

**DRILLING GAS HYDRATES ON HYDRATE RIDGE,  
CASCADIA CONTINENTAL MARGIN  
SITES 1244-1252**



**VOLUME 204  
INITIAL REPORTS**

**PROCEEDINGS OF THE  
OCEAN DRILLING PROGRAM**

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

# PROCEEDINGS OF THE OCEAN DRILLING PROGRAM

Volume 204

Initial Reports

Drilling Gas Hydrates on Hydrate Ridge,  
Cascadia Continental Margin

Covering Leg 204 of the cruises of the Drilling Vessel *JOIDES Resolution*  
Victoria, British Columbia, Canada, to Victoria, British Columbia, Canada  
Sites 1244–1252  
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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:

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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.

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 bulk of the shipboard-collected data from this leg is available on the World Wide Web and is accessible at [www-odp.tamu.edu/database](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 77845-9547, USA. E-mail: [database@odpemail.tamu.edu](mailto:database@odpemail.tamu.edu).

Some close-up photographs of very dark cores have been tonally enhanced to better illustrate particular features of interest.

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

The cover photograph shows a sample of gas hydrate recovered from 2.69 meters below seafloor near the summit of Hydrate Ridge during Leg 204 (Sample 204-1250D-1H-CC, 12–14 cm). It illustrates one of the many different types of hydrate fabric observed during Leg 204. In this sample, horizontal layering probably reflects in situ hydrate formation parallel to the bedding. Vertical sediment-filled cracks likely reflect disruption caused by drilling. The photograph is by ODP Photographer John Beck.

# 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, and the fluctuations of climate. In addition, study of the Earth's deep biosphere is an emergent research objective.

ODP, an international partnership of scientists and research institutions from 22 countries, operates the drillship *JOIDES Resolution*. This state-of-the-art research vessel contains eight levels of laboratories and other scientific facilities required for carrying out the program's objectives.

The management of ODP involves a partnership of scientists and governments. International oversight and coordination are provided by the ODP Council, which is made up of representatives from the member countries. Overall scientific and management guidance is provided by representatives from the Joint Oceanographic Institutions for Deep Earth Sampling (JOIDES).

Joint Oceanographic Institutions, Inc. (JOI), a nonprofit consortium of 18 U.S. oceanographic institutions, serves as the National Science Foundation's prime contractor for ODP. JOI implements scientific objectives, plans, and recommendations of the JOIDES committees through major 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 have worked together successfully for many years to manage the Ocean Drilling Program. We look forward to many exciting discoveries and continued international collaboration as we further our scientific mission, especially the planning for the future of ocean drilling beyond 2003.

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We recognize that several aspects of the logistics of this leg—almost no transit to, from, and between sites; the difficulties in handling and processing gas hydrate samples quickly; the amount and complexity of new instrumentation brought in for this leg; and the record-keeping complications caused by returning to sites multiple times—presented significant challenges to the personnel, supplies, and data handling on board. We thank the ODP staff and the crew of the *JOIDES Resolution* for responding to these challenges with efficiency and good humor. We are also grateful to the Catermar crew for ensuring a pleasant working environment.

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# CD-ROM CONTENTS: CHAPTERS

1. **Leg 204 Summary**  
Shipboard Scientific Party
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Shipboard Scientific Party

# CD-ROM CONTENTS: CORE DESCRIPTIONS

Visual core descriptions (VCDs) and smear slide and thin section data tables are included in this section. ASCII versions of the smear slide data tables are also available (see [“ASCII Tables”](#)).

## Site 1244

[Visual Core Descriptions](#) · [Smear Slides](#)

## Site 1245

[Visual Core Descriptions](#) · [Smear Slides](#) · [Thin Sections](#)

## Site 1246

[Visual Core Descriptions](#) · [Smear Slides](#)

## Site 1247

[Visual Core Descriptions](#) · [Smear Slides](#)

## Site 1248

[Visual Core Descriptions](#) · [Smear Slides](#) · [Thin Sections](#)

## Site 1249

[Visual Core Descriptions](#) · [Smear Slides](#)

## Site 1250

[Visual Core Descriptions](#) · [Smear Slides](#)

## Site 1251

[Visual Core Descriptions](#) · [Smear Slides](#) · [Thin Sections](#)

## Site 1252

[Visual Core Descriptions](#) · [Smear Slides](#)



## CD-ROM CONTENTS: ASCII TABLES

This CD-ROM contains ASCII versions of all of the [smear slide data tables](#) presented under “Core Descriptions.” A complete listing of the ASCII tables can be found listed below.

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

### PC COMPUTERS

By default, double-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.

### MACINTOSH 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

You can open files with .TXT extensions in any text editor or spreadsheet program but not directly from PDF files.

