IODP Expedition 341S: SCIMPI and 858G ReCORK

Week 1 Report (19–27 May 2013)

Operations

Victoria Port Call and Transit to Hole 858G

IODP SCIMPI and 858G ReCORK Expedition (341S) officially began when the ship departed Victoria, Canada, at 1800 h on 19 May. In the days leading up to our departure, the SCIMPI and CORK scientists and engineers moved onboard and began assembling and testing their systems. After a short transit to Hole 858G, our first planned operation was to remove the existing CORK and install a new CORK for pressure monitoring in Middle Valley axial rift of the Juan de Fuca ridge. Our second planned operation was to make the first installation of the Simple Cabled Instrument for Measuring Parameters In situ (SCIMPI) on the Cascadia margin. Both installations are to be incorporated into the NEPTUNE Canada observatory network. In addition to the science objectives of installing these two observatory systems, 14 educators and four instructors are participating in a "School of Rock" on Expedition 341S. This program provides hands-on research experiences for earth and ocean science educators. After the 219 nmi transit at an average speed of 10.1 nmi/h, we arrived at Hole 858G at 1630 h on 20 May.

Hole 858G

At Hole 858G, we planned to recover the existing CORK and install a new CORK observatory. The last time this CORK was replaced during ODP Leg 169 the operations were challenging, with the upper and lower parts of the CORK head breaking off, the loss of the data logger, and seals that had failed leading to significant mineralization. We expected that pulling out the CORK on Expedition 341S might present similar difficulties.

After arriving at Hole 858G, we lowered the thrusters and the hydrophones, deployed a seafloor positioning beacon, and switched to dynamic positioning mode at 1703 h. Before we could start with our first objective, retrieving the existing CORK at Hole 858G, we had to de-torque the cable for the new camera system. So, the rest of the evening of 20 May was spent lowering the camera system to the seafloor. Scientists, engineers, and operations continued planning for operations and preparing the CORK and SCIMPI observatory systems.

The de-torquing of the new camera system's fiber optic cable was completed when the camera was back on board at 0030 h on 21 May. We then lowered the CORK pulling tool with three stands of drill collars to the seafloor, deployed the camera system, and started maneuvering to lower the CORK pulling tool over the existing Hole 858G CORK head.

Positioning and lowering the CORK pulling tool over the CORK head was complicated by poor environmental conditions. This included swells up to ~3.5 m, waves up to ~5 m, and winds up to 30 nmi/h. After three hours, we had landed and secured the CORK pulling tool to the Hole 858G CORK head.

Once the CORK pulling tool landed over the CORK head, we pulled up to verify that it had successfully latched in. We started to pull upward, but the CORK would not unlatch and come out of the hole. We attempted to pull it out 20 times starting with ~100,000 lbs of overpull, but

eventually reaching up to more than ~150,000 lbs of overpull. On the last attempt, the CORK pulling tool released from the CORK head at ~1220 h on 21 May.

After inspecting the CORK head again, we maneuvered the CORK pulling tool and lowered it back over the CORK head at ~1350 h on 21 May. This time when we pulled upward, we observed only ~5,000 to 10,000 lbs of overpull and then the weight reduced; the drillers thought that perhaps the CORK head was partly engaged, but then slipped out of the pulling tool. Several more attempts to engage and pull the CORK never resulted in more than ~10,000 lbs of overpull. On at least one attempt, after the weight reduced, the CORK pulling tool rotated back and forth, suggesting that the CORK head was seated in the hole well enough to at least inhibit rotation. Because we suspected that either the CORK pulling tool or CORK head might have been damaged, we decided to retrieve the CORK pulling tool to inspect the J-slot that engages the dogs on the CORK head. We started raising it at 1430 h and it arrived back on deck at 2000 h on 21 May.

We found that part of the CORK head had broken off inside the CORK pulling tool. The lower latch dogs and their attached sleeves were wedged inside the CORK pulling tool. Pulling upward on these lugs activates the CORK latching mechanism.

At this point, our only option remaining to retrieve the Hole 858G CORK head was to attempt to latch on to the upper set of dogs on the CORK head using the CORK running tool. We expected this to be a challenging operation given the poor sea state and the very small, $^{1}/_{8}$ inch clearance between the CORK head and the CORK running tool. Before lowering the CORK running tool, we decided to cut off the tapered cone skirt from the CORK pulling tool and attach it to the CORK running tool.

We finished welding the skirt from the CORK pulling tool onto the CORK running tool at 0145 h and started lowering it to the seafloor. At 0730 h, the CORK running tool was at the seafloor and we made many attempts to latch onto the Hole 858G CORK head throughout the rest of the day.

