

IODP Expedition 368X: Return to Hole U1503A (South China Sea)

Week 2 Report (18–24 November 2018)

The second week of the International Ocean Discovery Program (IODP) Return to Hole U1503A (South China Sea) Expedition (368X) included the transit to Hole U1503A (proposed Site SCSII-9B), reentering Hole U1503A, and RCB coring from 995.1 to 1470.5 m. All times in this report are in ship local time (UTC + 8 h).

Operations

The second week of Expedition 368X began while underway to Hole U1503A. The transit was completed after 24.6 h and ended at the expedition's first and only site, Hole U1503A (proposed Site SCSII-9B). The average vessel speed was 11.5 kt over the 284 nmi distance. The vessel arrived at Site U1503 at 0900 h on 18 November and the thrusters were lowered. The vessel shifted to dynamic positioning mode at 0953 h and the drill floor was cleared to begin operations on Hole U1503A. We did not deploy an acoustic positioning beacon, but prepared one for immediate deployment if required.

The upper guide horn was removed and a reentry funnel extension was lowered and secured in the moonpool. A four-stand rotary core barrel (RCB) bottom-hole assembly was assembled and lowered to 2990 mbrf. The subsea camera was deployed and run down the drill string while the drill string was deployed to 3874 mbrf. The search for the reentry system was quickly successful. The reentry cone was observed to be slightly below the level of the seafloor and full of debris from the previous drilling at Hole U1503A. The vessel was positioned for reentry and the bit was lowered into the reentry cone at 0014 h on 19 November. After several attempts to reenter the casing, the bit passed into the casing at 0039 h. The subsea camera system was recovered and a free-fall funnel (FFF) was welded to the top of the reentry funnel extension. The reentry FFF and extension were deployed down the outside of the drill pipe.

The upper guide horn was reinstalled and the bit was lowered into the 10³/₄ inch casing. The drill string was filled every 20 stands as the string was lowered towards the bottom of the casing. The driller tagged hard fill inside the casing at 956 m. The top drive was picked up and the driller washed down while pumping with slow rotation to 995.1 m. Total depth was reached at 1600 h on 19 November. A 30-barrel high viscosity sweep was circulated and a nonmagnetic core barrel was deployed to begin RCB coring in Hole U1503A.

Cores 2R–40R (995.1–1364.9 m) were cored at a rate of just over 100 m per day and recovery was generally poor (17%). Recovery began to improve in Cores 41R–51R (1364.9–1470.5 m; 38%) and the penetration rate dropped to less than 4 m/h. At the end of the week, we were

continuing RCB coring in Hole U1503A in order ultimately to recover and log basement. The top of basement is estimated to be at 1640 m.

Science Results

During the transit, laboratory groups continued safety training and reorientation to the vessel and their individual laboratories. The scientists began to acquire and analyze data from the Hole U1503A RCB cores. We held daily meetings with the entire science party to discuss operational and laboratory updates.

Lithostratigraphy

The structural geologists and petrologist spent the first several days of the week re-familiarizing themselves with the instrumentation and methods to be used during core description. We attended training sessions given by the IODP JRSO technical staff, including an introduction and safety training for the handheld portable X-ray fluorescence (pXRF) spectrometer, training for the operation of the Section Half Imaging Logger (SHIL) and Section Half Multisensor Logger (SHMSL), and an overview of the use of Sample Master (curation) and DESClogik (description software).

Later this week, the sedimentologists started to describe cores from Hole U1503A by a combination of visual core description (VCD), core imaging, and core scanning for color spectra and magnetic susceptibility (MS). Cores 2R to 48R (995.1–1441.7 m) were described based primarily on macroscopic description and define a single lithostratigraphic unit. Unit I (Cores 2R–48R) is composed of well consolidated to lithified claystone interbedded with greenish gray and dark greenish gray sandstone and siltstone intervals. The claystone intervals are dark reddish brown and moderately to heavily bioturbated. There are two types of sandstone, differentiated based on color, carbonate content, and sedimentary structures. The greenish gray sandstone is well sorted, massive, and has a higher carbonate content. Thin sections from this lithology show angular quartz and plagioclase in a carbonate cement. The dark greenish gray sandstones contain fining upward sequences and mud clasts. Siltstone interval occurrences increase downhole and contain cross, parallel, and convolute laminations.

Archive core halves from Cores 2R-1A to 48R-CC were measured on the SHMSL. We observe a decrease in the average MS for intervals deeper than Core 41R (1374.5 m). Color reflectance data in sandstone intervals is consistent with high carbonate content.

pXRF data were collected on archive core halves. Reddish brown claystone generally has a higher Fe content relative to other lithologies. Greenish gray sandstone has high Ca content. In intervals of high bioturbation, Fe content is low and Ca and Al content is high. Discrete samples for X-ray diffraction (XRD) measurement were measured in Cores 4R–28R. Unit I primarily

consists of quartz, plagioclase, and clay minerals. Relative mineral abundance is stable with the exception of Cores 5R and 9R, which are dominated by quartz and plagioclase.

