Photomicrographs of rocks recovered at DSDP Site 395

A–C. A sequence of representative photomicrographs of successively coarser grained basalts from aphyric pillow basalt Unit A_2.

A. Sample 395-9-1, 128-138 cm. Altered elongate olivine (brown) in matrix of needle-like plagioclase and titanomagnetite. Plane polarized light. Glass is virtually absent in this unit.

B. Sample 395A-7-1, 75-77 cm. Olivine "hopper" crystals in a matrix of acicular plagioclase and titanomagnetite. Crossed nichols.

C. Sample 295-15-2, 130-136 cm. Granular and skeletal olivine in a matrix of skeletal plagioclase, clinopyroxene, and titanomagnetite. Crossed nichols.

D. A photomicrograph of tiny olivine crystals in a glass pillow rim of aphyric basalt Unit A_3. Note contrast of olivine crystal morphologies in photomicrograph A. Sample 395A-56-3, 94-96 cm. Plane polarized light.

E–G. Photomicrographs of phyric basalts.

E. Sample 395A-17-1, 131-132 cm. Phyric basalt Unit P_1. Brown plagioclase spherulites in clear glass. Sample from pillow rim. Plane polarized light.

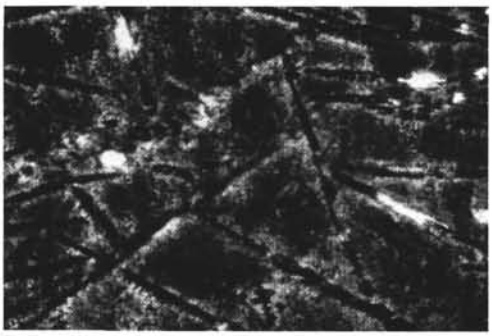
F. Sample 395A-31-1, 83-87 cm. Phyric basalt Unit P_5. Skeletal groundmass plagioclase in a matrix of dendritic to spherulitic clinopyroxene and titanomagnetite. Crossed nichols.

G. Sample 395-18-1, 56-58 cm. Phyric basalt Unit P_1. Strongly zoned plagioclase phenocryst clumped with smaller, unzoned plagioclases. The interior of the zoned crystal may have grown in a less fractionated magma which was mixed with the magma containing the smaller plagioclases (Rhodes et al., this volume; Dungan et al., this volume). Crossed nichols.

H. Serpentinized peridotite Sample 295-18-1, 56-58 cm. Web-like serpentine after olivine with uniform extinction. Rock is a harzburgite boulder recovered in an unusual sequence of plutonic rocks beneath aphyric basalt Unit A_2 in Hole 395. Crossed nichols.

