

IODP Expedition 323: Bering Sea Paleoceanography

Week 8 Report (23-30 August 2009)

30 August 2009

OPERATIONS

Week 8 of Expedition 323 began while spacing out to fire the first APC core at Hole U1345A (originally NAV-1B) in our northernmost Aleutian Basin region site. By Tuesday morning, five holes, had been cored. Holes U1345A, U1345C, U1345D, and U1345E were cored using nonmagnetic coring assemblies to a total depth of ~150 m DRF. Hole U1345B, a microbiology-dedicated hole, was cored to 36.7 m. Both, per-fluoro-methyl-cyclohexane (PFTs) and microspheres were deployed for contamination testing at this hole.

All holes were offset 20 m northwest from the last one cored at an average seafloor depth of 1019.54 m DRF. APC recovery for Holes U1345A to U1345E was Hole U1345A: 101.1% (148.49 m recovered); Hole U1345B: 104.2% (38.24 m recovered); Hole U1345C: 102.9% (152.85 m recovered); Hole U1345D: 103.1% (154.62 m recovered); Hole U1345E: 102.8% (154.15 m recovered). Site U1345 ended coring operations on Expedition 323.

The remainder of Week 8 was spent in transit to Yokohama, Japan. The vessel has traveled 1276 nm in 120.1 hrs, averaging 10.6 nm/hr. By midnight 29 August, the remaining distance was 1023 nm. Current ETA to Yokohama is the morning of September 4th.

SCIENCE RESULTS

This week of the expedition focused on completing measurements and descriptions of core sections and samples from Sites U1345 and U1342, writing site reports, preparing presentations for the science meetings for Sites U1344 and U1345, and planning for and discussing postcruise research activities and sampling.

The sedimentology group finished describing, imaging and scanning core sections from Site U1345. The main lithologies are diatom-rich or diatom-bearing silt/silty clay/sandy silt with frequent laminated intervals and authigenic carbonates. We also described and imaged the remaining hard rock samples from Hole U1342D. These are black to bluish-black polymictic volcanoclastic sandstones and breccias with feldspar crystals and basaltic clasts, ranging from poorly to well-sorted. The last thin sections from the hard rock were also described. Final XRD data from Sites U1344 and U1345 were also analyzed and interpreted for the site reports. In addition, the group members continue their effort of making corrections to the visual core description database.

The micropaleontology group completed analyses of core catcher samples from Site U1345. A composite age depth model was developed with five biostratigraphic datum events based on radiolarians, diatoms, and silicoflagellates. The age depth model reveals

a relatively high average sedimentation rate of ~30 cm/k.y. and provides an estimate of 0.5 Ma for the base of cored section. Calcareous microfossils are generally rare at the site, but are well preserved and abundant at some horizons, especially in samples corresponding to laminated intervals. Foraminifers are generally very abundant. Siliceous microfossils show moderate to poor preservation; however they are common to abundant. The organic walled microfossils show very good preservation and are very abundant. Changes in diversity and abundance of the microfossil groups reflect glacial-interglacial variability (e.g., extent of sea-ice coverage and productivity).

Catwalk samples for interstitial water (IW) chemistry, bulk sediment geochemistry, and microbial cell counts were collected from cores retrieved from Holes U1345A and U1345B. All core sections from Hole U1345B were sampled at high resolution for microbiology (i.e., cell abundance, RNA/DNA analysis, amino acid composition and community structure), while selected core sections at Hole U1345A were sampled at low resolution. PFT analyses confirmed that these samples were not contaminated with drilling fluid. IW samples were taken both on the catwalk and from the microbiology-dedicated cores at high resolution. Like at Hole U1344C, sampling for methane took place in very high resolution (one sample every 25 cm) on the catwalk by drilling holes into the core liner and taking 2 cm³ of sediment into headspace vials. This method proved to be successful, as methane profiles allow for accurate calculations of methane production.

Samples were used to determine concentrations of alkalinity, dissolved inorganic carbon, sulfate, ammonium, sulfide, majors ions (i.e., Ca, Na, K) and minor ions (i.e., Fe, Mn). Analysis of solid phase fractions included total nitrogen, carbon and sulfur. Site U1345 has very high microbial activity and the shallowest sulfate–methane transition zone of all Expedition 323 sites.

All cores from Holes U1345A, U1345C, U1345D and U1345E were measured on the fast track and the whole round multisensor logger (WRMSL) systems for bulk density and magnetic susceptibility and on the natural gamma radiation logger. Cores from Hole U1345B were only measured on the fast track STML before being stored in the cold room for microbiological sampling. Typically, the undisturbed section 2 of each core was selected for thermal conductivity measurements. Determination of moisture and density (MAD) was conducted only on cores retrieved at Hole U1345A. Core continuity was typically broken and disturbed by gas-expansion cracking and gaps. Consequently, WRMSL P-wave velocity measurements were not taken for cores collected at Site U1345.

Paleomagnetic measurements were carried out on all archive section halves from cores recovered at Holes U1345A, U1345C, U1345D and U1344E. No polarity reversal was identified. Furthermore, seven mini-core specimens taken from the basement volcanic rocks recovered at Hole U1342D at the Bowers Ridge were also measured for NRM with stepwise AF demagnetization up to 60 mT using the Molspin spinner magnetometer and the D-Tech AF demagnetizer.

The only downhole measurements made at Site U1345 were three deployments of the APCT-3 tool in Hole U1345A. The measured temperatures ranged from 4.92°C at 42.4 m DSF to 8.15°C at 108.9 m DSF, indicating a local geothermal gradient of 48.5°C/km. A simple estimate of the heat flow can be obtained from the product of the geothermal gradient by the average thermal conductivity (1.064 W/m°C), which gives a value of 51.6 mW/m², in agreement with existing measurement in the area.

The composite depth scale and splice at Site U1345 is complete and continuous from 0.0 to 167.6 m CCSF-A. The splice ranges from the top of Core U1345A-1H to U1345D16H-7, 146.6 cm and no appended intervals. The composite depth scale (CCSF-A scale) and the splice (CCSF-D scale) are based primarily on the stratigraphic correlation of the whole-round track magnetic susceptibility data.

HSE AND TECHNICAL SUPPORT ACTIVITIES

During this week, the technical staff completed processing cores from Site U1345, assisting scientists with their instruments, data processing, and solving equipment issues as they arise. A total of 5740 m of core were recovered and processed during the expedition. All but the last 500 m were stored in refrigerated storage with the remainder stored on the Upper Tween deck.

End of cruise activities are in full swing in preparation for the Yokohama portcall. Taking advantage of the long transit into Yokohama, marine technicians are working on instrument upgrades and laboratory maintenance projects.

The weekly fire and boat drill was not held. No HSE issues to report. We are currently keeping a watch on Typhon Krovanh, which is expected be downgraded to a strong gale when we intercept its path late Tuesday night.