

NATIONAL SCIENCE FOUNDATION
WASHINGTON, D.C. 20550



OFFICE OF THE
DIRECTOR

This volume of "The Initial Reports of the Deep Sea Drilling Project" is being sent to you with the compliments of the National Science Foundation.

The scientific data incorporated in this volume are of vital interest to the academic and scientific community and it is hoped that such data will prove valuable in your research efforts in achieving knowledge about the earth and its environments.

Sincerely,

W. D. McElroy
W. D. McElroy,
Director



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 IX

covering Leg 9 of the cruises of the Drilling Vessel "*Glomar Challenger*"
Papeete, Tahiti to Balboa, Panama
December 1969–January, 1970

PARTICIPATING SCIENTISTS

James D. Hays, Harry E. Cook III, D. Graham Jenkins, Frances M. Cook,
John T. Fuller, Robert M. Goll, E. Dean Milow, William N. Orr.

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

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:

Hays, J. D. *et al.*, 1972, Initial Reports of the Deep Sea Drilling Project, Volume IX. Washington (U.S. Government Printing Office) ---+--- pp.

Jenkins, D. G. and Orr, W., 1972, Planktonic Foraminiferal Biostratigraphy of the Eastern Equatorial Atlantic. In Hays, J. D. *et al.*, 1972, Initial Reports of the Deep Sea Drilling Project, Volume IX. Washington (U.S. Government Printing Office) ---+--- pp.

Printed: January 1972

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

Foreword

Drilling and coring operations of the Deep Sea Drilling Project were started in August of 1968. The achievements leading to the scientific discoveries to date have elicited expressions of strong commendation for the Project from many quarters. It has excited not only the more than three hundred scientists of this country who have been involved in the project's planning and execution, but many others throughout the United States and abroad who are following the progress of this national program. The Project comprises the first wide-ranging, systematic effort aimed at the recovery of cored samples taken completely through the sedimentary layer of the deep ocean basins. A first, preliminary, examination of the material recovered already has led to a significant advance in our knowledge of the constitution and history of the earth. Further significant advances will result from in-depth laboratory studies. In years to come research on the core materials will contribute to the interest and enthusiasm of research scientists and graduate students. In addition, industry also should benefit greatly from the Project, both through the technological advances that are being made and through the information on natural resources that is being produced.

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 Scripps Institution of Oceanography of the University of California. The University has, in turn, subcontracted with Global Marine Incorporated, for the services of the drilling ship, *GLOMAR CHALLENGER*. Scientific planning, both of the detailed drilling itinerary and of the preliminary analyses leading to these Initial Re-

ports, has been conducted under the auspices of the Joint Oceanographic Institutions for Deep Earth Sampling (JOIDES). The JOIDES consortium has convened several panels for that purpose, consisting of a large number of distinguished scientists from academic institutions, government agencies, and private industry. In addition, technological advice has been given freely by many individuals, engineers and operations executives, from the petroleum and other industry. Altogether, the project has afforded a point of focus to involve the active interest and participation of the Nation's leading scientists and technologists.

The initial contract period of drilling operations consisted of an eighteen-month reconnaissance survey of the Atlantic and Pacific Oceans. With the positive confirmation of the technological feasibility and scientific value of the work, a decision was made to continue the activities for 30 months beyond the initial period. The proposed extension will include a broader geographic range of operations as well as more detailed work upon continental margins and other features of planetary significance. The ultimate goal is a fundamental advancement of our knowledge of the earth that should lead to enhanced capabilities to predict and control its processes and to exploit intelligently its natural resources.



William D. McElroy

Washington, D. C.
December, 1969

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; the Institute of Marine Sciences, 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.

Through discussions sponsored by the JOIDES organization, with support from the National Science Foundation the Lamont-Doherty Geological Observatory operated a drilling program with Dr. J. Lamar Worzel as Principal Investigator. This successful drilling effort early in the summer of 1965, on the Blake Plateau region off Jacksonville, Florida, used the drilling vessel, *Caldwell I*.

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 for an eighteen-month drilling program in the Atlantic and Pacific Oceans, termed the Deep Sea Drilling Project. Operations at sea began in August 1968.

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 these five 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 will provide reference material for a multitude of future studies in fields such as biostratigraphy, physical stratigraphy, and paleomagnetism, that will afford a new scope for studies of the physical and chemical aspects of sediment provenance, transportation, deposition, and diagenesis. In-hole measurements, as feasible, should 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 as soon as possible 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.

