

IODP Expedition 353: Indian Monsoon Rainfall

Week 6 Report (4–10 January 2015)

Operations

Hole U1445A was cored to a total depth of 672 mbsf with 666.4 m of core recovered (99%). Coring advances of 8 m were utilized for Cores U1445A-33X, 34X, and 38X–66X to allow for core expansion within the core liner.

After completion of coring operations in Hole U1445A, the hole was swept with 50 barrels of high viscosity mud and then displaced with heavy weight (10.6 lb/gal) mud in preparation for downhole logging operations. The hole was then logged using the triple combo tool string, including the magnetic susceptibility sonde (MSS), and the Formation MiroScanner (FMS)-sonic tool. Each tool string was run twice from 85–444 mbsf. Neither tool string was able to pass below a bridge at 444 mbsf. Downhole logging operations were completed at 0630 h on 7 January. The drill string was pulled from the hole with the bit clearing the seafloor at 0711 h, ending Hole U1445A.

The vessel was offset 20 m south and Hole U1445B was spudded at 1010 h on 7 January. Cores U1445B-1H to 4H were retrieved with 101% recovery. The bit cleared the sea floor at 1320 h, ending Hole U1445B.

The vessel was offset 20 m west and Hole U1445C was spudded at 1415 h on 7 January. While retrieving Core U1445C-9H, the forward core winch line parted with approximately 240 m of line and the core barrel hanging below. After the core line and barrel were retrieved, the core line was re-headed and coring operations resumed. While retrieving Core U1445C-12H, the core winch line parted again, this time leaving the core barrel assembly and ~530 m of core line at the bottom of the drill string. We switched to the aft core winch line and attempted to fish the core barrel and line. The core line was grabbed, pulled from the drill string, and coring resumed, using the new wire on the aft winch.

Piston coring continued through Core U1445C-24H to a depth of 218.3 mbsf. The advanced piston corer temperature tool (APCT-3) was used on Cores U1445C-20H and 22H. Following two partial APC strokes, the XCB coring system was deployed for Cores U1445C-25X to 36X (218.2–305.2 mbsf). After coring operations were completed the hole was displaced with heavy mud. The pipe trip out of the hole was delayed for 3 h while a hydraulic dump valve was replaced on the iron roughneck power unit. The bit cleared the rig floor at 0430 h on 10 January. We secured the rig for transit and the sea voyage to Site U1446 (BB-7) began at 0548 h on 10 January.

After a 97 nmi transit, the vessel arrived at Site U1446 at 1515 h on 10 January. As the thrusters were lowered, a fishing line was spotted. The ship maneuvered around the line and dynamic

positioning assumed control at 1614 h. An APC/XCB bottom-hole assembly was made up and Hole U1446A was spudded at 2225 h on 10 January.

Science Results

The sedimentology team has described sediments from Holes U1445A, U1445B and U1445C, which are dominated by biosiliceous clays throughout. Due to the homogeneous nature of the sediments only one stratigraphic unit is recognized, divided into two subunits (Ia and Ib) primarily based on nannofossil and biosilica content. Subunit Ia lies between 0 and 165.28 m CSF-A and is characterized by olive gray to dark olive gray clay with biosilica, and clay with nannofossils, with occasional beds of nannofossil or biosilica-rich clay. Foraminifer fragments are a persistent but variable component of the Subunit Ia clays. One vitric ash, likely to be the Toba ash, was identified at Holes U1445A and U1445B at ~12 m CSF-A, but was not recovered in Hole U1445C. One interval of clayey calcareous ooze, rich in fine-grained authigenic carbonate, was correlated across Holes U1445A and U1445C at ~100 m CSF-A. Subunit Ib occurs from 165.28–667.56 m CSF-A, and is defined by the first occurrence of biosilica-rich clays at Holes U1445A and U1445C. The sediments in Subunit Ib are dominated by very dark greenish gray biosilica-rich clays with glauconite, with significant periods of increased diatom content between ~160 and 330 m CSF-A. From ~570 to 670 m CSF-A an increase in calcium carbonate content, primarily due to an increase in calcareous nannofossils, is noted. Foraminifer fragments and nannofossils are both much less common in Subunit Ib than Ia, but are present in small numbers throughout. Thin (~3–20 cm) turbidites are present in sediments from both Subunits Ia and Ib, varying in composition from silt-sized quartz-rich silt/sands, to foraminifer-rich sands, with occasional bioclastic-rich sands. Rarely the coarser bioclastic-rich sands contain fragments of corals or bivalves typical of shallow-water environments. Soupy and mousse-like intervals, characteristic of gas hydrate dissociation, were identified in sediments recovered using the APC at Holes U1445A, U1445B and U1445C, from both Subunits Ia and Ib. Overall, cores from Hole U1445C recovered with the XCB were considerably less disturbed by drilling and gas expansion than those recovered from Hole U1445A at the equivalent depth.

