

## **IODP Expedition 341: Southern Alaska Margin**

### **Week 6 Report (30 June–6 July 2013)**

#### **Operations**

Week 6 of Expedition 341 (Southern Alaska Margin) began while piston coring Hole U1418E. Piston coring continued through Core U1418E-13H to a final depth of 182.3 mbsf. Total depth was reached at 1000 h on 30 June. After laying out the final core, the drill string was tripped back to 133.4 mbsf and the top drive was set back. The drill string was then tripped back to surface and the bottom-hole assembly (BHA) was set back in the derrick. The bit cleared the rotary table at 1900 h, ending Hole U1418E. A total of 11 piston cores were taken over a 100.6 m interval and recovered 98.7 m of core (98%). There were two intervals drilled without coring: the first was a 78.0 m interval and the second was a 3.0 m interval.

After clearing the sea floor, the vessel was offset 20 m to the west of Hole U1418E. Hole U1418F was spudded at 0445 h on 1 July. After spudding Hole U1418F, the hole was drilled without coring to 260.0 mbsf. The wash barrel was then pulled and Cores U1418F-2R and -3R were cut to 279.4 mbsf, but were empty when recovered on the rig floor. The core barrel, which had been dropped to cut Core U1418E-4R, was retrieved and a core barrel with a bit de-plugger was deployed. RCB coring with non-magnetic RCB core barrels resumed and Cores U1418F-4R to -69R were cut to 919.6 mbsf. During the course of the week, 68 RCB cores were recovered over a cored interval of 659.6 m and recovered 487.1 m (74%).

At week's end the vessel was still RCB coring in Hole U1418F.

#### **Science Results**

The lithology of Site U1418 has been described from 0–728 m (CSF-A) based on the six holes drilled. The upper 257 m (CSF-A) is dark gray (N 4) mud, lonestones and interbedded mud and silt suggesting continuous but variable terrigenous sediment deposition from ice-rafting, hemipelagic settling and sediment gravity flows. Silt laminae are up to 1 cm-thick and have sharp erosive lower contacts. Below this unit, dark greenish gray (10Y 4/1), muddy, clast-poor diamict interbedded with dark gray (N 4) mud, and mud with dispersed clasts continues to 728 m (CSF-A). Although the thicknesses of the diamict layers and the clast content vary, a repeating pattern is observed throughout. Mud is laminated at scales ranging from sub-mm up to 4 mm thick with gradational contacts. Intervals of laminae with variable thickness are bounded by thin beds of clast-poor diamict forming the interbedded diamict and mud lithofacies. Coarse sand, granules, and lonestones of variable composition including sedimentary, metasedimentary, and granitoid lithologies are present. A biosiliceous component, including diatoms and sponge spicules, is present in bioturbated intervals and some intervals are calcareous bearing. The fine scale lamination and presence of abundant granules and pebbles suggest deposition dominated by meltwater plumes and ice rafting.

Holes U1418A to U1418F were studied for biostratigraphy. Abundant calcareous microfossils are present with sporadic siliceous microfossil abundances. In spite of the low diatom abundance, species composition of diatom-rich samples is diverse. The age of the cored

sediments is younger than 1 Ma based on biostratigraphy of all of the microfossil groups. Radiolarian datums from Holes U1418A to U1418E suggest the bases of these Holes are 30 kyr to 0.4 Ma in age. The sediments from the base of Hole U1418F are older than 0.5 Ma based on diatoms, planktic foraminifera and radiolarian datums.

Sediments from Holes U1418A–U1418E are normal polarity and are within the Brunhes Chron. The Brunhes/Matuyama reversal was obtained in Core U1418F-43R (657.5–667.4 mbsf) and part of the reversal transition is observed.

Physical property measurements were performed on whole-round core sections from Holes U1418D, U1418E and U1418F, including low- and high-resolution magnetic susceptibility and gamma-ray attenuation bulk density and natural gamma radiation. Discrete moisture and density measurements from working halves were completed to the base of Hole U1418D and to 500 m (CSF-A) in U1418F, while *P*-wave velocity and shear strength measurements have been completed to the base of U1418D and to 620 m (CSF-A) in U1418F. Bulk density, natural gamma radiation, porosity, and shear strength all show cyclic variability superimposed on long-term trends with increasing depth. Seismic velocities increase linearly down-core, from ~1500 to >1700 m/s, while density increases asymptotically, from ~1.8 g/cm<sup>3</sup> at the surface to ~2.1 g/cm<sup>3</sup>. Porosity decreases asymptotically down-core, ranging from ~60% near the surface to ~40% at 500 m (CSF-A).

