

**May 9, 2005**

**IODP EXPEDITION 307:  
MODERN CARBONATE MOUNDS: PORCUPINE DRILLING  
WEEK 2 REPORT**

**OPERATIONS**

**HOLE U1316A, 2 May:** The Schlumberger Triple Combo was the first logging suite to be deployed. On its way down the pipe it came upon an obstruction at 45 mbsf, 5 m of the logging string was still up inside the drill pipe. The string was picked up and run back down, but would not pass beyond 30 mbsf, coincident with the Lockable Float Valve. It was speculated that the heave and the shallow engagement of the drill pipe in the hole (30 m) caused the pipe to walk around and wallow out the top of the hole. The logging program was suspended and the tools recovered. The Schlumberger logging sheaves were rigged down and the drill string was pulled clear of the sea floor at 0640 hr 2 May. This officially ended Hole U1316A.

**HOLE U1316B:** The drill ship was offset 20 m north of Hole U1316A. The bit was positioned at a depth of 955 mbrf, and Hole U1316B was spudded at 0830 hr 2 May. Core 1H recovered 5.5 m, establishing the sea floor at 959.0 mbrf. APC coring continued with cores through 8H to a final depth of 59.5 mbsf (1018.5 mbrf). The drill string was pulled clear of the sea floor at 1500 hr 2 May. This officially ended Hole U1316B. The decision was made to move over to the nearby Site U1317, PORC-3A, and core the shallow APC/XCB holes before coming back to PORC-4A to core Hole U1316C. Hole U1316C will be cored with an RCB BHA, which will require a pipe trip after APC/XCB coring.

**HOLE U1317A:** The drill pipe was pulled up to 797 mbrf and the vessel was moved in DP mode to Site U1317, PORC-3A. A Datasonics positioning beacon SN 2190, 16 khz, 199 dB was deployed at 1837 hr 2 May, officially marking the beginning of on-site operations for Hole U1317A. There was difficulty obtaining an accurate reading from the PDR, because of the high bathymetric slopes of the carbonate mound, the PDR tending to give readings shallower, by up to 40m, than the actual depth at the rig floor. This, together with the slightly different locations of the site in the proposal and the site in the prospectus, caused a delay of approximately 5 hours in retrieving the first core from Hole U1317A, owing to piston coring into water. Hole U1317A was spudded (at the location given in the prospectus) on the third attempt at 2335 hr 2 May. Core 1H recovered 6.5 m, which established a sea floor depth of 832.5 mbrf.

APC coring continued on U1317A through 16H to 130.8 mbsf (956.8 mbrf). PFTs and micro-sphere tracer material were run on all cores. APC temperature measurements were made on 3H, 7H and 12H. The Adara electronics was found damaged after 7H. The data was recovered, but the electronics will need to be sent to shore for repair. Over-pulls were required on all temperature runs, 70 klbs on 12H. The Tensor tool was run on cores 3H through 7H. It was removed after Core 7H when an over-pull was required. Both Cores 15H and 16H had short strokes, which initiated the switch to XCB. Both 17X and 18X had short advances of 5.5 m and 2.5 m, respectively. Hole 1317A reached a TD of 138.8 mbsf (964.8 mbrf). The drill string was pulled clear of the sea floor at 1815 hr 3 May. This officially ended Hole U1317A.

**HOLE U1317B:** The vessel was offset 25 m southeast of Hole A. Hole U1317B was spudded at 1920 hr 3 May. Sea floor was established at 809.0 mbrf. Continuous APC coring was

conducted from 1H through 16H to 145.2 mbsf (954.2 mbrf). No tracer material was run on Hole B. The Tensor tool was run on cores 3H through 12H. Over-pulls were required on 10H and 12H through 16H, with 80 klbs needed for cores 12H and 13H. Core 13H had to be drilled over. After core 16H had a short stroke the coring system was switched to XCB. Core 17X advanced only 3 m and coring was ended with a TD of 148.2 mbsf (957.2 mbrf). The drill string was pulled clear of the sea floor at 0815 hr 4 May. This officially ended Hole U1317B.

**HOLE U1317C:** The vessel was offset 25 m southeast of Hole B. Hole U1317C was spudded at 1000 hr 4 May. Sea floor was established at 802.7 mbrf. Continuous APC coring was conducted from 1H through 16H to 143.3 mbsf (946.0 mbrf). No tracer material was run on Hole C. The Tensor tool was run on Cores 3H through 11H. Over-pulls were required on 10H and 14H through 16H. After Core 16H the coring system was switched to XCB. Core 17X advanced only 2.2 m and coring was ended with a TD of 153.0 mbsf (955.7 mbrf). The drill string was pulled clear of the sea floor at 2130 hr 4 May. The drill string was tripped back to the surface. The bit cleared the rotary at 2330 hr 4 May. This officially ended Hole U1317C. The bit, the seal bore drill collar and the non-mag drill collar were laid out.

