Weekly Coring and Scientific Report for IODP Expedition 389
Hawaiian Drowned Reefs 2023

8th September 00:00 – 14th September 24:00
All times in HST Hawaii Standard Time (UTC -10)

1. Operations

Three boreholes were cored or started during this week; M97A, M97B and M98A.

Hole M97B was the planned increased depth borehole on the location KAW-04B. M97A was cored using diamond rotary barrels from 0.00 mbsf and 35.05 mbsf between 00:00 on 8th September and 17:20 on the 9th September. Casing was set to 2.0 mbsf, and coring advanced slowly due to very hard-to-drill layers alternating with intervals that were easier to drill. At approximately 17:20 on 9th September, having achieved 35.05 mbsf, the coring string became tight in the hole, prompting the need to recover the seafloor corer. Twenty-five core barrels were removed from the seafloor corer and were processed by the curation team over a 16-hour period and stored in the MSCL container for scanning.

The seafloor corer was re-deployed at a location 5 m from M97A at 15:54 on 10th Sept and borehole M97B was advanced by wash boring to 0.50 m above the terminal depth of M97A. Casing was set at 15.75 mbsf, but had to be retrieved because of lack of advancement. After changing out the bit, casing was then set to a depth of 18.50 mbsf and rotary coring commenced at 20:03 on 11th September. Because an issue with the hydraulic oil system was identified, the seabed coring system stopped coring at a depth of 59.35 mbsf at 17:30 on 12th September.

The vessel transited to location MAH-01A, the seafloor corer was deployed at Site M98A following routine predive checks on deck, and coring commenced at 07:20 on 13th September. Core from the previous borehole (M97B) was processed and stored in the MSCL container for scanning.

Borehole M98A was advanced by rotary coring from 0.0 to 10.23 mbsf and casing set to 7.46 mbsf by 03:03 on 14th September. Due to difficult-to-drill unconsolidated gravel substrate the borehole was advanced using a wash bore from 12.53 mbsf. The bore washed to 13.00 mbsf. By midnight on 14th September coring to a depth of 18.14 mbsf had been achieved.

2. Hole summary

Hole	M97A	M97B	M98A
Latitude	19°56.528 N	19°56.526 N	20°03.3018 N
Longitude	156°03.7711 W	156°03.7726 W	156°11.384 W
Cores recovered	25	12	N/A
Drilled length (Coring)	35.05 m	24.98 m	17.67 m
Drilled Length (Open Hole)	N/A	34.37 m	0.47 m
Recovered length	26.42 m	23.17 m	N/A
Depth in hole	35.05 m	59.35 m	18.14 m
Hole recovery %	75 %	93 %	N/A

3. Science

M97A and M97B form a composite hole down to ~ 60 m below the top of the H2 (KAW-04B) at 414 m water depth that is interpreted to have developed from MIS7 before drowning at the MIS 6/5 deglaciation.

The recovered cores sections are characterized by truly spectacular reef frameworks, with high core quality and very high recoveries, particularly between 35 to 60 mbsf (>90 %). The lithologies are diverse with mixtures of metre-scale sequences of algal boundstones, coralgal boundstones, coralgal-microbialite boundstones, microbialite boundstones etc. Locally there are thick, multi-cm scale crusts of coralline algae with visible vermetid gastropods, and deci-cm scale thick accumulations of

microbialites filling the majority of the primary reef frameworks. Significant variations in coral growth forms and genera are also observed up core.

Preliminary paleoenvironmental interpretations would tend to suggest shallow, high energy reef sequences. Numerous sub-massive Porites and large columnar Porites colonies were also recovered that – if well preserved as macroscale observations suggest – could be amenable to multi-year paleoclimate reconstructions.

No interstitial pore water samples have been extracted from the cores as no unconsolidated matrices have been recovered to date.

Cores from M96D, M97A and M97B were run through the multi-sensor core logger (MSCL), which measures natural gamma ray, magnetic susceptibility, resistivity, density and P-wave velocity. The nature of core recovered from the latter two holes was very favourable for MSCL measurements allowing for 95% of the data to pass QA/QC (less than 20% of the M96D data was retained due to the fragmented nature of the core). High-resolution scans (sampling rate of 0.5 cm as opposed to the standard 2 cm) were performed on selected sections. The results showed that the standard sampling rate is adequate for the carbonate/coral core samples. As the cores were also drained, a contact gap between transducers in the core prohibited transmission of P-waves.

4. HSE Activity

Daily toolbox talks take place with the contractor at 11:30 for the outgoing night shift and at 23:30 for the outgoing day shift.

On Sunday 10th September, weekly safety meetings were attended at 11:00 for the day shift and 13:00 for the night shift. HSE matters over the past week were reviewed and the onboard medic gave guidance and an instructional video on how to use the onboard Zoll defibrillators.

The weekly deck walk was undertaken at 09:30 on 8th September by the ESO Operations Manager and vessel and contractor staff.

ESO has initiated a card system (ESO Work Observation Card) to allow participants to report H&S concerns, as well as positive actions by colleagues and the wider ship community. These cards augment the system managed by the vessel and contractor. Comments are shared anonymously at daily meetings and actions taken to resolve any concerns raised. The system has been well received by ESO staff and the science party. For the week between 8th Sept and 14th Sept 10 cards were collected.

