

GOLDEN EYE: Electromagnetic Deep Sea Profiler for the Investigation of Marine Mineral Resources

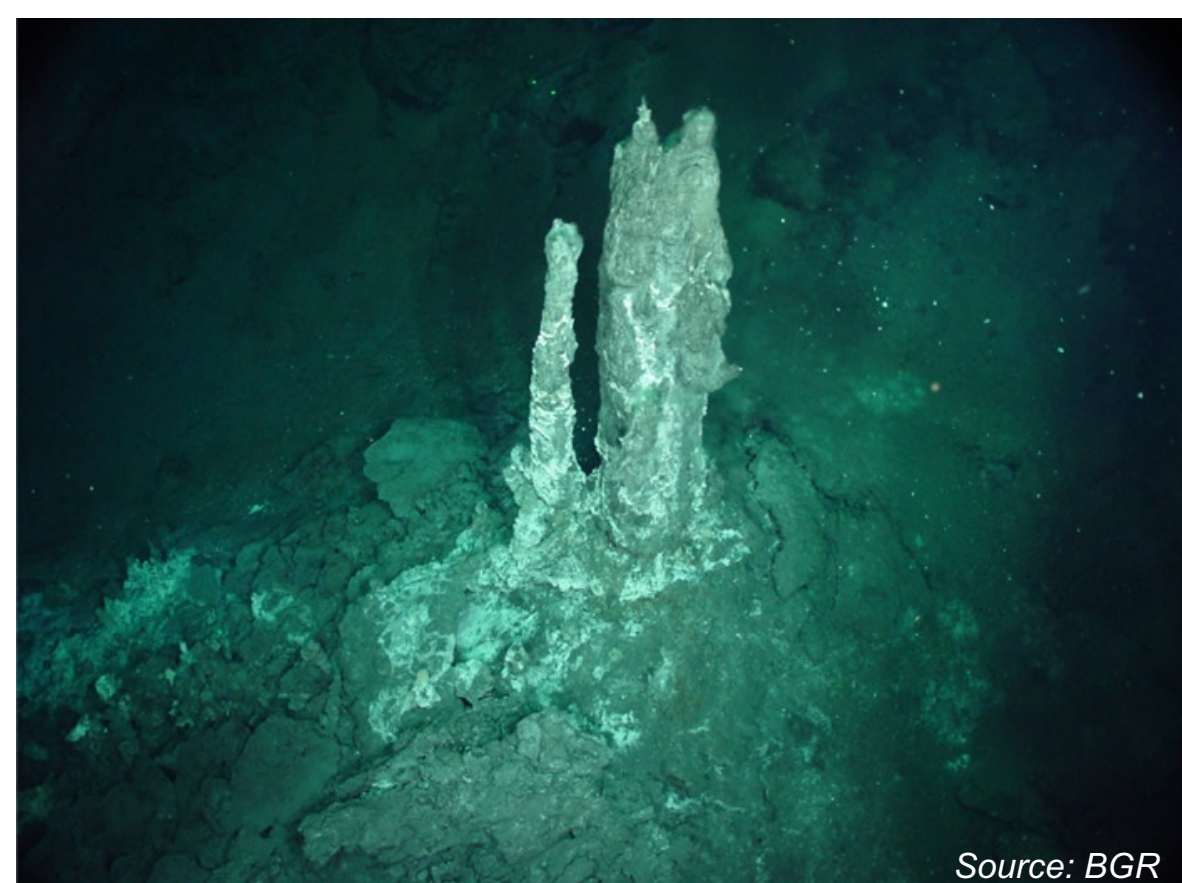
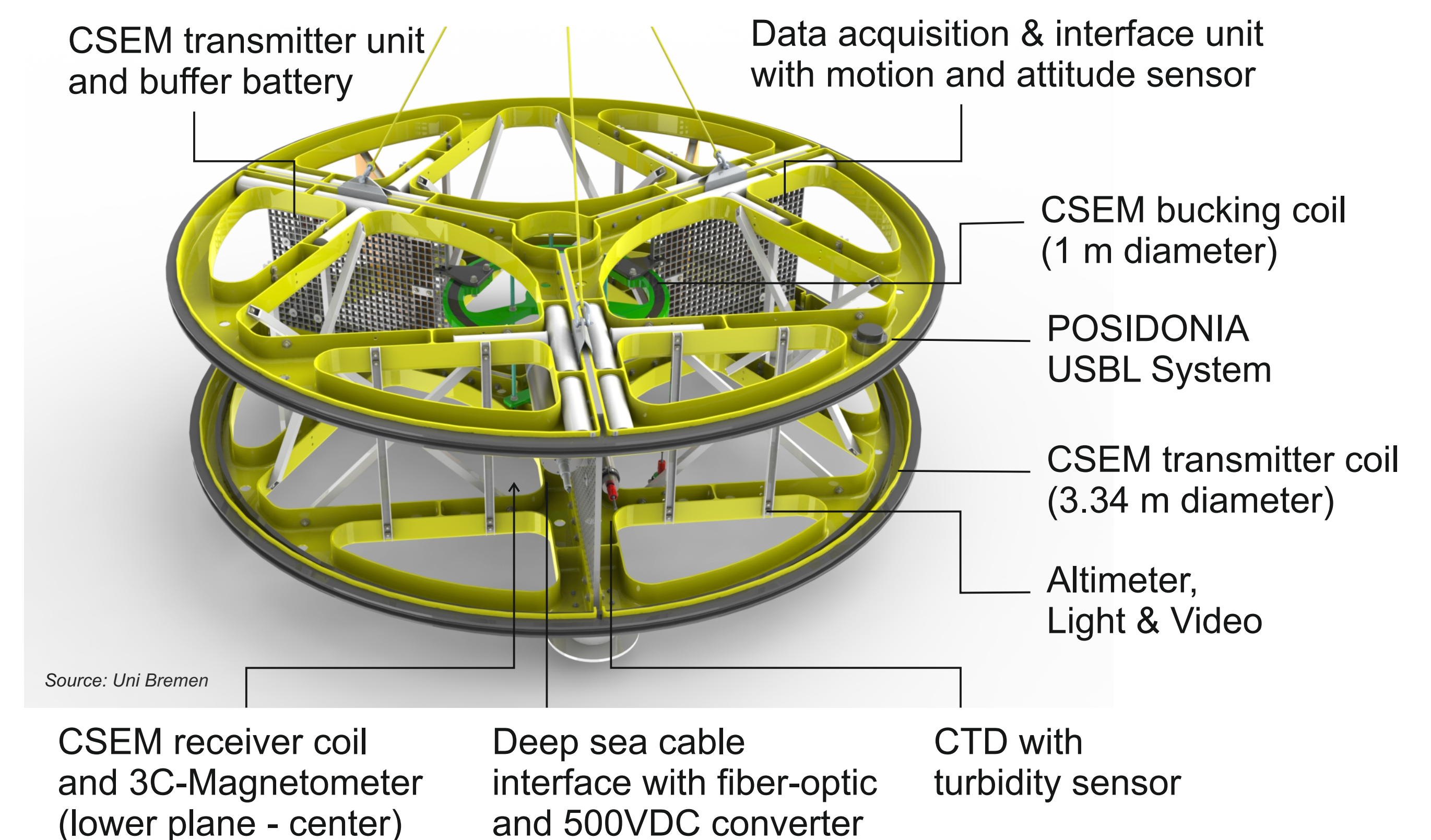
Objectives

