IODP Expedition 341: Southern Alaska Margin

Week 4 Report (16–22 June 2013)

Operations

Week 4 of Expedition 341 (Southern Alaska Margin) began while still XCB coring at Hole U1417D at 460.6 mbsf. After cutting Core U1417D-65X to 470.3 mbsf, Hole U1417D was terminated after successive XCB cutting shoes were damaged during coring operations by obstructions remaining in the hole. The drill string was then pulled from the hole and the bit cleared the rotary table at 1430 h on 16 June, ending Hole U1417D. A total of 36 piston cores were taken from Hole U1417D over a 220.1 m interval with a total recovery of 214.64 m of core (98%). There was a 3.8 m-long drilled interval within the APC section of the hole. A total of 28 XCB cores were cut over a 246.4 m interval with a recovery of 89.78 m of core (36%). Overall core recovery for Hole U1417D was 304.42 m for the 466.5 m cored interval (65%).

After clearing the sea floor, the vessel was offset 20 m to the west of Hole U1417D. The remaining APC/XCB BHA components were disassembled and laid out. The RCB components for the BHA were assembled and run to the seafloor. The top drive was then picked up, the bit was spaced, and Hole U1417E was spudded at 0230 h on 17 June. Water depth was calculated from a tide-adjusted offset from Hole U1417D to be 4188.6 mbsl. After spudding Hole U1417E, the hole was drilled down to 264 mbsf. The wash barrel was then pulled and Cores U1417E-2R to -5R were cut to 302.2 mbsf. The wash barrel was again deployed and the hole was advanced with a drilled interval to 399.0 mbsf. The wash barrel was pulled and RCB coring with non-magnetic RCB core barrels began from Core U1417E-7R and continued through Core U1417E-39R to a final depth of 709.5 mbsf. A total of 195 barrels of high viscosity mud were used during the drilling/coring process. At the conclusion of the drilling/coring phase of Hole U1417E an additional 50 barrel sweep of high viscosity mud was pumped to condition the hole for logging. After pumping the final sweep, the RST tool was deployed by wireline and the shifting sleeve inside the mechanical bit release (MBR) was pulled, releasing the bit at the bottom of Hole U1417E. After releasing the bit, the sleeve was shifted back and the top drive was set back. A total of 37 rotary cores were taken in Hole U1417E over a 348.7 m interval and recovered 146.92 meters (42%). There were two drilled intervals during Hole U1417E, which added up to 360.8 m of advance without recovery.

The drill string was then tripped out of the hole and the end of the pipe was set at 81.7 mbsf for logging operations. The triple combo logging string was then rigged up and run into the hole (RIH) reaching a total depth of 626 mbsf at 0200 h on 21 June. The hole was then logged up and the tools were pulled to surface and rigged down. After rigging down the triple combo tool string, the VSI tool string was rigged up. During the rig up time, the Protective Species Observation watches began and it became immediately apparent that a small colony of seals were surrounding the vessel. The decision was made to terminate the VSI run for the day, pull back the VSI tool string, rig down and prepare the FMS Sonic tool string for deployment. The FMS Sonic tool string was then rigged up and deployed to a depth of 571.5 mbsf. Two passes were made with the tool string and the tool string was then pulled to the surface and rigged down. The Magnetic Susceptibility Sonde (MSS) was then rigged up and run. The maximum depth the MMS reached was 206.0 mbsf. The hole was then logged with two runs and the MMS was pulled to surface and rigged down. The VSI tool was then rigged up and RIH. After

attempting to position the tool to the greatest possible depth, only one station was completed at ~211 mbsf. The tool was pulled out of the hole to the surface and rigged down. All logging equipment was rigged down and the knobbies were removed from the drill string. The drill string was then pulled from the hole.

At week's end the vessel was pulling the BHA from the hole and preparing to get underway to Site U1418 (GOA16-1A).

Science Results

The lithostratigraphy at Site U1417 has been described from 0–707.8 m (CSF-A). A record of tidewater glaciation is seen by the presence of interpreted iceberg rafted diamict in Holes U1417B, U1417D, and U1417E starting at approximately 260 m (CSF-A) transitioning upsection into frequently occurring lonestones. Beneath this unit is a 40 m-thick interval of dark greenish gray diatom bearing mud, lacking lonestones, which is highly bioturbated with *Zoophycos* burrows. The lower 300 m-thick unit recovered primarily in Hole U1417E records a history of fan building that includes coarse grained intervals that are dominated by gravity flow diamicts and graded sand beds that contain rounded pebble intraclasts, plant debris, and coal granules. These intervals alternate with color banded mud and diatom ooze. Thin intervals of carbonate-cemented sandstone and siltstone also occur at 450 m (CSF-A) and continue downhole.

The biostratigraphic examination of samples from Site U1417 is almost complete. Samples from Site U1417 reveal rich assemblages of siliceous microfossils, while calcareous microfossils are less abundant. Diatom and radiolarian biostratigraphic schemes indicate Site U1417 covers an interval spanning the last ~10 Ma. The microfossil assemblages at Site U1417 also provide insight into paleoclimatologic and paleoceanographic conditions. In particular, the relative abundance of some diatom and radiolarian assemblages and the coiling direction of the foraminifer *N. pachyderma* may allow for the identification of colder and warmer conditions for some intervals. Rare occurrences of benthic foraminiferal species that are more commonly found in shallower environments, brackish water and coastal diatoms, and abundant plant material in some core catcher samples suggest transport from shallower environments to this site.

