Geophysical Research Abstracts,
Vol. 10, EGU2008-A-11335, 2008
SRef-ID: 1607-7962/gra/EGU2008-A-11335
EGU General Assembly 2008

In-situ measurements of temperature, geochemical porewater composition, and microbial activity suggest that methane emission and turnover at Dvurechenskii mud volcano is controlled by upward fluid flow

T. Feseker (1,2), A. Lichtschlag (1), J. Felden (1), F. Wenzhöfer (1), D. de Beer (1), T. Ertefai (3), F. Schmidt-Schierhorn (3), A. Boetius (1,4)

(1) MPI for Marine Microbiology, Bremen, Germany, (2) IFM-GEOMAR, Kiel, Germany (tfeseker@ifm-geomar.de), (3) University of Bremen, Bremen, Germany, (4) Jacobs University, Bremen, Germany

The ascent of warm methane-rich fluids at cold seep systems creates temperature anomalies close to the seafloor and leads to the evolution of methanotrophic communities. Sulfide is produced in near-surface sediments through anaerobic oxidation of methane with sulfate that diffuses downward from the seawater into the sediment. The flux of sulfate into the sediment is limited to diffusion, as mixing by benthic animals is absent due to the anoxic bottom water. The emission and microbial turnover of methane at Dvurechenskii mud volcano in the Sorokin trough, Black Sea, was investigated in detail during the M72/2 and M72/3 cruises of RV Meteor and the ROV Quest 4000. In-situ temperature measurements using a short temperature lance operated by the ROV allowed to quickly identify a small area with high temperature gradients of up to 11 °C/m in the near-surface sediments, pointing to high rates of fluid seepage. Away from this hotspot, the temperature gradients decreased rapidly to around 0.3 °C/m at the upper flanks of the mud volcano. Close to the center of the temperature anomaly, an in-situ measurement using a benthic chamber revealed a methane emission of around 450 mmol/(m2 d) from the sediment into the water column. While sediment samples from push cores and gravity cores showed high methane concentrations throughout the mud volcano, in-situ incubation experiments (INSINC) and

ex-situ laboratory analyses yielded the highest microbial activity close to the flanks and very low activity at the hotspot. Furthermore, in-situ microprofiler measurements indicate that the sulfide efflux from the sediments into the water column is inversely correlated to the temperature gradient, suggesting that high rates of fluid flow at the hotspot hinder the microbial turnover of methane by limiting the diffusive input of sulfate from the seawater into the sediment.

This work contributes to the BMBF/DFG Geotechnologien program "Methane in the Geo/Bio System", projects MUMM and METRO.