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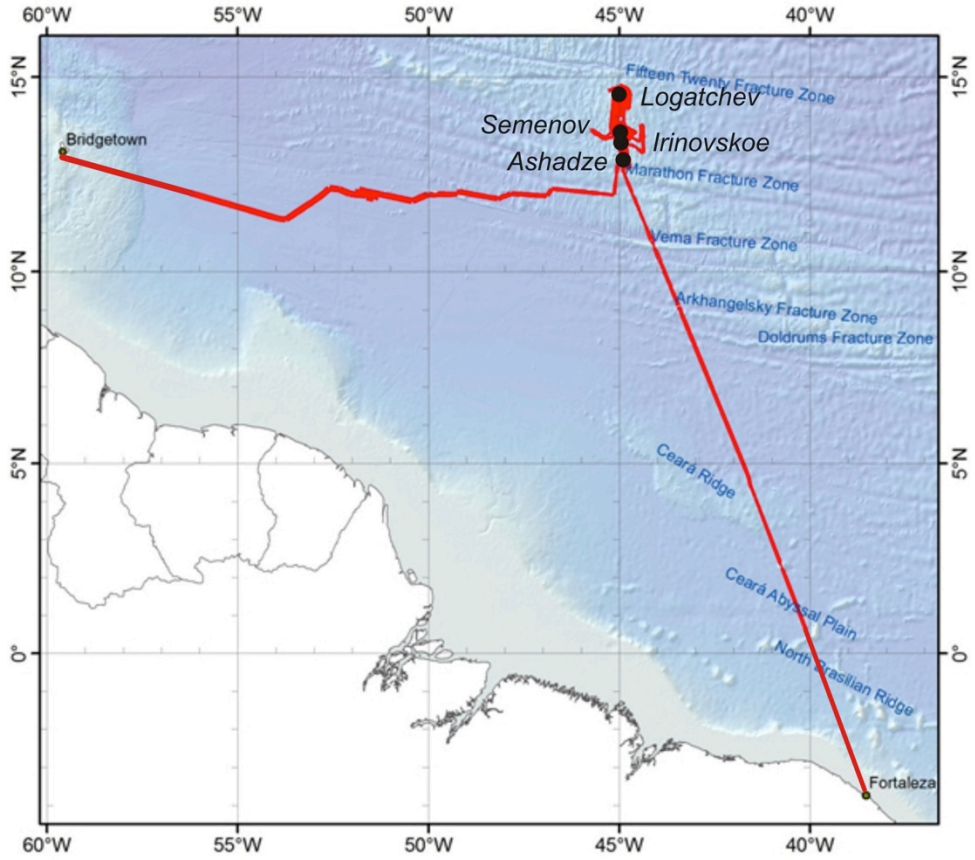
Short Cruise Report
RV METEOR M 126

Fortaleza (Brazil) – Bridgetown (Barbados)
April 18 – May 21, 2016
Chief Scientist: Prof. Dr. Nicole Dubilier
Captain: Rainer Hammacher



Objectives

The goal of this cruise was to enhance our understanding of the links between geophysical, geochemical and biological processes at hydrothermal vents. We visited four hydrothermal vent fields located between 13° N and 15° N on the Mid-Atlantic Ridge: Logatchev, Semenov, Irinovskoe and Ashadze. These four vent fields differ in their seafloor tectonics and basement rock compositions. These differences affect the distribution and composition of hot and diffuse hydrothermal fluids as well as the diversity and distribution of the biological communities. Our research focused on the following questions: What are the local geological controls on hydrothermal venting and biological communities? What are the dominant energy sources for microorgansims in the vent fluids and plume, and how do these influence the composition and distribution of the vent communities? How do viruses affect the biogeochemistry and ecology of hydrothermal vents? Our main working platform for sampling rocks, fluids and biota, and for experiments and in situ measurements was the remotely operated vehicle (ROV) QUEST from MARUM, Bremen. We also deployed a CTD/Rosette sampler equipped with Miniaturized Autonomous Plume Recorders to analyze the dimensions and the geochemistry of the hydrothermal plumes above the vent fields and to sample their microbial communities. The collected data will be analyzed in an integrative manner by an interdisciplinary team of national and international researchers to provide information on the interactions between the lithosphere, hydrosphere and biosphere of hydrothermal vents on the Mid-Atlantic Ridge.

