RV SONNE - SO295 "NoduleMonitoring-2"

31.10. - 23.12.2022, Port Hueneme - Port Hueneme (USA)

4th Weekly Report (21. - 27.11.2022)

On November 21 we completed the first ROV dive in the Plume Impact area (Fig.1). The work went smoothly and efficiently. The main reason for this was the improved navigation with the USBL thanks to the installed secondary antenna, which greatly reduced the time needed to search for specific sampling locations and equipment on the seafloor. In the dive, two experimental chambers ('CUBE' mesocosms) could be positioned above sponges to study the influence of cover with resuspended sediment on energy and material fluxes in the benthic food web with a focus on filter-feeding organism. In addition, several benthic chambers and microprofilers could be deployed to investigate possible effects on seafloor oxygen uptake rates.

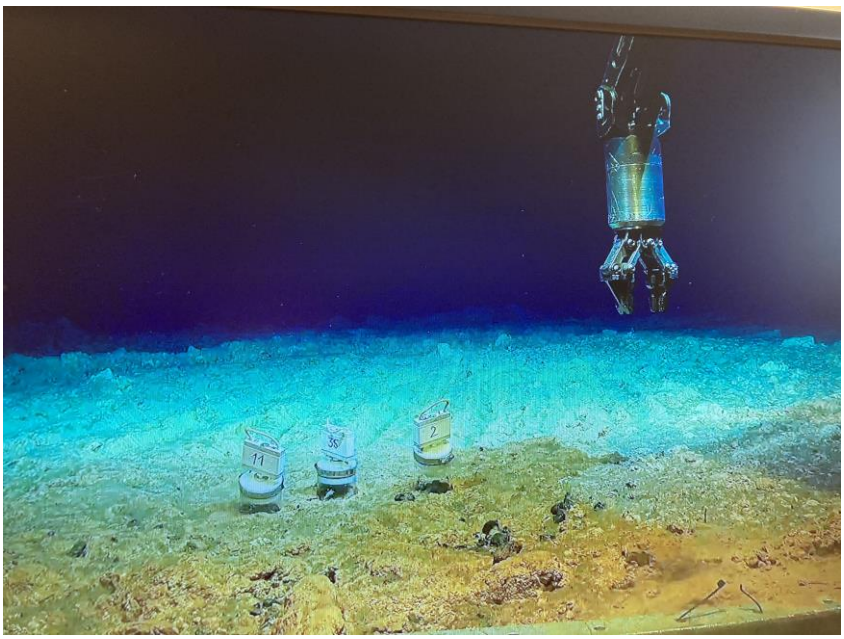

Fig. 1: ROV arm operating push-corers

A lot of energy was put into the localization of the sediment sampling performed so far with the multicorer and the boxcorer - as well as into the planning of future sampling in the remaining days in the BGR area. In this context, we are mainly concerned with two questions. First, how well did we hit the collector tracks during sampling in the collector impact area, and second, at what distances from the collector impact area should sampling take place to study the effect of cover with sediments stirred up by the collector. Acoustic and imaging surveys with the AUV and OFOS are helping with both questions, and the scientists and engineers in charge are hard at work collecting and georeferencing imagery where the traces of MUC and BC sampling can be seen and where the sediment cover of the nodules can be well assessed. In one of the images, we also managed to locate a bottom weight that could belong to the lost BGR mooring - just a few meters next to the deployment position from 2021, thus strengthening the suspicion that the mooring triggered but

drifted on its way up and may have sunk back to the seafloor after implosion of buoyancy bodies at another position.

