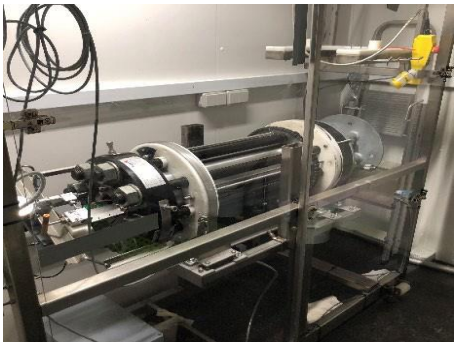
Danish National Research Foundation
Danish Center for Hadal Research
HADAL

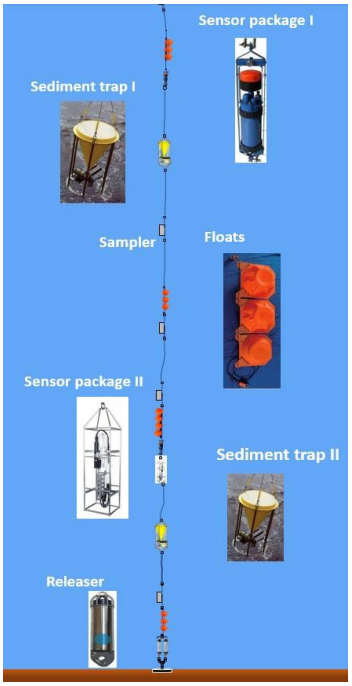
Highlight summary 2021

HADAL was established in September 2020 to investigate life and biogeochemistry in one of the most remote, extreme, and scantly explored habitats on Earth – the deepest oceanic trenches. During 2021, personnel has been recruited, critical research infrastructure has been established and novel discoveries have been made.

A large, **well-equipped workshop** for development, construction, and service of deep-sea instrumentation and a dozen **thermoregulated pressure tank systems** have been established. The tank systems enable investigations of pressure effects on enzyme kinetics, redox processes, metabolism, growth, biological interactions, and microbial evolution. Some tanks are equipped with penetrators for online measurements of biological, chemical, and physical parameters during pressure treatments, while other tanks are designed for seagoing expeditions to investigate freshly collected deep-sea samples. **A mooring system** for quantifying hydrography and deposition dynamics at great depth has been developed, along with **autonomous instruments** for sampling and in situ quantification of biogeochemical processing. The mooring, pressure chambers and instruments will be applied during a series of expeditions in the coming years.

Analysis of samples and data compiled during a predeceasing deep-sea project (HADES-ERC) revealed surprising findings that have been published. Hadal regions are quantitatively important sites for the sequestration of organic carbon, but also for the burial of toxic mercury. At the same time, trenches act as hot spots for the turnover of organic material, mediated by highly diverse microbial communities via the complete suite of redox processes known from coastal environments. It has for instance been discovered that hadal bacteria can convert fixed nitrogen to inert dinitrogen gas and thus remove bioavailable nitrogen in the deep sea. Overall, biogeochemical processing and biological communities within and between hadal trench systems are surprisingly diverse and function very differently than in other deep-sea environments.





A) A 12 L large rotating pressure tank for investigating the degradation of sinking particles, B) A 5ml small pressure tank for online monitoring of microbial responses and enzyme kinetics during pressure treatments.
C) A 3.5 km long mooring of instruments and sediment traps to be deployed in 2022 at 9.5 km depth to explore annual dynamics in hydrography and material deposition in the Japan Trench.