Narrative

The R/V Meteor left Fortaleza, Brazil on April 19th, 2016 only half a day later than planned. The short delay was caused by problems with Brazilian customs as well as the late arrival of critical equipment for the cruise. The transit to our working area between 13° N and 15° N on the Mid-Atlantic Ridge took four days. On the way to the working area the scientists were busy setting up their labs and equipment, and in the evenings we had meetings to discuss the research planned during the cruise. On April 21st, the second day of the transit, we conducted a CTD cast for background values on open ocean chemistry and microbiology.

On the evening of April 23rd we arrived just south of our working area and began bathymetric mapping of the seafloor using the ship's multibeam echosounder. On April 24th, we conducted our first CTD in the working area, just above the hydrothermal vent field Semenev 2 and saw a strong signal from the vent plume. In the early afternoon of the same day, the ROV MARUM Quest successfully completed its first dive of the cruise at Semenev 2, and first *Bathymodiolus* mussel samples were collected. Bathymetric mapping of the working area was conducted throughout the night.

From April 25th – 27th, ROV work was not possible due to high swell and problems with the ROV winch. CTD casts and tow-yos were conducted during the daytime at the Irinovskoe and Logatchev vent fields, with bathymetric mapping conducted throughout the night. On April 28th, the ROV was able to dive again, and mussel samples were collected at the Irina 2 and Quest sites at Logatchev. Bathymetric mapping was conducted between Logatchev and Irinovskoe during the night.

On April 29th, a ROV dive at Irinovskoe led to the first discovery of *Bathymodiolus* mussels at this vent. After the dive, a CTD cast was conducted above the vent plume at Irinovskoe, and bathymetric mapping was done between Irinovskoe and Ashadze. On April 30th, a ROV dive at Ashadze focused on geological reconnaissance and sampling of vent fluids. At night, a CTD cast was done in the Ashadze plume, and bathymetric mapping conducted during the transit to Semenov.

On May 1st, we began the first of a series of mussel transplant experiments at Semenov using the ROV, with additional equipment brought to the seafloor with the MPI lift. Diffuse and hot fluids for geochemical and microbiological analyses were also sampled. A CTD tow-yo above a core complex 15 nm north of Semenov failed to find indications for active venting. On May 2nd, we continued our mussel transplant experiment at Semenov, and successfully deployed, for the first time, IDEFIX, an in-depth fixation device for immediate fixation of animal samples. Diffuse fluids were sampled in and around mussel beds, and hot fluids were collected from the Ash Lighthouse site. At night, an in situ pump for the collection of free-living microorganisms was deployed at Semenov.

On May 3rd, a CTD tow-yow was done above Irinovskoe, followed by a ROV dive at this vent field for geology reconnaissance, sampling of hot fluids at Active Pot, and deployment of a temperature logger (also at Active Pot). At night, bathymetric mapping was conducted between Irinovskoe and Semenov. From May 4th – 6th, we worked at Semenov, with ROV dives during the day on May 4th and 5th, CTD casts during the day of May 6th, and bathymetric mapping during all three nights. On May 5th, the bottom part of the MPI lift detached from the top part during deployment and could not be recovered.

On May 7th, the ROV dived at Logatchev for biota and fluid sampling, as well as video

surveying of the Irina II black smoker. After the dive, we did a short CTD tow-yo in the north of Logatchev, and then transited to Semenov. On May 8th, the ROV pilots had a day off, and CTD casts and tow-yos were conducted in the Semenov vent plume and across the vent field. On May 9th, the ROV dived at Semenov for continuation of mussel transplant experiments, fluid and sediment sampling, and deployment of a temperature logger at the Michelangelo chimney. After the dive, the in situ pump was deployed for collection of free-living microorganisms. After transiting to Irinovskoe, we spent the night doing a CTD tow-yo across this vent field.

From May 10th to 12th, we did ROV dives at Irinovskoe (May 10th and 12th) and Semenov (May 11th), deployed the in situ pump at Semenov (May 11th deployment, May 12th recovery), and conducted CTD casts and tow-yos as well as bathymetric mapping during the nights. On May 13th - 15th, we worked at Logatchev, where we dived with the ROV during the days of May 13th and 15th (the ROV pilots had the day off on May 14th), deployed and recovered the in situ pump, conducted CTD casts and tow-yos in the Logatchev plume and across the vent field, and did bathymetric mapping at night.

