ODP Leg 203 Cruise Report: Dynamics of earth and ocean systems, Site 1243A&B

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ODP Leg 203 Cruise (Dynamics of earth and ocean systems) have been done during 30 May (Balboa, Panama) – 7 July (Victoria, Canada) 2002 and completed two holes of 1243A&B. Site 1243 in the eastern equatorial Pacific is in a particularly interesting location for understanding the interplay between ocean chemistry, productivity, climate, and plate tectonics in a fast-spreading environment.

We drilled a cased reentry hole (Hole 1243A), the location of a future Dynamics of Earth and Ocean Systems (DEOS) multidisciplinary observatory. The drill site was located in 10- to 12-Ma lithosphere at a water depth of 3882 m. The hole was drilled to a total depth of 224 m, which included 121 m of sediment and 103 m of basement penetration. We inserted casing to 212 meters below seafloor (mbsf) and cemented the casing in place, with the top of the cement at a depth of 199 mbsf. Subsequent logging showed that the casing was well bonded to basement in the lower 40 m and that the deviation of the hole never exceeded 1 degree from vertical. Casing complications obviated coring and scientific logging this hole. Hole 1243A will subsequently be used to install an observatory-quality broadband three-component seismometer (0.001-5 Hz) as well as a high-frequency three-component seismometer (1-20 Hz) to ensure high-fidelity recording over the range of frequencies normally recorded by the terrestrial Global Seismic Network. The seismic system, as well as other instrumentation associated with the observatory, will be connected to a DEOS mooring for both power and high-speed data telemetry to a land station and the Internet.

The equatorial site satisfies two scientific objectives of crustal drilling: (1) it is located in one of the high-priority regions for the Ocean Seismic Network and DEOS, and (2) it is in oceanic crust created by fast seafloor spreading, providing a rare opportunity to examine crustal genesis, evolution, and crust/mantle interaction for a seafloor-spreading end-member responsible for generating the majority of the oceanic lithosphere. To satisfy the secondary objective, we drilled a second uncased hole (Hole 124B) fitted with a reentry funnel 600 m east of Hole 1243A. Rotary coring alone was used in an effort to sample the sediment/basement interface as well as the uppermost fast-spreading lithosphere. Hole 1243B is characterized by 110 m of sediment and a total penetration of 195 m. Core recovery throughout basement averaged 25%, and the lower sediment and basement were logged.

On the basis of hand specimens, thin section descriptions, and shipboard geochemical analyses, eight basement units were defined. Units 1, 3, 4, 5, 6, 7, and 8 are volcanic basaltic units. Units 1, 3, and 7 are aphyric basalts. Units 4, 5, and 6 are sparsely plagioclase and olivine phyric basalts. Unit 8 consists of moderately plagioclase and olivine phyric basalt. Unit 2 is represented by a piece of limestone. All the basement basaltic units are interpreted as pillow lavas based on the presence of glassy margins and associated vesicular zones. No evidence of thicker massive lava flows was found in the cores. This interpretation of the environment of eruption is further confirmed by downhole measurements in Hole 1243B. Inductively coupled plasma-atomic emission spectroscopy analyses conducted on board indicate that all units are tholeiitic except Unit 4, which consists of alkali basalt. The basement units range in thickness from 0.065 m (Unit 2) to 11.175 m (Unit 3). At the bottom of Hole 1243B, 5.3 m of drilling breccia was recovered. This consists of finely broken angular fragments of pillow basalts (Core 203-1243B-19R).

(Referred to the Leg 203 Preliminary Report).