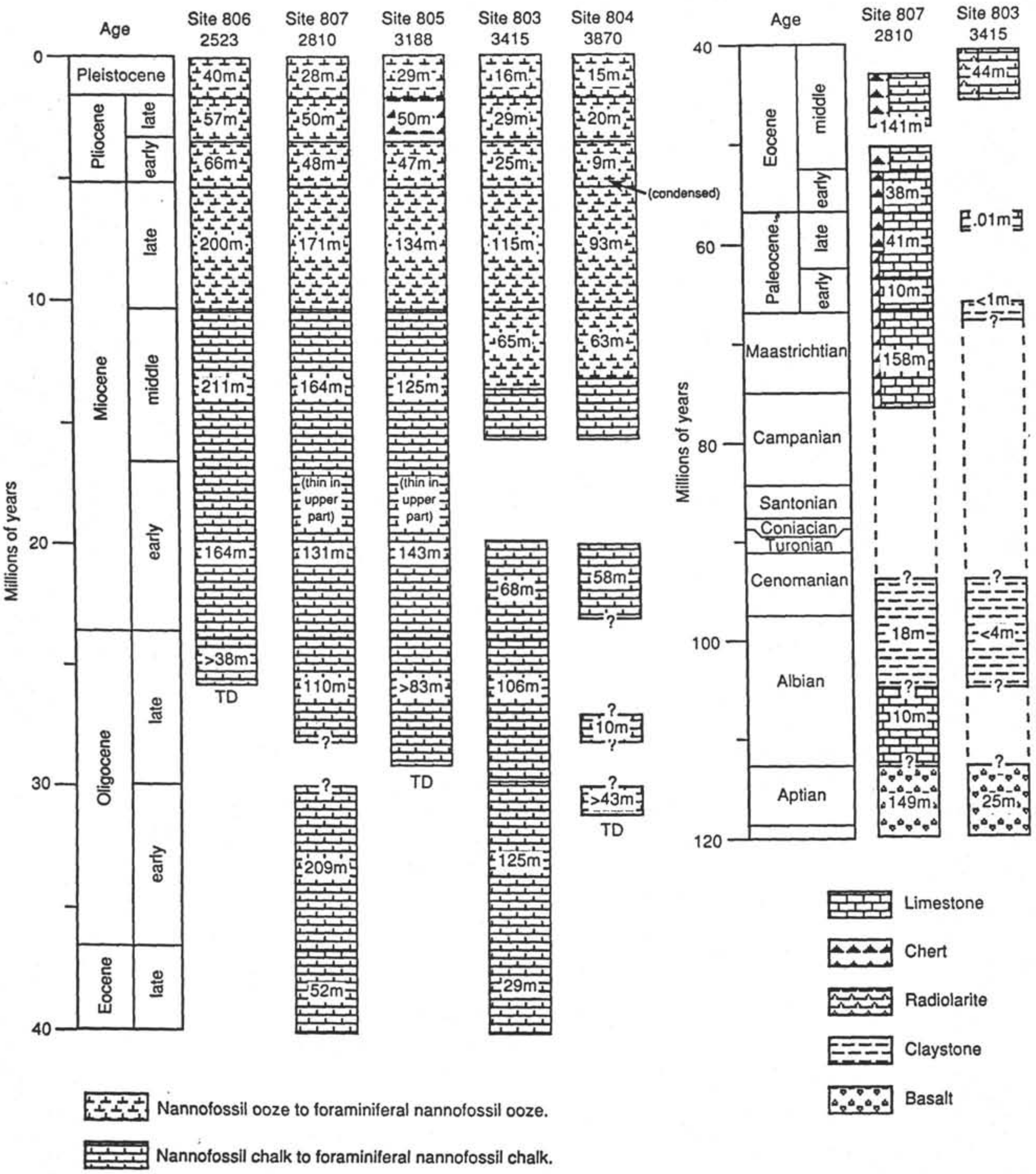

Figure 26. Sites drilled on the Ontong Java Plateau, western equatorial Pacific, during ODP Leg 130. Sites are arranged according to depth. Recovered sediment is shown as a function of age, rather than depth below seafloor, to highlight hiatuses within the drilled section. Sediment thicknesses given in the columns are approximate values based on shipboard biostratigraphy. Note, for example that the upper Miocene at Site 806 is approximately 200 m thick and thins downslope to approximately 93 m at Site 804. Age control through much of the Cretaceous is poor owing to dissolution of some calcareous microfossils.

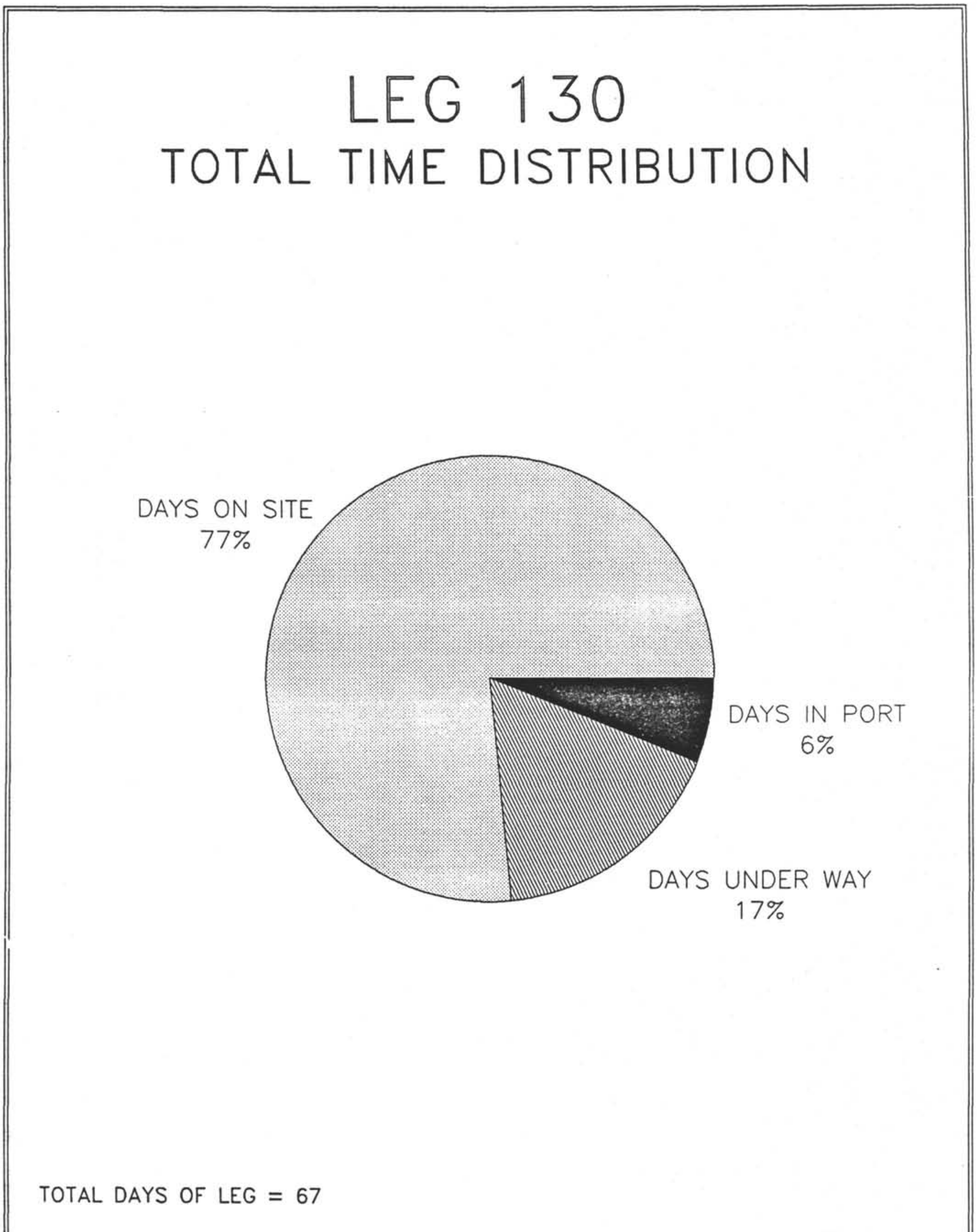
LEG 130
TOTAL TIME DISTRIBUTION
DAYS ON SITE
77%
DAYS IN PORT
6%
DAYS UNDER WAY
17%
TOTAL DAYS OF LEG = 67

