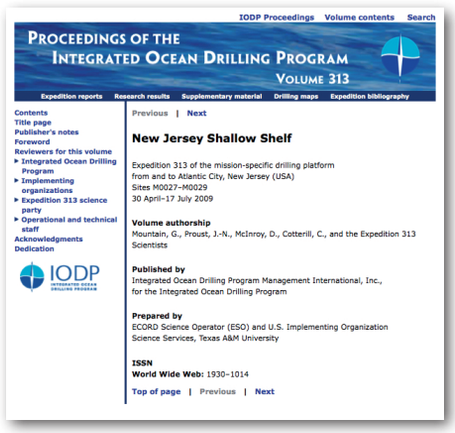

David McInroy

ECORD Science Operator News


Robert Gatliff

The Expedition 313, New Jersey Shallow Shelf, moratorium ended on December 4, 2010, with the publication of the Proceedings of the IODP Volume 313 (doi:10.2204/iodp.proc.313.2010). Results from Expedition 313 were reported at the 2010 AGU Fall Meeting, the Special Session on 'Sea Level, Near-Surface Currents, and the Stratigraphic Record: Recent Results'. Further scientific results are expected in peer-reviewed journals on completion of personal post-expedition research by the Science Party in the coming months. The Science Party will meet on August 15-19, 2011, in Salt Lake City, Utah, for the 2nd Post-Expedition Meeting to present and discuss their scientific findings to date.


IODP Proceedings Volume contents Search

PROCEEDINGS OF THE INTEGRATED OCEAN DRILLING PROGRAM
VOLUME 313

Expedition reports | Research results | Supplementary material | Drilling maps | Expedition bibliography

Contents
Title page
Publisher's notes
Foreword
Reviewers for this volume
Integrated Ocean Drilling Program
Implementing organizations
Expedition 313 science party
Operational and technical staff
Acknowledgments
Dedication

Previous | Next

New Jersey Shallow Shelf

Expedition 313 of the mission-specific drilling platform from and to Atlantic City, New Jersey (USA)
Sites M0027–M0029
30 April–17 July 2009

Volume authorship
Mountain, G., Proust, J.-N., McInroy, D., Cotterill, C., and the Expedition 313 Scientists

Published by
Integrated Ocean Drilling Program Management International, Inc., for the Integrated Ocean Drilling Program

Prepared by
ECORD Science Operator (ESO) and U.S. Implementing Organization Science Services, Texas A&M University

ISSN
World Wide Web: 1930–1014

Top of page | Previous | Next

Expedition 325, Great Barrier Reef Environmental Changes, is currently 10 months into the moratorium period. The 1st Post-Expedition Meeting (editorial) took place at College Station, Texas, from December 7-11, 2010. The Proceedings of the IODP Volume 325 is expected to be published online in July 2011. Some early results are beginning to emerge and have been summarised by Co-chief Scientists Jody Webster and Yusuke Yokoyama, and Staff Scientist Carol Cotterill *(this page)*.

ESO is continuing to follow the ECORD direction to aim to implement at least one mission-specific platform expedition before the end of the program. ESO is currently scoping the two highest ranked proposals currently with the Operations Task Force in parallel: Proposal 548 Chicxulub K-T Impact Crater and Proposal 716 Hawaiian Drowned Reefs. After liaising with IODP's Science Planning Committee and Operations Task Force in March 2011, ESO will formulate an MSP schedule for 2012 and 2013.

The ESO Chair, Robert Gatliff, has been working closely with the ECORD Council and the ECORD Managing Agency (EMA) to formulate a business plan for Europe's involvement in scientific ocean drilling post-2013. This plan is expected to be finalised by the end of April 2011.

David McInroy, ESO Science Manager and Robert Gatliff, ESO Chair - http://www.eso.ecord.org


Carol Cotterill

Unlocking climate and sea-level secrets since the Last Glacial Maximum: Preliminary Results from Expedition 325 to the Great Barrier Reef


Jody Webster


Yusuke Yokoyama

The Great Barrier Reef (GBR) is the largest epicontinental reef system on Earth, extending for 2000 km in a northwest-southeast orientation along the northeast coast of Queensland, Australia. In addition to encompassing numerous reef morphologies, from extensive fringing reefs, patch reefs, ribbon reefs and flood-tide deltaic reefs, the GBR lies in a tectonically stable region far from former ice margins (far-field site). These factors combined gave Expedition 325 the unique opportunity to investigate an unbiased record of reef growth, demise and environmental stress on different reef communities during the last deglaciation.

