Core 61 from Hole A at Site 400 contains the unconformable contact between the upper Campanian and the upper Albian. The former, a reddish yellow marly nannofossil chalk with brown streaks of organic matter, is preserved in Core 61 as cavings along with light brown to greenish gray marly chalk fragments in a grayish orange pink matrix. At the unconformity the upper Albian nannofossil chalk is reddish brown but, in the underlying Core 62 it is mainly light to medium bluish gray, is bioturbated and mottled medium dark gray, and contains grayish black carbonaceous layers characterized by very fine laminations. The latter are referred to in this volume as the Albian black shales.
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 XLVIII
covering Leg 48 of the cruises of the Drilling Vessel Glomar Challenger
Brest, France to Aberdeen, Scotland
May-July 1976

PARTICIPATING SCIENTISTS

Lucien Montadert, David G. Roberts,
Gerard A. Auffret, Wayne D. Bock, Pierre A. Dupeuble,
Ernest A. Hailwood, William E. Harrison, Hideo Kagami, David N. Lumsden,
Carla M. Muller, Detmar Schnitker, Robert W. Thompson,
Thomas L. Thompson, and Peter P. Timofeev

Shipboard Science Representative
Robert W. Thompson

Science Editor
John L. Usher

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.

References to this Volume:


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, where the whole edition is distributed free of charge, mailed to institutions and individuals to whom free copies are distributed. The mailing date is the correct date, not the printed date.

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

Volume 40—July, 1978
Volume 41—April, 1978
Volume 42—May, 1978
Volume 44—November, 1978
Volume 45—December, 1978
Volume 46—December, 1978
Supplement to Volumes 38-41—January, 1979

Additional microfiche copies of the Lithologic Core Descriptions for DSDP Sites 399 through 406 may be obtained, free of charge, upon request to:

Associate Chief Scientist
Science Services
Deep Sea Drilling Project, A-031
Scripps Institution of Oceanography
La Jolla, California 92038

Printed August 1979

Library of Congress Catalog Card Number 74-603338

For sale by the Superintendent of Documents, U.S. Government Printing Office
Washington, D.C. 20402 - Price $24.00
Stock Number 038-000-00413-1
Foreword

For the three and one-half years between 1872 and 1876, the H.M.S. CHALLENGER—after which D/V GLOMAR CHALLENGER is named—undertook the world's first major oceanographic expedition. It is fitting that our century should have its counterpart to that famous ship a century ago whose voyages helped establish oceanography as a science. It is equally fitting that GLOMAR CHALLENGER should be plying the same waters one century later seeking answers to new questions concerning the history of our planet and the life it supports. The fundamental advancement of our knowledge of the earth will lead to enhanced capabilities to understand its processes and to use its natural resources intelligently.

The Deep Sea Drilling Project is being undertaken within the context of the National Science Foundation's Ocean Sediment Coring Program. The Foundation is funding the project by means of a contract with the University of California, and the Scripps Institution of Oceanography is responsible for its management. The University has, in turn, subcontracted with Global Marine Incorporated for the services of the drilling ship, GLOMAR CHALLENGER.

Scientific planning is conducted under the auspices of the Joint Oceanographic Institutions for Deep Earth Sampling (JOIDES). The JOIDES consortium has convened advisory panels for that purpose, consisting of a large number of distinguished scientists from the academic institutions, Government agencies, and private industry of many countries. Altogether, the project has involved the active interest and participation of many of the world's best scientists and technologists.

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, and Mediterranean Sea, and Antarctic waters, the scientific objectives that had been set forth were successfully accomplished. Primarily, the age of the ocean basins and their processes of development were determined. Emphasis was placed on broad reconnaissance and on testing the involvement of the mid-oceanic rise systems in the development of the ocean basins.

From these concepts come major interpretations of the results of the drilling as they bear on patterns of sedimentation and physical and chemical characteristics of the ancient oceans.

As a result of the success of the Deep Sea Drilling Project, the National Science Foundation extended its contract with the University of California to encompass an additional 36 months of drilling, allowing GLOMAR CHALLENGER to continue operations throughout the oceans of the world in exploring the deep ocean floors for a period presently extending one full decade. Scientific interest will involve major effort in drilling deeply into the oceanic crustal igneous rocks to study the processes and mechanisms leading to the formation of the oceanic crust.

These reports contain the results of initial studies of the recovered core material and the associated geophysical information. The contribution to knowledge has been exceedingly large and future studies of the core material over many years will contribute much more.

The importance of the work of the Deep Sea Drilling Project and D/V GLOMAR CHALLENGER is internationally recognized. In response to this recognition, a number of nations are providing partial support. Effective January 1974, the USSR and the Federal Republic of Germany entered into agreements with the United States for participation and support. Similar arrangements were agreed to by Japan in July 1975, the United Kingdom in September 1975, and France in January 1976.

All people, in their lives, activities, and industry, should benefit greatly from the project—from the technological advances that are being made and through the information being obtained on natural resources.

