

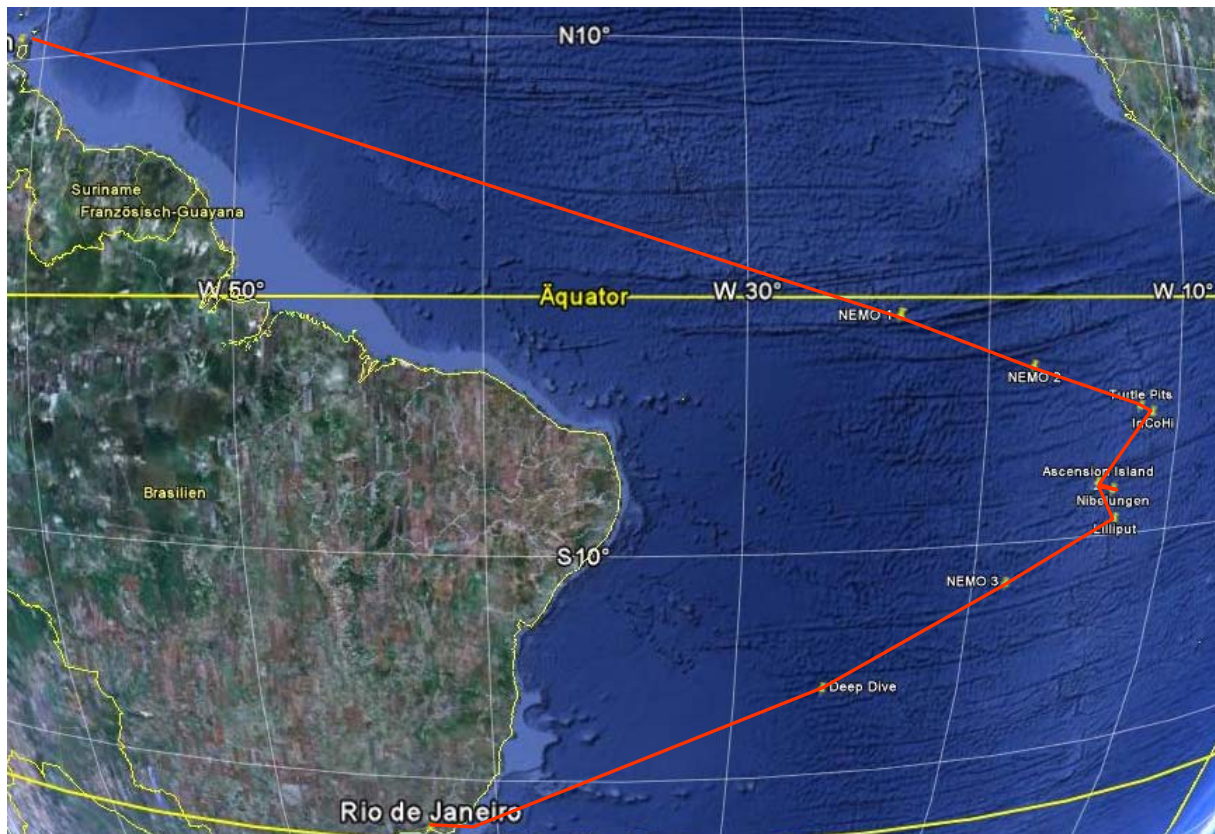
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Short Cruise Report
RV METEOR Cruise M78-2
Port of Spain (Trinidad and Tobago) – Rio de Janeiro (Brazil)
April 01.2009 – May 12.2007
Chief Scientist: Richard Seifert
Captain: Walter Baschek



Track of R/V METEOR cruise M78/2 (map: Google Earth)

Objectives and work plan

This cruise was the last scheduled within the DFG Special Priority Program 1144 to the major study sites at 5° to 11°S, on the southern Mid-Atlantic Ridge (MAR), following the investigations performed during and subsequent to cruises M62/5, CD169, M64/1, M68/1, and L'Atalante II 2008. Work focused on cross-disciplinary core questions of the SPP 1144:

- How does the energy and mass transfer from the mantle into the ocean take place?
- What are the time scales on which processes at spreading axes occur?
- How does the regional geology influence and control vent fluid composition and spatial and temporal changes in hydrothermal fluxes?