All magnetic measurements on the cores from Site U1417 have now been completed with on going interpretation. The APC cored intervals preserve a consistently strong and stable magnetization with inclinations consistent with geocentric axial dipole (GAD) predictions for both polarities and serially correlated declinations. The record resolves most polarity zones through the Olduvai Chron with several well-preserved polarity transitions and apparent polarity excursions. Observations of the XCB portions of U1417B and U1417D and the RCB cores from U1417E suggest that these sediments also preserve an interpretable polarity record for most of the cored interval. However, because of incomplete core recovery the development of a detailed magnetic stratigraphy below the Gauss Chron may be challenging.

Physical property measurements, including initial low-resolution gamma-ray attenuation density and magnetic susceptibility; high-resolution gamma-ray attenuation density, magnetic susceptibility, and *P*-wave velocity; and natural gamma, have been collected for all of Site

U1417. Discrete sample measurements were collected from Holes U1417A, U1417D, and U1417E, although shear strength measurements were discontinued because the sediments became too hard to insert vane blades starting at ~267 m (CSF-A). The quality of the logged whole round data reduces in quality and is scattered in the lower depths of Holes U1417B and U1417D due to intermittent recovery from XCB coring. Hole U1417E was cored using the RCB system and as a result, data quality improved relative to Holes U1417B and U1417D. The discrete *P*-wave velocity and moisture and density (MAD) samples showed a similar trend through Holes U1417B, U1417D, and U1417E, although variability of the *P*-wave data increased with depth.

Correlation between high-resolution whole-round physical property measurements of Holes U1417A to U1417D allowed the establishment of a final and almost complete splice sequence for Site U1417 from the mudline to 220.4 m (CCSF-D). In addition, correlation between XCB and RCB cores was possible for some intervals where recovery was high enough and a new affine table incorporating these correlations is currently being built. The stratigraphic correlators also started to integrate biostratigraphic and paleomagnetic age datums from Holes U1417A to U1417E in order to construct a preliminary shipboard age model.

Sampling of interstitial water (IW) whole rounds and gas head space samples was completed in Holes U1417D and U1417E. A large increase in methane (2–3 orders of magnitude) was observed towards the base of Hole U1417D (~420 m (CSF-A)) but without corresponding IW sampling. Both headspace gas and IW sampling was resumed at 400 m (CSF-A) in Hole U1417E to document and ensure detailed coverage of this transition. IW's from Holes U1417D and U1417E have been analyzed for alkalinity/pH, chlorinity, calcium, magnesium, sodium, potassium, sulfate, bromide, phosphate and ammonium. Analysis by ICP-AES is now on-going with the completion of sampling at Hole U1417E. Squeeze cake and discrete samples from Holes U1417D and U1417E are currently being prepared for the final set of analyses for C/N and inorganic carbon. The geochemical trends in Hole U1417D are similar to those of Holes U1417A, U1417B and U1417C (low organic carbon and carbonate contents, low sulfate and higher ammonium contents with depth). However, several distinct features have emerged at depth in Holes U1417D and U1417E. Peaks in IW alkalinity are observed below 300 m (CSF-A) and there is a decrease in Ca and an increase in Mg (the reverse of the upper profiles) at 300 m (CSF-A). Intervals with slight increases in carbonate contents occur (still <3% wt), perhaps associated with the formation of authigenic carbonate, and an interval of increased biogenic methanogenesis is indicated by the headspace gas profiles.

The logging staff scientists and the Schlumberger engineer are currently wireline logging Hole U1417E. Three tools strings have been run into the hole. The first one was the triple combo, which measures gamma ray, density, porosity, resistivity, magnetic susceptibility, and borehole size. The second run was with the FMS sonic tool string that measures acoustic velocity and provides high-resolution resistivity images of the hole. The third run was the magnetic susceptibility sonde (MSS), composed of a high-resolution sensor and a deep reading sensor (the same as the one on the triple combo). The logging group will complete the logging of Hole U1417E and process the data in the coming week.

Education and Outreach

In addition to routine updates on the *JOIDES Resolution* website (http://joidesresolution.org/), Facebook (https://www.facebook.com/joidesresolution), and Twitter (https://twitter.com/TheJR), videoconferences were conducted via Skype. Participants were school groups from Girl Start and the Ann Richards School in Austin, Texas and a group of US teachers called Climate Earth Labs in Mississippi. In total, E&O connected with 226 children and 19 adult participants via live video broadcasting. Other duties performed include Skype and Zoom test calls for upcoming video broadcasts; video broadcast scheduling, curriculum development and assisting scientists in labs.

Technical Support and HSE Activities

The following technical support activities took place:

- Processing of the cores from Site U1417 was completed.
- Ten thin sections were made.
- The Protected Species Observer Class was given to the mammal observers.
- The EZ Stick for determining distance was calibrated by using the Z-Boat at a distance of 940 m and 1400 m prior to the VSP run.
- The VSP was run in Hole U1417E.

The following HSE activities took place:

- A fire and boat drill was held on Monday, 17 June.
- The eye wash stations were tested.