IODP Expedition 349: South China Sea Tectonics

Week 6 Report (1–7 March 2014)

Operations

Week 6 of Expedition 349 (South China Sea Tectonics) began while pulling out of the hole (POOH) with the top drive from 759.8 to 730.62 m below sea floor (mbsf). After setting back the top drive, the drill string was pulled back to the surface. The bit was back on the rig floor at 1120 h on 1 March. The 10.75 inch casing stinger components were made up and the underreamer arms set to 12.75 inches. The top drive was then picked up and the mud motor and underreamer tested. After the test was successfully completed, they were racked back in the derrick. After assembling all the casing stinger components, a slip and cut of the drilling line was completed. The rig floor was then prepared for running 10.75 inch casing and 787.06 meters of casing with a 10.75 inch casing hanger were made up. The casing was lowered into the moonpool and secured with a casing elevator on the prepared landing platform. The buoyant weight of the casing string was 70 klb. The running tool was released from the casing and pulled back to the rig floor. It was then made up to the bottom of a drill collar stand and racked back in the derrick. The casing stinger with the bit, underreamer, and mud motor were then run inside the casing. Also included in the stinger were three stands of drill collars and 24 stands of drill pipe. The bit and underreamer were positioned just below the bottom of the casing after the running tool was landed and made up to the casing. The casing was run to the seafloor with drill pipe. The subsea camera system (VIT) was deployed and Hole U1432B was reentered at 0242 h on 3 March. The camera system was pulled back to the surface and set back into the storage position on the moonpool doors. The casing was run in the hole (RIH) to 223.5 mbsf. The top drive was picked up and the casing was lowered to 244.0 mbsf. The casing was washed to the bottom while pumping 530 gpm. At 530 gpm, the mud motor was turning the bit at 80–85 rpm with the underreamer arms extended to clear a 12.75 inch hole in front of the casing. The casing was steadily lowered until it was landed; the casing running tool was released at 1745 h on 3 March. The top drive was set back and the drill string tripped from the hole, clearing the seafloor at 2045 h on 3 March and then clearing the rig floor at 0915 h on 4 March. The casing stinger components were flushed with fresh water and either laid out or in the case of the drill collars, racked back in the derrick.

After successfully running the 10.75 inch casing, a cementing stinger was assembled. The stinger consisted of a reentry/cleanout bit, a bit sub, a stand of drill collars, 24 stands of 5 inch drill pipe, F Cup-type tester, another two drill collars, a tapered drill collar (TDC) and two stands of 5.5 inch transition drill pipe. The entire assembly was made up and lowered to just above the seafloor while stopping every 20 stands to fill the drill pipe with water. The camera system was run to just above the seafloor and Hole U1432B was reentered at 0344 h on 5 March. The camera system was pulled back to surface. The bit was lowered to 767 mbsf, which is 20 m above the

10.75 inch casing shoe. The F-cup tester was spaced out so that it was at 42 mbsf, inside the 16 inch casing. The circulating head was made up to the top of the drill string and the mud pumps were brought up to 60 spm to verify circulation up the annulus between the hole and the casing. After establishing circulation, the cement pump was used to pump 10 barrels of fresh water ahead of the cement slurry. Fourteen barrels of 15.5 ppg cement were mixed and pumped down hole, followed by another 10 barrels of fresh water. This was displaced down the drill string with 263 barrels of salt water using the mud pumps. After displacing the cement, the circulating head was removed and the driller attempted to pull the cement stinger out of the hole. The driller immediately noticed a steadily increasing overpull as he tried to pull out of the hole. After pulling up enough to remove 2 singles of drill pipe, we were unable to raise the drill string any further; the cement stinger was stuck in the hole. It now looks as if the formation collapsed around the 10.75 inch casing string preventing circulation up the open hole annulus and outside of the casing. Instead the circulation path was up between the 10.75 and 16 inch casing strings, bypassing the cup tester. In addition, the elevated temperatures at 700 mbsf accelerated the hardening of the cement. The drill string was worked for the next 9 h using combinations of overpull, torque, and pump pressure in an effort to free the drill string. At that point, we rigged up the wireline to sever the drill string. The drill string severing charge was lowered to just above the cup tester, which has a 1.5 inch internal diameter. The charge was activated at 0430 h on 6 March, but the pipe remained stuck in the hole. The wireline was pulled out of the hole and the tool cleared the rig floor at 0808 h. The drill pipe was worked with a maximum of 100 klb of overpull for ~1 h. The elevators were then lowered back to the elevator stool while the rig was offset 200 m. The top drive was picked up and the drill pipe was picked up slowly while moving the rig back to the original location. The pipe was worked free with a maximum of 400 amps of torque and 40 klb of overpull. The end of pipe cleared the seafloor at 1105 h. The top drive was set back and the drill string was pulled from the hole. The end of pipe was back on the rig floor at 1830 h. The seafloor positioning beacon was recovered while tripping drill pipe. The upper guide horn was reinstalled, the rig floor secured for transit, and the thrusters were raised. The vessel switched to transit mode at 2036 h on 6 March, ending Site U1432. The total time spent at Site U1432 was 17.9 days.

