

IODP Expedition 323: Bering Sea Paleoceanography

Week 5 Report (3-9 August 2009)

9 August 2009

OPERATIONS

Week 5 began while APC coring in Hole U1341C at Core U1341C-6H at a depth of 2203.9 m DRF and continued through Core U1341C-17H to a depth of 2297.9 m DRF using non-magnetic coring assemblies and with the FLEXIT orientation tool installed. Standard steel core barrels were then installed and coring continued through Core U1341C-27H. Final cored depth was 230 m DSF. Overall core recovery for the APC system was 106.2%. The drill string was pulled back to the rig floor and the BHA secured and the vessel was put into cruise mode at 0024 hours on August 3rd officially ending Site U1341.

After an 87 nautical mile transit from Site U1341 to Site U1342 (BOW-15A) averaging 10.9 knots, the speed was reduced, and thrusters and hydrophones were lowered. We then initiated dynamic positioning over Site U1342 (BOW-15B) at 0830 hr (UTC-11h) on August 3rd. Hole U1342A was spudded at 1320 hours on August 3rd recovering 1.8 m of core establishing an official seafloor depth of 829.7 m DRF. APC coring continued through Core U1342A-8H to a depth of 49.3 mbrf using non-magnetic coring assemblies and with the FLEXIT orientation tool installed. Coring with the APC system was suspended after two successive short, incomplete strokes of the core barrel and apparent refusal. Three meters of hole were then drilled with the APC/XCB bit and the XCB system was deployed and a short core (1 m) was drilled to identify the material at APC refusal. Basalt was recovered and Hole U1342A was terminated. Overall recovery for Hole U1342A using the APC coring system was 115.5% with 56.93 m recovered. Recovery for the XCB core was 0.46 m or 46.0%. The top drive was then set back and the drill string was pulled out of the hole and cleared the seafloor at 2220 hr on August 3rd.

Hole U1342B officially began when the drill string cleared the seafloor at 2220 hr on August 3rd. The vessel was offset 20 m east of Hole U1342A. Hole U1342B was spudded at 2315 hr on August 3rd. The barrel contained 5.33 m of core and an official seafloor depth was established at 830.4 m DRF. APC coring continued through Core U1342B-5H to a depth of 43.3 m DRF using non-magnetic coring assemblies. The top drive was then set back and the drill string was pulled out of the hole and cleared the seafloor at 0150 hr on August 4th.

Hole U1342C commenced at 0150 hr on August 4th. The vessel was moved 20 m east of Hole U1342B, the top drive was picked up and the drill string was spaced out placing the bit at 828.0 m DRF. Hole U1342C was spudded at 0235 hours on August 4th and the barrel recovered 7.2 m of core establishing an official seafloor depth of 830.3 m DRF. APC coring continued through Core U1342C-6H to refusal at a depth of 875.7 m DRF using non-magnetic coring assemblies and with the FLEXIT orientation tool installed.

Overall recovery for Hole U1342C using the APC coring system was 103.7% with 47.06 m recovered.

Hole U1342D commenced at 0800 hr on August 4th. The vessel was moved 20 m east of Hole U1342C and the top drive was picked up and the drill string was spaced out placing the bit at 826.2 m DRF. The first APC barrel was pressured up and fired and the barrel recovered 6.0 m of core and an official seafloor depth was established at 829.7 m DRF. Hole U1342D was spudded at 0830 hours on August 4th. APC coring continued through Core U1342D-5H to a depth of 873.7 m DRF using non-magnetic coring assemblies and with the FLEXIT orientation tool installed. On reaching refusal, the center bit was dropped and the hole was drilled 18.6 m to determine if there were sediments under the layer of hard rock (basalt). After a drilling break was observed the XCB coring system was deployed and used successfully to core an additional 65.1 m into the formation. Overall recovery for Hole U1342D using the APC coring system was 102.9% with 45.29 m recovered. Recovery for the XCB core was 41.1 m or 63.1% recovery. The drill string was pulled back to the rig floor and the BHA secured and the vessel was put into cruise mode at 1715 hr on August 5th officially ending Site U1342.