Richard C. Atkinson
Director

Washington, D. C.
October 1976
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 Oceans 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 which 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 studies of 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 on shore, is published after the completion of each cruise. These reports are a cooperative effort of the scientists participating in the cruise 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 ability, 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 had 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, is elegant testimony of 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 all humanity for many years to come.
Deep Sea Drilling Project

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

Bundesanstalt für Geowissenschaften and Rohstoffe, Federal Republic of Germany

Lamont-Doherty Geological Observatory, Columbia University

Rosenstiel School of Marine and Atmospheric Science, University of Miami

Scripps Institution of Oceanography, University of California

USSR Academy of Sciences

University of Washington

Woods Hole Oceanographic Institution

OPERATING INSTITUTION:

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

DEEP SEA DRILLING PROJECT

David G. Moore
Project Chief Scientist

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

* Includes member organizations during time of the cruise.

SENIOR PROJECT PERSONNEL

Mr. Frank C. MacTernan
Principal Engineer and Deputy Project Manager

Dr. Stan M. White
Associate Chief Scientist for Science Operations

Dr. John L. Usher
Associate Chief Scientist for Science Services

Mr. William R. Riedel
Curator

Mr. Stanley T. Serocki
Project Development Engineer

Mr. Valdemar Larson
Operations Manager

Mr. William T. Soderstrom
Finance Administrator

Mr. Robert Olivas
Logistics Officer

Mr. Robert S. Bower
Contracts Officer

Ms. Sue Strain
Personnel Officer
Participants Aboard

GLOMAR CHALLENGER for Leg Forty Eight:

Dr. Lucien Montadert
Co-Chief Scientist
Institut Français du Pétrole
BP 18
92502 Rueil-Malmaison
France

Dr. David G. Roberts
Co-Chief Scientist
Institute of Oceanographic Sciences
Wormley, Godalming GU8 5UB
Surrey
England

Dr. Gerard A. Auffret
Sedimentologist
Centre Océanologique de Bretagne
BP 337
29273 Brest Cedex
France

Dr. Wayne D. Bock
Paleontologist (Foraminifers)
Rosenstiel School of Marine and Atmospheric Science
4600 Rickenbacker Causeway
Miami, Florida 33149

Dr. Pierre A. Dupeuble
Paleontologist (Foraminifers)
Université de Rouen
76130 Mont-Saint-Aignan
France

Dr. Ernest A. Hailwood
Paleomagnetist
Department of Oceanography
University of Southampton
Southampton SO9 5NH
England

Dr. William E. Harrison
Organic Geochemist
Oklahoma Geological Survey
University of Oklahoma
830 van Fleet Oval
Norman, Oklahoma 73069

Dr. Hideo Kagami
Sedimentologist
Ocean Research Institute
University of Tokyo
Tokyo
Japan

Dr. David N. Lumsden
Sedimentologist
Department of Geology
Memphis State University
Memphis, Tennessee 38152

Dr. Carla M. Müller
Paleontologist (Nannofossils)
Geologisch-Paläontologisches Institut
Johann-Wolfgang-Goethe Universität
Frankfurt
Federal Republic of Germany

Dr. Detmar Schnitker
Paleontologist (Foraminifers)
Department of Oceanography
University of Maine
Walpole, Maine 04573

Dr. Robert W. Thompson
Sedimentologist/Shipboard Science Representative
Humboldt State University
School of Natural Resources-Oceanography
Arcata, California 95521

Dr. Thomas L. Thompson
Petroleum Geologist
University of Oklahoma
Department of Geology and Geophysics
Norman, Oklahoma 73069

Dr. Peter P. Timofeev
Sedimentologist
Geological Institute
USSR Academy of Sciences
Pyzhevskiyi per 7
Moscow ZH 17
USSR

Mr. Robert Knapp
Cruise Operations Manager
Deep Sea Drilling Project, A-031
Scripps Institution of Oceanography
La Jolla, California 92093

Mr. Robert J. Connolly
Weatherman
NOAA-National Weather Service
439 West York Street
Norfolk, Virginia 23510

Captain Loyd Dill
Captain of the Drilling Vessel
Global Marine, Inc.
Los Angeles, California 90017
Mr. Donald Cameron
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. Victor Sotelo
Marine Technician
Deep Sea Drilling Project, A-031
Scripps Institution of Oceanography
La Jolla, California 92093

