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

13th October 00:00 – 19th October 24:00
All times in HST Hawaii Standard Time (UTC -10)

1. Operations

There were fewer hours assigned to operations this week, although this is in part due to a short period of non-technical off-hire time and two long transits which have seen us circumnavigate the Big Island of Hawaii, finding ourselves back in the Site M99 area at the end of the week.

On Monday, we completed coring of M103A using all the barrels in the magazine with a number of full penetration runs, allowing us to terminate at 45.16 mbsf, which at the time was the longest single shot hole (with no washboring) to-date. Unfortunately, the lithology did not core well and we were only able to recover 31.4% of the cored material.

Recovery of M104A, cored over the 14th to 16th October, was much better at 92.67% to 46.39 mbsf (a new longest hole for the expedition). October 17th bought a short time off hire for non-technical reasons and a long transit to a new work area. Nevertheless, we did complete one borehole (M105A) and spud in to another (M106A).

Two boreholes were attempted at Site M106 in the Ka Lea (South Point) area (KAI-01A), neither had good recovery although what was recovered is valuable. Another transit to the north west of the Big Island allowed us to spud in borehole M99G and commence our plan to wash down to 31 mbsf (as we have previously cored near here). At midnight on the 19th, 16.14 mbsf had been achieved.

2. Completed hole summary

Hole	**103A**	**104A**	**105A**	**106A**	**106B**
Latitude	19.87701	19.87031	19.86749	18.85667	18.856771
Longitude	-154.939609	-154.953999	-154.972719	-155.688330	-155.688264
Cores recovered	33	22	14	4	10
Drilled length (Coring)	45.61	46.39	26.08	7.43	9.26
Drilled Length (Open Hole)	N/A	N/A	N/A	N/A	6.88
Recovered length	14.31	42.99	7.63	1.47	2.98
Depth in hole	45.61	46.39	26.08	7.43	16.14
Hole recovery %	31	93	29	20	32

3. Science

At HIL-05A, H2D, 402 m we drilled a 45.61 meter hole (M103A) recovering 14.61 m of core. The recovered lithologies down to ~40 mbsf were composed of disturbed algal boundstones, coralline algal nodules (rhodoliths) forming rudstone/floatstone textures and unconsolidated carbonate sediments, with some thin laminar and branching corals, transitioning to a 1-2 m thick sequence of coralgal and algal boundstones with massive *Porites*. From 40 to 45 mbsf, the sequence was characterized by volcanoclastic deposits and then highly disturbed basalt clasts indicating we were at or near the basement contact. The hole was terminated as all core barrels were used.

We moved 1.6 nm to HIL-04A to begin Hole M104A in 354 m water depth on the H2C reef terrace. Coring operations commenced rapidly and we penetrated to 46.39 mbsf. We recovered a spectacular sequence and over 93 % recovery was achieved. The sequence was composed of coralgal-microbialite, algal boundstones and coralgal boundstones, with locally well-developed CCA crusts and varying amounts of dark volcanoclastic sediments filling the internal cavities. Preliminary observations indicate the possibility of at least 3-4 different reef "units" comprised of different amounts and types of microbialites (absent in some units), corals, corallines algal crusts, and internal sediments – both lithified and unlithified. There appear to be some interesting transitions between the units that correspond to significant changes in the magnetic susceptibility MSCL data. Overall, a very successful and exciting

hole, but we made the decision to prematurely abandon the hole and move to HIL-03 due to timing constants around the upcoming port call and forecast of poor weather on the 17th October.

At Site M105 (HIL-03A, H2B, 338 m) we penetrated to 26 mbsf in Hole M105A, however there was very poor recovery in the top 18 m. Recovered lithologies indicate coralline algal nodules (rhodoliths) forming rudstones/floatstones and algal boundstones, with a 1-2 m thick sequence of coralgal boundstones composed of massive *Porites* in 6R and 7R. Below this in 9R we recovered ~8 m of basalt suggesting we may have recovered the H2B basement substrate.

After a brief port call we transited about 12 hours to Site M106 (KAL-01A, H1, 148.6 m). After drilling a 7.5 mbsf hole (M106A), we had to stop due to a mechanical issue with the seabed coring system. We then started a new hole, M106B (147.9 m water depth), washed down to 7 mbsf, and then cored to a depth of 16 mbsf. The lithologic facies of M106A/B is dominated by floatstones rich in gravel to cobble-sized rhodoliths for the upper 13 meters. Recovery was poor, but there are indications that there are intervals of algal and coralgal boundstone, particularly below 13 meters where several pieces of massive *Porites* was recovered.

We transited to site M99 (KAW-02C, H1 terrace), and started hole M99G which is in progress.

During week 7, interstitial pore water samples have been extracted from Holes M103A and M105A. Sampling was also attempted from Holes M104A and M106B but due to the consolidation of the material, no porewater could be sampled.

Logging of cores M102C, M103A, M104A, M105A, M106A, and M106B was completed. Natural gamma radiation, magnetic susceptibility, resistivity, and density were acquired with the multi-sensor core logger. As all the cores were drained, the contact gap between transducers in the core prohibited transmission of P-waves. Core recovered from different sites contained varying amounts of debris and other drilling-induced damage. Sections made up completely of loose rubble were not run. The fraction of MSCL data that passed the QA/QC process for each site are listed below.

Site	Cores Recovered #	Recovered m	Cores MSCL Logged #	MSCL Logged m	QA/QC Passed %
M102C	33	42.32	32	42.13	74.7
M103A	33	14.31	21	11.21	29.8
M104A	22	42.77	22	42.77	84.1
M105A	14	7.63	10	7.49	63.0
M106A	4	1.47	2	0.77	31.3
M106B	10	2.98	3	1.78	25.5

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.

