

PROJECT SITUATION REPORT DISC Drill 2012-13 Season

Project: T-350-M

Project Principal Investigator: Dr. Charles Bentley

Report No. 9 for period: 1-6-13 **through:** 1-12-13

Prepared by: Kristina Dahnert **Date:** 1-13-13

IDDO PERSONNEL ONSITE: Patrick Cassidy
Kristina Dahnert
Dave Ferris
Chris Gibson
Jason Goetz
Josh Goetz
Mike Jayred
Jay Johnson
Nicolai Mortensen
Elizabeth Morton
Tanner Kuhl (arrived at WSD)
Linda Morris (IDPO – arrived in MCM)

ACTIVITIES DURING PERIOD

- Completed the second deviation on Sunday, 1/6/13 at a depth of 2469.488m.
- Installed bulkheads on Instrument Section J. This section is again ready for use.
- Installed a new encoder on the level wind motor.
- Repaired a grounding issue in Instrument Section L. Began cleaning the tube and bulkheads for this section.
- Chris Gibson departed WAIS Divide on Monday, 1/7/13, a few days later than originally scheduled. Tanner Kuhl arrived on the flight that Chris left on.
- Continued broaching operations on the third deviation. Broaching was continued until the inclination delta was over 0.7° as measured before the arms were actuated and again after actuation.
- The ratchet ring, trigger arm and trigger were left on the drill for mill/broaching operations. The head on the set screws for the ratchet ring and screws mounting the trigger arm were packed with ice indicating that these parts were rubbing on the bore wall. The parts were removed for the final milling runs. One ratchet pall, pin and two springs were also missing. They are assumed to be in the parent borehole and should be collected during cleaning runs at the end of the season.
- Started and completed mill/broach hybrid operations on the third deviation on Tuesday, 1/8/13. As with previous deviations, multiple passes are made with the milling head and the broaching shoes and a subsequent run is made with the milling cutter and axial shoes to prepare a pad for the coring drill.
- Fabricated new springs for the ratchet ring and added retaining screws to prevent the pins holding the ratchet palls from coming out.

- Replaced the shear pins on lower actuator arms G1 and G3.
- Performed maintenance on the pump that is set up for use with the drop ring. The grease pocket at the end of the shaft contained a small amount of drill fluid. The seal was replaced and the area on the shaft where the seal runs was polished.
- The first core of the third deviation was drilled on Tuesday, 1/8/13. The core was 0.7 meters long and displayed broaching cut marks on the inside of the crescent. The core was drilled with a 1-meter core barrel and 3 screen configuration.
- The second core displayed only a small amount of broaching marks for the first few centimeters and then increased to full diameter. The first few cores of the deviation were less than one meter long, as we were still collecting broaching and milling chips and thus packing the screens before a full meter was drilled.
- The coring drill was reconfigured to add a fourth screen. The screens again filled before a full meter of core was obtained.
- The coring drill was reconfigured for a 2-meter core barrel and five screens. A sixth screen was subsequently added to allow for collection of a full 2-meter. Approximately 2/3-3/4 of one screen continued to fill with broaching chips each run.
- Added sintered bronze breathers to the magnetic coupler cavity of motor sections X and Y. An issue has been experienced this season with ice/frost building up on the end of the magnetic coupler which then binds the pump, not allowing it to spin. Previously, black electrical tape had been used to cover the cavity, and the bronze breathers are now a more permanent solution.
- On Wednesday, 1/9/13, the coring drill experienced an inability to re-enter the deviation hole using a 2-meter barrel and 6 screen configuration. After all usual tricks were tested, a new method was tried. With the cutter set at 80 rpm and a feed rate of 0.01 m/s. the drill was lowered, stopping when the inclination became erratic or dipped below 4.5°. Descent continued between 2221 meters and 2223 meters with the idea being to enlarge the lead-in to the deviation. When the drill was returned to the surface, it was found to contain a 1.7m core that had a small, short crescent from the parent hole and a crescent from the deviation bore running full length. The taper was 9.8mm per 1.22m, or 0.457°. The new method used to re-enter the original deviation, in effect, created a second deviation in between the original deviation and the parent borehole. The original deviation is referred to as 3A and the secondary deviation (between 3A and the parent borehole) is referred to as 3B.
- Coring continued on deviation 3B, but was temporarily halted when a small crescent from the parent borehole appeared on the core. This signified that we had never fully diverged from the parent bore or had begun to reenter it.
- Broaching operations were resumed in an attempt to remove the figure eight between the parent bore and 3B and then land the 2m coring drill on the 3B ledge, but with more inclination so it would diverge further from the parent bore. After further analysis, this plan was abandoned as the upper actuator arms would not have enough travel to push the top of the drill to the high side of the deviation.

