

Geophysical Research Abstracts
Vol. 12, EGU2010-10100-15, 2010
EGU General Assembly 2010
© Author(s) 2010



Controls on Sulfate Reduction in Shallow Submarine Hydrothermal CO₂ - Venting Sediments (Milos Island, Greece)

Elisa Bayraktarov (1), Kai Finster (1,4), Roy E. Price (2), Casey Hubert (3), and Timothy G. Ferdelman (1)

(1) Max-Planck Institute for Marine Microbiology, Celsiusstr. 1, 28359 Bremen, Germany (ebayrakt@mpi-bremen.de, tferdelm@mpi-bremen.de /0049 421 2028 690), (4) Department of Biological Sciences, Section for Microbiology, Aarhus University, Ny Munkegade 116, 8000 Aarhus, Denmark, (2) MARUM, Center for Marine Environmental Sciences, Leobener Straße 28359 Bremen, Germany , (3) School of Civil Engineering and Geosciences, Newcastle University, Newcastle upon Tyne, NE1 7RU United Kingdom

Microbial sulfate reduction is the dominant process in the anaerobic mineralization of organic matter in continental margin sediments (Jørgensen, 1982). While sulfate-reducing bacteria (SRB) are generally accepted to occur in environments of pH 6 – 8 (Widdel, 1988), recent studies have demonstrated sulfate reduction in low pH habitats like acidic lakes and rivers, areas of acid mine drainage, and CO₂-discharging hydrothermal vents. The latter are of particular interest, representing a system in which the degassing-effects of previously sequestered CO₂ can be investigated.

Incubation experiments were conducted on sediments from the low pH shallow-sea hydrothermal vent system of Palaeochori Bay, Milos Island, Greece. Abundant gas venting of CO₂ occurs throughout this bay, which lowers the pH of pore fluids adjacent to gas venting to values of ca. 5 – 6. The objective for this research was to investigate how changing pH and pCO₂ affect sulfate reduction rates in a system in which the pH is naturally reduced. The sediment in close proximity to the gas vent had an *in-situ* temperature of 75 °C (in 10 cm depth) and was covered with whitish precipitates. This sediment was compared to 1) sediment from the transition zone characterized by decreasing temperature, precipitates and increasing pH and 2) to ambient sediment showing no irregularities in terms of temperature, pH and content of precipitates.

To test the effect of pH on bulk sulfate reduction in these sediments, incubations at pH values of 3, 4, 5, 6 and 7 were performed by adjusting the pH of SRB media with 1 M phosphoric acid or NaHCO₃. In addition, the effect of CO₂-overpressure on the sulfate reduction rate was tested with respect to changing substrate. Different substrates, including H₂ and volatile fatty acids (VFA) mix which contained acetate, lactate, formate, succinate, butyrate and propionate, were added to slurries of sediment and medium (1:1.5 v/v) and sulfate reduction rates measured. Sediments not amended with external substrates showed increasing sulfate reduction rates with greater distance from the vent site. The pH optimum for sulfate reduction during 16 hours incubation at 40 °C exhibited different pH responses. Incubations of unamended transition zone sediment showed the highest rates of sulfate reduction (14 nmol cm⁻³ day⁻¹) being measured at pH 6, whereas incubation with the mixture of VFA electron donors resulted in the highest measured sulfate reduction rate being 10 nmol cm⁻³ day⁻¹ at pH 5. This may suggest that VFA electron donors stimulate a more acid-tolerant SRB population. The effects of changing CO₂ are currently being evaluated.

B.B Jørgensen. Mineralization of organic matter in the sea bed—the role of sulfate reduction. *Nature (London)*, 296, (1982) :643–645.

F. Widdel. Microbiology and ecology of sulfate- and sulfur-reducing bacteria. *In: A.J.B. Zehnder, Editor, Biology of Anaerobic Microorganisms*, Wiley, New York, NY, (1988), pp. 469-585.