Figure 27.

OPERATIONS SYNOPSIS

The ODP Operations and Engineering personnel aboard JOIDES Resolution for Leg 130 were:

Operations Superintendent:	Gene Pollard
Engineer:	Mark Robinson
Schlumberger Engineer:	James Coyne

OPERATIONS SYNOPSIS

Coring statistics and total time distribution for Leg 130 operations are presented in Tables 1 and 2 and Figure 27 (see pages 41, 42, and 75 of this report).

Guam to Site 803

The JOIDES Resolution left Guam at 0215 hr on 23 January 1990 and steamed toward Site 803 (OJP-4), 1180 nmi southeast of Guam. (All times given are UTC.) The magnetometer was streamed at 0255 hr, shortly after starting the transit. The first leg of the transit covered 932 nmi to OJP-5 (future Site 807), at an average speed of 11.4 kt. Seas were moderate at 5-9 ft, with winds gusting 28-40 kt and side currents running at 3 kt. A 42-nmi seismic survey was run at 8 kt over the OJP-5 site, and a 239-nmi seismic survey was run at 8 kt to Site 803 (OJP-4). The entire sea voyage to the first site covered 1213 nmi in 120 hr at an average speed of 10.1 kt.

Site 803

A 19-nmi pre-site seismic survey was run over the OJP-4 site under optimal GPS windows. The first beacon was dropped at 0120 hr on 28 January 1990 over proposed Site OJP4-A. A second beacon was dropped at 0126 hr to mark proposed Site OJP-4.

Hole 803A

The ship was positioned 100 m east of the second beacon in a water depth of 3426.1 meters below rig floor (mgsf). Core 130-803A-1H was taken at 1300 hr, 28 January 1990 and recovered 8.04 m of sediment. The mud line was estimated by drill pipe measurement (DPM) to be 3421.5 mbrf. Cores 130-803A-1H through -6H were taken from 0.0-55.5 mbsf, with 55.5 m of sediment cored and 57.99 m recovered (104.49% recovery). Orientation surveys were taken during Cores 130-803A-3H through -6H, but the orientation sleeve broke during the surveys, and the orientation data are questionable. The new, stronger APC piston-rod assembly was used without incident. The hole was terminated per program after Core 130-803A-6H. The BHA was pulled, and the bit cleared the sea floor at 1930 hr on 28 January 1990.

Hole 803B

The ship was offset 20 m east, and Hole 803B was spudded at 2050 hr on 28 January 1990 in a water depth of 3422.2 mbrf. Cores 130-803B-1H through -7H were taken from 0.0 to 61.3 mbsf, with 61.3 m of sediment cored and 58.18 m recovered (94.91% recovery). Orientation surveys were taken during Cores 130-803B-3H through -7H, but the camera malfunctioned and no data were recovered.

Cores 130-803B-6H and -7H were taken using the new APC breakaway piston head (BPH), with 19.0 m of sediment cored and 14.20 m recovered (74.74% recovery). The

BPH separated successfully on both runs. The new stronger APC piston-rod assembly also was used without incident.

While putting the APC core-barrel assembly into position for Core 130-803B-8H, the core barrel became stuck and could not be pulled out with an air tugger. Several attempts to free the core barrel were unsuccessful and the drill pipe was finally tripped out of the hole to recover the core barrel. The bit cleared the seafloor at 0530 hr on 29 January 1990, ending Hole 803B.

Hole 803C

The ship was offset 20 m east for further APC coring. The intention was to run the drill pipe 19 mbsf to spud the hole, but the first two APC attempts were water cores. A recheck of the drill pipe revealed that one stand had been left out of the string. The additional stand was run in the hole and Hole 803C was spudded at 1130 hr, 29 January 1990, and the hole was washed to 19.0 mbsf.

Cores 130-803C-1H through -23H were taken from 19.0 to 237.5 mbsf, with 218.5 m of sediment cored and 226.31 m recovered (103.6% recovery). Orientatioon surveys were taken on Cores 130-803C-1H through -23H. Directional surveys at 28.5 mbsf and at 57.0 mbsf indicated 1° of vertical drift. After Core 130-803C-24H (247.0 mbsf) was taken, the core would not pull free, even with 100,000 lb of overpull. The new "stronger" APC piston rod parted in the top thread, leaving the core barrel, with Core 130-803C-24H, in the hole. The BHA was pulled out of the hole to retrieve the core barrel, and it cleared the seafloor at 1445 hr on 30 January 1990, thus ending Hole 803C.

Hole 803D

The ship was offset another 20 m east, and Hole 803D was spudded at 1630 hr on 30 January 1990 in a water depth of 3424.0 mbrf. Cores 130-803D-1H through -24H were taken from 0.0 to 217.1 mbsf with 217.1 m of sediment cored and 228.88 m recovered (105.43% recovery). Orientation surveys were made on Cores 130-803D-3H through -24H.

