IODP Expedition 341: Southern Alaska Margin

Week 9 Report (21–27 July 2013)

Operations

Week 9 of Expedition 341 (Southern Alaska Margin) began while tripping out of Hole U1420A. The end of the pipe was set at 93.29 m DSF for downhole logging. A modified tool string, termed the Sonic-Induction tool string, was run to 282 m DSF. After repeated attempts to run the tool string deeper, the string was pulled back to the bottom hole assembly (BHA) and another pass to 282 m DSF was performed. After the final pass, the tool string became stuck in the BHA and the Kinley cutter was rigged up. The crimper was deployed and the logging cable was crimped, securing the tools in the BHA. The Kinley cutter was then deployed and the logging cable was cut. The drill string was then pulled back to surface, the logging tools removed from the BHA, and the BHA secured.

After a 1.5 h, 11.9 nmi transit the vessel arrived on location at Site U1421 (proposed site GOAL-17B). The vessel stabilized over Site U1421 at 0235 h on 22 July and the positioning beacon was deployed at 0245 h.

Hole U1421A was spudded at 0730 h on 22 July. The mud line core recovered 6.82 m of sediment and the sea floor was calculated to be at 718.5 mbsl. All piston cores were tide corrected at the drill down before each core was shot. Non-magnetic core barrels were used for APC coring from Core U1421A-1H through -8H and orientation was performed on Cores U1421A-2H through -8H. APC coring continued from Core U1421-9H to -19H with the half-length APC coring system using steel core barrels. Partial APC strokes were recorded on Cores U1421A-6H, -8H–10H, -13H–16H, -18H, and -19H. The XCB coring system was deployed from Core U1421A-21X through -85X. The total depth of 702.7 m DSF was reached at 1825 h on 26 July.

Three hundred sixty barrels of high viscosity mud were used to clean the hole during coring operations. The drill string was pulled back and the end of the pipe was set at 96.57 m DSF. The Sonic-Induction tool string was run to 698.3 m WSF and two passes were made. The Vertical Seismic Imager (VSI) tool was then rigged up and run in the hole (RIH). Protective Species Observation watches began at 0700 h. No protected species were observed during this period within the 1410 m-diameter exclusion zone, so the sound source was ramped up starting 1 h after the watches commenced. Watches continued throughout the VSI run with the sound source fired manually while RIH. After the tool tagged bottom, it was positioned at the first station. In all, nine stations were attempted and measurements were recorded at six stations. The tool was then pulled out of the hole to the surface and rigged down at 1630 h. The sound source was secured and Prospective Species Watch ceased after the last station was completed. The bit cleared the seafloor at 1715 h on 27 July, ending Hole U1421A.

Hole U1421B was spudded at 1925 h on 27 July. The mud line core recovered 6.23 m of sediment and sea floor was calculated to be 722.7 mbsl. After consultations with the stratigraphic correlator, Hole U1421B was abandoned after the mud line core, which was not taken at the ideal depth to achieve a complete section.

Hole U1421C was spudded at 2005 h on 27 July. The mud line core recovered 8.57 m of sediment and sea floor was calculated to be 721.8 mbsl. All piston cores were tide corrected at the drill down before each core was shot. Non-magnetic core barrels were used for APC coring from Core U1421C-1H through -6H. The half-length APC coring system was used for Cores U1421C-4H to -6H. After shooting Core U1421C-6H to a total depth of 38.2 m, we were unable to retrieve the core barrel which had became stuck. We terminated Hole U1421C and retrieved the BHA. After the BHA was back on board and disassembled, the ship started the transit to Valdez, Alaska at 1245 h on 28 July.

The ship is scheduled to arrive at Valdez at 1100 h on 29 July.

Science Results

Three Lithostratigraphic Units were recognized at Site U1420. Unit I from 0–58.2 m CSF-A consists of very dark gray muddy, clast-rich diamict interbedded with clast-poor diamict with angular to rounded clasts. This diamict was likely deposited from intense iceberg rafting along with mud from meltwater plumes. Unit II (58.2–448.5 m CSF-A) is dominated by washed pebbles, drilled (cylindrical shaped and abraded) rocks, and limited fine-grained lithologies. Unit III (448.5–1014.5 m CSF-A) is dominated by interbedded diamict and mud, which is interpreted to represent variations in the supply of ice-rafted debris and meltwater in a proglacial setting due to fluctuations in the grounding-line position. The dominance of diamict and mud with lonestones suggests the continuous presence of tidewater glaciers on the continental shelf during the deposition of Unit III.

Hole U1421A was cored to 702.7 m CSF-A (Cores U1421-1H to -85X) and core recovery was 30. Two Lithostratigraphic Units were defined. Unit I from 0–57 m CSF-A is very dark gray to dark greenish gray mud, interbedded with diatom bearing mud and diatom rich mud. The number of lonestones varies from dispersed to abundant below 6.4 m CSF-A. Unit II from 57 to 702.7 m CSF-A is very dark gray silty clast-rich diamict interbedded with clast-poor diamict and mud with abundant clasts. Most common clast lithologies are siltstone, sandstone, basalt, and argillite. Evidence of downslope transport within Unit II includes erosive lower boundaries of diamict and soft-sediment deformation in intervals of laminated diatom ooze. Muddy intervals with biogenic silica and low clast abundance indicate reduced ice rafting and/or increased productivity. Biosilica-rich or diatom-rich mud occurs in Cores U1421A-22X, -41X, and -55X–57X. Diatom ooze occurs in Cores U1421A-61X to -63X and -75X. A dark greenish gray finely laminated diatom ooze occurs in Section U1421A-63X-1.

