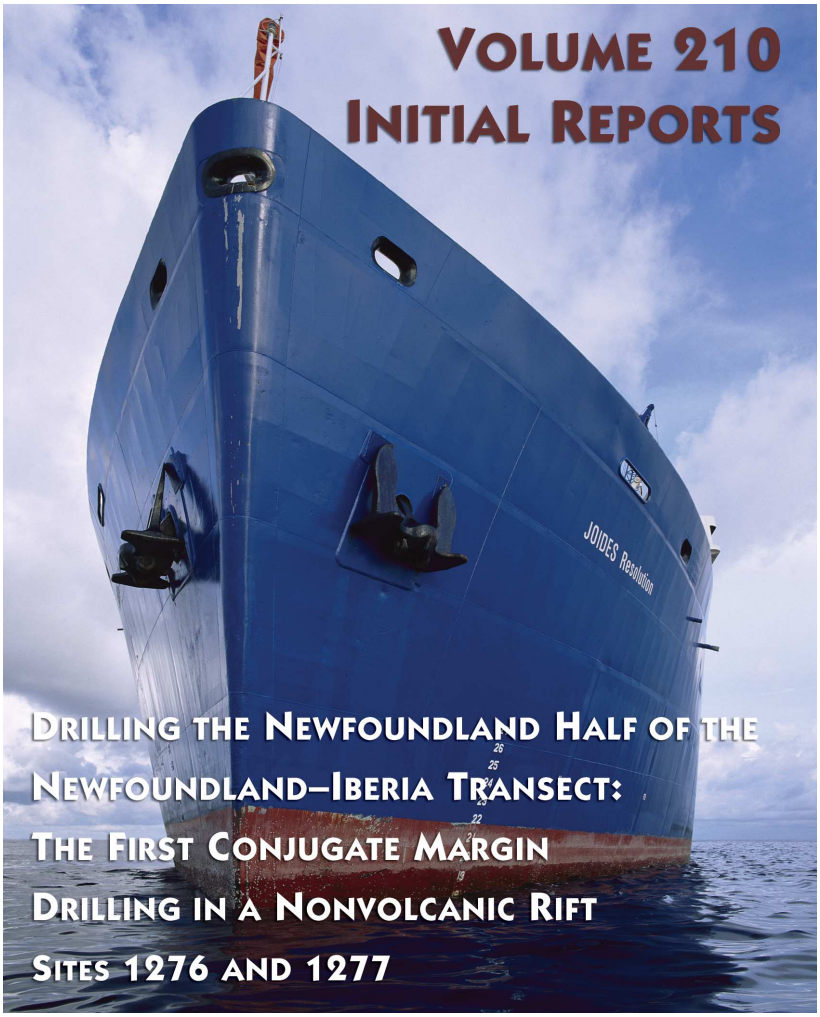


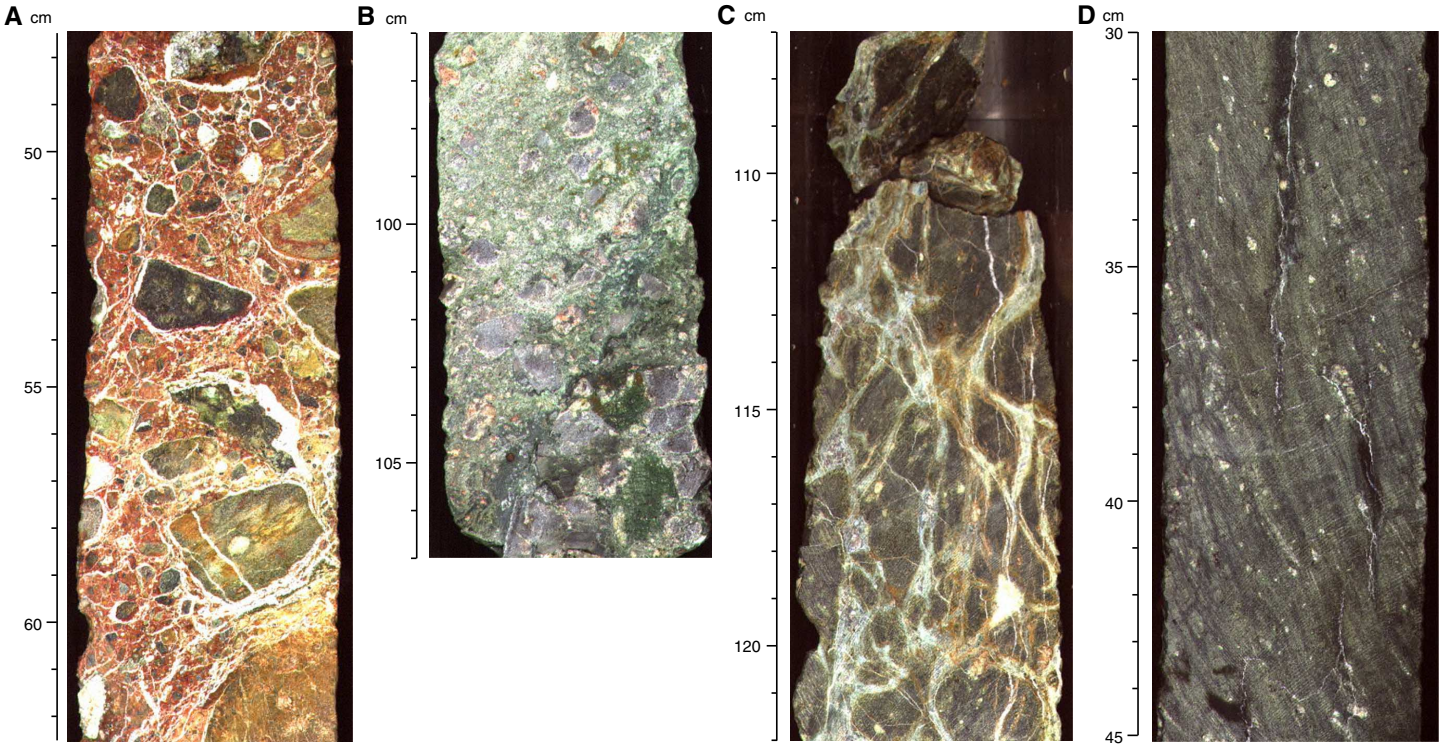
Volume 210
Initial Reports

Drilling the Newfoundland Half of the Newfoundland–Iberia Transect: The First Conjugate Margin Drilling in a Nonvolcanic Rift

Sites 1276 and 1277

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.



Frontispiece. Examples of basement rocks cored at Site 1277 in the Newfoundland Basin. **A.** A mass-flow deposit consisting of subangular to rounded clasts of serpentinized peridotite (with spinel foliation) and rare gabbros in a clay-rich calcareous matrix (interval 210-1277A-4R-1, 47.5–62.5 cm; 123.5 mbsf). **B.** An altered gabbro containing plagioclase and pyroxene porphyroblasts in a strongly altered, weakly foliated, chlorite-rich matrix (interval 210-1277A-2R-1, 96–107 cm; 104.9 mbsf) lies ~19 meters above A. The gabbro is interpreted to be a sliver of crust displaced by mass movement at the contemporary seafloor. Only serpentinized peridotites were recovered in the lower part of the hole, and these are interpreted to represent in situ basement that was unaffected by mass wasting. **C.