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

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

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

Deep Sea Drilling Project Publications Staff

Dr. Ansis G. Kaneps
Science Editor

Ms. Paula Worstell
Science Editor

Mr. James Shambach
Science Editor

Mr. Ray Silk
Production Manager

Ms. Virginia L. Roman
Art Supervisor

Mr. Fred Laughter
Science Editor

Ms. Mary A. Young
Production Coordinator

Ms. Janice E. Bowman
Production Coordinator
JOIDES Advisory Groups

Executive Committee

Dr. Maurice Rattray, Jr.,
University of Washington
Professor Dr. F. Bender
Bundesanstalt für Geowissenschaften und Rohstoffe
Dr. John V. Byrne
Oregon State University
Dr. Paul M. Fye
Woods Hole Oceanographic Institution
Dr. William W. Hay
Rosentiel School of Marine and Atmospheric Science
Sir Peter Kent, F.R.S.
Natural Environment Research Council
Dr. John A. Knauss
University of Rhode Island
Monsieur Yves LaPrairie
C.N.E.X.O.
Dr. Ryuizo Marumo
University of Tokyo
Dr. William A. Nierenberg
Scripps Institution of Oceanography
Dr. M. N. A. Peterson (Ex-officio)
Scripps Institution of Oceanography
Academician A. V. Sidorenko
Academy of Sciences of the USSR
Dr. Manik Talwani
Lamont-Doherty Geological Observatory

Dr. Dennis E. Hayes*
Lamont-Doherty Geological Observatory
Dr. James R. Heitzler
Woods Hole Oceanographic Institution
Dr. James P. Kennett
University of Rhode Island
Dr. LaVern D. Kulm
Oregon State University
Dr. Yves Lancelot*
C.N.E.X.O.
Dr. Anthony S. Laughton
Institute of Oceanographic Sciences
Dr. Xavier LePichon
C.N.E.X.O.
Dr. Dean A. McManus*
University of Washington
Dr. David G. Moore (Ex-officio)
Scripps Institution of Oceanography
Dr. M.N.A. Peterson*
Scripps Institution of Oceanography
Dr. Jean-Guy Schilling*
University of Rhode Island
Dr. George Shor*
Scripps Institution of Oceanography
Dr. Gleb Udintsev
Academy of Sciences of the USSR
Dr. E. L. Winterer
Scripps Institution of Oceanography
Dr. George P. Woolard
Hawaii Institute of Geophysics

Planning Committee

Dr. Joe S. Creager*
University of Washington
Dr. Helmut Beirsdorf
Bundesanstalt für Geowissenschaften und Rohstoffe
Dr. William R. Bryant
Texas A&M University
Mr. John I. Ewing*
Woods Hole Oceanographic Institution
Dr. Stefan Gartner*
Texas A&M University
Dr. C.G.A. Harrison*
Rosenstiel School of Marine and Atmospheric Science
Dr. William W. Hay
Rosenstiel School of Marine and Atmospheric Science

Dr. G. R. Heath
University of Rhode Island
Dr. Wolfgang Berger
Scripps Institution of Oceanography
Professor Dr. D. Bernoulli
Geologisch-Palaontologisches Institut, Basel
Dr. W. Bryant
Texas A&M University
Dr. S. E. Calvert
Institute of Oceanographic Sciences
Dr. C. J. Clausen
Norges Geotekniske Institutt
Dr. J. Conolly
Era North America Inc.

* Alternate
Advisory Panel on Inorganic Geochemistry
Dr. Joris M. Gieskes
Scripps Institution of Oceanography
Dr. G. N. Baturin*
Academy of Sciences of the USSR
Dr. Wallace S. Broecker
Lamont-Doherty Geological Observatory
Dr. D. S. Cronan
Royal School of Mines
Mr. John I. Ewing
Woods Hole Oceanographic Institution
Dr. Heinrich D. Holland
Harvard University
Dr. Ian R. Kaplan
University of California, Los Angeles
Dr. Frank T. Manheim
U.S. Geological Survey
Dr. Erwin Suess
Oregon State University
Dr. K. K. Turekian
Yale University
Dr. I. M. Varentsov
Geologiches Institut der Universität
Dr. K. H. Wedepohl
Geologches Institut der Universität

Advisory Panel on Industrial Liaison
Mr. W. A. Roberts
Phillips Petroleum Company
Mr. Fred C. Ackman
Exxon Exploration, Inc.
Mr. Melvin J. Hill
Gulf Oil Corporation
Dr. John D. Moody
Mobil Oil Corporation
Monsieur Gilbert Rutman
Societé Nationale des Pétroles D'Aquitaine

Advisory Panel on Ocean Crust
Dr. J. R. Cann
University of East Anglia
Dr. Claude J. Allegre
Universités de Paris 6 et 7
Dr. Leonid V. Dmitriev
Academy of Sciences of the USSR
Dr. Stanley R. Hart
Massachusetts Institute of Technology
Dr. James R. Heirtzler
Woods Hole Oceanographic Institution
Dr. Ikuo Kushiro
University of Tokyo

Advisory Panel on Ocean Margin (Active)
Dr. Seiya Uyeda
The University of Tokyo
Dr. René Blanchet
Centre de Recherche en Géologie
Dr. Creighton Burk
Marine Sciences Institute
Dr. Joe S. Creager
University of Washington
Dr. Kazuo Kobayashi
University of Tokyo
Dr. I. P. Kosminskaya
USSR Academy of Sciences
Dr. Loren W. Kroenke
Mineral Resources Division
Dr. Lavern D. Kulm
Oregon State University
Dr. Keith Kvenvolden
U.S. Geological Survey
Dr. William J. Ludwig
Lamont-Doherty Geological Observatory
Academician A. V. Pieve
USSR Academy of Sciences
Dr. Gordon Packham
The University of Sydney
Dr. David W. Scholl
U.S. Geological Survey
Dr. Roland Von Huene
U.S. Geological Survey

