IODP Expedition 385T:
Panama Basin Crustal Architecture and Deep Biosphere: Revisiting Holes 504B and 896A

Week 2 Report (25–31 August 2019)

Operations

Week 2 of International Ocean Discovery Program (IODP) Expedition 385T began with the completion of the final 160 nmi of the 1724 nmi transit from Antofagasta, Chile, to Hole 896A, arriving at 1254 h on 25 August 2019. The transit was completed in 5.75 d at an average speed of 12.5 kt.

After establishing dynamic positioning (DP), the upper guide horn was removed and a 92.5 m long bottom-hole assembly (BHA) was made up with an overshot tool to capture the CORK wellhead at the next site (Hole 504B). After making up 80 stands of drill pipe, reaching to 2389 m below rig floor (mbrf), the subsea camera was deployed. Another 36 stands of drill pipe were deployed to just above the seafloor at 3461 mbrf. The Hole 896A reentry system and CORK were quickly located and surveyed before we moved 0.75 nmi to Hole 504B in DP mode with the subsea camera deployed (0045–0245 h).

We arrived at Hole 504B at 0245 h on 26 August. During the subsequent 4 h, we attempted to capture the short pipe sticking up from the CORK ROV platform with a 6⅝ inch diameter overshot tool. At 0645 h, after three unsuccessful attempts to engage, we decided to pull the drill string with the overshot tool, which arrived at the rig floor at 1240 h. The overshot was removed and a fishing spear, which was fabricated by IODP JRSO staff for this specific purpose as a backup tool, was attached to the BHA. At 1300 h deployment of the drill string began while the ship moved back to Hole 896A in DP mode (1515–1845 h). The subsea camera was lowered at 1845 h, with the spear at 3197 mbrf; at the same time, the drilling line was slipped and cut and additional rig maintenance was completed. Deployment of drill pipe then continued until the spear had reached to just above the CORK at 3465 mbrf. The spear successfully penetrated into the CORK frame at 2215 h. We pulled the drill string until the spear with the Hole 896A CORK frame was at 3172 mbrf, and we offset the vessel ~50 m from Hole 896A. In order to find out how much of the CORK cabling with packers we had pulled out of the hole along with the CORK frame, we attempted to lay it all out on the seafloor by offsetting the vessel 20 m for each 28.5 m stand added to the drill pipe. A brief investigation of the seafloor did not reveal either the packer or the lead-in package on the seafloor, although some of the cabling was visible. Because the next step was to move over to Hole 504B and remove the wireline CORK there, three attempts were made to release the Hole 896A CORK frame from the spear on the seafloor, but the CORK frame remained firmly attached to the fishing spear. At 0300 h on 27 August we started to retrieve the drill string with the CORK frame attached. The subsea camera was

recovered at 0445 h and the CORK frame arrived on deck at 0955 h. Portions of the CORK frame had to be cut away to remove the fishing spear.

At 1100 h we began to lower the spear assembly back to the seafloor to recover the Hole 504B wireline CORK, while the vessel moved to Hole 504B in DP mode. The subsea camera was deployed at 1600 h, with the spear at 2501 mbrf. After the spear had reached 3457 mbrf, just above the CORK, it took ~1 h to engage the CORK frame at 1905 h. Given our lack of success in getting a visual on the seafloor of the elements below the Hole 896A CORK frame, we decided to pull the CORK vertically 390 m, offset 100 m from Hole 504B, and then pull whatever was attached slowly to the rig floor. At 2530 mbrf the subsea camera was retrieved. The spear arrived on deck at 0400 h on 28 August with bent tines and without the Hole 504B CORK frame, which must have fallen to the seafloor after the subsea camera was retrieved.

Operating under the assumption that the Hole 504B wireline CORK had been successfully removed from the hole, we decided to proceed with the logging and hydrogeologic objectives of the expedition. A logging BHA was made up to allow deployment of fluid sampling and temperature measurement tools with the coring line as well as Formation MicroScanner (FMS) wireline logging. At 0700 h deployment of the drill string began. At 1130 h (at a depth of 2412 mbrf) the subsea camera was deployed, and at 1400 h we began to survey the seafloor to locate the lost CORK frame from Hole 504B. The CORK frame was not located and at 1800 h we abandoned the search. We reentered Hole 504B at 1815 h and soon tagged an obstacle at 19 m below seafloor (mbsf), which was the expected depth of the top packer that had been deployed in the hole in 2001. We were not able to push the packer downhole with the logging BHA and we pulled out of the hole, clearing the seafloor at 1905 h. We then moved over to Hole 896A in DP mode (1915–2115 h) and reentered Hole 896A at 2130 h. As in the previous hole, we tagged an obstacle at 57 mbsf, which is presumed to be a stuck packer. Because we were able to push the packer only ~9 m downhole in half an hour with 10 klb of force, we decided that a milling job was needed. We pulled out of the hole, clearing the seafloor at 2240 h, offset 20 m north of Hole 896A, and began retrieving the drill string. The drill pipe traveling equipment was serviced between 0100 and 0145 h on 29 August. At 0600 h, the BHA with the logging bit was broken down on the rig floor.