** A homogeneous, foliated, porphyroclastic serpentinized peridotite dissected by a polyphase network of calcite and talc veins (interval 210-1277A-7R-2, 107–122 cm; 154.3 mbsf). **D.** A massive, foliated, serpentinized peridotite (harzburgite). The strong foliation is interpreted to be mylonitic (crystal-plastic recrystallization of olivine with porphyroblasts of pyroxene) (interval 210-1277A-9R-4, 30–45 cm; 175.3 mbsf).

Proceedings of the Ocean Drilling Program

Volume 210
Initial Reports
Drilling the Newfoundland Half of the Newfoundland–Iberia Transect: The First Conjugate Margin Drilling in a Nonvolcanic Rift

Covering Leg 210 of the cruises of the Drilling Vessel *JOIDES Resolution*
St. Georges, Bermuda, to St. John's, Newfoundland
Sites 1276 and 1277
6 July–6 September 2003

SHIPBOARD SCIENTISTS
Brian E. Tucholke, Jean-Claude Sibuet, Adam Klaus,
Michela Arnaboldi, Heike Delius, Anna V. Engström, Bruno Galbrun, Silvia Gardin, Richard N. Hiscott,
Garry D. Karner, Bryan C. Ladner, R. Mark Leckie, Chao-Shing Lee, Gianreto Manatschal,
Kathleen M. Marsaglia, Thomas K. Pletsch, Jörg Pross, Alastair H.F. Robertson, Dale S. Sawyer,
Derek E. Sawyer, Donna Shillington, Masaaki Shirai, Thérèse Shryane, Sharon Audra Stant,
Hiroyuki Takata, Elspeth Urquhart, Chris Wilson, Xixi Zhao