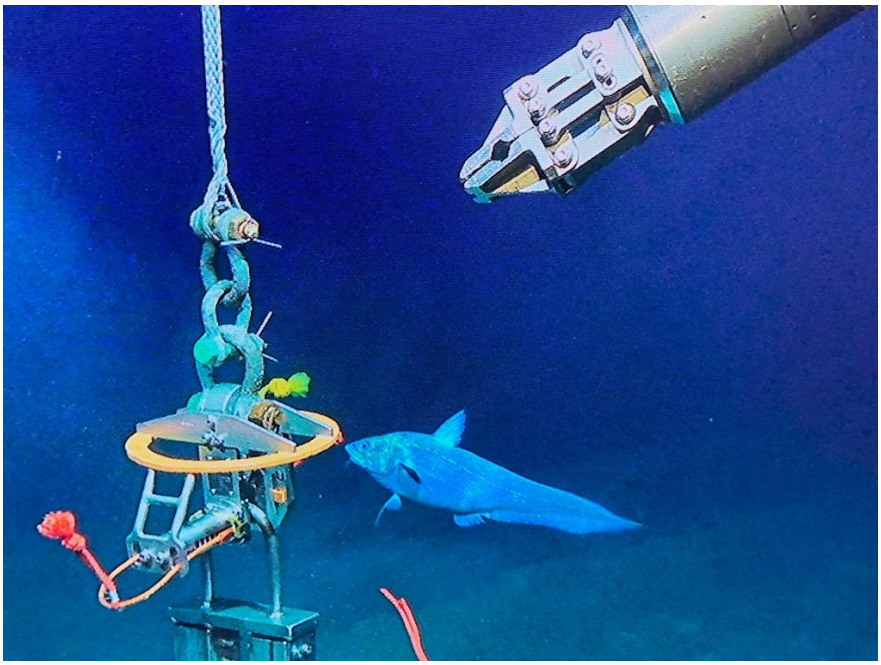

Fig. 2: The ROV triggers the Elevator releaser.

On November 22, we again searched the nodule colonization experiments with the ROV in the reference area (Fig. 2). The colonization frames were found and recovered directly upon arrival at the seafloor. The dive was completed with a larger fauna sampling program. During the night, multicorer and boxcorer (Fig.3) were operated again.

On November 23, we made another ROV dive to sample a 2019 restoration experiment conducted in a small-scale disturbance. Guided by restored underwater navigation, this time the ROV had no difficulty finding the disturbance trace caused by a towed sampling device (the so-called epibenthic sled). Immediately upon reaching the 'EBS track', the marker was found with which the position of the 2019 experiment was marked. 3 years ago, the upper horizon of the deeper and firmer sediment exposed by the EBS was loosened by the ROV using a type of rake to improve conditions for settlement. Many fewer organisms live in the deeper, more compacted layers than in the looser, upper layer. Cores have now been taken here to study the number and diversity of organisms compared to 2019. The experiment aims to investigate whether loosening by the tuber collectors compacted sediments can be suitable as a renaturation measure.

In the penultimate dive in the German license area, on 1November 24, all instruments and experiments were successfully recovered in the Thick Plume Impact Area. In the meantime, the difficult work with the elevator, with which we bring the instruments to the seafloor and recover them again, has almost become routine. The elevator is brought from the ship to the seafloor on the wire while the ROV descends, set down with visual control by the ROV. The hook is then released from the elevator by the ROV and hoisted back on deck. Meanwhile, the ROV is already deploying and launching the equipment on the seafloor. Similar steps are required for recovery in reverse order: Collecting the equipment on the elevator, hooking a hook lowered from the ship with a recovery frame, recovering the elevator by the ship while the ROV is surfacing.

The AUV was recovered after a dive into the reference area on November 24. From the drag marks and contamination on the vehicle, it could be directly read that contact with the seafloor had occurred. Based on the data, it could be understood that the AUV had attempted to 'dive into the seafloor' in response to an incorrect measurement of the distance to the seafloor. We are glad to have the AUV back on board safe and sound. Fortunately, before and after this unplanned trip to the seafloor, usable photo and sonar data have been recorded.

Fig. 3: Documenting the nodule coverage with the boxcorer

During the remaining days in the German license area, extensive sampling work was carried out with box grab and multicorer. The goal was to repeat some sampling that could not previously be done with the required precision in underwater navigation. In addition, the gradient in the thickness of the deposition of sediment suspended during the PATANIA II test was to be better resolved along the then prevailing flow direction at additional sampling locations.

After successful sampling by multicorer and box grab, the AUV prepared a final photographic documentation of the sampling sites.

Fig. 4: Multicorer deployment.

The last two OFOS dives in the German license area took place during the nights of Nov. 24 and Nov. 25, 2022. The OFOS dive on the night of 11/24/2022 looped approximately 4km southeast out from the PATANIA-II test area. The objective of this dive was to replicate the OFOS transect conducted during SO268 (2019). Using the photos from 2019 and from this year, the change in the megafauna community on the seafloor after being affected by the PATANIA-II test can be determined. During the dive, significant differences between the immediate vicinity of the PATANIA-II test area and the area 4 km away could already be observed. Especially sessile megafauna, such as cold water corals and sponges (Fig. 5) were more abundant in the distant area.

