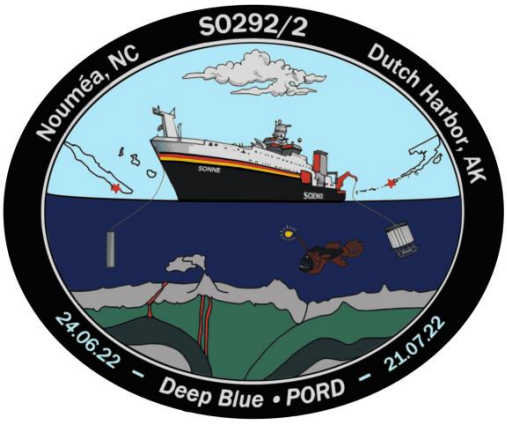
R/V SONNE

Expedition SO292/2

DeepBlue / PORD

24.06.2022 - 21.07.2022

Nouméa (NC) – Dutch Harbor (USA)



3. **Weekly Report** (04. - 10.07.2022)

The week started in the Southern Mariana forearc, the first of our two study areas. During the night we could extensively map the target mud volcano (MV) situated between 6000 and 7000 mbsl, being able to produce a nice map of the structure. Taking advantage of the beautiful weather and the perfect sea conditions on Monday the 4th we deployed the gravity cores, in order to sample diverse morphological features on the MV. Unfortunately the coring operations revealed more difficult than expected, with a low core retrieval. Nonetheless, we continued the scientific program with a dredge profile on the same target, which allowed us to collect a suite of different rock clasts from both lower and upper plate.

Subsequently, we used the RV SONNE own OFOS (Ocean Seafloor Observation System) to image the MV, getting spectacular footage of a clasts-rich ocean seafloor, mudflow terraces, and brucite chimneys. This not only confirmed the mud volcanic nature of this feature, but also allowed us to select a proper site for the deployment of the long-term pressure and temperature (p-T) observatory we built at MARUM. The NCB Observatory was then safely released on the seafloor on the 05.07, with the purpose of monitoring the p-T parameters of the MV sediments in the years to come, until its future retrieval. Such parameters will be key to understand the plate dynamic and the role of MVes in the fluid and solid cycling of the Mariana Subduction Zone.

We then steamed away in the direction of our second working area, in the Northern Mariana Forearc, which we reached on the 6th of July. Here we focused our research on multiple seafloor structures: Pacman MV, Cerulean Springs, Conical MV, a deep-sea basin E of Conical and two newly discovered MVs.

Figure 1: i) Terminal part of a MV flow as imaged during an OFOS dive; ii) typical suite of altered peridotite clasts retrieved during a dredge deployment.

Multiple gravity cores have been done during the rest of the week, coring known features (Pacman, Conical and Cerulean Springs), as well as two new structures, which were identified as MVs due to retrieval of serpentinite muds. These sample will be studied in order to determine the geochemical composition of the porewater, as well as the presence of microbial activity, in an effort to shed some light on the origin of the fluids and the life which they could fuel.

