Week 4 Drilling and Scientific Report for IODP Expedition 357 Atlantis Massif Serpentinization and Life

16th November 2015 – 22nd November 2015

1. Hole summary

Hole	M0076B	M0071B
Latitude	30^0 7.621	30^0 7.716
Longitude	30^0 7.716	42^0 9.187
First core	15/11/2015	18/11/2015
Last core	17/11/2015	19/11/2015
Cores recovered	10	3
Drilled length (Coring)	16.31	4.308
Drilled Length (Open Hole)	0	0
Recovered length	11.71	2.31
Final depth	16.31	4.308
Hole recovery	71.79	53.62

2. Science

The week began with continued RD2 operations at Hole M0076B (proposal site AM-11) on the carbonate cap to the north of the Lost City hydrothermal vent field. During drilling, several excursions were observed in the drill-mounted methane and oxidation-reduction potential sensors, particularly around 10.3 m penetration. After difficult drilling conditions prevented further coring past 16.31 m, two through-pipe runs were made of the optical acoustic gamma ray memory logging tool. The drill pipe was then tripped out of the hole, and no attempt was made to install a borehole packer. Ten cores totalling 11.71m length were recovered, with over 100% recovery in some sections and an overall recovery of 71.8%. The cores consisted primarily of mylonitic porphyroclastastic serpentinite with varying density of serpentine-talc-amphibole veins and degree of drilling induced fracturing. Five whole round core samples were collected for ephemeral microbiology, geochemistry and contamination testing from cores 3R, 5R, 7R, 9R, and 10R, with the rest of the material archived for core logging and OSP sampling.

Next, the RD2 collected core from Hole M0071B (proposal site AM-04). After 4.3m of penetration, drilling was halted due to a mechanical problem with the drill. Due to the shallow condition of the hole, no attempt was made to run memory logging tools in the hole; however, after tripping pipe out of the hole, a shortened borehole packer was installed in the hole. Downhole resistance prevented the stop ring on the borehole packer from insertion below the RD2 breakout table, which caused a slight lifting of the borehole packer when the RD2 was pulled off of the seafloor, but it is anticipated that the packer unit is below the seafloor. Three cores of serpentinite rubble, variably fractured mylonitic porphyroclastic serpentinites and minor gabbro were recovered with a total of 2.31m and 53.6 % recovery. Two whole round core samples from cores 2R and 3R were collected for ephemeral microbiology, geochemistry and contamination testing, with the rest of the material archived for OSP sampling.

Deteriorating weather conditions and rock drill maintenance caused a three-day hiatus in coring operations. During operational downtime and when sea state was amenable to it, 20-50m resolution multibeam mapping continued over the Atlantis Massif, focusing on the intersections with

the southern Atlantis Fracture Zone, the eastern Mid-Atlantic Ridge, and the eastern conjugate. The week ended with calmer seas that allowed a deployment of the MeBo rock drill at Hole M0070C (proposal site AM-07), having penetrated 2.73m by the end of the week. While drilling, correlated excursions in methane, oxidation reduction potential, and temperature were observed on the rock drill mounted sensor package during drilling.

In summary, 14.02 m of core was cumulatively collected in this week from two sites, accompanied by 6 rock drill mounted Niskin water samples.

During the week, shipboard analysis of samples for contamination tracer (i.e. PFC) testing continued to indicate that target concentrations in the drilling flushing water were not being achieved, even though higher pumping speeds were being implemented on the tracer pump system. This low concentration in the drilling fluid affects the ability to detect tracer on the ephemeral samples collected for microbiological analysis. Subsequent investigation revealed some defects in the pump systems that likely affected delivery rates, as bench tests indicated that less than a tenth of the desired flow rate was being delivered. The defects have been addressed and tracer delivery will continue to be monitored on future deployments.

The shipboard science party continues to prepare samples for ephemeral microbiological and geochemical investigation, including establishing enrichment incubations, cell detection and enumeration, and quantifying gas concentrations in the fluid samples. In addition, preliminary descriptions of all cores recovered to date have been completed.

