Biogeochemical Redox Cycling of Iron in Terrestrial and Aquatic Sediments

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The redox cycling of Fe in sediments and soils can influence the behavior of various organic and inorganic compounds in both aquatic and terrestrial ecosystems. The structure and function of microbial populations associated with Fe redox cycling is therefore an important topic in environmental microbiology and biogeochemistry. The energetics of iron reduction and oxidation will be discussed along with descriptions of some of the practical difficulties associated with isolation and culture of bacteria that oxidize Fe(II) at circumneutral pH under aerobic or anaerobic conditions. Many of these difficulties arise from the relatively rapid abiotic oxidation of Fe(II) by O_2 and other oxidants at circumneutral pH. The role of abiotic and biotic interactions in anaerobic Fe(II) oxidation will be discussed along with description of a continuous-flow system that minimizes artifacts of abiotic Fe(II) oxidation. Lastly, results of simple batch experiments that examined the potential for rapid, microbially-catalyzed redox cycling of Fe under anaerobic conditions will be presented. The potential for such redox cycling may lead to the development of novel microbial populations and/or communities specifically adapted to take advantage of the energy available during redox oscillations.