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

15th September 00:00 – 21st September 24:00
All times in HST Hawaii Standard Time (UTC -10)

1. Operations

Five boreholes were cored or started during this week at 4 locations: M96E, M96F, M97C, M99A and M99B. An unfortunate number of unrelated faults resulted in 4 of the boreholes ceasing before we would have preferred, nevertheless the material collected has given us an interesting look at the sub surface.

The decision to transit from M98A (MAH-01Aa) on 15th September was taken due to deteriorating weather. The more inshore sites offered a more sheltered working area.

KAW-04Bc / M97C was cored from the sea bed over a 4 day period starting on 15 September. At approximately 5.4 mbsf a very hard layer was encountered with very little progress made over two hours. It was decided to wash bore through this hard layer until a softer layer was pierced. This was achieved and continuous coring continued to a terminal depth of 35.62 mbsf. Several harder horizons were noted whilst coring but generally the material was more straightforward than at other locations

Boreholes M96E and M96F (KAW-06A) were cored on consecutive days due to M96E being forced to stop because of mechanical problems with the seabed coring systems after bore washing only to 6.9 mbsf. As our practice in this expedition is to start coring 0.5 m above the deepest borehole previously cored at the same location, our target was 7.0 mbsf, M96D having been cored to 7.6 mbsf previously. M96F was washed down to 6.5 mbsf and unfortunately only managed to core an additional 6 m before another problem required the seafloor corer to be brought back to deck.

KAW-02C / M99A was cored on 21 September to a depth of 6.44 mbsf, but was terminated because of a mechanical problem with the seafloor coring system. M99B was spud on 21 September, and was coring well with a programme of coring followed by casing. During the process of extracting the core barrel to case, an over-torqued joint was discovered which could not be loosened on the sea floor. The seafloor corer had to be returned to the deck to allow this procedure to take place. The corer was recovered with a section of core barrel protruding from the base of the corer. This was dealt with in a safe manner following a Toolbox talk where the procedure was defined and followed. All steelwork was recovered and good cores were extracted from the core barrels.

2. Hole summary

Hole	M96E	M96F	M97C	M99A
Latitude	20°02.131 N	20°02.130 N	19°56.330 N	19°50.392 N
Longitude	156°03.5619 W	156°03.5614 W	156°03.4910 W	156°05.2863 W
Cores recovered	0	5	32	6
Drilled length (Coring)	6.7 m	5.52 m	35.62 m	6.44 m
Drilled Length (Open Hole)	6.7 m	6.72 m	0.54 m	N/A
Recovered length	0 m	4.76 m	28.04 m	4.29 m
Depth in hole	6.7 m	12.24 m	36.16 m	6.44 m
Hole recovery %	0 %	86 %	79 %	67 %

3. Science

Hole M97C recovered cores down to ~ 36 m below the top of the H2 reef (KAW-01B) at the seaward edge of the terrace slope. This site forms a transect when combined with M97A and M97B. The recovered cores sections are characterized again by well-developed reef frameworks, with high core quality and very high recoveries between ~ 10 m to 30 mbsf. The lithologies are diverse with mixtures of metre scales sequences of algal boundstones, coralgal boundstones, coralgal-microbialite boundstones, microbialite boundstones etc. In contrast to M97B, algal boundstones were particularly

abundant between 20 to 30 mbsf, perhaps reflecting the sites more exposed setting closer to the reef margin. Unfortunately, all barrels were utilized during drilling and the hole was terminated early.

The decision was made to return to KAW-06A to penetrate deeper into the H4 reef terrace. Here, Hole M96F encountered a similar volcanoclastic-carbonate deposit in the top 5 m before recovering ~ 5 m of basalt flow recording a wide variety of flow textures, possibly indicative of eruption in a subaerial environment. Technical problems with the seafloor corer terminated the hole so we were unable to determine if there is reef below the flow.

The vessel then moved to the H1 reef terrace (KAW-02C) to core the upper sub-terrace at 132 mbsf that records MIS5(?) to mid deglacial reef development. Again, technical difficulties with the seafloor corer meant we abandoned the coring operation twice. However, both 5-6 mbsf sequences that were recovered in M99A and M99B revealed a well-developed and consistent sequence of algal boundstones, coralgal boundstones, coralgal-microbialite boundstones, microbialite boundstones indicative of a deepening upward sequence. Indications are we recovered the “drowned” top of this reef structure.

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

Cores from M97C, M98A, M99A and M99B were run through the multi-sensor core logger (MSCL), which measures natural gamma radiation, magnetic susceptibility, resistivity, density and P-wave velocity. Many of the recovered core sections contained varying amounts of debris and gaps. Nonetheless, data acquired over roughly 65 % of the core passed QA/QC. As all the cores were drained, the 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.

The weekly deck walk was undertaken on Saturday 16th September by the ESO Operations Manager and vessel and contractor staff.

On Sunday 17th 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 on how to assist with emergency situations where the onboard rescue stretcher may be required.

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 15th September and 21st September 3 cards were collected.

