

Composition and structure of fresh and aged Fe oxidation products

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The oxidation of dissolved Fe(II) by O₂ leads to the formation of amorphous to poorly crystalline Fe(III)-precipitates. These precipitates control the fate of major and trace elements at redox-interfaces and play an important role in many natural and technical systems. Dissolved phosphate (P), silicate and Ca are major factors controlling composition and structure of fresh Fe(III)-precipitates [1, 2]. In this study, we therefore investigated (i) the effects of silicate and Ca over a wide range of P/Fe ratios on the composition and structure of fresh Fe(III)-precipitates formed by oxidation of 0.5 mM Fe(II) in bicarbonate-buffered solution at pH 7.0 and (ii) changes in precipitate composition and structure during aging for 30 days at 40 °C.

During Fe(II) oxidation, mostly lepidocrocite (Lp) is formed at initial P/Fe ratios below ~0.1. Phosphate was nearly completely co-precipitated with Fe(III) up to an initial molar P/Fe ratio of ~0.55 in the absence of Ca and ~0.75 in the presence of dissolved Ca. Above these P/Fe ratios, only amorphous Fe(III)-phosphate formed and phosphate removal was incomplete. Enhanced co-precipitation of phosphate and Ca with Fe(III) was attributed to electrostatic effects and to the formation of mixed Ca-Fe(III)-phosphates. Silicate did not interfere with the initial phosphate uptake but inhibited lepidocrocite formation at low P/Fe ratios, instead promoting the formation of hydrous ferric oxide (HFO; ferrihydrite-like polymers with limited corner-sharing linkage of Fe(III)-octahedra). Continuing Fe(III) polymerization during aging led to the remobilization of phosphate, especially in the absence of Ca and silicate. Phosphate remobilization was limited in the presence of Ca, which stabilizes mixed Ca-Fe(III)-phosphate, and especially silicate, which inhibits Fe(III) polymerization into crystalline Fe(III)-precipitates.

The results from this study form the basis for an improved mechanistic and quantitative understanding of Fe(III)-precipitate formation and trace element co-sequestration at aquatic redox-interfaces and in technical systems, for example drinking water treatment for As removal.

[1] Voegelin *et al.* (2010) *Geochim. Cosmochim. Acta* **74**, 164-186. [2] Kaegi *et al.* (2010) *Geochim. Cosmochim. Acta* **74**, 5798-5816.

The occurrence of very high-grade pyrometamorphic xenocrysts/xenoliths in the plutonic rocks of the Alvand plutonic complex, Hamedan, Iran

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The Alvand plutonic complex and a sequence of poly-metamorphic rocks are situated near to Hamedan, Sanandaj-Sirjan zone, Iran. Restites, xenoliths and xenocrysts are abundant in granitoids of the complex but they are rare in gabbroic rocks. Restitic xenocrysts of garnet, sillimanite/andalusite and cordierite which subsequently reacted with granitic magmas are common in granitoids. In gabbroic rocks, especially in a wherlitic olivine gabbro, scarce xenocrysts of andalusite occur which have been converted to sillimanite and a pelitic xenolith in this rocks has been pyrometamorphosed to a very high grade mineral assemblage (e.g. a spinel, sillimanite, mullite and sanidine-bearing assemblage). Thermometric studies have indicated that this very high grade pyrometamorphic assemblage has been formed at peak temperature of more than 1000 °C (up to 1300-1400 °C) when mafic-ultramafic host magma interacted with Al-rich xenoliths.