

**VOLUME 202  
SCIENTIFIC RESULTS**

**SOUTHEAST PACIFIC  
PALEOCEANOGRAPHIC  
TRANSECTS  
SITES 1232-1242**



**PROCEEDINGS OF THE  
OCEAN DRILLING PROGRAM**

Prepared by the  
OCEAN DRILLING PROGRAM,  
TEXAS A&M UNIVERSITY,  
in cooperation with the  
NATIONAL SCIENCE FOUNDATION  
and JOINT OCEANOGRAPHIC INSTITUTIONS, INC.

# PROCEEDINGS OF THE OCEAN DRILLING PROGRAM

Volume 202

Scientific Results

Southeast Pacific Paleoceanographic Transects

Covering Leg 202 of the cruises of the Drilling Vessel *JOIDES Resolution*

Valparaiso, Chile, to Balboa, Panama

Sites 1232–1242

29 March–30 May 2002

## SHIPBOARD SCIENTISTS

Ralf Tiedemann, Alan C. Mix, Peter Blum,

Fatima F. Abrantes, Heather Benway, Isabel Cacho-Lascorz, Min-Te Chen, Margaret L. Delaney, José-Abel Flores,

Liviu Giosan, Ann E. Holbourn, Tomohisa Irino, Masao Iwai, Leah H. Joseph, Helga F. Kleiven, Frank Lamy,

Steven P. Lund, Philippe Martinez, Jerry F. McManus, Ulysses S. Ninnemann, Nicklas G. Piasias,

Rebecca S. Robinson, Joseph S. Stoner, Arne Sturm, Michael W. Wara, Wuchang Wei

## SHIPBOARD STAFF SCIENTIST

Peter Blum

## EDITORIAL REVIEW BOARD

Ralf Tiedemann, Alan C. Mix, Carl Richter, Bill Ruddiman

**Reference to the whole or to part of this volume should be made as follows:**

**Volume citation:**

Tiedemann, R., Mix, A.C., Richter, C., and Ruddiman, W.F. (Eds.), 2007. *Proc. ODP, Sci. Results, 202*: College Station, TX (Ocean Drilling Program). doi:10.2973/odp.proc.sr.202.2007

**Chapter citation:**

Tiedemann, R., and Mix, A.C., 2007. Leg 202 synthesis: southeast Pacific paleoceanography. *In* Tiedemann, R., Mix, A.C., Richter, C., and Ruddiman, W.F. (Eds.), *Proc. ODP, Sci. Results, 202*: College Station, TX (Ocean Drilling Program), 1–56. doi:10.2973/odp.proc.sr.202.201.2007

**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 printing date*, is the correct one.

The printing date of this volume: May 2007

The mailing dates of recent *Proceedings of the Ocean Drilling Program*:

Volume 208 (*Initial Reports*): May 2004

Volume 209 (*Initial Reports*): June 2004

Volume 210 (*Initial Reports*): October 2004

Volume 179 (*Scientific Results*): February 2007

Volume 193 (*Scientific Results*): March 2007

Volume 203 (*Scientific Results*): January 2007

Copies of this publication may be obtained from Publications Distribution Center, Integrated Ocean Drilling Program, Texas A&M University, 1000 Discovery Drive, College Station TX 77845-9547, USA. See the ODP publication list at [www-odp.tamu.edu/publications](http://www-odp.tamu.edu/publications) or contact IODP for prices and ordering information. Orders for copies require advance payment.

**ISSN**

Book: 0884-5891; CD-ROM: 1096-2514; World Wide Web: 1096-7451

Library of Congress 87-642-462

# PUBLISHER'S NOTES

This volume also appears on the World Wide Web. Any scientific corrections, revisions, or additions will be noted in the chapter (see "Chapter Notes") at [www-odp.tamu.edu/publications](http://www-odp.tamu.edu/publications).

This publication was prepared by the Integrated 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, 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, Ireland, Italy, The Netherlands, Norway, Portugal, Spain, Sweden, and Switzerland)

Institut National des Sciences de l'Univers–Centre National de la Recherche Scientifique (INSU-CNRS) (France)

Marine High-Technology Bureau of the State Science and Technology Commission of the People's Republic of China

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.

Current policy requires that all figures published in *Scientific Results* volumes of the *Proceedings of the Ocean Drilling Program* be provided by the authors.