Core 130-803D-24H did not fully stroke out and the core barrel became temporarily stuck in moderately stiff nannofossil ooze. Attempts to drill over the core barrel proved unsuccessful. Repeated overpulls, up to 170,000 lb, finally freed the core barrel.

APC coring was terminated at this point and XCB coring began. Cores 130-803D-25X through -66X were taken from 217.1 to 612.0 mbsf with 394.9 m of sediment cored and 248.47 m recovered (62.92% recovery). Various flapper and finger core catchers and XCB bits were tried in an effort to improve the XCB recovery of the stiff white nannofossil chalk. Good core recovery (67.79%) was obtained with 6-tooth hard-formation (sharp) carbide bits using two, hard-formation core catchers with soft springs. Recovery dropped to 15.69% below Core 130-803D-57X (534 mbsf), owing to the core jamming in the bit. Poor circulation through the bit was suspected, and the bit seal was found to be severely fluid cut (after sustaining 90 core-barrel runs).

A free-fall funnel (FFF) was dropped in Hole 803D so an RCB reentry could be made to core into basement in the same hole, rather than wash down a new RCB hole. The purpose in using the FFF was not only to save time but also to test the TV camera and coaxial cable, which would be required later at Site OJP-5. The TV picture was fuzzy but usable on deck. However, the picture was lost at 140 mbsl, despite repair attempts. Although the loss of the TV picture was critical, the FFF had been equipped with 4 floats and a sonar target as a precaution, and through-the-drill-pipe slimline sonar was available as a reentry backup tool. The BHA was run in to 8 m above the seafloor, the Schlumberger logging line was rigged up, and the sonar was run through drill pipe. The sonar acquired the FFF target, and reentry was completed down the throat of the FFF. This was the first known reentry of a free-fall funnel using the through the drill-pipe slimline sonar tool.

Rotary Cores 130-803D-67R through -71R were taken from 612.0 to 656.0 mbsf. Sediment was cored for 9.1 m (3.02 m of recovery), then basalt basement was encountered at 630.9 mbsf. A total of 34.9 m of basement was cored with 9.59 m of hard-rock recovery. The scientific objectives were reached at this point, coring was terminated, and the bit released at the bottom of the hole. After a short trip to condition the hole, a viscous mud sweep was circulated to clean the hole. The seafloor was unconsolidated down to 55 mbsf, so the open-ended BHA was pulled up to only 109 mbsf for logging.

The downhole logs were run as follows:

Run No. 1: Natural Gamma/Phasor Duel Induction/High Temperature Lithodensity/Long-spaced Sonic Digital/LDGO Temperature Logging (NGT/DIT/HLDT/SDT/TLT). The tool was run successfully at 900 ft/hr from 649.3 mbsf to 534.9 mbsf. As the HLDT was not functioning properly the interval from 534 to 98.7 mbsf was logged at a speed of 1800 ft/hr.

Run No. 2: Formation Microscanner/Gamma Ray/LDGO temperature(FMS/NGT/TLT). The FMS cable head and tool flooded on the first attempt. The tool was pulled, dried out, and successfully rerun.

Run No. 3: Natural Gamma/Aluminum Clay/Geochemical Speciman/High Temperature Lithodensity (NGT/ACT/GST/HLDT). The spcetra were out of tolerance on the GST/

Run No. 4: Natural Gamma/Borehole Compensated Sonic/LDGO Temperature Logging/Caliper/Gamma Ray (NGT/BHC/TLT). This tool was successfully rerun from 605.6 mbsf to 98.7 mbsf.

All logs were run with excellent hole conditions. The drill string was pulled out of the hole, the hole was left full of sea water, and the BHA cleared the rotary table at 1730 hr on 6 February 1990, ending Hole 803D.

Site 804

The transit to Site 804 (proposed site OJP-6) started at 1730 hr, 6 February 1990 and covered 98 nmi over 7.5 hr at an average speed of 13.0 kt. Upon arrival, a 47-nmi pre-site seismic survey was run over the proposed site. The beacon was dropped at 0545 hr, 7

February 1990, initiating Site 804.

Hole 804A

The ship was positioned 20 m east of the beacon in a water depth of 3878.4 mbrf. Core 130-804A-1H was taken at 1515 hr, 7 February 1990 and recovered 1.26 m of sediment. The mud line was estimated by drill-pipe measurement (DPM) to be 3872.8 mbrf. Cores 130-804A-1H through -6H were taken from 0.0 to 48.7 mbsf, with 48.7 m of sediment cored and 50.52 m recovered (103.74% recovery). Orientation surveys were taken during Cores 130-804A-3H through -6H. Hole 804A was terminated when the depth objective of 50 mbsf was reached.

Hole 804B

The ship was offset 40 m east of the beacon in a water depth of 3878.4 mbrf. Core 130-804B-1H was taken at 2145 hr, 7 February 1990 and recovered 4.64 m of sediment. The mud line was estimated by DPM to be 3871.8 mbrf. Cores 130-804C-1H through -15H were taken from 0.0 to 137.7 mbsf, with 137.7 m of sediment cored and 141.61 m recovered (102.84% recovery). Orientation surveys were taken on Cores 130-804-3H through -15H. Hole 804B was terminated when Core 130-803B-15H required 80,000 lb of overpull to free it after drilling 5 m over the core barrel.

Hole 804C

The ship was offset 60 m east of the beacon in a water depth of 3878.4 mbrf. Core 130-804C-1H was taken at 1445 hr, 8 February 1990, and recovered 6.31 m of sediment. The mud line was estimated by DPM to be 3872.2 mbrf. Cores 130-804C-1H through -13H were taken from 0.0 to 120.3 mbsf, with 120.3 m of sediment cored and 120.27 m recovered (99.98% average recovery).

The breakaway piston head was tested in Cores 130-804C-9H through -11H, but the piston came off in all three cores, in spite of passing deck tests with the outside and inner holes plugged. Recovery for the three cores was reduced from an average of 9.95 m to 8.34 m. Orientation surveys were taken on Cores 130-804C-3H through -13H. Cores 130-804C-14X through -33X were taken from 120.3 to 312.5 mbsf, with 192.2 m of sediment cored and 153.60 m recovered (79.92% recovery). Hole 804C was terminated after reaching the depth/age objectives.

The drill string was pulled out of the hole and the bit cleared the rotary table at 0830 hr, 10 February 1990, ending Hole 804C. Before departing Site 804, the VIT frame was run to the seafloor to test the TV camera and coaxial cable. After successful completion of this test, the TV was pulled, and the ship got under way at 1200 hr, 10 February 1990.