We were able to land the running tool over the CORK head multiple times but heaves up to 3.5 m and the tight fit prevented us from being able engage the dogs in the running tools J-slots. At midnight, we decided to abandon any further attempts to retrieve the Hole 858G CORK and started to retrieve the drill string. If we were successful in retrieving the CORK after this time, we would not have had sufficient time to install the replacement CORK head. The scientists decided it was better to leave the existing CORK in place (with the potential to access the borehole via an existing port) rather than leaving the hole open and venting.

Transit to Site U1416

After abandoning our attempts to recover the existing CORK at Hole 858G, we recovered the drill string and the CORK pulling tool was back on board at 0500 h on 23 May. We recovered the seafloor positioning beacon and at 0642 h started our transit to the location on the Cascadia Margin where we will deploy SCIMPI (Site U1416; proposed site CAS05-CORK). After a transit of 75 nmi, we arrived at Site U1416 at 1530 h.

Site U1416 SCIMPI Installation

Hole U1416A, SCIMPI Installation: Our plan at Site U1416 was to drill a hole to 260 mbsf and install the SCIMPI observatory. We assembled a 9.875 inch tri-cone bit with a mechanical bit release and lowered it to the seafloor. Before we started drilling the hole for SCIMPI, we deployed the seafloor positioning beacon 15 m north of Hole U1416A and conducted a 1.5 h camera survey to verify that the seafloor around Site U1416 was clear of the nearby Neptune observatories and cables. We started drilling Hole U1416A at 2153 h on 23 May, jetted-in to 12 mbsf, recovered the camera system, and began drilling ahead at 2245 h. On 24 May, we reached the target depth of 260 mbsf.

The drilling conditions were good with no drag when raising the bit off the bottom of the hole to make pipe connections or any fill. With the bit at the bottom of the hole, we circulated mud to clean the cuttings out of the hole. We raised the bit to 10 m off bottom and stopped rotation and circulation at 0955 h on 24 May. We waited 3 h to determine if the hole would be stable for the amount of time it would take us to deploy SCIMPI and still pull the drill string back out of the seafloor. After the 3 hours of waiting, the drillers started rotating and circulating without any trouble. The lowermost 10 m of the hole had filled in, but it was "soft" fill. The bit was easily lowered to the bottom of the hole where we circulated mud to clean the fill/cuttings out of the hole and released the bit. This required two runs of the coring line, the first to shift the mechanical bit release and the second to shift the sleeve back down. Then we removed the top drive, raised the drill string to remove a joint of pipe, and added a 5-m pup joint of pipe so we had the desired end of pipe depth and a pipe connection at the rig floor. We were now prepared to deploy SCIMPI.

The first step was to place the sinker bar into the pipe followed by the lowermost part of the SCIMPI string. Using alternating lifts with two sheaves, the rest of the SCIMPI string was sequentially raised up into the derrick using the pre-attached yale-grips. At the top, the electronic release system (ERS) was attached and tested. Although the data connection to the SCIMPI sensor string was working, the release would not activate. After some diagnosis (and switching out both mechanical parts of the ERS), a faulty cable was identified and replaced. With the ERS working, we zeroed out the wireline winch with the ERS at the top of the drill string and then started lowering the entire SCIMPI-ERS assembly at ~1900 h on 24 May. Originally, we intended to lower it at ~900 m/h but slowed this down to ~600 m/h.

SCIMPI was lowered without any problems until the sinker bar got ~30 m above the end of the pipe. At this depth, the wireline weight indicated that it was encountering something that was keeping it from going further down. So we started pumping slowly through the circulating head to try to help clear the way. After circulating for a short time, SCIMPI could now be lowered until the sinker bar was at the end of the pipe. Although it did not exit the end of the pipe, we decided to activate the ERS to release SCIMPI. As expected, we stopped receiving the SCIMPI data through the wireline. For the first ~30 m of retrieving the wireline with the ERS on the end, it was not completely clear from the weight that the ERS had released. After a while, the logging winch speed was increased and the ERS brought back to the ship. As the ERS was nearing the ship, it became apparent from the wireline tension that SCIMPI was still attached and had not released. The ERS was hung off at the rig floor at 2300 h (24 May) and we confirmed SCIMPI was still attached. The ERS had actuated with the dogs retracting enough to stop data communications but not enough to release SCIMPI. We confirmed that the ERS was operational

by cycling at rig floor and inferred that power had not been applied to the motor long enough to effect a complete release. Just before midnight on 24 May, we started our second attempt to deploy SCIMPI with the ERS. This time, we pumped slowly during the entire time we were lowering SCIMPI. The ERS fully released and we started pulling the pipe out of the hole. We continued pumping with the circulating head while pulling the uppermost 5 m pup joint and first joint of drill pipe, as well as the subsequent stand of pipe. The remaining pipe was pulled out in stands without circulation. The end of the pipe pulled out of the seafloor (0445 h on 25 May). As we continued pulling above the seafloor we observed ~15–20 m of SCIMPI cable and the command module coming out of the end of the pipe and floating in the water column. This appears to be very close to the length planned to be above seafloor. The first operational deployment of SCIMPI was successful.

