

IODP Expedition 353: Indian Monsoon Rainfall

Week 8 Report (18–24 January 2015)

Operations

Hole U1447A was cored to a total depth of 738 mbsf by 1200 h on 20 January. The hole was displaced with heavy mud and the drill string pulled from the hole. The bit cleared the seafloor at 1705 h. The total core recovery for Hole U1447A was 99%.

The vessel was offset 20 m south and Hole U1447B was spudded at 2045 h on 20 January. Three APC cores were taken for high-resolution pore water chemistry. The total depth of Hole U1447B is 24.4 mbsf. The bit cleared the seafloor, ending Hole U1447B at 2220 h on 20 January.

The vessel was offset 20 m east and Hole U1447C was spudded at 2300 h on 20 January. The seafloor was estimated at 1403.6 mbrf, based on recovery of Core U1447C-1H. Hole U1447C was cored to a total depth of 160.9 mbsf. The total core recovery for Hole U1447C was 100%. The bit cleared the seafloor at 1405 h and the rig floor at 1735 h on 21 January, ending Hole U1447C and Site U1447.

The vessel made the 9.4 nmi transit to Site U1448 (proposed site AA-4B) in dynamic positioning mode while the drill pipe was being pulled. The vessel arrived at Site U1448 at 1845 h on 21 January. Hole U1448A was spudded at 0010 h on 22 January. The seafloor was estimated at 1109.7 mbrf based on the recovery of Core U1448A-1H. Hole U1448A was then cored to a total depth of 421 mbsf. The bit cleared the seafloor at 1830 h on 23 January, ending Hole U1448A. One unsuccessful temperature measurement was attempted on Core U1448A-4H. Orientation data was collected on Cores U1448A-3H through 23H using the Icefield tool. Total core recovery for the hole was 103%.

The vessel was offset 20 m south and Hole U1448B was spudded at 2010 h on 23 January. The seafloor was estimated at 1107.9 mbrf based on the recovery of Core U1448B-1H. Hole U1448B was then cored to a depth of 358.6 mbsf using the APC and HLAPC systems with one drilled interval of 1.5 m after Core U1448B-19H. Temperature measurements using the advanced piston corer temperature tool (APCT-3) were taken on Cores U1448B-4H, 7H, 10H, and 15H. Orientation data was collected using the Icefield tool on Cores U1448B-3H through 19H. The drill string was then pulled from the hole and the bit cleared seafloor at 1830 h on 25 January, ending Hole U1448B.

The vessel was offset 20 m west and Hole U1448C was spudded at 0750 h on 25 January. Hole U1448C was cored to a depth of 34.3 m using the APC system. The last core on deck for Expedition 353 arrived at 0925 h on 25 January. A total of four cores were taken with a 101% recovery rate. The drill string was then pulled from the hole with the bit clearing the seafloor at 1000 h. The rig was secured for transit to Singapore.

Science Results

The sedimentology team has completed the description of the cores from Site U1447. The sediments recovered from this site are late Miocene to Holocene in age and are hemipelagic clay with a significant biogenic component and occasional thin turbidites. They are primarily composed of greenish gray clayey nannofossil ooze with foraminifers, glauconite, or biosilica; foraminifer-rich nannofossil ooze with clay; clayey calcareous oozes with varying proportions of foraminifers and glauconite; biosilica-rich clay with varying proportions of glauconite and nannofossils; and nannofossil-rich clay with biosilica. The cores have been divided into four major lithological units based on the observed lithological differences primarily on varying abundances of biosilica (diatoms and sponge spicules), turbidites, and nannofossils. Cores from Hole U1448A were also described. The major lithologies of this hole are nannofossil-rich clay alternating with nannofossil-rich clay with foraminifers and foraminifer-rich clay with nannofossils. The minor lithology includes volcanic ash and bioclastic sand turbidites. One major unconformity is identified at a depth of 378 m CSF-A in Section U1448A-56X-5 between middle Miocene clayey diatom ooze with nannofossils and late Miocene clayey biosiliceous ooze with nannofossils.

At Hole U1447A, calcareous microfossils are abundant (50%–90% of sediment particles) or common (10%–50%). Their preservation is generally very good to moderate, except in Samples U1447-A-22H-CC and 23H-CC that contained poorly preserved, overgrown nannofossils. Foraminifers are dominant to abundant in the upper 650 m CSF-A in Hole U1447A; abundance decreases slightly below 650 m. Preservation is generally good to moderate with a few poorly preserved foraminifers in Sample U1447A-31F-CC. Diatoms are sporadically present in the uppermost 566 m CSF-A of Hole U1447A. From 566–740 m CSF-A, their abundance varies between abundant and few. Diatom valve preservation ranges from good to poor and valves are better preserved whenever the abundance is higher than common. We established the age model for Site U1447 by combining nannofossil, planktonic foraminifer, and diatom datums with paleomagnetic reversal datums. Combined fossil biostratigraphy indicates that the base of Hole U1447A is between 9–10 Ma in age.

