

## **IODP Expedition 353: Indian Monsoon Rainfall**

### **Week 2 Report (7–13 December 2014)**

#### **Operations**

The *JOIDES Resolution* began the second week of Expedition 353 (Indian Monsoon) in transit to Site U1443 (proposed site N90E-2C). Site U1443 is a re-drill of Ocean Drilling Program (ODP) Site 758. After a 966 nmi transit from Singapore, averaging 11.7 kt, the vessel arrived at the first site of the expedition. A pre-spud meeting was held prior to arrival to review the planned operations at Site U1443. The vessel arrived at Site U1443 at 2037 h (UTC + 8 h) on 7 December. The thrusters were lowered and dynamic positioning (DP) assumed control at 2105 h. A positioning beacon was dropped. After the beacon landed, the vessel positioned to the site coordinates.

The calculated depth using the precision depth recorder (PDR) for Site U1443 was 2923.6 mbsl. The sinker bars were picked up and inserted through the main blocks. The wireline became stuck and a significant amount of coring line spooled off of the coring winch. The sinker bars were removed and 500 m of coring line were slipped and cut. The sinker bars were then re-installed. While shooting the first core, the core barrel broke. The vessel was moved 10 m north and Hole U1443A was spudded. Non-magnetic core barrels were used for APC coring for Core U1443A-2H and Cores U1443-4H through 15H; steel core barrels were used for Cores U1443A-1H and 3H. The FlexIT orientation tool was used for Cores U1443A-2H to 13H. Temperature measurements were taken with the APCT-3 temperature shoe on Cores U1443A-4H, 7H, 10H, and 13H. After switching to the half-length APC (HLAPC) coring system, coring continued from U1443A-16F to 29F. Overall, 29 APC and HLAPC cores were taken to a depth of 202 mbsf with a recovery 207.07 m (103%). The XCB coring system was then used to extend the hole to a total depth of 344 mbsf. A total of 19 XCB cores were taken over a cored interval of 142 m and 119.73 m of core were recovered (84%). After the final core was taken, 150 m of core winch line was slipped and cut. The drill string was then pulled out of the hole (POOH) and cleared the sea floor at 0225 h on 11 December, ending Hole U1443A.

The vessel was offset 20 m north for Hole U1443B. Non-magnetic core barrels were used for APC coring from Core U1443B-1H to 18H. The FlexIT orientation tool was used for Cores U1443B-2H to 16H. The HLAPC coring system was deployed for Cores U1443B-19F to 28F. In total, 28 piston cores were taken from 0–210 mbsf with a recovery of 207.89 m (99%). The XCB coring system was then used to take Cores U1443B-29X to 40X. The total depth of Hole U1443B was 326.4 mbsf. A total of 12 XCB cores were taken over a cored interval of 116.4 m and 100.31 m of core were recovered (86%). The drill string was then POOH and cleared the sea floor at 2310 h on 12 December, ending Hole U1443B.

The vessel was offset 20 m west to initiate Hole U1443C. An APC core barrel was shot into the mudline and the core barrel broke. The vessel was offset 15 m north and a second steel core barrel was shot. This core barrel was also broken, with part of it remaining in the bottom-hole assembly (BHA) and was successfully fished out on the second attempt. The vessel was again offset 15 m north and a third APC core barrel was broken during the shot. An XCB core barrel assembly was deployed to check the BHA components. It was decided to use the HLAPC to spud Hole U1443C. The vessel was offset 50 m south (20 m west of Hole U1443A).

Hole U1443C was spudded at 1040 h on 13 December and Cores U1443C-1F and 2F were retrieved. Coring continued with the full-length APC from Core U14443C-3H to 24H. This included two short (0.5 and 1.0 m) drilled intervals. The IceField tool was used for orientation on Cores U1443C-3H to 5H and the FlexIT orientation tool was used for Cores U1443C-6H to 19H. The HLAPC was again deployed extend piston coring from Cores U1443C-25F to 30F.

