PROCEEDINGS OF THE OCEAN DRILLING PROGRAM

VOLUME 174A
INITIAL REPORTS
CONTINUING THE NEW JERSEY MID-ATLANTIC SEA-LEVEL TRANSECT


James A. Austin, Jr., Nicholas Christie-Blick, Mitchell J. Malone, Serge Berné, Mai Kirstine Borre, George Claypool, John (Jed) Damuth, Heike Delius, Gerald Dickens, Peter Flemings, Craig Fulthorpe, Stephen Hesselbo, Koichi Hoyanagi, Miriam (Mimi) Katz, Hanne Krawinkel, Candace Major, Francine McCarthy, Cecilia McHugh, Gregory Mountain, Hiro Oda, Hilary Olson, Carlos Pirmez, Charles (Chuck) Savrda, Christopher Smart, Linda Sohl, Patricia Vanderaveroet, Wuchang Wei, Brian Whiting
Shipboard Scientists

Mitchell J. Malone
Shipboard Staff Scientist

Prepared by the OCEAN DRILLING PROGRAM
TEXAS A&M UNIVERSITY

Christine M. Miller, Jennifer A. Marin, and Katerina E. Petronotis
Volume Editors

in cooperation with the NATIONAL SCIENCE FOUNDATION and JOINT OCEANOGRAPHIC INSTITUTIONS, INC.
Reference to the whole or to part of this volume should be made as follows:

Print citation:


CD-ROM citation:


WWW citation:


Effective Publication Dates of ODP Proceedings

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

The mailing dates of recent Proceedings of the Ocean Drilling Program are as follows:

Volumes 171A/171B (Initial Reports): April 1998
Volume 172 (Initial Reports): June 1998
Volume 152 (Scientific Results): May 1998
Volume 157 (Scientific Results): June 1998
Volume 158 (Scientific Results): February 1998

Distribution

Copies of this publication may be obtained from Publications Distribution Center, Ocean Drilling Program, 1000 Discovery Drive, College Station, Texas 77845-9547, U.S.A. Orders for copies will require advance payment. See current ODP publication list for price and availability of this publication.

Printed November 1998

ISSN
Library of Congress 87-642-462

Printed in Canada by Friesens

The paper used in this publication meets the minimum requirements of American National Standard for Information Sciences–Permanence of Paper for Printed Library Materials, ANSI Z39.48–1984®
Foreword
By the National Science Foundation

The National Science Foundation is proud to play a leading role in partnership with the U.S. oceanographic community in the operation and management of the Ocean Drilling Program (ODP). We are equally proud of the cooperation and commitment of our international partners, who contribute both financial and intellectual resources required to maintain the high quality of this unique program. The Ocean Drilling Program, like its predecessor, the Deep Sea Drilling Project (DSDP), is a model for the organization and planning of research to address global scientific problems that are of high priority internationally and of long-term interest to the scientific community and general public.

Major scientific themes guiding the development of specific drilling cruises range from determining the causes and effects of oceanic and climatic variability to understanding the circulation of fluids in the ocean crust and the resultant formation of mineral deposits. Although such studies are at the forefront of basic scientific inquiry into the processes that control and modify the global environment, they are equally important in providing the background for assessing man's impact on the global environment or for projecting resource availability for future generations.

The transition from the DSDP to the ODP was marked by a number of changes. The 471-foot *JOIDES Resolution*, which replaced the *Glomar Challenger*, has allowed larger scientific parties and the participation of more graduate students, a larger laboratory and technical capability, and operations in more hostile ocean regions. The *JOIDES Resolution* has drilled in all of the world's oceans, from the marginal ice regions of the Arctic to within sight of the Antarctic continent. Over 1,200 scientists and students from 26 nations have participated on project cruises. Cores recovered from the cruises and stored in ODP repositories in the United States and Europe have provided samples to an additional 1,000 scientists for longer term post-cruise research investigations. The downhole geochemical and geophysical logging program, unsurpassed in either academia or industry, is providing remarkable new data with which to study the Earth.

In 1994, NSF and our international partners renewed our commitment to the program for its final phase. Of the 20 countries that supported ODP initially, only one, Russia, has been unable to continue for financial reasons. As the reputation and scientific impact of the program continue to grow internationally, we hope to add additional members and new scientific constituencies. This global scientific participation continues to assure the program's scientific excellence by focusing and integrating the combined scientific knowledge and capabilities of its member nations.