The sediment record in Hole U1448A is continuous to 378 m CSF-A, where a hiatus is present. The age of the sediment just above the hiatus is constrained by the presence of the nannofossil *Reticulofenestra rotaria* (6.91–7.42 Ma). Combined fossil biostratigraphy indicates the age of the sediment below the hiatus is 14.91–15.1 Ma, suggesting ~8 m.y. is missing from the sediment record. The co-occurrence of the diatoms *Rhaphidodiscus marylandicus* and *Annellus californicus* in Sample U1448-A-60X-CC indicates that the age of the bottom of Hole U1448A is 16.7–17.3 Ma.

Hole U1447A was sampled for geochemistry at an interval of one whole-round and headspace gas sample per core, while Hole U1447B was an intensive geochemistry hole with whole-rounds and headspace samples taken from every section. Analysis of these samples is mostly complete.

Site U1447 exhibits moderate to high levels of organic matter remineralization, with an alkalinity maximum greater than 30 mM and complete reduction of sulfate by ~22 m CSF-A. Chemistry downcore, to a depth of 738 m CSF-A, appears to be dominated by methanogenesis and mineral diagenesis. Changes in lithology also affect downcore pore water as, for example, pore water Si increases where the sediments have increased biogenic silica content. Carbonate content at Site U1447 varies between 20%–40%, while total organic carbon is around 1% with slightly lower values downcore.

Geochemistry analyses for Hole U1448A are also underway. Preliminary data shows that Hole U1448A is similar to Site U1447 in the overall diagenetic patterns but with a reduced signal from organic matter degradation consistent with a lower sedimentation rate. Headspace methane was detected but with values much lower (<30 ppmv) than at Site U1447 (>1000 ppmv), while alkalinity was also relatively low with a maximum ~16 mM. Analyses are underway for nutrients, ions, carbonate and total carbon, and major and minor elements.

Paleomagnetic measurements were conducted on the archive half sections from Site U1447 with alternating field (AF) demagnetization up to 10 mT, and for Hole U1448A with AF-demagnetization up to 10 mT for the APC cores. Discrete samples taken from the Holes U1447A and U1448A working half sections were also analyzed, with AF-demagnetization up to 80 mT. For Site U1447, the paleomagnetic signal is generally good down to ~260 m and ~110 m CSF-A for Holes U1447A and U1447C, respectively. We constructed a magnetostratigraphy for Hole U1447A from 0–1.173 Ma. For Hole U1448A, the paleomagnetic signal appears quite good from 0–205 m CSF-A and a magnetostratigraphy is currently being constructed. NRM measurements are ongoing for Hole U1448B.

The Physical Properties team ran standard physical property measurements on all core sections from Sites U1447 and U1448. The sampling resolution of the whole-round physical properties tracks was changed periodically at the request of the stratigraphic correlators to assist with stratigraphic correlation. Problems were encountered with data offsets between magnetic susceptibility measurements taken on whole-round sections and the corresponding point measurements, as well as differences between the two whole-round track measurements taken on corresponding sections. No thermal anomalies indicating gas hydrate presence were encountered at either site. There is a dramatic change in physical property measurements, which was determined to correlate with an ~8 Ma hiatus at Site U1448.

The stratigraphic correlators worked with the application developers to resolve the issues related to the affine and splice interval tables produced by *Correlator*. Splices for Sites U1443, U1445, U1446, and U1447 are now available. The correlation between holes at Site U1448 and the splice interval table for this site are being constructed.

Technical Support and HSE Activities

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

Laboratory/Computing:

- The advanced piston corer temperature tool (APCT-3) #22 was repaired.
- DESClogik data and core images were sent to shore daily for visual core description production.
- The Applications Developers continued to work on issues surrounding stratigraphic correlation software tools:
 - The CorrDownload application was modified.
 - The developers are hand-editing the splice interval tables produced from *Correlator* so that the tables can be uploaded to the LIMS database correctly.
- The Applications Developers modified SampleMaster so that users cannot overwrite previously uploaded samples.

HSE activities:

- A fire and boat drill is scheduled for 27 January.
- The eyewash stations and safety showers were tested.