## Science Results

The sedimentologists have described the cores from Holes U1443A, U1443B, and U1443C. Four distinct lithological units (I–IV) have been identified, based on visual observations, smear slides, and with guidance from physical properties data (magnetic susceptibility, reflectance, etc.). Unit I (0–115 m CSF-A) spans the Pleistocene to the middle Miocene and is characterized by gray–dark gray clayey nannofossil oozes with foraminifers and discrete volcanic ash horizons. Unit I is further divided into two subunits: Subunit Ia (0–27 m CSF-A) is characterized by nannofossil oozes with a high foraminiferal content (10–30%), a relatively high clay content (15–40%), and minor but frequent volcanic ash beds, one of which can be correlated to the large Toba eruption in the Late Pleistocene. Subunit Ib (27–116 m CSF-A) is characterized by gray–pale gray nannofossil oozes with authigenic carbonate, less abundant foraminifers (<15%), and lower clay content. Unit II (116–242 m CSF-A) spans the middle Miocene to the early Oligocene and is characterized by pale yellow nannofossil oozes and chinks with foraminifera, varying amounts of authigenic carbonate, and a low amount of clay (generally <10%). Unit II is subdivided into Subunit IIa, which is characterized by nannofossil oozes, and Subunit IIb, which is characterized by nannofossil chinks. There is a large hiatus of >20 m.y. between Unit II and Unit III with little to no recovery of Eocene sediments. Unit III (242–307 m CSF-A) spans the late Paleocene to the Maastrichtian and is characterized by pale brown and pale gray nannofossil chalk and nannofossil-rich calcareous chalk, with increasing siliceous components downhole coupled with an increase in the occurrence of chert as a minor lithology. Unit IV (307–338 m CSF-A) is late Campanian in age and is characterized by greenish marlstone with glauconite and common *Inoceramus* shell fragments.

Calcareous nannofossils are abundant throughout the Hole U1443A section, which covers the Late Pleistocene (<0.29 Ma) to late Campanian (>72.1 Ma), with a large unconformity that spans most of the Eocene. Nannofossil assemblages are typically tropical to subtropical, and are well preserved from the Pleistocene to the late Miocene (0–110 m CSF-A). Below this interval, evidence of diagenetic overgrowth becomes apparent, and worsens in the lower Miocene sections. Cretaceous sediments contain abundant moderately to poorly preserved nannofossils. The Cretaceous–Paleogene boundary is identified in Core U1443A-39X, and is highly bioturbated. Scanning electron microscopy (SEM) reveals that *Emiliana huxleyi* (<0.29 Ma) is present in the upper 50 cm of Hole U1443A and in the upper 10 cm of Hole U1443B. At Site U1443, diatoms occur most often from 0–28 m CSF-A and their occurrence is sporadic from 28–192 m CSF-A. The diatom community from 0–28 m CSF-A of Site U1443 is diverse and mainly consists of Pleistocene to Holocene species. The diatom assemblage is typical of warm to temperate, low-latitude ocean waters. Foraminifera are dominant to abundant in Cores U1443A-1H to 43X (Late Pleistocene to Maastrichtian). Foraminifera abundance decreases from common to few in Cores U1443A-44X to 48X. Preservation is good to moderate throughout the Cenozoic with a few exceptions in the late Miocene and in the Oligocene to Paleocene, where preservation is poor. Preservation in the Cretaceous samples is moderate to poor.

The chemistry laboratory spent the week processing and analyzing samples from Hole U1443A. Methane measurements were conducted on every core and the highest levels were near background levels. Interstitial waters were extracted from every APC and XCB core and very other HLAPC core. The scraping and squeezing of all but one of the interstitial water whole round samples from the APC and HLAPC cores was conducted under a nitrogen atmosphere. Analyses for carbonate carbon, total carbon, and total nitrogen are underway. Analyses of pore waters for alkalinity, chlorinity, major and minor elements, and ions have been completed. Results show a large decrease in alkalinity at the bottom of Hole U1443A, largely consistent with measurements from ODP Site 758. Downhole increases in Ca and decreases in Mg and K are consistent with reactions occurring in the basaltic basement. Total C analysis for Hole U1443A is completed but a third of the carbonate content analyses remain. Early results of total C and carbonate analyses indicate carbonate contents are between 60% and 80% from 0–100 m CSF-A, below which this increases to over 90% in some sections, while others have values as low as 57%.

