Danmarks Grundforskningsfonds
Danish Center for Hadal Research
HADAL

Highlight summary of 2022

The HADAL center aims to investigate and understand life and biogeochemistry in one of the most remote, extreme, and scantly explored habitats on Earth – the deepest oceanic trenches. As such the center relies on successful deep-sea expeditions. During 2022, researchers and technicians at HADAL contributed to five international expeditions targeting some of the deepest regions of the Pacific, Atlantic and Southern Oceans. Instrumentation, experimental protocols, and novel analysis developed in the previous year were used to recover samples, measure environmental parameters, and conduct experiments at extremely challenging conditions. Thousands of data and samples were collected and compiled in databases and sample repositories. Combined with data from previous expedition the efforts resulted in several novel discoveries. The insight documented that biogeochemical processing and microbial life, within and between different hadal trench systems, are surprisingly diverse but also distinct from other deep-sea settings.

Investigations of recovered sediment (Fig. 1), revealed that hadal trench systems are quantitatively important sites for organic carbon sequestration. Intensified sedimentation into largely anoxic sediment deposits mean that hadal trenches on average can sequester 70 times more carbon per m^2 than the ambient deep-sea. Thus, despite only covering between 1-2% of the ocean bed, trenches may very well act as quantitatively important sites for burial of organic material from a range of different sources and may play an important role for marine carbon cycling and climate feedbacks. Similarly, preliminary investigations also indicate that the trenches act as important deposit sites for trace metals and pollutants. The unique deposition dynamic also fosters surprisingly diverse but distinct microbial communities with several novel phylogenies that mineralize the deposited material. The high microbial diversity and intense microbial mineralization suggest that the adaptation to extreme pressure does not represent the same evolutionary bottleneck for microbes as has it does for higher life forms.

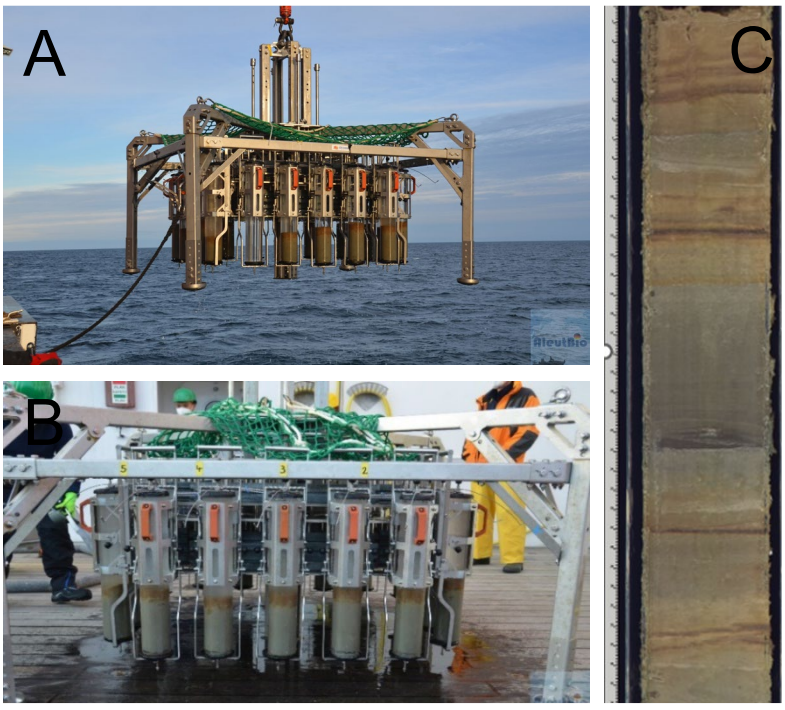

Fig 1A & B, Another set of sediment cores recovered from ~8 km of depth in the Aleutian trench. Fig 1 C, the vertical zonation represents an archive of past events such as deposits from volcanic eruptions, mass deposition during earthquakes, and past life. But careful analysis can also reveal the sediment sequestration of organic carbon, nutrients, trace metals, pollutants and exciting insight on microbial life processing the deposited material at these extreme depths.