Figure 1. 525A-52-3, 0–120 cm. Pulses of pebbly sandstone grading to medium sandstone. This section is part of a spectacular turbidite sequence with pebble conglomerates below and medium- to fine-grained sands above. Displaced shallow-water fossils and volcanogenic fragments are observed in hand specimen as well as under the microscope. Chalky pebbles are oriented with long axis parallel to bedding.

Figure 2. 527-32-4. The Cretaceous/Tertiary boundary is located at approximately 50 cm. Note the dramatic color change. Sediments below the boundary are pelagic in origin and contain 60–80% calcium carbonate, whereas sediments above the boundary are alternating beds of pelagic and volcanogenic sediments, probably of slump origin, that are in part oxidized (red color). Calcium carbonate content above the boundary in this section ranges from 7.5–74.5%, the average being 40.82%.

Figure 3. 525A-52-2, 7–11 cm. This sample is a laminated foraminifer biomicrite with included volcanic rock fragments in contact with vein-filling green smectite. This sample was taken from the finer-grained sections of a large turbidite deposit. Note altered volcanic rock fragments (palagonite) and smectite infilling foraminifer test. The test itself is also being replaced by smectite.

Figure 4. 526C-9-1, 4–7 cm. This thin section is taken from an algal coquina sand; the rounded algal grains along with intraclasts, fossils, and oncolites all indicate a shallow-water origin for this interval.

Figure 5. 528-37-5. In this section are alternating lithologies of chalks which represent 20,000 yr. cycles. Contacts between beds are gradational. The intense bioturbation in the upper part of the "red" beds and throughout the white beds may indicate changing bottom-water conditions (i.e., more oxygen, more bioturbation).

Figure 6. 525A-60-2, 21-29 cm. This thin section is taken from a volcaniclastic breccia within the basement complex. The sediment is highly volcaniclastic with fossil debris and intraclasts scattered throughout. The basalt fragments are severely altered; smectite is infilling and replacing weathered basalt grains. Recrystallization is also observed within the matrix.

Figure 7. 526C-9-1, 4–7 cm. These are algal filaments within an oncolite. Notice the included fossil hash and recrystallization of mud matrix into pseudospar. A large brachiopod shell is located in the center.

Figure 8. 527-42-1, 68–70 cm. This thin section is part of a highly bioturbated, pelleted, laminated foraminifer biomicrite (carbonate mudstone). It is reddish brown in color; FeO staining is observable within fossil fragments. The matrix, consisting of silt- and clay-size particles, has a high amount of noncarbonate minerals that are probably volcanogenic in origin. This carbonate mudstone is located between basalt layers.

Figure 9. 528-37-7, 20–23 cm. This thin section is taken from a core containing alternating beds of volcanically derived turbidite sands, silts, and clays with indurated nannofossil chalks. In particular, the thin section is from a small slump. Grading and volcanic intraclasts within a finer-grained matrix of carbonate and noncarbonate grains can be observed. Bottom is toward the left.

Figure 10. 528-29-4, 60-80 cm. A close-up interval of a highly bioturbated nannofossil chalk. Beautiful examples of *Zoo-phycus, Planolites,* and halo burrows are observed. The burrows cross-cut each other many times, indicating that the sediment was extensively reworked once it had been deposited.



Initial Reports of the Deep Sea Drilling Project

A Project Planned by and Carried Out With the Advice of the JOINT OCEANOGRAPHIC INSTITUTIONS FOR DEEP EARTH SAMPLING (JOIDES)

VOLUME LXXIV

covering Leg 74 of the cruises of the Drilling Vessel Glomar Challenger Cape Town, South Africa, to Walvis Bay, South Africa June to July, 1980

PARTICIPATING SCIENTISTS

Theodore C. Moore, Jr., Philip D. Rabinowitz, Anne Boersma, Peter E. Borella, Alan D. Chave, Gerard Duée, Dieter K. Fütterer, Ming-Jung Jiang, Klaus Kleinert, Andrew Lever, Hélène Manivit, Suzanne O'Connell, Stephen H. Richardson, and Nicholas J. Shackleton

SHIPBOARD SCIENCE REPRESENTATIVE

Peter E. Borella

EDITORS

Jan H. Blakeslee Marianna Lee

Prepared for the NATIONAL SCIENCE FOUNDATION National Ocean Sediment Coring Program Under Contract C-482 By the UNIVERSITY OF CALIFORNIA Scripps Institution of Oceanography Prime Contractor for the Project This material is based upon research supported by the National Science Foundation under Contract No. C-482.

Any opinions, findings, and conclusions or recommendations expressed in this publication are those of the author(s) and do not necessarily reflect the views of the National Science Foundation.

It is recommended that reference to the whole or to part of this volume be made in one of the following forms, as appropriate:

Moore, T. C., Jr., Rabinowitz, P. D., et al., 19_. Init. Repts. DSDP, 74: Washington (U.S. Govt. Printing Office).

Shackleton, N. J., and Hall, M. A., 19_. Oxygen and carbon isotope data from Leg 74 sediments. In Moore, T. C., Jr., Rabinowitz, P. D., et al., Init. Repts. DSDP, 74: Washington (U.S. Govt. Printing Office),

Effective Publication Dates of DSDP Initial Reports

According to the International Code of Zoological Nomenclature, the date of publication of a work and of a contained name or statement affecting nomenclature is the date on which the publication was mailed to subscribers, placed on sale, or when the whole edition is distributed free of charge, mailed to institutions and individuals to whom free copies are distributed. The mailing date, not the printed date, is the correct one.

Mailing dates of the more recent Initial Reports of the Deep Sea Drilling Project are as follows:

> Volume 65—January, 1983 Volume 66—March, 1982 Volume 67—November, 1982 Volume 68—October, 1982 Volume 69—May, 1983 Volume 70—April, 1983

March 1984

Library of Congress Catalog Card Number 74-603338

For sale by the Superintendent of Documents, U.S. Government Printing Office Washington, D.C. 20402

Foreword

The world's first major oceanographic expedition took place between 1872 and 1876. This four year expedition, aboard the H.M.S. Challenger covering nearly 70,000 nautical miles and gathering oceanographic data from 362 stations, expanded our basic knowledge of the world's oceans and provided a solid foundation for future studies in marine geology. A century later, another vessel also named Challenger has continued to expand our knowledge of the world's ocean and has helped revolutionize our concepts of how the seafloor and the continents form and change. The Drilling Vessel Glomar Challenger is plying the same waters as its historic counterpart, seeking answers to new questions concerning the history of our planet and the life it supports. The continued advancement of knowledge about the fundamental processes and dynamics of the earth will lead to a greater understanding of our planet and more intelligent use of its resources.