Advisory Panel on Ocean Margin (Passive)
Dr. J. R. Curray
Scripps Institution of Oceanography
Dr. A. W. Bally
Shell Oil Company
Professor Dr. D. Bernoulli
Geologisches Institut der Universität

*Alternate
Dr. Gleb Udintsev  
_P. P. Shirshov Institute of Oceanology, USSR_

Dr. Roland von Huene  
_U.S. Geological Survey_

Dr. Joel Watkins  
_University of Texas_

Dr. E. L. Winterer  
_Scripps Institution of Oceanography_

**Advisory Panel on Stratigraphic Correlations**

Dr. R. H. Benson  
_Smithsonian Institution_

Professor Dr. H. M. Bolli  
_Eidg. Technische Hochschule Zurich_

Geologisches Institut

Dr. D. Bukry  
_U.S. Geological Survey_

Dr. P. Cepek  
_Bundesanstalt für Geowissenschaften und Rohstoffe_

Dr. R. G. Douglas  
_University of Southern California_

Dr. S. R. Hammond  
_Hawaii Institute of Geophysics_

Dr. C. Helsley  
_Hawaii Institute of Geophysics_

Dr. N. Hughes  
_Department of Geology, Sedgwick Museum_

Dr. M. Petrushevskaya  
_USSR Academy of Sciences_

Dr. W. R. Riedel  
_Scripps Institution of Oceanography_

Dr. T. Saito  
_Lamont-Doherty Geological Observatory_

Dr. J. B. Saunders  
_Naturhistorisches Museum Basel_

Dr. N. F. Sohl  
_U.S. Geological Survey_

**Advisory Panel on Downhole Measurements**

Dr. R. Hyndman  
_Victoria Geophysical Observatory_

Mr. R. E. Boyce (Ex-officio)  
_Scripps Institution of Oceanography_

Dr. N. Christensen  
_University of Washington_

Dr. J. R. Heirtzler  
_Woods Hole Oceanographic Institution_

Dr. A. F. Richards  
_Lehigh University_

Dr. O. Serra  
_EL-F-ERAP_
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 CHALLENGER 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 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.

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 JODIES 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. Investigations not completed in time for inclusion in the Initial Reports for a specific cruise may not be published in other journals until final publication of that Initial Report for which it was intended. Notice of submission to other journals and a copy of the article should be sent to the DSDP Chief Science Editor.

* 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, 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's). 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 50ml 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 10ml sized samples or less. 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 curators 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; however 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 remainder 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.

G. The Deep Sea Drilling Project routinely processes by computer most of the quantitative data presented in the Initial Reports. Space limitations in the Initial Reports preclude the detailed presentation of all such data. However, copies of the computer readout are available for those who wish the data for further analysis or as an aid on selecting samples. A charge will be made to recover expenses in excess of $50.00 incurred in filling requests.

3. Other Records
Magnetics, seismic reflection, downhole logging, and bathymetric data collected by the GLOMAR CHALLENGER will also be available for distribution at the same time samples become available.

Requests for data may be made to:

Associate Chief Scientist, Science Services
Deep Sea Drilling Project (A-031)
Scripps Institution of Oceanography
University of California at San Diego
La Jolla, California 92093

A charge will be made to recover the expenses in excess of $50.00 in filling individual requests. If required, estimated charges can be furnished before the request is processed.