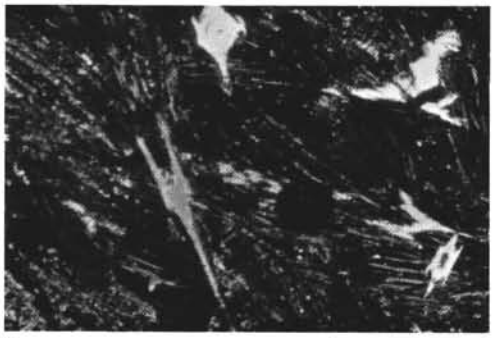
APHYRIC BASALTS

TYPE A_2



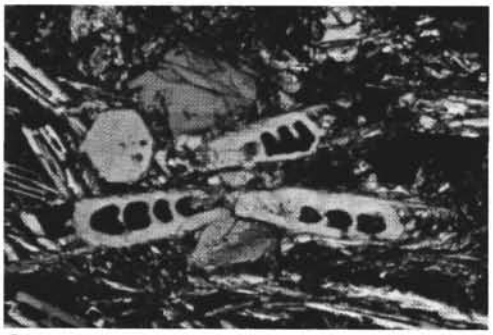
A

0.5 mm



B

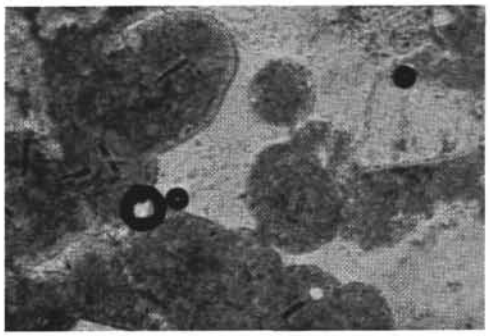
0.1 mm



C

0.1 mm

PHYRIC BASALTS

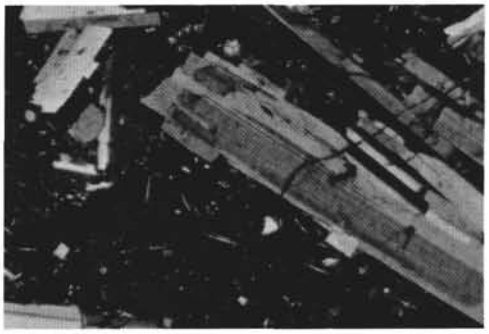


E

0.1 mm

F

0.1 mm

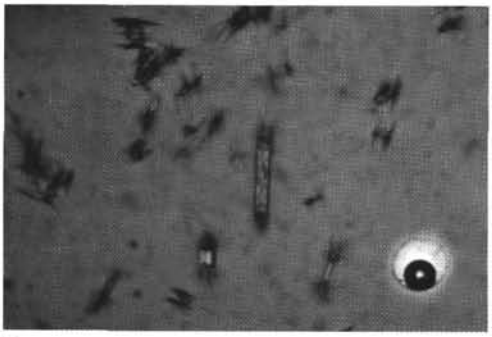


G

0.5 mm

APHYRIC BASALT

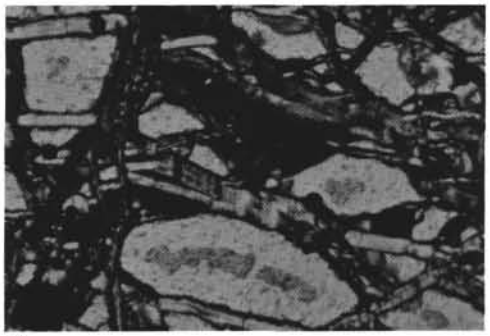
TYPE A_3



D

0.05 mm

SERPENTINIZED PERIDOTITE



H

0.1 mm

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 XLV

covering Leg 45 of the cruises of the Drilling Vessel *Glomar Challenger*
San Juan, Puerto Rico to San Juan, Puerto Rico
November 1975–January 1976

PARTICIPATING SCIENTISTS

William G. Melson, Philip D. Rabinowitz,
Henri Bougault, Toshitsugu Fujii, Andrew L. Graham,
Harlan P. Johnson, James R. Lawrence, James H. Natland,
Egfrid Prosser, J. Michael Rhodes, and Boris P. Zolotarev

SCIENCE REPRESENTATIVE

James H. Natland

SCIENCE EDITOR

James D. Shambach

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:

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

Melson, W. G., Rabinowitz, P. D., et al., 1978. *Initial Reports of the Deep Sea Drilling Project,* v. 45: Washington (U.S. Government Printing Office).

Melson, W. G., 1978. Chemical stratigraphy of Leg 45 basalts: electron probe analyses of glasses, *In* Melson, W. G., Rabinowitz, P. D., et al., 1978. *Initial Reports of the Deep Sea Drilling Project,* v. 45: Washington (U.S. Government Printing Office), p. 507-512.

Printed January 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 $14.25
Stock Number 038–000–00391–7

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 established 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

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; Rosentiel 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 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 Five

Dr. William G. Melson
Co-Chief Scientist
Department of Mineral Sciences
National Museum of Natural History
Smithsonian Institution
Washington, D.C. 20560

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

Dr. Henri Bougault
X-Ray Fluorescence Specialist
Centre Océanologique de Bretagne
CNEXO
BP 337
29273 Brest Cedex
France

Dr. Toshitsugu Fujii
Igneous Petrologist
Geological Institute
University of Tokyo
Hongo, Tokyo
Japan

Dr. Andrew L. Graham
Igneous Petrologist
Department of Mineralogy
British Museum of Natural History
Cromwell Road
London SW7 5BD
England

Dr. Harlan P. Johnson
Paleomagnetist
Cooperative Institute for Research in Environmental Sciences
University of Colorado
Boulder, Colorado 80302