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 map at the front of this volume was produced using Generic Mapping Tools (GMT) of Paul Wessel and Walter H.R. Smith ([gmt.soest.hawaii.edu](http://gmt.soest.hawaii.edu)). A site map showing the drilling locations for this leg and maps showing the drilling locations of all Ocean Drilling Program (ODP) and Deep Sea Drilling Project (DSDP) drilling sites are available on the volume CD-ROM in PDF format.

Cover photograph is a SeaWiFS image of central Chile that shows visible plumes of river outflow. The sediment-laden plumes extend ~70 km into the Pacific Ocean, boosting phytoplankton production as they pass. The snow-covered Andes Mountains are visible along the right side of the image. The capital city of Santiago is the grayish splotch west of the Andes at ~33.5°S. Image provided by ORBIMAGE. © Orbital Imaging Corporation and processing by NASA Goddard Space Flight Center.

# FOREWORD

## BY JOINT OCEANOGRAPHIC INSTITUTIONS, INC.

This volume presents scientific and engineering results from the Ocean Drilling Program (ODP). These results address the scientific and technical goals of the program, which are focused on the study of the dynamics of Earth's interior and environment, the evolution of oceanic crust, the fluctuations of climate, and the study of the Earth's deep biosphere.

Although ODP ended operations in 2003, science results from ODP's expeditions on the *JOIDES Resolution* continue to emerge. The results represent the contributions of scientists and research institutions from 22 ODP member countries. International oversight and coordination of the program was provided by the ODP Council, which was made up of representatives from the member countries. Scientific and management guidance was provided by representatives from the Joint Oceanographic Institutions for Deep Earth Sampling (JOIDES).

Joint Oceanographic Institutions, Inc. (JOI), a nonprofit consortium of 29 U.S. oceanographic institutions, serves as the National Science Foundation's prime contractor for ODP. JOI implemented scientific objectives, plans, and recommendations of the JOIDES committees through subcontracts to Texas A&M University (TAMU) for science operations and to Lamont-Doherty Earth Observatory (LDEO) of Columbia University for geochemical and geophysical well-logging services.

JOI, TAMU, and LDEO worked together successfully for many years to manage the Ocean Drilling Program. We look forward to many exciting discoveries and continued international collaboration on the Integrated Ocean Drilling Program as we further our scientific mission.

Steven R. Bohlen

President of the Joint Oceanographic Institutions and Executive Director of the Ocean Drilling Programs  
Washington, D.C.

# PREFACE

## THE VOYAGES OF DISCOVERY

The *Scientific Results* volumes of the *Proceedings of the Ocean Drilling Program* are about Earth and her oceans.

These volumes contain contributions to a better understanding of the history of our planet through time. This exploration of Earth's past is based on scientific analyses of layers of strata sampled by the *JOIDES Resolution* at key locations throughout the global ocean. These volumes are a tribute to the scientific exploration carried out by the men and women who contributed to these voyages of discovery. Like the pioneering exploration and research of Captain Cook aboard the first *Resolution*, these volumes are a credit to the human spirit, which sees no boundaries.

The papers in this volume are published in a new online format that will be archived on CD-ROM. The *Proceedings* contents are available to students, scientists, and the public throughout the world. Volumes, once housed in the libraries of the member nations of the Ocean Drilling Program (ODP), are now published on the Internet for a worldwide audience and are also available in CD-ROM format. This electronic publication enables future investigators to gain easier access to the results of ocean drilling research. I acknowledge and thank the authors for their contributions and willingness to participate in this new venture in our successful transition to electronic publications.

Each *Scientific Results* volume has an Editorial Review Board that is responsible for obtaining peer reviews of papers submitted to the volume. This board usually is made up of the two co-chief scientists for the cruise, the ODP staff scientist for the cruise, and one external specialist who is familiar with the geology of the investigated area. ODP staff coordinate the peer-review process and also edit and produce each paper.

Each *Scientific Results* volume contains one leg synthesis paper and other peer-reviewed papers that present the results of extensive research in various aspects of scientific ocean drilling related to each leg. Each paper submitted to a *Scientific Results* volume undergoes rigorous peer review by at least two specialists in the author's research field. Volumes may also contain short reports of useful data. These Data Reports do not include interpretation of results and are peer-reviewed by at least one specialist. We seek to maintain a peer-review system comparable to those of the most highly regarded journals in the geological sciences.

To acknowledge the contributions made by this volume's Editorial Review Board, the Board members are designated Editors of the volume. Reviewers of manuscripts for this volume, whose efforts are so essential to the success of the publication, are listed without attribution to any particular manuscript.

