Geophysical Research Abstracts, Vol. 7, 04438, 2005
SRef-ID: 1607-7962/gra/EGU05-A-04438

Methane in the seabed sediments of the south-western Baltic Sea.

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The deposition of organic material on the sea floor and its burial below the sulfate zone is the basis for a microbiological production of vast amounts of methane. Methane is an aggressive greenhouse gas when emitted into the atmosphere. The continuous methane formation in European margin sediments may lead to accumulations of free gas, to enhanced methane emission, and to complex carbonate structures.

Acoustical survey of gas bubbles in sediments combined with detailed biogeochemical studies is a potential approach to monitor the long-term organic load on the sea floor. The conceptual background is a close relationship between the sub-surface depth of sulfate penetration, the sulfate gradient and sulfate flux down to the sulfate-methane interface, and the rate of methane oxidation. As there is a stoichiometric coupling between sulfate and methane fluxes at the methane-sulfate interface, the methane gradient is a mirror image of the sulfate gradient. The methane gradient extends with depth to reach a point where the methane partial pressure exceeds the ambient hydrostatic pressure. This is the upper boundary of gas bubble occurrence, which can be detected by acoustic profiling as blanking.

Within the EU project METROL (methane flux control in ocean margin sediments) existing shallow seismic data have been interpreted from the south-western Baltic Sea, with the purpose to make a general map of the distribution of acoustic blanking, representing the distribution of methane bubbles in the sediments. The idea is thus, that the acoustic data with appropriate correction for water depth define the sub-surface position of the transitional sulfate-methane zone. This position in turn defines the sulfate

and methane fluxes and thereby allows a calculation of the methane oxidation rates.

Detailed studies have been made in order to calibrate the model concept. This includes besides acoustical data concurrent sediment coring, analysis of chemical pore water gradients and process rates in different sediment settings.

The close linkage between the geological sedimentation history and methane distribution is illustrated by a general presentation of the Baltic Sea sedimentation history. This is combined with case stories in the south-western Baltic Sea which includes the Bornholm- and Arkona sediment basins as well as the Mecklenburger Bay based on existing as well as newly acquired acoustic profiles.