5. Outreach Activity

On 14th September, Co-Chief Jody Webster participated in a ship-to-shore connection with the ECORD Summer School taking place at the Center for Marine Environmental Sciences (MARUM) at the University of Bremen (Germany). A video introducing Expedition 389 and a deck tour was produced by the Exp. 389 Onboard Outreach Officer Marley Parker and shown to the ECORD Summer School participants. Following the video, Jody Webster took part in a live Q&A. Thomas Felis, an onshore science party member from the MARUM was also present in person at the event.

Two blog posts have been published on the expedition blog site between the 8th and 14th of September. In Week 2, there were 943 views of the blog and it is being followed in 13 countries. A package of highlight photos for the offshore phase so far have been produced by Marley Parker, these have been uploaded to the Expedition 389 website. Posts have been uploaded to the social media platforms X, Facebook and Instagram over the past week. Daily reports from 8th September to 14th September have been released to the ECORD JISCMAIL distribution list and posted on the ECORD Expedition 389 webpage.

Onboard the MMA *Valour*, Jody Webster (Co-Chief Scientist) gave two summary presentations to off shift vessel crew on September 12th and 13th about the expedition science background and objectives.

6. Figures

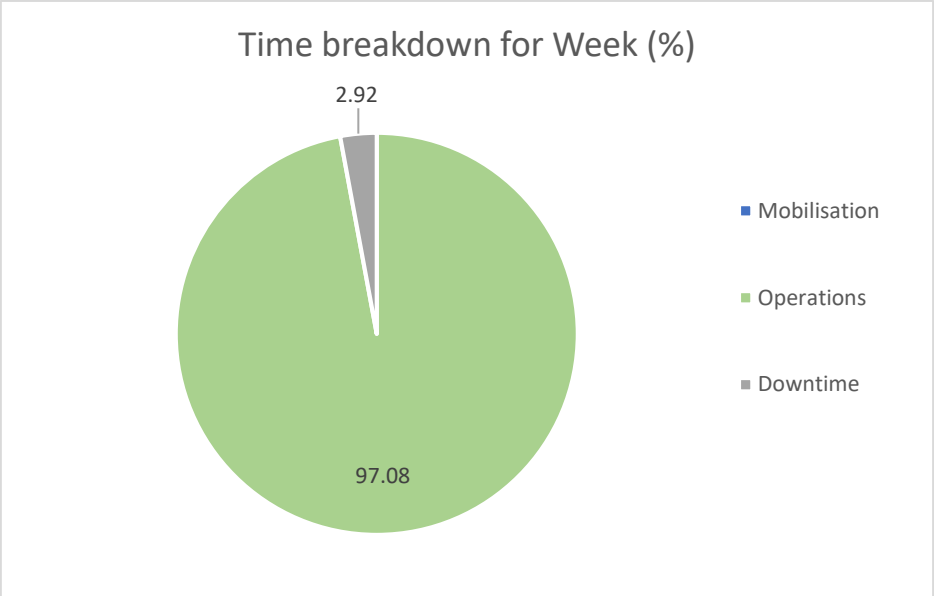

Figure 1: Breakdown of hours during Week 2 from 00:00 on 8th September to 14th September 2023 at 24:00.

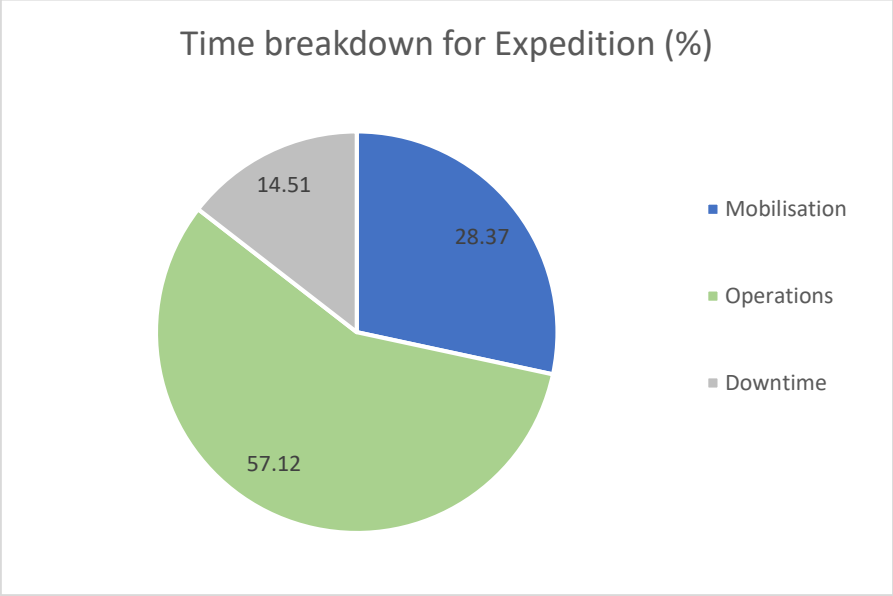

Figure 2: Breakdown of cumulative Expedition hours from 31st August 2023 at 17:50 to 14th September 2023 at 24:00.

7. Photographs

Clockwise from top left: Identifying the ideal sample for dating. Photo by ELB@ECORD_IODP. Excitement of spectacular core on deck. Photo by MarleyParker@ECORD_IODP. Big skies at sunset. Photo by HannahGrant@ECORD_IODP. Co-Chief Scientist Christina Ravelo examining samples in the ESO Science Container. Photo by MarleyParker@ECORD_IODP.