Geophysical Research Abstracts, Vol. 7, 04184, 2005
SRef-ID: 1607-7962/gra/EGU05-A-04184

Gullfaks Seep Area: Anaerobic Oxidation of Methane in sandy Sediments

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In the Gullfaks field (about 61˚15'N, 2˚15'E), one of the three giant oil fields located at the edge of the North Sea Plateau, gas accumulations are widespread (Hovland & Judd, 1988). A content of about $1.8*10^3$ tons of methane was estimated for a single accumulate at a depth of 230 below the seabed (Judd et al, 2002). This gas reservoir has natural leakage pathways and can escape as free gas forming pockmark structures at the seafloor. As part of the EU 5th framework project METROL we were able to explore this cold vent system with a combination of sediment high resolution echo sounder, ROV and TV MUC during a cruise with RV Heincke in spring 2004. Our research area was located southwest of a gas vent field, close to the top of the plateau. Here methane is gassing out of a reservoir in an area of about 0.1sqkm. The high permeability of the coarse sand, deposited under beach-like conditions in the last glacial period averts the formation of deep pockmarks like at the slope of the Norwegian Trench.

Microbial processes oxidize most of the methane within sediment. Beggiatoa mats associated with numerous small gas vents implicate the presence of high sulfide fluxes from the anaerobic oxidation of methane (AOM). High cell numbers of anaerobic methane oxidizers and symbiotic sulfate reducers were found with highest abundances in the uppermost 10cm of the sediment. In vitro sulfate reduction and AOM rate measurements showed their high metabolic activity. The underlying sediment is of glacial origin. Because of low Eh in the ground, oxidized iron minerals were dissolved and Fe(II) is released. Due to the high production of sulfides like greigite, iron monosulfide and pyrite are precipitated in the upper sediment layers. Interestingly, the coarse

sands show ripple structures and must be regularly flushed with oxygen rich bottom waters, which would be toxic to the anaerobic communities in the surface sediments. Again, this indicates a very high microbial activity.

This poster will show results of the first microbiological cruise in this unique seep area.

References

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