Week 2 Drilling and Scientific Report for
IODP[3]-NSF Expedition 501
New England Shelf Hydrogeology, 2025

9th June 00:00 – 15th June 24:00 EDT Eastern Daylight Time (UTC -4)

1. Operations

The 9th of June began with a crew transfer, with 9 expedition team members coming off the LB Robert, and 7 joining, all by Offshore Supply Vessel (OSV). Operations began running casing and drilling Hole M0111C. Casing was run to 33.3 mbsf and a bentonite plug used to seal the hole. The hole was drilled to 45.56 mbsf when coring began using the HPC and 4 cores were recovered. Open-hole drilling continued after the coring and reached 75 mbsf by 24:00 on the 9th of June.

On the 10th of June, the borehole was advanced to 110 mbsf where 2 HPC cores were recovered. The non-coring assembly (NCA) was used to advance to 125 mbsf in anticipation of coring with the Alien coring, but difficulties were encountered removing the NCA from the BHA, and the hole was cleaned for several hours.

Coring resumed using the Alien corer at 05:30 on the 11th of June at a depth of 125 mbsf with two cores recovered. The hole was advanced to 150 mbsf and coring using the Alien corer resumed from 14:00 until midnight.

Three cores were recovered using the Alien corer in the early hours of the 12th of June before the hole was prepared for water pumping. The packer was deployed at 07:15 and pumping commenced, eventually reaching a steady flow of 6 L/min. Groundwater samples were collected and preparations made for noble gas sampling.

Noble gas sampling was carried out from 00:00 to 19:10 on the 13th of June before removal of the packer and pump. Difficulties were encountered removing the packer and this was completed by 23:40 when drilling fluid was circulated to condition the hole ready for coring.

The 14th of June saw coring recommence with 18 cores recovered over a 57 m interval, and the hole at 228.36 mbsf by midnight.

Two cores were recovered before 02:00 on the 15th of June and the packer run in to attempt a further pump test, which was inconclusive. Difficulties were encountered trying to remove the packer and the decision was made to trip out of the hole. Coring tools were cleaned and the BHA run in again, reaching a depth of 204 mbsf by midnight on the 15th of June.

A breakdown of hours can be seen in Figure 1 and recovery log is shown in Figure 2.

2. Hole Summary

Hole	**M0111C**
Latitude	40.8746°N
Longitude	70.2697°W
First Core	001H
Last Core	039R
Cores Recovered	39
Drilled Length (coring)	107.02
Drilled Length (open hole)	124.9
Recovered Length	77.57
Depth in Hole	231.36 (deepest)
Hole Recovery	71% of cored sections

3. Science

During Week 4 the Expedition 501 Science Team used results from Hole M0111B to plan operations for Hole M0111C, which included spot coring for targeted interstitial water, microbiological, permeability, and noble gas sampling and groundwater pumping tests at two aquifer intervals. The team then began analyses on cores, interstitial water, and pumped groundwater from Hole M0111C.

The shore-based sedimentology team completed preliminary lithological interpretations from 45 – 177 mbsf in Hole M0111C based on photographs taken while the cores were in the liners. Through-liner descriptions of cores were of mud-dominated sections ranging from light grey to dark grey to brown and sand-rich intervals ranging from light grey to dark grey. Some mud-rich intervals showed layering interpreted by color changes, and some mud-prone intervals had a sand component. Shell fragments were noted in some mud intervals.

The aqueous geochemistry team measured salinity, ammonium, alkalinity, and pH on samples from interstitial waters collected via squeeze cakes from cores from 47 – 229 mbsf in Hole M0111C. In sandier intervals interstitial water was collected using Rhizon sampling. Interstitial water measurements showed freshening at depth. Salinity, ammonium, and alkalinity values were consistent with measurements on samples from Holes M0111A and M0111B. The team is investigating some differences in pH between holes. Shipboard interstitial water measurements of salinity, alkalinity, pH, and ammonium were conducted on spot samples during the pumping test to monitor change in chemistry as the pumping tests sampled fluids farther from the borehole. Large volume samples were collected for shore-based geochemical and microbiological work, as well as a number of discrete samples for methane, isotope, and noble gas analyses that were collected over the sampling interval of the pump test.