A new BHA was made up with additional drill collars and a milling bit to remove the packers left in both holes. At 0800 h we began lowering the drill pipe while moving the vessel to Hole 504B in DP mode (0710–1120 h). The subsea camera was deployed at 1330 h with the bit at 2731 mbrf. The top drive was installed at 1500–1530 h, with the bit at 3455 mbrf. We reentered Hole 504B for the second time at 1550 h and retrieved the subsea camera. The packer was encountered at 19 mbsf. We began milling and working the junk baskets at 1715 h with a maximum weight of 20 klb. At 0630 h on 30 August, with the milling bit at 70 mbsf and a lack of advance for several hours, we pulled out of the hole. During the milling process, ~250 barrels of high viscosity mud were pumped in 15–20 barrel sweeps to clear the hole of milling debris.

We deployed the subsea camera, so we could have a look at the junk baskets, and cleared the seafloor at 0850 h. The boot-type junk baskets appeared full.

We thought it was prudent to have a try at Hole 896A while the milling BHA was in place. We moved over to Hole 896A in DP mode (0915–1145 h) to see if the packer in that hole could be milled and pushed down more easily. We located Hole 896A and reentered it for the second time at 1252 h. The packer was tagged at 66 mbsf. After retrieving the subsea camera (1300–1445 h), we milled with up to 20 klb of weight on the packer, which at some point slid from 72 to 88 mbsf. We continued to mill until 1700 h, when we reached 95 mbsf with diminishing rate of advance. With ~15 h of time on the mill, we decided it was time to retrieve and inspect the milling bit and junk baskets. We pulled out and cleared the seafloor at 1745 h, set back the top drive, and retrieved the drill string while moving the vessel to Hole 504B in DP mode (1800–2100 h). The milling bit arrived at the rig floor at 0005 h on 31 August. The mill was inspected and an estimated 95% of the tungsten carbide was missing from the mill's face. The junk baskets were emptied and ~35 lb of packer debris were removed from the two boot-type junk baskets, consisting of a mixture of the Swagelok connectors from the top of the packers, steel baffling slats, rubber, and copper threads from the cabling.

We made up a new milling bit assembly (0100–0215 h) and, after servicing the rig, began to deploy the drill string at 0300 h. We deployed the subsea camera at 0830 h and reentered Hole 504B for the third time at 1042 h. After installing the top drive and retrieving the subsea camera (1100–1200 h), we tagged the packer at 70 mbsf and began milling at 1230 h. We advanced to 110 mbsf, pumping 25-barrel sweeps and applying a maximum weight of 22 klb. At 2330 h we decided to retrieve the drill string due to diminishing advance.

Science Results

Whereas removing the wireline CORK wellheads deployed in Holes 504B and 896A from the R/V *Revelle* in 2001 proved less difficult than expected, we have so far not been able to remove the packers and related cables. In preparation for hopeful tool deployments, the new Multi-Temperature Fluid Sampler (MTFS) was assembled on the catwalk with consultation with technicians on handling and with the rig floor crew on preferred assembly protocols. The Schlumberger logging engineer also prepared the FMS tool. No borehole temperature measurements, borehole water sampling, or FMS logging has been possible so far.

Outreach

The Outreach team continued their activities by composing three blogs on the joidesresolution.org website, seven posts for Twitter (https://twitter.com/TheJR), four posts for Instagram (http://instagram.com/joides_resolution), and six posts for Facebook

(https://www.facebook.com/joidesresolution). The team also continued working with the JR Academy students and their science communication projects. The first ship-to-shore broadcast was conducted on 27 August to a high school audience in the United States. Evening activities were organized by the Outreach officers for the JR Academy students, including a workshop on developing communication skills using a method to make science research accessible and relevant for a specific audience, and a second Watercolor Wednesday on techniques to use in illustration projects.

The team also continued the assessment of the onboard Outreach Officer position. Initial findings indicate that, although the JR accounts have fewer follower numbers compared to similar research programs, engagement rates among the JR community far exceed benchmark metrics, showing an active and engaged network. More data will be collected in the following weeks while the Outreach team focuses their efforts on effective recruitment strategies for the onboard Outreach position and partnerships within the U.S. and globally.

JR Academy

Classes and exposure to shipboard life and science have continued for the JR Academy. Class time included interviews with IODP JRSO technicians, the Schlumberger logging engineer, and the Outreach Officers about their fields and pathways into their careers. Class topics included seawater characteristics, plate tectonics, minerals and mineral properties, rocks, and understanding the coring notation system in ocean drilling expeditions. Skills development during class time included concept mapping, reflection, how to engage in the research process including question development, writing, reading and understanding scientific literature, notetaking for laboratory work, and scientific communication such as message development and refinement as well as blogging. Additionally, over the course of a number of days, shipboard technicians helped lead the class through the basic processing of a core. Through this, students learned the background concepts of the equipment, core flow and operating the core logging tracks, splitting core sections and describing them, making smear slides and thin sections, preparing and running samples on the X-ray Diffractometer (XRD), carbonate analyses in the Chemistry Laboratory, and making moisture and density measurements. Students have also continued to work on science communication projects and have begun to work on their research projects. Since arrival at Sites 504 and 896, the JR Academy has engaged with the science mission of Expedition 385T as much as possible, watching deployments and recoveries of equipment whenever possible, and following the operational progress.