**HOLE U1317D:** The vessel was offset 15 m south of Hole B. An RCB BHA with a mechanical bit release (MBR) and 3 stands of drill collars was made up. Hole U1317D was spudded at 0400 hr 5 May. Sea floor was established at 805.0 mbrf. The RCB was run with a center bit and the hole was drilled ahead to 110.0 mbsf (915.0 mbrf). The center bit was retrieved and RCB coring was conducted from 1R through 18R to a TD of 270.0 mbsf (1075.0 mbrf) at 0420 hr 6 May. PFTs and micro-sphere tracer material were run on all cores.

Hole U1317D was prepared for logging. A wiper trip was run from TD to 30 mbsf and back to TD. During the wiper trip up, over-pulls of 70 klbs at 242 mbsf and 30 klbs at 185 mbsf were experienced. On the wiper trip down, the bit took weight at 222 mbsf. A core barrel was dropped and the hole was reamed and washed down to TD, 270 mbsf. Two meters of fill was circulated out. A hole-cleaning sweep with 30 bbls of high viscosity mud was pumped around. The RCB bit was released and the hole was displaced with 84 bbls of sepiolite mud. The drill pipe was tripped to the logging depth of 88 mbsf.

The Schlumberger wire line logging sheaves were rigged up and the triple combo string was assembled. During the function test one of the tools had a communication problem and was replaced. The logging string was run in the hole. It took weight at 246 mbsf. The attempt to work the tools down was not successful and the hole was logged up from that depth. The data quality was good so a second pass was not necessary. The tools were pulled out of the hole and laid out at 0600 hr 6 May.

The second logging run was with the Well-seismic tool (WST). Preparation for this run required following the Marine Mammal Policy for seismic sources. The watch for marine mammals began an hour before the air gun was put through a soft start. The soft start required ramping up the firing pressure to operational levels over a 30-minute period. No mammals were sighted. The WST string was assembled and run into the hole to bottom at 246 mbsf. Check-shots were taken at 13 stations on the way up. The signals were good and the WST string was pulled out of the hole and laid out at 2000 hr 6 May.

The third logging run was with the FMS-sonic string. The FMS-sonic string was assembled and run to bottom. Two passes were made and the string was pulled out of the hole and laid out at 0100 hr 7 May. The Schlumberger wire line logging sheaves were rigged down, ending the logging operation at 0230 hr 7 May.

The drill pipe was tripped to surface. Beacon 2190 was released at 0326 hr and recovered. The MBR cleared the rotary at 0430 hr 7 May, ending Hole U1317D.

**HOLE U1316C:** The ship moved back over to Site PORC-4A in DP mode. The location coordinates for Hole 1316C was 20 m south-southeast from U1316A. An RCB BHA with a mechanical bit release (MBR) and 3 stands of drill collars was made up. Hole U1316C was spudded at 0800 hr 7 May. Sea floor was established at 959.0 mbrf. The RCB was run with a center bit and the hole was drilled ahead to 40.0 mbsf (999.0 mbrf). The center bit was retrieved and RCB coring was conducted from 1R through 11R to a TD of 143.1 mbsf (1102.1 mbrf) at 0010 hr 8 May. PFT s and micro-sphere tracer material were run on all cores.

Hole U1316C was prepared for logging. A wiper trip was run from TD to 58 mbsf and back to TD, there was no fill. The RCB bit was released and the hole was displaced with 44 bbls of high viscosity mud. The drill pipe was tripped to the logging depth of 59 mbsf.

The Schlumberger wire line logging sheaves were rigged up and the triple combo string was assembled. The logging string was run in the hole to TD at 143 mbsf and logged up. The data quality was good so a second pass was not necessary. The tools were pulled out of the hole and laid out at 0715 hr 8 May.

The second logging run was with the FMS-sonic string. The FMS-sonic string was assembled and run to bottom. Two passes were made and the string was pulled out of the hole and laid out at 1135 hr 8 May. The Schlumberger wire line logging sheaves were rigged down, ending the logging operation at 1330 hr 8 May.

The drill pipe was tripped to surface. Beacon 2197 was released at 1350 hr and recovered. The MBR cleared the rotary at 1515 hr 8 May, ending Hole U1316C.