Biostratigraphy

A 5 cm whole-round sample was collected from the core catcher by IODP JRSO technical staff. The sample was vacuum sealed and placed in cold storage for postexpedition analysis. Micropaleontological samples were not collected in exceptionally low recovery cores or in sediments that were not soft or semilithified.

Paleomagnetism

Hole U1503A archive core halves from Core 2R-1A to 48R-CC (995.1–1441.7 m), excluding the ones where only the core catcher was recovered, were measured on the superconducting rock magnetometer (SRM) at a 2.5 cm measurement spacing. After measuring the natural remnant magnetization (NRM), the cores were subjected to a stepwise in-line alternating field (AF) demagnetization. Depending on core recovery and lithology, usually only one discrete sample was collected from each core to perform AF demagnetization. No samples were collected for thermal demagnetization due to the time necessary to run those measurements and the limited duration of Expedition 368X.

All discrete samples (33 in total) were first measured to determine the anisotropy of magnetic susceptibility (AMS) with an AGICO Kappabridge KLY4. Then, the NRM was measured on the JR6 spinner magnetometer at room temperature and after demagnetization using the DTECH AF demagnetizer. Archive core halves and discrete samples show normal and reverse polarities. AMS shows an oblate shape with a fabric typical of sedimentation in calm pelagic environment.

Geochemistry

Headspace gas samples collected for the routine safety program contained less than 30 ppmv methane in Cores 2R to 44R. Methane content increases in Cores 45R–48R, with a maximum of 558 ppmv at 1427 m. Discrete sediment samples for carbonate, total carbon, nitrogen, and sulfur were collected. Total carbon content is generally low (0.6 wt%), however it increases to 1.1–1.7 wt% below 1367 m.

Discrete samples were collected for shipboard XRD analysis and colocated samples were retained for shore-based analysis for concentrations of major elements and several trace elements via inductively coupled plasma–atomic emission spectroscopy (ICP-AES).

Petrophysics

During the transit to Hole U1503A we received a reorientation and safety training in the Physical Properties Laboratories. Later in the week, we measured physical properties on Cores 2R to 48R for whole-round measurements of MS, gamma ray attenuation (GRA) density, natural gamma radiation (NGR), and split-core measurements of *P*-wave measurements using caliper (PWC),

moisture and dry density (MAD) measurements as well as thermal conductivity (TCON) on discrete samples. Because the contact between cores and liners is poor for RCB coring, no whole-round measurements of *P*-wave velocity were made.

The sediment bulk density of discrete sample measurements is relatively constant, with values around 2.2 g/cm³ for claystone and siltstone, and around 2.5 g/cm³ for sandstone. *P*-wave velocity increases with depth from 2300 m/s at 995 m to 2900 m/s at 1435 m. *P*-wave velocity values for sandstone are much higher, ranging 3100–4500 m/s. Thermal conductivity measurements range from 2–4 W/(m·K). Within lithologic Unit I we have identified six depth intervals with distinct physical properties. Relatively higher MS and NGR values are observed in intervals 995–1063 m and 1087–1272 m. From 1370–1442 m MS and NGR values are relatively low.

Technical Support and HSE Activities

The following technical support activities took place during Week 2.

Laboratory Activities

- Processed Hole U1503A cores.
- Olympus pXRF set up for use in the Downhole Measurements Laboratory.
- Technical staff are cross-training.
- NGR software testing continued. Data is being acquired and reported satisfactorily.
- Documentation of hardware communication and settings is being generated for all core loggers.

Application Support Activities

- Assisted technicians and scientists with various issues to support coring operations.
- Worked on modules of the new sampling/curation program.
- Working on converting LIMS to Excel to Java 9.
- Made the Bulk File download work on ship LORE.

IT Support Activities

- Repaired failed raid drive on server Krakatoa.
- Fixed coaxial cable at base of bow pedestal that was contributing to noise in satellite communications.
- Installed DiatomWare 2007 on four Transmitted Light Microscope computers.
- Fixed an Apple/Mac security software (McAfee End Point Security) compatibility issue with macOS High Sierra on a scientist computer.
- Fixed incorrect license file for Matlab on essential workstations.

- Discovered Acronis did not automatically start backups. Investigating continual backup failures on these select workstations.
- Investigating CommVault writing files to AMS webpage server.

HSE Activities

- Laboratory-specific safety training given to science party participants.
- Laboratory-specific safety training documents updated to include more safety issues specific to each laboratory.
- Personal Safety in Cold Environments training given to crew and technical staff participating in upcoming high latitude expeditions.
- Safety showers and eyewash stations tested.