Week 3 Drilling and Scientific Report for IODP Expedition 357 Atlantis Massif Serpentinization and Life

9th November 2015 – 15th November 2015

1. Hole summary

Hole	M0071A	M0072A	M0072B	M0070B	M0073A	M0076A
Latitude	30^0 7.694	30^0 7.791	30^0 7.794	30^0 8.538	30^0 7.899	30^0 7.623
Longitude	42^0 9.203	42^0 7.323	42^0 7.323	42^0 8.163	42^0 10.969	42^0 7.076
First core	10/11/2015	10/11/2015	12/11/2015	14/11/2015	15/11/2015	15/11/2015
Last core	10/11/2015	10/11/2015	12/11/2015	14/11/2015	15/11/2015	15/11/2015
Cores recovered	2	2	8	1	1	1
Drilled length (Coring)	5.22	2.225	11.603	1.3	2.2	1.72
Drilled Length (Open Hole)	0	0	0.825	0	0	0
Recovered length	2.85	0.87	6.49	0.38	0	0.4
Final depth	5.22	2.225	12.428	1.3	2.2	1.72
Hole recovery	54.6	39.1	52.22	29.23	0	23.26

2. Science

The week began with operations at Site M0071 (proposal site AM-04). MeBo drilling at Hole M0071A penetrated 5.22m and recovered 2.85 m in two cores. As drilling was ended early for technical reasons, no borehole logging or packer installation was performed. During drilling, a strong excursion in the methane signal on the rock drill mounted sensor package corresponded to the observation of gas bubbles in the rock drill video feed. Cored material consisted predominantly of porphyroclastic, moderately foliated serpentinite with prominent mesh texture overlying gabbro. Two whole round core samples were taken for microbiological and geochemical analyses, with the remainder retained for the OSP following full MSCL characterization.

Next, the RD2 drill collected core from two holes at Site M0072 (proposal site AM-01) on the carbonate cap north of the Lost City hydrothermal vent field. 2.33 m of penetration at Hole M0072A yielded 0.87m of serpentinized peridotite underlying unconsolidated pelagic carbonate sediment. Two whole round core samples were taken for microbiological and geochemical analyses, with the remainder retained for the OSP following full MSCL characterization. A second hole was started at Hole M0072B, just a few meters from Hole M0072A. Drilling penetrated 12.43m. Before recovering the cores to the ship, a borehole packer system was successfully deployed in the hole to enable future fluid sampling with submersible or ROV; logging was not attempted prior to packer installation due to technical reasons. 6.50 m of core was recovered, ranging from 24-41% recovery in the upper 5 cores and 71-103% recovery in the lower sections. The cores consisted predominantly of dunite and dunitic troctolite with minor gabbro and rodingite. The cores showed varying density of serpentine-amphibole-talc veins, mylonitic deformaton and degree of drilling induced fracturing. Five whole round core samples were collected for ephemeral microbiology, geochemistry and contamination testing from cores 1R, 3R, 5R, 7R, and 8R, with the rest of the material archived for OSP sampling.

Drilling operations were halted for roughly two days due to weather. In the interim, the science party collected additional background water samples with the ship's CTD Niskin rosette system and conducted additional multibeam surveys around the Atlantis Massif.

Drilling operations resumed at Site M0070 (proposal site AM-07) with an RD2 deployment at Hole M0070B. Drilling penetrated 1.3m and recovered 0.38m of mylonitic serpentinite rubble in one core. One whole round core sample was collected for ephemeral microbiology, geochemistry, and contamination tracer testing. Next, MeBo coring was attempted at Site M0073 (proposal site AM-05) on the far west of the Atlantis Massif, but no core was recovered from Hole M0073A after 2.2 m penetration.

The end of the week saw the deployment of the RD2 rock drill at Site M0076 (proposal site AM-11) on the carbonate cap of Atlantis Massif. Hole M0076A reached 1.72m and yielded 0.4m of unlithified basalt breccia. RD2 drilling resumed at Hole M0076B, and excursions in methane concentrations and oxidation-reduction potential were observed with the rock drill mounted sensor package during drilling.