On behalf of ODP and now the Integrated Ocean Drilling Program, the successor to ODP, I extend sincere appreciation to the members of the Editorial Review Board and to the reviewers for generously contributing their time and effort. This process ensures that only papers of high scientific quality are published in the *Scientific Results* volumes.

Paul J. Fox  
Director, Science Services, TAMU  
Integrated Ocean Drilling Program  
Texas A&M University  
College Station, Texas

## REVIEWERS FOR THIS VOLUME

Claudia Benetiz-Nelson  
Torsten Bickert  
Katharina Billups  
Stefanie Brachfeld  
Steven C. Clemens  
Hilairy Ellen Hartnett

Ann Holbourn  
K.A. Kryc  
Jennifer Latimer  
David Lazarus  
Hitoshi Mikada  
Rob Negrini

Joseph D. Ortiz  
Christopher J. Poulsen  
Christina Ravelo  
Carl Richter

# OCEAN DRILLING PROGRAM\*

National Science Foundation  
 4201 Wilson Boulevard  
 Arlington VA 22230, USA  
 Tel: (703) 306-1581; Fax: (703) 306-0390  
 Web site: [www.nsf.gov](http://www.nsf.gov)

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

Columbia University, Lamont-Doherty Earth Observatory

Florida State University

Oregon State University, College of Oceanic and Atmospheric Sciences

Pennsylvania State University, College of Earth and Mineral Sciences

Rutgers, The State University of New Jersey, Institute of Marine and Coastal Sciences and Faculty of Arts and Sciences

Stanford University, School of Earth Sciences

Texas A&M University, College of Geosciences

University of California at San Diego, Scripps Institution of Oceanography

University of California, Santa Cruz

University of Florida

University of Hawaii, School of Ocean and Earth Science and Technology

University of Miami, Rosenstiel School of Marine and Atmospheric Science

University of Michigan, College of Literature, Science, and the Arts

University of Rhode Island, Graduate School of Oceanography

University of South Florida, College of Marine Science

University of Texas at Austin, Institute for Geophysics

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, National Taiwan University in Taipei, and Korean Institute for Geology, Mining and Minerals

European Science Foundation Consortium for Ocean Drilling (Belgium, Denmark, Finland, Iceland, Ireland, Italy, The Netherlands, Norway, Portugal, Spain, Sweden, and Switzerland)

\*At time of completion of ODP cruises in September 2003. See [Publisher's Notes](#), p. 4, for list of funding agencies at time of cruise.



Federal Republic of Germany, Bundesanstalt für  
Geowissenschaften und Rohstoffe

France, Institut National des Sciences de  
l'Univers–Centre National de la Recherche  
Scientifique (INSU-CNRS)

Japan, University of Tokyo, Ocean Research  
Institute

### **ODP PROGRAM MANAGER**

Joint Oceanographic Institutions, Inc.  
1201 New York Avenue, NW, Suite 400  
Washington DC 20005, USA  
Tel: (202) 232-3900; Fax: (202) 462-8754  
E-mail: [info@joiscience.org](mailto:info@joiscience.org)  
Web site: [www.joiscience.org](http://www.joiscience.org)

### **ODP SCIENCE OPERATOR**

Integrated Ocean Drilling Program  
Texas A&M University  
1000 Discovery Drive  
College Station TX 77845-9547, USA  
Tel: (979) 845-2673; Fax: (979) 845-4857  
E-mail: [information@iodp.tamu.edu](mailto:information@iodp.tamu.edu)  
Web site: [iodp.tamu.edu](http://iodp.tamu.edu)

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

### **ODP LOGGING SERVICES OPERATOR**

Borehole Research Group  
Lamont-Doherty Earth Observatory  
of Columbia University  
PO Box 1000, 61 Route 9W  
Palisades NY 10964, USA  
Tel: (845) 365-8341; Fax: (845) 365-3182  
E-mail: [borehole@ldeo.columbia.edu](mailto:borehole@ldeo.columbia.edu)  
Web site: [www.ldeo.columbia.edu/BRG/ODP](http://www.ldeo.columbia.edu/BRG/ODP)

### **ODP SITE SURVEY DATA BANK**

Lamont-Doherty Earth Observatory  
of Columbia University  
PO Box 1000, 61 Route 9W  
Palisades NY 10964, USA  
Tel: (845) 365-8542; Fax: (845) 365-8159  
E-mail: [odp@ldeo.columbia.edu](mailto:odp@ldeo.columbia.edu)  
Web site: [ssdb.iodp.org](http://ssdb.iodp.org)