The physical properties team ran all cores from Hole M0111C through the multi-sensor core logger for measurements of P-wave velocity, bulk density, magnetic susceptibility, electrical resistivity, and natural gamma radiation measurements. The team developed strong correlations between MSCL data from Holes M0111A, M0111B, and M0111C. The correlations demonstrated minimal depth offset between holes and consistent log-based physical properties data values.

The hydrogeology team completed an extended pumping test in Hole M0111C which included measurements of water quality and basic water chemistry. The team worked with the geochemistry, microbiology, and noble gas teams to successfully collect multiple samples for shore-based analyses including stable and radiogenic isotope and noble gas measurements. A second pumping test was attempted at another interval, however the test was stopped early to assess downhole conditions. The team assessed the situation and developed a plan for another attempt at pumping from this second aquifer interval.

4. HSE Activity

No health and safety issues to report.

The ship's deck was checked regularly for stranded seabirds. A Leach's Storm Petrel was observed on the upper deck on the 15th of June and released unharmed.

5. Outreach Activity

- 4 blog posts and corresponding stories
- several social media posts on X (3), Bluesky (3), Instagram (3) and Mastodon (3) linking the blogsite plus corresponding stories
- 1 media article following the press release
- 1 Ship to shore-event ("Swiss Drilling Day" - IODP/ICDP Colloqium, Paul Moster Röggla, David Bekaert, Switzerland)
- Drone video on Youtube (https://youtu.be/npBbmyN5_00?si=2tFPlg8fhKhQu_VP)