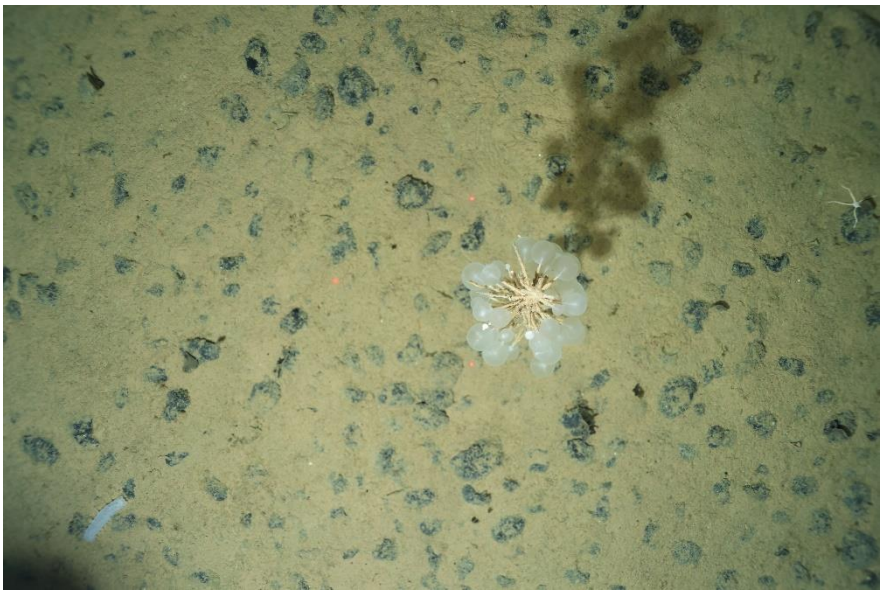

Fig. 5: OFOS image of a sponge southeast of the test area. A sea cucumber and brittle star are in the background.

On the night of November 25 the last OFOS dive in the German license area took place. This dive was conducted in the area that was plowed up while SO239 (2015) and SO268 (2019) were being plowed up using an epi-benthos sled (Fig.6) and a dredge unit. The dive proceeded according to plan and some dredge tracks were crossed. Compared to the area where the dive was previously conducted, there was significantly less sessile megafauna and in smaller size. Megafauna in small numbers, mainly sea cucumbers, could be found directly on the dredge tracks.

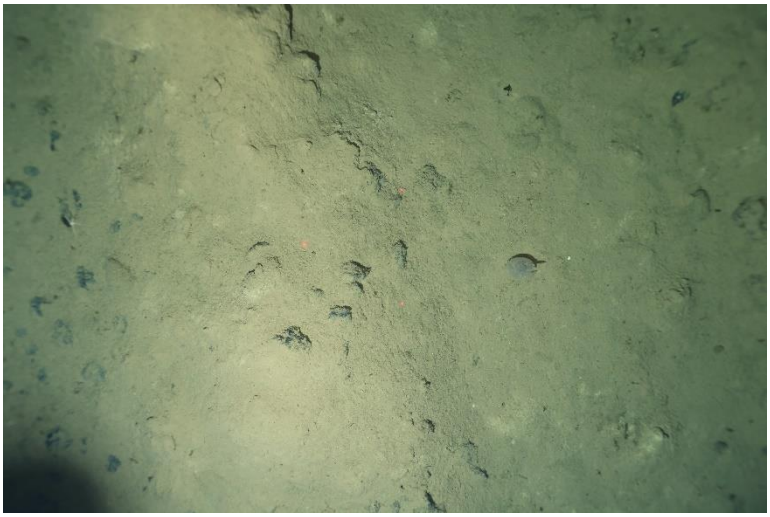

Fig. 6: OFOS image of a 2019 dredge track. The track is colonized by a sea cucumber.

On November 25, a BGR mooring was surveyed with the ship's Posidonia system to determine its exact location.

On the night of November 27, we proceeded to an area to the west with no nodules where an ROV dive would be conducted. In the morning the dive was initiated but had to be interrupted due to power supply failures. The ROV team spent the afternoon and into the evening troubleshooting the fault. The time was usefully filled with a CTD and a distinct OFOS dive.

Crew and scientists are well up and motivated. We look forward to the work in the following work area.

Greetings on behalf of all participants,

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