Since 1968, the Deep Sea Drilling Project has been supported by the National Science Foundation, primarily through a contract with the University of California which, in turn, subcontracts to Global Marine Incorporated for the services of the D/V *Glomar Challenger*. Scripps Institution of Oceanography is responsible for management of the University contract.

Through contracts with Joint Oceanographic Institutions, Inc. (JOI, Inc.), the National Science Foundation supports the scientific advisory structure for the project and funds pre-drilling geophysical site surveys. Scientific planning is conducted under the auspices of the Joint Oceanographic Institutions for Deep Earth Sampling (JOIDES). The JOIDES advisory group consists of over 250 members who make up 24 committees, panels and working groups. The members are distinguished scientists from academic institutions, government agencies and private industry from all over the world.

In 1975, the International Phase of Ocean Drilling (IPOD) began. Present IPOD member nations, Federal Republic of Germany, Japan, United Kingdom and France, provide partial support of the project. Each member nation takes an active role in the scientific planning of

v

the project through membership in JOIDES. Scientists from these countries also participate in the field work aboard the D/V *Glomar Challenger* and post-cruise scientific studies.

The first ocean coring operations for the Deep Sea Drilling Project began on August 11, 1968. During the ensuing years of drilling operations in the Atlantic, Pacific and Indian Oceans, the Gulf of Mexico, Caribbean Sea, Mediterranean Sea, and Antarctic waters, the scientific objectives that had been proposed were successfully accomplished. Primarily, the age of the ocean basins and their processes of development were determined. The validity of the hypothesis of sea floor spreading was firmly demonstrated and its dynamics studied. Emphasis was placed on broad reconnaissance and testing the involvement of mid-oceanic ridge systems in the development of the ocean basin. Later legs of the Challenger's voyages concentrated on the nature of the oceanic crust, the sedimentary history of the passive ocean margins, sediment dynamics along active ocean margins and other areas of interest. The accumulated results of this project have led to major new interpretations of the pattern of sedimentation and the physical and chemical characteristics of the ancient oceans.

Technological advances have provided new tools which in turn have opened new dimensions of scientific discovery. Since the introduction of the Hydraulic Piston Corer in 1979 virtually undisturbed cores of soft sediment layers can now be obtained. This technological advance has greatly enhanced the ability of scientists to study ancient ocean environments, as recorded by sediment characteristics and flora and fauna preserved in these sedimentary layers. A second major advance is the use of the hole after it is drilled. The project continually logs holes and performs geophysical and geochemical studies before, during and after drilling. Long term downhole geophysical seismic monitoring devices have been implanted successfully in DSDP holes. These new listening devices and geophysical studies have provided valuable information as to the origin and nature of the dynamic processes involved with plate tectonics.

These reports contain the results of the initial studies of the recovered core material and the associated geophysical information. All people benefit either directly or indirectly from this fundamental research. Knowledge about past and present conditions and processes are the foundations for future predictions and developments. Both short and long term benefits are obtained by advances in drilling technology and instrumentation. Information is being obtained about the origin and geographic distribution of natural resources. Just as the H.M.S. Challenger had a profound impact on scientific thought for over a century, this second Challenger expedition has given and will continue to give a greater understanding of the oceans and the processes that form and shape the earth.

Edward A. Knapp

Edward A. Knapp, Director

Washington, D.C. July 1983

Preface

Recognizing the need in the oceanographic community for scientific planning of a program to obtain deep sedimentary cores from the ocean bottoms, four of the major oceanographic institutions that had strong interests and programs in the fields of marine geology and geophysics formed, in May 1964, the Joint Oceanographic Institutions for Deep Earth Sampling (JOIDES). This group, Lamont-Doherty Geological Observatory; Rosenstiel School of Marine and Atmospheric Science, University of Miami; the Scripps Institution of Oceanography, University of California at San Diego; and the Woods Hole Oceanographic Institution, expressed an interest in undertaking scientific planning and guidance of the sedimentary drilling program. It was the purpose of this group to foster programs to investigate the sediments and rocks beneath the deep oceans by drilling and coring. The membership of this original group was later enlarged in 1968 when the University of Washington became a member, and again in 1975 when University of Hawaii Institute of Geophysics, the Oregon State University School of Oceanography, the University of Rhode Island Graduate School of Oceanography, and Texas A&M University Department of Oceanography became members. In accordance with international agreements, institutions of participating nations became members of JOIDES. Thus, during 1974 to 1976, the Bundesanstalt für Geowissenschaften und Rohstoffe of the Federal Republic of Germany, the Centre National pour l'Exploitation des Océans of France, the National Environmental Research Council of the United Kingdom, the University of Tokyo of Japan, and Academy of Sciences of the USSR became JOIDES members.

Through discussions sponsored by the JOIDES organization, with support from the National Science Foundation, Columbia University's Lamont-Doherty Geological Observatory operated a drilling program in the summer of 1965, on the Blake Plateau region off Jacksonville, Florida. With this success in hand, planning began for a more extensive deep sea effort. This resulted in the award of a contract by the National Science Foundation to the Scripps Institution of Oceanography, University of California at San Diego for an eighteen-month drilling program in the Atlantic and Pacific oceans, termed the Deep Sea Drilling Project (DSDP). Operations at sea began in August 1968, using the now-famous drilling vessel, the *Glomar Challenger*.

The goal of the Deep Sea Drilling Project is to gather scientific information that will help determine the age and processes of development of the ocean basins. The primary strategy is to drill deep holes into the ocean floor, relying largely on technology developed by the petroleum industry.

Through the efforts of the principal organizations and of the panel members, who were drawn from a large cross section of leading earth scientists and associates, a scientific program was developed.

Cores recovered from deep beneath the ocean floor provide reference material for a multitude of studies in fields such as biostratigraphy, physical stratigraphy, and paleomagnetism that afford a new scope for investigating the physical and chemical aspects of sediment provenance, transportation, deposition, and diagenesis. In-hole measurements, as feasible, provide petrophysical data to permit inference of lithology of intervals from which no cores were recovered.