4. 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.
# CONTENTS

<table>
<thead>
<tr>
<th>Chapter</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>ACKNOWLEDGMENTS</td>
<td>1</td>
</tr>
<tr>
<td><strong>PART I: INTRODUCTION</strong></td>
<td>3</td>
</tr>
<tr>
<td>1. OBJECTIVES OF PASSIVE MARGIN DRILLING</td>
<td>5</td>
</tr>
<tr>
<td>D. G. Roberts and L. Montadert</td>
<td></td>
</tr>
<tr>
<td>2. INTRODUCTION AND EXPLANATORY NOTES, LEG 48, IPOD PHASE OF THE DEEP SEA DRILLING PROJECT</td>
<td>9</td>
</tr>
<tr>
<td>L. Montadert, D. G. Roberts, and R. W. Thompson</td>
<td></td>
</tr>
<tr>
<td><strong>PART II: SITE REPORTS</strong></td>
<td>33</td>
</tr>
<tr>
<td>3. SITES 399, 400, AND HOLE 440A</td>
<td>35</td>
</tr>
<tr>
<td>The Shipboard Scientific Party</td>
<td></td>
</tr>
<tr>
<td>4. SITE 401</td>
<td>73</td>
</tr>
<tr>
<td>The Shipboard Scientific Party With Special Contributions by Maurice Bourbon, David N. Lumsden, and D. Mann</td>
<td></td>
</tr>
<tr>
<td>5. SITE 402/HOLE 402A</td>
<td>125</td>
</tr>
<tr>
<td>The Shipboard Scientific Party With a Special Contribution by D. Mann</td>
<td></td>
</tr>
<tr>
<td>6. SITES 403 AND 404</td>
<td>165</td>
</tr>
<tr>
<td>The Shipboard Scientific Party With a Special Contribution by D. Mann</td>
<td></td>
</tr>
<tr>
<td>7. SITES 405 AND 406</td>
<td>211</td>
</tr>
<tr>
<td>The Shipboard Scientific Party With a Special Contribution by D. Mann, and an Appendix by R. R. Harding</td>
<td></td>
</tr>
<tr>
<td><strong>PART III: PHYSICAL PROPERTIES STUDIES</strong></td>
<td>275</td>
</tr>
<tr>
<td>8. HEAT-FLOW RESULTS, DSDP LEG 48</td>
<td>277</td>
</tr>
<tr>
<td>A. J. Erickson, W. E. Avera, and R. Byrne</td>
<td></td>
</tr>
<tr>
<td>9. THERMAL REGIME OF THE NORTHERN BAY OF BISCAY CONTINENTAL MARGIN IN THE VICINITY OF DSDP SITES 400 TO 402</td>
<td>289</td>
</tr>
<tr>
<td>Jean-Paul Foucher and Jean-Claude Sibuet</td>
<td></td>
</tr>
<tr>
<td>10. INTERSTITIAL WATER STUDIES, LEG 48</td>
<td>297</td>
</tr>
<tr>
<td>R. Ellis, J. Pine, and J. M. Gieskes</td>
<td></td>
</tr>
<tr>
<td><strong>PART IV: PALEONTOLOGICAL STUDIES</strong></td>
<td>341</td>
</tr>
<tr>
<td>11. PALEOMAGNETISM OF LATE MESOZOIC TO HOLOCENE SEDIMENTS FROM THE BAY OF BISCAY AND ROCKALL PLATEAU, DRILLED ON IPOD LEG 48</td>
<td>305</td>
</tr>
<tr>
<td>Ernest A. Hailwood</td>
<td></td>
</tr>
<tr>
<td>12. CENOZOIC OSTRACODES: THEIR IMPORTANCE FOR BATHYMETRY, HYDROLOGY, AND BIOGEOGRAPHY</td>
<td>343</td>
</tr>
<tr>
<td>O. Ducasse and J. P. Peypouquet</td>
<td></td>
</tr>
<tr>
<td>13. CRETACEOUS OSTRACODES OF IPOD LEG 48 (HOLES 400, 400A, 401, 402A)</td>
<td>365</td>
</tr>
<tr>
<td>Renée Damotte</td>
<td></td>
</tr>
<tr>
<td>14. UPPER APTIAN AGGLUTINATED FORAMINIFERS FROM DSDP HOLE 402A</td>
<td>371</td>
</tr>
<tr>
<td>Wayne D. Bock</td>
<td></td>
</tr>
<tr>
<td>15. CENOZOIC DEEP WATER BENTHIC FORAMINIFERS, BAY OF BISCAY</td>
<td>377</td>
</tr>
<tr>
<td>Detmar Schnitker</td>
<td></td>
</tr>
<tr>
<td>16. CENOZOIC BIOSTRATIGRAPHY AND PALEOECOLOGY OF SITES 403 TO 406 BASED ON THE FORAMINIFERS</td>
<td>415</td>
</tr>
<tr>
<td>John W. Murray</td>
<td></td>
</tr>
<tr>
<td>17. STRATIGRAPHY AND PLANKTONIC FORAMINIFERS OF CENOZOIC DEPOSITS OF THE BAY OF BISCAY AND ROCKALL PLATEAU, DSDP LEG 48</td>
<td>431</td>
</tr>
<tr>
<td>Valeri A. Krasheninnikov</td>
<td></td>
</tr>
<tr>
<td>18. MESOZOIC FORAMINIFERS AND MICROFACIES FROM HOLES 400A, 401 AND 402A OF THE DSDP LEG 48</td>
<td>451</td>
</tr>
<tr>
<td>P. A. Dupeuble</td>
<td></td>
</tr>
<tr>
<td>19. STABLE ISOTOPES AND TERTIARY PALEONTOLOGICAL PALEOCEANOGRAPHY IN THE NORTHEAST ATLANTIC</td>
<td>475</td>
</tr>
<tr>
<td>C. Vergnaud Grazzini, C. Müller, C. Pierre, R. Létolle, and J. P. Peypouquet</td>
<td></td>
</tr>
<tr>
<td>20. RADIOLARIA FROM THE NORTHEASTERN ATLANTIC OCEAN, DSDP LEG 48</td>
<td>493</td>
</tr>
<tr>
<td>Annika Sanfilippo and W. R. Riedel</td>
<td></td>
</tr>
</tbody>
</table>
21. CENOZOIC DINOCYST STRATIGRAPHY OF SITES 403 TO 406 (ROCKALL PLATEAU), IPOD, LEG 48
   Lucy I. Costa and Charles Downie ........................................ 513