The offshore phase of IODP Expedition 325 took place from February 11 to April 6, 2010, with the Onshore Science Party (OSP) running from July 2-16, 2010 at the IODP Bremen Core Repository and laboratories in the MARUM building on the campus of Bremen University in Germany.

Coral reefs are excellent sea-level indicators and climate recorders. Scleractinian coral colonies can capture snapshots of oceanographic conditions at the time of their growth, giving an insight into sea-surface temperature, salinity and other parameters such as run-off through analysis of geochemical proxies and the coral skeletons. The reef community composition can give an indication as to position on the reef high wave energy fore-reef or low energy sheltered back reef, and so sea levels at the time of growth, whilst accurate dating by mass spectrometry determines the timing of climate and sea-level changes since the Last Glacial Maximum (LGM).

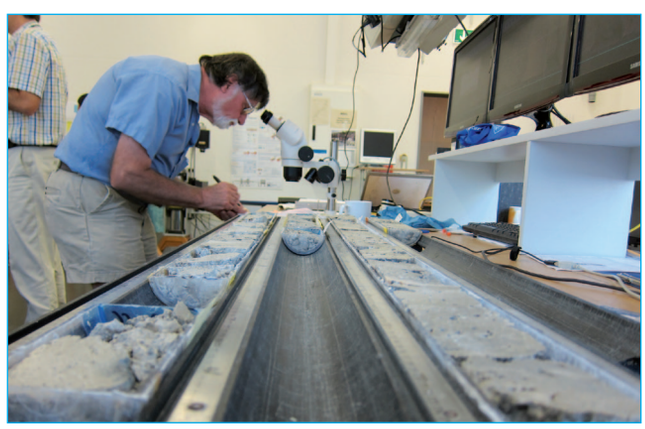


Figure 1: Analysis of the coral species present in each core being conducted by Don Potts during the OSP (A. Gerdes © ECORD/IODP).

The scientific objectives of Expedition 325 were:

1) To establish the course of sea-level rise during the last deglaciation (~20-10 ka) assessing the validity, timing and amplitude of melt water pulse events and testing glacio-hydro-isostatic modelling

2) To reconstruct the nature and magnitude of seasonal-millenial scale climate variability (*e.g.,* sea-surface temperature and salinity) including the identification of specific phenomena such as El Niño-Southern Oscillation (ENSO),

3) To determine the biological and geological response of the GBR to abrupt sea-level and climate change including the identification of reef drowning events, modelling reef building and environmental changes during reef development.

To meet these objectives, a succession of fossil reef structures preserved on the shelf edge seaward of the modern barrier reef system were cored from the *Greatship Maya*. A total of 34 holes from four transects, located at three different geographical positions along the GBR shelf, were cored in depths ranging from 42.27-167.14 metres below present-day sea level.

Achieving the above goals will require considerable shore-based analysis and cross-discipline collaboration. Analysis of the IODP minimum and standard measurements on more than 6000 samples taken during the OSP is ongoing *(Figure 1, page 3)*. However, preliminary results suggest that not only will the above scientific objectives be met, but that two additional outcomes can be addressed:

1) New sea-level and paleoclimate information from corals that likely span the LGM (MIS2), pre-LGM (MIS3) and several earlier Pleistocene periods,

2) A high-resolution record of near continuous sedimentation from a fore-reef slope site will compliment the reef development record obtained from the fossil reef structures on the shelf edge.

Whilst offshore, 68 samples of coral were subsampled from core-catcher material from the top, middle and base of each hole for preliminary dating prior to the OSP. This was done under agreement from the full Science Party and Sample Allocation Committee in order to better guide descriptions, collaborative sample requests and the sampling strategy at the OSP. To ensure rapid sample throughput, no sample screening for diagenesis or detrital contamination was performed for either the U-Th or radiocarbon measurements. However, the preliminary age interpretations suggest that Expedition 325 has successfully recovered a complete sequence of material from the LGM interval, through the first half of the deglaciation up to 10 ka *(Figure 2)*. All age interpretations will be further refined in the detailed dating of about 4000 additional samples from across all the holes.

