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Short Cruise Report
METEOR M81-2c

Bridgetown - Bremerhaven
23.04 - 14.05 2010
Chief Scientist: J. Schneider v. Deimling
Captain: W. Baschek

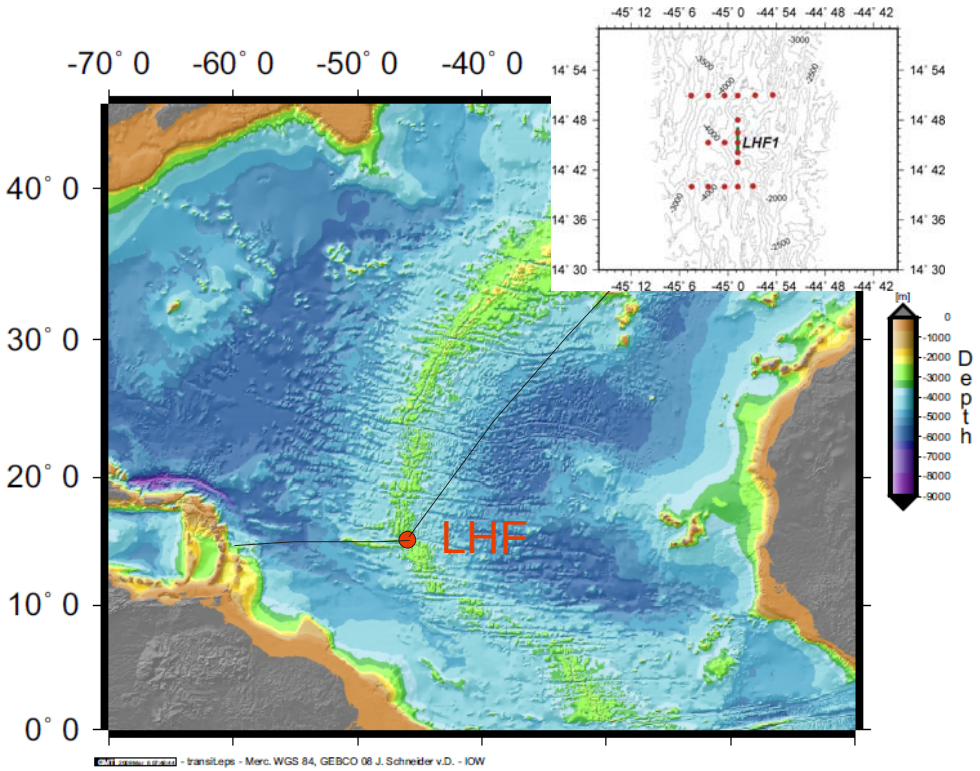

Figure 1: Bathymetric chart showing the transit area of cruise M81-2c, the Logatchev hydrothermal field (LHF) on the Mid-Atlantic Ridge, and the locations of the planed stations (inlet, red dots).

Objectives

The cruise to the Logatchev hydrothermal vent field at 14°45‘ N / 44°58.8’ W on the Mid-Atlantic Ridge is part of the DFG SPP 1144, which investigates the links between geophysical, geochemical and biological processes in hydrothermal vent areas. The Logatchev field represents one of the main study areas within the SPP 1144 and was already intensively studied on previous cruises. The Logatchev hydrothermal field is characterized by a broad spectrum of fluid compositions, hydrothermal deposits, and a highly specified fauna. Methane, hydrogen, and 3-helium are important components of submarine hydrothermal fluids of the Logatchev field.

Our objective on Meteor cruise M81/2c was to characterize the transport of methane and 3-helium within the hydrothermal plumes emitted from the vent field into the water column. Through an intensive investigation of the gas dispersion in the water column we planned to describe the concentration distribution within a distance of a few kilometers away from the sources. Coupled current measurements (LADCP, Lowered Acoustic Doppler Current Profiler) provide a description of the current regime, which strongly influences the plume dispersion. The combination of gas chemical and oceanographic datasets will provide a basis for a quantitative estimate of the gas- and fluid-emission from the field. The plume dispersion and concentration pattern will provide additional information about mixing processes and microbial CH_4-consumption rates within the plume waters. The investigation of the stable isotope composition of methane ($\delta^{13}C_{CH4}$) allows for an estimate of the microbial carbon isotope fractionation in hydrothermal plumes.

The results of the cruise are an integral part of the SPP 1144 and will help to generate a mass balance to describe the transport of matter from the mantel into the hydrosphere. Continuous hydro acoustic records during the transit and at the Logatchev field will complement existing bathymetric datasets and will be used to map the hydrothermal particle plume in the hydrothermal field.