On May 16th, the ROV dived at Ashadze, where we focused on geological reconnaissance and fluid sampling. Due to bad weather, we were not able to deploy the ROV on May 17th at Logatchev as originally planned, and therefore began our transit to Bridgetown, Barbados the evening of May 16th, with a last CTD cast on May 17th. On May 18th, we successfully recovered a sediment trap mooring (4000 m cable) deployed by scientists from the Royal Netherlands Institute for Sea Research in January 2015 to investigate the effects of Saharan Dust on the Atlantic. We continued our transit to Bridgetown, and arrived there the morning of May 21st.

Acknowledgements

M126 was an interdisciplinary research cruise within the Research Area “Geo–Biosphere Interactions” of the MARUM Cluster of Excellence. We thank Captain Rainer Hammacher and the officers and crew of R/V METEOR for their very generous, friendly and professional assistance and support. Many thanks to Dr. Peter Girguis (Harvard University) for letting us use his in situ mass spectrometer. The cruise was planned and coordinated by MPI-Bremen, with the help of scientists from the involved institutes. The cruise was funded by the MARUM DFG-Research Center / Excellence Cluster “The Ocean in the Earth System” at the University of Bremen, Germany. The Leitstelle Deutsche Forschungsschiffe in Hamburg and the shipping operator (Briese Schiffahrts GmbH & Co. KG) provided technical support for the vessel to accommodate technical challenges required for sea-going operations.

Participants

Name	Discipline	Institution
Dubilier, Nicole, Prof. Dr.	Symbiosis, Chief scientist	MPI-Bremen
Bach, Wolfgang, Prof. Dr.	Geology	MARUM
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Albrecht, Sebastian	imaging	Fielax
Reeves, Eoghan, Prof. Dr.	GIS, Data management	Univ. Bergen
Shaen, Adam	Hot fluid geochemistry	Univ. Bergen
Garbe-Schönberg, Dieter,	Hot fluid geochemistry	CAU
Dr.	Trace elements, KIPS	Harvard
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Ansorge, Rebecca	Symbiosis	UGA
Sibert, Ryan	Symbiosis	Flomotion
Wendlinger, Pascal	Movie making	MPI-Bremen
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Reuter, Christian	ROV	MARUM
Büttner, Hauke	ROV	MARUM
Engemann, Greg	ROV	MARUM
Fröhlich, Siefke	ROV	MARUM
Klar, Steffen	ROV	MARUM
Mertens, Thomas	ROV	MARUM
Schade, Tobias	ROV	MARUM
Zarrouk, Marcel	ROV	DWD
Hempelt, Juliane	Bordwetterwarte	

CAU	Christian-Albrechts-Universität zu Kiel, Germany
DWD	Deutscher Wetterdienst, Geschäftsfeld Seeschiffahrt
Flomotion	Flomotion Film, München, Germany
Geomar	Helmholtz Centre for Ocean Research, Kiel, Germany
Harvard	Harvard University, Cambridge, USA
MARUM	Center for Marine Environmental Sciences, Univ. Bremen, Germany
MPI-Bremen	Max Planck Institute for Marine Microbiology, Bremen, Germany
MUN	Memorial University Newfoundland, Canada
OSU	Ohio State University, Columbis, Ohio, USA
Roscoff	Biological Station Roscoff, France
UGA	University of Georgia, Athens, USA
Univ. Bergen	University of Bergen, Norway
Univ. Bremen	University of Bremen, Germany
Univ. Hamburg	University of Hamburg, Germany