Following publication of each report, the core materials and data collected on the cruise will be made available to qualified scientists through the Curator of the Deep Sea Drilling

Project, following policies 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 stratification 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.

The members of JOIDES and the scientists from all interested organizations who have served on the various advisory panels are proud to have been of service to the Nation 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):

Lamont-Doherty Geological Observatory, Columbia
University

Rosenstiel School of Marine and Atmospheric Sci-
ences, University of Miami.

Scripps Institution of Oceanography, University of
California

University of Washington

Woods Hole Oceanographic Institution

OPERATING INSTITUTION:

Scripps Institution of Oceanography
University of California at San Diego
La Jolla, California

Principal Investigator:
W. A. Nierenberg

Project Manager:
K. E. Brunot

Project Chief Scientist:
M. N. A. Peterson

Participants Aboard GLOMAR CHALLENGER for Leg Nine:

Dr. James D. Hays
Chief Scientist
*Lamont-Doherty Geological
Observatory
Palisades, New York*

Dr. Harry E. Cook III
Geologist
*University of California
Riverside, California*

Dr. D. Graham Jenkins
Paleontologist
*University of Canterbury
Christchurch, New Zealand*

Mrs. Frances M. Cook
Geologist (Independent)
Riverside, California

Mr. John T. Fuller
Geologist
*Kennecott Exploration, Inc.
San Diego, California*

Dr. Robert M. Goll
Paleontologist
*Lamont-Doherty Geological
Observatory
Palisades, New York*

Mr. E. Dean Milow
Paleontologist
*Scripps Institution of Oceanography
La Jolla, California*

Dr. William N. Orr
Paleontologist
*University of Oregon
Eugene, Oregon*

Mr. James A. Dawson
Cruise Operations Manager
*Gulf Oil Corporation
Ventura, California*

Mr. William J. Goad
Coring Engineer
*Hycalog
Houston, Texas*

Mr. Charles A. Green
Meteorologist
*NOAA
Washington, D. C.*

Captain Robert A. Wilson
Master, D/V "Glomar Challenger"
*Global Marine, Inc.
Los Angeles, California*

Mr. Cotton Guess
Drilling Superintendent
*Global Marine, Inc.
Los Angeles, California*

Mr. J. Travis Rayborn
Tool Pusher
*Global Marine, Inc.
Los Angeles, California*

Mr. Michael Lehmann
Laboratory Officer
*Scripps Institution of Oceanography
La Jolla, California*

Mr. Clifford L. Collier
Electronics Technician
*Scripps Institution of Oceanography
La Jolla, California*

Mr. Lloyd Russill
Electronics Technician
*Scripps Institution of Oceanography
La Jolla, California*

Mr. George Jones
Photographer
*Scripps Institution of Oceanography
La Jolla, California*

Mr. Richard H. Du Bois
Marine Technician
*Scripps Institution of Oceanography
La Jolla, California*

Mr. William P. Jones
Marine Technician
*Scripps Institution of Oceanography
La Jolla, California*

Mr. Robert Olivas
Marine Technician
Scripps Institution of Oceanography
La Jolla, California

Mr. Jack Minter
Marine Technician
Scripps Institution of Oceanography
La Jolla, California

Mr. Victor Sotelo
Marine Technician
Scripps Institution of Oceanography
La Jolla, California

Mr. Don Cameron
Marine Technician
Scripps Institution of Oceanography
La Jolla, California

Mr. Royce John Fiske, III
Marine Technician
Scripps Institution of Oceanography
La Jolla, California

Senior Project Personnel

Mr. Kenneth E. Brunot
Project Manager
Mr. Darrell L. Sims
Project Engineer
Mr. William R. Jack
Contracts Officer
Mr. Thomas B. Hurtt
Business Officer
Dr. Melvin N. A. Peterson
Chief Scientist
Dr. N. Terence Edgar
Coordinating Staff Geologist
Dr. Elizabeth L. Gealy
Executive Staff Geologist

Dr. Thomas A. Davies
General Editor and Scientific Information Officer
Mr. William R. Riedel
Curator
Dr. Anthony C. Pimm
Staff Geologist
Mr. Robert W. Gilkey
Logistics Officer
Mr. Thomas J. Wiley
Public Information Officer
Dr. Robert W. Rex
Head of X-Ray Mineralogy Laboratory