# LEG 202 PARTICIPANTS\*

## SHIPBOARD SCIENTIFIC PARTY

**Ralf Tiedemann**

**Co-Chief Scientist**

GEOMAR

Christian-Albrechts-Universität  
zu Kiel

Wischhofstrasse 1-3

24148 Kiel

Germany

[rtiedemann@geomar.de](mailto:rtiedemann@geomar.de)

**Alan C. Mix**

**Co-Chief Scientist**

College of Oceanic and Atmospheric Sciences

Oregon State University

104 COAS Administration Building

Corvallis OR 97331-5503

USA

[mix@coas.oregonstate.edu](mailto:mix@coas.oregonstate.edu)

**Peter Blum**

**Staff Scientist**

Ocean Drilling Program

Texas A&M University

1000 Discovery Drive

College Station TX 77845-9547

USA

Present address (25 November 2003):

Integrated Ocean Drilling Program

Texas A&M University

1000 Discovery Drive

College Station TX 77845-9547

USA

[blum@iodp.tamu.edu](mailto:blum@iodp.tamu.edu)

**Fatima F. Abrantes**

**Paleontologist (diatoms)**

Departamento de Geologia Marinha

Instituto Geologico e Mineiro

Estrada da Portela

Zambujal, Aptdo 7586

2720 Alfragide

Portugal

[fatima.abrantes@igm.pt](mailto:fatima.abrantes@igm.pt)

**Heather Benway**

**Sedimentologist**

College of Oceanic and Atmospheric Sciences

Oregon State University

104 Ocean Administration Building

Corvallis OR 97331

USA

[hbenway@coas.oregonstate.edu](mailto:hbenway@coas.oregonstate.edu)

**Isabel Cacho-Lascorz**

**Sedimentologist**

Department of Earth Sciences

University of Cambridge

Godwin Laboratory

New Museums Site, Pembroke Street

Cambridge CB2 2SA

United Kingdom

Present address (26 September 2003):

GRC Geociències Marines, Dept. Estrat. Paleont.

i Geoc. Marines

Facultat de Geologia, Universitat de Barcelona

C/ Martí Franques s/n

08028 Barcelona

Spain

[isabel@geo.ub.es](mailto:isabel@geo.ub.es)

\*Addresses at time of cruise, except where updated by the leg participants before publication.

**Min-Te Chen****Sedimentologist**

Institute of Applied Geophysics  
National Taiwan Ocean University  
2 Pei-Ning Road  
Keelung 202  
Taiwan  
[mtchen@mail.ntou.edu.tw](mailto:mtchen@mail.ntou.edu.tw)

**Margaret L. Delaney****Inorganic Geochemist**

Ocean Sciences Department  
University of California, Santa Cruz  
1156 High Street  
Santa Cruz CA 95064  
USA  
[delaney@ucsc.edu](mailto:delaney@ucsc.edu)

**José-Abel Flores****Paleontologist (nannofossils)**

Departamento de Geología  
Universidad Salamanca  
Facultad de Ciencias  
37008 Salamanca  
Spain  
[flores@usal.es](mailto:flores@usal.es)

**Liviu Giosan****Physical Properties Specialist**

Department of Geology and Geophysics  
Woods Hole Oceanographic Institution  
Woods Hole MA 02543  
USA  
[lgiosan@whoi.edu](mailto:lgiosan@whoi.edu)

**Ann E. Holbourn****Paleontologist (foraminifers)**

Institut für Geowissenschaften  
Christian-Albrechts-Universität  
zu Kiel  
Olshausenstrasse 40  
24118 Kiel  
Germany  
[ah@gpi.uni-kiel.de](mailto:ah@gpi.uni-kiel.de)

**Tomohisa Irino****Sedimentologist**

Graduate School of Environmental Earth Science  
Hokkaido University  
N10-W5, Kitaku  
Sapporo 060-0810  
Japan  
[irino@ees.hokudai.ac.jp](mailto:irino@ees.hokudai.ac.jp)

**Masao Iwai****Paleontologist (diatoms)**

Department of Natural Environmental Science  
Kochi University  
2-5-1 Akebono-cho  
Kochi 780-8520  
Japan  
[iwaim@cc.kochi-u.ac.jp](mailto:iwaim@cc.kochi-u.ac.jp)