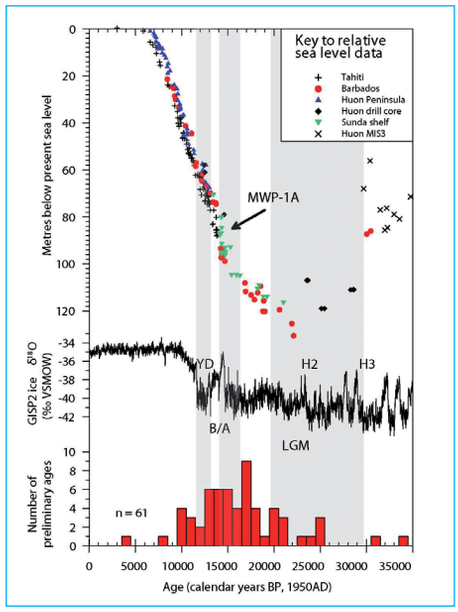


Figure 2: Histogram showing preliminary chronology measurements on core-catcher materials recovered on Expedition 325. The distribution of ages clearly indicates that the recovered fossil coral reef cores span key periods of interest for sea-level change and environmental reconstruction, including the Last Glacial Maximum (LGM) and Heinrich Events 1 and 2 (H2, H3), Bølling-Allerød (B/A) and Younger Dryas (YD). Previously published data on relative sea level from 20 cal ka BP through to present (upper, symbols) along with GISP2 ice $\partial^{18}O$ (a proxy for temperature over Greenland; lower thin black line) are plotted for comparison.

Source of published data: ***Tahiti:*** *Bard et al, 1996; Bard et al, 2010;* ***Huon Peninsula:*** *Chappell and Polach 1991; Edwards, Beck et al. 1993; Yokoyama et al., 2001a,b;* ***Huon drill core:*** *Cutler, Edwards et al. 2003;* ***Sunda shelf:*** *Hanebuth, Stattegger et al. 2000;* ***Barbados:*** *Fairbanks 1989; Bard, Hamelin et al. 1990);* ***GISP2:*** *Stuiver and Grootes 2000.*

In conclusion, the preliminary assessment of cores acquired during Expedition 325 indicates:

1. Shelf-edge features identified on the multibeam bathymetry datasets are definitely fossil coral reef, and therefore constructional features.
2. Nine distinct lithologies have been identified - modern seafloor sediment, coralgal boundstone, coralgal/microbialite boundstone, microbialite boundstone, packstone/grainstone, rudstone, lime sand, lime pebbles and mud.
3. There are series of distinct lithological successions - drowned tops, basal sediments and packstone, that appear to grow on older more complicated Pleistocene sequences - all of which are different spatially and temporally.
4. The upper coralgal-microbialite reef sequence is well developed and thick (up to 20-30m in some holes).
5. *Acropora*-dominated assemblages indicate shallow reef settings with basal section abundant microbialites, giving an excellent sea-level and reef response record.
6. Preliminary age data confirm that the cores acquired span the LGM to post-glacial, with the lower sequence encompassing back to MIS3, with indications of episodic reef growth backstepping up the shelf with rapid drowning events.
7. Benthic foraminifer assemblages, with assessments of abundance and preservation, help provide an indication of water depths (relative sea level) at the time of deposition.
8. For the first time, microbiology samples taken immediately after core recovery will be compared to samples taken from immediately adjacent depths after shipping and storage of the cores at a steady 4°C to assess the impact of shipping and storage of cores on the microbial community.

Detailed analysis is ongoing, with publication of the Expedition Report due in July 2011, and key papers covering sea-level rise, paleoclimate and microbiology expected in the second half of the year. However, the preliminary results give an exciting indication of the importance of this expedition to addressing many of the outstanding questions in the global climate and sea-level histories of the LGM and post-glacial period.

Carol Cotterill, ESO Staff Scientist, Jody Webster and Yusuke Yokoyama, Co-Chief Scientists and Expedition 325 Scientists.

GBREC Expedition 325: http://www.eso.ecord.org/expeditions/325/325.php