Advisory Groups

JOIDES Executive Committee

- Dr. Maurice Ewing
Lamont-Doherty Geological Observatory
- Dr. F. G. Walton Smith
Institute of Marine Sciences
- Dr. William A. Nierenberg
Scripps Institution of Oceanography
- Dr. Maurice Rattray, Jr.
University of Washington
- Dr. Paul M. Fye
Woods Hole Oceanographic Institution

Planning Committee

- Dr. J. Lamar Worzel
Lamont-Doherty Geological Observatory
- Mr. William R. Riedel
Scripps Institution of Oceanography
- Dr. M. N. A. Peterson—Ex officio
Scripps Institution of Oceanography
- Dr. Joe S. Creager
University of Washington
- Dr. Arthur E. Maxwell
Woods Hole Oceanographic Institution
- Dr. William W. Hay
Rosenstiel Institute of Marine and Atmospheric Sciences

Atlantic Advisory Panel

- Dr. William A. Berggren
Woods Hole Oceanographic Institution
- Dr. N. Terence Edgar
Scripps Institution of Oceanography
- Dr. Cesare Emiliani
Rosenstiel Institute of Marine and Atmospheric Sciences
- Dr. Maurice Ewing
Lamont-Doherty Geological Observatory
- Dr. Anton Hales
University of Texas at Dallas
- Dr. Raymond Siever
Hoffman Laboratory
- Dr. Tj H. van Andel
Oregon State University
- Dr. Dennis E. Hayes
Lamont-Doherty Geological Observatory
- Dr. Eric D. Schneider
United States Naval Laboratory

Pacific Advisory Panel

- Dr. Enrico Bonatti
Rosenstiel Institute of Marine and Atmospheric Sciences
- Dr. Robert E. Burns
University of Washington
- Dr. John I. Ewing
Lamont-Doherty Geological Observatory

- Dr. Dean A. McManus
University of Washington
- Dr. LaVerne D. Kulm
Oregon State University
- Dr. Alexander Malahoff
Hawaii Institute of Geophysics
- Dr. David G. Moore
Naval Undersea Research and Development Center
- Dr. Edward L. Winterer
Scripps Institution of Oceanography
- Dr. David W. Scholl
United States Geological Survey

Gulf Advisory Panel

- Dr. Henry L. Berryhill, Jr.
United States Geological Survey
- Dr. Arnold H. Bouma
Texas A & M University
- Dr. Joe S. Creager
University of Washington
- Dr. Joseph R. Curray
Scripps Institution of Oceanography
- Dr. William W. Hay
Rosenstiel Institute of Marine and Atmospheric Sciences
- Dr. Elazar Uchupi
Woods Hole Oceanographic Institution
- Dr. Guillermo P. Salas
Ciudad Universitaria
- Dr. Charles E. Helsley
University of Texas at Dallas
- Dr. J. Lamar Worzel
Lamont-Doherty Geological Observatory

Indian Ocean Advisory Panel

- Dr. Manik Talwani
Lamont-Doherty Geological Observatory
- Dr. Robert L. Fisher
Scripps Institution of Oceanography
- Dr. James R. Heirtzler
Woods Hole Oceanographic Institution
- Dr. Marcus G. Langseth
Lamont-Doherty Geological Observatory

Mediterranean Advisory Panel

- Dr. J. Brackett Hersey
Department of the Navy
- Dr. Kenneth J. Hsu
Geologisches Institut, E.T.H.
- Dr. Robert J. Hurley
Rosenstiel Institute of Marine and Atmospheric Sciences
- Dr. William B. F. Ryan
Lamont-Doherty Geological Observatory

Site Survey Panel

- Dr. N. Terence Edgar
Scripps Institution of Oceanography
- Dr. Robert E. Burns
University of Washington
- Dr. Maurice Ewing
Lamont-Doherty Geological Observatory
- Dr. Manik Talwani
Lamont-Doherty Geological Observatory

Advisory Panel on Heat Flow

- Dr. Richard P. von Herzen
Woods Hole Oceanographic Institution
- Dr. Art Lachenbruch
United States Geological Survey
- Dr. Marcus G. Langseth
Lamont-Doherty Geological Observatory
- Dr. Clive R. B. Lister
University of Washington
- Dr. John G. Sclater
Scripps Institution of Oceanography