- A plan was formulated to broach from 2227 meters, which is the bottom depth of 3A, up to 2219 meters. The idea was to keep the upper arms above 2220m, so they would stay in the deviation notch. During execution of this attempt, shear pins in all three arms of the upper actuator section were found to have sheared. We believe the pins sheared because the upper arms were in the area that had been milled previously. The wall in this section of the parent hole has over 1° of inclination change from 2217 to 2221m. When the broach is pulled up at 0.04 m/s (0.03 m/s was also tried) the arms cannot react fast enough and become overloaded.
- Broaching resumed between 2221 meters and 2204 meters (the original broaching stroke length for this deviation) in order to remove the shoulder left by the milling operations. This was done in an attempt to aid the 2m coring drill in re-entering 3A, the original deviation at this depth.
- Fabricated 20 new nickel shear pins for the actuator arms
- Rebuilt three shear pin assemblies
- Emptied the chip hopper
- After attempts to reenter 3A with the coring drill were unsuccessful, additional broaching was performed to make the transition ramp into 3A more gradual, however, the drill would hang up on a ledge and not make the turn during each attempt.
- The pin on the trigger assembly used with the drop ring during broaching operations was found to have sheared when the ring did not deploy during one run. It appears as though the drop ring had bound up against the borehole wall during the previous run, causing the pin to snap due to cutter rotation.
- After all attempts to reenter 3A were exhausted, attempts were revived to reenter 3B and steer this deviation further away from the parent hole. This was initially begun using a 1m core barrel and 2 screen coring drill configuration. Initial angle was used and side cutters were mounted on the coring head in order to urge the drill away from the parent hole. While it took some effort to guide the shorter coring drill into 3B, a method was devised to travel down to a very specific depth in the parent hole and actuate over into 3B, above the figure eight between the parent hole and 3B, but just below the figure eight between 3B and 3A, thus preventing entry into 3A as desired. With figure eights now on both sides of 3B, the arms were now coarse aligned to a non-optimal angle, so as to send two arms out on each actuator section. This allowed the arms to straddle the punctured column of the figure eight between the parent and 3B.
- A 0.57 meter core was eventually acquired from 3B, with the crescent of the parent hole having faded out over the length of the core. The diverging angle was measured to be 0.11° (2mm/m). This coincides with the inclination change witnessed while coring. A third screen was subsequently added in order to obtain full 1-meter cores per run.
- Began fabrication of two new pins for the drop ring trigger. New bushings were also made for the trigger housing block.
- Received all motor driver components ordered by IDDO in Madison on 1/2/13.
- Filled fluid tanks with 11 Isopar-K drums and 7 141B drums.
- 2nd and 3rd shifts enjoyed a night off on Saturday, 1/12/13.

SAFETY

- Elizabeth Morton attended the weekly camp safety meeting. This week's meeting focused on back safety and prevention of repetitive stress injuries.

COMMENTS

(Problems, Concerns, Recommendations, Etc.)

- Sridhar Anandkrishnan presented a well-attended science lecture on Thursday, 1/10/13, highlighting the science at WAIS Divide, PIG (Pine Island Glacier) Camp and POLENET sites around western Antarctica.
- NSF has approved a 3-day extension for drilling operations. Drilling operations will now continue until Thursday, 1/31/13, as opposed to Monday, 1/28/13, as was originally scheduled.