Narrative

The cruise M81-2c served as an alternate cruise to compensate former technical failure during R/V MS Merian 10/02 and R/V Poseidon 380 in 2009. Thus the formerly planned transit of R/V Meteor from Bridgetown/Barbados to Bremerhaven was a chance to gather data for the project SPP 1144 in the Logatchev hydrothermal field (LHF). This third attempt seemed to fail in a very last moment. Even though the scientific equipment was already loaded on METEOR, 4 of 7 scientists haven’t arrived yet at the vessel in the evening of the 22th of April. With an over 50% cut in man power, the previously planned scientific program would not have been possible to be carried out. The reason for the delay was the explosive eruption of volcano Eyjafjallajökull that caused a several days lasting shutdown of virtually all European airports. Only through very much personal effort from Julia Köhler, Anna Friedrichs, Gregor Halfmann and Robin Keir, a transfer from Germany to Barbados succeeded in the very last moment before the ship had to leave the harbour of Bridgetown. At 08:00 o’clock in the morning of the 23th of April, METEOR left the harbour of Bridgetown heading eastwards to the Mid Atlantic Ridge. A maximum of 4 engines were used to reach the working area as early as possible while steaming with 10 knots against the trades. Meanwhile the scientific equipment was installed in the labs and thoroughly tested. A very limited 3 days of station work time required maximum efficiency once we had arrived in the area of interest. Thus we decided to drive a test CTD station with 4200 m depth 36 hours before reaching the working area to have some extra time for troubleshooting and for training of our four assistant students. This guaranteed the later smooth operation of day and night shifts once we had arrived at LHF. The test CTD station was successful. All sensors worked properly, and water samples were successfully analyzed for methane concentration in the clean lab.

After 3.5 days of steaming we arrived at the Logatchev hydrothermal field (LHF) at 14°45‘N and 44°58’W at 27.04 00:15 UTC. An unfavorable combination of long-periodic swell from the North and wind from the East caused heavy roll over 20° during station work, especially as the thruster of METEOR wasn’t working and maneuvering/steering the vessel into a better orientation to the swell was not possible. Nevertheless, CTD operation and careful analytical work in the lab could be conducted. The sampling strategy was to start with the southern cross-section from west to east and then to directly sample the Logatchev hydrothermal field I and II, and the northerly section. Preliminary data reveal, that the hydrothermal plume was successfully sampled (Fig. 3) with maximum methane concentration up to 119 nM at 2900 m water depth. Within the following 3 days we could complete the 18 CTD station program to sample methane and helium, to measure the water velocity with lowered ADCP, and to conduct one Parasound mapping directly above Logatchev I to leave the working area in time at the 29.04 at 18 o’clock local time.
From the 29.04 until 05.03 the deep water multibeam system 120 was logging bathymetry to spot potential new seamounts until entering the EEZ of the Azores. Logging was then restarted after leaving the EEZ of the Azores in the morning of the 7th of Mai and could be successfully continued. As predicted from our meteorologists on board, temperature of both water and air dropped by 1° per day to prepare us for arrival in Bremerhaven.

Until Saturday, METEOR was in time in regard to reaching Bremerhaven on the 13th. However, the weather had significantly worsened with up to 45 knots wind gusts and high waves. The vessel was heavily pitching and speed dropped occasionally below 4 knots. Even though the multibeam was logging, the data is very much disturbed by heavy movement of the vessel and gas bubble entrainment underneath the transducer during the recordings from Saturday and Sunday.

Fig.2: METEOR on Sunday 9th of Mai.

On Monday, the storm intensity ceased and METEOR entered the French EEZ and the European continental slope. Thus, the last mapping station 309 was finished and METEOR could steam with over 10 knots to reach the final destination Bremerhaven on the 14th of Mai 2010

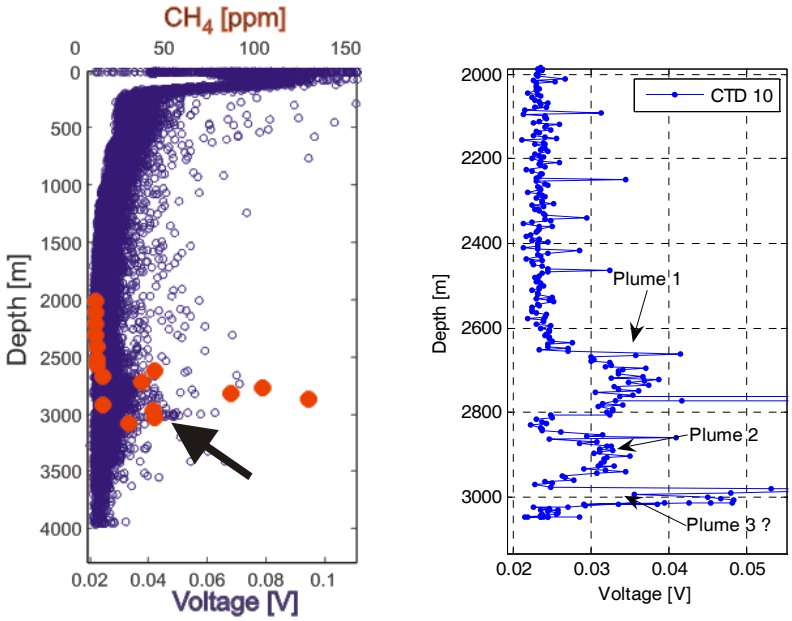

Fig.3: Raw MAPR OBS voltages and CH4 ppm values over water depth (a) shows data gathered during CTD6-CTD18 down- and upcasting. Methane concentrations are shown from CTD10 directly above LHF (red dots). The arrow indicates the positive OBS anomaly (b) shows three OBS plumes in deep water recorded during CTD10 (downcast).