Dr. James R. Lawrence
Geochemist
Lamont-Doherty Geological Observatory
Palisades, New York 10964

Dr. James H. Natland
Igneous Petrologist & Science Representative
Deep Sea Drilling Project, A-031
Scripps Institution of Oceanography
La Jolla, California 92093

Dr. Egfrid Prosser
Igneous Petrologist
Institute for Applied Geophysics of the Technical University
2 Theresienstrasse 41/IV
8 Munich
Federal Republic of Germany

Dr. J. Michael Rhodes
Geochemist
Lockheed Electronics Company
Geochemistry Branch
16811 El Camino Real
Houston, Texas 77058

Dr. Boris P. Zolotarev
Igneous Petrologist
Geological Institute of the USSR
Academy of Sciences of the USSR
Pyzhevskiy per., 7
Moscow
USSR

Mr. V. F. Larson
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 Joseph A. Clarke
Captain of the Drilling Vessel
Global Marine, Inc.
Los Angeles, California 90017

Mr. James Ruddell
Drilling Superintendent
Global Marine, Inc.
Los Angeles, California 90017

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

Ms. Anne Gilbert
Chemist
Deep Sea Drilling Project, A-031
Scripps Institution of Oceanography
La Jolla, California 92093

Ms. Adele Caldara
Curatorial Representative
Deep Sea Drilling Project
Lamont-Doherty Geological Observatory
Palisades, New York 10964

Mr. Paul Laughton
Electronics Technician
Deep Sea Drilling Project, A-031
Scripps Institution of Oceanography
La Jolla, California 92093

Mr. Lloyd Russill
Electronics Technician
Deep Sea Drilling Project, A-031
Scripps Institution of Oceanography
La Jolla, California 92093

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

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

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

Ms. Louise Henry
Yeoman
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. Manik Talwani
Lamont-Doherty Geological Observatory

Dr. Warren S. Wooster
Rosensteil School of Marine and Atmospheric Science

Dr. William A. Nierenberg
Scripps Institution of Oceanography

Dr. Arthur E. Maxwell
Woods Hole Oceanographic Institution

Dr. Maurice Rattray
University of Washington

Prof. Dr. F. Bender
Bundesanstalt für Bodenforschung

Dr. Hans Closs **
Bundesanstalt für Bodenforschung

Mr. John I. Ewing
Lamont-Doherty Geological Observatory

Dr. Paul M. Fye
Woods Hole Oceanographic Institution

Dr. Charles J. Merdinger
Scripps Institution of Oceanography

Dr. Gleb Udintsev
P. P. Shirshov Institute of Oceanology

Dr. Melvin N. A. Peterson (Ex-Officio)
Scripps Institution of Oceanography

Dr. John V. Byrne
Oregon State University

Monsieur Jacques Debyser
CNEXO

Dr. Richard A. Geyer
Texas A&M University

Sir Peter Kent, F.R.S.
Natural Environment Research Council

Dr. John A. Knauss
University of Rhode Island

Monsieur Yves La Prairie
CNEXO

Captain T. K. Treadwell
Texas A&M University

Dr. P. R. Twinn
Natural Environment Research Council

Dr. Seiitiro Utida
Ocean Research Institute
University of Tokyo

Dr. Norman D. Watkins
University of Rhode Island

Dr. George P. Woollard
Hawaii Institute of Geophysics

Dr. Joe S. Creager
University of Washington

Dr. William W. Hay
Rosenstiel School of Marine and Atmospheric Science

Dr. Noriyuki Nasu
University of Tokyo

Dr. N. Terence Edgar
Scripps Institution of Oceanography

Dr. Vern Kulm
Oregon State University

Planning Committee

Mr. John I. Ewing
Lamont-Doherty Geological Observatory

Dr. William W. Hay
Rosenstiel School of Marine and Atmospheric Science

Dr. Joe S. Creager
University of Washington

Mr. William R. Riedel
Scripps Institution of Oceanography

Dr. James R. Heirtzler
Woods Hole Oceanographic Institution

Dr. Gleb Udintsev
P. P. Shirshov Institute of Oceanology

Dr. Hans Closs
Bundesanstalt für Bodenforschung

Dr. George Shor
Scripps Institution of Oceanography

Dr. Helmut Beiersdorf
Bundenstalt für Geowissenschaften und Rohstoffe

Dr. William Bryant
Texas A&M University

Dr. C. G. A. Harrison
Rosenstiel School of Marine and Atmospheric Science

Dr. Dennis E. Hayes
Lamont-Doherty Geological Observatory

* Includes members during time of Leg 36 (April-May 1974)