Correlation between high-resolution whole-round physical property measurements of Holes U1418A, U1418C, U1418D and U1418E allowed the establishment of a final and continuous splice sequence (CCSF-D) for Site U1418, where only three tie points are equivocal. Hole U1418F consists of rotary (RCB) cores at depths greater than the splice, while Hole U1418B consists of two special-purpose cores for porewater sampling and were not used in the splice. In order to correct for the affine growth, we also developed an additional depth model, CCSF-B, which compressed the CCSF-A and -D scales into a scale that has the same total depth of sediment column as the interval actually drilled. Ongoing work includes the integration of available age datums for the construction of an initial age model.

Sampling of interstitial water whole rounds and gas headspace samples was resumed on Hole U1418D shortly above the maximum sediment depth from Hole U1418A (in m CSF-A), and continued through Hole U1418F (with some overlap) to ensure continuous down-core profiles. The interstitial water samples from Holes U1418D and U1418F were immediately analyzed for alkalinity/pH and chlorinity. For Hole U1418D, IC analysis for cations and anions, and photometric analysis for ammonium and phosphate, has been completed. These analyses are on going for Hole U1418F. ICP-AES analysis has been completed on Hole U1418A interstitial water samples. Discrete samples from Holes U1418A and U1418D have been prepared and analyzed for total carbon, nitrogen and carbonate contents. In Holes U1418D and U1418F, low concentrations of alkalinity, sulphate, and phosphate are recorded. Increases in barium, strontium and lithium are recorded down-core. Dissolved silica is high but shows no clear down-core trend. Methane remains at high but variable concentrations through Holes U1418D and U1418F, ranging from 5,000–63,000 ppmv. Total organic carbon (TOC) contents range from 0.3–0.9 wt%, and show an overall down-core increase. The pattern of TOC is anti-correlated with CaCO<sub>3</sub>%, which fluctuates between 0–5% superimposed upon an overall down-core decrease through Holes U1418A and U1418D.

In order to integrate features observed at Site U1417 at a larger scale across multiple datasets, we have made a preliminary comparison between lithostratigraphy, physical properties, logging, and seismic data. Core observations and logging data have been compared mainly to evaluate the nature and extent of sediment through poorly recovered depth intervals and to examine whether sedimentary facies can be observed at the borehole scale. Generally, lithological boundaries in cores correspond to transitions between low and high magnetic susceptibility (MS) values in logging data. Diamict intervals have also been related to high MS values below 350 m (CCSF-B). Volcaniclastic sand/silt observed in cores is often found to correspond with an increase in potassium measured in spectral gamma ray logs, while sand layers are generally corresponding with lower total gamma ray intervals. Generally, log and physical properties data show good correspondence when displayed in the CCSF-B and WMSF depth scales, respectively, although there is a vertical offset on the order of a few meters. Similar trends and distinct features are found in both log and core measurements, including natural gamma radiation, bulk density, *P*-wave velocity, and magnetic susceptibility. Based on two-way travel times calculated from average *P*-wave velocities from cores and logs, we find that the lithostratigraphic unit and logging unit boundaries often coincide with significant seismic reflections or boundaries between primary seismic sequences. Taken together, preliminary correlations between core, log, and seismic data indicate that full characterization of the drilled interval will be possible at multiple scales (from centimeters to hundreds of meters), even through intervals of lower core recovery.

## **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 and Zoom. Participants were school groups from the Carnegie Museum of Natural History in Pittsburgh, Pennsylvania; Havelock North High School and St. John's College in New Zealand; and we were a featured session at the Newcastle University, England Northeast Science Festival. In total, E&O connected with 165 children and 65 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 the labs.

## **Technical Support and HSE Activities**

The following technical support activities took place:

- The cryogenic magnetometer tracking system is experiencing difficulties. The possible cause is the gearbox on the drive motor, which has been making noise. The gearbox will be repaired during a down interval.
- The SHMSL crashed and one reason for this may be the cables to the USB 4000 unit. There are also issues with the calibrations and calibration file selection.
- The core saw blade was replaced after a blade was ruined by hitting a piece of an XCB bit in a core.

- Following the range calibration with the Zodiac, new interchangeable ends were made for the EZ Stick, one for 1400 meters.

The following HSE activities took place:

- A fire and boat drill was held on Wednesday, 3 July.
- All of the eye wash stations were tested on 6 July.