



Immunocytochemical localization of coenzyme M reductase in anaerobic methane-oxidizing archaea

C. Heller (1), M. Hoppert (2), N. Schäfer (1) and J. Reitner (1)

(1) Geoscience Center of the University of Goettingen, Germany, (2) Institut for Microbiology and Genetics, University of Goettingen, Germany, (cheller1@gwdg.de)

On the NW Black Sea shelf different carbonate build-ups associated with cold methane seepage were found. These build-ups harbour diverse microbial communities based on the anaerobic oxidation of methane (AOM), dominated by two archaeal guilds: ANME-1 (anaerobic-methane-oxidizing communities)/DSS consortia and ANME-2/greigite-bearing DSS-consortia (1). These microorganisms constitute the largest sink of methane on earth, but despite of their relevance for the global carbon cycle little is known about the biology of AOM.

It is generally accepted that the anaerobic oxidation of methane is coupled to the reduction of sulfate. Furthermore phylogenetic and biochemical analyses suggested that ANME-archaea have supposedly reversed the methanogenic pathway, where the final step is catalyzed by the methyl-coenzyme M reductase (MCR) (2,3). Immunogold labeling of microbial mats with a specific antibody against the coenzyme M reductase revealed that this specific enzyme was located in both ANME-1- and ANME-2-archaea. This is in accordance with the hypothesis that two enzymes, structurally similar to MCR from methanogens, are present in both organisms, catalyzing either methane oxidation or methanogenesis (4). The data also show that MCR-like enzymes are not only encoded in the genomes of ANME-1 and ANME-2, but are, in fact, expressed at high levels. Due to the fact that MCR is a Ni-based enzyme, it is supposed that a Ni anomaly within methane-related carbonates is a good proxy of AOM. High Ni-amounts in the methane-related carbonates mean supposedly that MCR-like enzymes are enriched within CaCO₃-forming microbial mats.

References: (1.) Reitner, J. et al. (2005). *Facies*, 51, 66-79. (2.) Hallam, S.J. et al. (2004). *Science*, 305, 1457-1462. (3.) Hoehler, T.M. et al. (1994). *Global Biogeochemical Cycles*, 8, 4, 451-463. (4.) Krüger, M. et al. (2003). *Nature*, 426, 878-881.