After a 292 nautical mile transit from Site U1342 to Site U1343 (GAT-4C) averaging 11.2 knots, the speed was reduced, and thrusters and hydrophones were lowered. We then initiated dynamic positioning over Site U1343 (GAT-4C) at 2008 hours (UTC-11h) on August 6th. The top drive was picked up and the drill string was spaced out placing the bit at 1953.4 m DRF or 5 m above the “corrected” PDR depth of 1958.4 m DRF. The first APC barrel was pressured up and fired and the barrel recovered approximately traces of mud line in the core catcher. After calling the first core empty, the bit was repositioned at 1958.4 m DRF and a 5.5 m core was recovered and an official seafloor depth was established at 1962.4 m DRF. Hole U1343A was spudded at 0305 hr on August 7th. APC coring continued through Core U1343A-22H to a depth of 201.5 m DRF using non-magnetic coring assemblies. Coring with the APC system was suspended by plan with no recorded drill-over. Overall recovery for Hole U1342A using the APC coring system was 101.2% with 203.86 m recovered. The top drive was then set back and the drill string was pulled out of the hole and cleared the seafloor at 2100 hr on August 7th ending Hole U1343A.

Hole U1343B officially began when the bit cleared the seafloor at 2100 hr on August 7th. The vessel was offset 30 m north of the prospectus site position. The top drive was picked up and the drill string was spaced out placing the bit at 1959.9 m DRF. The first APC barrel was pressured up and fired and the barrel recovered 7.0 m of core and an official seafloor depth was established at 1950.9 m DRF. Hole U1343B was spudded at 2240 hr on August 7th. A total of 4 APC cores were recovered for high resolution microbiological sampling to a depth of 43.3 m. Average core recovery for the APC on Hole U1340B was 103.5% with 44.8 m CSF. Hole U1343B ended on clearing the seafloor at 0115 hr on August 8th.

Hole U1343C began when the drill string cleared the seafloor at 0115 hr on August 8th. The ship was offset 30 m west from the prospectus site position. The top drive was

picked up and the drill string was spaced out placing the bit at 1961.9 m DRF. The APC was deployed and Hole U1343C was spudded at 0305 hr on August 8th. APC coring continued through Core U1343C-26H to a depth of 234.2 m DRF using non-magnetic coring assemblies. Overall recovery for Hole U1343C using the APC coring system was 98.65% with 231.04 meters recovered. The top drive was then set back and the drill string was pulled out of the hole and cleared the seafloor at 0010 hr on August 9th ending Hole U1343C.

SCIENCE RESULTS

Week five marks the start of the second half of the Expedition and a time when scientists and the USIO staff start planning for a successful completion of the cruise. It is both a time for reflection and excitement as expedition scientists begin to evaluate their findings, discuss and plan for post-expedition sampling and research, and focus on the work ahead.

Two meetings were held during the week to present and discuss the preliminary scientific results from Sites U1341 and U1342, as well as an additional meeting to present the scientific objectives and operations plan for the Bering Gateway Sites GAT-4C (U1343) and GAT-3C (U1344).

During the week, we finished describing and analyzing sediments from Hole U1341C (original Site BOW-14C) and completed coring four holes at the last site on the Bowers Ridge (U1342, original Site BOW-15A). Holes U1342A, U1342B and U1342C were cored to only 53.3, 43.3, and 45.4 m DSF because we unexpectedly encountered basaltic rock at the bottom of Hole U1342A. The recovered sediment section for each of the first three holes was 56.93 m CSF (115.5%), 44.83 m CSF (104%), and 47.06 m CSF (103.7%), respectively. Hole U1342D was APC cored to 44.0 m DSF (recovery 45.29 m CSF or 102.9%) and then XCB cored to recover the underlying volcanoclastic rocks down to a total depth of 127.7 m DSF.

We arrived at the Site U1343 (GAT-4C) on Friday August 7th at night and by Sunday night we had completed APC coring of Holes U1343A through U1343C.

Sedimentology

Site U1341: The sediment recovered from Hole U1341C was similar to the material in Holes U1341A and U1341B, consisting mainly of dark greenish gray to dark olive to olive diatom ooze, diatom silt and diatom clay. Hole U1341C extended to Core U1341C-27H and therefore covered only the upper part of the sequence recovered in Hole U1341B. Sediment that contained variable amounts of sponge spicules, and calcareous microfossils (nannofossils, foraminifers) were recovered in the upper 120 m (CSF-A). Soft sediment deformation due to slumping was largely confined to Cores U1341C-2H and 10H. Laminated intervals were found in Cores U1341C-1H, 2H, 10H-13H and 25H. Authigenic carbonate was found as an accessory component at the bottom of the hole. Dropstones occurred occasionally throughout the record. Sediment bioturbation was slight to moderate, and absent in laminated intervals. Drilling disturbance was mostly negligible.

