IODP Expedition 336: Mid-Atlantic Ridge Microbiology

Site Summary: Sediment and Basement Contact Coring in Holes U1383D, U1383E, U1382B, U1384A

This section summarizes the results of APC coring of sediments and XCB coring of the sediment/basement transition at three Sites U1383 (NP-2), U1382 (near Hole 395A), and U1384 (NP-1).

In Hole U1383D, 44.3 m of sediment were drilled, of which the lowermost 1 m was XCB cored basalt and limestone-cemented breccia (0.76 m of basement were recovered). Nearby Hole U1383E cored 44.2 m of sediment and 1 m of basaltic basement, of which 0.3 m were recovered. The basalts are aphyric and slightly to moderately altered. They are distinct from the uppermost basaltic flow RCB cored in Hole U1383C, so represent a different lithostratigraphic unit.

Hole U1382B was drilled midway between Holes 395A and U1382A; here, 90.0 m of sediments were APC cored and 8.8 m were advanced with the XCB, recovering a piece of basalt and countless mm- to cm-sized pebbles of completely altered plutonic and ultramafic rocks at the basement/sediment interface. These rocks are interpreted as part of a sedimentary breccia overlying the massive basalt of Unit 1 cored in Hole U1382A.

In Hole U1384A, 94.7 m of sediments are underlain by basalt and limestone-cemented breccia, of which 1 m was drilled and 58 cm recovered. Basalts are aphyric and sparsely vesicular with glassy to variolitic to microcrystalline groundmass. They are between 3 to 10% altered and display brown alteration halos along clay veins and fractures.

The sediments at all sites are nannofossil ooze with layers of foraminiferal sand. The lowermost several meters of the sedimentary pile are brown and appear clay-rich. Sediments from Hole U1382B show moderately rounded rock fragments concentrated in layers or dispersed in the ooze. These fragments range from coarse sand to pebble in grain size and consist of serpentinized mantle peridotite, gabbro, troctolite, and basalt. Both XCB cores from Hole U1382B also contain coarse sediment with predominantly serpentinite clasts, including soapstone and talc-tremolite schist. The occurrence of these rock fragments is consistent with the polymict sedimentary breccia recovered during basement drilling in Holes 395A and U1382A. The deformed and metasomatized lithologies encountered in Hole U1382B corroborate the hypothesis that this material has transported to the Site U1382 area in North Pond by mass wasting events and that its source is a oceanic core complex, probably in the southern rift mountains. Layers of foraminifer sand are abundant in all holes and many show erosional bases and fining upward sequences, suggesting that they represent deposits of turbidity currents.

Each of the four holes cored were intensively sampled for microbiology and interstitial water analyses. The sampling program was similar for each of the holes. In total, we collected 167 whole-round samples for interstitial waters and 691 whole-rounds samples for microbiologic analyses. Sampling density was increased in the bottom section. Pore waters in these basal sediments are dominated by diffusion of components from the basement fluids into the sedimentary pile. They allow estimation of basement fluid compositions by extrapolation. Whole round cores were preserved for shore-based molecular analysis to provide a detailed description of the microbial community. Ship-based enrichment cultures were established to enrich for multiple metabolic functional groups. These cultures will be analyzed onshore for both metabolic activity and community composition. Sediment sections remaining after whole round sampling were analyzed for oxygen using optodes. Hard rock samples were sectioned and allocated following previous strategies established during the hard rock drilling phase of the expedition. Multiple basalt samples were provided for RNA/DNA, geochemistry and culture analysis.

An extensive, high-resolution physical properties data set was obtained for all holes. This included whole-round, split core, and discrete measurements of magnetic susceptibility, velocity, density, porosity, natural gamma, and resistivity