SHIPBOARD STAFF SCIENTIST
Adam Klaus

VOLUME EDITOR
Heather Nevill

VOLUME GRAPHIC DESIGNER
Deborah L. Partain

VOLUME PRODUCTION EDITOR
Kenneth R. Sherar

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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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Deutsche Forschungsgemeinschaft (Federal Republic of Germany)

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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**. If you cannot access this site or need additional data, please contact the Data Librarian, Integrated Ocean Drilling Program, Texas A&M University, College Station TX 77845-9547, USA. E-mail: **database@iodp.tamu.edu**.

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

Supplemental data on the volume CD-ROM were provided by the authors and may not conform to ODP publication standards.

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**).

Cover photograph of the *JOIDES Resolution* at sea on her final Ocean Drilling Program leg 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, 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
President of the Joint Oceanographic Institutions and Executive Director of the Ocean Drilling Programs
Washington, D.C.

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

Member Organizations of the Joint Oceanographic Institutions for Deep Earth Sampling (JOIDES)

Columbia University, Lamont-Doherty Earth Observatory

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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

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**
Web site: **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**
Web site: **iodp.tamu.edu**

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**
Web site: **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**
Web site: **ssdb.ldeo.columbia.edu**

Leg 210 Participants*

Shipboard Scientific Party

Co-Chief Scientist
Brian E. Tucholke
Department of Geology and Geophysics
Woods Hole Oceanographic Institution
MS 22
Woods Hole MA 02543-1541
USA
btucholke@whoi.edu

Co-Chief Scientist
Jean-Claude Sibuet
Ifremer Centre de Brest
BP 70
29280 Plouzané Cedex
France
jcsibuet@ifremer.fr

Staff Scientist
Adam Klaus
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
aklaus@iodp.tamu.edu

Michela Arnaboldi
Organic Geochemist
Department of Geological Sciences
University of Michigan
2534 C.C. Little Building
425 East University Avenue
Ann Arbor MI 48109-1063
USA
marna@umich.edu

Heike Delius
Logging Staff Scientist
Department of Geology
University of Leicester
University Road
Leicester LE1 7RH
United Kingdom
hd21@leicester.ac.uk

Anna V. Engström
Petrologist
Department of Geology and Geochemistry
Stockholm University
10691 Stockholm
Sweden
anna@geo.su.se

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

Bruno Galbrun
Paleomagnetist
Département de Géologie Sédimentaire
Université Pierre et Marie Curie
Case 117
4 Place Jussieu
75252 Paris Cedex 05
France
bgalbrun@ccr.jussieu.fr

Silvia Gardin
Paleontologist (nannofossils)
CNRS FR 32 "CEPAGE"
Université Pierre et Marie Curie
4 Place Jussieu
Case 104
75252 Paris Cedex 05
France
gardin@ccr.jussieu.fr

Richard N. Hiscott
Sedimentologist
Earth Sciences Department
Memorial University of Newfoundland
St. John's NF A1B 3X5
Canada
rhiscott@mun.ca

Garry D. Karner
Physical Properties Specialist
Marine Geology and Geophysics
Lamont-Doherty Earth Observatory
of Columbia University
PO Box 1000, 61 Route 9W
Palisades NY 10964
USA
garry@ldeo.columbia.edu

Bryan C. Ladner
Paleontologist (nannofossils)
Department of Geological Sciences
Florida State University
108 Carraway Building
Tallahassee FL 32306-4100
USA
ladner@gly.fsu.edu

R. Mark Leckie
Paleontologist (foraminifers)
Department of Geosciences
University of Massachusetts
611 North Pleasant Street
Amherst MA 01003
USA
mleckie@geo.umass.edu

Chao-Shing Lee
Physical Properties Specialist
Institute of Applied Geophysics
National Taiwan Ocean University
2 Pei-Ning Road
Keelung 202
Taiwan
leecs@mail.ntou.edu.tw

Gianreto Manatschal
Structural Geologist
Centre de Géochimie de la Surface
Ecole et Observatoire des Sciences de le Terre
1 Rue Blessig
67084 Strasbourg
France
manatschal@illite.u-strasbg.fr

Kathleen M. Marsaglia
Sedimentologist
Department of Geological Sciences
California State University, Northridge
18111 Nordhoff Street
Northridge CA 91330-8266
USA
kathie.marsaglia@csun.edu