To answer these questions, a comprehensive set of data and samples was obtained from 4 hydrothermally active areas:

- Vents around 4°48'S: Found and sampled for the first time in 2004 during cruise M64/1, these vents provide a wide variety of fluid types, habitats and geological settings to investigate the linkages between magmatism, fluid circulation and ecosystems in the deep sea.
- Inside corner high at 5°S: There is mounting evidence that the deep crust also plays an important role in hydrothermal circulation and that water in the deep crust can strongly influence magmatic processes. Earlier studies during M47/2 and L'Atalante 2008 have shown the presence of good lower crustal exposures on an inside corner high just south of the 4°48'S vent fields.
- The 'Nibelungen' field hosting the 'Drachenschlund' black smoker vent found during M68/1 at 8°18' S/13°30'W in 2915 m water depth. This is one of the few known ultramafic-hosted systems, the first of its kind to be found on the southern MAR.
- Lilliput Vent Fields at 9°32'S: Discovered during M64/1, this area located in much shallower water than the 4°48'S vents provides an ideal compliment, enabling the study of the influence of water depth on hydrothermal and biological processes.

The work comprised measurements at individual vents (ROV "Kiel 6000", IFM-GEOMAR), detailed plume mapping (AUV, CTD) and integrated analysis of the flow field (CTD, moorings, AUV). The investigation of trace metals and dissolved gases (including signatures of stable isotopes) for fluids of distinct vents carried on the time series investigation started in 2005 and will contribute significantly to understand the evolution of the vent systems.

Methodologies applied to obtain data and samples were:

- A Remotely Operated Vehicle (ROV Kiel6000, IFM-GEOMAR) for ocean floor investigations and sampling of microbial mats and water samples including the application of a profiler to obtaining geochemical profiles of the upper sediment layer *in-situ*;
- an Autonomous Underwater Vehicle (AUV Abyss, IFM-GEOMAR) for plume mapping and high resolution bathymetry;

- CTD/Carousel water sampler equipped with ADCP and Back Scatter Sensor for profiling and sampling of the water column;
- Wax corer (VSR) for sampling basaltic glasses;
- Multi Beam Echo-Sounding (EM 120) surveys for bathymetry.

In total, 87 stations were performed within the 17.5 working days including 16 ROV-dives, 23 rock sampling stations (VSR), 22 water stations (CTD), and about 1000nm of profiling (multi beam echo sounding).

Short narrative of the cruise (times are ship time)

At the morning of March 30th the vanguard of the scientific party boarded R/V METEOR at Port of Spain with a delay of two days against schedule to strip the 11 containers with scientific equipment and to mobilize the ROV and the AUV. The delay was caused by a late arrival of the trans Atlantic flights and by closure of the harbour at the 29th due to a security check in preparation of the visit of Barack Obama to Trinidad. After the scientific party was completed in the evening of the 30th, the mobilization of the heavy gear and the distribution of equipment to the laboratories went quickly forward. R/V METEOR left Port of Spain harbour April 2nd for the about 3100nm long transit to the first working area at 4°48'S, MAR after a successful harbour test of the ROV. During the transit, concentrations of halogenated organic compounds were determined in air and water samples by the IfBM Uni-HH. The objective of this work, performed under the auspicious of the excellence cluster CLISAP, is to shed light on the relevance of tropical coastal zones for the atmospheric burden of halogenated molecules. FS METEOR crossed the equator in the early morning of April 11th. To avoid any hindrance of the work ahead by force majeure, we took care to enter the southern hemisphere with the whole crew being orderly baptized. At April 12th the first of three Argo Floats was launched on behalf of the BSH at 1°S, 24°W. At this opportunity, a launch and recovery test was performed using a dummy of the AUV. Also at April 12th, recording of bathymetry and water currents were started using the ship based EM 120 and ADCP, respectively. A second Argo Float was launched Easter Monday at 03°S, 18°W.