**Leah H. Joseph****Sedimentologist**

Environmental Studies/Geoscience  
Hobart and William Smith Colleges  
4136 Scandling Center  
Pulteney Street  
Geneva NY 14456  
USA  
Present address (12 April 2005):  
Environmental Studies Program  
Ursinus College  
PO Box 1000  
Collegeville PA 19426  
USA  
[Ljoseph@ursinus.edu](mailto:Ljoseph@ursinus.edu)

**Helga F. Kleiven****Sedimentologist**

Bjerknes Centre for Climate Research and  
Department of Geology  
Universitetet i Bergen  
Allègaten 41  
5007 Bergen  
Norway  
[kikki@geol.uib.no](mailto:kikki@geol.uib.no)

**Frank Lamy****Sedimentologist**

Fachbereich Geowissenschaften  
 Universität Bremen  
 Postfach 33 04 40  
 28334 Bremen  
 Germany

Present address (12 April 2005):  
 GeoForschungsZentrum Potsdam  
 Telegrafenberg  
 14473 Potsdam  
 Germany

[flamy@gfz-potsdam.de](mailto:flamy@gfz-potsdam.de)

**Steven P. Lund****Paleomagnetist**

Department of Earth Sciences  
 University of Southern California  
 University Park  
 Los Angeles CA 90089-0740  
 USA

[slund@usc.edu](mailto:slund@usc.edu)

**Philippe Martinez****Organic Geochemist**

Département de Géologie et Océanographie  
 Université de Bordeaux I  
 Avenue des Facultes  
 33405 Talence  
 France

[p.martinez@epoc.u-bordeaux1.fr](mailto:p.martinez@epoc.u-bordeaux1.fr)

**Jerry F. McManus****Sedimentologist**

Department of Geology and Geophysics  
 Woods Hole Oceanographic Institution  
 121 Clark MS #23  
 Woods Hole MA 02543  
 USA

[jmcmanus@whoi.edu](mailto:jmcmanus@whoi.edu)

**Ulysses S. Ninnemann****Logging Staff Scientist**

Borehole Research Group  
 Lamont-Doherty Earth Observatory of Columbia  
 University  
 PO Box 1000, 61 Route 9W  
 Palisades NY 10964  
 USA

Present address (12 April 2005):  
 Bjerknes Centre for Climate Research and  
 Department of Geology  
 Universitetet i Bergen

Allègaten 41  
 5007 Bergen  
 Norway

[ulysses.ninnemann@geol.uib.no](mailto:ulysses.ninnemann@geol.uib.no)

**Nicklas G. Pias****Stratigraphic Correlator**

College of Oceanic and Atmospheric Sciences  
 Oregon State University  
 104 Ocean Administration Building  
 Corvallis OR 97331-5503  
 USA

[pias@oce.orst.edu](mailto:pias@oce.orst.edu)

**Rebecca S. Robinson****Sedimentologist**

Department of Geological Sciences  
 Princeton University  
 Guyot Hall  
 Washington Road  
 Princeton NJ 08544  
 USA

[rebeccar@princeton.edu](mailto:rebeccar@princeton.edu)

**Joseph S. Stoner****Paleomagnetist**

Institute of Arctic and Alpine Research  
 University of Colorado at Boulder  
 1560 30th Street  
 450 UCB  
 Boulder CO 80309-0450  
 USA

Present address (12 April 2005):  
 College of Oceanic and Atmospheric Sciences  
 Oregon State University  
 104 COAS Administration Building  
 Corvallis OR 97331-5503  
 USA

[stoner@coas.oregonstate.edu](mailto:stoner@coas.oregonstate.edu)

**Arne Sturm****Physical Properties Specialist**

GEOMAR  
 Christian-Albrechts-Universität zu Kiel  
 Wischhofstrasse 1-3  
 24148 Kiel  
 Germany

[asturm@geomar.de](mailto:asturm@geomar.de)

**OBSERVERS****Pedro Crignola**

Oficina Técnica de Puerto Varas  
 Servicio Nacional de Geología y Minería  
 La Paz #406  
 Puerto Varas  
 Chile

[sernageomin@surnet.cl](mailto:sernageomin@surnet.cl)

**Robert Marquina Herrera**

Instituto Del Mar Del Peru  
 Esquina Gamarra y General Valle S/N  
 Chucuito-Callao  
 Peru  
 ANEXO 251-242

[rmarquina71@hotmail.com](mailto:rmarquina71@hotmail.com)

