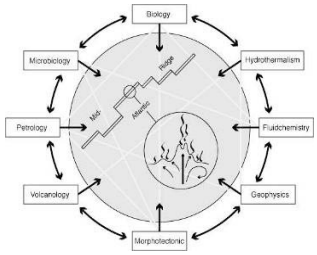
MSM 10/3

Jan. 11th – Feb. 13th, 2009

1st weekly report



The German research vessel Maria S. Merian set sail from Las Palmas on the Canary Islands with 14 scientists, 8 ROV (remote operated vehicle) crew members and 23 crew members, to investigate the Logatchev hydrothermal vent field at 14°45' N, 44°58' W on the Mid-Atlantic Ridge (MAR). This cruise is part of the German Science Foundation's Priority Program "From Mantle to Ocean" (SPP 1144) in which scientists are working together to better understand the geology, chemistry, and biology of hydrothermal vents on the slow-spreading MAR. We have scientists from the Max Planck Institute for Marine Microbiology, the IFM-Geomar, the University of Kiel, the University of Hamburg, the Jacob's University Bremen, and the French CNRS (Biological Station of Roscoff) on this cruise.

Fig. 1: Harbor test of the ROV Kiel 6000 in Las Palmas

Our containers were released from customs later than originally planned, delaying the begin of our cruise by three days, but giving us plenty of time in Las Palmas to enjoy its lovely tapas bars and freídoras (small fish restaurants) along the beach promenade. Thanks to the hard work of the crew, the ROV was mobilized and successfully tested in the harbor in only 2.5 days. We have the ROV Kiel 6000 on board with the Kiel ROV crew and the additional support of a ROV pilot from MARUM, Bremen. We will use the ROV to dive to the 3000 m deep seafloor of the Logatchev vent field, collect samples and recover instruments we put out one year earlier during a previous SPP 1144 cruise.

On the second day of our transit to Logatchev we made a little detour to a seamount to do bathymetric mapping with the Merian's multibeam echo sounder. The seamount is interesting because it may be active, but neither plate tectonics nor what we know about hot spots can explain this activity. A ROV test dive at the seamount down to 1800 m water depth was successful and we saw hard black structures that looked like lava flows and typical seamount fauna such as sponges (Fig. 2), gorgonian sea fans, ophiorid bristle stars, and galatheid squat lobsters. A more extensive mapping of the seamount is planned during a later IFM-Geomar cruise with the RV Poseidon.

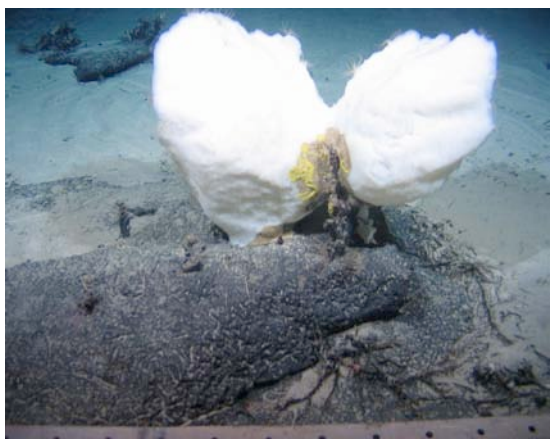


Fig. 2: Seamount sponge (copyright: IFM-Geomar)

Fig. 3: Fritz Abegg, the scientific ROV team leader, explaining the ROV Kiel 6000 to the scientists

The scientists used the 6 days transit to Logatchev to set up their labs and get their instruments and equipment ready, while the ROV crew was busy preparing the ROV for station work. In the evenings, the scientists gave talks about their research and the work they have planned for this cruise and the ROV team gave us a little introduction to the Kiel 6000 (Fig. 3).

Thanks to strong tail winds we reached Logatchev on January 17th and on the evening before celebrated our arrival (and the common birthdays of both the 1st officer and the chief scientist on that day) with a fantastic barbecue that the cook and steward prepared on the back deck of the ship.