A report, describing the core materials and information obtained both at sea and in laboratories onshore, is published after the completion of each cruise. These reports are a cooperative effort of shipboard and shorebased scientists and are intended primarily to be a compilation of results which, it is hoped, will be the starting point for many future new and exciting research programs. Preliminary interpretations of the data and observations taken at sea are also included.

Core materials and data collected on each cruise will be made available to qualified scientists through the Curator of the Deep Sea Drilling Project, following a Sample Distribution Policy (p. xvii) approved by the National Science Foundation.

The advent of Glomar Challenger, with its deep-water drilling capability, is exceedingly timely. It has come when geophysical investigation of the oceans has matured through 20 to 30 years of vigorous growth to the point where we have some knowledge about much of the formerly unknown oceanic areas of our planet. About one million miles of traverses have been made which tell us much about the global pattern of gravity, magnetic and thermal anomalies, and about the composition, thickness, and stratigraphy of the sedimentary cover of the deep sea and continental margin. The coverage with such data has enabled the site selection panels to pick choice locations for drilling. The knowledge gained from each hole can be extended into the surrounding area. Detailed geophysical surveys were made for most of the selected locations prior to drilling.

The earth sciences have recently matured from an empirical status to one in which substantial theories and hypotheses about major tectonic processes are flourishing. Theories about the origin of magnetic fields and magnetic reversals, about ocean floor spreading and continental drift, and about the thermal history of our planet have led to specific predictions that could be tested best by an enlightened program of sampling of deep sea and continental margin sediments and underlying rocks.

In October 1975, the International Phase of Ocean Drilling (IPOD) began. This international interest, and the true participation of both the scientists and governments of a number of nations, are eloquent testimony to the importance of the work being done by the Deep Sea Drilling Project.

The members of JOIDES and DSDP and the scientists from all interested organizations and nations who have served on the various advisory panels are proud to have been of service and believe that the information and core materials that have been obtained will be of value to students of earth sciences and to all humanity for many years to come.

Deep Sea Drilling Project

MEMBER ORGANIZATIONS OF THE JOINT OCEANOGRAPHIC INSTITUTIONS FOR DEEP EARTH SAMPLING (JOIDES):¹

Bundesanstalt für Geowissenschaften und Rohstoffe, Federal Republic of Germany

University of California at San Diego, Scripps Institution of Oceanography

Centre National pour l'Exploitation des Océans, Paris

Columbia University, Lamont-Doherty Geological Observatory

University of Hawaii, Hawaii Institute of Geophysics

University of Miami, Rosenstiel School of Marine and Atmospheric Science

Natural Environment Research Council, London

Oregon State University, School of Oceanography

University of Rhode Island, Graduate School of Oceanography

Texas A&M University, Department of Oceanography

University of Tokyo, Ocean Research Institute

University of Washington, Department of Oceanography

U.S.S.R. Academy of Sciences²

Woods Hole Oceanographic Institution

OPERATING INSTITUTION:

Scripps Institution of Oceanography University of California at San Diego La Jolla, California W. A. Nierenberg, Director

DEEP SEA DRILLING PROJECT

Dr. M. N. A. Peterson Principal Investigator Project Manager

Mr. Robert S. Bower Assistant Project Manager for Administration and Contracts Officer

Dr. Yves Lancelot Chief Scientist

Dr. Matthew H. Salisbury Associate Chief Scientist for Science Operations

Dr. Russell B. Merrill Associate Chief Scientist for Science Services

Dr. William R. Riedel Curator

Mr. Stanley T. Serocki Project Development Engineer

Mr. Paul Porter Operations Manager

Mr. William T. Soderstrom Finance Administrator

Mr. Robert Olivas Logistics Office:

Includes member organizations during time of cruise.
 This institution and its committees and panel members are noncontributing members of Joides.

Ms. Sue Strain Personnel Officer

Participants aboard GLOMAR CHALLENGER for Leg Seventy-four

Dr. Theodore C. Moore, Jr. Co-Chief Scientist Graduate School of Oceanography University of Rhode Island Kingston, Rhode Island 02881

Dr. Philip D. Rabinowitz Co-Chief Scientist Lamont-Doherty Geological Observatory Columbia University Palisades, New York 10964

Dr. Anne Boersma Paleontologist (forams) Lamont-Doherty Geological Observatory Columbia University Palisades, New York 10964

Dr. Peter E. Borella Staff Science Representative Deep Sea Drilling Project, A-031 Scripps Institution of Oceanography La Jolla, California 92093

Dr. Alan D. Chave Paleomagneticist Geological Research Division A-015 Scripps Institution of Oceanography La Jolla, California 92093

Dr. Gerard Duée Sedimentologist Laboratoire Géologie Stratigraphique Université des Sciences et Techniques de Lille 59650 Villeneuve D'Ascq France

Dr. Dieter K. Fütterer Sedimentologist Geologisch-Paläontologisches Institut und Museum der Universität Kiel Olshausenstrasse 40/60 2300 Kiel Federal Republic of Germany

Mr. Ming-Jung Jiang Paleontologist (forams) Department of Oceanography Texas A&M University College Station, Texas 77843

Dr. Klaus Kleinert **Physical Properties Specialist** Geologisches Institut der Universität Tübingen Sigwartstrasse 10 D7400 Tübingen 1 Federal Republic of Germany Mr. Andrew Lever Sedimentologist Department of Mineral Resources Engineering Imperial College of Science and Technology London SW7 2BP United Kingdom Dr. Hélène Manivit Paleontologist (nannos) Laboratoire de Palynologie BRGM B.P. 6009 F-45018 Orléans 4646 Cedex France Ms. Suzanne O'Connell Igneous Petrologist Lamont-Doherty Geological Observatory Columbia University Palisades, New York 10964 Mr. Stephen H. Richardson Igneous Petrologist Department of Earth and **Planetary Sciences** Massachusetts Institute of Technology Cambridge, Massachusetts 02139 Dr. Nicholas J. Shackleton Paleontologist (forams)/ Isotope Geochemist Godwin Laboratory University of Cambridge Free School Lane Cambridge CB2 3RS United Kingdom Michael A. Storms **Cruise Operations Manager** Deep Sea Drilling Project, A-031

Scripps Institution of Oceanography

La Jolla, California 92093

Mr. Melvin Fields Weatherman Deep Sea Drilling Project, A-031 Scripps Institution of Oceanography La Jolla, California 92093

Captain Joseph A. Clarke Master of the Drilling Vessel Global Marine Inc. 8369 Vickers Street San Diego, California 92111

