



## **PROCEEDINGS OF THE OCEAN DRILLING PROGRAM**

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

# PROCEEDINGS OF THE OCEAN DRILLING PROGRAM

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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).

This volume includes 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 in PDF. These maps were produced using Generic Mapping Tools (GMT) of Paul Wessel and Walter H.R. Smith ([gmt.soest.hawaii.edu](http://gmt.soest.hawaii.edu)).

Cover photograph is a bulkhead on the rig floor of the *JOIDES Resolution* by Mark Gilmore.

# 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 20 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

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# 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.

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# CD-ROM CONTENTS: INTRODUCTION AND CHAPTERS

## INTRODUCTION

### Introduction: Leg 184 Postcruise Research Bibliography

## CHAPTERS

### STRATIGRAPHY: BIOTIC, LITHIC, ISOTOPIC, AND MAGNETIC

- 1. Data Report: Mineral Magnetic Properties of Sediments from Site 1144, Northern South China Sea**  
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Manuscript number: 184SR-204
- 2. Toward a High-Resolution Stable Isotope Stratigraphy of the Last 1.1 m.y.: Site 1144, South China Sea**  
Christian Bühring, Michael Sarnthein, and Helmut Erlenkeuser  
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- 3. Data Report: Oxygen and Carbon Isotopes from Site 1146, Northern South China Sea**  
Steven C. Clemens and Warren L. Prell  
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- 4. Data Report: Stable Isotopes from Site 1143**  
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- 5. Data Report: Stable Isotopes from Sites 1147 and 1148**  
Xinrong Cheng, Quanhong Zhao, Jiliang Wang, Zhimin Jian, Peifen Xia, Baoqi Huang, Dianyong Fang, Jian Xu, Zhen Zhou, and Pinxian Wang  
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- 6. Data Report: Diatom Records of ODP Site 1143 in the Southern South China Sea**  
Jun Lu, Muhong Chen, Rujian Wang, and Vladimar S. Pushkar  
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- 7. Oligocene–Early Miocene Dinoflagellate Stratigraphy, Site 1148, ODP Leg 184, South China Sea**  
Shaozhi Mao, Guoxuan Wu, and Jie Li  
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- 8. Miocene Planktonic Foraminiferal Biostratigraphy of Sites 1143 and 1146, ODP Leg 184, South China Sea**  
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  - 9. Oligocene–Miocene Planktonic Foraminifer Biostratigraphy, Site 1148, Northern South China Sea**  
Qianyu Li, Zhimin Jian, and Baohua Li  
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  - 10. Early Oligocene–Pleistocene Calcareous Nannofossil Biostratigraphy of the Northern South China Sea (Leg 184, Sites 1146–1148)**  
Xin Su, Yilin Xu, and Quiang Tu  
Manuscript number: 184SR-224
  - 11. Abundance Variations of Planktonic Foraminifers during the Mid-Pleistocene Climate Transition at ODP Site 1144, Northern South China Sea**  
Fan Zheng, Quanyu Li, Xia Tu, Muhong Chen, Baohua Li, and Zhimin Jian  
Manuscript number: 184SR-222
- GEOCHEMISTRY, MINERALOGY, AND SEDIMENTOLOGY**
- 12. Geochemistry of Pliocene Sediments from ODP Site 1143 (Southern South China Sea)**  
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Manuscript number: 184SR-201
  - 13. Geochemical and Stable Isotopic Compositions of Pore Fluids and Authigenic Siderite Concretions from Site 1146, ODP Leg 184: Implications for Gas Hydrate**  
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Manuscript number: 184SR-202
  - 14. Data Report: Late Miocene–Pleistocene Mineralogy, Site 1146**  
Eve Arnold  
Manuscript number: 184SR-203
  - 15. Origin and Nature of Green Clay Layers, ODP Leg 184, South China Sea**  
Federica Tamburini, Thierry Adatte, and Karl B. Föllmi  
Manuscript number: 184SR-206
  - 16. Data Report: Carbonate and Organic Carbon Contents of Sediments from Sites 1143 and 1146 in the South China Sea**  
Li-Wen Wang and Hui-Ling Lin  
Manuscript number: 184SR-207

**17. Alkenone Stratigraphy of the Northern South China Sea for the Past 35 m.y., Sites 1147 and 1148, ODP Leg 184**

J.L. Mercer and M. Zhao  
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**18. Data Report: Marine and Terrigenous Lipids in the Sediments from the South China Sea, Site 1148, Leg 184**

Ping'an Peng, Chiling Yu, Guodong Jia, Jinafang Hu, Jianzhong Song, and Gan Zhang  
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S. Boulay, C. Colin, A. Trentesaux, F. Pluquet, J. Bertaux, D. Blamart, C. Buehring, and P. Wang  
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**20. Isotopic Chemistry of Organic Carbon in Sediments from Leg 184**

Joel S. Leventhal  
Manuscript number: 184SR-215

**21. Data Report: Late Miocene–Quaternary Biogenic Opal Accumulation at ODP Site 1143, Southern South China Sea**

Rujian Wang, Jianru Li, and Baohua Li  
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**22. Data Report: Pleistocene Paleoclimatic Cyclicity of Southern China: Clay Mineral Evidence Recorded in the South China Sea (ODP Site 1146)**

Alain Trentesaux, Zhifei Liu, Christophe Colin, Sébastien Boulay, and Pinxian Wang  
Manuscript number: 184SR-210

# CD-ROM CONTENTS: ASCII TABLES

This CD-ROM contains ASCII versions of selected data tables. A complete listing of the ASCII data tables can be found below.

You can access these data directly from the PDF files. Depending on your computer platform, the following information applies.

## PC COMPUTERS

By default, clicking on a filename with a .TXT extension will launch the Notepad application. You can configure your computer's operating system so that files on this CD with .TXT extensions automatically open in other software, such as Microsoft Excel. Follow these steps from the pull-down menu: Windows 95 and NT operating systems: View > Options > File Types; and Windows 98, 2000, ME, and XP systems: View > Folder Options > File Types.

## MAC COMPUTERS

All table files with .TXT extensions will automatically open into Excel. If you do not have Excel installed on your computer, you may view these files through other spreadsheet or text-editor programs. Open the application of your choice, select File > Open, and open the ASCII file.

## UNIX COMPUTERS

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## 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 184 Site Map](#)

[ODP Map](#) (Legs 100–Current)

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## CD-ROM CONTENTS: INDEX TO LEG 184 *INITIAL REPORTS AND SCIENTIFIC RESULTS VOLUMES*

The index covers both the *Initial Reports* and *Scientific Results* portions of Volume 184 of the *Proceedings of the Ocean Drilling Program*. The index contains a subject and taxonomic index.

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## CD-ROM CONTENTS: COMPILED ELECTRONIC INDEX

The Compiled Electronic Index of the *Proceedings of the Ocean Drilling Program* contains the indexes of Volumes 101–178, 180–184, 186–192, and 196. 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 [“Searching a PDF Document”](#) in README.PDF.

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