IODP Expedition 329: South Pacific Gyre Microbiology

Week 8 Report (28 November–4 December 2010)

OPERATIONS

Week 8 of Expedition 329 began with the vessel coring Core U1370D-3H. An APCT-3 temperature measurement was taken on Core U1370D-4H. The APC coring system was used to take a total of 8 cores to 68.2 mbsf with 70.26 meter recovery (103 %). After Core U1370D-8H was retrieved, the bit was advanced and rotated into basement to verify basement depth and then tripped back to just above the seafloor, ending Hole U1370D at 1250 hours (UTC-10h) on 28 November.

Hole U1370E began at 1250 hours on 28 November when the APC coring assembly cleared the seafloor after completing Hole U1370D. The ship was offset 20 meters east and Hole U1370E was spudded at 1445 hours. Seafloor depth was established with a mudline core at 5085.3 mbrf. An APCT-3 temperature measurement was taken on Cores U1370E-3H, 5H, and 6H. The APC coring system was used to take 9 cores to 65.6 mbsf with 70.20 meter recovery (107 %). PFT was mixed in with the drilling fluid (sea water) and pumped on all cores for contamination testing. After Core U1370E-9H, the bit was advanced and rotated into basement to verify basement depth and then tripped back to just above the seafloor ending Hole U1370E at 0855 hours on 29 November.

Hole U1370F was offset 20 meters south of Hole U1370E. Hole U1370F was spudded at 1010 hours on 29 November. Seafloor depth was established with a mudline core at 5084.8 mbrf. The APC coring system was used to take 8 cores to 64.7 mbsf with 66.32meter recovery (102.5 %). PFT was mixed in with the drilling fluid (sea water) and pumped on all cores for contamination testing. After Core U1370F-8H, the bit was advanced and rotated into basement to verify basement depth and APC advance. The drill string was then tripped to the surface, clearing the rotary table at 0530 hours on 30 November. The rig floor was secured for the transit to the next site, ending Hole U1370F and Site U1370 at 0600 hours on 30 November.

After a 499 nm, 51.0-hour transit from Site U1370 that averaged 9.8 knots, the speed was reduced, and thrusters were lowered. Dynamic positioning and rig operations at Site U1371 (Scientific Prospectus Site SPG-12A) began at 0907 hours on 2 December. Hole U1371A was spudded at 1845 hours. The wash down hole was drilled to determine depth of basement. Mudline was established as 5316.0 mbrf using the drill bit tag depth. After drilling down, basement was established at 5438.5 mbrf (122.5 mbsf). The bit was pulled back above the seafloor at 2350 hours on 2 December, ending Hole U1371A.

The vessel was offset 20 meters west of Hole U1371A. After making up the first APC core barrel, the core barrel was run to bottom on the wireline and the APC core barrel was fired from 5310 mbrf. The core barrel came back empty and the bit was repositioned to 5315 mbrf. Hole U1371B was spudded at 0300 hours on 3 December. Seafloor depth was established at 5316.4 mbrf (5305.1 mbsl) with a mudline core. Vessel heave during spud in was approximately 4 meters. The first mudline core was too disturbed for science and the hole was terminated.

The vessel was offset 20 meters north of Hole U1371B and Hole U1371C was spudded at 0445 hours. Core U1371C-1H came back with a full core barrel and no obvious mudline. Shoot depth was 5312 mbrf, which was 3 meters higher than the shoot depth for Hole U1371B. The best explanation for another mudline failure was the high heave (+4 meters) at the time of spudding. A total of 1 core was taken with

a total recovery of 9.85 meters (103.5%). Hole U1371C was abandoned after Core U1371C-1H and the vessel was moved 20 meters east.

Hole U1371D was spudded at 0635 hours on 3 December. Seafloor depth was established with a mudline core at 5311.1 mbrf (5299.9 mbsl). Orientation with the FLEXIT tools was done on Cores U1371D-1H through U1371D-11H. APCT-3 temperature measurements were taken on Cores U1371D-4H, 5H, 6H, 8H and 10H. While pulling Core U1371D-6H, the coring line parted at the wire rope socket. The core barrel and sinker bars fell back inside the drill pipe. The wireline was removed from the hole and re-headed at surface. The aft sinker bars were then installed and a rotary core barrel was dropped to "fish" the sinker bars. The sinker bars were recovered by wireline, and then Core U1371D-6H was recovered. Total time from the incident to resumption of coring was 5.5 hours. Coring continued until refusal on Core U1371D-14H. The APC coring system was used to take 14 cores to 126.0 mbsf with 126.87 meter recovery (100.7 %). After Core U1371D-14H, the bit was advanced and rotated into basement to verify basement depth and then the bit was tripped back to just above the seafloor ending Hole U1371D at 1330 hours on 4 December. During the last core, a leak was noticed coming from the drill string directly under the top drive. Closer examination revealed the leak coming from between the top saver sub and the 20' knobby. The top drive was set back, the 20' knobby and saver sub were removed and replaced prior to the resumption of coring.