3. HSE Activity

N/A

4. Figures

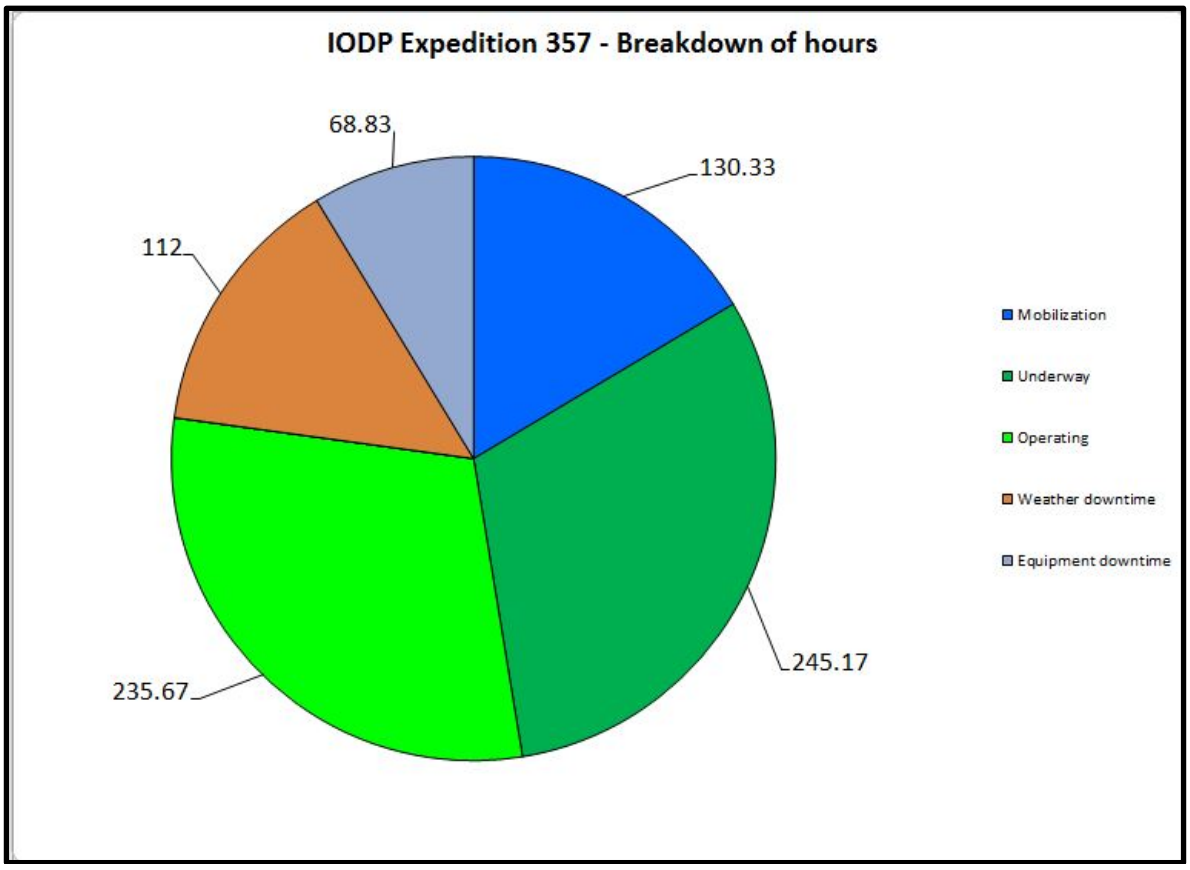

Figure1: Breakdown of hours from the start of mobilisation to midnight on November

22nd.