As with the previous week, prior to deployment of the rock drills at a new site, a cast of the ship's CTD Niskin rosette was performed at each site to collect water samples for comparative microbiology and geochemistry. At the end of active drilling, water samples were also collected from the rock drill mounted sensor package Niskin bottles. In summary, 11.0 m of core was cumulatively collected in this week from six different Holes, accompanied by 12 rock drill mounted Niskin water samples and 42 water column ship's CTD Niskin water samples.

Preliminary analysis of tracer concentrations in fluid, rock, and sediment samples indicate that the custom-designed perfluoromethylcyclohexane tracer delivery system mounted on the rock drills is delivering tracer in the flushing waters used during drilling. Modifications to the tracer delivery system between deployments have resulted in bringing the tracer concentration closer to the target range of 1 mg tracer per liter of flushing water. Preliminary analysis of gas concentrations in bottom water samples collected by the ship's CTD package, as well as the rock drill mounted sample bottles, indicates variable nanomolar concentrations of hydrogen, but methane concentrations are generally below the detection limit.

3. HSE Activity

Waiting on Weather from 08:30 12th November until 16:40 on 14th November.

4. Figures

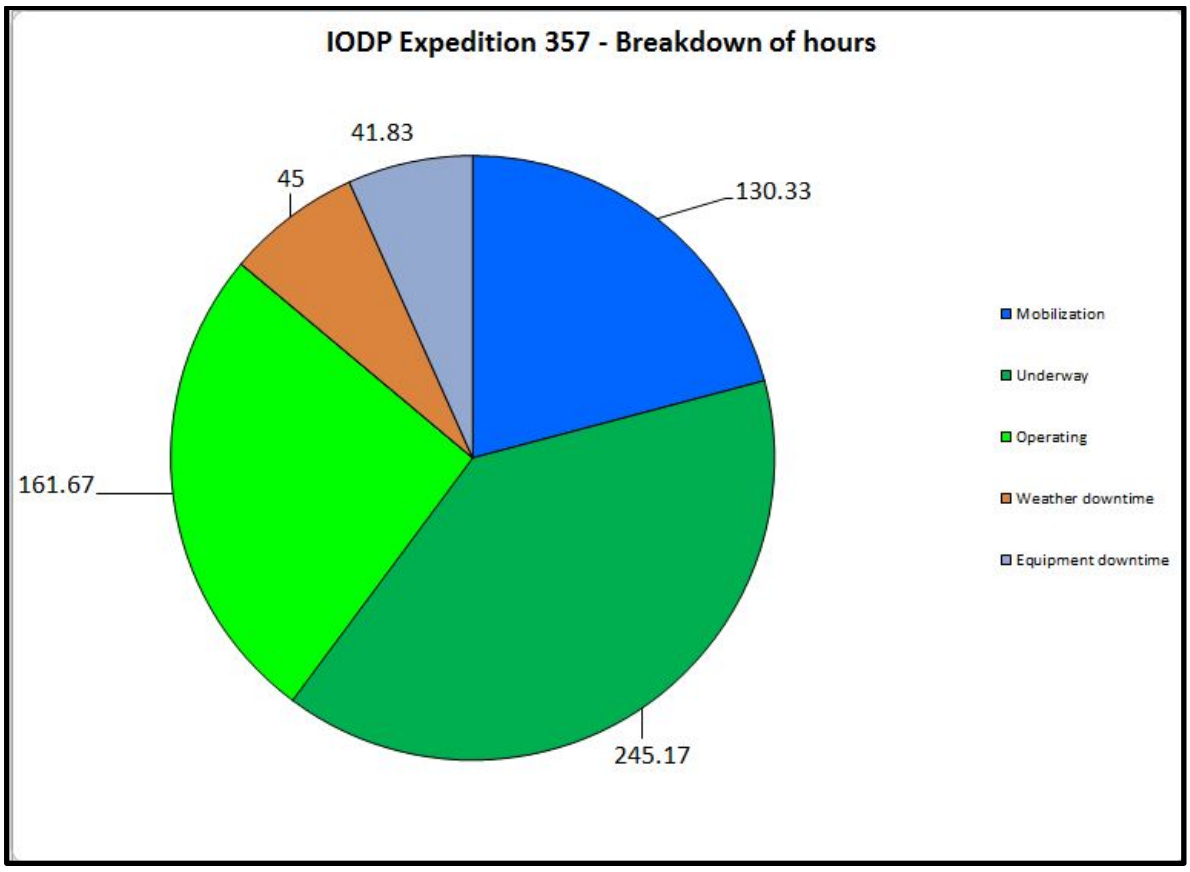

Figure1: Breakdown of hours from the start of mobilisation to midnight on November 15th.

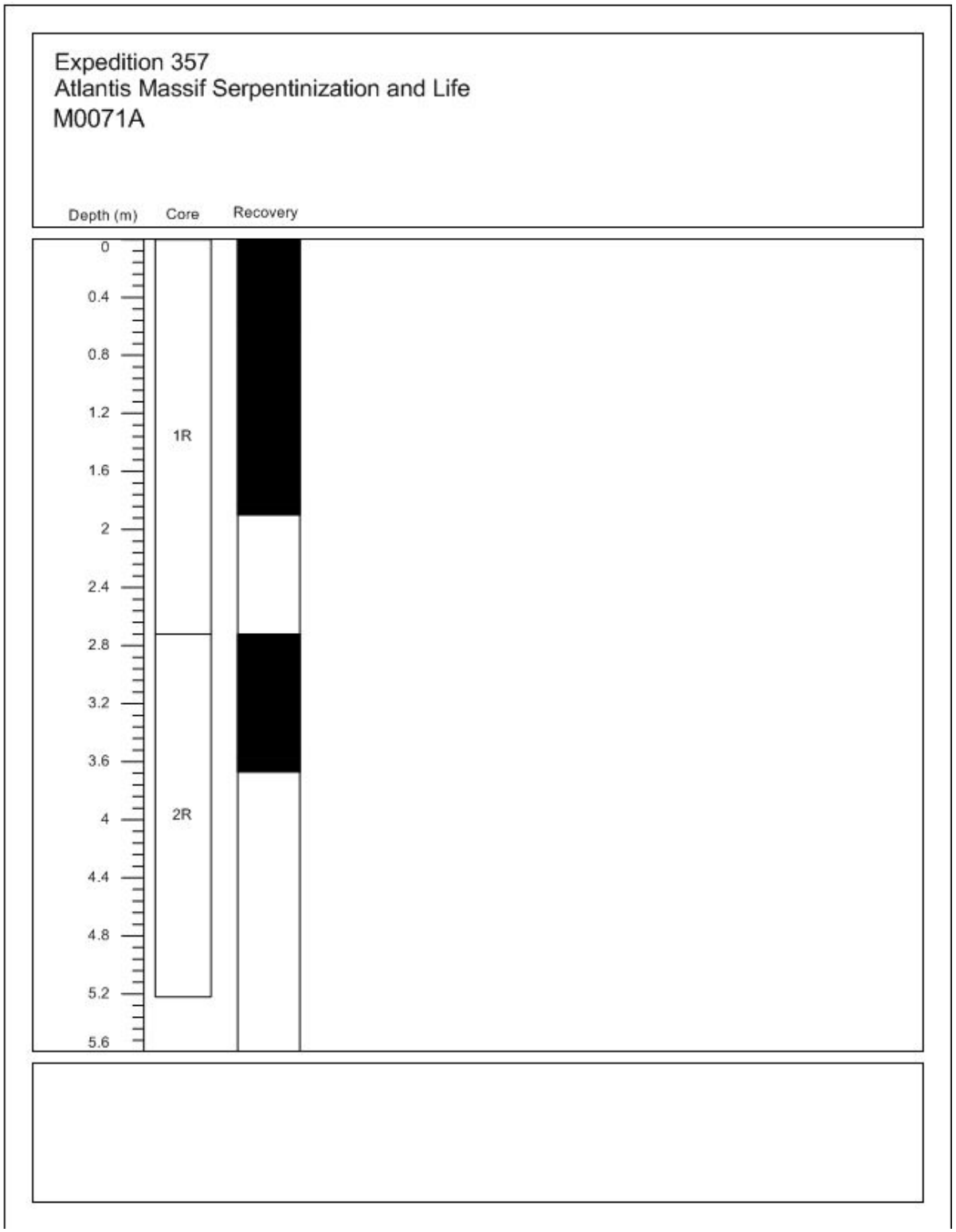

Figure 2: Core runs and recovery (Black shading) for site AM-02A, M0071A.