The first working area being the active hydrothermal systems of 'Turtle Pits' at 04°48'S, 012°22'W was reached April 15th. Having overcome initial problems, all scientific gear performed excellently, except for the AUV. Thus, we could meet all scientific goals until we proceeded April 24th to the Inside Corner High (ICH) located at 5°S. After a successful ROV-dive investigating the top of ICH, we moved on to Ascension Island. Having arrived at Ascension Island at sunrise of 26th, a TV team of 4 persons were embarked in exchange for 4 scientists and Meteor steamed to the hydrothermal working area "Nibelungen" with the active site "Drachenschlund", being one of the few known ultramafic-hosted active hydrothermal systems. During two ROV-dives, high quality samples of the fluids emitted with a temperature of 372°C by the "Drachenschlund" were obtained for the first time. The TV-team disembarked back to Ascension Island April 28th, and we proceeded to our last working area "Lilliput", an active hydrothermal region with common occurrence of diffuse venting accompanied by rich vent fauna and especially symbiotic mussels. Work was highlighted by several successful AUV-dives with the AUV launched during ongoing ROV-work. An extended program on the geology of the area and the biology of vent mussels was realized and we started an investigation on the influence of tides on diffuse sources and the associated

microbiology. We left “Lilliput” at noon May 3rd heading to Rio de Janeiro. The transit was paused at May 6th for a deep dive test of ROV and AUV down to 6000m water depth. While the AUV completed the planned mission at 5900m without problems, the ROV dive was terminated at 4500m due to malfunction of the propellers. FS METEOR moored in Rio de Janeiro May 11th.

Acknowledgments

We would like to thank Captain Baschek and his crew on R/V Meteor for their excellent cooperation as well as T. Ohms and D. Quadfasel at the "Leitstelle Meteor" for the professional patronage.

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List of participants:

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Huusmann, Hannes	ROV	IFM-GEOMAR
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UBU	Institut für Umweltphysik, Universität Bremen
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Univ. Münster	Geologisch-Paläontologisches Institut, Westfälische Wilhelms-Universität Münster
Schilling	Schilling Robotics, Davis, California, U.S.A.
DWD	Deutscher Wetterdienst Geschäftsfeld Seeschifffahrt