**Michael W. Wara****Stratigraphic Correlator**

Ocean Sciences Department  
 University of California, Santa Cruz  
 A316 Earth and Marine Sciences  
 1156 High Street  
 Santa Cruz CA 95064  
 USA

[mwara@es.ucsc.edu](mailto:mwara@es.ucsc.edu)

**Wuchang Wei****Paleontologist (nannofossils)**

Scripps Institution of Oceanography  
 University of California, San Diego  
 Geoscience Research Division  
 La Jolla CA 92093-0244  
 USA

Present address (18 February 2003):

PaleoServe  
 4389 Corte de la Fonda  
 San Diego CA 92130  
 USA

[wei@paleoserve.com](mailto:wei@paleoserve.com)

**Flavia Cecilia Valásquez Ruiz**

Oficina Técnica de Puerto Varas  
 Servicio Nacional de Geología y Minería  
 La Paz #406  
 Puerto Varas  
 Chile

[geoflavia21@hotmail.com](mailto:geoflavia21@hotmail.com)

**Juan Carlos Tapia Aldas**

Instituto Oceanografico de la Armada (INOCAR)  
 Avendio 25 de Julio via Puerto Maritimo  
 PO Box 5940  
 Guayaquil  
 Ecuador

[juancar279@hotmail.com](mailto:juancar279@hotmail.com)  
[geologia@inocar.mil.ec](mailto:geologia@inocar.mil.ec)

## TRANSOCEAN SEDCO FOREX OFFICIALS

### **Peter Mowat**

#### **Master of the Drilling Vessel**

Overseas Drilling Ltd.  
707 Texas Avenue South, Suite 213D  
College Station TX 77840-1917  
USA

### **Scott Pederson**

#### **Drilling Superintendent**

Overseas Drilling Ltd.  
707 Texas Avenue South, Suite 213D  
College Station TX 77840-1917  
USA

## ODP SHIPBOARD PERSONNEL

### **Tim Bronk**

Assistant Laboratory Officer

### **Shannon Center**

Marine Laboratory Specialist (Photographer)

### **Lisa Crowder**

Marine Laboratory Specialist (Core Laboratory)

### **Sandy Dillard**

Marine Laboratory Specialist  
(Downhole Tools/Thin Sections)

### **John Michael Davis**

Marine Computer Specialist

### **David Fackler**

Programmer

### **Dean Ferrell**

Drilling Services Technician

### **Dennis Graham**

Marine Laboratory Specialist (Chemistry)

### **Ron Grout**

Operations Manager

### **Burney Hamlin**

Laboratory Officer

### **Mike Hodge**

Marine Computer Specialist

### **Jessica Huckemeyer**

Marine Laboratory Specialist (Curator)

### **Brian Jones**

Marine Laboratory Specialist (Chemistry)

### **Steven W. Kittredge**

Schlumberger Engineer

### **Jurie Kotze**

Marine Electronics Specialist

### **William Thomas Mefferd**

Marine Laboratory Specialist (Core Laboratory)

### **Deborah L. Partain**

Marine Laboratory Specialist (Yeoperson)

### **Heather Paul**

Marine Laboratory Specialist (Core Laboratory)

### **Pieter Pretorius**

Marine Electronics Specialist

### **Mads Radsted**

Marine Laboratory Specialist (Paleomagnetism)

### **Patrick Riley**

Marine Laboratory Specialist  
(Physical Properties)

### **Johanna Suhonen**

Marine Laboratory Specialist  
(Underway Geophysics)

### **Bob Wheatley**

Marine Laboratory Specialist (X-Ray)

## PUBLICATION SERVICES STAFF\*

**Katherine W. Bastian**  
Assistant Editor

**Karen Benson**  
Production Specialist II

**Jami Castillo**  
Editor

**Mary Chapman**  
Production Specialist I

**Gudelia ("Gigi") Delgado**  
Senior Publications  
Coordinator

**Patrick H. Edwards**  
Production Specialist III

**Jaime A. Gracia**  
Supervisor of Production

**Lauren Gracia**  
Student Assistant

**Cassandra Harashe**  
Student Assistant

**Jenni Hesse**  
Editor

**Jennie L. Lamb**  
Graphics Specialist II

**Shana C. Lewis**  
Editor

**Ginny Lowe**  
Reports Coordinator

**Nancy H. Luedke**  
Graphics Specialist II

**Amy McWilliams**  
Editor

**Angeline T. Miller**  
Manager of Publication  
Services

**Linda Orsi**  
Graphics Specialist II

**Deborah L. Partain**  
Supervisor of Graphics

**Lorri L. Peters**  
Supervisor of Editing

**M. Kathleen Phillips**  
Publications Specialist

**Barbara Riggs-Turner**  
Administrative Assistant

**Jennifer Pattison Rumford**  
Electronic Publications  
Specialist

**Kenneth Sherar**  
Production Specialist II

**Ann Yeager**  
Distribution Specialist

\*At time of publication.