Thomas K. Pletsch
Sedimentologist
Technical Mineralogy and Sedimentology Section
Bundesanstalt für Geowissenschaften und Rohstoffe
Stilleweg 2
30655 Hannover
Germany
t.pletsch@bgr.de

Jörg Pross
Paleontologist (palynomorphs)
Institut für Geowissenschaften
Universität Tübingen
Sigwartstrasse 10
72076 Tübingen
Germany
joerg.pross@uni-tuebingen.de

Alastair H.F. Robertson
Sedimentologist
Grant Institute of Earth Science
School of Geosciences
University of Edinburgh
West Mains Road
Edinburgh EH9 3JW
United Kingdom
Alastair.Robertson@ed.ac.uk

Dale S. Sawyer
Physical Properties Specialist
Department of Earth Science
Rice University MS-126
PO Box 1892
Houston TX 77001-1892
USA
dale@rice.edu

Derek E. Sawyer
Physical Properties Specialist
Department of Geosciences
Pennsylvania State University
320 Deike Building
University Park PA 16802
USA
dsawyer@geosc.psu.edu

Donna Shillington
Logging Scientist
Southampton Oceanography Centre
European Way
Southampton SO14 3ZH
United Kingdom
djshill@soc.soton.ac.uk

Masaaki Shirai
Sedimentologist
Ocean Research Institute
University of Tokyo
1-15-1 Minamidai
Nakano, Tokyo 164-8639
Japan
shirai@ori.u-tokyo.ac.jp

Thérèse Shryane
Structural Geologist
Galway Geofluids Research Centre
Department of Earth and Oceanographic Science
National University of Ireland, Galway
Galway
Ireland
shryane@ireland.com

Sharon Audra Stant
Student Trainee
Department of Geological Sciences
Florida State University
108 Carraway Building
Tallahassee FL 32306-4100
USA
stant@gly.fsu.edu

Hiroyuki Takata
Paleontologist (foraminifers)
Research Center of Coastal Lagoon Environments
Shimane University
Nishi-kawatsu 1060
Matsue, Shimane 690-8504
Japan
yuu@soc.shimane-u.ac.jp

Elspeth Urquhart
Paleontologist (foraminifers/radiolarians)
Rosenstiel School of Marine and Atmospheric Science
University of Miami
4600 Rickenbacker Causeway
Miami FL 33149
USA
eurquhart@rsmas.miami.edu

Chris Wilson
Sedimentologist
Department of Earth Sciences
The Open University
Walton Hall
Milton Keynes MK7 6AA
United Kingdom
r.c.l.wilson@open.ac.uk

Xixi Zhao
Paleomagnetist
Department of Earth Sciences
University of California, Santa Cruz
1156 High Street
Santa Cruz CA 95064
USA
xzhao@es.ucsc.edu

Transocean Officials

Pete Mowat
Master of the Drilling Vessel
Overseas Drilling Ltd.
707 Texas Avenue South, Suite 213D
College Station TX 77840-1917
USA

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

ODP Shipboard Personnel

Christopher Bennight
Marine Laboratory Specialist (Chemistry)

Gerald W. Bode
Marine Laboratory Specialist (Curator)

Timothy Bronk
Assistant Laboratory Officer

Jason Deardorff
Marine Laboratory Specialist (Core)

David Fackler
Programmer

Kevin Grigar
Drilling Engineer

Michael Hodge
Marine Computer Specialist

Shannon Housley
Marine Laboratory Specialist (Photographer)

Brian Jonasson
Operations Manager

Peter Kannberg
Marine Laboratory Specialist (Core)

Steve Kittredge
Schlumberger Engineer

Jurie Kotzé
Marine Electronics Specialist

William Mills
Laboratory Officer

David Morley
Marine Computer Specialist

Deborah L. Partain
Marine Laboratory Specialist (Yeoperson)

Pieter Pretorius
Marine Electronics Specialist

Patrick Riley
Marine Laboratory Specialist
(Physical Properties)

Johanna Suhonen
Marine Laboratory Specialist
(Underway Geophysics)

Paul Ténière
Marine Laboratory Specialist (Paleomagnetism)

Robert Wheatley
Marine Laboratory Specialist (Chemistry)