Station list

Station Meteor	Area	Research station no.	MARUM GeoB	Date (UTC)	Latitude, Longitude
M126/0484	Fortaleza	484 CAL	GeoB 21201	19.04.2016	03°20.990'S, 038°04.770'W
M126/0485	Reference CTD	485 CTD	GeoB 21202	21.04.2016	04°05.660'N, 041°26.050'W
M126/0486	S of Ashadze	486 MBES	GeoB 21203	23.04.2016	12°34.920'N, 044°53.470'W
M126/0487	Semenov-2	487 CTD	GeoB 21204	24.04.2016	13°30.820'N, 044°57.770'W
M126/0488	Semenov-2	488 ROV	GeoB 21205	24.04.2016	13°30.724'N, 044°57.822'W
M126/0489	Semenov-2	489 MBES	GeoB 21206	25.04.2016	13°32.000'N, 044°57.140'W
M126/0490	Irinovskoe	490 TOWYO	GeoB 21207	25.04.2016	13°20.903'N, 044°57.346'W
M126/0491	Irinovskoe	491 TOWYO	GeoB 21208	25.04.2016	13°19.811'N, 044°57.038'W
M126/0492	Irinovskoe	492 MBES	GeoB 21209	26.04.2016	13°24.600'N, 044°55.800'W
M126/0493	Logatchev	493 ROV	GeoB 21210	26.04.2016	14°45.160'N, 044°58.760'W
M126/0494	Logatchev	494 TOWYO	GeoB 21211	26.04.2016	14°45.561'N, 044°58.815'W
M126/0495	Logatchev	495 MBES	GeoB 21212	26.04.2016	14°49.410'N, 044°56.090'W
M126/0496	Logatchev	496 ROV	GeoB 21213	27.04.2016	14°45.169'N, 044°58.754'W
M126/0497	Logatchev	497 TOWYO	GeoB 21214	27.04.2016	14°43.195'N, 044°56.709'W
M126/0498	Logatchev	498 TOWYO	GeoB 21215	28.04.2016	14°46.839'N, 044°57.845'W
M126/0499	Logatchev	499 ROV	GeoB 21216	28.04.2016	14°45.181'N, 044°58.725'W
M126/0500	Logatchev	500 MBES	GeoB 21217	29.04.2016	14°45.060'N, 044°58.770'W
M126/0501	Irinovskoe	501 ROV	GeoB 21218	29.04.2016	13°19.993'N, 044°54.634'W
M126/0502	Irinovskoe	502 CTD	GeoB 21219	29.04.2016	13°19.954'N, 044°54.639'W
M126/0503	E of Ashadze	503 MBES	GeoB 21220	30.04.2016	13°09.370'N, 044°47.710'W
M126/0504	Ashadze-2	504 ROV	GeoB 21221	30.04.2016	12°59.514'N, 044°54.386'W
M126/0505	Ashadze	505 CTD	GeoB 21222	01.05.2016	12°59.507'N, 044°54.381'W
M126/0506	Ashadze	506 MBES	GeoB 21223	01.05.2016	12°59.880'N, 044°54.630'W
M126/0507	Semenov-2	507 LIFT	-	01.05.2016	13°30.810'N, 044°57.760'W

M126/0508	Semenov-2	508 ROV	GeoB 21224	01.05.2016	13°30.845'N, 044°57.798'W
M126/0509	Semenov-2	509 LIFT	-	02.05.2016	13°30.710'N, 044°57.440'W
M126/0510	N of Semenov	510 TOWYO	GeoB 21225	02.05.2016	13°46.953'N, 044°57.226'W
M126/0511	Semenov-2	511 ROV	GeoB 21226	02.05.2016	13°30.797'N, 044°57.791'W
M126/0512	Semenov-2	512 MOR	-	03.05.2016	13°30.818'N, 044°57.779'W
M126/0513	Irinovskoe	513 TOWYO	GeoB 21227	03.05.2016	13°17.394'N, 044°54.835'W
M126/0514	Irinovskoe	514 ROV	GeoB 21228	03.05.2016	13°20.010'N, 044°55.365'W
M126/0515	Irinovskoe	515 MBES	GeoB 21229	03.05.2016	13°19.240'N, 044°55.270'W
M126/0516	Semenov-2	516 LIFT	-	04.05.2016	13°30.720'N, 044°57.850'W
M126/0517	Semenov-2	517 MOR	GeoB 21230	04.05.2016	13°30.818'N, 044°57.779'W
M126/0518	Semenov-2	518 ROV	GeoB 21231	04.05.2016	13°30.782'N, 044°57.753'W
M126/0519	E of Ashadze	519 CTD	GeoB 21232	05.05.2016	12°58.358'N, 044°51.770'W
M126/0520	Semenov-2	520 LIFT	-	05.05.2016	13°30.800'N, 044°57.790'W
M126/0521	Semenov-2	521 POS	-	05.05.2016	13°30.800'N, 044°57.790'W
M126/0522	Semenov-2	522 ROV	GeoB 21233	05.05.2016	13°30.781'N, 044°57.772'W
M126/0523	Semenov-2	523 MBES	GeoB 21234	05.05.2016	13°30.730'N, 044°57.690'W
M126/0524	Semenov-2	524 CTD	GeoB 21235	06.05.2016	13°30.797'N, 044°57.777'W
M126/0525	Semenov-2	525 MOR	GeoB 21236	07.05.2016	13°30.750'N, 044°57.790'W
M126/0526	Semenov-2	526 MBES	GeoB 21237	07.05.2016	13°30.970'N, 044°57.980'W
M126/0527	Logatchev	527 ROV	GeoB 21238	07.05.2016	14°45.155'N, 044°58.743'W
M126/0528	Logatchev	528 TOWYO	GeoB 21239	08.05.2016	14°46.168'N, 044°57.982'W
M126/0529	Semenov-2	529 CTD	GeoB 21240	08.05.2016	13°30.827'N, 044°57.758'W
M126/0530	Semenov-2	530 TOWYO	GeoB 21241	08.05.2016	13°30.172'N, 044°57.491'W
M126/0531	Semenov-2	531 MBES	GeoB 21242	08.05.2016	13°31.700'N, 044°58.280'W
M126/0532	Semenov-2	532 ROV	GeoB 21243	09.05.2016	13°30.812'N, 044°57.743'W
M126/0533	Semenov-2	533 MOR	-	10.05.2016	13°30.832'N, 044°57.805'W
M126/0534	Irinovskoe	534 TOWYO	GeoB 21244	10.05.2016	13°19.897'N, 044°56.581'W

