



IODP Expedition 357: Atlantis Massif Serpentinization and Life

An IODP Mission Specific Platform Expedition

Organised by the

ECORD Science Operator (ESO)

Applications are invited from scientists in countries participating in IODP to join the Science Party for IODP Expedition 357: Atlantis Massif Serpentinization and Life. Any scientists from IODP countries who feel that their expertise is relevant to the objectives of the proposal may apply.

The proposal upon which this expedition is based was submitted as IODP Proposal #758 'Serpentinization and life: biogeochemical and tectono-magmatic processes in young mafic and ultramafic seafloor'. The proposal was first submitted in 2009 and became highly ranked by the IODP Science Advisory Structure before being scheduled by the ECORD Facility Board in 2013. The full proposal, as well as up-to-date expedition information, can be found on the Expedition 357 webpage <http://www.eso.ecord.org/expeditions/357/357.php>.

The Co-chief Scientists for this Expedition are Gretchen Früh-Green, Department of Earth Sciences, ETH Zurich, Switzerland, and Beth Orcutt, Bigelow Laboratory for Ocean Sciences, USA.

Background and objectives:

IODP Expedition 357 will address two exciting discoveries in mid-ocean ridge research: off-axis, serpentinite-hosted hydrothermal activity, exemplified by the Lost City Hydrothermal Field (LCHF) on the Atlantis Massif oceanic core complex (30°N, Mid-Atlantic Ridge); and the significance of tectono-magmatic processes in forming and exposing heterogeneous mafic and variably serpentinized ultramafic lithosphere that are key components of slow and ultraslow spreading ridges. Serpentinization is a fundamental process that controls rheology and geophysical properties of the oceanic lithosphere and has major consequences for heat flux, geochemical cycles and microbial activity in a wide variety of environments. However, we currently have no constraints on the nature and distribution of microbial communities in ultramafic subsurface environments. Our proposed drilling focuses on:

1. exploring the extent and activity of the subsurface biosphere in young ultramafic and mafic seafloor;
2. assessing how abiotic and biotic processes change with aging of the lithosphere and with variations in rock type;
3. quantifying the role of serpentinization in driving hydrothermal systems, and in sustaining microbiological communities, and in the sequestration of carbon in ultramafic rocks; and
4. characterizing tectono-magmatic processes that lead to lithospheric heterogeneities and the evolution of hydrothermal activity associated with detachment faulting.

This expedition will utilize seabed rock drill technology (MeBo and BGS Seafloor Rockdrill 2) to core a series of shallow (50-80 mbsf) holes across the Atlantis Massif, where detachment faulting exposes both mafic and ultramafic lithologies on the seafloor. We aim to recover in-situ sequences of sediments, hydrothermal deposits/veins, and basement rocks that comprise a broad zone of detachment faulting across: a spreading-parallel (E-W) profile along the southern wall and at varying distances from the LCHF; and a ridge-parallel (N-S) profile into the center of the massif, where the dominant rock compositions changes from ultramafic to gabbroic. Drilling the E-W profile will allow us to evaluate how microbial communities evolve with variations in hydrothermal activity and with age of emplacement on the seafloor. We aim to compare microbial activity and diversity in areas of diffuse H₂-rich fluid flow and carbonate precipitation with communities in areas away from the active hydrothermal system and with variable substrates and crustal ages. By quantifying the extent and evolution of carbonate precipitation, we will evaluate the potential for natural CO₂ sequestration in serpentinizing peridotites. Drilling the N-S profile will allow us to evaluate how faulting and lithospheric heterogeneities influence hydrothermal alteration and the nature of the deep biosphere in varying lithologies; and to assess the role of the differing rheologies of gabbros and serpentinized ultramafic rocks in localizing detachment faults.

Timing:

It is anticipated that the offshore phase of the expedition will last 46 days in the period October-December 2015 (exact dates to be confirmed), with only a subset of the Science Party participating. Offshore activities will focus on core recovery, curation, sampling for ephemeral properties including microbiological sampling, and downhole logging. The cores will not be split at sea. Please see <http://www.eso.ecord.org/expeditions/msp.php>.

Subsequently, an Onshore Science Party (OSP) will be held at the MARUM, University of Bremen, in early 2016 (exact dates to be confirmed), where the cores will be split. The OSP is expected to be 2-3 weeks long, the exact length dependent on core recovery. All members of the Science Party must attend for the whole duration of the Onshore Science Party. Please see <http://www.eso.ecord.org/expeditions/osp.php>.

Successful applicants will be invited either as an offshore-onshore participant, or as an onshore-only participant.

Expertise sought:

While other expertise may be considered, specialists in the following fields are required: sedimentology, microbiology, organic geochemistry, inorganic geochemistry, structural geology, igneous petrology, metamorphic petrology, paleomagnetism, geophysics and petrophysics/downhole logging.

Where to apply, IODP Program Member Offices:

USA: [US Science Support Program \(USSSP\)](#)

Europe and Canada: [ECORD Science Support & Advisory Committee \(ESSAC\)](#)

Japan: [Japan Drilling Earth Science Consortium \(J-DESC\)](#)

P.R. China: [IODP-China](#)

Brazil: [IODP-CAPES-Brazil](#)

Australia/New Zealand: [Australia-New Zealand IODP Consortium \(ANZIC\)](#)

Korea: [Korea International Ocean Discovery Program \(K-IODP\)](#)

India: [IODP-India](#)

Applications should reach the above organisations no later than **Friday 9th January 2015**; shortlisted candidates will be considered by ESO in February 2015.

See details under <http://www.iodp.org/apply-to-sail/>.

For further details from ESO, please contact:

David McInroy, ESO Science Manager, dbm@bgs.ac.uk

Sophie Green, Expedition Project Manager, soph@bgs.ac.uk

Dayton Dove, Expedition Project Manager, dayt@bgs.ac.uk