22. DINOFLAGELLATE BISTRATIGRAPHY OF NEOGENE AND QUATERNARY SEDIMENTS AT HOLES 400/400A IN THE BAY OF BISCAY (DEEP SEA DRILLING PROJECT LEG 48) ........................................ 531
   Rex Harland

23. MARINE APTO-ALBIAN PALYNOMORPHS FROM HOLES 400A AND 402A, IPOD LEG 48, NORTHERN BAY OF BISCAY .......... 547
   Roger J. Davey

   D. J. Batten

25. CALCAREOUS NANNOFOSILS FROM THE NORTH ATLANTIC (LEG 48) .......... 589
   Carla Müller

26. AMMONOIDEA FROM THE LOWER CRETAEOUS OF HOLE 402A IN THE BAY OF BISCAY, DSDP LEG 48 .......... 641
   Otto Renz

PART V: SEDIMENTOLOGICAL STUDIES .......... 647

27. X-RAY MINERALOGY FROM HOLES 399, 400, 400A, 401, 402 AND 402A OF BAY OF BISCAY .......... 649
   G. Cassat

28. X-RAY MINERALOGY STUDIES, LEG 48—ROCKALL REGION (SITES 403, 404, 405, AND 406) .......... 665
   C. Latouche and N. Maillet

29. PECULIARITIES OF MESO-CENOZOIC SEDIMENTATION IN THE BAY OF BISCAY AND ROCKALL PLATEAU REGIONS, LEG 48 .......... 677
   P. P. Timofeev, N. V. Renngarten, and V. V. Eremerov

30. MINERALOGY AND GEOCHEMISTRY OF UPPER CRETACEOUS AND CENOZOIC SEDIMENTS FROM NORTH BISCAY BAY AND ROCKALL PLATEAU (EASTERN NORTH ATLANTIC), DSDP LEG 48 ........ 703
   Pierre Debrabant, Hervé Chamley, Janine Foulon, and Henri Maillot

31. SOME TRACE ELEMENTS AND THEIR RELATION TO OXYGEN AND CARBON ISOTOPES IN THE CARBONATE SAMPLES RECOVERED FROM HOLE 400A OF DSDP LEG 48 .......... 727
   Maurice Renard, René Létolle, and Gilbert Richebois

32. OXYGEN AND CARBON ISOTOPES FROM BULK CARBONATES AND FORAMINIFERAL SHELLS AT DSDP SITES 400, 401, 402, 403, AND 406 .......... 741
   René Létolle, Colette Vergnaud Grazzini, and Catherine Pierre

33. TRANSFORMATION OF OPALINE SILICA IN SEDIMENTS FROM BAY OF BISCAY AND ROCKALL BANK .......... 757
   Hideo Kagami

34. INSOLUBLE RESIDUE DATA AND PRELIMINARY INTERPRETATION—QUATERNARY SEDIMENT: DSDP SITES 403 AND 405 .......... 765
   David N. Lumsden

35. PETROGRAPHY AND MINERALOGY OF VOLCANOGENIC SEDIMENTS FROM DSDP LEG 48, SOUTHWEST ROCKALL PLATEAU, SITES 403 AND 404 .......... 771
   R. K. Harrison, R. W. O'B Knox, and A. C. Morton with contributions by R. J. Merriman and C. W. Wheatley