Acknowledgements

We gratefully acknowledge that this cruise was passed as an alternate cruise by the METEOR control station, even though the time schedule was very tight in regard to the subsequent shipyard time in Bremerhaven. This enabled us to finally gather extra data for the project SPP 1144. The friendly and professional work of Captain W. Baschek, his officers and crew members supported us very much at any time. Once more we want to honor the great effort of our students to finally reach the vessel in time, which was very important for a successful cruise.

The work was supported by the priority program SPP 1144 of the German Science Foundation (DFG, funding number SCHM 2530/1-3) and DFG Koordinatorantrag M81 (project identification GASLOG).

Participants

1.	Jens Schneider v. D.	Chief Scientist	IOW
2.	Robin Keir	Senior scientist	IFM-GEOMAR
3.	Klaus Peter Wlost	CTD	IOW
4.	Gregor Halfmann	CTD	Uni HH, IfM-ZMAW
5.	Julia Köhler	ADCP	Uni HH, IfM-ZMAW
6.	Anna Friedrichs	ADCP	Uni HH, IfM-ZMAW
7.	Haugen Grefe	Helium	Uni Bremen
8.	Andreas Raeke	Weather Station	DWD

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-IFM-ZMAW Institut für Meereskunde Centre for Marine and Atmospheric Sciences
University of Hamburg, Germany

-IFM-GEOMAR Leibniz Institut für Meereswissenschaften
Kiel, Germany

-DWD Deutscher Wetterdienst Hamburg, Germany

Stationlist

Station	Date	Time UTC	PositionLat	PositionLon	Depth [m]	Gear/ deplo
ME814/286-1	24.04.2010	14:20	13° 46,14' N	55° 12,45' W	5234	MB 1
ME814/287-1	25.04.2010	11:30	14° 6,84' N	51° 23,05' W	5036	CTD 1
ME814/288-1	25.04.2010	14:31	14° 6,89' N	51° 22,93' W	5039	MB 2
ME814/289-1	27.04.2010	00:15	14° 41,05' N	45° 3,78' W	3786	CTD 2
ME814/290-1	27.04.2010	04:40	14° 40,83' N	45° 1,44' W	3935	CTD 3
ME814/291-1	27.04.2010	09:44	14° 40,91' N	44° 59,67' W	3916	CTD 4
ME814/292-1	27.04.2010	13:43	14° 40,95' N	44° 58,58' W	3474	CTD 5
ME814/293-1	27.04.2010	18:24	14° 40,96' N	44° 57,79' W	3423	CTD 6
ME814/294-1	27.04.2010	22:16	14° 40,94' N	44° 56,50' W	2944	CTD 7
ME814/295-1	28.04.2010	01:24	14° 41,03' N	44° 55,65' W	2616	CTD 8
ME814/296-1	28.04.2010	04:32	14° 43,01' N	44° 56,86' W	2944	CTD 9/PS 1
ME814/297-1	28.04.2010	09:40	14° 45,21' N	44° 58,70' W	3028	CTD 10/PS 2
ME814/298-1	28.04.2010	14:14	14° 47,66' N	44° 56,61' W	2911	CTD 11
ME814/299-1	28.04.2010	18:00	14° 47,93' N	44° 57,80' W	3119	CTD 12
ME814/300-1	28.04.2010	21:30	14° 47,99' N	45° 1,13' W	3945	CTD 13
ME814/301-1	29.04.2010	00:56	14° 47,98' N	44° 59,64' W	3629	CTD 14
ME814/302-1	29.04.2010	05:50	14° 48,00' N	44° 58,85' W	3383	CTD 15
ME814/303-1	29.04.2010	09:36	14° 47,91' N	45° 4,01' W	3660	CTD 16
ME814/304-1	29.04.2010	13:18	14° 50,96' N	44° 58,79' W	3469	CTD 17
ME814/305-1	29.04.2010	16:40	14° 46,46' N	44° 58,84' W	3266	CTD 18
ME814/306-1	29.04.2010	19:18	14° 45,57' N	44° 58,72' W	3131	PS 3
ME814/307-1	29.04.2010	20:15	14° 46,88' N	44° 58,99' W	3429	MB 3-PS4
ME814/308-1	29.04.2010	21:00	14° 45,53' N	44° 58,90' W	3083	MB 4