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Microbial Mats and Trace Metals Interaction in Surface Sediments

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Microelectrodes and optrodes can provide temporal profiles or two-dimensional images of solute's concentration but have been mainly developed for oxygen and nutrients. So far voltammetric electrodes can only measure the metals iron and manganese. Diffusive gradient in thin-films (DGT) uses a credit card size probe inserted into the sediment. Metal ions bind to a chelating resin after diffusion through a layer of polyacrylamide hydrogel. This device allows minimum disturbance of the sediment and induces a flux from the pore water that can be related to the elemental concentration in the sampled medium. Thus DGT provides a snapshot of the metal distribution in the sediment, which can be uncovered by spectrochemical analytical techniques in the laboratory. The aim of this study was to exploit the DGT methodology to investigate trace metal dynamics in microbial mats covering surface sediments. Results of DGT measurements showed that pronounced metal maxima develop at the water-microbial mat interface.Collectively, the results showed that microbial mats have a key-role in the remobilisation of metals at sediment-water interfaces. These are dynamic systems with diel variations generating strong metal concentration gradients on a small vertical scale.Temporal and regular vertical redox driven changes at the sediment-water interface suggested several mechanisms responsible for local metal remobilization: the microbially mediated oxidation of natural organic carbon and the subsequent reduction of oxyhydroxides of Fe and Mn and the microbial metabolism/catabolism itself. Photosynthetic activity did also seem to play an important role in the diffusion of redox-sensitive metals.