

IODP Expedition 323: Bering Sea Paleoceanography

Week 6 Report (9-15 August 2009)

15 August 2009

OPERATIONS

Week 6 of IODP Expedition 323 focused on coring and logging operations at Site U1343 (originally GAT-4C) in the northern Bering Sea region. The week began while coring Hole U1343D, 30 m south from the prospectus site position, at 1964.7 m DRF. The hole was quickly terminated after the first APC core did not penetrate as planned based on stratigraphic correlation data. Overall recovery for Hole U1343D was 100.0% with 8.5 m recovered.

Hole U1343E was started without any offset from Hole U1343D. APC coring continued down to Core U1343E-41H when the core was pulled with a ruptured core liner. Core U1343E-41H had to be hydraulically pressed out of the core barrel. This coincided with reaching the BSR (bottom simulating reflector). The sediment recovered was noticeably drier and harder at this depth. We continued coring the hole using a combination of the XCB and APC coring systems through Core U1343E-83X when we reached the total depth of 744.3 m DSF. Once the coring tools were secured the hole was prepared for wireline logging. Logging in Hole U1343E was conducted successfully using the triple combo and FMS-sonic tools reaching the total hole depth of 745 mbsf.

During the last part of the week we completed the 139 nautical mile transit from Site U1343 to Site U1344 (GAT-3C) averaging 10.3 nmi/hr. APC coring of Hole U1344A commenced at 0940 hr on 14 August at 3183 m DRF or 5 m above the “corrected” PDR depth of 3188 m DRF. APC coring continued through Core U1344A-26H to a depth of 245.6 m DRF using non-magnetic coring assemblies and with the FLEXIT orientation tool installed. Coring with the APC system was suspended after severely bending the steel core barrel on Core U1344A-27H. The XCB system was then deployed and coring continued through Core U1344A-35X (330.8 m DRF) ending week 6 at midnight on 15 August.

SCIENCE RESULTS

During this week, we completed coring and logging operations at Site U1343 and started coring our first hole at Site U1344 in the northern Bering Sea gateway region. Five holes, U1343A through U1343E were cored at the first site to total depths of 201.05 (U1343A), 35.5 (U1343B), 234.2 (U1343C), 8.5 (U1343D), and 744.3 (U1343E) m DSF. Recovery at these holes was 204.03 m (101%), 34.56 (97%), 231.04 (99%), 8.53 m (100%), and 700.27 (94%), respectively. Hole U1343B was a dedicated hole for microbiological sampling.

At Site U1344 we continue to APC/XCB core Hole U1344A. The total depth as of Sunday 16 August 2009 at 16:30 hr local time is 474.4 m DSF with a recovery of 417.03 m CSF (88%).

On Saturday 15 August 2009, we held the science meeting for Site U1343 to present and discuss our results.

The sediments at Hole U1343E are mostly diatom-rich clayey silt, diatom-rich silt and diatom silt with occasional diatom ooze. Laminated intervals in the upper 130 m can be correlated to the other holes at this site. There are sandy layers and sandy mottles in the core, and the sediment is coarser and more siliciclastic-rich than at any of the previous sites. Authigenic carbonate-containing layers are observed from Core U1343E-5H and become more common below 500 m. An increase in the occurrence of shells is observed throughout the same interval. The sediments are slightly to moderately bioturbated throughout, with frequent cracks and voids in the sediment from gas expansion as well.

At Site U1344, we have split, scanned, imaged and described all archive sections from Cores U1344A-1H through -32X. The sediments are similar to those observed at Site U1343, but are notably richer in siliciclastics. New features of the sediment at this site include thin sandy layers and worm tubes.

The micropaleontology group analyzed all core catcher samples from the Site U1343, plus an additional 3 extra PAL samples at Cores U1343A-8H, -10H and -12H in order to examine interglacial periods. A composite age depth model was constructed based on datums from all major groups of fossils (diatom, radiolarian, dinoflagellates, calcareous nannofossils, planktic foraminifera and silicoflagellates), yielding an age estimate of 2-2.4 Ma for the lowermost samples. The average sedimentation rate is ~26 cm/ky for the upper 320 m, and increases to ~56 cm/ky in the lower 300 m.

The preservation of all fossil groups is generally good to moderate. Calcareous planktic fossils show barren intervals from 250 m to the end of the record, probably related to dissolution and diagenetic recrystallization. Abundances of all groups increase in the upper 300 m, where all records show distinct larger amplitude variations.

Micropaleontological analysis of samples from the Site U1344 began by the end of the week. The latest age estimate is 250-430 ky and 300 ky for the bottom of Core U1344A-13H based in radiolarian and diatom datums, respectively.

Paleomagnetic measurements were made on the rest of the XCB cores from Hole U1342D and from Site U1343. At Site U1343, we identified the Brunhes/Matuyama boundary at the Holes U1343A, U1343C and U1343E, and both the top and bottom of the Jaramillo subchron and the top of the Cobb Mountain subchron at the Hole 1343E.

Catwalk samples for interstitial water (IW) chemistry, bulk sediment geochemistry, and microbial cell counts were collected from cores retrieved from Holes U1343A, U1343B and U1343E. We sampled for microbiology (i.e. cell abundance, RNA/DNA analysis, amino acid composition and community structure) at high-resolution at Hole U1343B, a microbiology-dedicated hole and in Hole U1343A and U1343E with lower resolution. In Hole U1343E we retrieved microbiology samples from 700 m CSF-A. Contamination

testing with liquid tracers (PFT) confirmed that these samples were not contaminated with drilling fluid although they were taken with XCB. IW samples were taken both on the Catwalk and in the microbiology-dedicated hole. We determined concentrations of pore water alkalinity, dissolved inorganic carbon, sulfate, ammonium, sulfide, major 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 U1343 has the highest microbial respiration activity among all sites studied so far on the expedition, and there is clear evidence in the IW chemistry for microbial activity even below 400 m CSF-A. Interestingly, DIC and PO_4^{3-} are both produced and consumed at this site

Downhole logging operations in Hole U1343E were conducted over 19 hrs starting on midday, 12 August. Two tool strings were deployed: the triple combo (natural gamma ray, porosity, density, resistivity) and the FMS-Sonic string (electrical images and sonic velocity). Operations proceeded smoothly, and all tool strings reached the bottom of the hole with only minimal fill between passes. The caliper logs shows that the hole was in good condition and that all data should be of good quality, allowing reliable core/log and seismic/log integration. All logging data were processed on site and transmitted to LDEO for quality control. Preliminary data were distributed to the science party for integration with the ongoing core measurement and description.

The composite depth scale and splice at Site U1343 was constructed from 0.0 to 779.18 m CCSF-A. The splice consists of one complete and continuous interval from the mudline to 270.47 m CCSF-A, and also includes appended cores from Hole U1343E (with unknown gaps) from 270.47 to 779.18 m CCSF-A.

HSE AND TECHNICAL SUPPORT ACTIVITIES

During this week, the technical staff was fully engaged processing cores from Site U1343 and U1344, assisting scientists with their instruments, data processing, and solving equipment issues as they arise.

Decking was installed in the forward section of the Science Pallet Stores's over head, providing an additional ~410 cubic feet of science supply storage. Including the overhead storage installed last week, we have increased science storage capacity by ~730 during this expedition. Part of this space has been used to store an emergency supply of D-tubes equivalent to 450 meters of recovery.

The weekly fire and boat drill was held as scheduled. There are no HSE issues to report.