The natural remanent magnetism (NRM) and the NRM after 10 or 15 mT alternating field (AF)-demagnetization was measured on all cores from Holes U1443A and U1443B. In addition, discrete samples were taken from APC and HLAPC cores from Hole U1443A (~70 samples) and analyzed for their remanence components. A preliminary magnetostratigraphy was constructed using the paleomagnetic data from Hole U1443A. Further sample analysis and core orientation data is needed to advance its development, including a comparison with data from Holes U1443B and U1443C.

Physical property measurements were made in Holes U1443A, U1443B, and U1443C. The Special Task Multisensor Logger (STMSL), or “fast track,” tool was used to measure magnetic susceptibility (MS), and bulk density. The Whole-Round Multisensor Logger (WRMSL) tool, which measures *P*-wave velocities in addition to MS and bulk density, was used to complement the STMSL measurements and occasionally crosscheck STMSL data. Following temperature equilibration, the natural gamma ray (NGR) tool was used to measure the naturally occurring radioactivity in the sediment. After the sections were split, moisture and density (MAD) samples were taken. In selected sections, the GANTRY tool was used to measure *P*-wave velocity along all the three axes as well as their shear strength.

The stratigraphic correlators used the magnetic susceptibility (MS) data from Site U1443 to construct the composite depth below the seafloor scale (CCSF-A) using Holes U1443A, U1443B, and U1443C. Density (GRA) data were less reliable due to cracks and were not used for correlation.  $L^*$ ,  $a^*$ , and RGB data were used to corroborate the constructed composite depth once they became available (usually several hours after drilling). For the cores recovered between ~75–100 mbsf, the lack of pronounced variations in the GRA and MS data precluded accurate construction of a composite depth scale across this interval. To minimize gaps in the final splice for Site U1443, a strategy was developed by the Chief Scientists to use the midpoint of Hole U1443B drilled intervals as the target depths for each core top in Hole U1443C. Tests of the new correlator-LIMS software downloaders and uploaders were successful. Tests recovering Site U1443 data on the splice depth scale using LIMS Reports III (LORE) will be performed after the slices are completed.

### **Education and Outreach Activities**

The Education and Outreach team held nine video conferences that reached 450 students across the United States and Germany. Expedition updates are being posted on Facebook (<https://www.facebook.com/joidesresolution>), Twitter (<https://twitter.com/TheJR>), Instagram ([http://instagram.com/joides\\_resolution](http://instagram.com/joides_resolution)), and on the <http://joidesresolution.org/> blogs.

### **Technical Support and HSE Activities**

This week the *JOIDES Resolution* Science Operator (JRSO) technical support groups activities focused on processing cores from Site U1443 and aiding the Indian Monsoon science party.

Core Laboratory:

- The core laboratory processed cores from Site U1443.

#### Physical Properties:

- The Section Half Imaging Logger (SHIL) software was modified to switch the collection of the Green and Blue color values in the database.
- The IR thermal imaging camera was tested and is ready for use on the catwalk.

#### Paleomagnetism:

- The new IceField core orientation tool was successfully deployed.

#### Downhole Logging:

- The data transfer protocol pathway for sending logging data to Lamont-Doherty Earth Observatory (LDEO) for processing was tested.

#### Application Developers:

- Worked with personnel on shore to correct a bug in Section Half Imaging Logger (SHIL) application, which was transposing the green and the blue values in the RGB data.
- Worked with the Curator and personnel on shore to correct core length problems in the LIMS database. Deployment and testing will be deferred until the transit to India to avoid core flow disruption at Site U1443.
- Completed work on the magnetic susceptibility loop (MSL) changes to apply a correction factor to the magnetic susceptibility measurements.

#### Marine Computer Specialist:

- The Internet is up and both ship satellites are communicating with the Indian Satellite.
- Assisted with troubleshooting the vibration-isolated television (VIT) camera communication issues.

#### HSE activities:

- A Fire and Boat Drill was held on 11 December.
- The eyewash stations and safety showers were tested.