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In situ and ex situ measurements in methane enriched sediments of Amon Mud Volcano (Nile Deep Sea Fan)

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Mud Volcanoes are one of the most important sources for marine methane seepage. Methane is an aggressive greenhouse gas and hence contributes to global warming. Therefore, the understanding of processes potentially influencing methane turnover, such as oxidation of methane and sulfate reduction, is crucial for constraining the methane budget. One of the main methane consuming processes at cold seep systems is the anaerobic oxidation of methane which is closely coupled to sulfate reduction and performed by consortia of archaea and bacteria. The archaeal partner seems to be the methane oxidizer and the sulfate is reduced by bacteria. These consortia are found in many seep systems all over the world.

The Nile deep sea fan is one of the largest fans in the world and numerous seep structures have been discovered on the Egyptian shelf. One of them is the Amon mud volcano (AMV) located at a water depth of 1100 m, in the eastern part of the delta. During Meteor cruise M-70/2 various habitats of the AMV were investigated and characterized by different *in situ* as well as *ex situ* methods. For our investigations of the AMV habitats mainly three *in situ* devices, the microprofiler and benthic chamber as well as a newly developed instrument for sulfate reduction rate measurements (INSINC) were used and combined with onboard methane oxidation rate measurements. Our ROV based investigations show that the AMV can be subdivided into different distinct zones. This is mainly caused by differences of gas and fluid seeping, which are influencing biotic as well as abiotic parameters.

Roughly, three different dominant habitats can be distinguished: disturbed center area,

center with bacterial mats and biogenic mounds. The inner part of the center has a very rough surface showing many cracks and steep hills. The sediment is highly gassy and gas ebullition into the water column was observed. We could not detect any sulfide in the upper sediment horizon and oxygen penetrates into the sediment indicating a penetration of seawater. In contrast the outer zone of the center, where mats of sulfide oxidizing bacteria are found above small hummocks, a shallower oxygen penetration and H2S were detected. At the outer rim of the AMV the seafloor is densely covered by biogenic mounds of up to 50 cm. These mounds consist of reduced sediments which are transported upwards by burrowing animals. Total oxygen uptake of these sediments was increased compared to other parts of the volcano due to active pumping as well as respiration of the infauna. Our data show that mud volcanoes like the AMV, are heterogeneous systems in which abiotic as well as biotic processes are strongly influenced by fluid and gas flow intensities often varying in space and time. *In situ* measurements are necessary for tracking such changes and to better characterize seep systems, especially processes influencing the methane release, which are crucial to understand the role of methane in the global carbon cycle.