Site U1342: Coring at Site U1342 recovered both soft sediment and basement lithologies. The upper soft sediment consists of alternating intervals of beautifully laminated diatom ooze and silty clay with occasional pennate diatom mats, planktonic foraminifer-rich laminae and intervals with large benthic foraminifers and calcareous nannofossils. A total of 50 laminated intervals were described in Holes U1342A, U1342C, and U1342D. Laminations are mainly parallel, but there are also rare cross laminations. The laminated intervals have sharp basal contacts with the silty clay and gradational, bioturbated tops. There are occasional ash layers and pods of ash that may be bioturbated thin ash layers. Gravel-sized, matrix-supported clasts are present throughout. Bioturbation tends to be moderate.

Below the diatom-rich sequence is very dark grey sandy silt to silty sand that contains mostly volcanogenic lithic sand with variable amounts of glauconite-bearing pellets, metamorphic rock fragments, quartz and feldspar, sponge spicules, and volcanic glass. In general, the sediment structure is chaotic due to bioturbation, soft-sediment deformation, and drilling disturbances. The grains are moderately well sorted and subangular to moderately rounded. The bottom section of the core through this lithology is soupy and represents flow-in during drilling.

The basement sequence comprises two main lithologies. The upper part is less than one meter thick consisting of vesicular and porphyritic basalt. Below this are interbedded gray, green, and red volcanogenic sandstone, siltstone and breccia. Most bed contacts are parallel but vague. Grains in the sand and some of the breccia beds are polymictic comprising a range of scoriaceous (black and red in color) and non-vesicular basalt fragments. There are also monomictic breccias with irregular shaped mafic clasts. Most beds are moderately to well sorted and some sandstone beds have dewatering structures.

Hole U1343A: Sediments in Hole U1343A are predominantly gray diatom-rich silty clay with green foraminifer-bearing diatom ooze, occasional ash layers, gravel size clasts, and pyrite mottles. Abundant gas expansion cracks occur throughout the sedimentary section.

Biostratigraphy

Site U1342: An age-depth model was constructed from diatom, radiolarian, dinoflagellate and calcareous nannofossil biostratigraphic markers giving a composite age of <1.5 Ma and a sedimentation rate of 3 cm/k.y. for the recovered section. Poor preservation of smaller siliceous and organic-walled microfossils (silicoflagellates, diatoms and dinoflagellates) and intervals barren in calcareous nannofossils suggests that winnowing is active at this site. Diatom assemblages also revealed reworking at the uppermost layers and at the basement of all holes at this site.

Site U1343: By the end of the week, analyses began of core catcher samples from this gateway location. Biostratigraphic markers (radiolarians, silicoflagellates, diatoms) have so far provided an estimated age between 0.74 and 0.9 Ma at the base of Core U1343C-20H.

Paleomagnetism

Site U1342: We have done paleomagnetic measurements on APC core section halves of cores from Holes U1342A, U1342C, and U1342D except for the XCB cores. We have identified the Brunhes/Matuyama boundary, and both the top and base boundaries of Jaramillo and Cobb mountain subchrons. We collected 13 mini-core specimens from the basement volcanic rocks to reconstruct the paleolatitude where the rocks initially formed. We are planning to measure the rock samples during the transit to Yokohama.

Geochemistry and Microbiology

Site U1342: We collected catwalk samples for interstitial water chemistry, bulk sediment geochemistry, and microbial cell counts. We sampled for microbiology, interstitial water and solid phase at high-resolution at Hole U1342B, a microbiology-dedicated hole. Samples taken for shore-based microbiology analysis include total cell abundance, RNA, and amino acids. For IW samples taken both on the catwalk and in the microbiology-dedicated hole, we determined concentrations of alkalinity, dissolved inorganic carbon, sulfate, ammonium, sulfide, major (i.e., Ca, Na, K) and minors (i.e., Fe, Mn) elements. Analysis of solid phase fractions included total nitrogen, carbon and sulfur. Site U1342 has the lowest microbial respiration among all sites.

HSE AND TECHNICAL SUPPORT ACTIVITIES

During this week, the technical staff was fully engaged processing cores from Sites U1341, U1342 and U1343, assisting scientists with instruments and data processing. Staff are troubleshooting problems as they arise and continue to fine tune science and software systems, including addressing issues with the unexpected recovery of hard rock core.

On a time available basis, work continues on the reorganization of the ship's storerooms. Decking was installed in the forward end of the staging area's overhead providing an additional ~320 cubic feet of science supply storage.

The weekly fire and boat drill was held as scheduled. The captain provided additional training for the technical staff in the operation of the ship's lifeboats. There are no HSE issues to report.