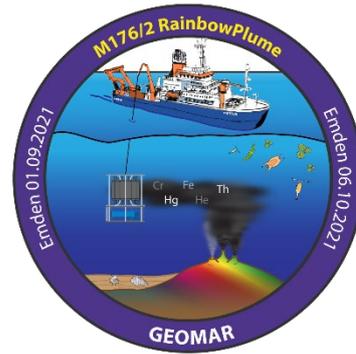


RV METEOR

Cruise M176/2 RainbowPlume

1<sup>st</sup> September – 6<sup>th</sup> October 2021

Emden - Emden

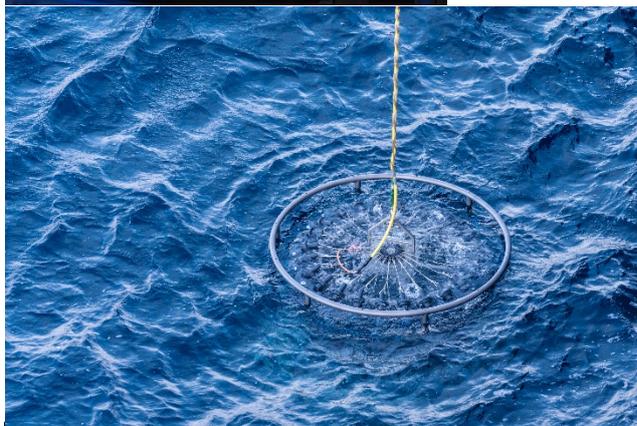


### 3. Weekly Report (13<sup>th</sup> -19<sup>th</sup> September 2021)

Cruise M176/2 is continuing its activities in the study area (36°15 N, 33°53 W) and we have built up a routine of daily CTDs and tow fish operations. The weather is still very kind to us with low winds and pleasant temperatures, but a reasonable swell of 1.5-2 m.



On a daily basis we sample in detail the non-buoyant hydrothermal plume emanating from the Rainbow vent field using the trace metal clean titanium CTD. This CTD is operated by a dedicated winch system with a Kevlar cable (Fig. 1), thereby preventing contamination of the samples during the sample collection. We sample just above and just below the plume, which means between 1700 m and 2300 m, with the plume maxima being at ca. 2100 m. Once on deck Niskin bottles are removed from the frame and taken to our trace metal clean container where the water is filtered into a large number of different bottles for analysis at sea and in the home laboratories. We are collecting particles from the plume for elemental and synchrotron analysis, and we collect waters which are filtered through various different filter pore sizes. The collection of various size fractions along the plume will provide detail on chemical transformations and allow us to decipher how much material (e.g. iron) is removed by sinking and remains in solution and may ultimately be available to phytoplankton growth in the surface ocean.



We also sample Niskins from the titanium CTD for helium isotopes which we use as a tracer of the hydrothermal fluid inputs to the ocean. Helium is a conservative tracer and allows us to follow the plume and determine the fluxes of elements. Helium is sampled into copper tubes, which are clamped and then can hold the helium in the seawater for years. The helium isotope analysis will be conducted at the University of Bremen.

Fig. 1: Top: Winch with Kevlar conducting wire. Below: Deployment of titanium CTD frame. Photo E. Achterberg (top) and C. Rohleder

We are deploying daily another 3 CTDs (stainless steel) for the collection of Ra and Th isotopes to al-

low us to assess time scales of plume movement and trace element scavenging processes. Large volume samples (110 l) are collected for Ra isotopes and pumped over Mn cartridge for short-lived Ra analysis on board and long-lived Ra in Kiel. For Th isotopes we also measure both on-board (Th 234) and on land (Th 230).



Fig. 2: Sun setting on METEOR. Photo C. Rohleder

We already see very nice clear Th isotope signals in the plume, indicating scavenging processes.

We have a week to go in our study region and will start heading back to Emden on September 28<sup>th</sup>. The officers and crew on the METEOR are doing a great job at facilitating our research and making our life as pleasant as possible on board.

Follow our Rainbow Plume Blogs:

GEOMAR: <https://www.oceanblogs.org/rainbowplume/2021/09/12/hydrothermal-plume-geochemical-study-rainbowplume/>

Jacobs University: <https://www.jacobs-university.de/blog-posts-research-cruise-m1762>

RV METEOR at sea 36°N/33°W

Eric Achterberg

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