**HOLE1318A:** The rig was secured for transit and the vessel was underway to Site PORC-2A. As the vessel came on site the thrusters were lowered and the vessel was positioned over the site coordinates. Beacon 2197 was dropped at 1649 hr 8 May, beginning Site U1318, Hole U1318A. The PDR provided a sea floor depth of 430.4 mbrf. An APC/XCB BHA was made up with 2 stands of collars. Hole U1318A was spudded at 2045 hr 8 May. A sea floor depth was established at 420.3 mbrf. APC coring continued through 4H to 37.7 mbsf (448.5 mbrf). PFT s and micro-sphere tracer material are being run on all cores. An APC temperature measurement was made on 3H. The Tensor tool was started on Core 3H.

## **SCIENCE SUMMARY**

**OPERATIONS:** Site U1316 to the west of Challenger Mound and Site U1317 on the mound proper (only 700 meters apart) were successfully drilled and logged. APC drilling at Site U1317 initiated the highly anticipated exploration of the Challenger Mound. Hole U1317A was sampled for interstitial water geochemistry and microbiology. The remaining sections from U1317A were split with the rock saw before description, however, the high density of coral pieces lead to deformation of the internal structure of the sediment in the split-core face. For this reason, Cores U1317C-1H to 5H and U1316B-7H were split with the saw after being frozen to approximately  $-50^{\circ}\text{C}$  for 2 days. This resulted in a good preservation of the internal core structure (coral floatstone and rudstone) and a marked improvement over orthodox core splitting, despite short ice expansion cracks (<1cm long) being observed in many of the cores. Core sections from Hole U1317B and the remainder of Hole 1317C were left unopened for anticipated onshore computer aided tomographic (CAT) scanning, freezing, splitting, and lithological description. The dedicated microbiology core sections from Hole U1316D were run through the Fast Track MST in order to obtain at least some data for stratigraphic correlation before the microbiologists sub-sampled their 1.5m section.

This caused approximately a 10-minute delay in removing the core section to the cold room that was deemed microbiologically acceptable. A science meeting to discuss the results from Site U1316 was held during the downhole logging operation at Hole U1317D.

**SITE U1316 (PORC-4A):** The off-mound Site U1316 is characterized by silty clays in the upper 45 mbsf and is underlain by a thin (11 m), yet distinct, coral-bearing unit. A sharp boundary at the base of this unit is interpreted as the stratigraphic equivalent of the mound base and coincides with a major litho- and biostratigraphic hiatus of several million years. The sedimentary unit below it (55-143 mbsf) is dominated by massive greenish-grey silty clays to sandstones of probable Miocene age, bearing bivalve and gastropod shells, and abundant glauconite grains. Dolomite has been recognized at some depths, for example between 92-93 mbsf, which coincides with the geochemically critical methane oxidation zone.

Interstitial water alkalinity, ammonia, and sulfate profiles indicated two zones of microbiological activity: an upper zone of activity between the surface and 10 mbsf, and a lower zone between 80 and 100 mbsf, ostensibly driven by methane oxidation. Total prokaryote abundances appear to be low throughout most of Site U1316, but exhibit an increase at the sulfate-methane transition. Concave-up curvature in the profiles of minor elements Li, Sr, and B suggest that high rates of sediment burial in the uppermost 80 mbsf may be dominating diffusion.

Downhole logging identified several thin (<2m) high density, high velocity, low porosity beds that may be correlated to reflectors on the seismic section.

**SITE U1317 (PORC-3A):** Challenger Mound (Site U1317) is dominated by coral-rudstone to floatstone facies throughout the entire upper 130-150 mbsf. We found that the upper coral-bearing unit thickens to the southeastern direction upslope towards the mound summit, from Hole U1317A to U1317B to U1317C. Noteworthy are distinct carbonate rich and lighter-colored layers with poor coral preservation and dissolution. A central question is whether these carbonate rich layers are of depositional or diagenetic origin. The mound base, identified at ~130 mbsf of U1317A, is surprisingly similar to its equivalent found at the off-mound site (Site U1316). The underlying unit is very similar to the one recovered from U1316, with sediments ranging from glauconitic clays to fine sandstones.

Dissolved Sr concentrations that peak near 125 mbsf indicate aragonite to calcite recrystallization near the mound base. A broad methane-sulfate transition is observed below 130 mbsf. Methane is first detected at 130 mbsf (2.1 ppm) and gradually increases concentration with depth to 16000 ppm at 220 mbsf. Sulfate concentrations decrease from seawater concentration at the surface (28 mM) and to 1 mM at 200 mbsf. Hydrogen sulfide was not detected.

Downhole logging produced similar results to those from Hole 1316C: thin low porosity layers interrupting a steady compaction trend with depth.

#### **TECHNICAL SUPPORT ACTIVITIES**

During the second week of Expedition 307 the shipboard labs were busy processing cores and samples as coring continued. A Vertical Seismic Profile/Check Shot logging run was successfully completed on Hole U1317D.

#### **HSE ACTIVITIES**

A fire and boat drill was held on 6 May for the entire ship's complement.