

September 13, 2004

**IODP EXPEDITION 301T: TRANSIT/COSTA RICA APL
SITE SUMMARIES: 1253 AND 1255**

The Costa Rica hydrogeology operation, which took place during the transit between Expeditions 301 and 303, was designed to replace CORK-II downhole instrument strings in holes drilled at Ocean Drilling Program (ODP) Leg 205 Sites 1253 and 1255 offshore Costa Rica. The CORKs are instrumented in a fractured horizon in the oceanic section of the incoming plate (Site 1253) and in the décollement zone (Site 1255) to investigate fluid geochemistry and flow across the margin and their implications for the seismogenic zone and subduction factory. This operation was necessary because during *Atlantis* cruise 11-8 (27 February–7 March 2004) the *Alvin* was unable to recover and thus redeploy the downhole osmotic fluid samplers (OsmoSamplers) and miniaturized temperature loggers. The OsmoSamplers installed during Leg 205 were designed to collect a time series of samples for fluid and gas analyses over a 2 y period; after 2 y, samples and the information they contain are progressively lost. The associated temperature loggers will stop recovering data after 6 October 2004.

Site 1253

After a smooth 3411 nm transit from Astoria, Oregon, the ship arrived at Site 1253 at 11:12 hr on September 4, 2004. The *Alvin* operations had left the two Site 1253 OsmoSampler packages seated at depth, the tools and ~550 m of Spectra line attached, and a ring and float attached ~20 m above the CORK wellhead. Operations commenced with the attempts to retrieve the OsmoSampler packages. After fishing for the line and float assembly for just over 3 hours, we started pulling out of the hole attached to the Spectra line, which we had hoped was secured to both OsmoSampler packages and sinker bar. After tripping out of the hole, we found that we had captured the float, some of the Spectra line and the metal ring used to tie on the float. The remainder of the fished components either dropped to the seafloor during the trip out or remain in Hole 1253A. This was left to be found and hopefully recovered after we completed operations at Hole 1255A.

Upon completing successful operations at Site 1255, we returned to Site 1253 and reentered Hole 1253A with a fishing tool to inspect for the OsmoSampler packages and any remaining hardware. The hole was found to be completely clear. The OsmoSamplers were not found, thus it was assumed they had been removed from the hole and dropped onto the seafloor when the Spectra line parted during initial fishing operations. The new OsmoSampler packages (upper level within a screen and lower level in the open hole) were assembled with a new sinker bar and 500m line to a seafloor float and deployed in Hole 1253A without incident. Visual inspection with the vibration isolated TV (VIT) confirmed that the float assembly was properly deployed just above the CORK. After unlatching from the CORK, the ship was offset and a systematic seabed survey was conducted utilizing the VIT and the dynamic positioning system. After ~7 hours of survey, the samplers were found ~20m SE of the wellhead. A grappling system was rigged and deployed on the VIT sled. Within 2.25 hours miscellaneous hardware, the upper OsmoSampler, and Spectra line were recovered. The whereabouts of the lower OsmoSampler and sinker bar remain uncertain.

Hole 1253A fluids coils from two of the Teflon OsmoSamplers were subsampled for shipboard measurements of alkalinity, pH, ammonium, and salinity, and for a wide variety of postcruise analyses. Two further copper coils will also be analyzed for gases and organic components postcruise. Initial salinity analyses in the two separate fluid coils have very similar profiles suggesting two complete years of fluids were obtained.

Site 1255

After the initial attempted retrieval of OsmoSamplers at Site 1253, the ship was offset to Site 1255 in DP mode. Once in position, we latched onto the CORK, and successfully pulled the OsmoSampler package out of the hole. The new OsmoSampler package with a 150 m line to a seafloor float was assembled and deployed into Hole 1255A. After two attempts the coring line was successfully disconnected from the instrument strings, with the float assembly properly deployed just above the CORK.

The OsmoSamplers recovered from Hole 1255A were subsampled for shipboard measurements of alkalinity, pH, ammonium, and salinity and for further postcruise studies. Inspection indicated the osmotic pumps worked well throughout the period deployed. In addition, osmotic flow-meter fluids were subsampled for postcruise analyses to determine relative flow rates and direction. The temperature loggers recovered are in excellent shape.

Operations for this transit leg required 3.8 days, concluding September 8, 2004. Recovery of the fluid samplers and temperature loggers will provide 2 y high-resolution time series of fluid chemistry and temperature, and at Site 1255 also of fluid flow rates and relative flow direction. The alkalinity and ammonium concentrations at the two sites are distinct. They are considerably higher in the décollement fluid, at Site 1255, with maximum values of 17.1mM and 1,828.1 μ M, respectively, than in the igneous complex formation fluid, at Site 1253, with maximum values of 0.8mM and 170.2 μ M, respectively. Bacterially mediated diagenesis of organic matter is responsible for the high alkalinity and ammonium observed at Site 1255.