M126/0535	Irinovskoe	535 ROV	GeoB 21245	10.05.2016	13°20.574'N, 044°54.694'W
M126/0536	Irinovskoe	536 TOWYO	GeoB 21246	11.05.2016	13°19.940'N, 044°56.555'W
M126/0537	Semenov-2	537 MOR	GeoB 21247	11.05.2016	13°30.832'N, 044°57.805'W
M126/0538	Semenov-2	538 ROV	GeoB 21248	11.05.2016	13°30.803'N, 044°57.771'W
M126/0539	Semenov-2	539 MOR	-	12.05.2016	13°30.800'N, 044°57.760'W
M126/0540	E of Semenov	540 MBES	GeoB 21249	12.05.2016	13°31.360'N, 044°53.060'W
M126/0541	Irinovskoe	541 ROV	GeoB 21250	12.05.2016	13°19.996'N, 044°54.644'W
M126/0542	Irinovskoe	542 MBES	GeoB 21251	12.05.2016	13°21.110'N, 044°54.460'W
M126/0543	Logatchev	543 CTD	GeoB 21252	13.05.2016	14°45.161'N, 044°58.745'W
M126/0544	Logatchev	544 ROV	GeoB 21253	13.05.2016	14°45.148'N, 044°58.741'W
M126/0545	Logatchev	545 MOR	-	14.05.2016	14°45.161'N, 044°58.745'W
M126/0546	Logatchev	546 MBES	GeoB 21254	14.05.2016	14°45.060'N, 044°59.120'W
M126/0547	Logatchev	547 CTD	GeoB 21255	14.05.2016	14°45.182'N, 044°58.756'W
M126/0548	Logatchev	548 TOWYO	GeoB 21256	14.05.2016	14°46.148'N, 044°57.467'W
M126/0549	Logatchev	549 TOWYO	GeoB 21257	14.05.2016	14°47.314'N, 044°57.968'W
M126/0550	Logatchev	550 MBES	GeoB 21258	14.05.2016	14°47.270'N, 044°55.330'W
M126/0551	Logatchev	551 ROV	GeoB 21259	15.05.2016	14°45.053'N, 044°58.610'W
M126/0552	Logatchev	552 MOR	GeoB 21260	15.05.2016	14°45.161'N, 044°58.745'W
M126/0553	Logatchev	553 MBES	GeoB 21262	15.05.2016	14°45.070'N, 044°58.640'W
M126/0554	Ashadze-2	554 ROV	GeoB 21261	16.05.2016	12°59.497'N, 044°54.394'W
M126/0555	Last CTD	555 CTD	GeoB 21262	17.05.2016	11°59.750'N, 047°33.560'W
M126/0556	Vema	556 MOR	GeoB 21263	18.05.2016	11°59.910'N, 049°15.130'W