Hole U1371E began at 1330 hours on 4 December, when the APC coring assembly cleared the seafloor after completing Hole U1371D. After offsetting the vessel 20 meters east, Hole U1371E was spudded at 1605 hours on 4 December. Seafloor depth was established with a mudline core at 5310.2 mbrf. Prior to midnight, the APC coring system was used to take 6 cores to 55.7 mbsf with 118.16-meter recovery for a recovery percent of 92.2%. Non-magnetic core barrels were used for the first 6 cores. PFT was mixed in with the drilling fluid (sea water) and pumped on all cores for contamination testing. The week ended still coring on Hole U1371E at midnight on 4 December.

SCIENCE RESULTS

During Week 8, the scientific party processed, described and analyzed core samples and data from Sites U1370 (original survey cruise Site SPG-11A) and U1371 (Scientific Prospectus Site SPG-12A). Expedition scientists presented the highlights of the Site U1370 results at a science meeting and documented them in the site reports. The co-chief scientists presented an overview of the scientific objectives for Site U1371.

Site U1370

Site U1370 is located at 5074 m water depth in a region of abyssal hill topography trending NE-SW (065˚). Basement age is estimated between 73.6 and 79.5 Ma based on the site's location within magnetic polarity Chron 33n. The closest previous drilling site is ODP Site 1123, 810 nm away. The sedimentary history of Site U1370 was recovered by advanced piston coring in five holes (U1370B to U1370F), although only three holes reached basement depth. The ~70 m thick sediment section predominantly consists of zeolitic metalliferous pelagic clay, while a short (~2.9 m) interval of calcareous nannofossil ooze is present near the sediment/basement interface. The age of this interval is early Paleocene based on foraminifer biostratigraphy.

As was the case at all the other Expedition 329 sites, a wash hole (Hole U1370A) was drilled to confirm basement depth and to locate any potential hard layers in the sedimentary sequence. Then, Hole

U1370B was primarily assigned for stratigraphy, Holes U1370C and U1370D for biogeochemistry and microbiology, respectively. At Holes U1370B and U1370C, it was not possible to recover a good mudline core because the extreme heave conditions and great water depth at Site U1370 made it very hard to estimate when to shoot the piston core from the desired depth. A good mudline core was finally achieved in Hole U1370D allowing us to continue APC coring this hole to basement depth. All cores from Hole U1370D were transferred to the cold room in the Geochemistry/Microbiology Laboratory where they were measured for dissolved oxygen concentration immediately after catwalk curation. Subsequently, the core sections were transferred to the Core Laboratory where they were measured for physical properties, split into working and archive halves and visually described. Cores from Hole U1370E were sampled mainly for interstitial water chemistry directly on the catwalk and then transferred to the core refrigerator for additional high-resolution biogeochemical sampling. Cores from Hole U1370F were also transferred to the core refrigerator immediately after catwalk curation for high-resolution sampling in aseptic conditions for microbiological studies. Samples from Hole U1370F were processed for shipboard microbial cell enumeration and cultivation and shore-based molecular studies. A number of samples were taken directly to the Radioisotope Container Laboratory for inoculation with stable and radioactive isotope tracers. Unsampled whole-round core sections from Holes U1370E and U1370F were brought to the Core Laboratory and integrated into the routine core flow.

Site U1371

Site U1371 is located in the southwestern edge of the South Pacific Gyre at 5306 m water depth in a region of abyssal hill topography trending NE-SW (050˚). The closest previous drilling site is ODP Site 276, 800 nautical miles away. The site location lies within magnetic polarity Chron 32n.2n. Therefore, the crustal age may range from 71.5 Ma to 72.9 Ma. The principal objectives at Site U1371, the last site of the expedition, are to determine the habitability, activity and microbial community composition in the subseafloor sediments at the southern most edge of the South Pacific Gyre. In context with the other drill sites, Expedition 329 aims to resolve how much microbial communities vary from the heart of the gyre (Site U1368) to the southern edge and whether living microbes persist in this sediment for the last ~73 million years.

At Site U1370, it was also difficult to retrieve a good first mudline core because of the combination of the ship's heave and great water depth. Two attempts were made in Holes U1371B-1H and U1371C-1H without success. Both core barrels were retrieved nearly full. A third attempt, Core U1371D-1H, recovered a good mudline core and allowed us to continue coring to basement depth (~126 mbsf) in Hole U1371D. Fourteen cores were recovered from Hole U1371D for a 126.87-meters core recovery (101%).

Cores U1371B-1H, U1371C-1H and U1371D-1H through 14H were sampled in the catwalk for safety and analytical methane measurements, and then transferred to the cold room in the Geochemistry/Microbiology Laboratory for dissolved oxygen measurements. Subsequently, these cores were transferred to the Core Laboratory for routine shipboard measurements of physical properties using the laboratory's whole-round and half-round multi-sensor loggers. Cores are being split into working and archive halves and visually described. The sediment in Cores U1371D-1H to 6H consists of clay-bearing diatom ooze with radiolarians with occasional ash layers.

By the end of the week, Cores U1371E-1H to 6H had been recovered. Cores from Hole U1371E were sampled for pore water chemistry directly on the catwalk and then brought to the hold-deck's core

refrigerator for additional sampling for a broad range of biogeochemical species. A number of syringe and whole-round core samples for microbiological studies were also taken from this hole.

TECHNICAL SUPPORT AND HSE ACTIVITIES

This week the technical staff supported the processing and data collection for the cores recovered from Sites U1370 and U1371. A fire and boat drill was held on Sunday 5 December.