Technical Support and HSE Activities

Technical personnel engaged in supporting science, engineering, and JR Academy activities. In addition, staff members worked on special maintenance projects, documentation, and lab cross-training.

JR Academy

- Guided the students through whole-round measurements, core splitting, core description, section half measurements, magnetic measurements, and discrete physical properties and chemistry measurements.
- Students have finalized their projects and will be working with technical staff to complete their measurements/projects in the laboratories this week and next.
- Students were given demonstrations on thin section production, and Hole 504B thin sections were made for JR Academy.
- Students attended a SampleMaster Class and sampled core for their studies.
- Students attended a walkthrough of the carbonate analysis.

Laboratory Activities

- Fantail:
    - Completed preventative maintenance on portside winch level-wind. Found a seized motor, replaced with spare motor, tested and placed back into service. Bearings on seized motor replaced, tested, and placed back into storage as spares.
- Curation:
    - Scraped off old paint and rust from core catcher press with wire brush.
    - Worked on Catwalk entry Excel spreadsheets.
    - Organized curator files on the server.
    - Physical counts completed on all curatorial supplies with curator and supplies reorganized.
    - Worked on Catwalk Strategy Illustrations.
- Thin Section:
    - Completed a suite of sample thin sections for microscope/imaging testing.
    - Rewrote Thin Section Laboratory Confluence page to conform to electronic notebook standards.
    - Testing continues on the “LacCore” method for thin section impregnation. Looking at alternative epoxies.
- Chemistry:
    - LN2 Generator gauge failed and was replaced with spare. Looking into issue.
    - Testing stopped on the TOC analyzer and a new manifold was ordered.
    - New Gas Monitoring program and data logger are nearly finished.

    - Completed the cable for the Cahn balance. All Cahn balances are ready for the next expedition.
    - Installed the new natural gas analyzer and tracked down an issue with a faulty pressure sensor. Reconfigured the sample introduction lines.
    - Made placards with instructions for weighing samples on the Cahn balance.
    - Started creating an Excel workbook to monitor QA/QC data for ammonium and phosphate.
- X-Ray:
    - New computer for the Malvern was set up.
    - Found condensation inside the Bruker D4 XRD cabinet as well as light corrosion. The system is off and drying. Checking the Haskris controller and control valve for issues.
- Physical Properties:
    - X-ray Multisensor Logger (XMSL): replaced two fans on the modular power supply.
    - MAD: Experimenting with the amount of material measured and how it affects the quality of the results.
    - Section Half Multisensor Logger (SHMSL):
        - Fixed hardware and software issues that were preventing the accurate placement of the sensor based on the laser profile.
        - Removed sensor mounts from track, replaced rubber stand-offs and elastic components. Remounted and position calibrated.
        - New magnetic susceptibility standard holder being fabricated that will help correctly position the MS2E and MS2K probe tips.
    - New MS3 meter:
        - Successfully resolved communication issues with the Barrington Magnetic Susceptibility MS3 meter.
        - New IMS plug-in developed for both the Whole-Round Multisensor Logger (WRMSL) and SHMSL.
        - Testing on both tracks in progress.
- Core Splitting:
    - Reassembled the core splitting saw after last week's hardware issues and put back into service. Spare servo and gearhead ordered.
- Downhole Measurements:
    - Fabricated centering rings for the Kuster fluid sampling tool.
- Miscellaneous:
    - Completed science library book reorganization and inventory.
    - Reorganized leisure library by genre and last name.
    - Continued installing legacy logos in the stairwell, 86 logos installed so far.

Logistics Activities

- Started paperwork for offgoing 379T/385T shipments including items to be shipped for Siem Offshore (polar containers, drilling elevators, etc.).

Application Support Activities

- GEODESC
    - Continued meetings to design database and software.
    - Continued work to develop Excel and VBA prototypes to determine how to meet the requirements for the Data Capture application.
- IMS
    - Built and tested several Vis to obtain data from web services and to parse the retrieved information.
    - Modified Vis in WRMSL plugin to use new LIMS-Data and PARSE-ID libraries.
- Completed work with Marine Computer Specialist (MCS) and Assistant Laboratory Officer to build two laptop hosts to run Cahn Balance, one for the Radiation Van and one for the Department of Energy van.
- Updated video and network drivers on developers' laptops with help from the MCS.

I.T. Support Activities

- Fixed elevation movement issue with the satellite Bow antenna.
- Upgraded iPrint appliance to 4.0.2.

HSE Activities

- Held the weekly fire and boat drill as scheduled.
- Showers and eye wash stations checked.