Site 805

Upon leaving Site 804, a 20-nmi, 2.75-hr seismic survey was run over the site at 7.3

kt. The transit from Site 804 to Site 805 covered 63 nmi in 7.5 hr at an average speed of 8.4 kt. A 22-nmi, 2.75-hr, pre-site seismic survey was run over the proposed site at 8.4 kt. Minimal satellite positioning was available. A beacon was dropped at 2250 hr, 10 February 1990, but the weight came off the beacon, and it floated back to surface. An additional 6-nmi survey track was run, and a second was dropped at 2345 hr, 10 February 1990, on the proposed site, initiating Site 805. An attempt to retrieve the floating beacon was unsuccessful.

Hole 805A

The ship was positioned 100 m south of the beacon in an estimated water depth of 3204.4 mbrf. Core 130-805A-1H was taken at 0630 hr, 11 February 1990 and recovered 2.99 m of sediment. The mud line was estimated by drill-pipe measurement (DPM) to be 3199.5 mbrf. Cores 130-805A-1H through -6H were taken from 0.0 to 50.5 mbsf, with 50.5 m of sediment cored and 52.22 m recovered (103.41% recovery). Orientation surveys were taken during Cores 130-805A-3H through -6H. Hole 805A was terminated when the depth objective of 50 mbsf was reached. At this point, the drill pipe was tripped out of the hole, and the bit cleared the seafloor at 1115 hr, 11 February 1990.

Hole 805B

The ship was positioned 100 m south and 30 m east of the beacon in an estimated water depth of 3202.4 mbrf. Core 130-805B-1H was taken at 1145 hr, 11 February 1990 and recovered 6.70 m of sediment. The mud line was estimated by DPM to be 3197.8 mbrf. Cores 130-805C-1H through -28H were taken from 0.0 to 263.2 mbsf, with 263.2 m of sediment cored and 271.30 m recovered (103.08% recovery). Orientation surveys were taken during Cores 130-805B-3H through -28H.

APC refusal was reached at Core 130-805B-28H (263.2 mbsf) when the core barrel would not pull free with 100,000 lb of overpull. The APC core barrel was washed over for 7 m but still required 80,000 lb overpull to pull it free. This was another successful test of the new APC equipment, which includes a stronger piston rod and washover capability. Core 130-805B-28H was recovered with 9.96 m of sediment and no damage to the core barrel.

XCB coring was initiated at this point and Cores 130-805B-29X through -50X were taken from 263.2 to 473.3 mbsf, with 210.1 m of sediment cored and 173.59 m recovered (82.62% recovery). The sonic core monitor (SCM) was tested on Core 130-805B-47X. A 9.5-m section was cored, but only 0.70 m of sediment was recovered. The SCM electronics performed properly, but the core jammed in the shoe. Hole 805B was terminated after reaching Oligocene sediments.

Hole 805C

The ship was positioned 100 m south and 60 m east of the beacon in an estimated water depth of 3202.4 mbrf. Core 130-805C-1H was taken at 1000 hr, 13 February 1990 and recovered 7.80 m of sediment. The mud line was estimated by DPM at 3198.7 mbrf. Cores 130-805C-1H through -25H were taken from 0.0 to 235.8 mbsf, with 235.8 m of sediment cored and 236.34 m recovered (100.23% recovery). Orientation surveys were taken during Cores 130-805C-3H through -10H.

APC coring was interrupted for 45 min after Core 130-805C-7H, when the beacon signal became intermittent at 1540 hr, 13 February 1990, so a backup beacon was launched at 1552 hr, 13 February 1990.

The breakaway piston head was tested in Cores 130-805C-21H and -23H. Recovery was reduced from an average of 9.78 m to 5.82 m during these test runs.

APC coring was terminated at 235.8 m, a shallower depth than in the previous hole, to avoid getting the core barrel stuck and having to drill over the core again. XCB coring was initiated at this point, and Cores 130-805C-26X through -55X were drilled from 235.8 to 523.9 mbsf with an average of 80% recovery. Below 523.9 mbsf, the sediment repeatedly jammed in the shoe and reduced recovery in Cores 130-805C-56X through -64X to 16% in spite of increasing the pump pressure to 1000 psi. The Polypak seal in the bit seal (ring) was later found to be completely eroded away, explaining why the XCB bit nozzles were plugging and the core was jamming in the bit throat. Hole 805C was terminated after penetrating into Oligocene sediments.

A short pipe trip to 100 mbsf was made to condition the hole (no fill or drag was encountered), and a mud sweep was made to clean the hole. The bit was pulled up to 116.3 mbsf, and logging began.

Logs were run as follows:

Run No. 1: NGT/DIT/LSS. The first pass was run successfully at 900 ft/hr from 609.9 mbsf (1.2 m off the bottom) to 100.3 mbsf. A second successful run was made at 900 ft/hr from 199.9 to 100.3 mbsf.

Run No. 2: NGT/ACT/HLDT/GST. The tool was run into the hole but was pulled when it was discovered that a bullnose, used to open the lockable flapper valve, had not been run. The tool then was lowered to a depth of 609.3 mbsf, and the logging run was started. This run was aborted at 331.6 mbsf, as the GST was not operating properly. The tool was lowered to 443.8 mbsf (the depth where the GST began to malfunction), and a repeat log was run. The GST did not produce neutrons properly during this repeat run. The tool was lowered to 199.9 mbsf to determine if the formation had been activated. There was no sign of neutron activation, so the string was pulled out of the hole.

Upon completion of the logging program, the hole was left full of seawater, the pipe tripped to the surface, and the BHA cleared the rotary table at 0345 hr, 17 February 1990, ending Hole 805C.

Site 806

The transit from Site 805 to Site 806 covered 81 nmi in 6.25 hr at an average speed of

13.0 kt. A 17-nmi, pre-site seismic survey was run over the proposed site for 2.0 hr at 8.5 kt. Good GPS satellite positioning was available for the site survey. The beacon was dropped at 2052 hr, 17 February 1990, on the proposed site, initiating Site 806.

