IODP Expedition 359: Maldives Monsoon and Sea Level

Week 5 Report (26 October–1 November 2015)

The fifth week of the IODP Expedition 359 consisted of coring operations at Site U1466 (MAL-2A, 26 October), Site U1465 (MAL-01A; 26–28 October), and Site U1467 (MAL-09A; 28 October–1 November).

Operations

Hole U1466B was completed at 1220 h on 26 October officially ending operations at Site U1466. The ship was moved in dynamic positioning (DP) mode ~1 nmi back to Site U1465 while a new RCB bit/bottom-hole assembly (BHA) was prepared. Once on station, the drill string was lowered to the sea bottom and a seafloor depth was established as 512 mbsl. The top drive was picked up, and after spacing out the drill string Hole U1465B was spudded at 0655 h. The hole was drilled down to 65.9 mbsf before deploying an RCB core barrel. Continuous rotary coring began at that point and continued through Core U1465B-23R to 221.3 mbsf. Recovery was poor through the high porosity carbonate sedimentary unit. RCB half-cores were used a few times in an attempt to improve recovery with very limited success. Ultimately the inability to effectively clean the hole, high drilling torque, and occasional stuck pipe led us to abandon the hole at 0215 h on 27 October. The drill string was pulled with the top drive to 63.5 mbsf before becoming stuck for 0.75 h. Once the drill string was freed, the bit was pulled clear of the seafloor at 0610 h, and the top drive was set back. The ship was offset 20 m east of Hole U1465B to start Hole U1465C. A third hole at this site was not originally planned; however, due to the exceptionally poor recovery in Hole U1465B, we decided to make another attempt to core the formation using the half-length APC and the XCB coring systems. The target depth was reduced from the original 720 to 500 mbsf, recognizing that given the sedimentological properties of the formation it was highly unlikely that hole conditions would allow penetrating even that deep. In this hole, the cores were not oriented nor were any temperature measurements taken. An APC/XCB BHA was assembled with a mechanical bit release (MBR) system above the bit even though no logging was planned. The MBR was included in order to have the option of releasing the bit in case the pipe became stuck in the hole. After spacing out the wireline core barrels, the drill string was lowered to the bottom where a seafloor tag established a mudline depth of 510 mbsl. Hole U1465C was spudded at 1330 h on 27 October. The hole was drilled down to 55 mbsf before coring began. Recovery was poor; however, the objective was to try and reach ~500 mbsf (or into the sediment drifts below the drowned reef complex). APC/XCB coring was ultimately suspended at 233.2 mbsf because, just as happened in the previous Hole U1465B, all circulation began going downhole into the formation, and the drillers were no longer able to get the drill cuttings pumped up and out of the hole. After discussion, the general consensus was that

most likely both holes were drilled into an area of very high porosity within the ancient reef. This made it impossible to further deepen either hole.

At 1430 h on 28 October, we decided to stop further hole cleaning attempts at this site and move the ship to Site U1467 (MAL-09A), the most basinal site of our program. The bit was pulled clear of the seafloor at 1430 h, the top drive was racked back, and the drill string was pulled back to the surface. During the pipe trip, the seafloor positioning beacon was released and recovered back aboard at 1705 h. The ship was secured for transit and we started the transit to Site U1467 at 1818 h. The short transit was completed in 2 h at 8.5 kt. At 2045 h on 28 October the ship was under DP control over Site U1467. We prepared an APC/XCB BHA including a non-magnetic drill collar for oriented piston coring and a MBR for eventual wireline logging and as insurance for freeing a stuck BHA.

Hole U1467A was spudded at 0055 h on 29 October with the bit positioned at 481 mbsl. Core U1467A-1H recovered 3.5 m, establishing a seafloor depth of 487 m. Oriented piston coring continued through Core U1467A-4H to 32.0 mbsf; a single formation temperature measurement (APCT3) was made while taking Core 3H at 22.5 mbsf. Right from the start, the coring system was not behaving normally. Barrels were seating high, then dropping down while under 300–400 psi pressure; the resultant jarring impact caused the shear pins to shear and the barrels to fully stroke. Five thousand pounds of overpull were necessary to free the core barrels themselves. In an attempt to determine whether there was some sort of blockage or a broken flapper valve, an XCB core barrel was deployed. This barrel also landed high and also experienced an initial 5000 lb overpull. Convinced that something was wrong in the BHA, we decided to abandon the hole, recover the drill string, and inspect the coring assembly. The bit arrived back on the rig floor at 0900 h on 29 October. Upon inspection of the coring tools, the MBR, float valve, and landing shoulders were all determined to be in good shape, but further inspection determined that the XCB latch sleeve was damaged and was the reason why the wireline barrels were jamming upon deployment and recovery. Therefore, the latch sub and sleeve were replaced. The drill string was deployed back to the seafloor and Hole U1467B was spudded at 1430 h. Core U1467B-1H recovered 3.46 m, establishing a water depth of 487 m. Oriented APC coring continued through Core 37H to 338 mbsf. Formation temperature measurements (APCT3) were made while taking Cores U1467B-3H, 5H, 7H, and 9H (22.5, 41.5, 60.5, and 79.5 mbsf, respectively); however none of these temperature measurements appear to be good. At 2100 h, after reaching refusal with the HLAPC (Core U1467B-42F at 361.4 mbsf), coring was suspended in order to test the Motion Decoupled Hydraulic Deployment System (MDHDS) and Electrical Release System (ERS) overshot system.