We wish the program smooth sailing and good drilling!

Neal Lane
Director
National Science Foundation
Arlington, Virginia
Foreword
By Joint Oceanographic Institutions, Inc.

This volume presents scientific and engineering results from the Ocean Drilling Program (ODP). The papers presented here address the scientific and technical goals of the program, which include providing a global description of geological and geophysical structures including passive and active margins and sediment history, and studying in detail areas of major geophysical activity such as mid-ocean ridges and the associated hydrothermal circulations.

The Ocean Drilling Program, an international activity, operates a specially equipped deep-sea drilling ship, the JOIDES Resolution, which contains state-of-the-art laboratories, equipment, and computers. The ship is 471 feet (144 meters) long, is 70 feet (21 meters) wide, and has a displacement of 18,600 short tons. Her derrick towers 211 feet (64 meters) above the waterline, and a computer-controlled dynamic-positioning system stabilizes the ship over a specific location while drilling in water depths up to 27,000 feet (8230 meters). The drilling system collects cores from beneath the seafloor with a derrick and drawworks that can handle 30,000 feet (9144 meters) of drill pipe. More than 12,000 square feet (1115 square meters) of space distributed throughout the ship is devoted to scientific laboratories and equipment. The ship sails with a scientific and technical crew of 51 and a ship’s crew (including the drill crew) of 62. The size and ice-strengthening of the ship allow drilling in high seas and ice-infested areas as well as permit a large group of multidisciplinary scientists to interact as part of the scientific party.

Logging, or measurements in the drilled holes, is an important part of the program. ODP provides a full suite of geochemical and geophysical measurements for every hole deeper than 1300 feet (400 meters). For each such hole, there are lowerings of basic oil-industry tools: nuclear, sonic, and electrical. In addition, a Formation MicroScanner is available for high-resolution imaging the wall of the hole, a 12-channel logging tool provides accurate velocity and elastic property measurements as well as sonic waveforms for spectral analysis of energy propagation near the wall of the hole, and a vertical seismic profiler can record reflectors from below the total depth of the hole.

The management of the Ocean Drilling Program involves a partnership of scientists and governments. International oversight and coordination are provided by the ODP Council, a governmental consultative body of the partner countries, which is chaired by a representative from the United States National Science Foundation (NSF). The ODP Council periodically reviews the general progress of the program and discusses financial plans and other management issues. Overall scientific and management guidance is provided to the operators of the program by representatives from the group of institutions involved in the program, called the Joint Oceanographic Institutions for Deep Earth Sampling (JOIDES).

The Executive Committee (EXCOM), made up of the administrative heads of the JOIDES institutions, provides general oversight for ODP. The Science Committee (SCICOM), with its advisory structure, is made up of working scientists and provides scientific advice and detailed planning for the Ocean Drilling Program. SCICOM has a network of panels and committees that screen drilling proposals, evaluate instrumentation and measurement techniques, and assess geophysical survey data and other safety and siting information. SCICOM uses the recommendations of the panels and committees to select drilling targets, to specify the location and major scientific objectives of each two-month drilling segment or leg, and to provide the science operator with nominations for co-chief scientists.

Joint Oceanographic Institutions, Inc. (JOI), a nonprofit consortium of U.S. oceanographic institutions, serves as the National Science Foundation’s prime contractor for ODP. JOI is responsible for seeing that the scientific objectives, plans, and recommendations of the JOIDES committees are translated into scientific operations consistent with scientific advice and budgetary constraints. JOI subcontracts the operations of the program to two universities: Texas A&M University and Lamont-Doherty Earth Observatory.
of Columbia University. JOI is also responsible for managing the U.S. contribution to ODP under a separate cooperative agreement with NSF.

Texas A&M University (TAMU) serves as science operator for ODP. In this capacity, TAMU is responsible for planning the specific ship operations, actual drilling schedules, and final scientific rosters, which are developed in close cooperation with SCICOM and the relevant panels. The science operator also ensures that adequate scientific analyses are performed on the cores by maintaining the shipboard scientific laboratories and computers and by providing logistical and technical support for shipboard scientific teams. Onshore, TAMU manages scientific activities after each leg, is curator for the cores, distributes samples, and coordinates the editing and publication of scientific results.