James A. Ruddell Drilling Superintendent Global Marine, Inc. 8369 Vickers Street San Diego, California 92111

Mr. Ted Gustafson Laboratory Officer Deep Sea Drilling Project, A-031 Scripps Institution of Oceanography La Jolla, California 92093

Mr. William Mills Curatorial Representative Deep Sea Drilling Project, A-031 Scripps Institution of Oceanography La Jolla, California 92093

Mr. Kenneth Thompson Chemist Deep Sea Drilling Project, A-031 Scripps Institution of Oceanography La Jolla, California 92093

Mr. David Collart Logging Engineer Gearhart-Owen Wire Line P.O. Box 1258 Fort Worth, Texas 76101

Mr. Gary Barnes Electronics Technician Deep Sea Drilling Project, A-031 Scripps Institution of Oceanography La Jolla, California 92093 Mr. Robert R. Current Electronics Technician Deep Sea Drilling Project, A-031 Scripps Institution of Oceanography La Jolla, California 92093

Mr. Thomas Witte Special Tools Technician Deep Sea Drilling Project, A-031 Scripps Institution of Oceanography La Jolla, California 92093

Mr. Burnette Hamlin Marine Technician Deep Sea Drilling Project, A-031 Scripps Institution of Oceanography La Jolla, California 92093

Mr. Craig Hallman Marine Technician Deep Sea Drilling Project, A-031 Scripps Institution of Oceanography La Jolla, California 92093

Mr. Robert Iuliucci Marine Technician Deep Sea Drilling Project, A-031 Scripps Institution of Oceanography La Jolla, California 92093

Mr. David Ripley Marine Technician Deep Sea Drilling Project, A-031 Scripps Institution of Oceanography La Jolla, California 92093

Mr. Victor Sotelo Photographer Deep Sea Drilling Project, A-031 Scripps Institution of Oceanography La Jolla, California 92093

Ms. Louise Henry Yeoperson Deep Sea Drilling Project, A-031 Scripps Institution of Oceanography La Jolla, California 92093

Deep Sea Drilling Project Publications Staff

Principal Editor Jan H. Blakeslee

Editors Rosemary Amidei Marian G. Bailey Susan Orlofsky Elizabeth Whalen Production Manager Raymond F. Silk

Production Assistants Elaine Bruer Madeleine A. Mahnken

Production Coordinators Mary A. Young Nancy Durham Art-Photo Supervisor Virginia L. Roman

Illustrators Myrtali Anagnostopoulos Vicki Cypherd Tommy F. Hilliard (this volume) Elizabeth Peters Alice N. Thompson

JOIDES Advisory Groups*

Executive Committee Dr. James D. Baker, Jr. University of Washington Prof. Dr. F. Bender Bundesanstalt für Geowissenschaften und Rohstoffe Dr. William W. Hay Rosenstiel School of Marine and Atmospheric Science Dr. G. Ross Heath **Oregon State University** Dr. Charles E. Helsley Hawaii Institute of Geophysics Sir Peter Kent, F.R.S. Natural Environment Research Council Dr. John A. Knauss University of Rhode Island Dr. Noriyuki Nasu University of Tokyo Dr. William A. Nierenberg Scripps Institution of Oceanography Dr. M. N. A. Peterson (ex-officio) Scripps Institution of Oceanography Monsieur Gerard Piketty Centre National pour l'Exploitation des Océans Dr. A. V. Sidorenko Academy of Sciences of the U.S.S.R. Dr. John Steele, Chairman Woods Hole Oceanographic Institution Dr. Manik Talwani Lamont-Doherty Geological Observatory Professor T. K. Treadwell, Jr. Texas A&M University **Planning Committee** Dr. Helmut Beiersdorf Bundesanstalt für Geowissenschaften und Rohstoffe Dr. William R. Bryant Texas A&M University Dr. Joe R. Cann University of Newcastle Dr. Joe S. Creager University of Washington Dr. J. Dymond Oregon State University Dr. John Ewing, Chairman Woods Hole Oceanographic Institution Dr. Dennis E. Haves Lamont-Doherty Geological Observatory Dr. Kazuo Kobayashi University of Tokyo

* Membership at time of cruise.

Dr. Yves Lancelot Scripps Institution of Oceanography Dr. Xavier LePichon Centre National pour l'Exploitation des Océans Dr. Ralph Moberly Hawaii Institute of Geophysics Dr. T. C. Moore, Jr. University of Rhode Island Dr. L. Nikitin Academy of Sciences of the U.S.S.R. Dr. William Riedel (ex-officio) Scripps Institution of Oceanography Dr. Wolfgang Schlager University of Miami Dr. E. L. Winterer Scripps Institution of Oceanography **Advisory Panel on Sedimentary Petrology** and Physical Properties Dr. Michael Arthur U.S. Geological Survey Dr. R. Bennett National Oceanic and Atmospheric Administration Dr. J. Conolly ERA North America Inc. Dr. John W. Handin Texas A&M University Dr. George deVries Klein University of Illinois Dr. I. N. McCave University of East Anglia Dr. Frédéric Mélières Université Pierre et Marie Curie Dr. Ralph Moberly (ex-officio) Hawaii Institute of Geophysics Dr. O. H. Pilkey Duke University Dr. A. Richards, Chairman Lehigh University Dr. Peter Rothe Geographisches Institut der Universität Mannheim Dr. Matthew H. Salisbury (ex-officio) Scripps Institution of Oceanography Prof. Peter D. Timofeev Academy of Sciences of the U.S.S.R. **Advisory Panel on Organic Geochemistry** Dr. Earl W. Baker Florida Atlantic University Dr. Geoffrey Eglinton (ex-officio) University of Bristol