The MDHDS is being developed for use when deploying the T2P temperature pressure tool; however, it can also be used to deploy the SET/SET2 and SETP wireline tools. The ERS will also be useful for deploying future CORK thermistor strings. Both systems are deployed using the electric logging line. The MDHDS system was assembled and hung off at the rig floor and the ERS was attached to the top of the MDHDS. The system was deployed into the hole using

the electric logging line, but all communication with the ERS was lost and the tool had to be recovered back to the rig floor. Subsequent testing indicated that a component had failed in the ERS electronic module. This was subsequently repaired and the tool was deployed back into the hole; however, during the descent a concern was raised about the compatibility of the MDHDS/SET system with the standard Mechanical Bit Release (MBR) and float valve assembly in the deployed BHA. The MDHDS is designed to be deployed through a Lockable Flapper Valve (LFV) and has been deployed in this manner on a previous expedition. In this case an MBR was being run in lieu of an LFV because it provided another way to free up the drill string should it become stuck in the hole. The test was suspended and after some discussion and research it appeared the MDHDS system was compatible and the SET tool being deployed was also compatible as long as the shear pins were not sheared in the SET tool as would be the case when taking a normal temperature measurement. There was no plan to do this during the MDHDS test; however, there was some concern that if the shear pins accidently sheared and the SET tool scoped out, then it would have been impossible to recover back inside the BHA because of the float valve flapper engaging a square shoulder. Because of this potential risk to a high value hole, the test was suspended and the tools were pulled out of the hole. The system was back at the rig floor just before 0300 h on 31 October.

Continuous oriented APC coring resumed and continued until 0615 h on 31 October when Core U1467B-45H reached 389.9 mbsf. Core 45H achieved full stroke; however, at 100 klb overpull the barrel required drillover with the XCB core bit. Coring then continued using the HLAPC through Core U1467B-61F to 465.1 mbsf. Coring with the HLAPC was suspended when the last two cores each had 100 klb overpull and required drillover. At 1530 h we switched to the XCB coring system. Coring continued through Core U1467B-77X to 617.2 mbsf. At that time the assistant driller noted that he was getting high (10 klb) overpull when recovering the XCB core barrels. An HLAPC was deployed and this barrel landed high, then after pressuring up the drill string the shear pins prematurely sheared at 400 psi (upon impact) after being pushed through the XCB double window latch sleeve. These were the same symptoms experienced earlier in Hole U1467A with the XCB latch sleeve. With the hole only 97 m from the desired TD, a meeting was called with the Co-Chiefs and technical personnel to discuss options. We decided to stop coring Hole U1467B, recover/repair the BHA, and modify the plan for Hole U1467C. APC coring to 200 m was already planned for Hole U1467C, so we plan to add drilling to ~610 m, XCB coring to the target depth, and wireline logging. The drill string was recovered, the XCB latch sleeve was replaced, the ship was offset 20 m to the north of Hole U1467B, and Hole U1467C was started at 1620 h on 1 November. The seafloor depth established with the recovery of Core U1467C-1H is 487 m. As of midnight on 1 November, we had extended coring in Hole U1467C to 111.2 mbsf (Cores U1467C-2H to 12H).

Science Results

Overview

This week, we completed scientific coring operations at Sites U1466 (MAL-2A) and U1465 (MAL-1A), and we began operations at Site U1467 (MAL-09A).

Please see the science summary report for Site U1466 for detailed information.

Education and Outreach

This week we conducted nine education events with eight schools in the United States (Ohio and New Jersey), Canada (British Columbia), Germany (Hamburg), Chile (Valparaiso), and one science club in New Jersey. We also posted daily updates and photos on our social media outlets (Facebook [https://www.facebook.com/joidesresolution], Twitter [https://twitter.com/TheJR], and Instagram [http://instagram.com/joides_resolution]) and in blogs on the *JOIDES Resolution* website (http://joidesresolution.org/).

Technical Support and HSE Activities

Laboratories

- Processing of cores and samples from Holes U1466B and U1467A, U1467B, and U1467C.
- Water samples collected daily with the Wildco Beta Water Sampler at approximately 15 m water depth for analysis of plankton.
- A negative offset was detected on the point source magnetic susceptibility sensor on the Section Half Multisensor Logger (SHMSL) to the loop sensor on the Whole-Round Multisensor Logger (WRMSL). The offset is likely due to the point sensor having a positive reading when the sensor is zeroing. Technicians have been trying to find the source of the positive reading in the track zeroing position.
- Logging data was transferred to LDEO and returned to the ship successfully using the newly established data transfer protocol.

HSE Activities

- A fire drill was conducted on 27 October.
- The eyewash stations and safety showers were tested.