Proceedings of the International Ocean Discovery Program

Volume 399

Building Blocks of Life, Atlantis Massif

Expedition 399 of the R/V *JOIDES Resolution*
from and to Ponta Delgada, Portugal
Sites U1309 and U1601
12 April–12 June 2023

Volume authorship
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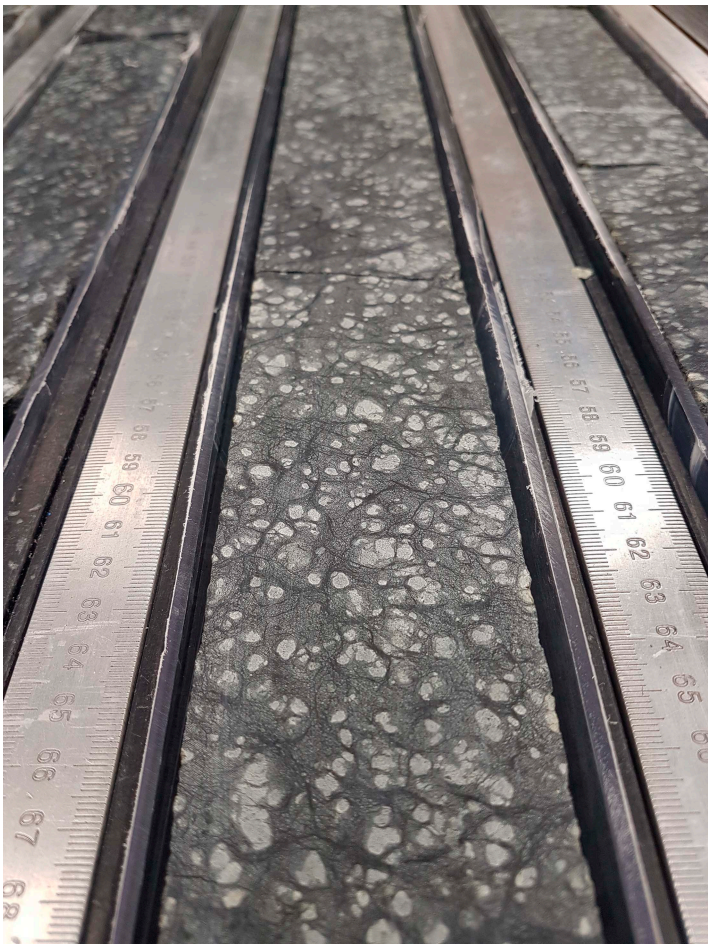

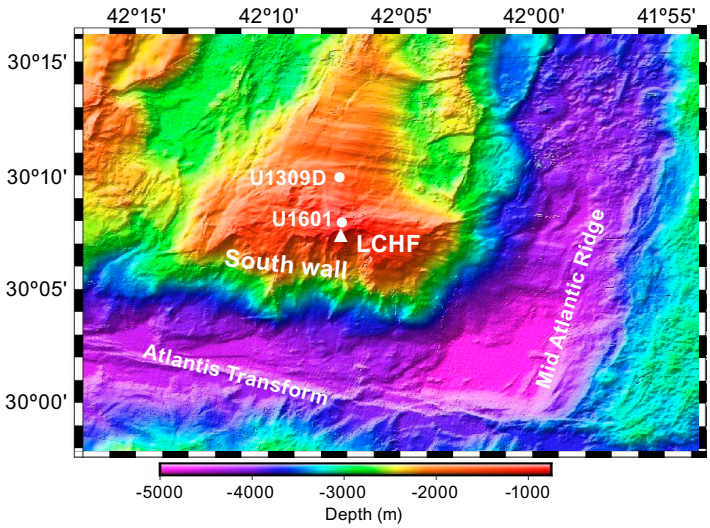

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The JRSO is supported by the NSF. Any opinions, findings, and conclusions or recommendations expressed in this material do not necessarily reflect the views of the NSF, the participating agencies, TAMU, or Texas A&M Research Foundation.

The bulk of the shipboard-collected core data from this expedition is accessible at **https://zenodo.org/communities/iodp** (see list of **available data sets**). If you cannot access this site or need additional data, please contact Data Librarian, International Ocean Discovery Program *JOIDES Resolution* Science Operator, Texas A&M University (**database@iodp.tamu.edu**).