Dr. J. Gordon Erdman Phillips Petroleum Company Dr. Eric M. Galimov Academy of Sciences of the U.S.S.R. Dr. John M. Hunt Woods Hole Oceanographic Institution Dr. Keith Kvenvolden, Chairman U.S. Geological Survey Dr. Philip A. Meyers University of Michigan Dr. Ken Pisciotto (ex-officio) Scripps Institution of Oceanography Dr. Bernd R. T. Simoneit University of California, Los Angeles Dr. B. Tissot Institut Francais du Pétrole Dr. Dietrich Welte Lehrstuhl für Geologie, Geochemie, und Lagerstatten des Erdöls und der Kohle Dr. E. L. Winterer (ex-officio) Scripps Institution of Oceanography **Advisory Panel on Information Handling** Dr. D. W. Appleman, Acting Chairman Smithsonian Institution Dr. Thomas A. Davies Middlebury College Dr. H. Glashoff Bundesanstalt für Geowissenschaften und Rohstoffe Dr. John C. Hathaway U.S. Geological Survey Dr. A. Loeblich, Jr. University of California, Los Angeles Dr. M. S. Loughridge National Oceanic and Atmospheric Administration Dr. T. C. Moore, Jr. (ex-officio) University of Rhode Island Mr. Peter Woodbury (ex-officio) Scripps Institution of Oceanography Dr. V. V. Zdorovenin Academy of Sciences of the U.S.S.R. **Industrial Liaison Panel** Mr. R. L. Adams Conoco Incorporated Dr. N. P. Budnikov Ministry of Geology of the U.S.S.R. Mr. Melvin J. Hill Gulf Oil Corporation Dr. Ing. Guenter Peterson Deutsche Schachtbau und Tiefbohrergesellschaft mbH Mr. W. A. Roberts, Chairman Phillips Petroleum Company M. Gilbert Rutman Societé Nationale des Pétroles d'Aquitaine

Mr. G. Williams United Kingdom Offshore Operators Association, Ltd. **Advisory Panel on Ocean Crust** Dr. James L. Bischoff U.S. Geological Survey Dr. N. A. Bogdanov Academy of Sciences of the U.S.S.R. Dr. Robert G. Coleman U.S. Geological Survey Dr. J. Dymond (ex-officio) Oregon State University Dr. Rolf Emmermann Universität Karlsruhe Dr. Paul J. Fox, Chairman Université Pierre et Marie Curie Dr. Jean Francheteau Centre National pour l'Exploitation des Océans Dr. Jose Honnorez Rosenstiel School of Marine and Atmospheric Science Dr. H. P. Johnson University of Washington Dr. Roger L. Larson Lamont-Doherty Geological Observatory Dr. Ralph Moberly (ex-officio) Hawaii Institute of Geophysics Dr. James H. Natland (ex-officio) Scripps Institution of Oceanography Dr. M. Ozima University of Tokyo Dr. Ralph Stephen Woods Hole Oceanographic Institution Dr. John Tarney University of Birmingham Dr. M. Treuil Institut Physique du Globe Advisory Panel on Ocean Margin (Active) Dr. Peter F. Barker University of Birmingham Dr. René Blanchet Université de Bretagne Occidentale Dr. William T. Coulbourn (ex-officio) Scripps Institution of Oceanography Dr. Joe S. Creager (ex-officio) University of Washington Dr. W. R. Dickinson University of Arizona Dr. Y. I. Dmitriev Academy of Sciences of the U.S.S.R. Dr. D. M. Hussong Hawaii Institute of Geophysics Dr. Daniel Karig Cornell University Dr. Keith Kvenvolden (ex-officio) U.S. Geological Survey

Dr. Xavier LePichon (ex-officio) Centre National pour l'Exploitation des Océans Dr. Kazuaki Nakamura University Institute of Tokyo Dr. Thomas Shipley (ex-officio) Scripps Institution of Oceanography Dr. Roland von Huene, Chairman U.S. Geological Survey Dr. H. W. Walther Bundesanstalt für Geowissenschaften und Rohstoffe Dr. Joel S. Watkins Gulf Science and Technology Company Advisory Panel on Ocean Margin (Passive) Dr. Robert E. Sheridan University of Delaware Dr. Helmut Beiersdorf (ex-officio) Bundesanstalt für Geowissenschaften und Rohstoffe Dr. Arnold H. Bouma U.S. Geological Survey Dr. William R. Bryant (ex-officio) Texas A&M University Dr. Joseph R. Curray Scripps Institution of Oceanography Mr. John A. Grow U.S. Geological Survey Dr. K. Hinz Bundesanstalt für Geowissenschaften und Rohstoffe Dr. John M. Hunt (ex-officio) Woods Hole Oceanographic Institution Dr. H. Kagami University of Tokyo Dr. Yves Lancelot Scripps Institution of Oceanography Dr. L. Montadert Institut Français du Pétrole Professor V. Nalivkin Liteynyi Prospect, Leningrad Dr. D. G. Roberts Institute of Oceanographic Sciences, Surrey Professor Dr. E. Seibold Universität Kiel Dr. Robert E. Sheridan, Chairman University of Delaware Dr. S. Snelson Shell Development Company Dr. J. Thiede Universitetet i Oslo Dr. P. R. Vail Exxon Production Research Company Dr. Jan E. Van Hinte Vrije Universiteit

Advisory Panel on Pollution Prevention and Safety Dr. N. I. Beliv Ministry of Gas Industry, U.S.S.R. Dr. George Claypool U.S. Geological Survey Dr. Brian E. Davies Sohio Petroleum Company Dr. R. G. Douglas (ex-officio) University of Southern California Dr. John Ewing (ex-officio) Woods Hole Oceanographic Institution Dr. Paul J. Fox (ex-officio) Université Pierre et Marie Curie Dr. Louis E. Garrison, Chairman U.S. Geological Survey Dr. H. Grant Goodell University of Virginia Dr. Arthur E. Green Exxon Production Research Company Dr. A. J. Horn Atherton, California Dr. Ernst Hotz Deminex Mr. J. Laherrère Compagnie Français des Pétroles Dr. Yves Lancelot Scripps Institution of Oceanography Dr. David B. MacKenzie Marathon Oil Company Dr. A. E. Maxwell (ex-officio) Woods Hole Oceanographic Institution Dr. Robert E. Sheridan (ex-officio) University of Delaware Dr. G. D. Taylor British Petroleum Company, Ltd. Dr. Roland von Huene (ex-officio) U.S. Geological Survey Advisory Panel on Inorganic Geochemistry Dr. J. Dymond (ex-officio) Oregon State University Dr. H. Elderfield University of Leeds Dr. Joris M. Gieskes, Chairman Scripps Institution of Oceanography Dr. Margaret Leinen University of Rhode Island Dr. Frank T. Manheim U.S. Geological Survey Dr. Kenneth A. Pisciotto (ex-officio) Scripps Institution of Oceanography Dr. I. D. Ryabchikov Academy of Sciences of the U.S.S.R.

