

MARIA S. MERIAN

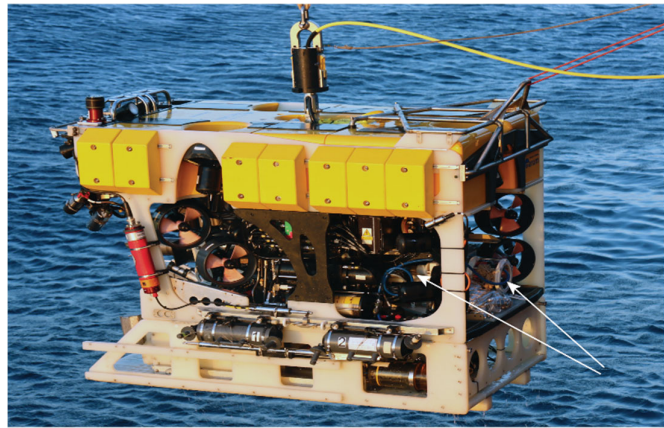
MSM125 Algeciras - Funchal

January 30 – February 06, 2024

Weekly Report (Jan. 30. - Feb. 05., 2024)



MSM125 is a short cruise of only four working days with the aim of testing deep-sea research devices developed at MARUM and MPI-Bremen as part of the Cluster of Excellence "The Ocean Floor - Earth's Uncharted Interface" in in-situ operation so that they can be used in future research expeditions. One of these devices is the In-situ Mass Spectrometer (ISMS), which is used with Remotely Operated Vehicles (ROVs) and measures dissolved gases (e.g. CH₄, H₂S, CO₂, O₂) at deep-sea hydrothermal vents and cold seeps at depths of up to 4500 m and temperatures of up to 350°C. The ISMS was previously used during the RV METEOR cruise M190 with the ROV QUEST. The purpose of the current cruise was to test further technical developments and to integrate it as a heavy payload into the much smaller ROV MARUM SQUID, with which this device can also be used in the future with smaller research vessels that have less capacity, e.g. for deck space, container stowage or accommodation for ROV personnel.



ROV SQUID with the ISMS installed (arrows)

The second device to be tested is the Dynamic Autoclave Piston Corer (DAPC), with which the cores of gas-rich sediments can be recovered from the depths under in-situ pressure without suffering a loss of the free gas phase during ascent. Only pressure cores guarantee the exact quantification of dissolved or free gases or gas hydrates in supersaturated deep-sea sediments.

Another item on the program of the cruise was to test a mobile telepresence system developed at MARUM. The aim is to ultimately obtain a transportable and low-cost telepresence for livestream transmissions that can be operated by the ROV team "on the side" so that no extra personnel are required.

Our working areas were the three mud volcanoes Al Gacel (775 m), Captain Arutyunov (1320 m) and Bonjardim (3060 m) in the Gulf of Cádiz. They were selected because their large number of gas seeps and the presence of gas hydrates in different seep environments and water depths offer ideal test conditions.

On January 30, we started in Algeciras, Spain. On board are 18 scientists and technicians from the Bremen institutions MARUM and MPI for Marine Microbiology as well as the University of the Azores, Portugal, the Hassan II University of Casablanca in Morocco and the company Corsyde, Berlin. After a short transit of only 9 hours we had reached the first working area, and we used the rest of the day and night to map Al Gacel and some smaller mud volcanoes in the vicinity. The EM122 multibeam echo sounder and the Parasound subbottom profiler were used to record the bathymetry of these areas and also signals from plumes of escaping gas bubbles. This data should enable us to identify alternative deployment areas for our equipment tests.



Deployment of the DAPC.

Unfortunately, the dive planned for January 31 had to be canceled due to high waves, and we were also unable to dive the next day. Instead, we used the time to core the Captain Arutyunov mud volcano and map other mud volcanoes in the area. The core positions selected on the basis of hydroacoustic data were first sounded with the gravity corer and, if found suitable, also sampled with the DAPC. On February 1, a first short dive and on February 2, finally a complete dive at the Al Gacel mud volcano were successful, during which the ISMS was used. In the meantime, coring continued and further mud volcanoes were mapped. On the evening of February 2nd we set off for the Bonjardim mud volcano, about 8 hours away, where we spent our last working day with gravity coring and DAPC deployments.



*ISMS measurement of dissolved gases in seep fluids on top of *Gigantidas mauritanicus* bivalves at the Al Gacel mud volcano..*

Despite the initially unfavorable sea conditions, at least for diving, the trip was a complete success. The tests of the ISMS provided valuable insights to further optimize the system for future use on ROVs of different size classes. The tests of the pumps, the pH and flow sensor and the new in-situ calibration of the mass spectrometer were consistently positive. The DAPC has proven itself in use. It has recovered cores from water depths of up to 3000 m under pressure, brought intact gas hydrates to the surface and enabled the quantification of the gases contained in the sediment by means of controlled degassing on deck. The mobile telepresence system has proven itself in a YouTube stream received at MARUM and will be used in future research cruises.



Gas hydrate from the Captain Arutyunov mud volcano.

Since the morning of February 4, we have been in transit to our destination port of Funchal on Madeira, where we will arrive on February 6. We have four intensive days of work behind us, which have provided us with valuable insights into the equipment we are testing. We would like to thank Captain Soeren Janssen and his extremely helpful crew of the MARIA S. MERIAN, whose competent assistance at all levels helped us to achieve this success. We were given a very warm welcome, had a really good time together, and we regret that the voyage is coming to an end so soon.

Greetings from on board the MARIA S. MERIAN on behalf of all participants

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