IODP Expedition 341: Southern Alaska Margin

Week 3 Report (9–15 June 2013)

Operations

Week 3 of Expedition 341 (Southern Alaska Margin) began while still XCB coring at Hole U1417B at a depth of 300.6 mbsf. XCB cores were cut from Core U1417B-42X through Core U1417B-47X to a depth of 358.8 mbsf. Hole U1417B was terminated after Core U1417B-47X at a final depth of 4559.5 mbrf (358.8 mbsf). At the conclusion of coring the top drive was set back and the drill string was pulled from the hole. The sea floor was cleared at 1645 h on 9 June, ending Hole U1417B. A total of 33 piston cores were taken over a 223.4 m interval at Hole U1417B with a total recovery of 211.97 m of core (95%) and 14 XCB cores were cut over a 135.4 m interval with a recovery of 50.99 m (38%). Overall core recovery for Hole U1417B was 262.96 m for the 358.8 m cored interval (73%).

After clearing the sea floor, the vessel was offset 20 m to the south of Hole U1417B. The top drive was then picked up and the bit was spaced out to 4200 mbrf in an attempt to recover a complete 9.5 m core, 1 m below the mud line. The 9.5 m core was recovered and with a 1 m advance/drilled interval. The mud line was estimated to be 4199.0 mbrf (4188.1 mbsf).

Hole U1417C was spudded at 1950 h on 9 June. Orientation was performed from Core U1417C-3H through Core U1417C-20H. Non-magnetic core barrels were used for APC coring from Core U1417C-2H through Core U1417C-25H to a depth of 213.8 mbsf. APC coring with wireline was extended starting with Core U1417C-26H through Core U1417C-29H using the half-length APC coring system. The final depth of Hole U1417C was 226.0 mbsf. A total of 28 piston cores were taken over a 225.0 m interval on Hole U1417C with a total recovery of 216.83 m of core (96%). Hole U1417C was terminated after Core U1417C-29H at a final depth of 4425.0 mbrf (226.0 mbsf). At the conclusion of coring the top drive was set back and the drill string was pulled from the hole. The sea floor was cleared at 0725 h on 11 June, ending Hole U1417C.

After clearing the sea floor, the vessel was offset 20 m to the west of Hole U1417C. The main blocks were then hung off and the rig crew performed a slip and cut of the drilling line, removing 115’ of line from the drilling line system and slipping a new 115’ of line into the system. The top drive was then picked up and the bit was spaced out to 4194.5 mbrf in an attempt to recover approximately 6.5 m on the mud line core. The mud line core was 6.05 m long and the depth of the seafloor was calculated to be 4198.0 mbrf (4187.0 mbsf)

Hole U1417D was spudded at 1155 h on 11 June. Non-magnetic core barrels were used for APC coring from Core U1417D-1H through Core U1417D-18H. After Core U1417D-18H, the non-magnetic core barrels were removed, the half-length APC coring system was deployed and APC coring continued to Core U1417D-37H at a final depth of 223.9 mbsf. There was one drilled interval after Core U1417D-20H of 3.8 m. The XCB system was deployed from Core U1417D-38X. On Core U1417D-59X, the core barrel came back with part of the XCB cutting shoe missing. The subsequent cores were carefully cut trying to recapture the “junk” left in the bottom of the hole. Signs of mechanical disturbance from the junk continued at each core. Coring with the XCB system continued through Core U1417D-64X to a depth of 4658.6 mbrf (460.6 mbsf).

At week’s end the vessel was still XCB coring on Hole U1417D at a depth of 460.6 mbsf.

Science Results

Holes U1417A, B, C, and D show a similar succession of lithofacies in the upper 220 m (CSF-A). In Unit 1 dark gray mud is the dominant lithology with thin interbeds of volcanic ash and biogenic-rich mud. Dispersed lonestones begin at 5 m (CSF-A) and are present throughout. Regularly reoccurring diatom oozes alternate with thicker intervals of dark gray mud with low biogenic content over an 80 m thick interval. Unit 2 begins at 160 m (CSF-A) and is a gray to greenish gray mud with distinct thin interbeds of fine sand and silt with fewer lonestones and less biogenic sediment. Unit 3 is a 30 m thick interval of diamict (thin beds of granules to pebbles in a muddy matrix with gradational lower contacts) interbedded with mud, suggestive of a period of intense iceberg rafting. Unit 4 is a dark greenish gray diatom bearing mud, lacking lonestones that is highly bioturbated with *Zoophycos* burrows.

The biostratigraphy for Holes U1417A, B, and C have been completed and Hole U1417D is in progress. Based upon diatom and radiolarian biostratigraphy, Holes U1417A, B, and C cover the last 2.8 to 3.5 Myr. Although diatom and radiolarian analyses have mainly focused on core catcher samples, we increased the resolution for diatom biostratigraphy by taking smear-slides from split-core sections. This sampling in between core catchers allowed us to better constrain the ages as well as gather paleoecologial information. Foraminifera are, in general, poorly preserved and where they are most abundant there is often post-depositional calcite on their shells. We are also finding benthic foraminifer species that may indicate low-oxygen conditions in the older parts of the record along with pyritic preservation of all three microfossil groups.

