



Biogeochemistry of Norwegian cold-water coral reef sediments

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Cold-water coral ecosystems may constitute a geologically significant fraction (>1%) of global carbonate production (Lindberg and Mienert, 2005). Thriving cold-water coral reefs are also considered to be hot-spots of diversity and biomass production. Nevertheless, the impacts of these ecosystems on the adjacent sediment and associated geochemical processes including carbonate preservation are poorly understood.

Here we present the first data quantifying the biogeochemical processes in modern (post-glacial) cold-water coral reef sediments. This work integrates organoclastic sulfate reduction rates, multi-element pore-water profiles and solid-phase analyses of gravity cores (8 sites at two reefs) retrieved during *R/V Polarstern* expedition ARK-XXII/1a to the mid-Norwegian cold-water coral reefs in June 2007.

The reef sediments are comprised of coral fragments embedded in loose silt or clay and biogenic debris (of 0,5 to 3,2 m thickness). The base of the coral-bearing reef sediments consists of highly compacted glacial clays. High carbonate contents (up to 75 %) and low organic carbon contents (~0,5 %) characterize the reef sediments. Pore-water Ca^{2+} , Mg^{2+} and Sr^{2+} profiles indicate that on-going carbonate precipitation dominates any carbonate dissolution. Overall microbial activity in these sediments is low; measured sulfate reduction rates are less than $1 \text{ nmol S cm}^{-3} \text{ d}^{-1}$. Pore-water analyses reveal elevated Fe^{2+} and Mn^{2+} concentrations suggesting that Fe and Mn reduction occurs. This may be the result of sulfide reacting with the available reactive

iron pool to form Fe-sulfides indicated by the absence of sulfide in the pore water. Fe and Mn reduction may also be attributed to dissimilatory microbial metal reduction. Iron reduction linked to microbial sulfate reduction may enhance diagenetic carbonate precipitation and coral preservation in these sediments as suggested for the older cold-water coral mound systems drilled in IODP Expedition 307 (Ferdelman et al., 2006). Extremely low methane concentrations ($<0,5 \mu\text{M}$) were found at all depths and sites along the Norwegian margin. This argues against a linkage between coral reef distribution and the appearance of hydrocarbon seepage as formulated by Hovland et al. (1998).