IODP Expedition 353: Indian Monsoon Rainfall

Week 1 Report (29 November–6 December 2014)

Operations

The *JOIDES Resolution*'s first line ashore in Singapore was at 0936 h on 29 November 2014. The vessel was berthed at Loyang Jetty 2A for the duration of the port call. IODP *JOIDES Resolution* Science Operator staff plus the Co-chief Scientists boarded the ship on 29 November. The Indian Monsoon scientists boarded the ship the next day, 30 November. The Siem Offshore crew and subcontractors crew changed on 30 November. Arrangements for utilization of pneumatic trucks for loading drilling mud were made. However, the 20 tons of Sepiolite did not clear customs in time to be loaded during the port call. All other expedition supplies were loaded including fresh produce.

Welds were inspected on the new Orbit valve and cement line. Nine of thirteen welds failed the inspection. The valve and sections of cement line were removed and sent for repair. The repaired lines were then welded back in place and then successfully passed inspection. The American Bureau of Shipping (ABS) conducted the annual survey along with lifeboat inspection. The inspections were passed with no notable exceptions. The annual radio survey was also performed.

Fuel was loaded by barge (1600 metric tons) along with three tanks of lube oil (13,580 gallons). All outbound surface freight and air freight were offloaded. The vessel was secured for sea with final maintenance checks performed prior to departure. The pilot arrived on aboard at 0948 h and the last line was released at 1010 h on 4 December. We began the 955 nmi passage to Site U1443 (N90E-2C) with an estimated time of arrival of 2400 h on 7 December.

We are continuing to gather and provide information necessary to obtain clearance to occupy the remaining Expedition 353 sites, all of which are in Indian waters. Permissions are contingent upon a naval inspection of the ship that will take place in Visakhapatnam, India, after Site U1443 is completed.

Science Results

The Indian Monsoon Expedition science party includes individuals from 10 IODP member countries and 11 nationalities. In addition, two education officers (one USA, one German) are on board to conduct outreach activities during the expedition.

The scientists spent the first week of the expedition becoming familiar with the laboratories, core flow, curation, sampling, and publication procedures used on the ship. Each laboratory team submitted a draft of their methods used for shipboard analyses.

The sedimentologists have been spending the time in port and on the transit setting up the core description software (DESCLogik) and familiarizing themselves with shipboard equipment. This includes the Section Half Imaging Logger (SHIL) used for core imaging and the Section Half Multisensor Logger (SHMSL), which records color reflectance and magnetic susceptibility. The provisional DESCLogik templates for both the macroscopic (half core) and microscopic (smear slide) core descriptions have been set up with the help of the technical staff. The sedimentologists have also been training on smear slide preparation and interpretation using old core material and the onboard training slides. The sedimentologists are familiarizing themselves with the literature and core descriptions from ODP Site 758, which will be re-drilled at Site U1443 (proposed site N90E-2C).

The micropaleontologists familiarized themselves with the microscopes, camera equipment, and the descriptive information capture software (DESCLogik). They also edited the DESCLogik value lists for bioevents and species. The micropaleontology team had a discussion on which timescale to use, which biostratigraphic markers to use, and what the best approach is to handle the high number of samples to be processed in the laboratory over the upcoming weeks.

The geochemists held several meetings, including a laboratory tour and orientation, and a detailed safety briefing highlighting safety equipment and some of the procedures and hazards specific to the chemistry laboratory. The geochemists were introduced to basic sample flow, processing, and the essential tasks of the chemistry group including methane measurements. The group discussed standard measurements as well as some of the planned sampling specific for individual science projects.

The paleomagnetists familiarized themselves with the paleomagnetism equipment and software. They ran several experimental tests to ensure consistency in relation to calculations and data formats across shifts. The paleomagnetists decided on a preliminary plan for archive half core measurement resolution (5–10 cm) and experimental methodology, such as determining the demagnetization level and number of onboard discrete samples for the expedition. In addition, they practiced discrete sampling and labeling from the working half core.

The physical property scientists met with the laboratory technicians for training in the physical property laboratories. Core flow procedures were reviewed, and operating instructions were given for the Whole-Round Multisensor Logger (WRMSL/STMSL), thermal conductivity, natural gamma ray measurements, moisture and density (MAD) sampling and procedures, and the split core shear wave and *P*-wave measurements. Practice runs using old sediment cores were conducted. Errors in compressional wave velocities were detected when we ran a water standard through the MST, so all sensors in the physical property laboratories are being checked and recalibrated as necessary. The physical properties team had several meetings to discuss sampling intervals for shipboard analyses.

The stratigraphic correlators familiarized themselves with the construction of composite depths below the seafloor, a common depth scale for multiple adjacent holes and splices constructed of

core intervals from multiple holes. This involved continued interaction with application developers and Chief Scientists. Specifically, the SCORS Data File Downloader was used to download density (GRA) and magnetic susceptibility (MS) test data from the LIMS database, Correlator was used to build up composites and splices, and the SCORS Affine/Splice Uploader was used to upload affines and splices back to the LIMS database.