Siliceous microfossils occur infrequently at Site U1421 while calcareous microfossils are continuously present. Diatoms at Site U1421 are within the biostratigraphic Zone NPD 12 (0–0.3 Ma) throughout the section recovered. Radiolarians found in Sample U1421A-77X-CC (616.33 m CSF-A, median depth) are in the *Botryostrobus acquilonaris* Zone (0–0.5 Ma). However in Sample 341-U1421A-46X-CC (343.59 m CSF-A, median depth), we recorded the LO of *Lychnocanoma sakaii* suggesting that sediment are older than 0.03 Ma. Based on microfossil biostratigraphic data, the oldest collected sediments are between 0.03 to 0.3 Ma. Benthic foraminifera appear to be a mixture of transported specimens, largely shallow water (neritic; <100 m) *Elphidium* spp., and in situ specimens comprised primarily of *Epistominella pacifica*,

Eubuliminella exilis, and *Islandiella norcrossi*, which are expected to be abundant at middle neritic to upper bathyal depths (~100–1000 m) in the Gulf of Alaska. *Elphidium* spp. specimens are often fragmented, further suggesting that they have been transported to this location. When the siliciclastic sand fraction is low and foraminiferal group abundances increase, the deeper water fauna dominates and *Elphidium* spp. are rare to absent, suggesting periods of reduced downslope transport. However, sandy samples with *Elphidium* spp. dominate the core catcher samples. Relatively more radiolarian and diatom taxa typically found in shallow water (neritic) are observed at the lower part of the section. Deeper water (>500 m) radiolarians increase in proportional abundance between 300 and 400 m CSF-A, suggesting a decline in sedimentation from the shelf during that interval. Neritic radiolarian and planktic foramifer species are typical for subarctic faunas. The ratio of cold water to temperate water planktic foraminiferal species fluctuates, suggesting some changes in temperature in this record.

During the last week we finished measuring and processing paleomagnetic data from Site U1420 and began to measure sediments from Site 1421. Data collected at Sites U1420 and U1421 revealed normal polarity through the recovered interval.

The stratigraphic correlators identified a bug regarding the application of the splice and worked to correct the error. In addition, real-time stratigraphic correlation primarily using "fast-track" (Special Task Multi-Sensor Logger) physical property data was performed at Hole U1421B to guide the drilling operations as needed to recover the most complete sequence possible at Site U1421.

We measured physical properties on all cores from Hole U1421A. All routine track measurements, including magnetic susceptibility, gamma ray attenuation (GRA) bulk density, *P*-wave velocity, and natural gamma radiation (NGR), were collected. GRA bulk density shows an increase downhole within the APC cores (0–96 m CSF-A) with slight drops at ~20 and ~50 m CSF-A. NGR measurements varied between 14 and 41 counts per second, showing a down-hole increase to ~96 m. *P*-wave velocity values from the track varied between ~1500–~2200 m/s. Discrete *P*-wave measurements measured on the working-half sections ranged from ~1450–1975 m/s. *P*-wave values show significant scatter, with a slightly increasing down-hole trend. Shear strength measurements ranged from ~5–80 kPa and generally increase down-hole, with increasing scatter observed starting at Core U1421A-6H. We measured multiple instances of elevated (~50–80 kPa) shear strength at ~50, ~60, ~80 and ~110 m CSF-A. Moisture and density measurements show generally increasing bulk density and decreasing porosity from ~0–50 m CSF-A. Below ~50 m CSF-A, bulk density values vary from 1.9–2.4 g/cm^3 and porosities range from 28%–45% with no significant trend.

Downhole logging operations in Hole U1420A were completed at 2345 h on 21 July, after one logging tool string was deployed. Due to concerns about difficult borehole conditions and limited time at the end of the expedition, this modified tool string (the "Sonic-Induction tool string") was designed to record the highest priority logging measurements for science objectives in a single logging run. The Sonic-Induction tool string measured total gamma ray, borehole diameter, sonic velocity, and resistivity between the base of the pipe (at 93.3 m DSF) and 282 m DSF. The logs, recorded in meters below rigfloor, were shifted to meters below seafloor based on the step increase across the mudline identified in the gamma ray measurement. The caliper log indicates that borehole diameter was greater than 18 inches in the upper and lower sections of the logged

interval, and between 13 and 18 inches in the intermediate interval. Despite the enlarged borehole size in this latter interval, the logging data quality is good, as evidenced by repeatability in the measurements between the two logged passes. Variations in *P*-wave velocity and resistivity logs from Hole U1420A highlight distinctive intervals that likely correspond to changing lithology, and provide geophysical characterization in an interval through which core recovery was very low (avg. <4%).

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 from New Zealand were: the Hawkes Bay Brand of the Royal Society of New Zealand, University of Otago, Massey University Kid's Club, Geological and Nuclear Sciences scientists, Victoria University, Otago University Advanced School Sciences Academy, and Team New Zealand Homeschool Group. Other groups were Rochedale High School in Australia, the Texas State Aquarium Sea Camp, the Alaska Public Lands Office, and the Consortium for Ocean Leadership. In total, E&O connected with 155 children and 226 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:

- Core processing and analytical support for the Science Party.
- End-of-expedition activities including:
    - Preparing end-of-cruise shipments;
    - Completing expedition Technical Reports;
    - Closing down of the laboratories and preparing them for the next expedition.

The following HSE activity took place:

- The weekly fire and abandon ship drill was held as scheduled.