A complete set of the logging data collected during the expedition is available at **http://mlp.ldeo.columbia.edu/logdb/scientific_ocean_drilling**. If you have problems downloading the data, wish to receive additional logging data, or have questions regarding the data, please contact Database Administrator, Borehole Research Group, Lamont-Doherty Earth Observatory of Columbia University (**logdb@ldeo.columbia.edu**).

Supplemental data were provided by the authors and may not conform to IODP publication formats.

JRSO expedition photos are the property of IODP and are public access.

Some core photographs have been tonally enhanced to better illustrate particular features of interest. High-resolution images are available upon request.

Cover photograph shows serpentinized harzburgites recovered during Expedition 399. Photo credit: Johan Lissenberg/Cardiff University and IODP JRSO.

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Expedition reports

Chapters

Core descriptions

Visual core descriptions (VCDs) are presented in PDF files for each site. Thin sections, smear slides, and/or tabular core description information for each site or hole are presented in tab-separated value (TSV) format or PDF in the CORES directory. The entire set of core images in PDF is available in the IMAGES directory.

Site U1309: **Visual core descriptions** · **Thin sections** · GEODESC files
Site U1601: **Visual core descriptions** · **Thin sections** · GEODESC files

Supplementary material

Supplementary material for the Volume 399 expedition reports includes petrophysics data in MLAPP, Microsoft Word, and Microsoft Excel formats. A full list of directories can be found in SUPP_MAT in the volume zip folder or on the **Supplementary material for Volume 399 expedition reports** web page.

Expedition research results

Data reports

Titles are available in **HTML**.

Drilling location maps

A site map showing the drilling locations for this expedition and maps showing the drilling locations of all International Ocean Discovery Program (IODP) expeditions, produced using QGIS (**http://www.qgis.org**), and all Integrated Ocean Drilling Program, Ocean Drilling Program (ODP), and Deep Sea Drilling Project (DSDP) expeditions, produced using Generic Mapping Tools (GMT) of Paul Wessel and Walter H.F. Smith (**https://www.generic-mapping-tools.org**), are available in PDF.

IODP Expedition 399 site map
IODP map
Integrated Ocean Drilling Program map (Expeditions 301–348)
ODP map (Legs 100–210)
DSDP map (Legs 1–96)

Dedication

In view of the imminent end of the current International Ocean Discovery Program and a 40 year international coordinated effort to study the ocean's vast subsurface, we dedicate this volume to the past and present staff of the *JOIDES Resolution* Science Operator (JRSO) and the R/V *JOIDES Resolution* who have allowed scientific discovery to be performed at the highest levels since the inception of the ocean drilling program.

The drilling successes achieved during Expedition 399 are a direct result of their accumulated knowledge and expertise.

Acknowledgments

We thank Donna Blackman, Beth Orcutt, Gretchen Früh-Green, Marianne Quemeneur, and Bénédicte Menez, who contributed significantly to the proposal and helped shape the scientific objectives and drilling targets. Antony Morris provided valuable input to the paleomagnetism experimental design and data processing. The operational difficulties encountered during the expedition could have resulted in severely diminished outcomes. We deeply thank the many members of the shipboard technical staff and crew who identified ways to accomplish the goals of the expedition safely, efficiently, and under continuously changing requirements. We also thank outreach officers Lesley Anderson and Sara Treadwell, who stepped in to carry out substantial shipboard activities. Shore-based *JOIDES Resolution* Science Operator (JRSO) personnel and Texas A&M University Environmental Health and Safety provided critical input and oversight throughout this time. Extensive postcruise activities were required to complete the core splitting, curation, imaging, core description, and sampling that was not carried out shipboard. We thank the JRSO personnel at the Gulf Coast Repository for their impressive efforts and innovative solutions in accomplishing these unplanned activities.