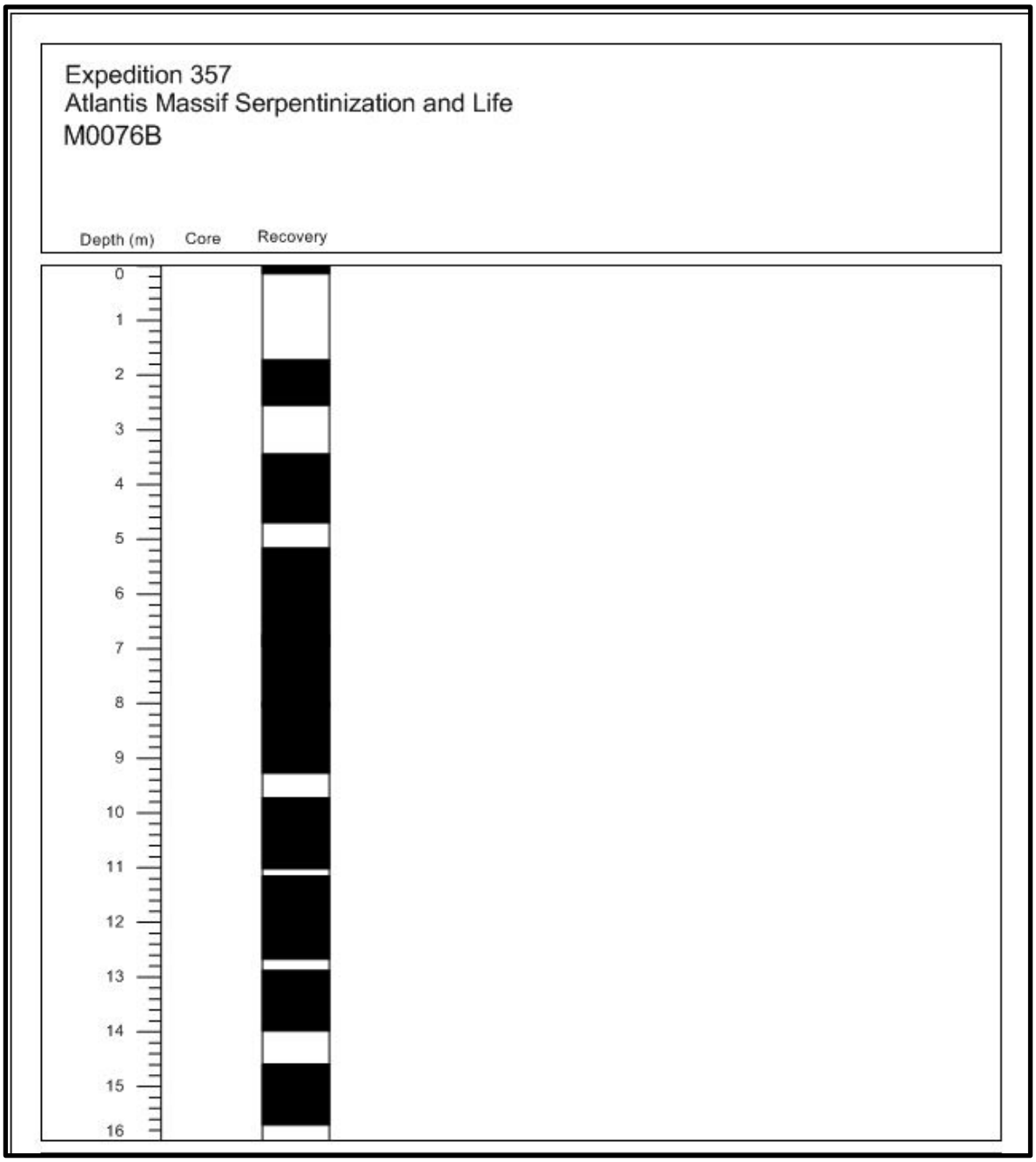

Figure 2: Core runs and recovery (Black shading) for site AM-11A, M0076B.