### [Smear slide data tables](#)

## Smear Slide Data Tables

**Site 1244** smear slide table.

**Site 1245** smear slide table.

**Site 1246** smear slide table.

**Site 1247** smear slide table.

**Site 1248** smear slide table.

**Site 1249** smear slide table.

**Site 1250** smear slide table.

**Site 1251** smear slide table.

**Site 1252** smear slide table.

## 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 204 Site Map](#)

[ODP Map](#) (Legs 100–204)

[DSDP Map](#) (Legs 1–96)

## RELATED LEG DATA

### DOWNHOLE LOGGING AND CORE DATA

A CD-ROM containing processed logging data and a subset of core data is included with the printed version of this volume. However, a more complete set of the logging data collected by ODP Logging Services is available online at [www.ldeo.columbia.edu/BRG/ODP/DATABASE/DATA/search.html](http://www.ldeo.columbia.edu/BRG/ODP/DATABASE/DATA/search.html). If you have problems downloading the data, wish to receive additional logging data, or have questions regarding the data, please contact: Data Services Manager, ODP Logging Services, Borehole Research Group, Lamont-Doherty Earth Observatory of Columbia University, PO Box 1000, 61 Route 9W, Palisades NY 10964, USA; Tel: (845) 365-8343; Fax: (845) 365-3182; E-mail: [logdb@ldeo.columbia.edu](mailto:logdb@ldeo.columbia.edu).

The majority of the core data on the CD are available on the Web at [www-odp.tamu.edu/database](http://www-odp.tamu.edu/database). If you cannot access the ODP database or need additional data, please contact: ODP Data Librarian, Ocean Drilling Program, Texas A&M University, 1000 Discovery Drive, College Station TX 77845-9547, USA; Tel: (979) 845-8495; Fax: (979) 458-1617; E-mail: [database@odpemail.tamu.edu](mailto:database@odpemail.tamu.edu).

## COMPILED ELECTRONIC INDEX

The Compiled Electronic Index of the *Proceedings of the Ocean Drilling Program* included on the volume CD-ROM contains individual indexes of Volumes 101–178, 180, 183, and 186. 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.

# CD-ROM DIRECTORY STRUCTURE

## 204IR.PDF

(Preliminary pages and table of contents)

## README.PDF

(Information about the volume CD-ROM)

## README.TXT

(ASCII version of information about the volume CD-ROM)

## ACROREAD

(Acrobat Reader installation software and instructions for different platforms)

### MAC

### WINDOWS

### UNIX

### README.TXT

## MAPS

(Drilling location maps)

**204\_MAP.PDF** (Leg 204 site map)

**ODPMAP.PDF** (ODP map, Legs 100 through 204)

**DSDPMAP.PDF** (DSDP map, Legs 1 through 96)

## VOLUME

(Leg 204 *Initial Reports* volume)

### CHAPTERS

(Volume chapters)

**IR204\_01.PDF** (Leg 204 Summary)

**IR204\_02.PDF** (Explanatory Notes)

**IR204\_03.PDF** (Site 1244)

**IR204\_04.PDF** (Site 1245)

**IR204\_05.PDF** (Site 1246)

**IR204\_06.PDF** (Site 1247)

**IR204\_07.PDF** (Site 1248)

**IR204\_08.PDF** (Site 1249)

**IR204\_09.PDF** (Site 1250)

**IR204\_10.PDF** (Site 1251)

**IR204\_11.PDF** (Site 1252)

### CORES

(Visual core descriptions, smear slide and thin section data tables, and digital core images)

**COR\_1244.PDF** (Site 1244)

**COR\_1245.PDF** (Site 1245)

**COR\_1246.PDF** (Site 1246)

**COR\_1247.PDF** (Site 1247)

**COR\_1248.PDF** (Site 1248)

**COR\_1249.PDF** (Site 1249)

**COR\_1250.PDF** (Site 1250)

**COR\_1251.PDF** (Site 1251)

**COR\_1252.PDF** (Site 1252)

**IMAGES** (PDF files of core images)

### TABLES

(ASCII versions of smear slide data tables)

**S\_SLIDES** (Sites 1244 through 1252)

**README.TXT**

### INDEX.PDX

(Acrobat file used to enable Acrobat Search of the Leg 204 *Initial Reports*)

## ODPINDEX

(Compiled Electronic Index of the *Proceedings of the Ocean Drilling Program*)

**101NDX.PDF through 178NDX.PDF, 180NDX.PDF, 183NDX.PDF, and 186NDX.PDF**  
(Index files)

### NDX.PDX

(Acrobat file used to enable Acrobat Search of the Compiled Electronic Index)