Foreword

The International Ocean Discovery Program (IODP) represents the latest incarnation of almost five decades of scientific ocean drilling excellence and is generally accepted as the most successful international collaboration in the history of the Earth sciences. IODP builds seamlessly on the accomplishments of previous phases: the Deep Sea Drilling Project, Ocean Drilling Program, and Integrated Ocean Drilling Program. The 2013–2023 IODP Science Plan (*Illuminating Earth's Past, Present, and Future*) defines four themes and thirteen challenges for this decade of scientific ocean drilling that are both of fundamental importance in understanding how the Earth works and of significant relevance to society as the Earth changes, at least in part in response to anthropogenic forcing. This phase of IODP represents an intense level of international collaboration in bringing diverse drilling platforms and strategies to increasing our understanding of climate and ocean change, the deep biosphere and evolution of ecosystems, connections between Earth's deep processes and surface manifestations, and geologically induced hazards on human timeframes.

The *Proceedings of the International Ocean Discovery Program* presents the scientific and engineering results of IODP drilling projects, expedition by expedition. As in the preceding Integrated Ocean Drilling Program, expeditions in the current IODP phase are conducted by three implementing organizations, each providing a different drilling capability. These are the US Implementing Organization (USIO; through September 2014) and the *JOIDES Resolution* Science Operator (JRSO; as of October 2014), providing the leased commercial vessel *JOIDES Resolution* for riserless drilling operations; JAMSTEC's Institute for Marine-Earth Exploration and Engineering (MarE3), providing the drillship *Chikyu* for riser and occasional riserless operations; and the European Consortium for Ocean Research Drilling (ECORD) Science Operator (ESO), providing "mission-specific" platforms (MSPs) for expeditions that extend the IODP operational range where neither drillship is suitable, for example, in polar environments and in shallow waters. Scheduling decisions for each capability are made by three independent Facility Boards, each of which includes scientists, operators, and platform funding partners: the *JOIDES Resolution* Facility Board (JRFB), *Chikyu* IODP Board (CIB), and ECORD Facility Board (EFB). At the beginning of the current IODP, the three Facility Boards agreed to utilize Publication Services at the USIO and now the JRSO for production of all expedition *Proceedings* volumes and reports.

The current IODP differs from prior scientific ocean drilling programs in that it has neither a central management organization nor commingled funding for program-wide activities. Yet this phase of IODP retains a fundamental integrative structural element: a "bottom-up" evaluation of all proposals for drilling expeditions by a single advisory structure composed of scientists representing all international program partners. International scientists may submit drilling proposals to the Science Support Office; all submitted proposals are then evaluated by a Science Evaluation Panel in the context of the Science Plan.

The current IODP also has an international integrative level for high-level discussion and global consensus-building: the IODP Forum. The Forum is not only charged with assessing program-wide progress toward achieving the current Science Plan, but also with overseeing approaches toward a new bright future of scientific ocean drilling post 2023. At present, IODP involves 22 international funding agencies, including those from the United States, Japan, an Australia/New Zealand consortium (ANZIC), China, India, South Korea, and the 15 members of ECORD (Austria, Canada, Denmark, Finland, France, Germany, Ireland, Italy, the Netherlands, Norway, Portugal, Spain, Sweden, Switzerland, and the United Kingdom). The IODP membership represents an unparalleled level of international scientific collaboration; one of the greatest and ongoing strengths of scientific ocean drilling.

Henk Brinkhuis
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IODP publications

Scientific Prospectus

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Preliminary Report

McCaig, A., Lang, S.Q., Blum, P., and the Expedition 399 Scientists, 2024. Expedition 399 Preliminary Report: Building Blocks of Life, Atlantis Massif. International Ocean Discovery Program. **https://doi.org/10.14379/iodp.pr.399.2024**

Proceedings volume

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Expedition reports

McCaig, A.M, Lang, S.Q., Blum, P., Abe, N., Brazelton, W., Coltat, R., Deans, J.R., Dickerson, K.L., Godard, M., John, B.E., Klein, F., Kuehn, R., Lin, K.-Y., Lissenberg, C.J., Liu, H., Lopes, E.L., Nozaka, T., Parsons, A.J., Pathak, V., Reagan, M.K., Robare, J.A., Savov, I.P., Schwarzenbach, E., Sissmann, O.J., Southam, G., Wang, F., and Wheat, C.G., 2025. Expedition 399 summary. In McCaig, A.M., Lang, S.Q., Blum, P., and the Expedition 399 Scientists, Building Blocks of Life, Atlantis Massif. Proceedings of the International Ocean Discovery Program, 399: College Station, TX (International Ocean Discovery Program). **https://doi.org/10.14379/iodp.proc.399.101.2025**

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Supplementary material

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