One of our first tasks was to deploy a mooring about 5 nm away from the Logatchev vent field in 4000 m water depth (Fig. 4). The mooring is 120 m long and has instruments (5 MicroCats and 5 RCM current meters) that will continuously measure the temperature, salinity, and current velocities over the next two months. The mooring is anchored on a sill between two valleys north of the Logatchev area, and will give us a better understanding of how seafloor topography influences mixing processes in the water column near the vent field.

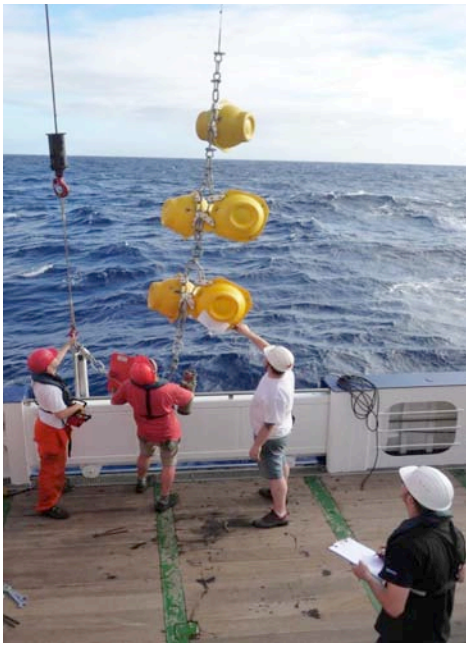


Fig. 4: The yellow buoyancy spheres are hooked on to the 100 m mooring so it will float in the water column

On the morning of the 18th we had planned our first ROV dive, but were disappointed to wake up and see no change in the weather we have been having for several days now: winds up to 7 bft and high waves. So instead, we ran CTDs and deployed 6 of 12 Ocean Bottom Seismometers that will be spread out in a grid across the Logatchev vent field to record seismic activity. These will collect data for two months and then be recovered together with the mooring during a SPP 1144 cruise with the Poseidon in March.

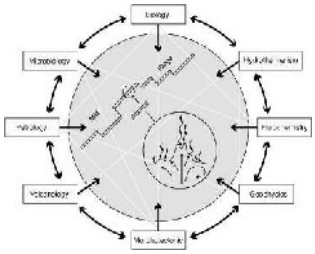
The support of the ship's crew is exceptional, they are going out of their way to help us with even our smallest requests. Aside from a few problems with queasiness at the beginning of the transit for some of our students that are on their first cruise, we are now all in good spirits, and enjoying the warm and sunny weather while hoping for calmer seas for diving.

Nicole Dubilier and the scientific crew of MSM10/3
January 18th, 2009

MSM 10/3

Jan. 11th – Feb. 13th, 2009

2nd weekly report



The second week of our Hydromar VII cruise began with quite an adventure. On the evening of January 18th we received a distress call from a couple on a 36 ft sailboat with a broken mast about 100 nautical miles (nm) away from us. The sea had been quite rough for the entire week, with winds up to 7 – 8 Bft and waves up to 4 m high. The sailboat was downwind of us, and we spent the entire night with the sailboat moving steadily ahead of us at 6 kn, as the captain of the sailboat did not want to turn the boat into the wind towards our direction for fear of the mast breaking completely, with the possibility of it then causing the boat to capsize. Although we immediately headed in their direction after getting the call, it took us almost 15 hours before we were able to sight the boat around 10 on the morning of January 19th. We had hoped to bring the sailboat along side the Merian, but the high waves made this impossible (Figure 1). As the couple had decided to abandon their boat, Captain von Staa gave the order to use the Merian's Fast Rescue Boat to bring the couple from their boat to our ship. The exhausted but otherwise healthy couple arrived safely on the Merian together with their wet luggage, and after recuperating for a few days are now learning a lot about hydrothermal vents!

Fig. 1: Sailboat rescue. The sea looks a lot calmer on this photo than it actually was!

