# Danmarks Grundforskningsfonds
# Danish Center for Hadal Research
# HADAL

## *Highlight summary of 2023*

The HADAL center investigates life and element cycling in the deepest part of the global ocean – the hadal trenches, one of the most remote and underexplored environments on Earth. Our work has documented that the trenches act as focal points for deposition of organic material, sustaining elevated biological activity of largely unknown life forms that flourish at extreme hydrostatic pressure. Our investigations rely on successful deep-sea expeditions and during 2023, researchers and technicians at HADAL participated in four international expeditions. The main aims were to investigate the effect of hydrostatic pressure on microbial performance and to collect sediment for specific geochemical and microbial analysis. One important achievement during an expedition to the Japan trench was the deployment of a large mooring system (Fig 1). The mooring will be recovered in August 2024 after 15 months of deployment. The collected data and samples will enable us to resolve and understand deposition dynamics and ocean mixing at hadal depth.

During the past year the HADAL team made more important discoveries. It was shown, that due to particle scavenging, material focusing and elevated microbial overturn of organic material, trench sediments have high inventories of "*Persistent Organic Pollutants*". Thus, despite their remoteness, hadal trenches are affected by anthropogenic activities and act as important depocenters for legacy pollutants. Detailed genomic investigations also demonstrated that deposition pathways, sharp redox zonation's and hydrostatic pressures shape and form distinct, but surprisingly diverse microbial communities in hadal sediments. This might indicate that high hydrostatic pressure does not represent the evolutionary bottleneck for microbial life as it does for higher lifeforms. Another surprising finding was that hydrostatic pressure transform sinking organic matter and the associated microbial communities while facilitating the leakage of dissolved organic carbon (DOC) during the descend. Due to increasing pressure, sinking aggregates are therefore a source for resilient DOC and may play an important role for deep sea carbon sequestration and climate feed-backs.

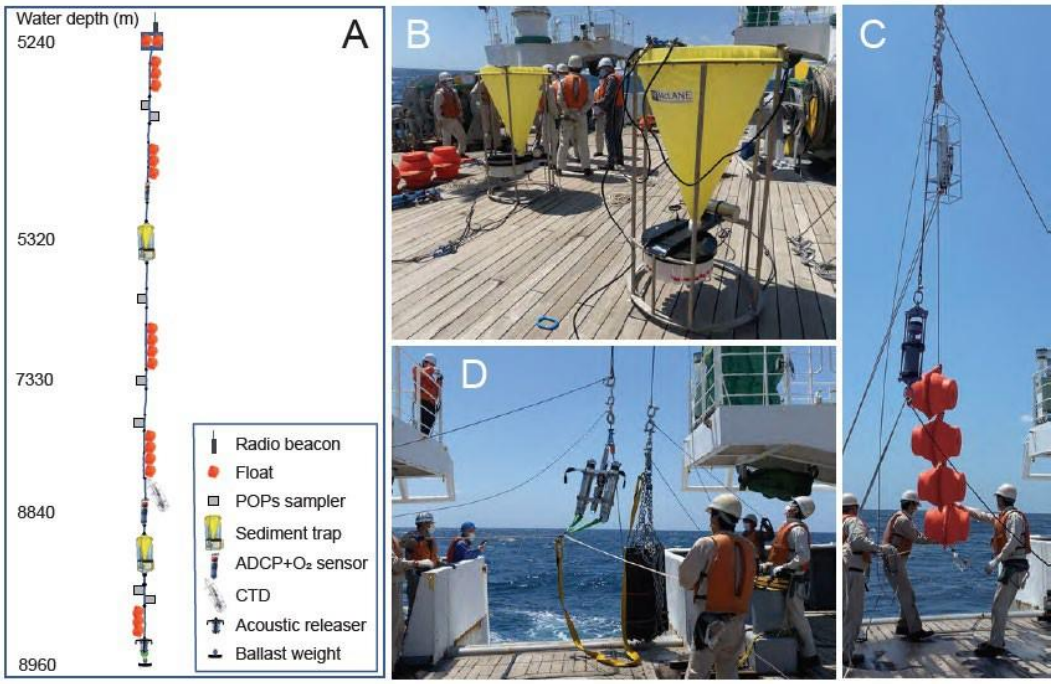


*Fig 1A. Diagram of a 3.5 km long mooring equipped with sediment traps, sensors, and samplers. The mooring will be deployed for 15 months to resolve dynamics in material deposition and important environmental parameters to understand pelagic-benthic coupling and ocean mixing at great depth. Figs 1B show the preprogrammed sediment traps that collect sinking material at different time intervals. Fig 1C and 1D show on-deck activities during the elaborate deployment of the mooring from the TUMSAT-based research vessel Umitaka.*