Dr. Samuel M. Savin Case Western Reserve University Dr. Y. Tardy Laboratoire de Pédologie et Géochemie, Toulouse Dr. K. H. Wedepohl Geochemisches Institut der Universität, Göttingen **Stratigraphic Correlations Panel** Dr. V. A. Basov Academy of Sciences of the U.S.S.R. Dr. R. H. Benson Smithsonian Institution Dr. P. Čepek Bundesanstalt für Geowissenschaften und Rohstoffe Dr. Joe S. Creager (ex-officio) University of Washington Dr. D. Graham Jenkins Open University, Buckinghamshire Dr. Catherine Nigrini La Habra Heights, California Dr. Richard Z. Poore, Chairman U.S. Geological Survey Dr. J. B. Saunders Naturhistorisches Museum, Basel Dr. J. L. Usher (ex-officio) (deceased) Scripps Institution of Oceanography **Downhole Measurements Panel** Dr. Heinz Beckmann Technische Universität Clausthal Mr. R. E. Boyce (ex-officio) Scripps Institution of Oceanography Dr. William R. Bryant (ex-officio) Texas A&M University Dr. N. Christensen University of Washington Dr. R. Hyndman, Chairman Pacific Geoscience Centre, Sidney, BC Mr. A. H. Jageler Amoco Production Research Company Dr. Hajimu Kinoshita Chiba University Dr. D. H. Matthews University of Cambridge Dr. Yuri Neprochnov Academy of Sciences of the U.S.S.R. Dr. Vince Renard Centre National pour l'Exploitation des Océans Dr. A. Richards Lehigh University Mr. J. R. Severns McCulloh Oil Corporation **Advisory Panel on Ocean Paleoenvironment** Dr. Charles Adelseck, Jr. (ex-officio) Scripps Institution of Oceanography Dr. Wolfgang Berger Scripps Institution of Oceanography

Dr. Hervé Chamley Université des Sciences et Techniques de Lille Dr. Robert G. Douglas, Chairman University of Southern California Dr. G. Eglinton (ex-officio) University of Bristol Dr. Dieter Fütterer Geol.-Paleontol. Inst. der Univ. Kiel Dr. James Hays Lamont-Doherty Geological Observatory Dr. Hugh C. Jenkyns University of Oxford Dr. James P. Kennett University of Rhode Island Dr. T. C. Moore, Jr. (ex-officio) University of Rhode Island Dr. William Ruddiman Lamont-Doherty Geological Observatory Dr. S. O. Schlanger University of Hawaii Dr. W. V. Sliter U.S. Geological Survey Dr. Y. Takayanagi Tohoku University Dr. P. P. Timofeev Academy of Sciences of the U.S.S.R. Dr. E. L. Winterer (ex-officio) Scripps Institution of Oceanography **Advisory Panel on Site Surveying** Dr. Robert G. Douglas (ex-officio) University of Southern California Dr. E. J. W. Jones University of London Dr. Paul J. Fox (ex-officio) Université Pierre et Marie Curie Dr. Dennis E. Hayes (ex-officio) Lamont-Doherty Geological Observatory Dr. Brian T. R. Lewis University of Washington Dr. Shozaburo Nagumo University of Tokyo Dr. Philip D. Rabinowitz (ex-officio) Lamont-Doherty Geological Observatory Dr. Wolfgang Schlager (ex-officio) University of Miami Dr. Roland Schlich Institut Physique du Globe Dr. A. A. Schreider Academy of Sciences of the U.S.S.R. Dr. Robert E. Sheridan (ex-officio) University of Delaware Dr. Roland von Huene (ex-officio) U.S. Geological Survey Dr. Wilfried Weigel Universität Hamburg

Deep Sea Drilling Project SAMPLE DISTRIBUTION POLICY*

Distribution of Deep Sea Drilling samples for investigation will be undertaken in order to (1) provide supplementary data to support GLOMAR CHAL-LENGER scientists in achieving the scientific objectives of their particular cruise, and in addition to serve as a mechanism for contributions to the *Initial Reports;* (2) provide individual investigators with materials that are stored with samples for reference and comparison purposes.

The National Science Foundation has established a Sample Distribution Panel to advise on the distribution of core materials. This panel is chosen in accordance with usual Foundation practices, in a manner that will assure advice in the various disciplines leading to a complete and adequate study of the cores and their contents. Funding for the proposed research must be secured separately by the investigator. It cannot be provided through the Deep Sea Drilling Project.

The Deep Sea Drilling Project's Curator is responsible for distributing the samples and controlling their quality, as well as preserving and conserving core material. He also is responsible for maintaining a record of all samples that have been distributed, shipboard and subsequent, indicating the recipient and the nature of the proposed investigation. This information is made available to all investigators of DSDP materials as well as to other interested researchers on request.

The distribution of samples is made directly from one of the two existing repositories, Lamont-Doherty Geological Observatory and Scripps Institution of Oceanography, by the Curator or his designated representative.

1. Distribution of Samples for Research Leading to Contributions to Initial Reports

Any investigator who wishes to contribute a paper to a given volume of the *Initial Reports* may write to the Chief Scientist, Deep Sea Drilling Project (A-031), Scripps Institution of Oceanography, University of California at San Diego, La Jolla, California 92093, U.S.A., requesting samples from a forthcoming cruise. Requests for a specific cruise should be received by the Chief Scientist two months in advance of the departure of the cruise in order to allow time for the review and consideration of all requests and to establish a suitable shipboard sampling program. The request should include a statement of the nature of the study proposed, size and approximate number of samples required to complete the study, and any particular sampling technique or equipment that might be required. The requests will be reviewed by the Chief Scientist of the Project and the cruise co-chief scientists; approval will be given in accordance with the scientific requirements of the cruise as determined by the appropriate JOIDES advisory panel(s). If approved, the requested samples will be taken, either by the shipboard party if the workload permits or by the curatorial staff shortly following the return of the cores to the repository. Proposals must be of a scope to ensure that samples can be processed and a contribution completed in time for publication in the Initial Reports. Except for rare, specific instances involving ephemeral properties, sampling will not exceed one-quarter of the volume of core recovered, with no interval being depleted and one-half of all core being retained as an archive. Shipboard sampling shall not exceed approximately 100 igneous samples per investigator; in all cases co-chief scientists are requested to keep sampling to a minimum.

The co-chief scientists may elect to have special studies of selected core samples made by other investigators. In this event the names of these investigators and complete listings of all materials loaned or distributed must be forwarded, if possible prior to the cruise or as soon as possible following the cruise, to the Chief Scientist through the DSDP Staff Science Representative for that particular cruise. In such cases, all requirements of the Sample Distribution Policy shall also apply.