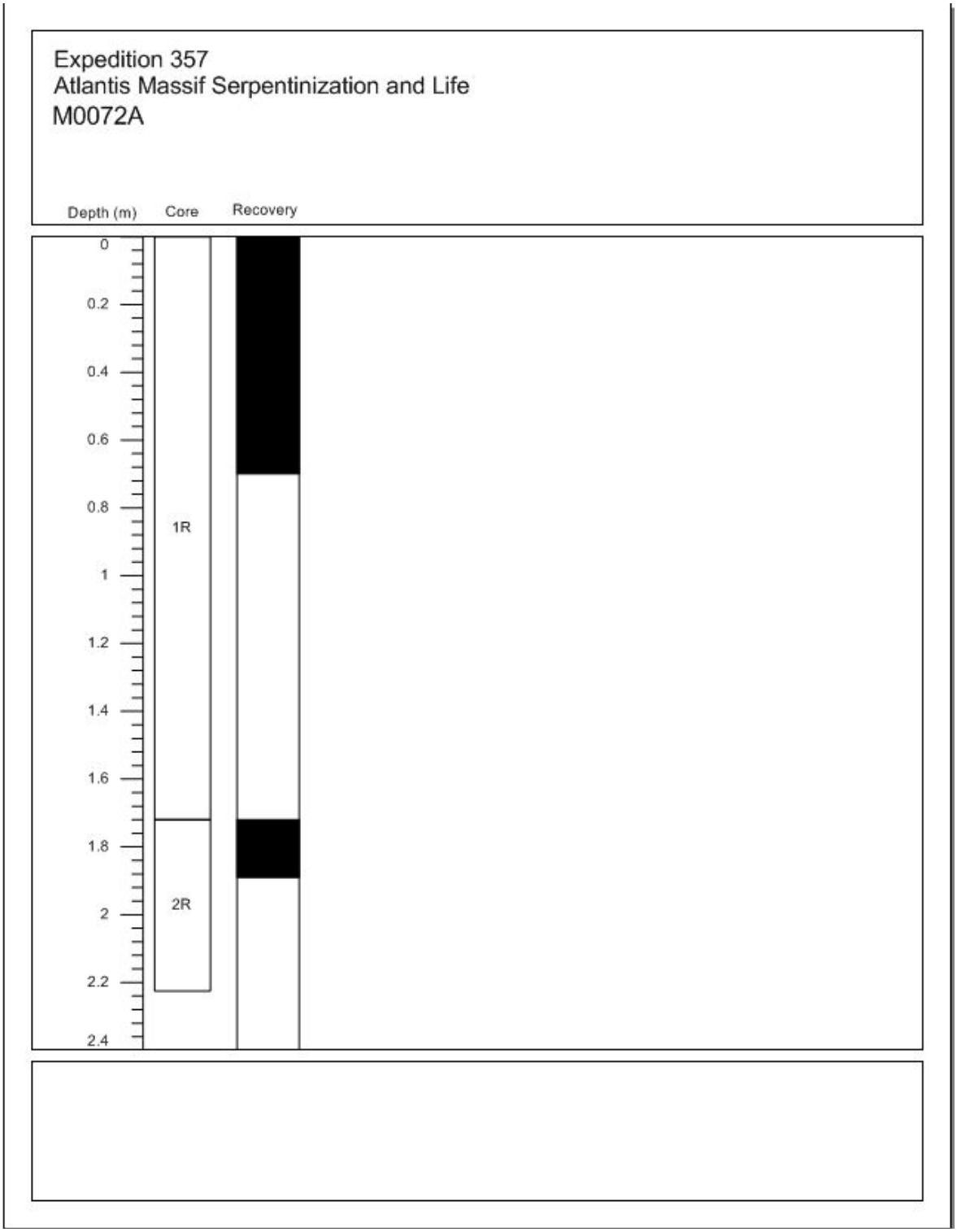

Figure 3: Core runs and recovery (Black shading) for site AM-06A, M0072A.

