Effects of iron transformations on the biogeochemistry of trace elements

Andreas Voegelin (CH), Thilo Behrends (NL), Scott Johnston (AU),
Jeffrey Catalano (US) and Erik Smolders (BE)

Iron (Fe) is the most abundant redox-active metal in the Earth's crust and is of major importance with respect to trace element dynamics in many natural and engineered systems. The natural Fe cycle is controlled by redox transformations between ferrous Fe(II) and ferric Fe(III) compounds. In addition, zerovalent Fe(0) and ferrate Fe(VI) are used in engineering applications such as soil or groundwater remediation or water treatment. In many systems, the formation, transformation, aging, and dissolution of Fe-bearing solids dramatically affect the solubility, mobility, bioavailability, and toxicity of associated trace elements. Redox-sensitive trace elements may be directly oxidized or reduced by dissolved and solid-phase Fe species. Furthermore, a wide range of trace elements (metals, metalloids, oxyanions) are affected by structural incorporation into Fe phases, adsorption processes, or formation of nanoparticulate co-precipitates with Fe.