Geophysical Research Abstracts, Vol. 9, 09432, 2007
SRef-ID: 1607-7962/gra/EGU2007-A-09432


# Biogeochemical processes associated with microbial mats of the Nile Deep Sea Fan pockmark area

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Recently discovered fluid-escape structures of the Nile Deep Sea Fan were investigated during the "Bionil" cruise with the German research vessel Meteor within the framework of the ESF EUROCORES EUROMARGIN project MEDIFLUX. We revisited the central zone of the Nile Deep Sea Fan discovered earlier during the NAUTINILE cruise. This zone consists of negative topographic features (pockmarks), vast carbonate pavements, highly porous crusts and sulfidic sediments covered with microbial mats. By intensive video survey of the pockmark area with the ROV Quest of MARUM (University of Bremen), a large, kidney shaped flat area of 60x100 m was discovered at the Eastern border of the shallow pockmark area (1700 m). Here dense bacterial mats cover blackish, highly reduced sediments. Microscopy revealed that the mat is mainly formed by bacteria phylogenetically associated with the Arcobacter group, which produces enormous masses of sulfur filaments by oxidation of sulfide. At cold seeps, the production of sulfide is related to anaerobic oxidation of methane (AOM) by sulfate reduction (SR). Here we tested whether most sulfide produced by AOM is either consumed by thiotrophic bacteria (e.g. Arcobacter, Beggiatoa, Thiomargerita) or geochemically scavenged by iron or manganese. Different in situ and ex situ techniques were applied: With the help of a microprofiler (MIC), on which up to 10 microsensors were mounted, the oxygen penetration depth, sulfide concentration, temperature and pH profiles were determined. Inside the mat very steep oxygen, pH and sulfide profiles were measured, indicating a high microbial activity. In additional measurements outside the mat-covered sediment, oxygen penetrated down to 3 cm and no sulfide was detected. Measurements at the border of the

mat showed intermediate values for oxygen, sulfide and pH. Parallel to the microprofiler, the oxygen uptake rates were assessed by the deployment of a benthic chamber. The results showed very high oxygen uptake rates on the bacterial mat and significantly lower oxygen uptake at the reference site just outside the mats. To elucidate the role of methane in this setting, SRR and AOM rates were assessed on retrieved cores; SRR was also measured in situ. In addition, the geochemistry of the sediments underneath the microbial mats was investigated. The combination of these different techniques will allow us to constrain the fate of methane seeping from greater depth and its linkage to other processes like sulfate reduction, microbial sulfide oxidation and iron precipitation.