36. REMARKS CONCERNING THE GLAUCONTIC MATERIALS COLLECTED DURING LEG 48 .......... 787
   G. S. Odin

37. UPPER CRETAEOUS TO QUATERNARY SEDIMENTARY PROCESSES IN THE BAY OF BISCAY FROM TEXTURAL, MINERALOGICAL, AND COARSE FRACTION STUDIES .......... 791
   G. A. AufTret and L. Pastouret
<table>
<thead>
<tr>
<th>Chapter</th>
<th>Page</th>
<th>Chapter</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>38. BLACK SHALES OF THE BAY OF BISCAY AND CONDITIONS OF THEIR FORMATION, DEEP SEA DRILLING PROJECT LEG 48, HOLES 400A, 402A</td>
<td>831</td>
<td>P. P. Timofeev and L. I. Bogolyubova</td>
<td></td>
</tr>
<tr>
<td>39. MINERALOGY AND GEOCHEMISTRY OF SELECTED ALBIAN SEDIMENTS FROM THE BAY OF BISCAY, DEEP SEA DRILLING PROJECT LEG 48</td>
<td>855</td>
<td>Frédéric Mélières</td>
<td></td>
</tr>
<tr>
<td>41. MAGNETIC ANISOTROPY AND SEDIMENT TRANSPORT DIRECTIONS IN NORTH ATLANTIC EARLY CRETACEOUS BLACK SHALES AND EOCENE MUDSTONES CORED ON DSDP LEG 48</td>
<td>909</td>
<td>Ernest A. Hailwood and William O. Sayre</td>
<td></td>
</tr>
<tr>
<td>PART VI: ORGANIC GEOCHEMISTRY</td>
<td>919</td>
<td></td>
<td></td>
</tr>
<tr>
<td>42. ORGANIC GEOCHEMISTRY OF CRETACEOUS MUDSTONES AND MARLY LIMESTONES FROM DSDP SITES SITES 400 AND 402, LEG 48, EASTERN NORTH ATLANTIC</td>
<td>921</td>
<td>G. Deroo, J. P. Herbin, J. Roucaché, and B. Tissot</td>
<td></td>
</tr>
<tr>
<td>43. TETRAPYRROLE PIGMENTS IN CRETACEOUS SEDIMENTS FROM THE BAY OF BISCAY, IPOD LEG 48, HOLE 402A</td>
<td>931</td>
<td>Earl W. Baker and Susan E. Palmer</td>
<td></td>
</tr>
<tr>
<td>44. LIPID GEOCHEMISTRY OF CRETACEOUS BLACK SHALES FROM THE BAY OF BISCAY, SITE 402, AND OF EOCENE MUDSTONE FROM THE ROCKALL PLATEAU, SITE 404</td>
<td>935</td>
<td>Bernd R.T. Simoneit</td>
<td></td>
</tr>
<tr>
<td>45. SEDIMENT C_,_C HYDROCARBONS FROM IPOD LEG 48—BAY OF BISCAY</td>
<td>943</td>
<td>Jean K. Whelan and John M. Hunt</td>
<td></td>
</tr>
<tr>
<td>46. GEOCHEMISTRY OF CARBON: DEEP SEA DRILLING PROJECT, LEG 48</td>
<td>947</td>
<td>J. G. Erdman and K. S. Schorno</td>
<td></td>
</tr>
<tr>
<td>47. PETROLEUM-GENERATING POTENTIAL OF SEDIMENTS FROM LEG 48, DEEP SEA DRILLING PROJECT</td>
<td>951</td>
<td>J. W. Kendrick, A. Hood, and J. R. Castano</td>
<td></td>
</tr>
<tr>
<td>48. GEOCHEMICAL ANALYSIS OF SAMPLES FROM LEG 48, HOLE 402A, BAY OF BISCAY</td>
<td>955</td>
<td>Daniel B. Pearson and Wallace G. Dow</td>
<td></td>
</tr>
<tr>
<td>49. SHIPBOARD ORGANIC GEOCHEMISTRY</td>
<td>959</td>
<td>William E. Harrison and Jean L. LaPorte</td>
<td></td>
</tr>
<tr>
<td>51. BASIC ORGANIC GEOCHEMICAL DATA OF LEG 48 MATERIAL</td>
<td>977</td>
<td>T. Doran, P. G. Johnson, P.J.D. Park, G. C. Speers, and J. Williams</td>
<td></td>
</tr>
<tr>
<td>PART VII: REGIONAL GEOLOGICAL STUDIES</td>
<td>993</td>
<td></td>
<td></td>
</tr>
<tr>
<td>52. DREDGED ROCKS FROM THE ARMORICAN AND CELTIC MARGINS</td>
<td>995</td>
<td>G. A. Auffret, L. Pastouret, G. Cassat, O. De Charpal, J. Cravaté, and P. Guennoc</td>
<td></td>
</tr>
<tr>
<td>53. PRELIMINARY RESULTS OF A SEISMIC REFRACTION STUDY IN THE MERIADZEK-TREVELYAN AREA, BAY OF BISCAY</td>
<td>1015</td>
<td>Félix Avedik and David Howard</td>
<td></td>
</tr>
<tr>
<td>55. THE WESTERN ROCKALL PLATEAU: STRATIGRAPHY AND STRUCTURAL EVOLUTION</td>
<td>1061</td>
<td>D. G. Roberts, L. Montadert, and R. C. Searle</td>
<td></td>
</tr>
</tbody>
</table>
PART VIII: CRUISE SYNTHESIS .......... 1089

56. MINERALOGY OF THE CLAY FRACTION OF THE ATLANTIC OCEAN SEDIMENTS, DSDP LEG 48 .......... 1091
    P. P. Timofeev, M. A. Rateev, and N. V. Renn-garten

57. MARGIN PALEOENVIRONMENTS OF THE NORTHEAST ATLANTIC .......... 1099
    D. G. Roberts and L. Montadert

58. CHRONOLOGY AND BIOSTRATIG-RAPHY OF NORTHEAST ATLANTIC SEDIMENTS, DSDP LEG 48 .......... 1119
    Ernest A. Hailwood, Wayne Bock, Lucy Costa, Pierre A. Dupeuble, Carla Müller, and Detmar Schnitker

PART IX: APPENDIX .......... 1155

I. EXAMINATION OF POTENTIAL GEOCHEMICAL CONTAMINANTS IN LEG 48 MATERIAL .......... 1157
    T. Doran and P. G. Johnson

INDEX .......... 1161

ENCLOSURES IN POCKET AT THE BACK OF THE VOLUME

Superlogs for Sites 400 through 406.
Figure 2 of Chapter 2.
Figure 18 of Chapter 3.
Figure 25 of Chapter 5.

