

BLAKE-BAHAMA BASIN (SITE 391)

- A. **Massive Miocene gravity-flow deposits, recovered at Site 391 between 150 and 650 meters sub-bottom.** About 500 meters of turbidites and debris flows including intraclastic chalk breccias (shown) accumulated in less than 12 million years. The green and brown clasts are radiolarian-rich clay and were apparently lifted from pre-existing deposits and carried in a viscous slurry to their present resting places. (Section 391A-12-3)
- B. **Enlarged view of radiolarian-rich clay clast in chalk matrix** deposited by Miocene gravity flows described above (A). The long axes of most of the clasts are oriented parallel to bedding. (Sample 391A-13-1, 127-130 cm)
- C. **Lower Miocene siliceous mudstone in sharp contact with nannofossil chalk.** Note microfaults near base of the mudstone. The sequence is contained within the gravity flow deposits described above (A). (Sample 391A-13-1, 50-150 cm)
- D. **Cretaceous variegated claystone.** The presence of these variegated claystones in the mid-Cretaceous sequence at Site 391 in addition to those previously cored during DSDP Leg 11 indicates the basinwide extent of this unit. (Sample 391C-6-1, 0-100 cm)
- E. **Thinly laminated Neocomian limestone.** The visible millimeter-thick laminae are themselves compound and average 6.7 laminations per mm. Some zones (lighter gray) have been reworked by bottom organisms. (Sample 391C-30-2, 0-100 cm)
- F. **Upper Tithonian-lower Berriasian limestone with a large halo-stained burrow.** The burrow fill is calcareous clay containing about 5 per cent nannofossils. Stylolites, seen near the top of the sample and below the burrow, are common throughout the lower part of the limestone. (Sample 391C-42-3, 0-100 cm)

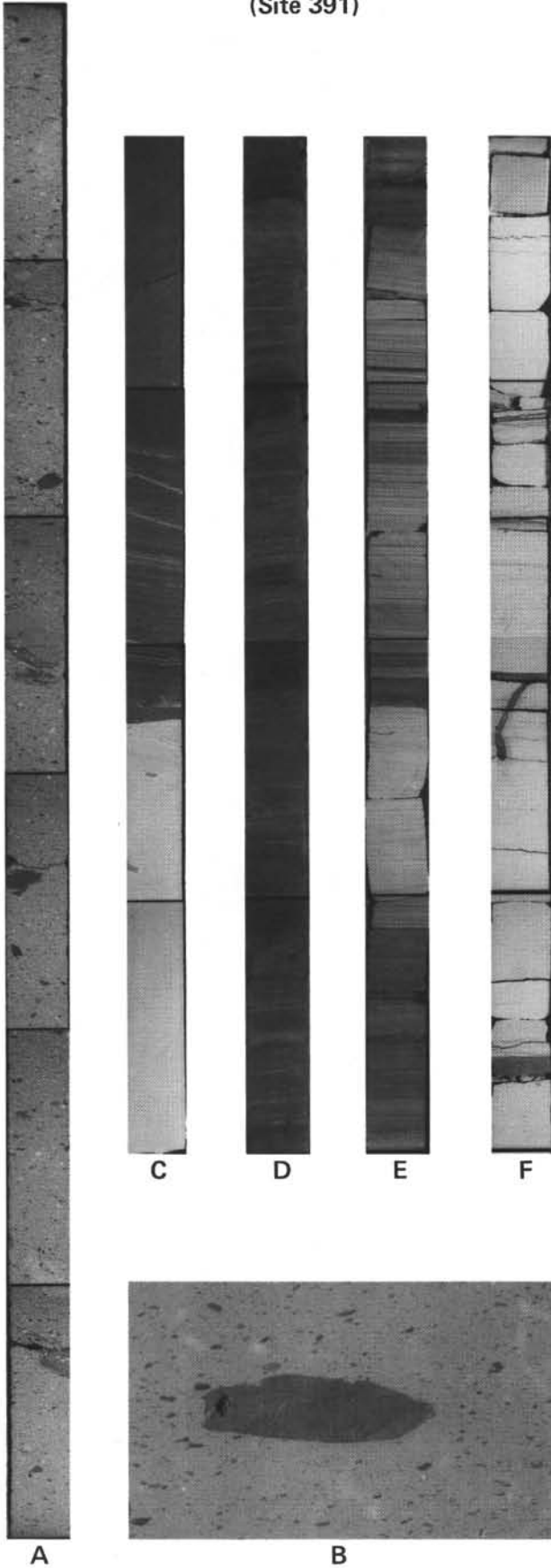
CONTINENTAL RISE HILLS (SITE 388)