Seafloor Massive Sulfides (SMS) are polymetallic mineral deposits that precipitate from hydrothermal vent systems along mid-oceanic ridges, back-arc spreading zones or island arcs and form among the most conductive rocks on earth. They contain high grades of heavy metals such as copper, gold, silver, and zinc and trace metals of rare earths - all materials of high demand in the growing high-tech industry. Nevertheless, only a few valuable sites have been localized so far that would admit a sustainable mining of SMS resources in the near future.

Since 2011, annual research cruises have been conducted by German scientist, to explore known and discover new SMS fields along the Central Indian Ridge (CIR) between 21° and 25° south. SMS deposits have been inferred from rock sampling, sidescan sonar and video imaging. This August, the German Federal Institute for Geosciences and Natural Resources (BGR) has been authorized by the ISA for an exploration license for a 10,000 km² area close to the Rodriguez Triple Junction at the CIR. Annual research cruises shall explore and evaluate SMS resources. Electromagnetic site characterization is the only considered geophysical exploration method that provides direct information about the value and architecture of the resource itself.



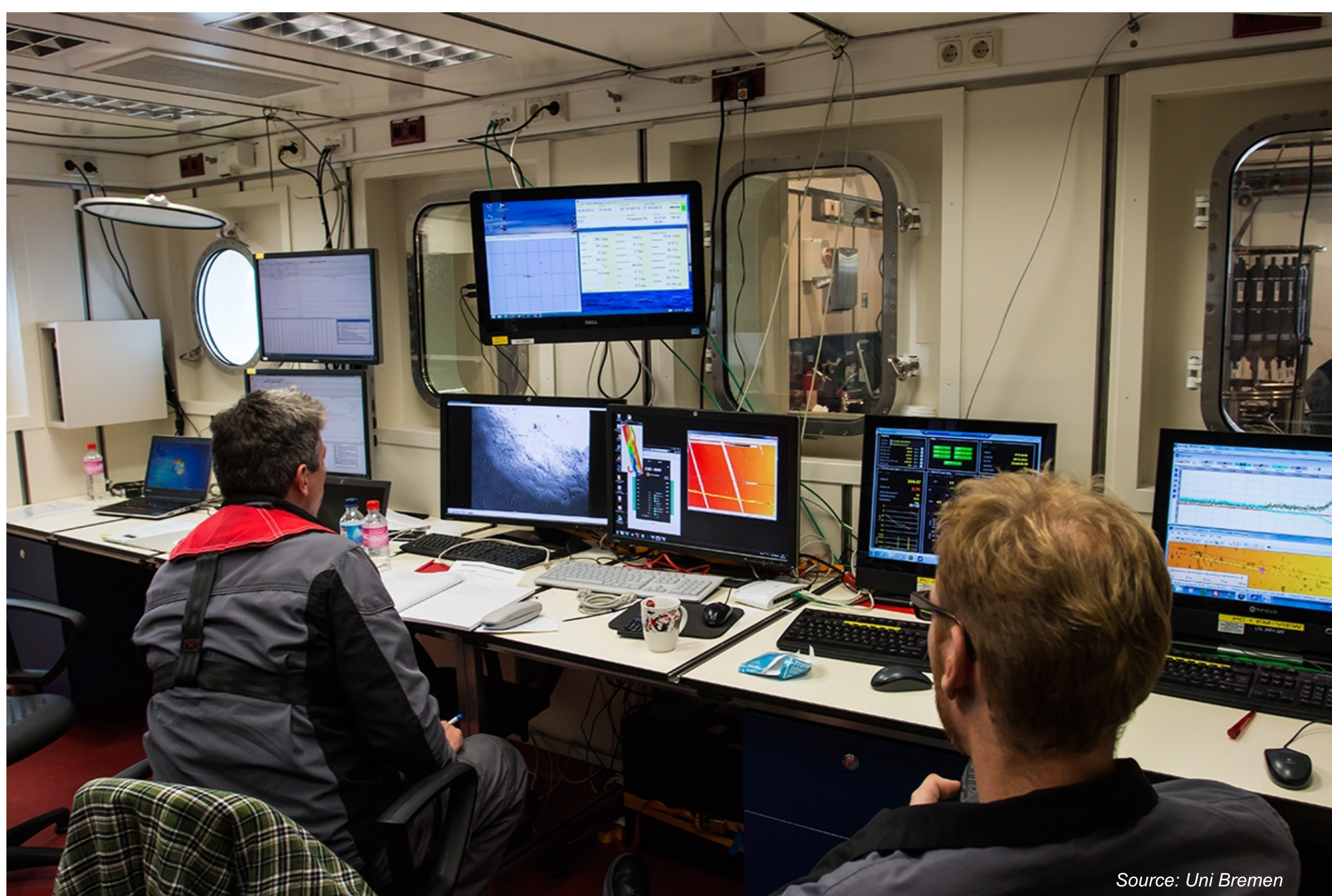
Golden Eye deployed for its first mission on RV SONNE in the North Sea in September 2014.



Black smoker form at hydrothermal vents from precipitates of hot fluids that contain base metals and rare earth minerals.



Massive sulfide sample from the Indian Ocean with high copper content.



Golden Eye control room; Data inspection and video observations on RV SONNE.

Electromagnetic Imaging System

Golden Eye is a development based on the benthic electromagnetic profiler MARUM NERIDIS that approved his capabilities in a number of coastal and continental shelf surveys. The deep sea electromagnetic profiler **Golden Eye** just completed its first field expedition from aboard the new German research flagship RV SONNE in the North Sea and is now well prepared for two SMS related surveys in the Mediterranean Sea and in the Central Indian Ocean in 2015.

Golden Eye lands on the seafloor or glides with well constrained ground distance to allow high resolution EM mapping of electrical conductivity and magnetic susceptibility of the subsurface in up to 5000 m water depth. The fiberglass structure of **Golden Eye** is designed to cause minimum scatter of electromagnetic fields that are generated by large horizontal induction loops with a maximum diameter of 3.5 m. Several frequencies between 10 and 20,000 Hz can be combined and jointly inverted to resolve the resistivity structure of the topmost 5 to 10 meters below seafloor. Furthermore it will allow to monitor the surrounding ecosystem and possible damage caused to the environment by mining activities by the aid of a high definition photographic camera system.