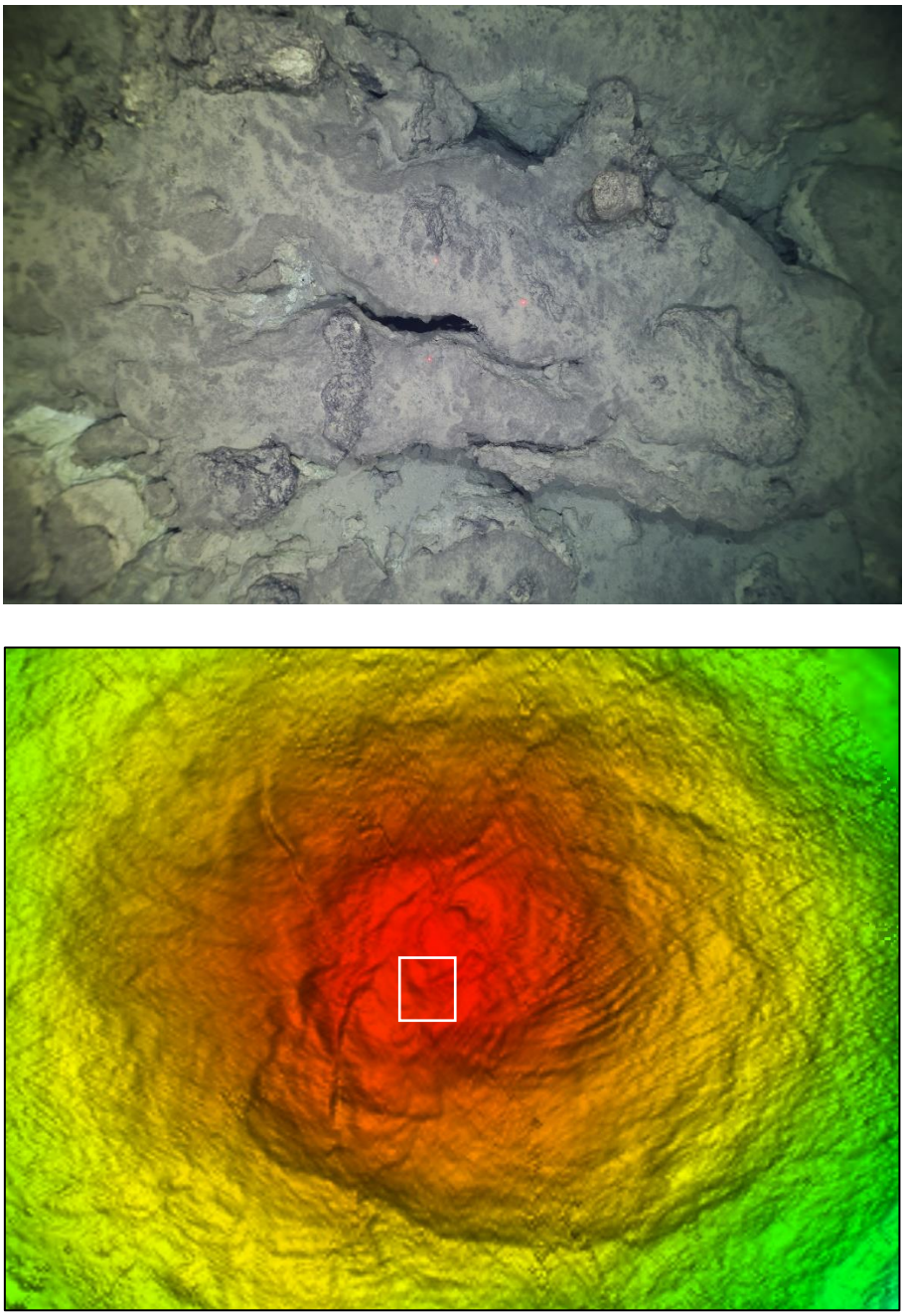


Figure 2: i) seafloor images from the OFOS dive on Conical showing deep fractures; ii) map of Conical MV summit with approximate location of figure i), typical MV morphologies (faults, mud flows, summit mound) can be clearly noted.

Two further OFOS dives were performed at Cerulean Springs and Conical, with the latter returning spectacular images of carbonate chimneys, ferromanganese crusts and deep fractures scattered on the seafloor. Moreover, we deployed the dredge two more times on Conical and Pacman, getting a discrete amount of samples which will be driving further petrological studies once onshore. The site selected for the deployment of our second observatory was Cerulean Springs, as it has been identified in the past as the one with the

highest fluid flow emission of the whole forearc (Mottl et al, 2003). The second NCB observatory was also flawlessly deployed on the 07.07, in a location chosen from the seafloor imagery of the OFOS dive and a temperature profile perpendicular to it.

Finally, we also managed to core a deep-sea basin in the forearc, and two new MVs, which recovered respectively a turbidite record and beautiful blue serpentinite muds. Despite the limited time at sea and the difficult targets (MVs are notoriously difficult to core), the SO292/2 expedition already set several records, namely: i) longest OFOS dive at maximum instrument depth (6000 mbsl), ii) deepest MV ever discovered, sampled and instrumented, and finally iii) first turbidite record of the Mariana Forearc retrieved after the DSDP Leg 60 in 1982.

Figure 3: blue serpentinite mud from a newly discovered MV oozing out of the core catcher.

Every scientific and crew participant is contributing to the success of this expedition and, as the days go by and the masks mandate wears off, the scientific team gets more united, making work and living on board very pleasant.

On behalf of the entire SO292/2 Team
Walter Menapace (Chief Scientist)

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