** Alternate

Dr. James Kennett
University of Rhode Island

Dr. LaVern D. Kulm
Oregon State University

Dr. Yves Lancelot
CNEXO

Dr. Anthony S. Laughton
Institute of Oceanographic Sciences

Dr. Xavier Le Pichon
CNEXO

Dr. Dean A. McManus
University of Washington

Dr. Noriyuki Nasu
Ocean Research Institute

Dr. Jean-Guy Schilling
University of Rhode Island

Dr. Tj. H. VanAndel
Oregon State University

Dr. George P. Woollard
Hawaii Institute of Geophysics

Dr. Stefan Gartner
Texas A&M University

Dr. E. L. Winterer
Scripps Institution of Oceanography

Dr. Arnold Bouma
Texas A&M University

Dr. N. Terence Edgar
Scripps Institution of Oceanography

Advisory Panel on Sedimentary Petrology and Physical Properties

Dr. George H. Keller
NOAA Atlantic Oceanographic and Meteorological Laboratories

Dr. Alexander P. Lisitzin
USSR Academy of Sciences

Prof. Dr. G. Muller
Laboratorium für Sedimentforschung, Heidelberg

Dr. Alfred G. Fischer
Princeton University

Mr. Henry L. Gill
Naval Civil Engineering Laboratory

Dr. C. J. Frimann
Norwegian Geotechnical Institute

Dr. S. E. Calvert
Institute of Oceanography Wormley, Godalming

Dr. Wolfgang Berger
Universität Kiel

Dr. William R. Bryant
Texas A&M University

Dr. Ross Heath
Oregon State University

Dr. Fréderic Mélières
Université Pierre et Marie Curie

Dr. Harry E. Cook
University of California at Riverside

Dr. Adrian F. Richards
Lehigh University

Advisory Panel on Organic Geochemistry

Dr. Keith A. Kvenvolden
NSAS Ames Research Center

Dr. Earl W. Baker
Northeast Louisiana University

Dr. Ellis E. Bray
Mobil Oil Company

Dr. N. A. Eremenko
Institute of Geology and Exploration of Combustible Mineral Resources

Dr. William W. Hay
Rosenstiel School of Marine and Atmospheric Science

Dr. Richard D. McIver
Esso Production Research Laboratory

Dr. John M. Hunt
Woods Hole Oceanographic Institution

Dr. J. Gordon Erdman
Phillips Petroleum Company

Dr. Erwin Suess
Oregon State University

Dr. A. A. Geodekjan
P. P. Shirshov Institute of Oceanology, USSR

Dr. Dietrich Welte
Lehrstuhl für Geologie, Geochemie, und Lagerstratten des Erdols und der Kohle Rhein-West. Techn. Hochschule