Figure 1 of Chapter 27.
Appendix C of Chapter 37.
Figures 10, 14, and 23 of Chapter 55.
Figure 5 of Chapter 59.

Lithologic Core Descriptions, Sites 399 through 406, on microfiche cards.
"The present is the key to not much more than the Pleistocene and Pliocene." Anonymous Sedimentologist

ACKNOWLEDGMENTS

Leg 48 of the Deep Sea Drilling Project was the second leg of the International Phase of Ocean Drilling to be dedicated to drilling passive ocean margins in the northeast Atlantic. Its success was due to the hard work of many persons before, during, and after the leg.

Formulation of the objectives of passive margin drilling both in general and in the northeast Atlantic owes much to the critical reviews and stimulating contributions made by the JOIDES Ocean Margin Passive Panel under the able guidance of Joe Curray (Chairman). We wish to thank John Ewing, Bert Bally, Karl Hinz, Danny Bernoulli, John Hunt, Hideo Kagami, Eugen Seibold, Dave Moore, Jorn Thiede, Peter Vail, Bill Bryant, Helmut Beirsdorf, Robert Sheridan, and John Grow for their guidance and comments both before and after the leg.

The success of Leg 48 in large part was due to the thorough multichannel surveys made before and after the cruise in both the Biscay and Rockall areas. These surveys enabled definition of scientific objectives, assigning priority to problems, and application of the drilling results to the margin as a whole. We wish to thank the Department of Energy (UK) and IFP-CNEXO-CEPM for their financial support of pre- and post-cruise surveys and for their agreement to reproduce the seismic profiles in this Initial Report.

At sea, Captain L. Dill and his crew responded splendidly to operational difficulties. We would particularly like to thank the drilling crew for their superior effort in replacing the lost drill string whilst at sea; especial thanks go to Bob Knapp, Operations Manager, for his unstinting help in these difficult circumstances in reformulating the drilling program and, indeed, throughout the leg. Our marine technicians, under the able guidance of Mike Lehmann, did a fine job. Gayle Burns, our yeoman, coped with massive amounts of Franglais, American English, and English English with aplomb that added greatly to the efficiency and success of the cruise.

During Leg 48, logging of passive margin sites was carried out at sea for the first time. The logging program was generously provided through the Natural Environment Research Council by the Department of Energy (UK) whom we wish to thank. David Mann of the Department of Energy and Schlumberger Ltd. (UK) helped formulate the logging suite and also contributed to the analysis of the logs; Geoff Lamb of Schlumberger Ltd. (UK) carried out the logging on board with great efficiency. The success of the logging program in single-bit holes owes all to the ingenious bit release mechanism developed by V. F. “Swede” Larson of DSDP Operations. During the leg, complete monitoring of hydrocarbons and source-rock potential was made possible by the generous loan of the IFP Pyrolysis Analyzer from the Institut Français du Pétrole and by the hard work of Jean Laporte. A complete paleomagnetics program was made possible by the provision of a magnetometer by the Natural Environment Research Council (UK). By no means least, we would like to thank Dave Moore for his help throughout the planning and execution of the leg, and especially for allowing us (when called at 0300 California time) to be flexible in choosing new sites after the loss of the drill string.

In preparing this volume, we would like to thank John Usher, Mary Beth Owen, Mary Young, and Janice Bowman for their help and patience in assembling the volume; a special note of gratitude is extended to the DSDP artists who prepared figures, plates, and tables.

We are indebted to colleagues whose shoreside studies have contributed much to the success of this volume. L. Montadert is grateful to the Institut Français du Pétrole, CNEXO, and CEPM (IFP, SNEA[P], CFP) which permitted the acquisition of data and his participation in Leg 48 studies. Particular thanks are due to the geophysicists (J. P. Fail, R. Donatien, J. Cassand) and crew of the M. S. Florence of the Institut Français du Pétrole who made the seismic surveys and to several geologists (B. Soulhol, S. Oum, I. Aydinak, J. P. Esteve) involved in the preparations of the leg at IFP. Discussions with colleagues at IFP (M. Poulet, O. de Charpal) and CNEXO (J. C. Sibuet, Y. Lancelot) were helpful. D. G. Roberts wishes to acknowledge the Department of Energy for supporting his participation in Leg 48 studies. Particular thanks are due to the scientists and crew of RSS Discovery, R. V. Seismariner (Seismograph Services Ltd.), and M. V. Oil Hunter (S & A Geophysical Ltd.) for their help at sea. Discussions with A. S. Laughton, R. C. Searle, and R. B. Kidd were valuable.

Finally, we wish to thank the UK IPOD Coordinating Committee of the Natural Environment Research Council (Sir P. E. Kent, FRS, Chairman, and A. S. Laughton) and IPOD France (F. Boillot, J. Debyser, and X. Le Pichon) for their help and support.