Fig. 2: Our water chemists Marco Warmuth and Annette Heddaeus with CTD samples

We were able to resume our scientific program on January 20th. As the seas were still too rough for deploying the ROV Kiel 6000, we kept ourselves busy running CTDs, CTD Tow-yos, and MAPR Tow-yos. Our goal is to better understand how the plumes that rise from the Logatchev vents are dispersed in the water column, and how currents and tides influence this dispersal. On January 22nd we were excited to find a vent plume at 3200 m. All known vent structures at the Logatchev 1 hydrothermal vent field (LH1) where we are currently working are above 3000 m. As vent plumes on the Mid-Atlantic Ridge always rise about 200 – 400 m above their source, we now know that there must be active vents as deep as 3400 – 3600 m! We are now deploying even more CTDs and CTD Tow-yos in our hunt for these new vent sites and our poor water chemists are getting almost no sleep at all (Figure 2).

On January 25th, we were delighted to wake up to a somewhat quieter sea and were able to dive with the ROV Kiel 6000 for the first time. Although the dive was cut short after only 3 hours because of oil leakage, we were able to sample fluids for chemical and biological analyses and collect mussels for molecular and physiological measurements.

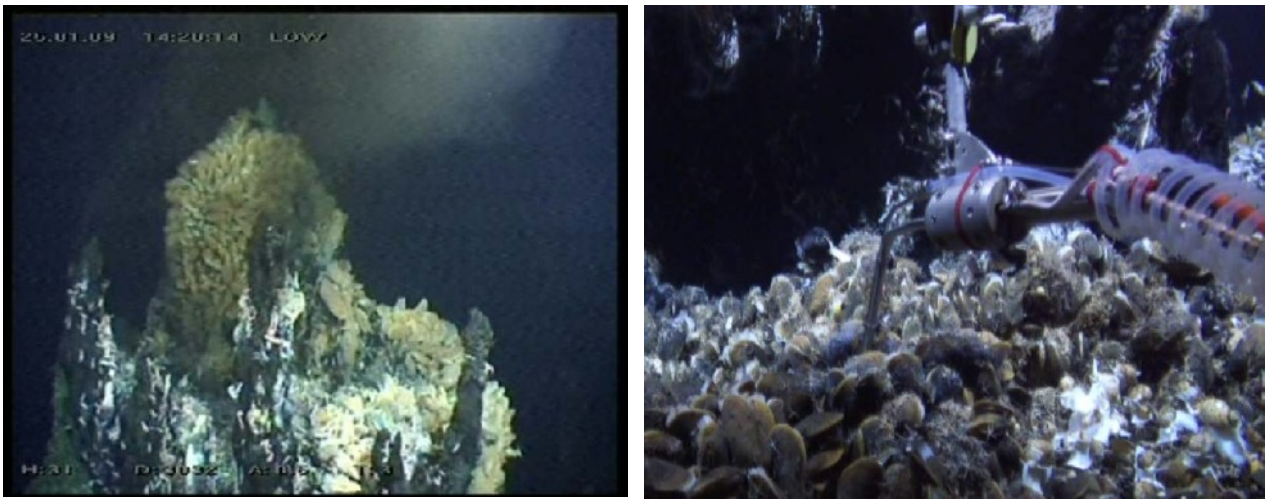


Fig. 3: Images from our ROV dive of the Logatchev hydrothermal vent field at 3030 m depth. On the left, the active smoker Irina II, and on the right, the sampling of diffuse vent fluids from a mussel bed for GB analyses (see below). Copyright: IFM-Geomar

Particularly exciting for us was the successful deployment of an in situ mass spectrometer (GB for Gas Buster). The GB was developed by Peter Girguis and Scott Wankel (Harvard University) and can measure all dissolved gases (e.g. H_2S, CH_4, H_2, O_2, CO_2, etc.) at depths down to 4000 m. Stéphane Hourdez (CNRS, Roscoff Biological Station) is our GB Master for this cruise. With his online readings of CH_4 and H_2 we can, for the first time, quickly assess while diving, which sites are strongly influenced by vent fluids and choose our samples accordingly.