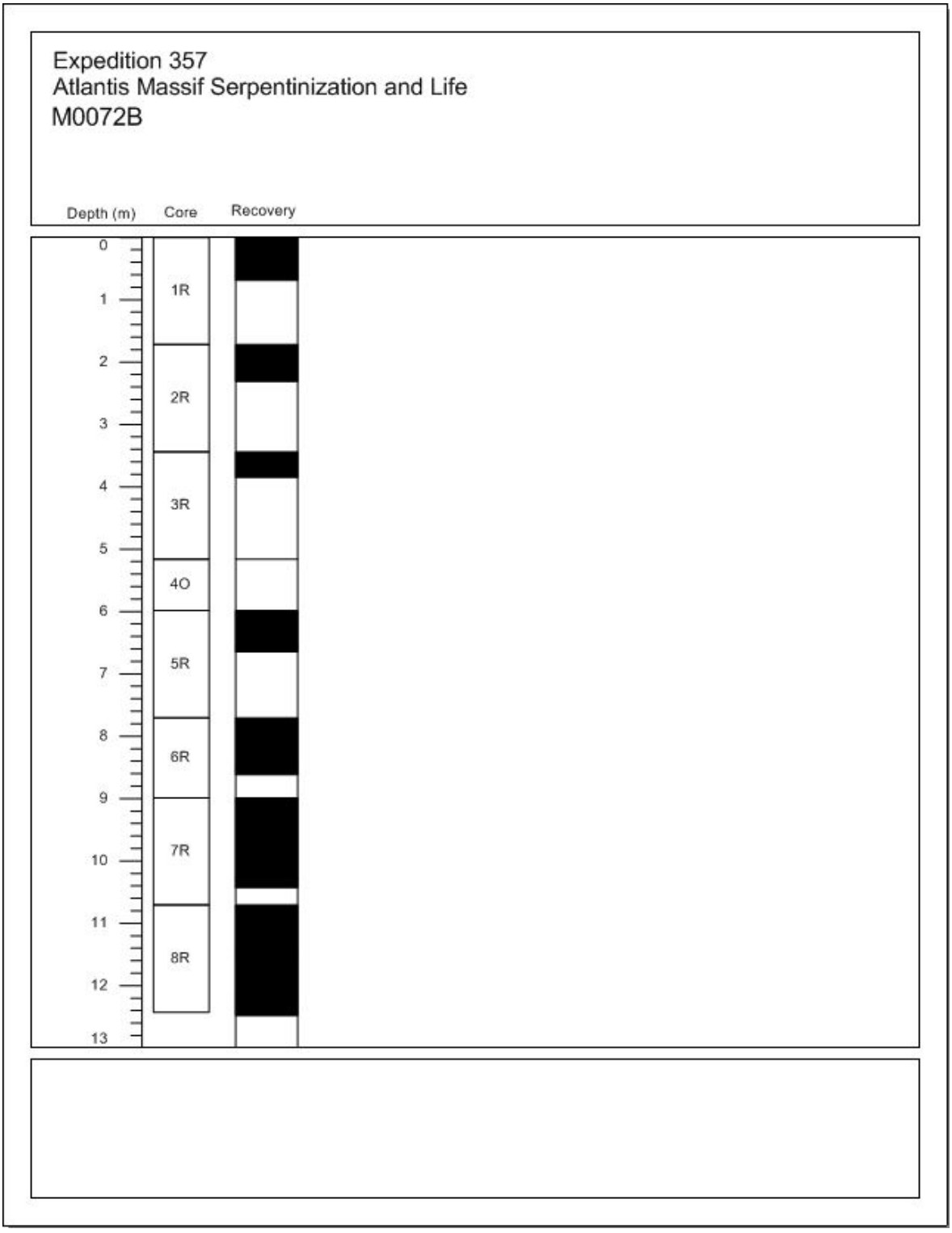

Figure 4: Core runs and recovery (Black shading) for site AM-07A, M0072B.