Publication Services Staff*

Karen Benson
Production Specialist II

Anthony Tyler Caviness
Student Assistant

Gudelia ("Gigi") Delgado
Senior Publications Coordinator

Jaime A. Gracia
Supervisor of Production

Mendy A. Harrison
Assistant Editor

Michiko Hitchcox
Yeoperson

Kathryn M. Johnson
Graphics Specialist

Jennie L. Lamb
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Editor

Nancy H. Luedke
Graphics Specialist II

Amy McWilliams
Editor

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Mary Elizabeth Mitchell
Publications Coordinator Assistant

Heather M. Nevill
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Deborah L. Partain
Supervisor of Graphics

Lorri L. Peters
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Administrative Assistant

Jennifer Pattison Rumford
Electronic Publications Specialist

Kellie Scamardo
Production Specialist II

Kenneth Sherar
Production Specialist II

Katherine W. Steuer
Student Assistant

Ann Yeager
Distribution Specialist

*At time of publication.

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The first ocean drilling that was planned specifically to undertake conjugate-margin sampling in a nonvolcanic rift was accomplished during Ocean Drilling Program (ODP) Leg 210. The initial vision for such drilling dates back to the days of the Deep Sea Drilling Project, and it was carried forward by the Joint Oceanographic Institutions for Deep Earth Sampling (JOIDES) Passive Margin Panel and Atlantic Regional Panel before being codified in a report by the JOIDES North Atlantic Rifted Margins Detailed Planning Group in 1991. We thank the individuals on these panels who acted as advocates for conjugate-margin drilling. Throughout this period and up to the present, many others participated in workshops, discussions, and development of proposals for drilling in the Newfoundland–Iberia rift and on the Newfoundland margin. Contributions by J. Austin, G. Boillot, M.C. Comas, N.W. Driscoll, M. Enachescu, A. Grant, F. Gradstein, W.S. Holbrook, J. Hopper, L. Jansa, C. Keen, H.C. Larsen, K.E. Louden, P.R. Miles, T. Minshull, D.S. Sawyer, J.-C. Sibuet, S.P. Srivastava, B.E. Tucholke, and R.B. Whitmarsh are particularly acknowledged.

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The engineering and drilling challenges for drilling a projected 2-km hole during Leg 210 were enormous, and the program required careful planning and execution. We thank G. Pollard for help with the initial drilling, casing, and coring plan. We are particularly grateful to Brian Jonasson, Leg 210 Operations Manager, for his contributions to developing this plan and for his expert guidance during the shipboard operations. He, together with Drilling Superintendent Tim McCown and the dedicated Transocean drilling crew, assured that we were well informed as we pursued our deep-drilling objectives and that we followed our objectives as aggressively as possible while always maintaining safe operating conditions. We also wish to acknowledge the help of John MacIntosh, Transocean Electrical Supervisor, who was instrumental in successfully completing numerous reentries under the exceptionally difficult conditions of having to deal with both a completely buried reentry cone and strong, muddy bottom currents; John even accepted suggestions from the “upstart” Co-Chief Scientists with good cheer.

The shipboard technical staff, led by Laboratory Officer William Mills, provided outstanding support for all the scientific operations during the cruise. Steve Kittredge, Schlumberger Logging Engineer, provided astute advice as we attempted logging operations in the difficult hole conditions of Site 1276. We are grateful to George Claypool, who was available 24/7 to give advice from shore about organic geochemistry and hydrocarbon monitoring during drilling and coring operations. We also thank Barry Freifield, who kindly provided and set up on the ship a portable X-ray computed tomographic imaging system for use during Leg 210.

We thank Captain Pete Mowat and the ship's Transocean crew, as well as the Catermar staff, for their service throughout Leg 210. Their courtesy, dedication, and professionalism were central both to successful operations and to congenial shipboard life during the leg.

A special thanks is due to Adam Klaus, Shipboard Staff Scientist, who was invaluable in organizing shipboard scientific operations, maintaining communication among the diverse group of scientists during Leg 210, and, especially, guiding the Co-Chief Scientists through myriad details of how best to accomplish our scientific objectives (in addition to providing excellent cappuccino at critical moments!).

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CD-ROM Contents: Chapters

1. **Leg 210 Summary**
   Shipboard Scientific Party

2. **Explanatory Notes**
   Shipboard Scientific Party

3. **Site 1276**
   Shipboard Scientific Party

4. **Site 1277**
   Shipboard Scientific Party

5. **Data Report: Marine Geophysical Data on the Newfoundland Nonvolcanic Rifted Margin around SCREECH Transect 2**
   Donna J. Shillington, W. Steven Holbrook, Brian E. Tucholke, John R. Hopper, Keith E. Louden, Hans Christian Larsen, Harm J.A. Van Avendonk, Sharon Deemer, and Jeremy Hall

CD-ROM Contents: Core Descriptions

Visual core descriptions (VCDs); smear slide and thin section data tables; piece, vein, and magmatic segregation logs; and digital images are included in this section. VCDs; smear slide and thin section data tables; piece, vein, and magmatic segregation logs are combined into one PDF file for each site. ASCII versions of smear slide data tables are also available (see **"ASCII Tables"**).