The weekly deck walk was undertaken on Saturday 14th October by the ESO Operations Manager and vessel and contractor staff.

On Sunday 15th October, 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 discussed how to stabilise major bone fractures.

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 13th October and 19th October, 3 cards were collected (1 positive comment, 1 hazard and one request for action), all have been closed out. Staff were encouraged to keep completing the forms as they are important to improve our safety on board the vessel and ESO operations in the future. Positive behaviour comments are also welcome.

5. Outreach Activity

During week 7, three new blog posts were uploaded to the expedition blog site located at https://expedition389.wordpress.com/: 'Peering into a lost world' (13th October) and 'Behind the Scenes: Looking after the data' (17th October). In Week 7, there were 691 views of the expedition blog site and it is being followed in 61 countries, an increase of 3 from last week. Posts have also been uploaded to the social media platforms X and Facebook over the past week. Daily reports from 13th October to 19th October have been released to the ECORD JISCMAIL distribution list and posted on the ECORD Expedition 389 webpage.

6. Figures

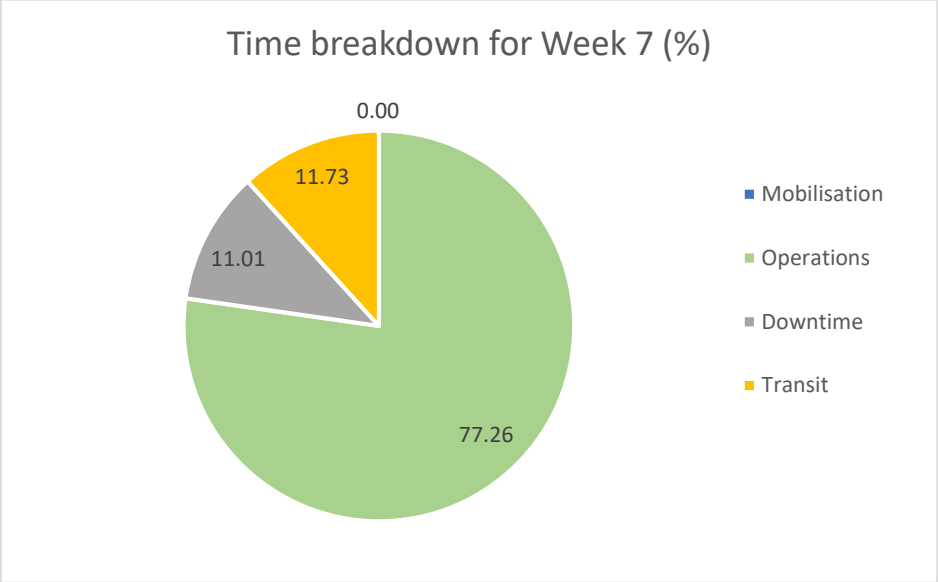

Figure 1: Breakdown of hours during Week 7 from 00:00 on 13th October to 19th October 2023 at 24:00. Much of the downtime recorded this week in the time breakdown was reimbursement for earlier problems.

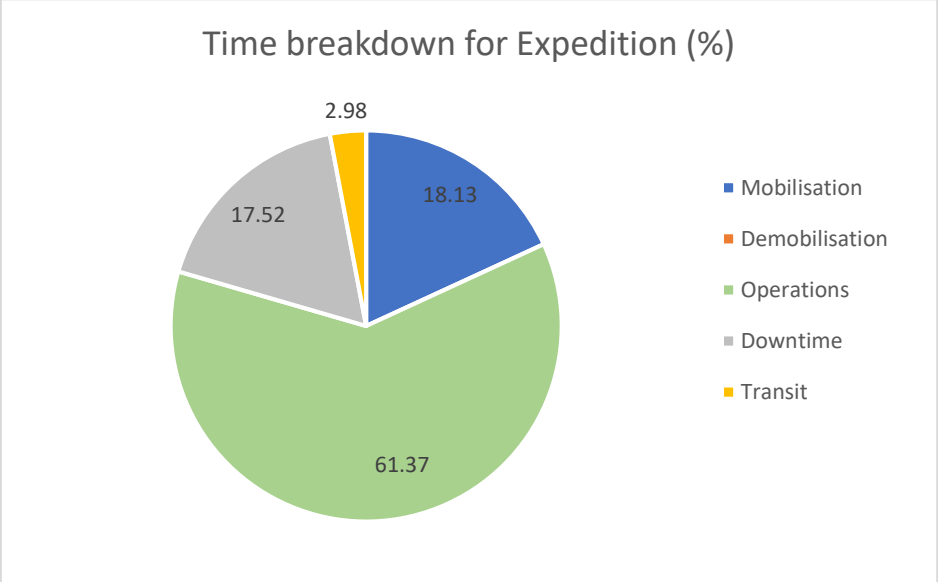

Figure 2: Breakdown of cumulative Expedition hours from 31st August 2023 at 17:50 to 19th October 2023 at 24:00.

7. Photographs

Clockwise from top left. Mauna Kea from the back deck of the MMA Valour. Photo by MarisaRydzy@ECORD_IODP. Deck curation and transfer of core from split aluminum liners to plastic liners. From left to right: Patrizia Gepraegs (ESO Curator), Pankaj Khanna (Sedimentologist) and Marc Humblet (Coral Specialist). Photo by ELB@ECORD_IODP. A panorama of the MMA Valour. Photo by MarcHumblet@ECORD_IODP.