Geophysical Research Abstracts, Vol. 9, 04284, 2007
SRef-ID: 1607-7962/gra/EGU2007-A-04284

Dissimilatory iron reduction in estuarine sediments: microbial diversity and Fe(III) bioavailability

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A combined geochemical-microbiological approach is used to investigate enzymatic iron reduction in intertidal sediments of the polluted Scheldt estuary, Northwest Europe. Well-known metal reducers, including members of the family *Geobacteraceae* and the genus *Shewanella*, constitute only a small fraction ($\leq$ 1%) of the iron reducing community. Instead, facultative anaerobic, Fe(III) reducing *Ralstonia* and strictly anaerobic, spore-forming *Clostridium* species dominate. These species are able to utilize a variety of electron acceptors – a flexibility that may help the organisms survive in the highly dynamic estuarine sediments. The diversity and abundance of culturable Fe(III) reducers (10^4-10^5 cells g^{-1} sediment), plus high concentrations of chemically reducible solid-phase Fe(III) at the sites, implies a high potential for enzymatic Fe(III) reduction. The large build-up of pore water Fe(II) (200-300 μmol L^{-1}) above the zone of sulfate depletion further supports *in situ* enzymatic Fe(III) reduction. However, the organisms only reduce a fraction of the chemically reactive Fe(III) present in the sediments. Possible reasons for the incomplete microbial utilization of the available Fe(III) pool will be discussed.