Advisory Panel on Information Handling

- Dr. Melvin A. Rosenfeld
Woods Hole Oceanographic Institution
- Dr. Daniel W. Appleman
United States Geological Survey
- Mr. Jack G. Barr
Chevron Research Laboratory
- Dr. James C. Kelley
University of Washington
- Dr. Robert W. Rex
University of California, Riverside
- Mr. William R. Riedel
Scripps Institution of Oceanography
- Dr. Thomas A. Davies—Ex Officio
Scripps Institution of Oceanography

Advisory Panel on Organic Geochemistry

- Dr. John M. Hunt
Woods Hole Oceanographic Institution
- Dr. Earl W. Baker
Carnegie-Mellon University
- Dr. Ellis E. Bray
Mobil Oil Co., Inc.
- Dr. J. Gordon Erdman
Phillips Petroleum Co.

Advisory Panel on Paleontology and Biostratigraphy

- Dr. William A. Berggren
Woods Hole Oceanographic Institution
- Dr. C. W. Drooger
University of Utrecht
- Dr. William R. Evitt
Stanford University

- Dr. William W. Hay
Rosenstiel Institute of Marine and Atmospheric Sciences
- Dr. Erle G. Kauffman
Smithsonian Institution
- Dr. Helen N. Loeblich
University of California, Los Angeles
- Dr. Emile A. Pessagno, Jr.
University of Texas at Dallas
- Mr. William R. Riedel
Scripps Institution of Oceanography
- Dr. Tsunemasa Saito
Lamont-Doherty Geological Observatory

Advisory Panel on Sedimentary Petrology and Geochemistry

- Dr. Eugene A. Rusnak
United States Geological Survey
- Dr. Edwin L. Hamilton
Naval Undersea Research and Development Center
- Dr. Melvin N. A. Peterson
Scripps Institution of Oceanography
- Dr. Robert W. Rex
University of California, Riverside
- Dr. Tj H. van Andel
Oregon State University
- Dr. George V. Wood
British Petroleum Research Center

Advisory Panel on Well Logging

- Dr. A. E. Worthington
Chevron Oil Field Research Company
- Dr. Richard L. Caldwell
Mobil Oil Corporation
- Dr. James E. Carothers
Phillips Petroleum Company
- Dr. Donald Elrod
Humble Oil and Refining Company
- Dr. H. B. Evans
Marathon Research Center
- Dr. Robert D. Gerard
Lamont-Doherty Geological Observatory
- Dr. H. H. Jageler
Pan American Petroleum Corporation
- Dr. George V. Keller
Colorado School of Mines
- Dr. Harry A. Shillibeer
Gulf Research and Development Company

Advisory Panel on X-ray Mineralogy

- Dr. Richard L. Hay
University of California, Berkeley
- Dr. Pierre Biscaye
Lamont-Doherty Geological Observatory
- Dr. Kurt Boström
Rosenstiel Institute of Marine and Atmospheric Sciences

Dr. Edward D. Goldberg
Scripps Institution of Oceanography
Dr. John C. Hathaway
Woods Hole Oceanographic Institution
Dr. Stanley McCaleb
Sun Oil Research Center
Dr. Robert W. Rex
University of California, Riverside

Advisory Panel on Paleomagnetism and Age Dating

Dr. Joseph D. Phillips
Woods Hole Oceanographic Institution
Dr. G. Brent Dalrymple
United States Geological Survey
Dr. Jack R. Dymond
Oregon State University

Dr. C. G. A. Harrison
*Rosenstiel Institute of Marine and Atmospheric
Sciences*
Dr. Neil D. Opdyke
Lamont-Doherty Geological Observatory

**Advisory Panel on Igneous and Metamorphic
Petrography**

Dr. Ian D. MacGregor
University of California, Davis
Dr. Frederick A. Frey
Massachusetts Institute of Technology
Dr. Stanley R. Hart
Carnegie Institution of Washington
Dr. William G. Melson
Smithsonian Institution
Dr. A. Miyashiro
Lamont-Doherty Geological Observatory

Deep Sea Drilling Project

SAMPLE DISTRIBUTION POLICY

1. Requests for samples should be addressed to: Curator, Deep Sea Drilling Project; Scripps Institution of Oceanography, University of California at San Diego; La Jolla, California 92037. The requests should specify the quantities and intervals in the core required, a statement of the proposed research, the possibility of returning residue to the Curator, the estimated time required to complete and publish the results, and the availability or need of funding and availability of equipment and space foreseen for the research. Initial core description should normally serve as a basis for these sample requests. In order to ensure that early requests for highly desirable but limited samples can all be honored, distribution of samples will not be made until at least one month after the date of publication of each issue of the initial core description. The only exceptions to this policy will be for samples leading to the initial core description, or for specific instances involving ephemeral properties.