If a dispute arises or if a decision cannot be reached in the manner prescribed, the NSF Sample Distribution Panel will conduct the final arbitration.

Any publication of results other than in the *Initial Reports* within twelve (12) months of the completion of the cruise must be approved and authored by the whole shipboard party and, where appropriate, shore-based investigators. After twelve months, individual investigators may submit related papers for open publication provided they have submitted their contributions to the *Initial Reports*. A paper too late for inclusion in the *Initial Reports* for a specific cruise may not be published elsewhere until publication of that *Initial Reports* for which it was intended. Notice of submission to other journals and a copy of the article should be sent to the DSDP Staff Science Representative for that leg.

^{*}Revised October 1976

- 2. Distribution of Samples for Research Leading to Publication Other Than in Initial Reports
 - A. Researchers intending to request samples for studies beyond the scope of the *Initial Reports* should first obtain sample request forms from the Curator, Deep Sea Drilling Project (A-031), Scripps Institution of Oceanography, University of California at San Diego, La Jolla, California 92093, U.S.A. On the forms the researcher is requested to specify the quantities and intervals of the core required, make a clear statement of the proposed research, state time required to complete and submit results for publication, and specify the status of funding and the availability of equipment and space foreseen for the research.

In order to ensure that all requests for highly desirable but limited samples can be considered, approval of requests and distribution of samples will not be made prior to 2 months after publication of the Initial Core Descriptions (ICD). ICD's are required to be published within 10 months following each cruise. The only exceptions to this policy will be for specific instances involving ephemeral properties. Requests for samples can be based on the Initial Core Descriptions, copies of which are on file at various institutions throughout the world. Copies of original core logs and data are kept on open file at DSDP and at the Repository at Lamont-Doherty Geological Observatory, Palisades, New York. Requests for samples from researchers in industrial laboratories will be handled in the same manner as those from academic organizations, with the same obligation to publish results promptly.

B. (1) The DSDP Curator is authorized to distribute samples to 50 ml per meter of core. Requests for volumes of material in excess of this amount will be referred to the NSF Sample Distribution Panel for review and approval. Experience has shown that most investigations can be accomplished with samples 10 ml or smaller. All investigators are encouraged to be as judicious as possible with regard to sample size and, especially, frequency within any given core interval. The Curator will not automatically distribute any parts of the cores which appear to be in particularly high demand; requests for such parts will be referred to the Sample Distribution Panel for review. Requests for samples from thin layers or important stratigraphic boundaries will also require Panel review.

(2) If investigators wish to study certain properties which may deteriorate prior to the normal availability of the samples, they may request that the normal waiting period not apply. All such requests must be reviewed by the Curator and approved by the NSF Sample Distribution Panel.

- C. Samples will not be provided prior to assurance that funding for sample studies either exists or is not needed. However, neither formal approval of sample requests nor distribution of samples will be made until the appropriate time (Item A). If a sample request is dependent, either wholly or in part, on proposed funding, the Curator is prepared to provide to the organization to whom the funding proposal has been submitted any information on the availability (or potential availability) of samples that it may request.
- D. Investigators receiving samples are responsible for:

(1) publishing significant results; contributions shall not be submitted for publication prior to 12 months following the termination of the appropriate leg;

(2) acknowledging, in publications, that samples were supplied through the assistance of the U.S. National Science Foundation and others as appropriate;

(3) submitting five (5) copies (for distribution to the Curator's file, the DSDP repositories, the GLOMAR CHALLENGER's library, and the National Science Foundation) of all reprints of published results to the Curator, Deep Sea Drilling Project (A-031), Scripps Institution of Oceanography, University of California at San Diego, La Jolla, California 92093, U.S.A.;

(4) returning, in good condition, the remainders of samples after termination of research, if requested by the Curator.

- E. Cores are made available at repositories for investigators to examine and to specify exact samples in such instances as may be necessary for the scientific purposes of the sampling, subject to the limitations of B (1 and 2) and D, above, with specific permission of the Curator or his delegate.
- F. Shipboard-produced smear slides of sediments and thin sections of indurated sediments, igneous, and metamorphic rocks will be returned to the appropriate repository at the end of each cruise or at the publication of

the *Initial Reports* for that cruise. These smear slides and thin sections will form a reference collection of the cores stored at each repository and may be viewed at the respective repositories as an aid in the selection of core samples.

3. Reference Centers

As a separate and special category, samples will be distributed for the purpose of establishing up to five reference centers where paleontologic materials will be available for reference and comparison purposes. The first of these reference centers has been approved at Basel, Switzerland.

Data Distribution Policy

Data gathered on board D/V Glomar Challenger and in DSDP shore laboratories are available to all researchers 12 months after the completion of each cruise. The files are part of a coordinated computer database, fully searchable and coordinated to other files. Data sets representing a variety of geologic environments can be arranged for researchers who may wish to manipulate the database directly.

Most data requests are filled free of charge, except if they are unusually large or complex and direct costs exceed \$50.

When data are used for publication, the National Science Foundation must be acknowledged and DSDP provided with five reprints for inclusion in the DSDP index of publications and investigations. Requests for data should be submitted to:

> Data Manager, Deep Sea Drilling Project Scripps Institution of Oceanography (A-031) University of California, San Diego La Jolla, California 92093

Telephone: (714) 452-3526 Cable Address: SIOCEAN

- I. The database includes files generally available both in digital form on magnetic tape and as microfilm copies of the original observation forms.
 - A. Geophysical data include underway bathymetry, magnetics, and sub-bottom profiles; bathymetry data exist both as 12-kHz and 3.5-kHz records. Underway data are processed by DSDP and the Geological Data Center at Scripps Institution of Oceanography (SIO). Seismic records are available in microfilm and photographic prints.