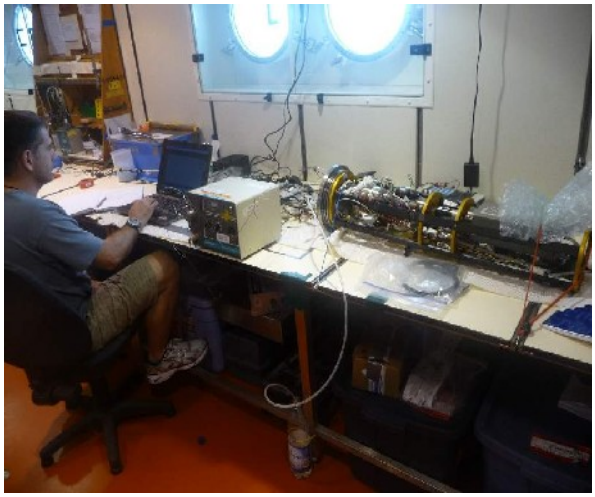


Fig. 4: Stéphane Hourdez reading out data from the in situ mass spectrometer (aka Gas Buster)

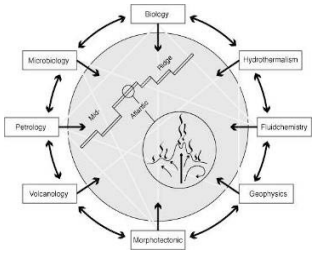
We are very much enjoying our cruise on the Merian, the ship is well designed for scientific research, the crew is incredibly helpful and supportive, and the cook is ruining our waistlines with his fantastic food.

Nicole Dubilier and the scientific crew of MSM10/3
January 25th, 2009

MSM 10/3

Jan. 11th – Feb. 13th, 2009

3rd weekly report



During the third week of our Hydromar VII cruise we learned a lot more about oceanography than we ever thought we would during this cruise. As the winds were consistently too strong at 6 – 7 Bft and the waves too high at 3, sometimes even 4 m, we were not able to deploy the ROV throughout the entire week. So we ran one CTD after another, using a variety of techniques including CTD casts, tow-yos, and jojos (Fig. 1). We are still hunting for the elusive source of methane and hydrogen in the water column at depths below 3000 m. We are now convinced that there must be active sites in the rift valley but have not yet been able to pinpoint them to a specific location.

Fig. 1: Our CTD Master, Fritz Karbe, preparing the CTD for a cast.

Fig. 2: Our cook, Waldemar Arndt, with the tuna fish for the barbecue

On January 29th we celebrated Hump Day (Bergfest) with an evening barbecue and enjoyed three different kinds of grilled fish: a magnificent tuna fish that Captain von Staa had fortuitously "organized" in Las Palmas, mackerel, and a fresh mahi-mahi caught by one of the ROV team members off the stern of the boat. Our cook (Figure 2) and the steward, Frank Liiders, outdid themselves in preparing and serving the delicious fish barbecue.

As in the week before, Sunday morning had a special present for us: the winds had quieted down overnight to 4 Bft and we were finally able to deploy the ROV again. This time, we could spend the whole day on the seafloor and successfully completed a number of objectives. We retrieved two instruments that had been left on the seafloor for

over a year: the “Ocean Bottom Pressuremeter” or OBP that monitors pressure changes in bottom waters to assess vertical displacements of the seafloor (Figure 3), and the SMoni (Smoker Monitoring Device), for monitoring the temperature of hot fluids from black smokers.

Fig. 3: Images from our ROV dive at the Logatchev hydrothermal vent field. On the left, the recovery of the OBP and on the right, the sampling of *Bathymodiolus* mussels near the active vent site Irina II. Copyright: IFM-Geomar

Mussels were collected for analyses of their symbiotic bacteria (Fig. 3 and 4) and hot fluids from the Irina II structure were sampled for chemical and microbiological analyses. The in situ mass spectrometer measurements of the hot smoker fluids (as high as 350°C) showed that these are highly enriched in hydrogen, methane, CO_2, sulfide and other reduced compounds.

Fig. 4: Processing of the collected *Bathymodiolus* mussels in the deck lab of the MS Merian

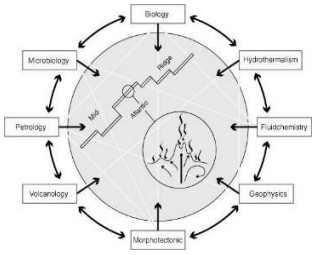
Last but not least, and as during the past two weeks, we are being well taken care of by the crew that continues to pamper us with their help, support and friendliness.

