Activity and Diversity of Ironoxidizers Obtained from Oxic-Anoxic Interfaces of an Acidic Fen

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Minerotrophic peatlands (fens) that are connected to the groundwater flow can receive Fe(II) released from surrounding soils. Fe(II) oxidizes to Fe(III) in the surface peat layers when subjected to aeration. Thus, aerobic Fe(II) oxidizing bacteria have to compete with rapid abiotic Fe(II) oxidation. However, acidic conditions and low O_2 concentrations will favour microbial processes. In this study, we investigated the activity and diversity of microaerophilic Fe(II) oxidizers along an oxic-anoxic gradient in a minerotrophic acidic fen (pH ˜4.8) located in northern Bavaria, Germany. FeS probes indicated that the oxygenated zone reached an average depth of 16 cm during the growing season followed by maximum dissolved Fe(II) concentrations (up to 160 μM) in the soil solution. Numbers of microaerophilic Fe(II)-oxidizers determined by most probable number technique (MPN) peaked in 10-to-20 cm depth with 10ˆ4 cells per gram peat, compared to 10ˆ3 and 10ˆ2 cells per gram peat in 0-to-10 cm and 30-to-40 cm depth, respectively. Thus, Fe(II) oxidizers appeared to use the opposing gradients in this fen. From 10-20 cm depth, microaerophilic Fe(II) oxidizers were cultured in softagar tubes with opposite gradients of O_2 and Fe(II) at pH 5. Microelectrode measurements in several enrichment cultures showed that microaerophilic Fe(II) oxidizers were restricted to a maximum oxygen saturation of 30 percent in the softagar. Enrichments formed a sharp rust-coloured band of cells and Fe(III) hydroxides at the oxic-anoxic interface. Amounts of microbially produced Fe(III) hydroxides were about three times higher compared to chemical oxidation. Cultured Fe(II) oxidizers were related to *Rhodopseudomonas* sp., *Acidobacterium* sp., *Gallionella* sp., and *Siderooxidans lithoautotrophicus*, a circumneutral lithoautotrophic Fe(II) oxidizer. These results suggest that Fe(II) oxidizing microorganisms can successfully compete with chemical oxidation at oxic-anoxic interfaces in the acidic fen and link Fe-oxidation to microbial Fe(III) reduction under conditions of redox fluctuations.

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