# CD-ROM CONTENTS: SYNTHESIS AND CHAPTERS

## SYNTHESIS

### 1. Leg 202 Synthesis: Southeast Pacific Paleoceanography

Ralf Tiedemann and Alan Mix  
doi:10.2973/odp.proc.sr.202.201.2007

## CHAPTERS

### STRATIGRAPHY

### 2. Late Quaternary Paleomagnetic Secular Variation and Chronostratigraphy from ODP Sites 1233 and 1234

Steve P. Lund, Joseph Stoner, and Frank Lamy  
doi:10.2973/odp.proc.sr.202.208.2006

### 3. Magnetostratigraphic Calibration of the Late Oligocene Climate Transition

Benjamin P. Flower and Kathryn E. Chisholm  
doi:10.2973/odp.proc.sr.202.204.2006

### 4. Astronomically Calibrated Timescales from 6 to 2.5 Ma and Benthic Isotope Stratigraphies, Sites 1236, 1237, 1239, and 1241

Ralf Tiedemann, Arne Sturm, Silke Steph, Stene P. Lund, and Joseph S. Stoner  
doi:10.2973/odp.proc.sr.202.210.2007

### 5. Data Report: Tropical and Equatorial Calcareous Nannofossil Pleistocene Biostratigraphy, ODP Leg 202

José-Abel Flores, Wuchang Wei, Gatsby E. López-Otálvaro, Carmen Alvarez, and Francisco J. Sierra  
doi:10.2973/odp.proc.sr.202.214.2006

### 6. Data Report: Radiolarian Biostratigraphy, ODP Leg 202, Site 1237

Mysti Weber and Nicklas Piasias  
doi:10.2973/odp.proc.sr.202.213.2006

### GEOCHEMISTRY

### 7. Data Report: Organic Carbon and Biomarker Variations, Sites 1237 and 1239

Chikara Abe, Masanobu Yamamoto, and Toshihisa Irino  
doi: 10.2973/odp.proc.sr.202.203.2006



**8. Phosphorus, Barium, Manganese, and Uranium Concentrations and Geochemistry, Nazca Ridge Site 1237 Sediments**

Cecily O.J. Chun and Margaret L. Delaney  
doi:10.2973/odp.proc.sr.202.205.2006

**9. Lack of Isotopic Fractionation of  $\delta^{15}\text{N}$  of Organic Matter during Long-Term Diagenesis in Marine Sediments, ODP Leg 202, Sites 1234 and 1235**

Maria G. Prokopenko, Douglas E. Hammond, and Lowell Stott  
doi:10.2973/odp.proc.sr.202.207.2006

**10. Data Report: Major and Trace Element Data for Leg 202 Sites 1233 and 1234**

James McManus  
doi:10.2973/odp.proc.sr.202.202.2006

**11. Data Report: Mg/Ca, Sr/Ca, Mn/Ca, and Oxygen and Carbon Isotope Records of Pliocene–Pleistocene Foraminifers from ODP Leg 202 Site 1237**

Michael W. Wara and Ana Christina Ravelo  
doi:10.2973/odp.proc.sr.202.206.2006

**PALEOCEANOGRAPHY**

**12. Pliocene Changes in Tropical East Pacific Upper Ocean Stratification: Response to Tropical Gateways?**

Silke Steph, Ralf Tiedemann, Jeroen Groeneveld, Arne Sturm, and Dirk Nürnberg  
doi:10.2973/odp.proc.sr.202.211.2006

**13. Pliocene Mixed-Layer Oceanography for Site 1241, Using Combined Mg/Ca and  $\delta^{18}\text{O}$  Analyses of *Globigerinoides sacculifer***

Jeroen Groeneveld, Silke Steph, Ralf Tiedemann, Dieter Garbe-Schönberg, Dirk Nürnberg, and Arne Sturm  
doi:10.2973/odp.proc.sr.202.209.2006

**PALEOMAGNETISM**

**14. Detailed Paleomagnetic and Rock Magnetic Variability within Three High-Resolution Study Intervals from Site 1233**

Steve P. Lund, Joseph Stoner, James Channell, and Frank Lamy  
doi:10.2973/odp.proc.sr.202.212.2007

## CD-ROM CONTENTS: DRILLING LOCATION MAPS

A site map showing the drilling locations for this leg and maps showing the drilling locations of all Ocean Drilling Program (ODP) and Deep Sea Drilling Project (DSDP) drilling sites are available in PDF format.

