

## **IODP Expeditions 367 and 368: South China Sea Rifted Margin**

### **Expedition 368 Week 4 Report (1–6 May 2017)**

The fourth week of the IODP South China Sea Expedition 368 consisted of (a) the installation of a reentry funnel and 10.75 inch casing to 723.7 m in Hole U1502B, and (b) rotary core barrel (RCB) coring below the casing from 723.7 to 825.1 m. All times in this report are in ship local time (the same as in Hong Kong, UTC + 8 h).

#### **Operations**

The week started while preparing the rig floor for reentry and casing operations in Hole U1502B. The hydraulic release tool (HRT) was made up to a landing stand and racked back in the derrick. The prepared mud skirt was moved onto the moonpool doors and centered underneath the rotary table. After rigging up to run 10.75 inch casing, 625 joints of casing (723.7 m) were run through the mud skirt. The landing stand was picked up and the casing was lowered through the moonpool and latched into the mud skirt. The bit, underreamer, and mud motor were assembled, and the mud motor and underreamer were function tested in the moonpool with good results. The remainder of the drill string was assembled, and the reentry funnel was welded securely to the mock hanger.

The drilling and casing assembly were lowered to the seafloor. After servicing the rig, the drill string was spaced out and Hole U1502B was spudded at 3763.7 mbsl at 1255 h on 1 May 2017. The drilling and casing installation continued until the mud skirt landed on the seafloor. After successfully drilling the 723.7 m long casing string into the seafloor, the go-devil was inserted into the drill pipe and pumped down to release the casing at 2220 h on 2 May. The drill string released from the casing assembly and the bit and underreamer were pulled back through the casing and back to the rig floor. After removing the tri-cone bit, the mud motor and underreamer were flushed with fresh water and laid out. The upper guide horn was reinstalled and the drill floor reassembled. The RCB outer core barrel was set up in the rotary table and the core barrels were spaced out to the outer core barrel. The remainder of the RCB bottom-hole assembly was made up and the drill string was lowered to 3732 m. The subsea camera system was deployed and run to near bottom in preparation for reentering Hole U1502B to begin coring operations. After a 3.5 h search, we found the Hole U1502B reentry cone and reentered the hole at 0400 h on 4 May.

The bit was lowered through the casing until encountering fill at 715.3 m, 12.4 m above the total depth of the hole. The top drive was picked up, a core barrel was dropped, and the hole was washed and reamed to bottom. A 20-barrel mud sweep was circulated to help clean cuttings from

the hole. Once the hole was clean, coring began in Hole U1502B from 727.7 m. Coring continued to 825.1 m (Core U1502B-16R) with a recovery of 55.9 m (57%).

## **Science Results**

This week scientists continued documenting their results from Site U1501 in the site reports, acquired and analyzed data from Hole U1502B, and began summarizing the results from Hole U1502A for presentations and reports. The IODP Operations Superintendent gave a presentation on casing installation and led tours to the engine room, the drill floor, and the bridge. On 4 May, the science summary meeting for Hole U1502A was held with the participation of the Expedition 367 scientists.

### *Lithostratigraphy*

Cores 36R to 40R from Hole U1502A and Cores 2R to 16R from Hole U1502B were described this week using a combination of visual core description, microscope examination of smear slides and thin sections, core imaging, color spectra, and magnetic susceptibility.

Four lithostratigraphic units have been defined in Hole U1502A. Unit I extends from Core 2R to 39R and consists of brownish and greenish clay, silty clay and clay-rich nannofossil-ooze with minor sandy silt, and nannofossil-rich clay with foraminifers. Unit II extends from core interval U1502A-40R-1, 0 cm, to 40R-6, 83 cm, and consists of dark greenish gray biosiliceous clay with abundant diatoms and sponge spicules. Unit III is defined by a light gray dolomitic limestone intercalated with a meta claystone from core interval U1502A-40R-6, 83 cm, to 41R-1, 31 cm. Unit IV is a hydrothermally-altered basalt in the last section of Core 41R at the base of the hole.

In Hole U1502B, Cores 2R to 4R-1, 0–27 cm, consist of limestone intercalated with highly fractured clast-rich clay, which can be correlated with similar units at the bottom of Hole U1502A. Cores U1502B-4R to 16R consist of hydrothermally altered and brecciated plagioclase-phyric basalt. Veins of quartz, epidotes, and sulfides are common.

### *Structural Geology*

The structural features of the sediment and rocks in Hole U1502A were also measured and described (width, frequency, and composition of veins, orientations and dipping angles of fractures and veins, etc). Many observed fractures are drilling induced. Natural fractures mainly concentrate on the lower part of Lithologic Unit II, where most of them have mm-scale offsets on fracture surfaces, and are often associated with a color alternation between greenish and brownish zones, possibly due to fluid alterations.

### *Biostratigraphy*

Several claystone and sandstone samples from Cores U1502B-2R to 6R were processed and examined for foraminifera, calcareous nannofossils, and diatom content. All samples are barren of microfossils except for Sample U1502B-3R-1W, 94–99 cm, where abundant agglutinated benthic foraminifera were found. This benthic faunal assemblage indicates deep-sea deposition below the calcium carbonate compensation depth. The benthic foraminiferal association found in this sample is similar in composition to that reported from Eocene deposits of coarse pyroclastic sediment overlying igneous basement at ODP Site 643 in the Norwegian Sea, which suggests an Eocene age for Core U1502B-3R.