- G. **Stiff Miocene clay** cored between 284 and 330 meters sub-bottom is probably responsible for a flat-lying seismic reflector at 0.32 sec sub-bottom. The horizon, which passes beneath the structure of the hills, may correspond to reflector X which is found farther south under the continental rise. (Sample 388A-8-1, 50-100 cm)

BLAKE NOSE (SITES 390 AND 392)

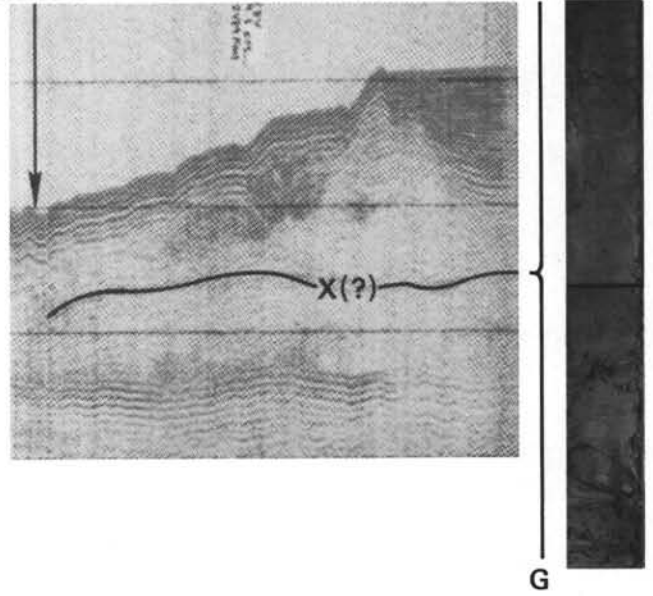
- H. **Middle and lower Eocene siliceous nannofossil ooze from Hole 390A.** This sequence contains an excellent fossil record allowing the inter-comparison of nannofossil, foraminifer, and radiolarian assemblages. (a) Sample 390A-3-3, 60-140 cm; (b) *Chiasmolithus grandis*, nannofossil from Sample 390A-core catcher; (c) *Podocyrtes sinuosa*, radiolarian from 390A-3-3, 100 cm; (d) *Hantkenina mexicana-dumblei* group, foraminifer from Sample 390A-3-3, 93-95 cm)
- I. **Oolitic limestone showing "dripstone" texture,** from about 232 meters sub-bottom. The dripstone texture was formed at the shelf break under vadose conditions. (Sample 392A-22-1, 95-99 cm)

Blake-Bahama Basin
(Site 391)

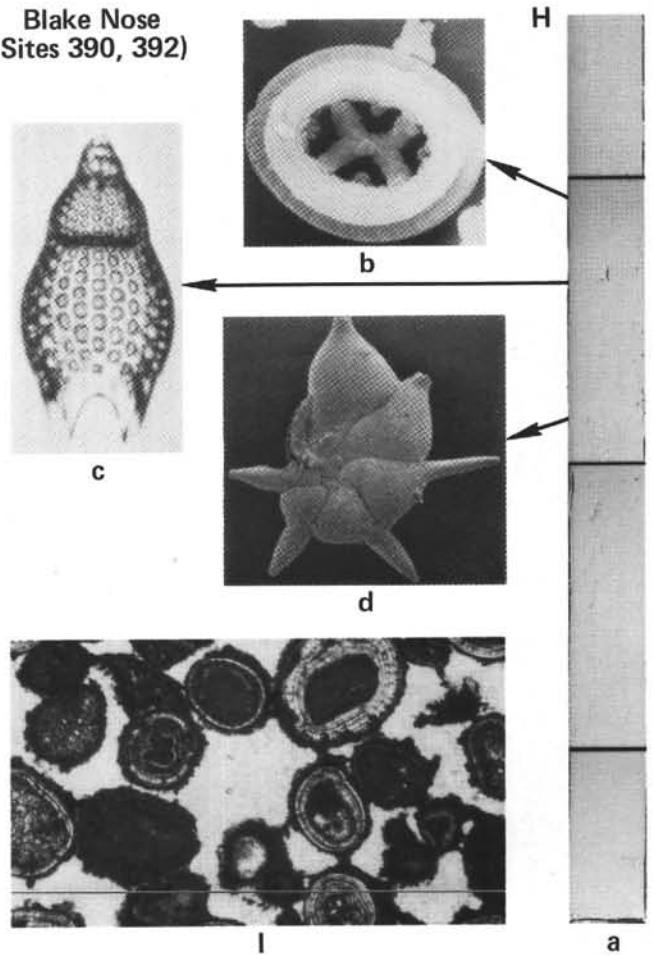


Continental Rise Hills
(Site 388)