Hole 806A

The ship was positioned 30 m east of the beacon in an estimated water depth of 2534.4 mbrf. The first core was attempted in a water depth of 2525 mbrf. The core barrel became stuck in the pipe while being retrieved by the coring winch and could not be jarred loose or knocked loose by pumping. The drill string had to be pulled, and the outer-shear-pin sub dogs were found to have broken off and jammed the core barrel in the drill pipe. The core barrel was empty and thus this was considered a water core. Core 130-806A-1H was taken at 0530 hr, 18 February 1990 and recovered 7.75 m of sediment. The mud line was estimated by drill pipe measurement (DPM) to be 2531.8 mbrf. Cores 130-806A-1H through -9H were taken from 0.0 to 83.7 mbsf, with 83.7 m of sediment cored and 85.95 m recovered (102.69% recovery). Orientation surveys were conducted during Cores 130-806A-3H through -9H. Hole 806A was terminated when the depth objective of 83 mbsf was reached. At this point, the pipe was pulled out of the hole, and the bit cleared the seafloor at 1100 hr, 18 February 1990.

Hole 806B

The ship was positioned 60 m east of the beacon. Core 130-806B-1H was taken at 1140 hr, 18 February 1990 and recovered 6.54 m of sediment. The mud line was estimated by DPM to be 2531.0 mbrf. Cores 130-806B-1H through -34H were taken from 0.0 to 320.0 mbsf, with 320.0 m of sediment cored and 335.20 m recovered (104.75% recovery). Orientation surveys were conducted during Cores 130-806B-3H through -17H. APC refusal was reached at Core 130-806B-34H when the core barrel became stuck and would not pull free, even with 100,000 lb of overpull. At this point, the core barrel was washed over 8 m and finally pulled free with 20,000 lb of overpull.

Cores 130-806B-35X through -78X were taken from 320.0 to 743.1 mbsf, with 423.1 m of sediment cored and 331.16 m recovered (78.27% recovery). The XCB bit nozzles started plugging at Core 130-806B-40X (378.2 mbsf), and the sinker-bar assembly was removed to permit pump pressures up to 900 psi. This adjustment succeeded in improving core recovery until Core 130-806B-63X (598.6 mbsf), when the chalk became much harder and started jamming in the shoe. Attempts to improve recovery by reducing weight on bit (WOB) and using different cutting shoes met with mixed results because the formation alternated between hard and soft chalk. The sonic core monitor (SCM) was tested during Core 130-806B-77X, but the target jammed in the liner support sleeve, and only 0.35 m of core was recovered. The SCM electronics appeared to work properly and showed that the blockage occurred during the first part of the coring process.

Coring was terminated in Hole 806B at 743.1 m in lower Miocene sediments, with recovery totaling 666.36 m (89.67% average recovery).

The first air drop in ODP history was made at 0420 hr, 20 February 1990, resulting in the successful delivery of a magnetic susceptibility coil, directional-survey camera, and TV-camera parts (but no ice cream machine).

Hole 806B Logging

After coring operations ceased, the pipe was pulled to 92 mbsf, and a high-viscosity mud sweep was made to clean the hole. The following logging runs were made:

Run No. 1: NGT/DIT/LSS. Two logs were run successfully from 741.0 to 90.2 mbsf at a rate of 900 ft/hr (306 m/hr). Less than 2 m of fill was found at the base of the hole.

Run No. 2: NGT/ACT/HLDT/GST/TLT. The tool was lowered down the hole to a depth of 740.1 mbsf and pulled back up at a rate of 600 ft/hr (204 m/hr). The GST malfunctioned at 702.9 mbsf and was again lowered to 740.1 mbsf to restart the run. The second run up the hole proceeded smoothly until 486.5 mbsf, at which point the GST lost resolution. The tool string was lowered to 504.4 mbsf and the run restarted a third time. This third run was completed to a depth of 88.4 mbsf, but the GST did not recalibrate properly. The tool was lowered one final time, to a depth of 334.1 mbsf, in order to restart the GST, but this attempt was also unsuccessful. The tool string was finally pulled on deck, the pipe pulled out of the hole, and the BHA cleared the seafloor at 1830 hr, 22 February 1990.

Hole 806C

The ship was positioned 90 m east of the beacon. Core 130-806C-1H was taken at 1840 hr, 22 February 1990, and recovered 5.58 m of sediment. The mud line was estimated by DPM to be 2531.9 mbrf. Cores 130-806C-1H through -33H were taken from 0.0 to 309.6 mbsf, with 309.6 m of sediment cored and 320.61 m recovered (103.56% recovery). Orientation surveys were taken during Cores 130-806C-3H through -12H. APC coring was terminated at Core 130-806A-33H (309.6 m) to avoid getting the core barrel stuck in the hole.

Cores 130-806C-34X through -57X were taken from 309.6 to 541.7 mbsf. From that point, the hole was drilled ahead with a center bit to 599.0 mbsf. A spot core (Core 130-806C-58X) was taken from 599.0 to 608.5 mbsf to obtain a sedimentary interval not recovered in the previous hole. The spot core was successful in obtaining the interval. The hole was drilled further with a center bit to a depth of 740.0 mbsf. Cores 130-806C-59X through -62X were taken from 740.0 to 776.4 mbsf. The XCB coring operation drilled 278.0 m and recovered 203.01 m of sediment (73.02% average recovery).

Coring was terminated in Hole 806C after reaching the Miocene/Oligocene boundary. At Hole 806C, a total of 587.6 m of sediment was cored and 523.62 m recovered (89.11% recovery). After coring operations ceased, the pipe was pulled out of the hole, and the BHA cleared the rotary table at 0900 hr, 25 February 1990, ending Site 806.

Site 807

The transit from Site 806 to Site 807 covered 251 nmi in 28.5 hr at an average speed of 8.81 kt. A 30-nmi seismic survey was run over the proposed site in 4.0 hr at 7.5 kt. The 200-in. water gun was used on the transit and site survey. GPS satellite positioning was not available for the site survey but was available for the final positioning. The beacon was dropped at 1530 hr, 26 February 1990, on the proposed site, initiating Site 807.

Hole 807A

The ship was positioned 30 m south-southwest of the beacon in an estimated water depth of 2821.4 mbrf. Core 130-807A-1H was taken at 2230 hr, 26 February and recovered 7.37 m of sediment. The mud line was estimated by drill-pipe measurement (DPM) to be 2815.1 mbrf. Cores 130-806B-1H through -27H were taken from 0.0 to 254.4 mbsf with 254.4 m of sediment cored and 263.11 m recovered (103.42% recovery). Orientation surveys were taken during Cores 130-807A-3H through -27H. APC coring was terminated at Core 130-807A-27H when the overpull increased from 5 to 100,000 lb.

