

S Maria S. Merian cruise MSM 04/3
Second Weekly Report, period 29th Jan. – 4th Feb.



The second week of Merian cruise MSM 04/3 continued very similar to how the first week ended: diving with ROV Jason during daytime and running CTD casts or bathymetry mapping profiles during nighttime. With a moderate sea state of 1.5-2.5 m wave height driven by the steadily blowing ENE to E trades, the weather did its best for us and diving was possible every day. The air temperature is around 25°C and the sun is shining every day, only sporadically interrupted by a few light showers, which makes life on board very agreeable.

Initially we kept up a regular pattern of 12 hours water time for the ROV which allowed us to recover sample material every night. This was necessary because many biological samples and gas analyses on hot fluids required rapid recovery and immediate processing. Later in the week, we had also two 24-hour dives, which allowed us to extend our operation radius on the seafloor. Our diving activities during 9 days of station work now sum up to 8 dives with 85 hours bottom time.



Fig. 1. Dense aggregation of the shrimp *Rimicaris exocculata* at the “Irina II” main sulfide structure.

The main target of this week’s dives was the Irina II mound and adjacent areas, including the main sulfide structure on the top with hot fluid outlets and dense aggregations of mussels and shrimp, the mussel field on the western mound slope, the so called “OBT site” at its northern margin, and flats with bacterial mats and cracks with diffuse outflow adjacent to marker “Anya”. Another frequently visited site was the smoking crater structure Quest, which served as a reference site for the Irina II analyses, while the smoking craters in the southern part of the Logatchev field were visited with one dive.

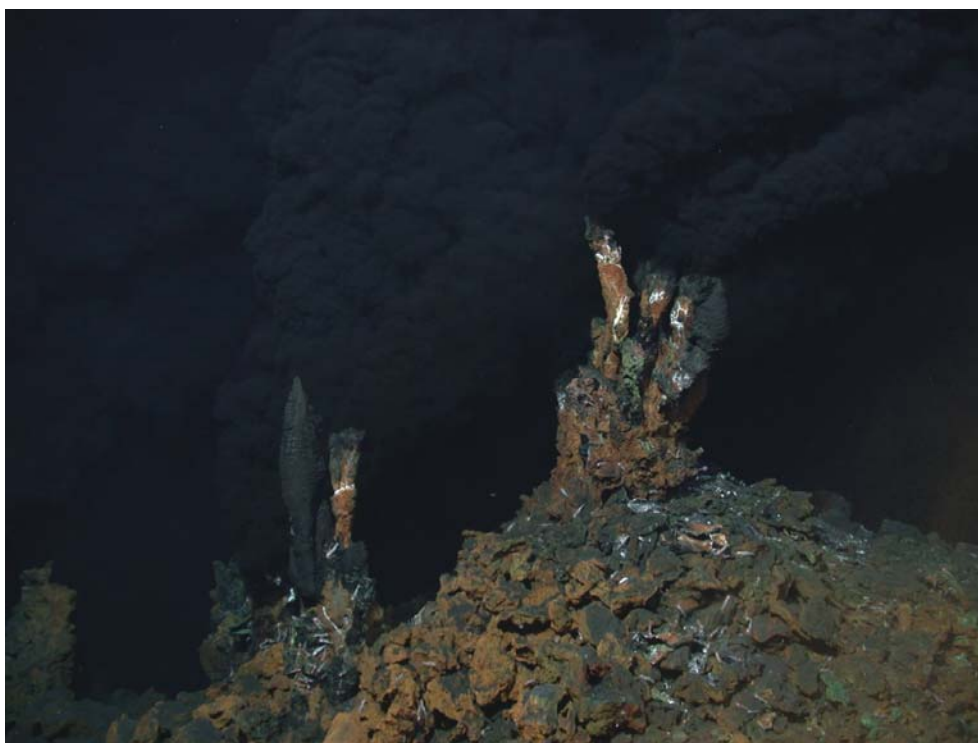


Fig. 2. Black smokers along the rim of the smoking crater “Anna Louise”.