At the end of Week 6 the vessel was underway to Site U1433 (SCS-4B) with an estimated time of arrival at 0230 h on 8 March.

Science Results

With no new core this week, the scientists worked to finalize Methods sections and the Site U1431 reports. They also began working on the Site U1432 report. We held a science meeting to discuss the results from Hole U1432C. We also examined the differences between Sites U1431 and U1432 in anticipation of core from Hole U1432B. The Staff Scientist reviewed a summary of the different types of reports written by the science party during the expedition and when

those reports are published. A number of scientists also presented their own research in a series of 15 minute talks during crossover meetings held throughout the week.

After we were forced to abandon Hole U1432B without achieving one of our primary science objectives; to date the onset of spreading in the East Sub-basin of the South China Sea, the science party met to discuss how best to spend the remaining operational time for the expedition. We decided the first priority was to go to alternate Site SCS-6C, located on a basement high only ~18 miles northeast of Site U1432. Although this site may not directly address the initiation age of spreading in this part of the South China Sea, the nature of the basement high is not known. It could be a volcanic extrusion associated with early continental breakup and the onset of seafloor spreading, extruded lower crustal materials from lower crust extension, exhumed mantle materials, or a basement high composed of Mesozoic rocks. Coring at this location will help to identify the nature of this structure and improve our understanding of continental breakup and seafloor spreading processes.

Increasing ship heave (up to 2.5 m) forced us to re-evaluate this plan. As a result, we decided to transit to primary Site SCS-4B, located in the Southwest Sub-basin of the South China Sea, where we will drill near the relict spreading ridge to determine the termination age for seafloor spreading in this sub-basin. Physical properties and magnetics measurements on basement rocks will also help elucidate the reasons for the strong contrast in magnetic anomalies between the East and Southwest Sub-basins. After we reach out basement objective at this site (predicted total depth of 965 mbsf), we will transit back to alternate Site SCS-6C if operational time is still available.

Education and Outreach

We held 10 ship-to-shore video events with schools and universities in China, the Philippines, Spain, and the United Kingdom. We spoke with two schools in Guangzhou, China, reaching 34 middle school students and ~300 high school students. We also held events with the Institute of Oceanology in Qingdao (50 graduate students), China University of Geosciences in Wuhan (100 undergraduate and graduate students), China University of Geosciences in Beijing (200 undergraduate and graduate students), and Tongji University in Shanghai (90 graduate students). We spoke with a paleontology class at the University of the Philippines. We held two events with the United Kingdom, one with 67 girls from a high school in London and a second event with graduate students visiting the UK from the University of São Paulo in Brazil. Finally, we spoke with very enthusiastic high school students filling an auditorium in Salamanca, Spain. The local press attended this event as well.

Technical Support and HSE Activities

The following technical support activities took place:

Laboratory:

- Storeroom inventory completed.
- Book inventory completed.
- Underway:
    - Magnetometer deployed on transit to Site U1433.

The following HSE activities took place:

- A boat and fire drill was held on 3 March.