Lamont-Doherty Earth Observatory (LDEO) of Columbia University is responsible for the program’s logging operation, including processing the data and providing assistance to scientists for data analysis. The ODP Data Bank, a repository for geophysical data, is also managed by LDEO.

Core samples from ODP and the previous Deep Sea Drilling Project are stored for future investigation at four sites: ODP Pacific and Indian Ocean cores at TAMU, DSDP Pacific and Indian Ocean cores at the Scripps Institution of Oceanography, ODP and DSDP Atlantic and Antarctic cores through Leg 150 at LDEO, and ODP Atlantic and Antarctic cores since Leg 151 at the University of Bremen, Federal Republic of Germany.

Scientific achievements of ODP include new information on early seafloor spreading and how continents separate and the margins evolve. The oldest Pacific crust has been drilled and sampled. We have new insights into glacial cycles and the fluctuations of ocean currents throughout geological time. ODP has also provided valuable data that shed light on fluid pathways through the lithosphere, global climate change both in the Arctic and near the equator, past sea-level change, seafloor mineralization, the complex tectonic evolution of oceanic crust, and the evolution of passive continental margins.

Many of the scientific goals can be met only with new technology; thus the program has focused on engineering as well as science. To date, ODP engineers have demonstrated the capability to drill on bare rock at mid-ocean-ridge sites and have developed techniques for drilling in high-temperature and corrosive regions typical of hydrothermal vent areas. A new diamond coring system promises better core recovery in difficult areas. In a close collaborative effort between ODP engineers and scientists, a system has been developed that seals selected boreholes (“CORKs”) and monitors downhole temperature, pressure, and fluid composition for up to three years. When possible, ODP is also taking advantage of industry techniques such as logging while drilling, to obtain continuous downhole information in difficult-to-drill formations.

JOI is pleased to have been able to play a facilitating role in the Ocean Drilling Program and its cooperative activities, and we are looking forward to many new, exciting results in the future.

James D. Watkins
Admiral, U.S. Navy (Retired)
President
Joint Oceanographic Institutions, Inc.
Washington, D.C.
OCEAN DRILLING PROGRAM*

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

University of California at San Diego, Scripps Institution of Oceanography
Columbia University, Lamont-Doherty Earth Observatory
University of Hawaii, School of Ocean and Earth Science and Technology
University of Miami, Rosenstiel School of Marine and Atmospheric Science
Oregon State University, College of Oceanic and Atmospheric Sciences
University of Rhode Island, Graduate School of Oceanography
Texas A&M University, College of Geosciences
University of Washington, College of Ocean and Fishery Sciences
Woods Hole Oceanographic Institution
Australia/Canada/Chinese Taipei/Korea Consortium for Ocean Drilling, Department of Primary Industries and Energy (Australia), Natural Resources Canada (Canada), National Taiwan University in Taipei, and Korean Institute for Geology, Mining and Minerals
European Science Foundation Consortium for Ocean Drilling (Belgium, Denmark, Finland, Iceland, Italy, The Netherlands, Norway, Portugal, Spain, Sweden, Switzerland, and Turkey)
Federal Republic of Germany, Bundesanstalt für Geowissenschaften und Rohstoffe
France, Institut Français de Recherche pour l’Exploitation de la Mer
Japan, University of Tokyo, Ocean Research Institute
People’s Republic of China, Marine High-Technology Bureau of the State Science and Technology Commission of the People’s Republic of China
United Kingdom, Natural Environment Research Council

PRIME CONTRACTOR
Joint Oceanographic Institutions, Inc.
Washington, D.C.
Kathryn Moran
Director, Ocean Drilling Programs

OPERATING INSTITUTION
College of Geosciences
Texas A&M University
College Station, Texas
David B. Prior
Dean

OCEAN DRILLING PROGRAM
Paul J. Fox
Director
Jack G. Baldauf
Deputy Director
Richard G. McPherson
Administrator
Brian Jonasson, Manager
Drilling Services
Ann Klaus, Manager
Publication Services
Thomas A. Davies, Manager
Science Services

LOGGING OPERATOR
Borehole Research Group
Lamont-Doherty Earth Observatory
Columbia University
Palisades, New York
David Goldberg, Head