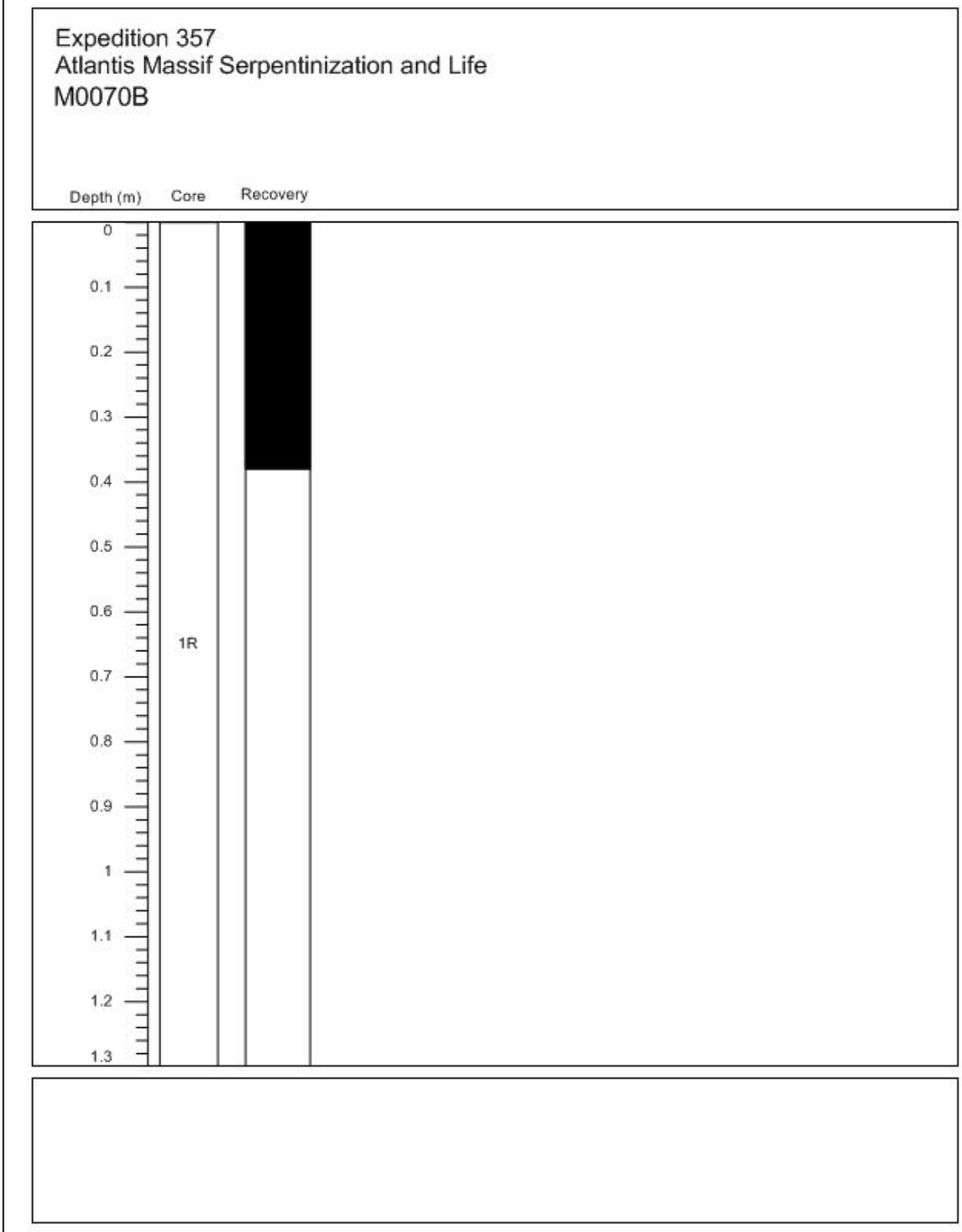

Figure 5: Core runs and recovery (Black shading) for site AM-07A, M0070B.