- B. Physical property data obtained on board Glomar Challenger include:
 - Analytical water content, porosity, and density
 - Density and porosity by Gamma Ray Attenuation Porosity Evaluator (GRAPE) Acoustic velocity by Hamilton Frame Method Thermal conductivity Heat flow (*in situ*) Natural gamma radiation (discontinued

after Leg 19)

Well logs

C. Sediment data obtained on board ship and from core samples in DSDP shore laboratories include:

Core photographs

Visual core descriptions Smear slide descriptions

X-ray diffraction

X-ray fluorescence

Total carbon, organic carbon, and carbonate determinations Grain-size determinations (sand, silt, clay) Interstitial water chemistry

- Gas chromatography
- D. Igneous rock data include: Core photographs Visual core descriptions Rock chemistry Paleomagnetics Thin-section descriptions
- E. Paleontologic data include fossil names, abundance, preservation, and age of sample and are available, for selected sites, for Tertiary and Mesozoic taxa. Range charts can be generated from the database, using the line printer. A glossary of fossil names is available on microfiche or magnetic tape.
- F. Ancillary files include: Site positions Sub-bottom depths of cores Master Guide File (a searchable core data summary file)
- II. Additional publications, aids to research, are periodically updated and distributed to libraries. Single copies, at no charge, are distributed on microfiche at 48X magnification, except for the Data Datas (C, opposite), which are at 24X. They include:
 - A. Guides to DSDP Core Materials, a series of printed summaries containing maxima, minima, and typical values for selected observations. Guides are available for each of the

major ocean basins and for Phases I, II, and III of the drilling program. The source data summary file is also available.

- B. Index to Initial Reports and Subsequent Publications and Investigations is a comprehensive key word index to chapters of the Initial Reports and to papers and investigations in progress which cite DSDP samples or data. The Index and its annotated bibliography serve to inform researchers of other investigators working on similar projects. Each paper is assigned key words for field of study, material, geographic area, and geologic age. A complete citation, including the assigned key words, is printed in the bibliography. Key words are permuted to form a comprehensive cross-index to the author reference list.
- C. Data Data, a series of informal memoranda providing a quick reference to accessible data, is available on microfiche. Also available is a site position map to assist researchers in largearea studies. (Site positions are plotted on a bathymetry map compiled by the SIO Geologic Data Center.)
- D. Data Retrieval and Application Computer Programs to perform data management and retrieval functions and a set of programs designed to provide special graphic displays of data are available; they may be of limited use because of differences in computer hardware. All current programs are written in ALGOL for a Burroughs 7800 computer system. Software inquiries may be addressed to the Data Manager.

CONTENTS

Chapter		Page C	Chapter Pag	ge
PA 1	RT I: INTRODUCTION AND SITE REPORTS INTRODUCTION AND EXPLANATORY NOTES T. C. Moore, Jr., P. D. Rabinowitz, P. Borella, A. Boersma, and N. J. Shackleton	. 3	 PITHONELLOID CALCAREOUS DINO- FLAGELLATES FROM THE UPPER CRE- TACEOUS AND CENOZOIC OF THE SOUTHEASTERN ATLANTIC OCEAN, DEEP SEA DRILLING PROJECT LEG 74 53 D. K. Fütterer 	33
2. 3. 4.	SITE 525 Shipboard Scientific Party SITE 526 Shipboard Scientific Party SITE 527 Shipboard Scientific Party	. 41 1 . 161 . 237 1	 BIOTURBATION AND TRACE FOSSILS IN DEEP SEA SEDIMENTS OF THE WALVIS RIDGE, SOUTHEASTERN AT- LANTIC, LEG 74	43
5. 6.	SITE 528 Shipboard Scientific Party SITE 529 Shipboard Scientific Party	. 307 . 407 1	 4. NEOGENE AND QUATERNARY CAL- CAREOUS NANNOFOSSIL BIOSTRATIG- RAPHY OF THE WALVIS RIDGE	57
PART II: SPECIAL STUDIES		5	ECTION B: SEDIMENTOLOGY AND	
PAF	RT II: SPECIAL STUDIES	Ğ	GEOCHEMISTRY	
PAF SEC BIO 7.	RT II: SPECIAL STUDIES CTION A: PALEONTOLOGY, STRATIGRAPHY AND PALEOMAGNETISM CORRELATION OF MAGNETOSTRATIG- RAPHY AND NANNOFOSSIL BIOSTRA- TIGRAPHY IN UPPER CRETACEOUS AND LOWER PALEOCENE SEDIMENTS OF THE WALVIS RIDGE AREA	1 1 . 469	 GEOCHEMISTRY 5. OXYGEN AND CARBON ISOTOPE DATA FROM LEG 74 FORAMINIFERS	99
PAF SEC BIO 7. 8.	RT II: SPECIAL STUDIES TION A: PALEONTOLOGY, STRATIGRAPHY AND PALEOMAGNETISM CORRELATION OF MAGNETOSTRATIG- RAPHY AND NANNOFOSSIL BIOSTRA- TIGRAPHY IN UPPER CRETACEOUS AND LOWER PALEOCENE SEDIMENTS OF THE WALVIS RIDGE AREA	1 . 469 . 475	 SEOCHEMISTRY 5. OXYGEN AND CARBON ISOTOPE DATA FROM LEG 74 FORAMINIFERS	99 13 21
 PAH SEC BIO 7. 8. 9. 	RT II: SPECIAL STUDIES CIION A: PALEONTOLOGY, STRATIGRAPHY AND PALEOMAGNETISM CORRELATION OF MAGNETOSTRATIG- RAPHY AND NANNOFOSSIL BIOSTRA- TIGRAPHY IN UPPER CRETACEOUS AND LOWER PALEOCENE SEDIMENTS OF THE WALVIS RIDGE AREA H. Manivit and H. Feinberg PALEOGENE AND UPPER CRETACEOUS CALCAREOUS NANNOFOSSILS FROM DEEP SEA DRILLING PROJECT LEG 74 H. Manivit CRETACEOUS-TERTIARY PLANKTONIC FORAMINIFERS FROM THE SOUTH- EASTERN ATLANTIC, WALVIS RIDGE AREA, DEEP SEA DRILLING PROJECT LEG 74 A. Boersma	1 . 469 . 475 1 . 501	 GEOCHEMISTRY 5. OXYGEN AND CARBON ISOTOPE DATA FROM LEG 74 FORAMINIFERS	99 13 21 45

Chapter

Page Chapter

- 22. INTERSTITIAL WATER STUDIES, LEG 74 . . 701 J. M. Gieskes, K. Johnston, and M. Boehm

SECTION C: BASEMENT ROCKS

SECTION D: GEOPHYSICS AND LOGGING

PART III: SYNTHESIS

BACKPOCKET FOLDOUTS

CHAPTER 18, FIGURES 2–6. LITHOLOGY AND PHYSICAL PROPERTIES, LEG 74 SITES.

CHAPTER 18, FIGURE 8. SELECTED CORES, LEG 74.

CHAPTER 28, FIGURE 4. BATHYMETRY OF THE SOUTHWESTERN AFRICAN MARGIN.