List of Stations M78/2

Station	Date	Time	Lat	Lon	Depth [m]	Gear
ME782/257	12.04.2009	15:34	01° 0,00' S	23° 59,99' W	3129	AUV
ME782/258	12.04.2009	16:36	00° 59,85' S	23° 59,39' W	3126	FLOAT
ME782/259	14.04.2009	01:27	03° 0,00' S	18° 0,05' W	4785	FLOAT
ME782/260	15.04.2009	13:06	04° 48,63' S	12° 22,40' W	2973	ROV
ME782/261	15.04.2009	15:38	04° 49,73' S	12° 20,99' W	2940	AUV-T
ME782/262	15.04.2009	16:11	04° 47,26' S	12° 21,00' W	3135	AUV-T
ME782/263	15.04.2009	16:50	04° 49,73' S	12° 23,59' W	3000	AUV-T
ME782/264	16.04.2009	01:22	04° 47,46' S	12° 22,61' W	3072	CTD/RO
ME782/265	16.04.2009	04:36	04° 48,32' S	12° 22,26' W	2969	VSR
ME782/266	16.04.2009	07:03	04° 49,41' S	12° 23,60' W		AUV
ME782/267	16.04.2009	14:50	04° 48,19' S	12° 22,32' W	2977	ROV
ME782/268	16.04.2009	17:57	04° 48,14' S	12° 22,32' W		AUV
ME782/269	16.04.2009	19:20	04° 48,49' S	12° 22,21' W	2968	VSR
ME782/270	16.04.2009	23:05	04° 47,40' S	12° 22,60' W	3087	CTD/RO
ME782/271	17.04.2009	02:31	04° 45,83' S	12° 24,85' W	2997	CTD/RO
ME782/272	17.04.2009	06:02	04° 48,27' S	12° 20,99' W	2862	VSR
ME782/273	17.04.2009	08:17	04° 48,34' S	12° 20,98' W	2867	MB
ME782/274	17.04.2009	18:08	04° 48,24' S	12° 22,34' W	2980	ROV
ME782/275	18.04.2009	01:22	04° 45,50' S	12° 23,91' W	3185	CTD/RO
ME782/277	18.04.2009	07:17	04° 44,83' S	12° 22,10' W	3230	CTD/RO
ME782/278	18.04.2009	10:06	04° 44,80' S	12° 22,91' W	3106	VSR
ME782/279	18.04.2009	12:12	04° 48,55' S	12° 22,54' W	2981	ROV
ME782/280	18.04.2009	14:51	04° 48,76' S	12° 20,99' W	2931	VSR
ME782/281	18.04.2009	18:00	04° 48,61' S	12° 22,41' W	2973	ROV
ME782/282	19.04.2009	02:37	04° 44,41' S	12° 21,00' W	3241	CTD/RO
ME782/283	19.04.2009	05:29	04° 48,50' S	12° 23,00' W	2983	CTD/RO
ME782/284	19.04.2009	06:55	04° 49,40' S	12° 23,59' W	2995	AUV
ME782/285	19.04.2009	09:52	04° 49,20' S	12° 21,72' W	2890	VSR
ME782/286	19.04.2009	12:02	04° 49,20' S	12° 21,72' W	2906	VSR
ME782/287	19.04.2009	14:46	04° 48,12' S	12° 22,36' W	2979	ROV
ME782/288	20.04.2009	01:25	04° 52,60' S	12° 23,00' W	3038	CTD/RO
ME782/289	20.04.2009	04:09	04° 52,00' S	12° 21,45' W	3162	CTD/RO
ME782/290	20.04.2009	07:03	04° 48,27' S	12° 23,61' W	2982	VSR
ME782/291	20.04.2009	09:00	04° 49,40' S	12° 23,61' W	3000	AUV
ME782/292	20.04.2009	15:04	04° 50,00' S	12° 22,20' W	2996	VSR
ME782/293	20.04.2009	17:21	04° 43,02' S	12° 21,01' W	2874	MB
ME782/294	21.04.2009	01:07	04° 51,39' S	12° 19,70' W	3106	CTD/RO
ME782/295	21.04.2009	03:54	04° 48,20' S	12° 21,80' W	2943	CTD/RO
ME782/296	21.04.2009	07:18	04° 45,60' S	12° 22,50' W	3152	VSR
ME782/297	21.04.2009	11:24	04° 47,86' S	12° 22,58' W	3018	ROV
ME782/298	21.04.2009	22:52	04° 48,67' S	12° 23,71' W	3001	CTD/RO
ME782/299	22.04.2009	01:36	04° 47,90' S	12° 20,70' W	3016	CTD/RO
ME782/300	22.04.2009	04:35	04° 45,31' S	12° 23,45' W	3155	VSR
ME782/301	22.04.2009	07:06	04° 48,90' S	12° 23,62' W		AUV