Cores 130-807A-28X through -86X were taken from 254.4 to 822.9 mbsf, with 568.5 m of sediment cored and 435.53 m recovered (76.61% recovery). XCB coring was terminated when core recovery dropped below probable RCB system recovery. The sonic core monitor was run successfully on Cores 130-807A-74X, -76X, and -79X (recovery of 5.46, 8.44, and 2.40 m, respectively). Problems with chalk jamming in the shoe were noted in Core 130-807A-69X (659.2 mbsf; 1.46 m recovery). The sinker bars were removed at that point and a modified standard XCB shoe with a smaller inner diameter was used with good results.

Hole 807A Logging

Upon completion of coring at Hole 807A, the pipe was pulled to 100 mbsf, and a high-viscosity mud sweep was made to clean the hole. The bit was pulled to 85.6 mbsf, and logging operations began.

The following logs were completed.

Run No. 1: NGT/LSS/DIT/TLT. Successful downward and upward logging runs were made over the interval from 820.5 to 89.6 mbsf at 900 ft/hr. Approximately 2.4 m of fill was encountered at the base of the hole.

Run No. 2: NGT/ACT/HLDT. The log was run at 600 ft/hr from 821.1 to 323.4 mbsf, at which point problems with the heave compensator were encountered. The tool was lowered to 354.8 mbsf, the heave compensator turned back on, and logging data were collected to a depth of 75.6 mbsf.

At the end of logging operations, the pipe was pulled out of the hole, and the BHA cleared the seafloor at 2100 hr, 2 March, ending Hole 807A.

Hole 807B

The ship was positioned 60 m south-southwest of the beacon. A jet-in test was conducted to a depth of 69 mbsf. After the jet-in test, the ship was positioned 90 m south-southwest of the beacon. Core 130-807B-1H was taken at 2100 hr, 2 March and recovered 3.04 m of sediment. The mud line was estimated by DPM to be 2817.4 mbrf. Cores 130-807B-1H through -30H were taken from 0.0 to 278.6 mbsf with 278.6 m of sediment cored and 280.18 m recovered (100.57% recovery).

Orientation surveys were taken during Cores 130-807B-3H- through 10H. APC refusal was reached at Core 130-807B-30H (278.6 mbsf) when the overpull reached 120,000 lb. At this point, the pipe was pulled out of the hole and the BHA cleared the rotary table at 0115 hr, 4 March, ending Hole 807B.

Hole 807C

The ship was positioned 120 m south-southwest of the beacon. A new- style reentry cone was positioned under the rotary table, and a Double "J" tool was made up in a 16-in. casing hanger. The shoe, four joints of 16-in. casing, and the hanger were assembled and landed in the cone. The assembly was picked up and run slowly into the moonpool at 1000 hr, 4 March. Seas were mild, with 2-7-ft swells and 8-s periods. The cone was lowered about 3 m below the water surface when the driller observed the weight fluctuating between 36 and 15,000 lb, followed by a gradual loss of weight. A large surge was observed and a heavy dull thump was heard in the moonpool area. The cone was found to have unjayed and sunk to the seafloor.

A second new-style reentry cone was built, with the only change being the addition of two 10-x 10-in. holes in each of four mud-skirt plates and four 1-x 24-in. vertical slots in the reentry funnel to reduce surge effects while lowering the cone below the moonpool. An identical four-joint 16-in. casing string and BHA were jayed into the cone. Entry into the water was smoother (the holes seemed to reduce the heave surge effect), and the cone was run to the seafloor.

The ship was moved 150 m from the beacon, and Hole 807C was spudded at 0700 hr, 5 March when the 16-in. casing was jetted-in to a depth of 58.1 mbsf. The bit was unjayed and a hole was drilled to 360.0 mbsf. A mud sweep was then made and the pipe pulled out of the hole.

Twenty-five joints of 11.75-in. casing was made up and run to the seafloor. The reentry cone was located with the TV camera, and the cone was reentered after a 1.75-hr search. The casing was run in the hole to 349.8 mbsf and cemented in place. The cementing string was tripped out, and an RCB bit with a 12-drill-collar BHA was run to the seafloor. The cone was reentered after a 1.5-hr search.

The casing shoe was drilled out in 2.25 hr and a hole was drilled to 780.0 mbsf in hard chalk in 5.0 hr. RCB coring commenced at this point, and Cores 130-807C-1R through -56R (870.0-1216.3 mbsf) recovered 93.30 m of hard chalk (Cores 130-807A-1R through -24R), hard limestone (Cores 130-807A-25R through -41R), and chert (Cores 130-

807A-42R through -56R). Poor recovery often resulted from the hard chalk fracturing and jamming in the bit throat. The bit deplugger was run three times. The bit was pulled after 44.65 hr of rotation time.

A four-cone insert bit was run to the seafloor, and the reentry cone was entered after a short search. Cores 130-807C-57R through -79R (1216.3-1423.9 mbsf) were taken, with 91.25 m recovery in hard limestone. Basalt was encountered at 1380 mbsf. The bit was pulled after 42.0 rotating hours, and two shanks were found to have broken welds.

A second four-cone insert bit was run to the seafloor, and the reentry cone was entered after a short search. Cores 130-807C-80R through -88R (1423.9-1503.0 mbsf) were cut, with 50.59 m of basalt recovered. The bit was pulled after 35.08 hr of rotation time and one shank weld was found to have failed.

A third four-cone insert bit was run to the seafloor and the reentry cone was entered after a short search. Cores 130-807C-89R through -93R (1503.0-1528.4 mbsf) were cut with 13.10 m of basalt recovered and the bit was pulled after 18.16 rotating hr when it torqued up once again. The bit was examined with the TV camera at the seafloor and was found to have two shanks and cones missing; presumably they were left in Hole 807C. The bit was dropped on the seafloor by activating the mechanical bit release and the cone was reentered for logging. The pipe was set to 169 mbsf in preparation for logging.

Logs were run as follows:

Log No. 1: NGT/LSS/DIT/TLT. The log data were collected from 330.4 to 1492.9 mbsf and from 1528.3 to 348.7 mbsf at a rate of 900 ft/hr. Approximately 0.6 m of bottom fill was encountered.

Log No. 2: NGT/ACT/HLDT. The log was started at a depth of 1525.8 mbsf and run at a speed of 600 ft/hr. At 1467.9 mbsf, the caliper became jammed with debris, and the logging run was stopped. The tool was lowered again to 1527.0 and the logging run restarted. No further complications were encountered, and the data were collected up to a depth of 348.7 mbsf.

Log No. 3: NGT/FMS/GPIT/TLT. The first log with this tool was made at 900 ft/hr over the interval from 1509.1 to 947.3 mbsf, at which point the hole was too wide for the FMS caliper. The tool was lowered again to the base of the hole, and a second log was collected from 1507.8 to 1095.5 mbsf.