During the past week, measurements on the archive half were run through the superconducting rock magnetometer (SRM) to study the remanent magnetization. Holes U1417A, B, and C were completed and measurements of U1417D continue. These core halves were measured before and after alternating field demagnetization at peak fields of 5, 10, 15 and 20 mT. As found in Hole U1417A, a steeply positive viscous component was mostly or completely removed by AF fields 10 to 20 mT in all samples not affected by drilling disturbance. A consistently strong, apparently stable and well-preserved magnetization is revealed that exhibits an interpretable record of dual polarity in all Holes with a few well-resolved polarity boundaries. Inclinations in both polarities are consistent with geocentric axial dipole (GAD) values for the site location and declination is serially correlated. Observations of the XCB portion of U1417B and D suggest that these sediments extend into the Gauss Chron at U1417B and are presently within the Gilbert Chron at Hole U1417D. Measurements continue and a well-resolved magnetic stratigraphy is expected for most of the record at Site U1417 outside of possibly the lower Matuyama, where core quality was compromised.

Physical properties 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 radiation have now been collected through all of Holes U1417A, B, and C, as well as ~400 m (CSF-A) through Hole U1417D. The logged core data are reproduced between the Holes and continue to show cyclic variability in all measured properties down-core, although whole-round track data quality is reduced in the deeper sections of Holes U1417B and D due to incomplete recovery and variable core-width associated with the transition from piston coring to XCB coring at ~230 m (CSF-A). Discrete measurements of *P*-wave velocity, shear strength and moisture and density were resumed on Hole U1417D,

starting at Core U1417D-18H. Combining these data with measurements from Hole U1417A will yield the entire suite of discrete physical properties for depth of the site.

For coring and drilling of Holes U1417A, B, C, and D, we used stratigraphic correlation in real time, primarily using "fast-track" data from the special track multisensor logger (STMSL), and assisted in guiding the drilling operations by working directly with the co-chiefs, the operations superintendent, the drillers, and the tool pushers, as needed to recover a complete sequence and to obtain multiple copies of key intervals such as geomagnetic polarity transitions and boundaries. This process resulted in a preliminary "affine" table of depth offsets for the APC cores of Holes U1417A, B, C and D, which we refined by the incorporation of archival data (from the whole round multisensor logger and NGR), as well as a depth splice for the first ca. 224 m (CCSF-A) where full-length APC cores overlapped. Color reflectance data were used as a check on the correlations, but for this Site color variations were subtle, so primary correlations were based on magnetic susceptibility (MS) and gamma bulk density (GRA). Correlation between half-length APC cores and XCB cores (in which recovery of ~50% of the section is typical) was less successful, although for both core types some intervals of correlation between holes were documented. The correlation among the four Holes suggests that an essentially complete sequence was recovered to 190 m (CSF-A) or 224 m (CCSF-A; approximately the last 1.2 million years).

Sampling of interstitial water whole rounds and gas headspace continued down to the bottom of Hole U1417A. Headspace sampling was resumed in Hole U1417B from the maximum sediment depth in Hole U1417A to monitor for hydrocarbons. Interstitial water whole round sampling was resumed in Hole U1417C shortly above the maximum sediment depth reached in Hole U1417A, to achieve an overlap between both data sets. Sufficient interstitial water was recovered from all samples to satisfy all onboard analyses as well as shipboard and shore-based sample requests. The remaining interstitial water samples from Hole U1417A and those from Hole U1417C were analysed for alkalinity/pH, chlorinity, calcium, magnesium, sodium, potassium, sulfate, bromide, phosphate and ammonium. Further analysis by ICP-AES is still pending. Squeeze cake samples as well as discrete samples from Holes U1417A and C were freeze-dried, ground, and analysed for total C/N/S and inorganic carbon. The geochemistry data from Holes U1417A, B and C show overall low organic carbon and carbonate contributions to Site U1417, typical for an oligotrophic, deep-water setting. Interstitial water parameters show the zone of most intense organic matter remineralization occurring in the upper 40 m (CSF-A), and there is evidence for geochemical transformation processes in the upper 100 m (CSF-A), e.g., dissolution of ash and formation of authigenic clay minerals and carbonates.

During this week, the logging staff scientists and the Schlumberger engineer have finalized the tests on tools that will be used during the expedition.

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), eight videoconferences were conducted via Skype. Participants were school groups from Girl Start and the Ann Richards School in Austin, Texas; Marshfield High School in Missouri; Texas

State Aquarium's Sea Camp in Corpus Christi; a group of US teachers called Climate Earth Labs; a geology camp in New Zealand called GEO Camp; Alaska Sealife Center in Seward; and the Alaska Public Lands Office lunch session "Lunch with a Scientist" in Anchorage. In total, E&O connected with 218 children and 80 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:

- The cation problem with the Metrohm IC was fixed and it is now working properly.
- Currently trouble shooting the system for monitoring the pallet stores gases.
- The "abort" issues with the section half multisensor logger (SHMSL) were fixed.
- A second safety switch was added to the laser engraver.

The following HSE activities took place:

- The laser safety course and test were taken by all of the new technicians.
- The eyewash stations were tested.

In addition, the SIEM Waste Management Plan guidelines were introduced to the science party and IODP staff.