### *Paleomagnetism*

Archive section halves from Cores U1502A-24R to 41R were measured on the superconducting rock magnetometer (SRM) at 2.5 and 5.0 cm measurement spacing (depending on type of material). 80% of the NRM is removed with a 25 mT alternating field; however, magnetic inclinations remain too steep at  $\sim 60^\circ$ , clearly showing that AF demagnetization cannot remove the coring-induced magnetic overprint on the poorly magnetized cored material. Therefore, it has not been possible to construct a magnetostratigraphic age model for Hole U1502A.

Stepwise thermal demagnetization was conducted on 26 discrete samples from Hole U1501D and 10 samples from Hole U1502A. It was not possible to isolate the characteristic remanent magnetization (ChRM) due to an apparent remagnetization of these samples that was actually due to the non-ideal settings of the SRM to measure discrete samples. Stepwise AF demagnetization was also conducted on seven discrete samples from Hole U1502A and isolated the possible ChRM. Discrete samples for thermal demagnetization show similar issues as those from Hole U1501D in their first demagnetization steps and will continue to be measured using JR6.

Measurements of archive-half sections of Hole U1502B with in-line AF demagnetization of NRM at 5, 10, 15, 20, and 25 mT steps were started. We are optimistic that since the material has higher intensities, the drilling overprint will become a lesser problem.

### *Geochemistry*

Measurements of minor and major elemental data were completed for Site U1501 and Hole U1502A. The Site U1501 data show good correlation with lithostratigraphic unit boundaries and will be helpful in the investigation of the diagenetic environment and the interpretation of interstitial water data. Calcium carbonate content at Site U1501 averages 37% in Unit I, 8% in Unit II, and 3.5% in Unit III. Average TOC (wt%) ranges from 0.3 in Unit I, to 0.65 in Unit II, to below detection limit in Unit III. Headspace gas content of 49 samples taken at Site U1502 measured zero in all but four cores, where it ranged from 1.1 to 4.33 ppmv (U1502A-7R, 32R, 33R, and 36R).

## *Physical Properties*

Whole-round and core section half measurements of velocity, density, magnetic susceptibility, natural gamma radiation, and thermal conductivity have been conducted on Cores U1502A-38R to 41R and Cores U1502B-2R to 8R. Measurements of moisture and density are ongoing.

Bulk density (MAD and GRA), magnetic susceptibility (WRMSL and MS Point), natural gamma radiation (NGR), and *P*-wave velocity (WRMSL and caliper) measurements all show overall increasing values with depth. This trend is interrupted by abrupt shifts to lower values between ~700 and 750 m. Porosity and thermal conductivity measurements show decreasing values with depth.

The formation physical properties data have been projected on the site seismic section and correlated with the observed lithostratigraphic units. Major seismic reflections match well with the physical properties data. Moisture and density measurements and estimation of radioactive concentrations (K, U and Th) are ongoing.

## **Education and Outreach**

The Education/Outreach team continued to interview the scientists and edit stories for blog posts and other media outlets. They presented ideas for an onboard outreach activity between all members of the science party and technical staff. They also introduced the group to Reddit, and plan to schedule a Reddit session later in the cruise, when students across the world can ask questions to the scientists onboard.

The U.S. Education/Outreach Officer conducted live broadcasts with schools, scheduled other educational and outreach broadcasts, and communicated them to the crew and scientists. She produced blog stories daily and semidaily depending on the broadcast schedule at <http://joidesresolution.org>. She also promoted Expedition 368 on social media including Facebook (<https://www.facebook.com/joidesresolution>), Instagram ([http://instagram.com/joides\\_resolution](http://instagram.com/joides_resolution)), and Twitter (<https://twitter.com/TheJR>), #exp368. Additionally, she met with several scientists and colleagues for her research for the curriculum development project around microfossils, evolution, and climate change over time.

The Chinese journalists produced several news media pieces including news articles, broadcasts and live education/outreach broadcasts, and daily diary columns. Additionally they made a promotional movie about the expedition. They also posted blogs and news on Weibo, and produced and broadcast several videos, including short TV news reports for SMG News in China, and several articles for Science and Technology Daily.

## **Technical Support and HSE Activities**

### *Laboratory Activities*

- Switched over to the SRM backup water chiller system during routine maintenance of the ship's chilling water system. The switch over went smoothly with no interruption to SRM measurements, which were in progress.

### *Application and IT Support Activities*

- Work continued on the Coulometer project.
- Worked on DESCLogik bug that prevented display of piece log.
- Worked with Publications Specialist on Strater to better display unit description and core summary VCD reports.
- Completed SEM thumbnail automation process in the MUT system.
- Participated in the annual TAMU security risk assessment review.
- Preparation for the upcoming desktop workstation replacement project is ongoing.

### *HSE Activities*

- The weekly fire and boat drill was postponed.
- All safety equipment has been checked.