After logging, the pipe was pulled out of the hole and the BHA cleared the rotary table at 2400 hr, 22 March 1990, ending Site 807.

Site 807 to Guam

The thrusters and hydrophones were pulled, and the ship began a post-site survey toward Guam at 2400 22 March. A 203 nmi underway geophysics survey was conducted at 8.2 kt, requiring 22 hr.

The JOIDES Resolution arrived outside Apra Harbor, Guam, on 26 March. The harbor pilot arrived on board at 1930 hr 26 March. The first line ashore was at 2030 hr 26 March 1990, ending Leg 130.

TECHNICAL REPORT

The ODP Technical and Logistics personnel aboard JOIDES Resolution for Leg 130 of the Ocean Drilling Program were:

Laboratory Officer:	Burney Hamlin
Asst. Laboratory Officer:	Matt Mefferd
Yeoperson:	Michiko Hitchcox
Curatorial Representative:	Peggy Myre
Computer System Manager:	John Eastlund
Electronics Technician:	Barry Weber
Electronics Technician:	William Stevens
Electronics Technician:	Mark Watson
Photographer:	Stacey Cervantes
Chemistry Technician:	Mark Simpson
Chemistry Technician:	Mary Ann Cusimano
X-ray Technician:	Donald Sims
Marine Technician/ Underway Geophysics Lab:	Gus Gustafson
Marine Technician/ Underway Geophysics Lab:	Kenneth DuVall
Marine Technician/ Paleomagnetics Lab:	Wendy Autio
Marine Technician/ Shipping/Storekeeper:	Charles Williamson
Marine Technician Core Lab:	David Cunningham
Marine Technician Core Lab:	Carie Rivers

TECHNICAL REPORT

LEG 130 LAB OFFICER'S REPORT

Arriving in Guam, 19 January, we found the island cleaning up and drying out after the recent passage of Typhoon Koryn. The aftermath of the typhoon did not disrupt portcall proceedings.

PORT CALL

The Customs officials were more thorough than usual this visit, reducing technician crossover time. The freight containers were spotted in a timely manner; offgoing surface freight was loaded with cores in to a 40-ft refrigerated container and also into a 40-ft freezer container with the frozen samples.

A Digital Equipment Corporation representative came aboard to service an RA81 VAX disk drive. The unit was eventually replaced with a new drive, leaving the old one as a backup for Leg 130.

An American Bureau of Shipping inspector visited the lab module and reported a few deficiencies that were noted and corrected.

Air freight shipments were received and shipped the following day, leaving the weekend to distribute the shipments, clean up the labs and to prepare for the upcoming leg.

Heavy operations equipment from surface shipments was loaded on Monday. The ship refueled and sailed at noon, Tuesday, 21 January (local time), for the Ontong Java Plateau.

UNDERWAY

Navigation tapes were started upon leaving the dock, depth recorders were turned on and the magnetometer sensor deployed After a three day transit at over 11-kts/hr the ship arrived in the vicinity of site objective OJP-5, where seismic gear was streamed for a 30-hr survey. Our survey tied several pre-processed OJP-5 site surveys together and later verified the geology at OJP-5.

Site surveys were made at the remaining four site locations, with survey lines connecting Site 804 to Site 805 and Site 806 to Site 807. Lines 5 and 6A were made using a 200 $in.^3$ water gun, and an 80-$in.^3$ water gun. Line 6B across the Mariana Trench employed two 200 $in.^3$ water guns with satisfactory results.

The seismic records after our first site were collected at 7-8 kt with the hydrophone array pulled in close to the ship to maintain a 10 m depth with guns running free at 6-7 m depth. Digital seismic records were post-processed with the SIOSEIS programs. SIOSEIS was found to be sensitive to infrequent glitches occurring in the HIRES digitizing process or the tape-copying routine. Eventually all of the troublesome reels were processed. It was recommended that a library of seismic-tape "fixer" programs be available.

The 200 $in.^3$ water gun improved basement definition and the 80-$in.^3$ water gun contributed to mid-layer resolution in the seismic surveys across OJP-5 and the latter track..

Navigation plots were made using GEOPLOT for the shipboard geophysicist. Bathymetry data were manually entered for all lines so that depth and magnetic plots along the track could be made.

OPERATIONS SUPPORT

A free-fall funnel was deployed at Hole 803D to insure basement penetration. The electronic technicians found the TV reentry cable faulty, and the drillpipe was pulled for a bit change without seeing how the cone and reflectors had fared during the trip to the bottom. The MESOTECH downpipe sonar reentry tools were prepared for reentry. This sonar tool had not been used for years, as the TV reentries have been very successful, and a MESOTECH sonar-tool on the TV frame was considered the backup. However, the downpipe sonar-tool presentation was the best anyone could recall, and the mini-cone was successfully reentered by using it. This suggests that the usefulness of the sonar-tool on the TV frame can be improved by eliminating distracting reflections from TV frame legs and insuring that the signal is not degraded by the multiplexing process that makes it compatible with the Colmek TV systems. The troublesome TV cable was shortened 370 m and re-terminated with subsequent tests indicating that the TV system was again usable. The previous picture problems improved considerably after all the underwater connectors were taken apart and cleaned and the cables filled with new oil.

Reentries and sonar displays were recorded on video tape and have been returned to ODP for processing.

During the fishing operation for a dropped core barrel at Site 803, the multishot orientation camera was destroyed. The loss of the orientation camera was serious, as that left but one tool, and core-orientation was a major scientific objective for the leg. The usual third camera had been returned for repair after Leg 129. A request to shore for a replacement core orientation camera and another magnetic susceptibility coil resulted in the first air drop to the *JOIDES Resolution.* A Pacific Missionaries' twin-engine plane, flying from the island of Ponape on 20 February, dropped the needed instrumentation to technicians manning a Zodiac inflatable boat. The replacement camera was tested for the next site, and a new susceptibility coil was placed immediately into service.

Several successful deployments of the sonic core monitor were made. The tool will be returned to College Station for another phase of tool development and software support.

CURATORIAL

High-resolution sampling plans resulted in a record number of samples taken. More detailed work was planned on some of the recovered cores but has been deferred to shore labs. Critical intervals were foreseen such as the Cretaceous/Tertiary boundary, and special sampling plans were approved.

Whole-round cores were taken for shore analysis and were packaged separately so they can be off-loaded at a west coast U.S. port for shipment to Scripps Institution of Oceanography for study. The cores will be stored at the West Coast Repository at Scripps.

Some core liner contamination was noted; a liner in one box had a black residue in the liner and another box had external yellow stains. Organic samples taken from contaminated liners were flagged with caution notes.

