

IODP Expedition 329: South Pacific Gyre Microbiology

Week 7 Report (21-28 November 2010)

OPERATIONS

Site U1369

Week 7 of Expedition 329 began with the vessel underway, 405 nm from Site U1369 (Scientific Prospectus Site SPG-10A). The 98.1-hour transit from Site U1368, covered 1073 nm and averaged 10.9 knots. Hole U1369A was spudded at 0040 hours on 23 November. The PFT pump was turned on to displace the drill string with the contamination testing fluid. Hole U1369 was drilled to determine depth of basement. Mudline was established as 5290.5 mbrf by tagging with the bit. After drilling down, basement was established at 12.2 mbsf.

Hole U1369B was offset 20 meters to the west and spudded at 03:50 hours on 23 November. Seafloor depth was established at 5286.3 mbrf with a mudline core. Advanced piston coring continued to 15.9 mbsf. An XCB core barrel was dropped to attempt to core through a hard layer after initial examination of hard material recovered in the core catcher of the bottom-most core was thought to be chert. However, prompt further examination under light microscopy by multiple shipboard scientists verified the material to be altered basaltic glass, indicating that basement was reached with the APC system. Then, the XCB core barrel was immediately pulled without advancing. A total of 3 cores were taken with a total recovery of 18.14 meters (114.1%).

Hole U1369C was spudded 20 meters north of Hole U1369B at 11:35 hours on 23 November and advanced with the APC coring system to 14.6 mbsf before encountering basement. Seafloor was established at 5288.0 mbrf. A total of 3 cores were taken with a total recovery of 16.10 meters (110.3%).

Hole U1369D was spudded 20 meters east of Hole U1369C at 16:15 hours on 23 November. The core liner was shattered and even though the core barrel extended 9.5 meters, the only recovery was a few manganese nodules in the core catcher. Hole U1369D was abandoned. Recovery was limited to a 0.08 m-core length and the advance was recorded as 0.1 meters. Percentage of recovery was recorded as 80%.

Hole U1369E was offset 20 meters east of Hole U1369D and spudded at 1745 hours on 23 November. Seafloor depth was established with a mudline core at 5288.8 mbrf. The APC coring system was used to take 3 cores to 15.5 mbsf with a 15.49-meter recovery for a recovery percent of 99.9%.

PFT was mixed in with the drilling fluid (sea water) and pumped on all cores taken at Site U1369 for contamination testing. Coring operations at Site U1369 ended at 0730 hours on 24 November. The rig floor was secured for the 625 nm transit to the next site.

Site U1370

After a 56.5-hour transit from Site U1369, covering 625 nm, averaging 11.1 knots, the *JOIDES Resolution* began dynamic positioning and rig floor operations at Site U1370 (original Survey Cruise Site SPG-11) at 16:02 hours on 26 November. Hole U1370A was spudded at 02:30 hours on 27 November. The wash down-hole was drilled to determine depth of basement and the presence of any chert layers in the sediment section. After drilling down, basement was established at 5150.4 mbrf (or 64.7 mbsf).

After clearing the seafloor, the center bit was pulled by wireline, the vessel was offset 20 meters to the west and the drill string was spaced out to spud Hole U1370B. After making up the first APC core barrel, the core barrel was run to bottom on the wireline, and Hole U1370B was spudded at 0745 hours on 27 November. Seafloor depth was established at 5085.7 mbrf with a mudline core. The APC coring of Hole U1370B was terminated after the second core attempt. It appeared as if there was something blocking the seal bore collar, which prevented the core barrel from seating. The center bit was deployed to verify a clean seal bore assembly and to check flow against the slow circulating rates taken at the start of the hole. Subsequent problems determined that it was most likely due to the shear pins failing during the deployment of the core barrel. A total of 1 core was taken in Hole U1370B with a total recovery of 7.81 meters (100.1%).

