



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

**VOLUME 345 EXPEDITION REPORTS**

**HESS DEEP PLUTONIC CRUST:  
EXPLORING THE PLUTONIC CRUST AT A  
FAST-SPREADING RIDGE: NEW DRILLING AT  
HESS DEEP**

Expedition 345 of the riserless drilling platform  
Puntarenas, Costa Rica, to Balboa, Panama  
Site U1415  
11 December 2012–12 February 2013

**Volume authorship**

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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 participating agencies, IODP Management International, Inc., Consortium for Ocean Leadership, Lamont-Doherty Earth Observatory of Columbia University, Texas A&M University, or Texas A&M Research Foundation.

Abbreviations for names of organizations and publications in IODP reference lists follow the style given in *Chemical Abstracts Service Source Index* (published by American Chemical Society).

The bulk of the shipboard-collected core data from this expedition is accessible from the International Ocean Discovery Program U.S. Implementing Organization (IODP-USIO) Science Services, Texas A&M University (TAMU), at [iodp.tamu.edu/database/index.html](http://iodp.tamu.edu/database/index.html). If you cannot access this site or need additional data, please contact:

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A complete set of the logging data collected by IODP-USIO Science Services, Lamont-Doherty Earth Observatory (LDEO), is available at [brg.ldeo.columbia.edu/logdb/](http://brg.ldeo.columbia.edu/logdb/). 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; E-mail: [logdb@ldeo.columbia.edu](mailto:logdb@ldeo.columbia.edu)

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

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

Cover photograph shows examination of core taken from the core barrel during drilling operations on the *JOIDES Resolution*. Photograph by Bill Crawford.

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# Foreword

## By Integrated Ocean Drilling Program Management International, Inc.

The Integrated Ocean Drilling Program (IODP) concluded its decadal program (2003–2013) in September 2013. As envisioned in the Initial Science Plan (ISP), IODP expeditions utilized three scientific ocean drilling platforms to cover unprecedented areas of wide oceans, from ice-covered shallow water to full ocean depths. The major advance from the program predecessors, the Deep Sea Drilling Project and the Ocean Drilling Program, was the ability to drill miles of depth below seafloor. The living Earth is a dynamic system that is continuously evolving. Among its aims, IODP sought to understand this complex and unique system through scientific ocean drilling, sampling, and experimenting in deep holes, along with advancement of related scientific disciplines. IODP has been an international collaboration among scientists and nations with keen aspirations to attain the scientific goals of the ISP. By the program's end, IODP included participating members from 26 nations.

The *Proceedings* present the scientific and engineering results of IODP drilling projects, each designed to better understand the past, present, and future of the Earth system.

Each IODP expedition started with scientists who submitted research drilling proposals to test new and innovative ideas. These proposals then progressed to international scientific advisors (Science Advisory Structure) who nurtured, evaluated, ranked, and prioritized proposals. Scientists scheduled the science operations, selected science party members from scores of international scientists qualified to participate, planned platform operations, readied the drillship, and chose borehole locations. The science party, collectively and individually, conducted science on board and on shore. The co-chief scientists of each expedition have been responsible for synthesizing the scientific results and will continue in this role as IODP postcruise research results become available.

Ocean-drilling achievements help us to understand and interpret phenomena in various parts of the Earth system. Achievements in the two legacy drilling programs have validated the scientific concepts behind plate tectonics, contributed to the understanding of ocean circulation changes, and extended our knowledge of long- and short-term climate change. IODP has expanded and extended the scientific research conducted by the legacy programs, engaging in cutting-edge research concerning topics of global importance.

Three Implementing Organizations (IOs) conducted IODP drilling platform operations. Riserless platform operations have been conducted by the U.S. Implementing Organization (USIO), comprising the Consortium for Ocean Leadership, Inc., Texas A&M University through the Texas A&M Research Foundation, and Lamont-Doherty Earth Observatory of Columbia University. Riser platform operations have been conducted by the Japan Agency for Marine-Earth Science and Technology through Japan's Center for Deep Earth Exploration in cooperation with the Center for Advanced Marine Core Research at Kochi University. Mission-specific platform operations have been conducted by the European Consortium for Ocean Research Drilling (ECORD) Science Operator (ESO), comprising the British Geological Survey, the University of Bremen, and the European Petrophysics Consortium. The European IO represented the ocean-drilling efforts of 16 nations in Europe, plus Canada.

The discoveries presented in this volume build upon layers of knowledge and science developed over roughly the last fifty years. Through September 2013, expedition *Proceedings* were published by IODP Management International for IODP under the sponsorship of the U.S. National Science Foundation (NSF), Japan's Ministry of Education, Culture, Sports, Science and Technology, and other IODP members. The material is based upon research supported under Contract OCE-0432224 from NSF.

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\*At time of expedition.

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## Core descriptions

Visual core descriptions (VCDs), thin section data, and core images are included in this section. VCDs and thin sections are combined into PDF files for each site. The entire set of core images, including igneous and metamorphic domain images, is available in PDF in the IMAGES directory.

### Hole U1415E

[Visual core descriptions](#) · [Thin sections](#)

### Holes U1415F and U1415G

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## Expedition research results

### Data reports

Titles are available in [HTML](#).

### Syntheses

Titles are available in [HTML](#).

## Supplementary material

Supplementary material for this volume includes acoustic subbottom profiler data images in Adobe Illustrator format, vein/halo and alteration logs in Excel format, physical property data in Excel format, structural geology data in Excel format, initial core observation notes in PDF format, final core and thin section observations in Excel format, and a web gallery of thin section images in JPG format. See [README.TXT](#) in the SUPP\_MAT directory for a full listing of directories and files.

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# Drilling location maps

A site map showing the drilling locations for this expedition and maps showing the drilling locations of all Integrated Ocean Drilling Program (IODP), Ocean Drilling Program (ODP), and Deep Sea Drilling Project (DSDP) drilling sites are available 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/)).

**IODP Expedition 345 site map**

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# Expedition-related bibliography\*

## IODP publications

### *Scientific Prospectus*

Gillis, K., Snow, J.E., and Klaus, A., 2012. Hess Deep plutonic crust: exploring the plutonic crust at a fast-spreading ridge: new drilling at Hess Deep. *IODP Sci. Prosp.*, 345. doi:10.2204/iodp.sp.345.2012

### *Preliminary Report*

Expedition 345 Scientists, 2013. Hess Deep plutonic crust: exploring the plutonic crust at a fast-spreading ridge: new drilling at Hess Deep. *IODP Prel. Rept.*, 345. doi:10.2204/iodp.pr.345.2014

### *Proceedings volume*

Gillis, K.M., Snow, J.E., Klaus, A., and the Expedition 345 Scientists, 2014. *Proc. IODP*, 345: College Station, TX (Integrated Ocean Drilling Program). doi:10.2204/iodp.proc.345.2014

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