*At time of publication.
PARTICIPANTS ABOARD THE JOIDES RESOLUTION FOR LEG 174A*

James A. Austin, Jr.  
Co-Chief Scientist  
University of Texas Institute for Geophysics  
4412 Spicewood Springs Road  
Building 600  
Austin, TX 78759  
U.S.A.  
jamie@utig.ig.utexas.edu

Nicholas Christie-Blick  
Co-Chief Scientist  
Department of Earth and Environmental Sciences and  
Lamont-Doherty Earth Observatory  
Columbia University  
Palisades, NY 10964  
U.S.A.  
ncb@ldeo.columbia.edu

Mitchell J. Malone  
Staff Scientist/Inorganic Geochemist  
Ocean Drilling Program  
Texas A&M University Research Park  
1000 Discovery Drive  
College Station, TX 77845  
U.S.A.  
Mitchell_Malone@odp.tamu.edu

Serge Berné  
Sedimentologist  
Département Géosciences Marines  
IFREMER  
BP 70, 29280 Plouzané  
France  
sberne@ifremer.fr

Mai Kirstine Borre  
Physical Properties Specialist  
Department of Geology and Geotechnical Engineering  
Bygn. 204  
DTU, DK-2800 Lyngby  
Denmark  
maib@ipt.ntnu.no

George Claypool  
Organic Geochemist  
8910 W. 2nd Ave.  
Lakewood, CO 80226  
U.S.A.  
geclaypool@aol.com

John (Jed) Damuth  
Sedimentologist  
Department of Geology  
University of Texas at Arlington  
P.O. Box 19049  
Arlington, TX 76019  
U.S.A.  
damuth@uta.edu

Heike Delius  
LDEO Logging Trainee  
Angewandte Geophysik  
RWTH Aachen  
Lochnerstr. 4-20  
D-52056 Aachen  
Federal Republic of Germany  
heike@sun.geophac.rwth-aachen.de

Gerald Dickens  
Organic Geochemist  
Department of Earth Sciences  
James Cook University  
Townsville, Q4811  
Australia  
jerry.dickens@jcu.edu.au

Peter Flemings  
JOIDES Logging Scientist  
Department of Geosciences  
Pennsylvania State University  
442 Deike Building  
University Park, PA 16802-2714  
U.S.A.  
flemings@geosc.psu.edu

Craig Fulthorpe  
Physical Properties Specialist  
University of Texas Institute for Geophysics  
4412 Spicewood Springs Road  
Building 600  
Austin, TX 78759-8500  
U.S.A.  
craig@utig.ig.utexas.edu

Stephen Hesselbo  
Sedimentologist  
Department of Earth Sciences  
University of Oxford  
Parks Road  
Oxford OX1 3PR  
United Kingdom  
stephen.hesselbo@earth.ox.ac.uk

Koichi Hoyanagi  
Sedimentologist  
Department of Geology  
Shinshu University  
3-1-1 Asahi, Matsumoto, 390  
Japan  
hoya101@gipac.shinshu-u.ac.jp

Miriam (Mimi) Katz  
Paleontologist (benthic foraminifers)  
Lamont-Doherty Earth Observatory  
Columbia University  
Palisades, NYk 10964  
U.S.A.  
mkatz@ldeo.columbia.edu

---

* Addresses at time of cruise.
Hanne Krawinkel
Sedimentologist
Institut für Geowissenschaften
Johannes Gutenberg Universität Mainz
Becherweg 21, Mainz 55099
Federal Republic of Germany
hanne.krawinkel@po.uni-stuttgart.de

Candace Major
LDEO Logging Scientist
Borehole Research Group
Lamont-Doherty Earth Observatory
Columbia University
Palisades, NY 10964
U.S.A.
major@ldeo.columbia.edu

Francine McCarthy
Paleontologist (dinoflagellates)
Department of Earth Sciences
Brock University
St. Catherines, ON L2S 3A1
Canada
francine@craton.geol.brocku.ca

Cecilia McHugh
Sedimentologist
Department of Geology
Queens College (CUNY)
65-30 Kissena Blvd.
Flushing, NY 11367
U.S.A.
cmmhc@qcunix.qc.cuny.edu

Gregory Mountain
JOIDES Logging Scientist
Lamont-Doherty Earth Observatory
Columbia University
Palisades, NY 10964
U.S.A.
mountain@ldeo.columbia.edu