CORE LAB

As expected, the core lab was very busy this leg, with the technicians and scientists processing and sampling some 4.8 km of core material.

The magnetics lab ran smoothly but with the usual problems associated with the cryogenic magnetometer's track mechanics. The size of the kevlar reinforced cord used to convey the sample boat was increased making it necessary to splice rather than knot replacement pieces. An idler mechanism was incorporated into the drive-chain path to maintain a constant tension on the sample boat. Numerous whole cores were gauged and then processed with no problems. Continued experiments included running high-intensity basalt cores in the cryogenic magnetometer by changing sample speed and by making software adjustments. Routine maintenance was performed.

Obtaining core orientation pictures with one camera was a two technician effort, with one changing batteries and the other changing film. Practice reduced this operation to a 3 min. turn around time. Film development was sometimes deferred, and heading values for the paleomagnetists were read at the end of the site. Bubbles continued to plague the core orientation compass and were troublesome, making many of the exposures unusable. Instructions from Eastman Christenson, the manufacturer of the system, resulted in successfully repairing the tool.

The MultiSensorTrack's (MST) magnetic-susceptibility sensor began drifting unacceptably at the first site and the problem was traced to a bad coil. Our spare coil was too insensitive for the planned study so a new one was included in the air drop. High-resolution studies done with the MST magnetic-susceptibility sensor took 2 hr per core and contributed to a core-processing backlog. Other than this instrument problem, the MST system worked very well. XCB cores were processed when they were available and the APC cores split last allowing for extra sampling time. An additional core rack was added in the core entry area to store the backlog of cores.

CHEMISTRY LAB

The AA, Dionex, titration apparatus, and presses were reliable and supported the water chemistry program. Some difficulties were experienced in running samples on the CNS, including several failures of the combustion tube and some consistent but slightly high values for standards. A visit to the manufacturer's representatives for the CNS is planned to address these problems. Gas chromatograph standards were run to verify that the instruments were operating properly as a safety precaution; very little gas was observed, detected, or sampled.

X-RAY LAB

Both X-ray machines were operating after leaving port. The time-consuming standard calibrations on the XRF were completed. Program and sequence files were made to allow scanning a sample for all elements rather than one element per sample. Also, the precision silicon values was improved. One goniometer crystal, PET, is very temperature sensitive, therefore, the unit remained fully enclosed to ensure precision.

Near the end of the leg, problems with the X-ray units were related to the Haskris heat exchanger and chill water supply. A sticky water-level sensor resulted in low water in the reservoir, which reduced the unit's reserve heat sink capacity. Also, the chill water was several degrees warmer than usual, resulting in the same effect. Chill water to the Haskris inter cooler was interrupted every couple of weeks to clean the chill-water system's in-line filter. The operation takes the engineers less than 15 min, a time period usually maintained by the Haskris. If the cooling-water temperature is not maintained in the X-ray machines, they automatically shut themselves down to prevent damage. This automatic shutdown occurred, but the XRF failed to turn on. A component of the high voltage power supply to the X-ray tube failed and a service call was scheduled for the Guam portcall.

THIN-SECTION LAB

Forty thin sections were requested this leg and about half were basalt.

PALEO LAB

Some microscope-change requests were accommodated, and equipment that was not used was stored. Several of the paleontologists complained that there was not enough desk space to keep their reference books handy. Providing simple roll-about carts will be investigated. Minor plumbing leaks and air handler water leaks were attended to when problems were identified.

COMPUTER SERVICES

Many of the scientists this on this leg had sailed on previous ODP cruises and were experienced with the ship's computer systems. A minimal amount of time was needed for training. The record core recovery resulted in a record amount of raw data. It was necessary to store raw data on removable disk packs to retain room on the hard disks. Macintosh was the preferred computer, which, together with the file server, allowed scientists easy access to their data for processing.

A request was made to link Lamont's MASSCOMP Computer to the VAX. ETHERNET cable was extended, but the software necessary was not available to complete the link.

PHOTO LAB

Demands on the photo lab were heavy but routine.

ELECTRONICS SHOP

Three electronics technicians sailed on the leg, two of whom were on their first cruise. The senior ET split shifts with them to train and familiarize them with their many responsibilities. Special projects included completing wire runs and installation of the doppler sonar read-out panel in the underway lab, cable re-heading and monitor tuning, laboratory recorder and instrument service TOTCO support, downhole tool development, copy machine service, but to name a few.

SPECIAL PROJECTS

A replacement condenser coil for the Underway Lab's air conditioner arrived. Because of the high temperatures in the underway lab, the condenser was installed and was operating in time for the first seismic survey.

Seismic towing bundles were assembled to allow deployment and testing of the new 200 $in.^3$ water guns. The original gun cradles were modified to accommodate these water guns, as well as test and service stands constructed. Pad eyes were installed to reposition snatch blocks and chain falls to stabilize the gun disassembly derrick. Rig air was extended to both sides of the fantail work-bench in order to service the oil injector used with the new water guns.

Water meters were installed in the Koomey room and the starboard auxiliary pump room under the Koomey room. Usage will be logged once or twice a leg to determine the drill and potable water usage in the lab stack.

A cover was installed over the flammable gas bottle corral located on top of the core lab. This cover will help hold protect bottles.

The chief engineer replaced a solenoid-actuated chill-water valve in the computer user room air handler with a motorized valve. The replacement valve is much quieter than the original valve.

PROBLEMS

During the last week of the leg, it was discovered that the air volume being moved through the core-lab was fluctuating. The V-belts were slipping because of wear, and the drive motor mount had bottomed out instead of maintaining belt tension. Air conditioning and air volume to the core-lab and DHL were restored when new belts were installed.

It was suggested that the deck over the core lab and house be painted a light grey color to reduce the lab's heat load. Captain Oonk will discuss the suggested color variance with his management.

The low level of light available around the moonpool during night operations was pointed out to the SEDCO electrical supervisor as a safety problem. Mercury vapor floodlights illuminating the area are few in number, dirty, and old. Maintenance and deployment of the VIT, mini-cones, and reentry cones would all be easier and safer with better quality light. A recommendation to enhance the area's lighting will be made to SEDCO's maintenance.

SAFETY

The METS members participated in 10 weekly drills, including the use of the SCOTT air pack, hose handling, donning protective clothing, and simulations of sweeping smoke-filled areas for possible victims.

The use of hydrochloric acid was heavy on this paleo leg. The gallon-sized containers usually stocked were exhausted, making it necessary to revert to the 5-gallon carboys purchased in Guam. Transfers were made outside the lab with protective boots and clothing and with water handy.