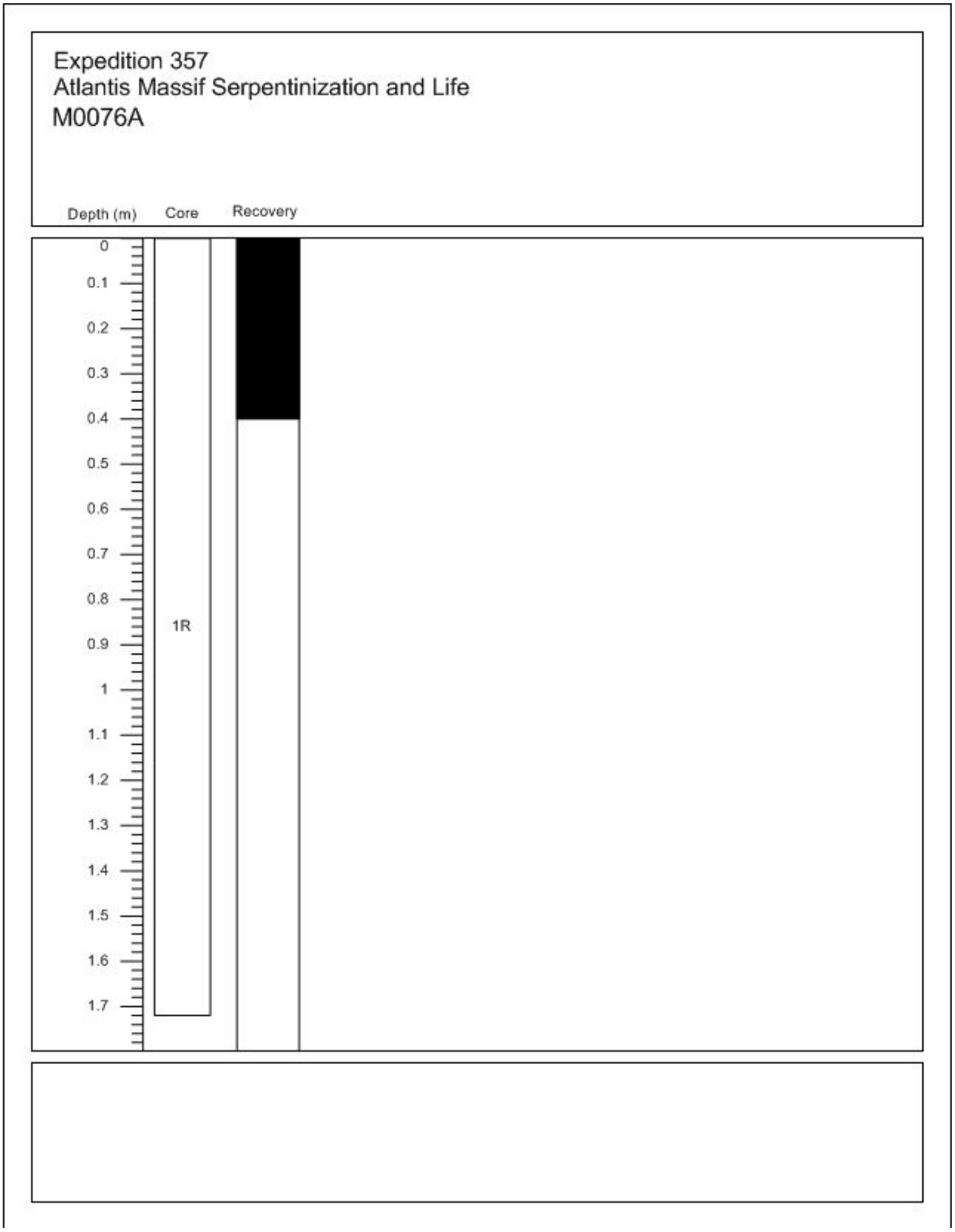

Figure 6: Core runs and recovery (Black shading) for site AM-07A, M0076A.