Site 388



Blake Nose
(Sites 390, 392)



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 XLIV

covering Leg 44 of the cruises of the Drilling Vessel *Glomar Challenger*
Norfolk, Virginia to Norfolk, Virginia
August-September 1975

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Prepared for the
NATIONAL SCIENCE FOUNDATION
National Ocean Sediment Coring Program
Under Contract C-482

By the
UNIVERSITY OF CALIFORNIA
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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:

Benson, W. E., Sheridan, R. E., et al., 1978. *Initial Reports of the Deep Sea Drilling Project*, v. 44: Washington (U.S. Government Printing Office).

Freeman, T. and Enos, P., 1978. Petrology of Upper Jurassic-Lower Cretaceous limestones, DSDP Site 391, *In* Benson, W. E., Sheridan, R. E., et al., 1978. *Initial Reports of the Deep Sea Drilling Project*, v. 44: Washington (U.S. Government Printing Office), p. 463-476.

Printed November 1978

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 \$15.25
Stock Number 038-000-00384-4

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; 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.

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, *Caldrill 1*.

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 University of California 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.

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 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 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.

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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 Repository, 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.

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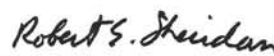
DEDICATION

Among the many other kinds of shared triumphs and tragedies, *Glomar Challenger* now shares with her illustrious namesake, HMS *Challenger*, the experience of a natural death at sea. The loss of any crew member is a sad event for it brings home to his fellow shipmates the reality of their own situation. Each one aboard *Challenger*, be he scientist, officer, driller, or seaman, shares in the common personal sacrifice and dedication to working long periods at sea far from family and friends. Each of us knows that the possibility of death exists on any cruise, and we are concerned more that we might deny our loved ones the final moment to say goodbye. Chief Steward Clint Rouse made this final sacrifice on 12 September 1975 after suffering a massive stroke.

Out of respect for Mr. Rouse and his family ashore, and for his example as a dedicated crewman, without which *Glomar Challenger* could never carry out her scientific goals, the shipboard scientific party hereby dedicates this volume to Clint Rouse — Chief Steward, *Glomar Challenger*.



William E. Benson
National Science Foundation
Co-Chief Scientist



Robert E. Sheridan
University of Delaware
Co-Chief Scientist

ACKNOWLEDGMENTS

As with all DSDP cruises, the hard work of many, both on board ship and on shore, contributed to the production of this volume. The Scientific Party of Leg 44 gratefully acknowledges this aid. Because of late changes in scheduling, the Leg 44 scientific program was not planned in detail until only a few weeks before *Glomar Challenger* sailed. John Ewing (Chairman), and the other members of the JOIDES Atlantic Panel, are responsible for defining the excellent scientific objectives and formulating the drilling program.

On board ship, Captain Joseph A. Clarke and his crew were called upon for extraordinary efforts as we encountered a series of mechanical and operational difficulties.

An "eleventh hour" illness deprived us of the services of Global Marine's veteran Drilling Superintendent, and we were extremely fortunate to have A. C. Wheeler, Jr., and Howard Guillot who in addition to handling their usual jobs also served as drilling superintendents. Because of their dedication and skill we were able to overcome many difficulties on the rig floor.

Cruise Operations Manager, Bob Knapp, competently supervised overall operations and faced the challenges of dealing with new and untried equipment. Meteorologist Mel Fields kept his record clear and "diverted" three hurricanes from our locations. We also thank Dr. Gene Schultz for excellent service under unusual and trying circumstances.

Our technical staff also did an outstanding job under the guidance of Laboratory Officer Don Marsee. And finally, we thank our yeoman, Louise Henry, who ruled the Science Office with a firm hand and greatly added to both our efficiency and the success of the cruise.

To these and all the others too numerous to cite individually, we express our appreciation and thanks.