6. Figures

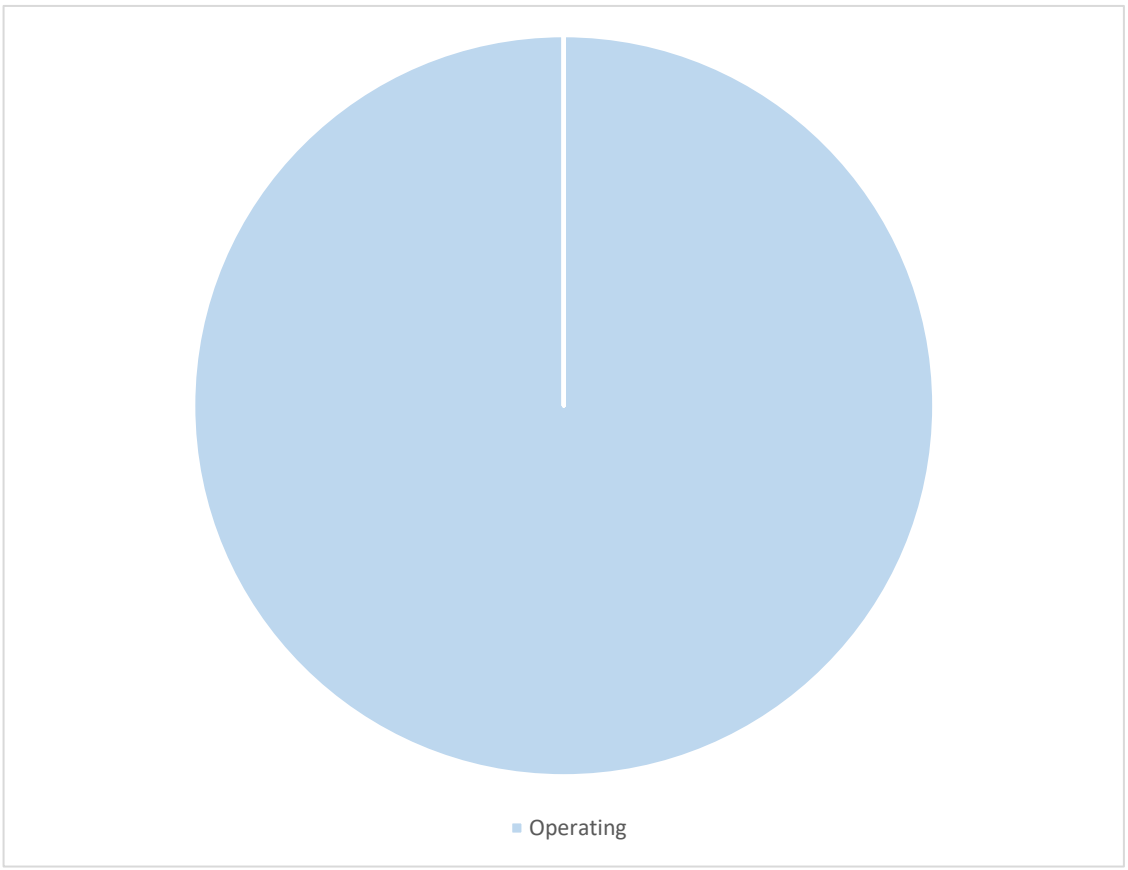

Figure 1 Breakdown of hours for week 4 (9th to 15th June 2025).

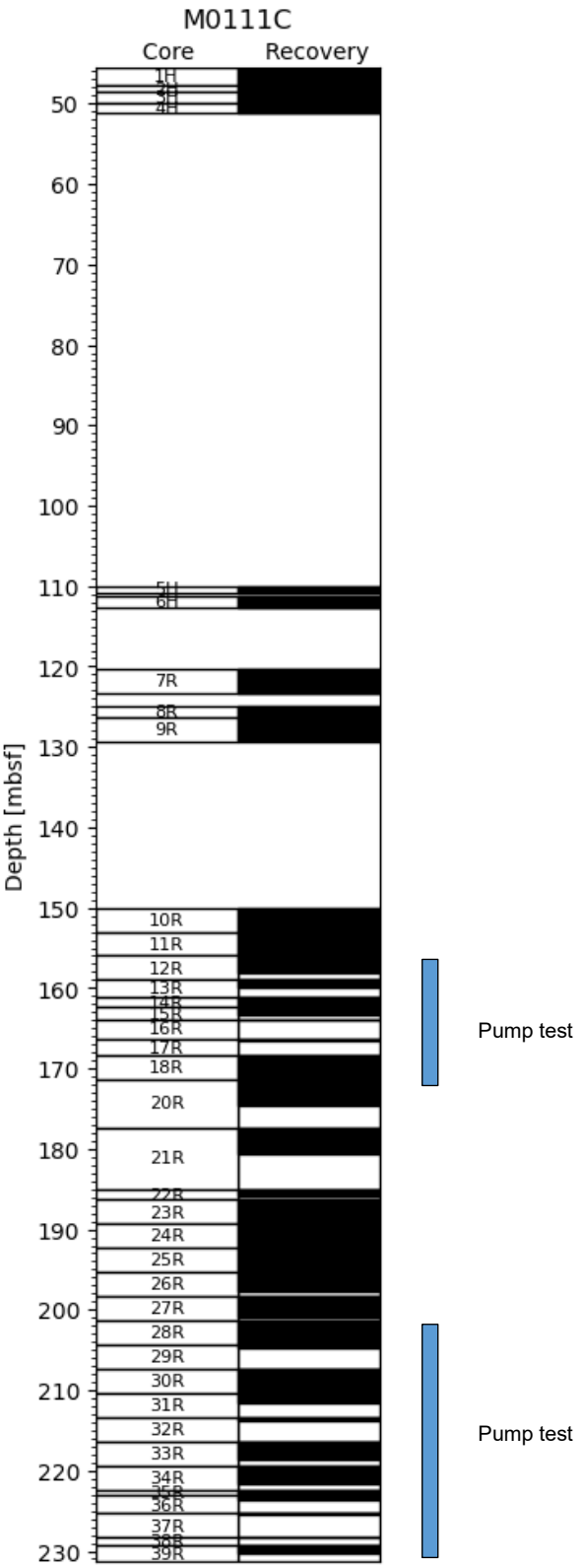

Figure 2 Core recovery for week 4 for Hole M0111C and location of successful pump tests.

7. Photographs

Clockwise from top left:. Setting up for groundwater sampling at the pumptest manifold. X501 expedition team transferring off of the LB Robert by Billy Pugh basket. X501 team watching the pump testing from the accommodation block. Sampling sediments for noble gas analysis.