Hole U1370C was offset 20 meters north and an attempt to spud the hole was made, but failed. After multiple wireline runs and multiple attempts to spud Hole U1370C, it was finally spudded at 18:10 hours when we decided to advance into the hole and then begin coring. During the effort to continue coring, several remediation efforts were attempted. The root problem seemed to be shear-pin failures during the wireline trip into the hole. Rig instrumentation indicated that the core line was receiving very high tension variations while the deeper the core line was run into the hole. Variations at times were around 2500 lbs of force. An extra shear pin was added to the system. This still failed prior to landing the core barrel. A 90° heading change was made to try to reduce the overall heave of the vessel. Decreasing weather and the heading change successfully reduced the heave by over a meter. In an attempt to dampen the tension variations, the compensator was opened for core barrel deployment. After a drilled advance of 7.8 meters, the core barrel was finally deployed without the shear pin failure that had been experienced all day. With 3 shear pins installed and the core barrel landed, the mud-pump pressure was insufficient to shear/shoot the APC core barrel and the core barrel was pulled to the surface and redressed with new shear system components and 2 shear pins. Hole U1370C was abandoned and the bit cleared the seafloor at 20:00 hours on 27 November, ending Hole U1370C.

Hole U1370D was offset 20 meters east and spudded at 21:15 hours. Seafloor depth was established with a mudline core at 5084.7 mbrf. By midnight on 27 November, the APC coring system had recovered 2 cores to 18.3 mbsf with 18.38 meter recovery (102.1%). The week ended while APC coring on Hole U1370D.

SCIENCE RESULTS

Scientific activities during Week 7 centered on describing, measuring and analyzing core samples and data from Sites U1369 (Scientific Prospectus Site SPG-10A) and U1370 (original Survey Cruise Site SPG-11). Expedition scientists presented the highlights of their initial results from Site U1369 at the science meeting and discussed them in the site reports. The co-chief scientists presented an overview of the scientific objectives for the next site, U1370.

The principal objectives at Sites U1369 and U1370 are to document the nature of subseafloor microbial communities in sediment with very low total activity and to test how oceanographic factors control variation in sedimentary habitats, metabolic activities, genetic composition and biomass from gyre center to gyre margin.

Site U1369 is located near the southern edge of the South Pacific Gyre at 5277 m water depth.

Basement age is estimated from extrapolated magnetic models and changes in spreading rate to be ~58

Ma. The sedimentary history of Site U1369 was recovered by the APC coring in three holes. Basalt fragments were recovered from the basal cores of these holes. All cores from Hole U1369B were transferred to the cold laboratory immediately after catwalk processing. Once measured, the core sections were brought back up to the Core Laboratory where they were measured for physical properties using the ship's petrophysics tracks and the cryogenic magnetometer, split into working and archive halves, digitally imaged and described.

The sediment at Site U1369 consists of approximately 16 m of zeolitic metalliferous clay. Principal components are phillipsite, red-brown to yellow-brown semi-opaque oxides (RSO), and clay. Manganese nodules were recovered from the sediment/water interface and shallow sediments in the mudline core at all holes. Calcareous and siliceous micro- and nanofossils are almost completely absent. The sediment/basalt interface consists of vitric sand overlying altered basalt. Sediment thickness and composition are fairly uniform from hole to hole.

Cores from Hole U1369C were thoroughly sampled for interstitial water chemistry and solid phase geochemistry. Cores from Hole U1369D were sampled at high resolution for a wide range of microbiology experiments, with many of them being initiated on board the ship. Experiments on major microbial processes and cultivations of viable microbes were initiated onboard at selected depths ranging from near the sediment/water interface to the sediment/basalt interface. Subsamples were routinely taken from all of the distinct lithologic units for post-cruise molecular assays and microbiological experiments.

Toward the end of the week, we arrived at Site U1370, located in a region of abyssal hill topography, scientific activities at Site U1370 were affected by the inability to recover cores for over half a day due to the combined effects of oceanic conditions (excessive heave) and great water depth at this site. Once coring was resumed, core processing continued. One core from Hole U1370B, and two cores from Hole U1370D were recovered by week's end. The cores were measured for dissolved oxygen concentration using micro-electrodes and -optodes in the cold room of the Microbiology Laboratory, and then brought up to the Core Laboratory for routine measurements.

A meeting was held to plan for end of cruise activities and to provide post-expedition publication guidelines. By week's end, all scientists were working on the Site U1369 reports and initiating analytical activities on the first cores of Site U1370.

TECHNICAL SUPPORT AND HSE ACTIVITIES

This week the technical staff supported the processing and data collection for the cores recovered from Sites U1369 and U1370. A fire and boat drill was held on Sunday 28 November.