

IODP Expedition 362: Sumatra Seismogenic Zone

Week 4 Report (28 August–3 September 2016)

OPERATIONS

Week 4 of Expedition 362 (Sumatra Seismogenic Zone) continued with coring operations in Hole U1480G. Cores U1480G-18R to 70R advanced from 909.3 to 1412.1 m below seafloor (mbsf) with 265.5 m recovered (53%).

SCIENCE RESULTS

Sedimentology and Petrology

Cores U1480G-14R to 54R (Section 1) contain bioturbated black and dark gray clay and silty clay, and structureless muddy sand with plant material and mud clasts. From Section 54R-1 to 60R-2, there is gray-green and minor reddish-brown clay with agglutinated foraminifers. Below this interval, there is reddish-brown tuffaceous silty clay with biosiliceous debris and minor white- to cream-colored calcareous ooze. Small pebble-size obsidian clasts occur in Core 52R.

Structural Geology

A thin interval in Core 26R contains a concentration of normal faults. Cores 39R–56R contain no deformation structures and bedding dips remain near horizontal. Cores 61R–62R have faults with a variety of orientations and crosscutting relationships that suggest the faults are nearly contemporaneous.

Biostratigraphy

Biostratigraphic data document high sedimentation rates in the upper Miocene sediment sequence. Planktonic foraminifers and nannofossils occur discontinuously but provide sufficient age control through most of this section; diatoms and radiolarians near the base of it constrain increased sedimentation rates. Below the upper Miocene sequence, radiolarians, diatoms, and nannofossils indicate a condensed interval.

Paleomagnetism

Paleomagnetic data exhibit considerable variation in Hole U1480G. The intensity of natural remanent magnetization (NRM) and magnetic susceptibility have higher values in the dark gray to black clay in Cores 31R–50R compared to the bioturbated greenish-black and reddish-brown clay and silt in Cores 16R–30R. NRM intensity then shows a steady downhole decrease in the

black to very dark gray clay of Cores 51R–60R. The NRM of representative discrete samples was investigated using stepwise alternating-field (AF) or thermal demagnetization. Remarkably high values of magnetic susceptibility and NRM intensity are observed in black sand and mud layers in Core 38R, indicating a change in magnetic minerals. The thermal demagnetization behavior of several discrete samples suggests that the magnetic carrier in this interval is greigite.

Geochemistry

We collected and processed 61 pore water samples (Hole U1480G, Cores 2R–48R). Chloride shows a slight increase downhole to ~580 mM at Core 48R. Mg, K, Li, B, and Si remain at low concentrations. Calcium shows a decrease in concentration below Core 6R, which likely reflects uptake by carbonate cementation, consistent with core observations and very low alkalinities (<2 mM below Core 4R).

Methane concentrations in headspace gas samples reached a peak of 3800 ppmv at Core 53R and were in the range of 3–1427 down to Core 62R. Ethane was detected in Cores 15R–62R and reached a maximum of 35 ppmv at Core 53R. Coulometry and elemental analysis continue to indicate low carbonate content (0–5 wt%) and low organic carbon content (0.1–0.8 wt%), and the organic C/N ratios remain within the range characteristic of marine organic matter. Minor input of terrestrial organic material is apparent from the strong positive correlation between C/N ratios and organic carbon content.

Physical Properties

The average bulk density is 2.18 g/cm³ for Cores 2R–60R. Porosity values show general but slight decrease from ~35% (Core 2R) to ~31% (Core 60R). *P*-wave velocity values increase by ~500 m/s at Core 54R and reach values as high as ~4500 m/s down to Core 70R. Magnetic susceptibility has relatively low values in the sands and clays in the upper and middle portions of Hole U1480G, reaches its lowest values in calcareous sediments, and increases to its highest values in the volcanoclastic sediments and igneous rocks at the base of the hole. Thermal conductivity values range from 0.2 to 1.6 W/(m·K) in the sands and clays, from 1.0 to 5.5 W/(m·K) in the pelagic sediments, and from 0.5 to 3.0 W/(m·K) in the volcanoclastic sediments near the base of the hole.

Core-Log-Seismic Integration

In the top part of the section (Hole U1480E and the upper part of Hole U1480F), there is continuous coverage of physical properties, which has enabled the generation of a synthetic impedance log. Comparison of this with the seismic profile across Site U1480 provides several tie points between the physical properties and strong reflectors. Additional tie points were identified in the deeper section of Hole U1480G based on lithology, structural geology, and physical properties. Based on these ties, the mean velocity throughout the cored section is ~2250 m/s, with interval velocities that increase downhole. This time-depth relationship gives a good overall agreement between seismic reflectors and the core measurements.

EDUCATION AND OUTREACH

We continued frequent videoconferences with high school and community college marine science classes in California as well as with a class at a French high school in Montevideo, Uruguay. We continued with blog and social media updates. Collaboration with scientists increased this week as we started working on more involved blogs and postcruise projects.

TECHNICAL SUPPORT AND HSE ACTIVITIES

Technical staff continued to support the science activities at Site U1480. We continue to fix minor issues with applications accessing web services.

Laboratory Activities

We completed work on SRM software utilities and continued to work on discrete sample measurements. The seismic source was assembled for a possible vertical seismic profile (VSP) planned during wireline logging. We fixed various SampleMaster bugs and provided stratigraphic correlation support. Finally, the ship's website was updated with several recent publications.

HSE Activities

We held the weekly fire and abandon boat drill on 28 August.