

Arsenic removal processes in mine drainage impacted systems

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For the last decades, great attention has been focused on the fate of arsenic released by sulfidic mine wastes weathering, since it may locally result in massive arsenic inputs to the environment due to acid mine drainage (AMD). In arsenic impacted water, sediments and soils, nanometer-sized iron-oxyhydroxysulfate and oxyhydroxide minerals have been recognized to scavenge arsenic via sorption reactions, As(III) being more mobile than As(V) in acidic conditions. Important questions however remain about the mechanisms of As oxidation and reduction reactions, and about the relative sorption affinities of As(III) and As(V)-oxyanions for complex heterogeneous nanominerals.

In the present communication, we will address major pathways for arsenic redox transformations that can be driven by either abiotic [1] [2] or microbial processes [3-6], some of which having been demonstrated to result in natural attenuation processes of arsenic polluted AMDs [1-5]. Examples will be chosen from studies using synchrotron-based X-ray absorption spectroscopy to monitor redox transformations that can be catalyzed by chemical [4], physical and biological factors [5-6]. Particular attention will be paid to the interplay between Fe(II)/Fe(III) and As(III)/As(V) redox couples in the presence or absence of oxygen, including Fenton-like processes [2]. In addition, examples of biotic redox transformations able to contribute to As sequestration by oxidized or reduced iron-containing minerals will be discussed in relation to the differing affinities of As(III) and As(V) species for specific mineral surfaces.

[1] Adra et al. (2013) *ES&T* **47**, 12784-12792. [2] Ona-Nguema et al. (2010) *ES&T* **44** (14), 5416-5422. [3] Egal et al. (2010) *Appl. Geochem.* **25**(12), 1949-1957. [4] Maillot et al. (2013) *GCA* **104**, 310-329. [5] Egal et al. (2009) *Chem. Geol.* **265**, 432-441. [6] Miot et al. (2009) *ES&T* **43**, 3315-3321.