Hiro Oda
Paleomagnetist
Marine Geology Department
Geological Survey of Japan
1-1-3 Hiashi, Tsukuba
Ibaraki 305
Japan
hodoh@gsj.go.jp

Hilary Olson
Paleontologist (planktonic foraminifers)
University of Texas Institute for Geophysics
4412 Spicewood Springs Road
Building 600
Austin, TX 78759-8500
olson@utig.ig.utexas.edu

Carlos Pirmez
LDEO Logging Scientist
Borehole Research Group
Lamont-Doherty Earth Observatory
Columbia University
Palisades, NY 10964
U.S.A.
pirmex@ldeo.columbia.edu

Charles (Chuck) Savrda
Sedimentologist
Department of Geology
Auburn University
210 Petrie Hall
Auburn, AL 36849-5305
U.S.A.
savrdae@mail.auburn.edu

Christopher Smart
Paleontologist (planktonic foraminifers)
Department of Geological Sciences
University of Plymouth
Drake Circus
Plymouth, Devon PL4 8AA
United Kingdom
csmart@plymouth.ac.uk

Linda Sohl
Sedimentologist
Lamont-Doherty Earth Observatory
Columbia University
P.O. Box 1000
Palisades, NY 10964
U.S.A.
sohl@ldeo.ldeo.columbia.edu

Patricia Vanderaveroet
Sedimentologist
Laboratoire de Sédimentologie et Géodynamique-SN5
Université de Lille I
59655 Villeneuve d’Ascq Cedex
France
Patricia.Vanderaveroet@univ-lille1.fr

Wuchang Wei
Paleontologist (nannofossils)
Scripps Institute of Oceanography
University of California at San Diego
La Jolla, CA 92093-0215
U.S.A.
wwei@ucsd.edu

Brian Whiting
Physical Properties Specialist
Geology Department
Central Washington University
Lind Hall
Ellensburg, WA 98926
U.S.A.
bmw@gis.cwu.edu

SEDCO OFFICIALS

Captain Anthony Ribbens
Master of the Drilling Vessel
Overseas Drilling Ltd.
707 Texas Avenue South, Suite 213D
College Station, TX 77840-1917
U.S.A.

Robert C. Caldow
Drilling Superintendent
Overseas Drilling Ltd.
707 Texas Avenue South, Suite 213D
College Station, TX 77840-1917
U.S.A.
**ENGINEERING AND OPERATIONS PERSONNEL**

<table>
<thead>
<tr>
<th>Name</th>
<th>Position</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gene Pollard</td>
<td>Operations Manager</td>
</tr>
<tr>
<td>Steve Kittredge</td>
<td>Schlumberger Engineer</td>
</tr>
<tr>
<td>Thomas Horton III</td>
<td>Schlumberger Logging-While-Drilling Engineer</td>
</tr>
</tbody>
</table>

**ODP TECHNICAL AND LOGISTICS PERSONNEL**

<table>
<thead>
<tr>
<th>Name</th>
<th>Position</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tim Bronk</td>
<td>Marine Lab Specialist (Chemistry)</td>
</tr>
<tr>
<td>Roy Davis</td>
<td>Marine Lab Specialist (Photographer)</td>
</tr>
<tr>
<td>Sandy Dillard</td>
<td>Marine Lab Specialist (Storekeeper)</td>
</tr>
<tr>
<td>John Eastlund</td>
<td>Marine Computer Specialist</td>
</tr>
<tr>
<td>Burney Hamlin</td>
<td>Laboratory Officer</td>
</tr>
<tr>
<td>Margaret Hastedt</td>
<td>Marine Lab Specialist (Paleomagnetism)</td>
</tr>
<tr>
<td>Kuro Kuroki</td>
<td>Assistant Lab Officer/Marine Lab Specialist (X-ray)</td>
</tr>
<tr>
<td>Brian Jonasson</td>
<td>Development Engineer</td>
</tr>
<tr>
<td>Jaque Ledbetter</td>
<td>Marine Lab Specialist (X-ray)</td>
</tr>
<tr>
<td>Erin McCarty</td>
<td>Marine Lab Specialist (Curator)</td>
</tr>
<tr>
<td>Matt Mefferd</td>
<td>Marine Computer Specialist</td>
</tr>
<tr>
<td>Erik Moortgat</td>
<td>Marine Lab Specialist (Physical Properties)</td>
</tr>
<tr>
<td>Chris Nugent</td>
<td>Marine Lab Specialist (Downhole Tools/Thin Sections)</td>
</tr>
<tr>
<td>Matt O’Regan</td>
<td>Marine Laboratory Specialist</td>
</tr>
<tr>
<td>Anne Pimmel</td>
<td>Marine Lab Specialist (Chemistry)</td>
</tr>
<tr>
<td>Jo Ribbens</td>
<td>Marine Lab Specialist (Yeoman)</td>
</tr>
<tr>
<td>Bill Stevens</td>
<td>Marine Electronics Specialist</td>
</tr>
<tr>
<td>Mark Watson</td>
<td>Marine Electronics Specialist</td>
</tr>
</tbody>
</table>