Science Objectives of Expedition: Scientific ocean drilling (Deep Sea Drilling Project [DSDP], Ocean Drilling Program [ODP], and Integrated Ocean Drilling Program) has never taken place in the Bay of Bengal north of 9°N. Thus, the core region of summer monsoon precipitation has never been investigated. DSDP Leg 22 (1974) and ODP Leg 121 (1989) drilled the southernmost region (5° to 9° N), capturing the distal end of the summer monsoon influence. India's partnership in International Ocean Discovery Program (IODP) provides an opportunity to investigate this key northern region. IODP Expedition 353 seeks to recover Upper Cretaceous through Holocene sediment sections that record the erosion and runoff signals from river input to the Bay of Bengal as well as the resulting north–south surface water salinity gradient. Analysis of sediment sections from the Mahanadi Basin (northeast Indian margin), the Nicobar-Andaman Basin (Andaman Sea) and the northern Ninetyeast Ridge (southern Bay of Bengal) will be used to understand the physical mechanisms underlying changes in monsoonal precipitation, erosion and run-off across time scales from millennial through tectonic. These sites will provide crucial new information within which to interpret differences among existing results from previous monsoon-themed drilling expeditions in the Arabian Sea (ODP Leg 117) and the east Asian marginal seas (ODP Leg 184; Integrated Ocean Drilling Program Expedition 346). These goals directly address challenges in the "Climate and Ocean Change" theme of the IODP Science Plan.

The major scientific objectives of Expedition 353 are as follows.

The Pliocene–Pleistocene objectives include reconstructing salinity changes as well as the erosion and runoff signals in the Bay of Bengal and Andaman Sea in order to:

- Establish the sensitivity and timing of changes in monsoon circulation relative to insolation forcing, latent heat export from the Southern Hemisphere, global ice volume extent, and greenhouse gas concentrations.
- Determine the extent to which Indian and East Asian monsoon winds and precipitation are coupled and at what temporal and geographic scales.
- Better separate the effects of climate change and tectonics on erosion and runoff.
- Provide verification targets for climate models: the majority of current atmosphere-ocean general circulation models do not accurately simulate the spatial or intraseasonal variability of monsoon precipitation.

The deep-time objectives include the following:

- To understand the timing and conditions under which monsoonal circulation initiated and reconstruct the variability of the Indian monsoon at orbital timescales.

- To unravel the relationship between Indian monsoon variability and major past global climatic events such as the Oligocene/Miocene cooling, the onset of the mid-Miocene Climatic Optimum, mid-Miocene cooling and Antarctic cryosphere expansion, and the Pliocene–Pleistocene enhancement of Northern Hemisphere glaciation.
- To establish a complete Oligocene–present astronomically tuned timescale based on high-resolution benthic and planktonic isotope reference curves for the Indian Ocean.
- To incorporate high-resolution distribution studies of well-preserved Oligocene–recent calcareous and siliceous microfossils from the Indian Ocean into global compilation studies of paleoclimatic and biotic evolution.

Technical Support and HSE Activities

This week the JRSO technical support groups activities focused on port call activities including both offloading/loading of shipments, preparing the laboratories for coring and logging, and providing laboratory safety, methods, and instrument orientations for the expedition scientists.

Laboratories:

- The new staff are being trained on the instruments and procedures in the laboratories.

X-ray:

- There were problems with the XRD cooling water flow that were fixed by back flushing the system. We are now troubleshooting sample handler issues with the vendor representative.

Physical Properties:

- We are investigating RGB values on the Section Half Imaging Logger (SHIL) to determine whether the green and blue values are switched in the database.
- A frequency correction for the magnetic susceptibility loops will be applied to the software for Whole-Round and Special Task Multisensor Loggers (WRMST and STMSL).
- We are preparing the IR thermal cameras to look for gas hydrates in the cores.

Chemistry:

- We are training scientists on the instruments.
- A new Barnstead Nanopure water maker was installed.
- Standards and reagents were made.
- We set up glove bags for the squeezer.

Curation:

- Held Sample Master training for the staff and scientists.
- A shipboard sampling plan was developed.

Downhole Logging:

- We are working with both logging scientists and Schlumberger representative on logging procedures.

Electronic Technician:

- Monitoring the VSAT frequencies.

Developers:

- We worked with correlation scientists to thoroughly test all components of new stratigraphic correlation tools: CorrDownloader, Correlator, and the AffineSpliceUploader.
- A short presentation was given to the scientists about shipboard reporting facilities: LIMS Reports, LORE, and LIMSpeak.
- A spreadsheet was produced containing all of the standards currently active in the database for the Expedition 353 technical staff.

HSE activities:

- A life boat/anti-piracy drill was held in port. The JRSO staff, scientists, and ship's crew were instructed on what to do in the event pirates are encountered.
- The ship's crew installed a water spray perimeter defense system along with concertina razor wire around the ship perimeter.