Site 1276

Visual Core Descriptions · Smear Slides · Thin Sections · Piece Log · Vein Log · Magmatic Segregation Log

Site 1277

Visual Core Descriptions · Piece Log

CD-ROM Contents: ASCII Tables

This CD-ROM contains **ASCII** versions of paleomagnetic data tables from the "Site 1277" chapter and all of the **smear slide data tables** presented under "Core Descriptions." A complete listing of the ASCII 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, 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.

Chapter 4, Site 1277

Table T2. Remanent magnetization intensity and inclination, Hole 1277A.
Table T3. Magnetic susceptibility measured with the point-susceptibility meter (AMST), Hole 1277A.

Smear Slide Data Tables

Hole 1276A smear slide table.

CD-ROM Contents: Supplementary Material

The *Initial Reports* CD-ROM contains supplementary material data files presented as PDF and Excel 97/98 spreadsheets. The files present a common midpoint navigation map and an expanded coring summary table. Supplementary material files are located in the SUPP_MAT directory.

CMP_NAV
CMP_NAV.PDF

CORE_SUM
1276_SUM.XLS

README.TXT

CD-ROM Contents: Drilling Location Maps

Two site maps 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.

ODP Leg 210 Site Map

ODP Map (Legs 100–210)

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**. 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**.

The majority of the core data on the CD are available on the Web at **www-odp.tamu.edu/database**. If you cannot access the ODP database or need additional data, please contact: Data Librarian, Integrated 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@iodp.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, 186, 188, 189, and 192. 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.

CD-ROM Directory Structure

- **210IR.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)
  - **210_MAP.PDF** (Leg 210 site map)
  - **ODPMAP.PDF** (ODP map, Legs 100 through 210)
  - **DSDPMAP.PDF** (DSDP map, Legs 1 through 96)
- **VOLUME** (Leg 210 *Initial Reports* volume)
  - **CHAPTERS** (Volume chapters)
    - **IR210_01.PDF** (Leg 210 Summary)
    - **IR210_02.PDF** (Explanatory Notes)
    - **IR210_03.PDF** (Site 1276)
    - **IR210_04.PDF** (Site 1277)
    - **IR210_05.PDF** (Data Report: Marine Geophysical Data)
  - **CORES** (Visual core descriptions; smear slide and thin section data tables; piece, vein, and magmatic segregation logs; and digital core images)
    - **COR_1276.PDF** (Site 1276)
    - **COR_1277.PDF** (Site 1277)
    - **IMAGES** (PDF files of core images)
  - **TABLES** (ASCII tables of paleomagnetic and smear slide data)
    - **IR210_04** (Chapter 4 files)
    - **S_SLIDES** (Site 1276)
    - **README.TXT**
  - **OVERSIZE** (Large-format tables and figures)
    - **IR210_03** (Chapter 3 files)
    - **IR210_05** (Chapter 5 files)
  - **MOVIES** (QuickTime viewable movies)
    - **IR210_03** (Chapter 3 files)
    - **README.TXT**
  - **INDEX.PDX** (Acrobat file used to enable Acrobat Search of the 210 *Initial Reports*)
- **SUPP_MAT** (Supplementary Material)
  - **CMP_NAV** (CMP navigation map in PDF)
    - **CMP_NAV.PDF**
  - **CORE_SUM** (Hole 1276A expanded coring summary table in Excel)
    - **1276_SUM.XLS**
  - **README.TXT**

(Continued on next page)

CD-ROM Directory Structure (continued)

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

- **101NDX.PDF through 178NDX.PDF, 180NDX.PDF through 183NDX.PDF, 186NDX.PDF, 188NDX.PDF, 189NDX.PDF and 192NDX.PDF**
  (Index files)
- **NDX.PDX**
  (Acrobat file used to enable Acrobat Search of the Compiled Electronic Index)

QUIKTIME
(QuickTime 6.5.1 installation software and instructions for different platforms)

- **MAC**
- **WINDOWS**
- **README.TXT**