Dr. Egon T. Degens
Geological-Paleontological Institut

Dr. Geoffrey Eglinton
University of Bristol

Dr. B. Tissot
Institut Français de Pétrole

Advisory Panel on Information Handling

Dr. Melvin A. Rosenfeld
Woods Hole Oceanographic Institution

Dr. Daniel W. Appleman
Smithsonian Institution

Dr. Jack G. Barr
Standard Oil Company of California

Dr. James C. Kelley
University of Washington

Mr. William R. Riedel
Scripps Institution of Oceanography

Dr. I. Mikhaltsev
P. P. Shirshov Institute of Oceanology

Dr. T. A. Davies (Ex Officio)
Middlebury College

Dr. H. Glashoff
Bundesanstalt für Geowissenschaften und Rohstoffe

Dr. T. Worsley
University of Washington

Mr. P. Grim
NOAA

Dr. A. Loeblich Jr.
University of California at Los Angeles

Professor Leonid Sitnikov
Academy of Sciences of the USSR

Dr. John L. Usher (ex-officio)
Scripps Institution of Oceanography

Advisory Panel on Pollution Prevention and Safety

Dr. Hollis D. Hedberg
Princeton University

Mr. John I. Ewing
Lamont-Doherty Geological Observatory

Dr. Louis E. Garrison
United States Geological Survey

Dr. Manik Talwani
Lamont-Doherty Geological Observatory

Mr. Oscar Weser
Scripps Institution of Oceanography

Dr. H. Grant Goodell
University of Virginia

Dr. E. L. Winterer
Scripps Institution of Oceanography

Dr. Joseph R. Curray
Scripps Institution of Oceanography

Dr. Seiya Uyeda
University of Tokyo

Dr. George Claypool
U. S. Geological Survey

Advisory Panel on Inorganic Geochemistry

Dr. Heinrich D. Holland
Hoffman Laboratory

Dr. Wallace S. Broecker
Lamont-Doherty Geological Observatory

Mr. John I. Ewing
Lamont-Doherty Geological Observatory

Dr. Joris M. Gieskes
Scripps Institution of Oceanography

Dr. Ian R. Kaplan
University of California at Los Angeles

Dr. Frank T. Manheim
University of South Florida

Dr. Karl K. Turekian
Yale University

Dr. Igor M. Varentsov
The USSR Academy of Sciences

Dr. Gleb N. Baturin
The USSR Academy of Sciences

Dr. Erwin Suess
Oregon State University

Dr. K. H. Wedepohl
Geochemisches Institüt der Universität/Gottingen

Dr. David S. Cronan
Imperial College

Industrial Liaison Panel

Mr. W. A. Roberts
Phillips Petroleum Company

Mr. Fred C. Ackman
Esso Exploration Inc.

Mr. Melvin J. Hill
Gulf Oil Corporation

Mr. John D. Moody
Mobil Oil Corporation

Monsieur Gilbert Rutman
Societé Nationale des Pétroles d'Aquitaine

Advisory Panel on Ocean Crust

Dr. William G. Melson
Smithsonian Institution

Dr. Leonid Dmitriev
Institute of Geochemistry, USSR

Dr. Stanley R. Hart
Carnegie Institution of Washington

Dr. James R. Heirtzler
Woods Hole Oceanographic Institution

Dr. Manik Talwani
Lamont-Doherty Geological Observatory

Dr. W. Jason Morgan
Princeton University

Dr. Hans Schmincke
Ruhr-Universität Bochum

Dr. Werner Schreyer
Ruhr-Universität Bochum

Dr. John C. Sclater
Massachusetts Institute of Technology

Dr. Nikolas Christensen
University of Washington

Dr. Gleb Udintsev
P. P. Shirshov Institute of Oceanology, USSR

Dr. J. R. Cann
University of East Anglia

Dr. Ikuo Kushiro
University of Tokyo

Dr. Claude Allegre
Universités de Paris 6 et 7

Advisory Panel on Ocean Margin (Active)

Dr. Seiya Uyeda
Lamont-Doherty Geological Observatory

Dr. Joe S. Creager
University of Washington

Dr. I. P. Kosminskaya
Institute of the Physics of the Earth, USSR

Dr. Loren W. Kroenke
University of Hawaii

Dr. Creighton A. Burk
Mobile Oil Corporation
Princeton, New Jersey

Dr. William J. Ludwig
Lamont-Doherty Geological Observatory

Dr. Gordon Packham
University of Sydney

Academician A. P. Pieve
Institute of Geology, USSR

Dr. David W. Scholl
U.S. Geological Survey

Dr. Roland Von Huene
U.S. Geological Survey

Dr. Kazuo Kobayashi
University of Tokyo

Dr. Lavern D. Kulm (ex-officio)
Oregon State University

Dr. Keith Kvenvolden
U. S. Geological Survey

Dr. Rene Blanchet
Ecole Normale Superieure de St. Cloud

Advisory Panel on Ocean Margin (Passive)