[ODP Leg 202 Site Map](#)

[ODP Map](#) (Legs 100–210)

[DSDP Map](#) (Legs 1–96)

## CD-ROM CONTENTS: INDEX TO LEG 202 *INITIAL REPORTS AND SCIENTIFIC RESULTS VOLUMES*

The index covers both the *Initial Reports* and *Scientific Results* portions of Volume 202 of the *Proceedings of the Ocean Drilling Program*. The index contains a subject and taxonomic index.

[Index to Leg 202](#)

## CD-ROM CONTENTS: COMPILED ELECTRONIC INDEX

The Compiled Electronic Index of the *Proceedings of the Ocean Drilling Program* contains the indexes of Volumes 101–205. The indexes are contained in the directory titled ODPINDEX and are named ###NDX.PDF (### = the leg number). These indexes can be searched individually or collectively. For information on using the Acrobat search function, see the Help function in Adobe Reader.

# CD-ROM DIRECTORY STRUCTURE

<b>202SR.PDF</b> (Preliminary pages and table of contents)		
<b>README.TXT</b> (ASCII version of information about the volume CD-ROM)		
<b>ACROREAD</b> (Acrobat Reader installation software and instructions for different platforms)	<b>MAC_OS</b>	
	<b>UNIX</b>	
	<b>WINDOWS</b>	
	<b>README.TXT</b>	
<b>MAPS</b> (Drilling location maps)	<b>202_MAP.PDF</b> (Leg 202 site map)	
	<b>ODPMAP.PDF</b> (ODP map, Legs 100 through 210)	
	<b>DSDPMAP.PDF</b> (DSDP map, Legs 1 through 96)	
<b>VOLUME</b> (Leg 202 <i>Scientific Results</i> volume)	<b>SYNTH</b> (Overview chapter)	<b>SYNTH.PDF</b> (Leg 202 Synthesis: Southeast Pacific Paleooceanography)
	<b>CHAPTERS</b> (Volume chapters)	<b>208.PDF</b> (Chapter 2: Paleomagnetic Secular Variation and Chronostratigraphy)
		<b>204.PDF</b> (Chapter 3: Magnetostratigraphic Calibration)
		<b>210.PDF</b> (Chapter 4: Timescales and Benthic Isotope Stratigraphies)
		<b>214.PDF</b> (Chapter 5: Data Report: Tropical and Equatorial Biostratigraphy)
		<b>213.PDF</b> (Chapter 6: Data Report: Radiolarian Biostratigraphy)
		<b>203.PDF</b> (Chapter 7: Data Report: Organic Carbon and Biomarker Variations)
		<b>205.PDF</b> (Chapter 8: Concentrations and Geochemistry, Nazca Ridge Site 1237)
		<b>207.PDF</b> (Chapter 9: Lack of Isotopic Fractionation of $\delta^{15}\text{N}$ )
		<b>202.PDF</b> (Chapter 10: Data Report: Major and Trace Element Data)
		<b>206.PDF</b> (Chapter 11: Data Report: Elemental Ratios and Isotope Records)
		<b>211.PDF</b> (Chapter 12: Tropical East Pacific Upper Ocean Stratification)
		<b>209.PDF</b> (Chapter 13: Pliocene Mixed-Layer Oceanography)
		<b>212.PDF</b> (Chapter 14: Paleomagnetic and Rock Magnetic Variability)
<b>OVERSIZE</b> (Large-format table)	<b>SR202205</b> (Chapter 8 file)	
<b>TABLES</b> (ASCII file of data table)	<b>SR202211</b> (Chapter 12 file)	
<b>202NDX.PDF</b> (Leg 202 <i>Proceedings</i> volume index)		
<b>ODPINDEX</b> (Compiled Electronic Index of the <i>Proceedings of the Ocean Drilling Program</i> )	<b>101NDX.PDF through 205NDX.PDF</b> (Index files)	