Nicole Dubilier and the scientific crew of MSM10/3
February 1st, 2009

MSM 10/3

Jan. 11th – Feb. 13th, 2009

4th and last weekly report



Our last week in the Logatchev working area began as all our previous weeks with winds too strong and seas too high for using the ROV. And as during the previous weeks, we kept ourselves busy deploying the CTD for casts, tow-yos and jojos. We have not yet been able to find evidence for a new active vent site. Instead, we regularly found methane and hydrogen in the water column at 50 – 100 m above the seafloor, even in the rift valley at depths of 4000 m. We are now trying to figure out if diffuse venting, possibly throughout large parts of the rift valley could explain the presence of methane and hydrogen just above the seafloor.

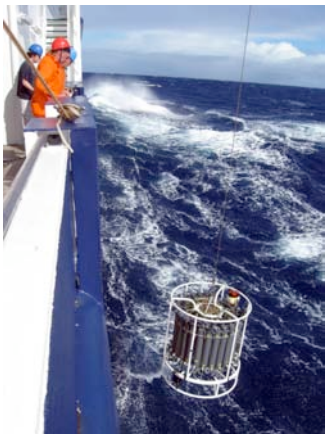


Fig. 1: CTD deployment

We spent February 2nd recovering Ocean Bottom Seismometers (OBS) that were deployed during the SPP 1144 cruise to Logatchev in December 2007 with the RV L'Atalante. These were placed in a grid on the seafloor to detect seismic activity. The working hypothesis for Logatchev is that a major fault zone connects the vent field to serpentinized host rock and the OBS data will be used to see if this hypothesis is correct.

Fig. 2: Recovery of an OBS

On Wednesday, February 4th we were up to Station Number 300 (each instrument or piece of equipment that is deployed or recovered during a cruise is given a station number) and this was apparently our lucky number! The seas calmed down enough for us to deploy the ROV and we were able to collect bacterial mats using push cores, retrieve loggers placed in a mussel bed at the Irina II structure one year ago to record temperature over long time periods, and collect samples for chemical, microbiological and biological analyses. We also recovered an Ocean Bottom Tiltmeter (OBT) that had been deployed for over a year to measure seafloor movements. By the time we were

ready to bring the ROV back to the ship, the wind had become stronger again, and the relatively high waves together with the added weight of the heavy OBT made the recovery of our ROV quite a challenge!

Fig. 3: Vent shrimp (*Rimicaris exoculata* and *Chorocaris chacei*) near vent fluids as hot as 110°C. The nozzle (held by the ROV arm) is taking up fluids for online analyses of methane, hydrogen, sulfide, oxygen and other gases using the in situ mass spectrometer. Copyright: IFM-Geomar

Thursday, Friday, and Saturday were back to the weather we came to know so well during this cruise, hot and sunny but very windy and waves too high for using the ROV. And as on both previous Sundays since we have been at Logatchev, the seas once again calmed down enough for us to dive again, and even better, Monday, our last working day of the cruise was also calm enough for using the ROV. With two full days of diving, we were able to get quite a bit of work done. We recovered the second SMoni (Smoker Monitoring Device) placed near a black smoker at Site B over a year ago for monitoring the long-term temperatures of hot fluids, collected mussels and shrimp for analyses of their symbiotic bacteria, and sampled both diffuse warm fluids and more focused hot fluids for chemical and microbiological analyses. The in situ mass spectrometer measurements of diffuse and hot fluids showed that the relationship between hydrogen, methane and temperature varies considerably between sites, indicating the presence of different fluid sources within the Logatchev vent field.

As of Monday evening, we have begun our return transit to Fort de France in Martinique. We are finishing our last experiments, and packing up the ROV and our scientific equipment for transport to Port of Spain in Trinidad and Tobago, from which the next SPP 1144 cruise with the MS Meteor to the hydrothermal vents on the southern Mid-Atlantic Ridge will begin in April of this year. We will be happy to be returning home to our much missed families and friends but will be sad to be leaving the MS Merian crew that has done such an excellent job of supporting and helping us during this cruise.

Nicole Dubilier and the scientific crew of MSM10/3
February 10th, 2009