Dr. Joseph R. Curray
Scripps Institution of Oceanography

Dr. A. W. Bally
Shell Oil Company

Academician V. V. Beloussov
Soviet Geophysical Committee

Professor Daniel Bernoulli
Geologisch-Palaontologisches Institüt, Basel

Professor Dr. Hans Closs
Bundesanstalt für Geowissenschaften und Rohstoffe

Mr. John Ewing
Lamont-Doherty Geological Observatory

Dr. K. Hinz
Bundesanstalt für Geowissenschaften und Rohstoffe

Dr. Lucien Montadert
Institut Français du Petrole

Mr. David G. Roberts
Institute of Oceanographic Sciences

Dr. E. Seibold
Geologisch-Palaontologisches Institüt, Universität-Kiel

Dr. Von Stackleberg
Bundesanstalt für Geowissenschaften und Rohstoffe

Dr. J. M. Hunt
Woods Hole Oceanographic Institution

Dr. H. Kagami
University of Tokyo

Dr. J. Thiede
Oregon State University

Advisory Panel on Ocean Paleoenvironment

Mr. Jacques Debyser
CNEXO, Paris

Dr. William W. Hay
Rosenstiel School of Marine & Atmospheric Science

Dr. Valeri A. Krasheninnikov
Geological Institute, USSR

Dr. Alexander Lisitzin
P. P. Shirshov Institute of Oceanology, USSR

Dr. James Kennett
University of Rhode Island

Professor B. M. Funnell
University of East Anglia

Dr. Ken Hsü
Eidg. Technische Hochschule

Dr. Y. Takayanagi
Tohoku University

Dr. W. Berggren
Woods Hole Oceanographic Institution

Dr. P. L. Bezrukov
Academy of the Sciences of the USSR

Dr. Pavel Cepek
Bundesanstalt für Geowissenschaften und Rohstoffe

Dr. Yves Lancelot
CNEXO

Dr. E. Moore
University of Rhode Island

Dr. N. Shackleton
University of Cambridge

Dr. Hans Thierstein
Scripps Institution of Oceanography

Dr. H. Bolli
E.T.H. Zurich

Dr. T. A. Davies
Middlebury College

Dr. Roland Von Huene
U.S. Geological Survey

Dr. Joe S. Watkins
University of Texas

Dr. Gleb Udintsev
P. P. Shirshov Institute of Oceanology, USSR

Dr. Edward L. Winterer
Scripps Institution of Oceanography

Dr. Shozaburo Nagumo
The University of Tokyo

Dr. Davis A. Fahlquist
Texas A&M University

Dr. Roland Schlich
Observatoire Géophysique du Parc St.-Maur

Advisory Panel on Site Surveying

Dr. Brian T. R. Lewis
University of Washington

Dr. Mahlon Ball
Rosenstiel School of Marine & Atmospheric Science

Dr. Elizabeth Bunce
Woods Hole Oceanographic Institution

Dr. Edgar S. Driver
Gulf Global Exploration Company

Mr. John Ewing
Lamont-Doherty Geological Observatory

Dr. Karl Hinz
Bundesanstalt für Geowissenschaften und Rohstoffe

Dr. Donald M. Hussong
Hawaii Institute of Geophysics

Dr. L. Kogan
Southern Branch of the Institute of Oceanology, USSR

Dr. Isabella Premoli-Silva
University of Milano

Mr. William R. Riedel
Scripps Institution of Oceanography

Dr. H.-J. Schrader
Geologisch-Palaontologisches
Institüt der Universität Kiel

Dr. Tj. H. Van Andel
Oregon State University

Professor Thomas J. Worsley
University of Washington

Dr. I. P. Kosminskaya
Institute of the Physics of the Earth, USSR

Dr. Marcus Langseth
Lamont-Doherty Geological Observatory

Dr. Vince Renard
Centre Oceanologique de Bretagne

Dr. G. Stober
Deminex, Dusseldorf

Stratigraphic Correlations Panel

Dr. R. H. Benson
National Museum of Natural History
Smithsonian Institution

Professor Dr. H. M. Bolli
Eidg. Technische Hochschule

Dr. D. Bukry
U. S. Geological Survey
Scripps Institution of Oceanography

Dr. R. G. Douglas
University of Southern California

Dr. S. R. Hammond
Hawaii Institute of Geophysics

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

Downhole Measurements Panel

Mr. R. E. Boyce (ex-officio)
Deep Sea Drilling Project
Scripps Institution of Oceanography

Dr. N. Christensen
University of Washington

Dr. J. R. Heritzler
Woods Hole Oceanographic Institution

Dr .R. Hyndman
Victoria Geophysical Observatory

Dr. A. F. Richards
Lehigh University

Dr. O. Serra
ELF-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.