Hole U1416B, Attempted Downhole Logging: We retrieved the drill string and the end of the pipe was back on board at 0720 h on 25 May. Since our primary operations for this expedition were completed and significant time remained in the expedition, we decided to drill and wireline log a second hole 40 m to the north of Hole U1416A to complement the SCIMPI installation. We assembled a 9.875 inch tri-cone bit with a mechanical bit release and lowered it to the seafloor. We spudded Hole U1416B at 1040 h on 25 May. We reached the total depth of 290 mbsf at 2230 h on 25 May. We circulated the hole with mud, released the bit, and started raising the end of the pipe up to 60 mbsf for logging. We set back the top drive with the end of the pipe at 260 mbsf, after which we continued pulling the pipe up the hole.

Initially, normal back flow was observed at the rig floor. While pulling one stand, no back flow was observed (the upper part of the drill string was dry), which was a bit unusual. When the next stand was pulled and disconnected, the back flow substantially increased out of the top of the drill pipe at the rig floor. The flow extended up into in the derrick. This required installation of the drill string safety sub and the circulating head. At this time (0045 h), the end of the end of pipe was at ~113 mbsf.

At 0115 h, we initiated circulation at 35 strokes per minute (spm) at 500 psi. After circulating an hour, the standpipe pressure had been reduced to the background level of the standpipe (essentially zero). At 0215 h, we deployed the camera system to observe the hole and observed flow coming out of the hole at the seafloor. At 0245 h, we pumped 70 barrels of mud (10.5 ppg) and displaced it into the hole. From 0300 to 0500 h, flow out of the hole at the seafloor ceased, but shortly thereafter resumed flowing. We then circulated the hole with seawater and then spotted 50 barrels of 11 ppg mud in the drill string at 0530 h. We did not observe any back pressure or flow up the drill string, which allowed us to remove the safety sub and circulating head. We pulled the end of the pipe out of the seafloor at 0600 h. After offsetting the ship to flush the mud out of the drill string, we resumed our observations of the seafloor at Hole U1416B with the camera system video and sonar. We observed continuous flow out of the hole from 0630 to 1445 h.

Eventually, we decided to drop a marker on the seafloor to unambiguously mark the location of Hole U1416B. We attached a short length of red polypro rope to a 5 m-long piece of metal pipe, added some reflective tape, and free-fall deployed it through the drill string when the ship position was 4 m south of the hole. Five minutes after deployment it exited the end of pipe. The metal pipe penetrated about halfway into the seafloor adjacent to the hole and was easily visible on the camera system data.

Due to conditions at Hole U1416B, we decided to go back to inspect previous Hole U1416A in which SCIMPI was installed. After a short dynamic positioning move (40 m to the south), we started observing the seafloor at Hole U1416A. We could clearly see the above seafloor portion of SCIMPI as we had left it 1.5 days before. We did not observe any flow or bubbles emanating from the hole, nor from the seafloor anywhere in the field of view around the hole. In addition, we did not observe any returns from the VIT camera system's sonar. After monitoring Hole U1416A for an hour with no indication of flow, we returned to Hole U11416B.

We moved the ship the 40 m north back to Hole U1416B and resumed our monitoring of the flow from the hole. We decided to deploy SHRIMPI-SCIMPI near Hole U1416B. SHRIMPI-SCIMPI consists of a single sensor module with temperature and conductivity sensors at the bottom, 30 m of cable, and a command module. The ship was positioned 4 m south of the hole (same as where the marker had been previously placed) and the SHRIMPI-SCIMPI was free-fall deployed though the drill string. We observed it exit the end of the drill string very close to the marker.

We resumed our video and sonar monitoring of the seafloor at Hole U1416B. At 1800 h on 25 May, we also started periodic (2 h) acquisition of sonar images at multiple heights above the seafloor to better analyze the flow out of the hole over time. On the morning of 27 May, our initial review of the camera and sonar data indicates that the rate and volume of flow is decreasing. We plan on continuing our monitoring of Hole U1416B until we have to depart for Victoria.