**Ocean Drilling Program Publication Services Staff*  

**Publication Services Manager**

- Ann Klaus

**Editorial Supervisor/Publications Specialist**

- M. Kathleen Phillips

**Senior Editor**

- Angeline T. Miller

**Editors**

- Phyllis M. Garman
- Ginny Peachey Jackson
- Susan Nessler
- Ruth N. Riegel
- John M. Scroggs

**Chief Production Editor**

- Jennifer Pattison Rumford

**Production Editors**

- Amy Brundeen
- Patrick H. Edwards (this volume)
- Jaime A. Gracia
- Lea Elaine Green

**Senior Publications Coordinator**

- Gudelia (“Gigi”) Delgado

**Copier/Distribution Specialist**

- Ann Yeager

**Chief Illustrator**

- Deborah L. Partain

**Illustrators**

- Coleena Burt
- Scott Elfstrom
- Nancy H. Luedke (this volume)
- Karen E. Wagner
- Cheng Wei

**WWW Administrator**

- Katerina E. Petronotis

**Production Assistants**

- Marianne Gorecki
- Mary Elizabeth Mitchell

**Student Assistants**

- Jaime Cawthron, Theresa Elam, Caressa Inman, Sonya Medina

*At time of publication.
PUBLISHER’S NOTES

This publication was prepared by the Ocean Drilling Program, Texas A&M University, as an account of work performed under the international Ocean Drilling Program, which is managed by Joint Oceanographic Institutions, Inc., under contract with the National Science Foundation. Funding for the program was provided by the following agencies at the time of this cruise:

Australia/Canada/Chinese Taipei/Korea Consortium for Ocean Drilling, Department of Primary Industries and Energy (Australia), Natural Resources Canada (Canada), National Taiwan University in Taipei, and Korean Institute for Geology, Mining and Minerals
Deutsche Forschungsgemeinschaft (Federal Republic of Germany)
European Science Foundation Consortium for Ocean Drilling (Belgium, Denmark, Finland, Iceland, Italy, The Netherlands, Norway, Portugal, Spain, Sweden, Switzerland, and Turkey)
Institut Français de Recherche pour l’Exploitation de la Mer (France)
National Science Foundation (United States)
Natural Environment Research Council (United Kingdom)
University of Tokyo, Ocean Research Institute (Japan)

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, the participating agencies, Joint Oceanographic Institutions, Inc., Texas A&M University, or Texas A&M Research Foundation.

The bulk of the shipboard-collected data from this leg is available on the World Wide Web and is accessible at <http://www-odp.tamu.edu/database>. If you cannot access this site or need additional data, please contact the ODP Data Librarian, Ocean Drilling Program, Texas A&M University, College Station, TX 77845, U.S.A. (e-mail: database@odp.tamu.edu).

Abbreviations for names of organizations and publications in ODP reference lists follow the style given in Chemical Abstracts Service Source Index (published by American Chemical Society).

The printed version of the Proceedings of the Ocean Drilling Program series will end with Initial Reports volume 175 and Scientific Results volume 169S. Beginning with Initial Reports volume 176 and Scientific Results volume 169, all Proceedings volumes will be published on CD-ROM and the World Wide Web <http://www-odp.tamu.edu/publications/>.

Initial Reports—CD-ROM format: ISSN 1096-2522
WWW format: ISSN 1096-2158

Scientific Results—CD-ROM format: ISSN 1096-2514
WWW format: ISSN 1096-7451