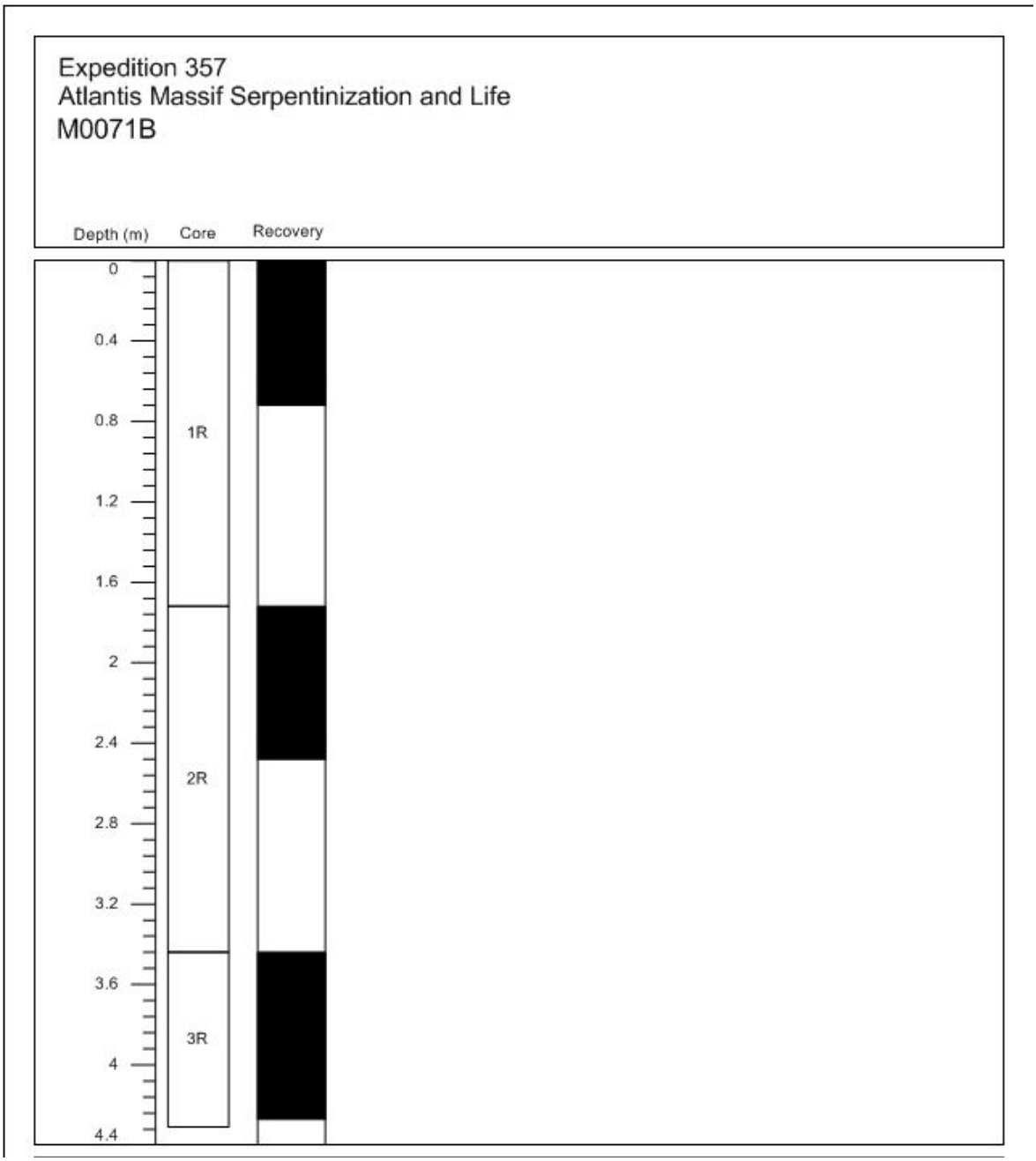

Figure 3: Core runs and recovery (Black shading) for site AM-04A, M0071B.