Proceedings of the International Ocean Discovery Program

Volume 389

Hawaiian Drowned Reefs

Expedition 389 of the *MMA Valour*
from and to Barbers Point Harbor, Hawai'i (USA)
Sites M0096–M0110
31 August–31 October 2023

Volume authorship
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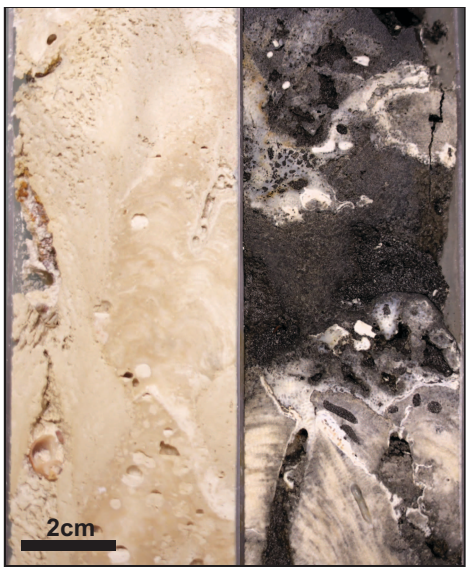

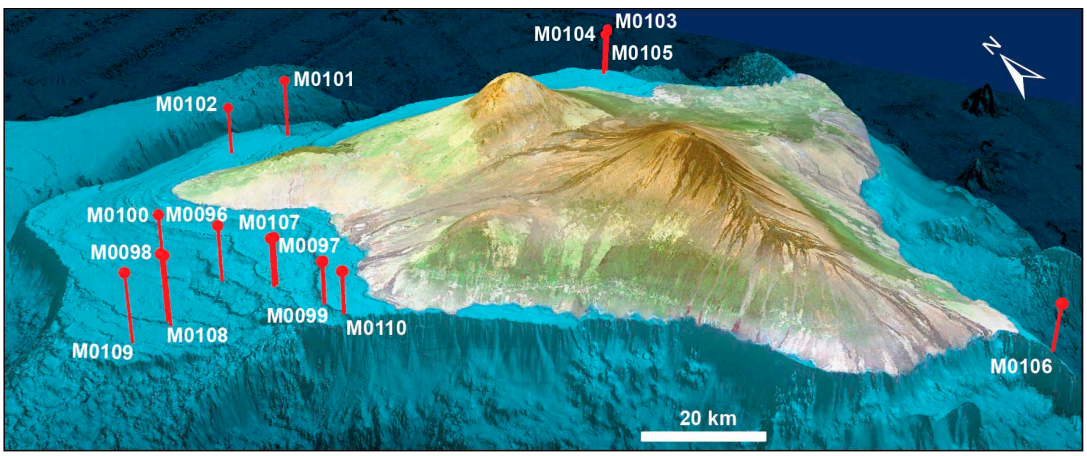

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IODP mission-specific platform data are accessible at **http://iodp.pangea.de**. If you cannot access this site or need additional data, please contact Data Librarian, PANGAEA, University of Bremen, MARUM, Leobener Strasse 8, 28359 Bremen, Germany. Tel: (49) 421-218-65951; Fax: (49) 421-218-98-65951.

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, PO Box 1000, 61 Route 9W, Palisades NY 10964, USA. Tel: (845) 365-8343; Fax: (845) 365-3182; Email: **logdb@ldeo.columbia.edu**.

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

ESO 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 photographs show (left) representative shallow reef frameworks from the same aged (MIS 7-6) reef terrace (H2) from the lee, dry (light core) and windward, and wet (dark core) sides of Hawai'i and (right) a sunset from the side of *MMA Valour*. Photo credits: Marley Parker, Hannah Grant, and IODP ESO. Site map shows the globally unique sequence of drowned fossil coral reefs that were cored during Expedition 389.

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Core descriptions

Visual core descriptions (VCDs) are presented in PDF files for each site. Thin sections and/or smear slides for each site or hole are presented in JPG format in the Supplementary material. The entire set of core images in PDF is available in the IMAGES directory.

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Supplementary material

Supplementary material for the Volume 389 expedition reports includes drilling data in PDF and Microsoft Excel format; geochemistry data in Microsoft Excel format; hyperspectral data in PDF, Microsoft Excel, and PNG formats; images in JPG format; onshore VCDs in PDF; and paleomagnetic data in Microsoft Excel format. A full list of directories can be found in SUPP_MAT in the volume zip folder or on the **Supplementary material for Volume 389 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 389 site map
IODP map
Integrated Ocean Drilling Program map (Expeditions 301–348)
ODP map (Legs 100–210)
DSDP map (Legs 1–96)

Acknowledgments

This project would not have been possible without the vast efforts of the last decades of mapping, other data collection, and studies that led to an understanding of the offshore geology of Hawai‘i and an interpretative framework that underpins IODP Expedition 389. We are grateful for the many scientists and institutions that contributed to and supported these previous studies. We also acknowledge the tireless efforts of the Benthic drilling team and the captain and crew of the *MMA Valour* during the offshore drilling phase of Expedition 389. While there are too many to individuals to name, we give special thanks to Dr. David Clague for his innumerable contributions to this project, including codeveloping the drilling strategy based on his extensive knowledge of the geology of Hawai‘i and giving advice from shore during the offshore drilling phase. Our guiding mantra, “What would Dave do?” helped us through the challenges and numerous decisions that had to be made in real time while at sea. Finally, we acknowledge the local Hawaiian community.

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
Chair, IODP Forum

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JOIDES Resolution Science Operator

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Preliminary Report

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Expedition reports

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Supplementary material

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