5. Outreach Activity

During week 3, three new blog posts were uploaded to the expedition blog site located at https://expedition389.wordpress.com/: ’Physics prevails’ (15th September), ‘A Conversation with Pankaj Khanna’ (16th September), and ‘The magic of the first look’ (19th September). In Week 3, there were 1310 views of the expedition blog site and it is being followed in 43 countries, an increase of 30 countries in the past week. Posts have been uploaded to the social media platforms X, Facebook and Instagram over the past week.

Co-Chief Scientist Jody Webster and Lead Expedition Project Manager Hannah Grant gave a ship-to-shore Operations and Science update to the EFB Meeting in Edinburgh, UK on the evening of September 21st.

Daily reports from 15th September to 21st September have been released to the ECORD JISCMAIL distribution list and posted on the ECORD Expedition 389 webpage.

6. Figures

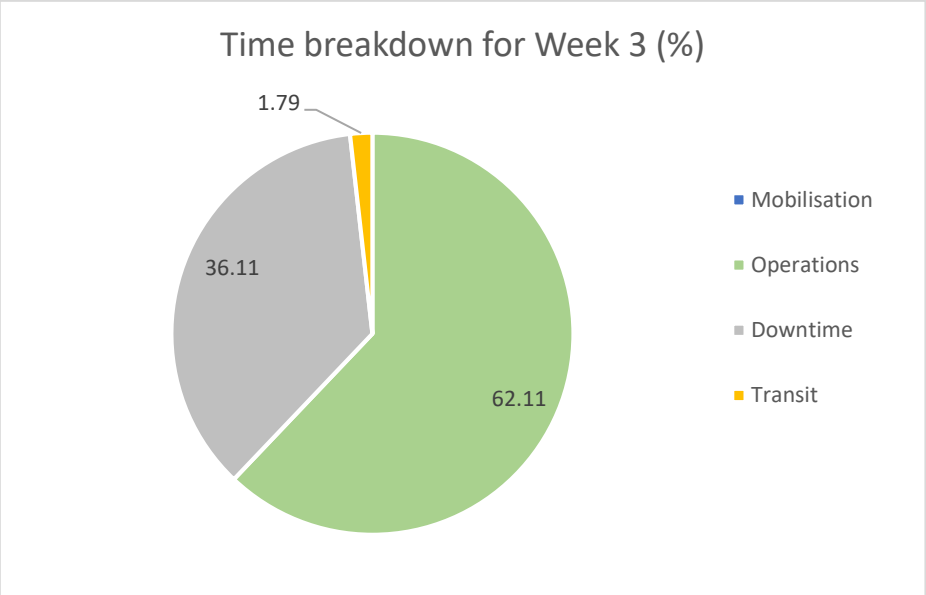

Figure 1: Breakdown of hours during Week 3 from 00:00 on 15th September to 21st September 2023 at 24:00.

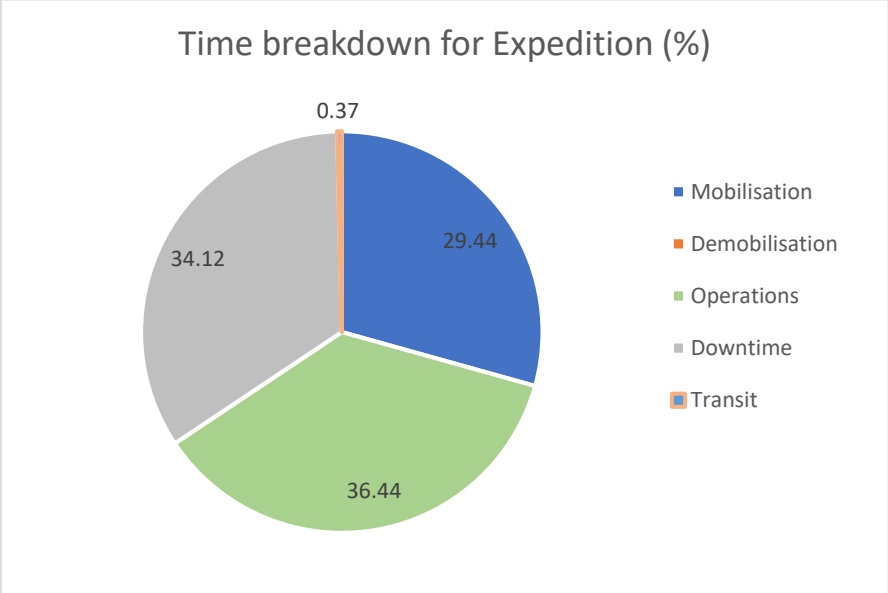

Figure 2: Breakdown of cumulative Expedition hours from 31st August 2023 at 17:50 to 21st September 2023 at 24:00

7. Photographs

Clockwise from top left: ESO Assistant Lab Manager and Curator Patrizia Gepraegs transferring core samples cored in an aluminium liner to a plastic liner during on-deck core curation. Photo by MarleyParker@ECORD_IODP. Core on deck. Photo by MarleyParker@ECORD_IODP. Processing of geochronology and aDNA samples by the geochemistry team. Photo by ELB@ECORD_IODP. Observing a stunning sunrise over Big Island. Photo by ELB@ECORD_IODP.