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 (I.C.D.). 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 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.

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

ACKNOWLEDGMENTS AND DEDICATION

As the inaugural cruise of the International Phase of Ocean Drilling, Leg 45 was the first to reap the benefits of organized international support for the Deep Sea Drilling Project. The many articles in this volume by French, German, British, Soviet, and Japanese contributors are testimony to the high level of support given to studies on DSDP samples by these newer members of JOIDES. Among the most important benefits of international cooperation during Leg 45 was the opportunity to share an exciting venture with people from different cultures, with different outlooks, and with a diverse range of cultural and geological backgrounds.

Leg 45 was the result of months of planning by the JOIDES Ocean Crust Panel and Planning Committee, and was the culmination of a scientific program involving extensive site surveys, detailed geophysical work, and preliminary sampling by dredge and core. We thank all who participated in the planning and execution of this work.

Two aspects of the shipboard scientific operation deserve special commendation. The CNEXO X-ray fluorescence van operated by Henri Bougault provided many reliable analyses of rocks including, for the first time on board the *Glomar Challenger,* a variety of trace elements. Also we had the benefit of a spinner magnetometer and alternating-field demagnetizing unit loaned to DSDP by Dr. J.M. Hall of Dalhousie University. Many of the important conclusions of Leg 45 stemmed from the initial chemical analyses and paleomagnetic results obtained virtually on the spot, and we are grateful particularly to Drs. Bougault and Hall for their efforts to make this equipment available.

At Site 395, drilled on Leg 45, we made use of an extensively redesigned re-entry cone which, when cemented into basaltic basement, provided an extremely durable and stable structure for our repeated deep-water re-entries. Operations Manager Swede Larson, Drilling Superintendent Jim Ruddell, and the drillers and derrick crew of the *Glomar Challenger* implanted the re-entry cone in the sea bed and, at times heroically, kept Hole 395A going and rock arriving on deck. Leg 45 was a success because of the skill, resourcefulness, and ingenuity of these men.

We would also like to thank Captain Joe Clarke and the crew of the *Glomar Challenger* for their part in the drilling operations, particularly for handling the ship well in persistently heavy seas. Captain Clarke skillfully handled the re-entries. Electronic technicians Lloyd Russill and Paul Laughlin several times overhauled the re-entry scanning tool, and we thank them for keeping a serious problem from becoming a critical one. The stewards' department made our lives comfortable and provided excellent cuisine throughout Leg 45.

The day-to-day scientific operations were ably supported by Laboratory Officer Mike Lehman and his crew of DSDP technicians. With Leg 45, we initiated a new igneous-rock handling, splitting, and sampling procedure. The technicians played a critical part in the formulation and ultimate success of this procedure. We would like to thank in particular Anne Gilbert for skillful preparation of XRF samples, and Adele Caldara for carefully recording the day-to-day flux of samples.

Thanks also to Ansis Kaneps and David Bukry for examining microfossils ashore and providing biostratigraphic information for Sites 395 and 396.

The preparation of this volume proceeded smoothly because of the editorial work of James Shambach, the careful rendering of at times nearly illegible figures by the DSDP Graphics Department, the timely and skillful typesetting and paste-up of employees of Volt Technical Corporation, and the diligence and organizational skills of members of the DSDP Production Department, notably Janice Bowman, Mary Young, and Madeleine Mahnken.

Many other people contributed to the success of Leg 45 and of this volume. Although we cannot mention them all, we owe to them a sincere debt of gratitude.

On Leg 45, the Second Mate was John Samuel Hinds. In the Spring of 1978, Mr. Hinds was killed in a helicopter accident while attempting to land on the *Glomar Java Sea.* We remember Mr. Hinds as a kindly and cheerful man, fond of poking around in the core lab to find out what new things we had recovered. In this way and in many others, Mr. Hinds was typical of the many thoughtful and encouraging people who, though only "side-line" participants, have supported our work, and the work of the Deep Sea Drilling Project, through the years. It is to these people that we would like to dedicate this volume.