

Multi- EM surveying and data analysis for deep-sea seafloor massive sulfide exploration

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SUMMARY

Deep-sea hydrothermal vent fields associated with the formation of seafloor massive sulfides (SMS) may become a future source of high-tech minerals such as Cu, Ni, Pb, Co, and REE, which are all demanded for the energy transition away from hydrocarbon resources. The identification and evaluation of the deposits in the deep ocean is a needle in a haystack problem. They are relatively small (size of a soccer field) and form in complex terrain at mid-ocean ridges, island arcs and back-arc spreading centres. The plume of active hydrothermal systems can be traced in the water column; however, active hydrothermal vents have an abundant, environmental sensitive fauna and low mineral potential. Inactive and extinct vent sites are generally missing characteristic seafloor expressions such as black smokers and distinct vent fauna, and may be hidden under a thin layer of sediments. An important aspect in mineral resource assessment is the inner structure and spatial extent of the SMS deposits, in particular their dimensions in depth, which can be addressed by geophysical methods.

In addition to magnetic and bathymetric surveying, we have collected a variety of marine frequency domain CSEM loop data and electric dipole-dipole data (DC conductivity, induced polarisation and self potential) over active and inactive hydrothermal vent fields associated with seafloor massive sulfides in the German licence areas located in the Indian Ocean. The data have been collected using BGR's unique deep-sea GOLDEN EYE CSEM profiler and newly acquired tandem Vulcan E-field receivers for self potential measurements. First results from the most recent cruise in 2021 indicate several anomalous features in the data that agree well with previously known, visually identified sulfide occurrences. The interpretation of the data is challenged by the complexity of the terrain and navigation issues. In our presentation we will give an overview of the current status of the data analyses and discuss our next steps to derive the 3D structure of the subseafloor mineral deposits.

Keywords: marine electromagnetics, seafloor massive sulfide exploration

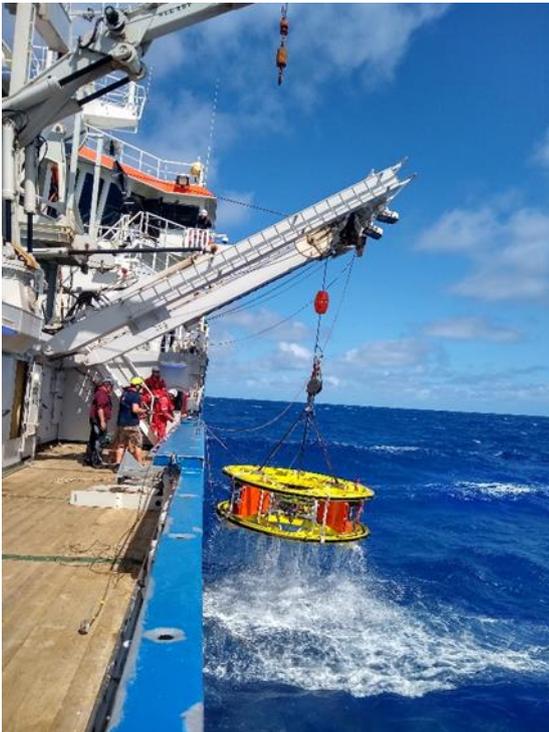


Figure 1. Left: Golden Eye recovery on RV Pelagia. Top: Vulcan E-field receiver being deployed at the aft deck.