Requests for samples from researchers in industrial laboratories will be handled in the same manner as those from academic organizations, and there will be the same obligation to publish results promptly. Requests from foreign scientists or organizations will also be considered.

2. The Deep Sea Drilling Project's Curator has the responsibility for distributing samples, controlling quality of samples, and preserving core material. He also has the responsibility for maintaining a record of requests for samples that have been processed and filled, indicating the investigator and subjects to be studied. This record will be available to investigators.

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

3. The National Science Foundation will establish a Sample Distribution Panel to advise on the distribution of core material, which will be chosen in accordance with its usual practices, in a manner which will assure advice in the various disciplines leading to a complete and adequate study of the core and related materials. The Curator and the Chief Scientist of the Deep Sea Drilling Project will meet with the Panel.

4. (a) Samples up to 3 cc/meter of core length can be automatically distributed by the Curator, Deep Sea Drilling Project or his authorized representative to any qualified investigator who requests them. The Curator will refrain from making automatic distribution of any parts of the cores which appear to be in particularly high demand and any requests for these parts of the cores will be referred to the Sample Distribution Panel for review. Requests for samples from thin layers or important stratigraphic boundaries will generally require Panel review.

(b) All requests for samples in excess of 4(a) above will be referred to the Sample Distribution Panel.

(c) If, in the opinion of scientific investigators, certain properties they wish to study may deteriorate prior to the normal availability of the samples, such investigators may request that the normal waiting period not apply. All such requests must be approved by the Sample Distribution Panel.

5. Samples will not be provided prior to the assurance that funding for sample studies either exists or is not needed. Provision of samples will not imply any associated commitment to fund the proposed or additional research. If a sample request is dependent, either wholly or in part, or proposed funding, the Curator will provide to the organization to whom the funding proposal has been submitted any information on the availability of samples that they may request, but will wait for final assurance that the funds are available before distributing the requested samples.

6. Investigators receiving samples are charged with:
 - i) the responsibility of promptly publishing worthwhile results;
 - ii) acknowledging, in publications, that the National Science Foundation supplied the samples;
 - iii) submitting three copies of all reprints of published results to the Deep Sea Drilling Project; Scripps Institution of Oceanography, University of California at San Diego; La Jolla, California 92037; and
 - iv) notifying the Curator of any additional work done on the sample that was not

stated in the original request for which the samples were made available; and

- v) returning, in good shape, remainder of samples after termination of research, if so requested by the Curator.
7. Cores will be made available at repositories for investigators to examine and specify exact samples, in such instances as this may be necessary for the scientific purposes of the sampling, subject to the limitations of 4(a), (b), (c), and 5 above, and with the specific permission of the Curator or his delegate.
 8. Cores of igneous and metamorphic rocks will also remain at the repositories where they will be available for observation and description, and where selected samples may be taken for thin-section preparation and other work.
 9. Within the context of sample distribution, there also falls the category of raw data and information. Examples of this information would be the magnetic tapes from the X-Ray diffraction studies, the X-Ray radiographs of the cores, and logging records. Such information would be available, after publication of the initial descriptions, to any qualified investigators, and could be reproduced by those prepared to defray the costs.
 10. This policy has the approval of the National Science Foundation and is incorporated in the Program Plan for the Deep Sea Drilling Project. It is now in effect.

