

## **IODP Expedition 360: SW Indian Ridge Lower Crust and Moho**

### **Week 1 Report (30 November–5 December 2015)**

#### **Operations**

Week 1 of Expedition 360 (Southwest Indian Ridge Lower Crust and Moho) began with the first line ashore at the Unity Container Terminal Berth in Colombo, Sri Lanka, at 1100 h on 30 November 2015 (UTC + 5.5 h). The Co-Chief Scientists, IODP technical staff, and the Expedition Project Manager boarded the ship. The remainder of the science party and the ship's crew boarded the vessel on the second day of the port call (1 December).

A total of 216 joints of 5½ inch drill pipe and 273 joints of 5 inch drill pipe were broken down from stands into single joints and offloaded for inspection and refurbishment. A total of 11 flat racks of drill pipe were loaded and blocked on flat racks for return to the United States. Additionally, 295 joints of new 5 inch drill pipe were delivered on flat racks and loaded into the ship's riser hold and to the top of the riser hatch and then secured for transit. The new pipe will be picked up and made up into stands at the first site of Expedition 360. Loading of miscellaneous drilling equipment, expedition stores, and food were completed during the port call.

On 2–3 December, 900 metric tons of marine gas oil were pumped from barges to the ship's fuel tanks. On 4 December, the port authority required the ship to move from the Unity Container Terminal berth to the JCT Transfer Jetty to complete port call operations. Following completion of the one-hour move, two pneumatic trucks with barite were delivered to the Jetty and the barite was pumped on board. The two trucks returned later with saltwater gel that was loaded into the ship's bulk tanks. Loading of all supplies was concluded at 1800 h on 5 December. The pilot was on board at 2000 h and the last line was released at 2018 h, getting the ship underway to the Atlantis Bank at full speed of 11.2 kt. We expect to arrive at proposed primary site AtBk-6 on 16 December.

#### **Science Results**

Atlantis Bank is a shallow platform (700 m water depth) that represents an oceanic core complex, the exposed footwall of an oceanic detachment fault, on the Southwest Indian Ridge. The seismological Moho lies at a depth of ~5 km below seafloor at this location. The overall "SloMo" Project is designed to utilize the tectonic window of Atlantis Bank to penetrate the seismological Moho for the first time and drill ~500 m into the mantle beneath. SloMo Phase 1 consists of Expedition 360, with a second leg to be considered for scheduling pending successful completion of the first leg. Phase II proposes to bring the riser drilling vessel *Chikyu* to Atlantis Bank to deepen the hole to below Moho.

The primary goal of Expedition 360 is to drill a deep hole, engineered for reentry, down to a nominal depth of 1300 m below seafloor. Specific objectives for Expedition 360 include drilling through a seafloor magnetic anomaly for the first time, projected to change from negatively polarized to positively polarized and back to negatively polarized crust down the hole, with the goal of determining the mechanisms by which marine magnetic anomalies are hosted in the lower crust. A second major objective is to determine the lateral continuity of the lower ocean crust encountered in ODP Hole 735B, located 3 km southwest of the primary proposed site AtBk-6. On a broader scale we seek to understand the range of mechanisms that control magma emplacement in oceanic core complexes, the footwalls of active oceanic detachment faults. Prior drilling at the Atlantis Massif oceanic core complex on the Mid-Atlantic Ridge (IODP Expeditions 304 and 305) revealed major differences between the 1508 m Hole 735B lower crust sequence at Atlantis Bank and the ~1400 m Hole U1309D lower crust sequence at Atlantis Massif, including the degree of deformation, type of alteration, and igneous stratigraphy. Expedition 360 seeks to determine if this is a consequence of the local site characteristics, or whether it reflects fundamental differences in the tectonic and magmatic evolution of the ocean crust between the Mid-Atlantic and Southwest Indian Ridges. In particular, IODP Expeditions 304 and 305 drilled a sequence of gabbros with intercalated intervals of mantle peridotite and mantle peridotite hybridized by impregnation of basaltic melt in Hole U1309D. This appears to indicate that a substantial portion of the ocean crust incorporates mantle rock. Is this unique to Site U1309 and Atlantis Massif or is it a general phenomenon in accretion of the ocean crust?

During the first week of the expedition, which was spent in port in Colombo to unload and load freight, the scientific party learned the protocols for rock description, data acquisition, data management, and responsibilities during the cruise. They were organized into disciplinary teams including igneous, metamorphic, and structural geology groups as well as geochemistry, petrophysics, paleomagnetism, and microbiology groups. All scientists presented their postcruise research proposals and sample requests and general sampling procedures were discussed. The scientific party was given a safety instruction tour of the shipboard laboratories, including information on potential hazards and protective equipment.

## **Education and Outreach**

Four Education and Outreach officers are sailing on Expedition 360. Their tasks include: coordinating and expediting media requests with and on behalf of the scientific party; publicizing IODP activities worldwide; setting up and managing live interactions with schools and other organizations onshore; maintaining social media and other blogs during the cruise; and preparing packages of material from the scientific results to be used by educators postcruise. Specific activities during Week 1 of the Expedition were:

### *General Activities*

- Assessment and inventory of equipment.
- Meetings and networking with scientists.

### *Interactions*

- Organization of schedule.
- Gathering of American and European video outreach registrations.
- Scheduling and streamlining procedures.
- Zoom videoconference tests with shore.
- First Zoom session with thirty 10-year-old students, Cours Bastide Primary School, Marseille, France.

### *Social Media*

- First video footage and photographs collected.
- Three Facebook (<https://www.facebook.com/joidesresolution>) posts, three *JOIDES Resolution* blog (<http://joidesresolution.org/>) posts, one Instagram ([http://instagram.com/joides\\_resolution](http://instagram.com/joides_resolution)) post, and three Twitter (<https://twitter.com/TheJR>) posts.

### *Media*

- News report for the BBC Science website.
- News articles in national newspapers in the UK and worldwide.
- Three news reports in Xinhua News Agency.

## **Technical Support and HSE Activities**

### *Laboratories*

- Laboratories were readied for coring.
- Freight was distributed.
- Microbiology cold room laminar flow enclosure constructed and installed.
- New 360° image line scan logger installed in core laboratory.
- Cores from previous drilling at ODP Site U735B were laid out in core laboratory for scientists use.
- Scientists were introduced to laboratories and started working with the JRSO technical specialists in each laboratory.

### *Freight*

- Offloaded:
  - Two refrigerated containers of core; gas bottles.
  - Air freight.
- Received:
  - Two IODP containers of D-Tubes and science supplies.
  - One IODP flat with drilling equipment.
- Regular and Hazardous Materials air freight.

### *HSE Activities*

- Conducted safety tours for scientists.
- Safety awareness sheets completed for chemistry and general ship areas.