Calcareous nannofossils, diatoms, and foraminifers are present throughout the majority of the recovered sections. The ages obtained from the calcareous nannofossils, planktonic foraminifers, and diatoms generally show good agreement; paleomagnetic reversal datums agree well with the biostratigraphic age model. A reworked zone compromises some planktonic foraminifer last occurrence events. Rare reworked nannofossils are often found in core-catcher samples from U1445A-1H to 21H, with occasional appearances of reworked material in deeper cores. Rare, small (mm to cm scale) rip-up clasts containing Eocene to Miocene nannofossil assemblages are present within the Pleistocene sediments. Calculated sedimentation rates at Hole U1445A are remarkably constant over the last ~6 m.y., suggesting a mean sedimentation rate of 11.4 cm/k.y.

Geochemical analyses of samples from Holes U1445A and U1445B are complete. For reasons that are still not understood, the coulometer malfunctioned after analyzing samples between Cores U1445A-60X and 70X. One possibility is that these samples contain unusual substances that degrade the coulometer solution. We will test this hypothesis using samples from Site U1446. Overall, methane at Site U1445 is mainly of biological origin. Carbonate content is higher and more variable in Subunit Ia than in Ib. Total organic carbon (TOC) ranges from 1% to 3%, with diatom-rich sediment in the upper part of Subunit Ib having ~0.5%–1% higher TOC content. Sulfate reduction is nearly complete at ~20 m CSF-A, coinciding with a peak in alkalinity and a decrease in Ca^{2+} . Changes in the down core profiles of pore water NH_4^+ and Mn^{2+} are also related to the redox changes and the degradation of organic matter. Dissolved Fe is high throughout the upper ~200 m CSF-A. Barium and silicate concentrations are found in high levels in the upper 200 m CSF-A and have similar trends downcore. This is most likely related to changes in diatom productivity and the accumulation of biogenic silica and barite in the sediments.

Measurements of natural remanent magnetism (NRM) and NRM after 10 mT AF-demagnetization on all cores from Site U1445 were completed. The ChRM was analyzed up to 80 mT for discrete samples from Hole U1445A, which were used to constrain the archive-section demagnetization level and any preliminary polarity interpretations. A magnetostratigraphy was constructed up to ~500 m CSF-A (>4.19 Ma) for Hole U1445A and a more tentative magnetostratigraphy up to ~220 m CSF-A (<2 Ma) for Hole U1445C. Hole U1445B was too shallow for any polarity changes to be recorded. Bulk magnetic properties of Hole U1445A sediments were evaluated based on the acquisition and measurement of laboratory remanences on discrete samples. They provide encouraging results for further investigation postcruise.

Standard shipboard physical property measurements were made on all cores from Site U1445. The data show an anomalous porosity trend. Downhole temperature measurements were taken on Cores U1445A-4H, 7H, 10H, and 13H and U1445C-20H and 22H. A geothermal gradient of 50°C/km was calculated for Site U1445. A FLIR infrared camera was used on the catwalk for the thermal imaging of cores in order to detect cold spots from gas hydrate dissociation occurring within the core. IR anomalies (cold spots) were first detected in Core U1445A-4H and were mostly concentrated between Cores U1445A-20H and 30X.

Hole U1445A was logged from 80–440 mbsf. The logging tool strings could not descend below 440 mbsf due to the formation of a bridge. Two passes of both the triple combo and the Formation MicroScanner (FMS)-sonic tool strings were made. The data are currently being processed onshore.

The stratigraphic correlators used high-resolution records of the physical properties of sediments recovered in Holes U1445A and U1445C to construct a preliminary splice that is continuous through the upper 230 m CCSF-A.

Education and Outreach

A total of eight video broadcasts were held over the past week, which included schools in the United States, Germany, and France. Approximately 180 students participated in the broadcasts.

Technical Support and HSE Activities

The main technical support activities for the past week were processing core and supporting laboratory activities.

Laboratory/Computing:

- Cores from Sites U1445 and U1446 were processed and sampled.
- Problems were encountered sending the downhole logging data directly to Lamont-Doherty Earth Observatory (LDEO) for processing using the established protocol. The data instead were sent to IODP and was then forwarded to LDEO.
- The coulometer is not working properly; the cause is being diagnosed.
- The plastic scintillators and the coincident detectors on the Natural Gamma Ray (NGR) logger have powered off on their own.
- The Imaging Specialist is lightening core photographs for Site U1445 and U1446.
- DESClogik output and images are being sent to shore daily for processing.
- The applications developers are continuing to work to correct issues with correlation software tools:
 - Provided information to the *Correlator* software developers about depth-calculation methods in the LIMS database.
 - Provided IODP shore personnel and the *Correlator* software developers with examples of magnetic susceptibility data exported from *Correlator* based on the affine table and splice interval table created in *Correlator*. This included detailed analysis of the data and discrepancies between the data exported and the intervals defined in the splice-interval-table.
- The Applications Developers corrected a bug in the Gas Analysis Report that prevented the retrieval of data from LIMS database.
- The Marine Computer Specialists created user and email accounts for Expedition 354.

HSE activities:

- A Fire and Boat Drill was held on 12 January.
- The Indian scientists that boarded in Visakhapatnam were provided a safety orientation, informed of the anti-piracy measures in place, and shown what to do in case of a piracy situation.
- The eyewash stations and safety showers were tested.