CONTENTS

PART I: SHIPBOARD REPORT

Chapter	Page
1. INTRODUCTION James D. Hays, Harry E. Cook III, D. Graham Jenkins, Frances M. Cook, John T. Fuller, Robert M. Goll, E. Dean Milow, William N. Orr	3
2. SITE 76 James D. Hays, Harry E. Cook III, D. Graham Jenkins, Frances M. Cook, John T. Fuller, Robert M. Goll, E. Dean Milow, William N. Orr	21
3. SITE 77 James D. Hays, Harry E. Cook III, D. Graham Jenkins, Frances M. Cook, John T. Fuller, Robert M. Goll, E. Dean Milow, William N. Orr	43
4. SITE 78 James D. Hays, Harry E. Cook III, D. Graham Jenkins, Frances M. Cook, John T. Fuller, Robert M. Goll, E. Dean Milow	209
5. SITE 79 James D. Hays, Harry E. Cook III, D. Graham Jenkins, Frances M. Cook, John T. Fuller, Robert M. Goll, E. Dean Milow, William N. Orr	317
6. SITE 80 James D. Hays, Harry E. Cook III, D. Graham Jenkins, Frances M. Cook, John T. Fuller, Robert M. Goll, E. Dean Milow, William N. Orr	401
7. SITE 81 James D. Hays, Harry E. Cook III, D. Graham Jenkins, Frances M. Cook, John T. Fuller, Robert M. Goll, E. Dean Milow, William N. Orr	449
8. SITE 82 James D. Hays, Harry E. Cook III, D. Graham Jenkins, Frances M. Cook, John T. Fuller, Robert M. Goll, E. Dean Milow, William N. Orr	487
9. SITE 83 James D. Hays, Harry E. Cook III, D. Graham Jenkins, Frances M. Cook, John T. Fuller, Robert M. Goll, E. Dean Milow, William N. Orr	537
10. SITE 84 James D. Hays, Harry E. Cook III, D. Graham Jenkins, Frances M. Cook, John T. Fuller, Robert M. Goll, E. Dean Milow, William N. Orr	615

PART II: SHORE LABORATORY STUDIES

Chapter	Page
11. X-RAY MINERALOGY STUDIES, LEG 9 DEEP SEA DRILLING PROJECT H. E. Cook and I. Zemmels	707
12. GRAIN SIZE ANALYSIS, LEG 9 DEEP SEA DRILLING PROJECT R. E. Boyce	779
13. CARBON AND CARBONATE ANALYSES, LEG 9 DEEP SEA DRILLING PROJECT R. E. Boyce and G. W. Bode	797
14. COCCOLITH STRATIGRAPHY, LEG 9 DEEP SEA DRILLING PROJECT David Bukry	817
15. COCCOLITH AGE DETERMINATIONS, LEG 9 DEEP SEA DRILLING PROJECT Stefan Gartner, Jr.	833
16. INTERSTITIAL WATER CHEMISTRY, LEG 9 DEEP SEA DRILLING PROJECT B. J. Presley and I. R. Kaplan	841
17. INTERSTITIAL WATER STUDIES ON SMALL CORE SAMPLES, LEG 9, DEEP SEA DRILLING PROJECT F. L. Sayles, F. T. Manheim, and L. S. Waterman	845
18. BITUMENS AND ORGANIC CARBON IN SAMPLES FROM DEEP SEA DRILLING PROJECT, LEG 9 Richard D. McIver	857
19. FURTHER PRELIMINARY RESULTS ON THE HIGHER WEIGHT HYDROCARBONS AND FATTY ACIDS IN THE DEEP SEA DRILLING PROJECT, LEG 9 Bernd R. Simoneit and A. L. Burlingame	859
20. AMINO ACID CONTENT OF SOME SAMPLES FROM THE DEEP SEA DRILLING PROJECT John F. Wehmiller, P. E. Hare	903

PART III: CRUISE LEG SYNTHESIS

21. AN INTERPRETATION OF THE GEOLOGIC HISTORY OF THE EASTERN EQUATORIAL PACIFIC FROM THE DRILLING RESULTS OF GLOMAR CHALLENGER, LEG 9 Shipboard party	909
--	-----

Chapter	Page
22. STRATIGRAPHY AND SEDIMENTATION H. E. Cook	933
23. PHYSICAL PROPERTIES SYNTHESIS F. M. Cook and H. E. Cook	945
24. SECTION ON RADIOLARIA FOR SYNTHESIS CHAPTER, LEG 9 Robert M. Goll	947
25. PLANKTONIC FORAMINIFERAL BIOSTRATIGRAPHY OF THE EASTERN EQUATORIAL PACIFIC, LEG 9 D. Graham Jenkins and William N. Orr	1059

APPENDIX

TIME STRATIGRAPHIC FRAMEWORK	1197
------------------------------------	------