Geophysical Research Abstracts, Vol. 7, 04812, 2005
SRef-ID: 1607-7962/gra/EGU05-A-04812

Organic carbon mineralization by sulfate-reducing bacteria in the oxic photic zone of microbial mats

H. M. Jonkers, N. Finke, U. Franke and D. de Beer
Max Planck Institute for Marine Microbiology, Bremen, Germany
hjonkers@mpi-bremen.de / Phone: +49 421 2028 838

Organic carbon in the oxic zone of microbial mats can potentially be respired by sulfate-reducing bacteria using either oxygen or sulfate as terminal electron acceptor. We detected highest sulfate reduction rates (65 nmol cm^{-3} h^{-1}) at the oxic/anoxic interface and still significant rates (15 nmol cm^{-3} h^{-1}) in the fully oxic top layers of an illuminated natural hypersaline microbial mat. However, in artificially grown mats with a much more extended photic zone (12 mm instead of 2 mm) no significant sulfate reduction rates could be detected in the upper oxic layers. Two-dimensional oxygen concentration measurements obtained with planar optodes, revealed that the oxic/anoxic interface of natural mats was in fact irregular. We can therefore not exclude that observed sulfate reduction in the oxic zone of natural mats was in reality a measuring artifact as parts of the underlying anoxic zone may have accidentally been included in the measurements. Culture experiments with isolated strains of sulfate-reducing bacteria from microbial mats revealed that organic carbon was oxidized under fully oxic conditions with oxygen but not with sulfate as terminal electron acceptor. Moreover, of the organic substrates that supported anaerobic sulfate reduction only few supported aerobic respiration. The latter observation thus indicates that aerobic respiration in sulfate-reducing bacteria is substrate-dependent. Interestingly, radiotracer experiments showed that cellular organic carbon incorporation rates under fully oxic conditions were significant in comparison to anoxic incorporation rates (55-80%). These experimental results suggest that sulfate-reducing bacteria potentially play an important role in organic carbon mineralization in the fully oxic photic zone of microbial mats. Whether this process in natural mats is also supported by sulfate reduction under fully oxic conditions remains enigmatic. Considering the phylogenetic diversity of dissimilatory sulfate-reducing bacteria it may well be that responsible

strains are as yet not identified and that representatives were not active in our artificially grown mats. The processes of aerobic respiration and sulfate reduction under oxic conditions by sulfate-reducing bacteria are also interesting from an evolutionary viewpoint. Representative species apparently adapted to changing environmental conditions with the rise of oxygenic photosynthesis about 2.8 billion years ago.