ME782/302	22.04.2009	13:20	04° 48,25' S	12° 22,33' W	2995	ROV
ME782/303	23.04.2009	03:04	04° 51,00' S	12° 22,00' W	3098	VSR
ME782/304	23.04.2009	05:43	04° 49,22' S	12° 22,19' W	2965	CTD/RO
ME782/305	23.04.2009	08:46	04° 47,14' S	12° 21,11' W	3108	AUV-T
ME782/306	23.04.2009	10:04	04° 50,06' S	12° 21,20' W	3048	AUV-T
ME782/307	23.04.2009	11:04	04° 49,95' S	12° 23,73' W		AUV-T
ME782/308	23.04.2009	14:29	04° 48,61' S	12° 22,38' W	2969	ROV
ME782/309	24.04.2009	00:04	04° 48,58' S	12° 22,40' W	2969	MB
ME782/310	24.04.2009	13:12	05° 6,09' S	11° 41,08' W	1517	ROV
ME782/311	24.04.2009	23:12	05° 7,59' S	11° 41,50' W	1894	MB
ME782/312	26.04.2009	16:32	08° 17,92' S	13° 30,42' W	2948	ROV
ME782/313	26.04.2009	22:54	08° 20,08' S	13° 35,00' W	2997	MB
ME782/314	27.04.2009	10:01	08° 17,83' S	13° 30,53' W	2886	ROV
ME782/315	27.04.2009	19:37	08° 17,06' S	13° 26,01' W	2947	MB
ME782/316	29.04.2009	05:48	09° 31,67' S	13° 11,91' W	1652	AUV-T
ME782/317	29.04.2009	06:11	09° 33,12' S	13° 11,93' W	1538	AUV-T
ME782/318	29.04.2009	09:05	09° 31,70' S	13° 12,24' W		AUV
ME782/319	29.04.2009	11:11	09° 32,85' S	13° 12,64' W	1489	ROV
ME782/320	29.04.2009	15:10	09° 32,91' S	13° 12,53' W	1489	AUV
ME782/321	29.04.2009	23:45	09° 32,85' S	13° 12,45' W	1487	CTD/RO
ME782/322	30.04.2009	01:41	09° 32,51' S	13° 14,00' W	1642	CTD/RO
ME782/323	30.04.2009	08:53	09° 31,48' S	13° 12,83' W	1522	VSR
ME782/324	30.04.2009	11:50	09° 32,63' S	13° 12,77' W	1519	ROV
ME782/325	30.04.2009	15:17	09° 33,04' S	13° 12,49' W	1510	AUV
ME782/326	30.04.2009	22:56	09° 31,86' S	13° 11,60' W	1666	CTD/RO
ME782/327	01.05.2009	00:28	09° 31,46' S	13° 11,83' W	1638	CTD/RO
ME782/328	01.05.2009	01:32	09° 29,61' S	13° 12,23' W	1724	MB
ME782/329	01.05.2009	09:48	09° 32,50' S	13° 12,57' W	1501	ROV
ME782/330	01.05.2009	11:24	09° 32,85' S	13° 12,52' W		AUV
ME782/331	01.05.2009	23:16	09° 32,30' S	13° 11,29' W	1672	CTD/RO
ME782/332	02.05.2009	03:51	09° 31,81' S	13° 12,31' W	1509	CTD/RO
ME782/333	02.05.2009	06:39	09° 30,03' S	13° 14,47' W	1785	MB
ME782/334	02.05.2009	09:46	09° 33,31' S	13° 11,84' W		AUV-T
ME782/335	02.05.2009	11:52	09° 32,82' S	13° 12,55' W	1491	ROV
ME782/336	02.05.2009	15:58	09° 33,23' S	13° 12,38' W	1465	AUV
ME782/337	03.05.2009	00:38	09° 33,10' S	13° 12,40' W	1490	CTD/RO
ME782/338	03.05.2009	02:07	09° 32,60' S	13° 12,50' W	1507	CTD/RO
ME782/339	03.05.2009	03:45	09° 32,00' S	13° 12,60' W	1533	CTD/RO
ME782/340	03.05.2009	04:50	09° 28,68' S	13° 10,49' W	2017	MB
ME782/341	03.05.2009	10:25	09° 32,99' S	13° 11,88' W	1561	AUV-T
ME782/342	04.05.2009	16:29	11° 59,99' S	18° 30,00' W	4358	FLOAT
ME782/343	06.05.2009	14:44	16° 9,26' S	26° 18,72' W	6028	ROV
ME782/344	06.05.2009	15:00	16° 9,28' S	26° 18,71' W	6029	AUV