During repeated visits of Irina II and Quest structures, we collected sample material for successive onboard incubation experiments with microbes and symbiotic tissues as well as analyses of hot and moderately heated fluids. Physical and geochemical gradients at hot and moderately heated hydrothermal environments were measured by a 8-channel high-T probe mounted to the ROV and a micro-profiler measuring gradients of T, O₂, sulfide and H₂ above mussel fields and in the upper inter-individual space. An in-situ incubation chamber was used for mussel incubation experiments on O₂ respiration and sulfide depletion.

All instruments deployed by Meteor cruise M 64/2 are now recovered, including the ocean bottom tilt meter (OBT), the ocean bottom pressure meter (OBP), the 25-m long vertical temperature mooring and arrays of single miniaturized temperature loggers (MTL) in the Irina II mussel field and the smoking crater site Quest. Readings of the temperature loggers revealed that these instruments have collected data until late 2005, which matches the initially planned duration of their stay on the sea floor. The new OBP, OBT and one set of 10 MTL were deployed again with three successive dives.

One important task of this cruise is to verify the geographical positions of the various previously mapped hydrothermal structures on the basis of long baseline navigation (LBL) used by Jason. As one important result, we have calibrated an offset for previously reported positions. Another perhaps even more important finding is that previous cruises have underestimated the number of hydrothermal structures. Dive 257 ROV revealed that the southern part of the Logatchev hydrothermal vent field additionally to the three previously mapped smoking craters “Site B”, “Irina I” and “Anna Louise” harbors a fourth crater structure which is located between “Anna Louise” and “Site A”. Although this structure was already found by Meteor cruise M 64/2, it was not recognized as a new one and marked as “Anna Louise”. We

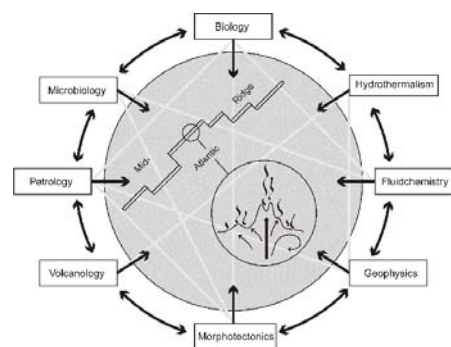
named the structure “Smoky Strobe”, which refers to a strobe light that apparently was lost by a towed video sled and which we found lying next to the crater rim. With an estimated diameter of 10 m, “Smokey Strobe” is considerably smaller than neighboring craters.

Three “tow-yo” CTD stations were carried out during this week. The CTD–rosette was alternately lowered and raised through the water column as the instrument was dragged about 500 meters behind the ship at a speed of 0.5 knot. In this way, properties such as particle concentration could be mapped throughout the plume interval of about 2500 to 3000 meters. In addition discrete water samples were captured and analyzed for methane, hydrogen, and trace metals. Due to the serpentinization of mantle rocks, the Logatchev vents emit high concentrations of these chemicals, which appear as plumes in the surrounding waters. The tow-yo measurements indicate that one plume was spreading along the 2750 meter contour to the south and east. To the northeast, it may be that the plume spreads at a deeper level, but this is not as clear.

In two nights between ROV dives, the bathymetric mapping at the transition of the Mid-Atlantic Ridge to the Fifteen-Twenty Fracture Zone was continued which was started Sunday night during the rescue operation of the S/V Spica. The mapped area covers a so-called inside corner at a mid-oceanic ridge transform fault. In such settings very often lower crust and upper mantle material outcrops along large detachment faults, showing characteristic corrugation marks which strike parallel to the spreading direction. Therefore it was the need to map the area in a higher resolution than the available Japanese and French bathymetry of R/V Yokosuka and R/V Atalante, respectively. The transits from the Logatchev Field to this area were planned along different routes, so that also a considerable part of the Mid-Atlantic Ridge Central Valley next to the Logatchev Field could be mapped. The data show a large fault striking N/S which basically can be traced from the Logatchev Field approximately 40 km to the north. It can be speculated that such faults are directly correlated to hydrothermal systems and serve as pathways for the hot fluids.

At the end of this week of very intensive work and, we feel as if we have been here for a long time although we arrived only 9 days before. The days are long while the cruise is short, and we have only three days left until we will leave again and head to Las Palmas.

We are all in good health and send our best wishes.
 Christian Borowski and the MSM 04/3 shipboard party.
 4th February 2007



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