

Comparison of arsenic and mercury release linked to iron and sulfur biogeochemical processes

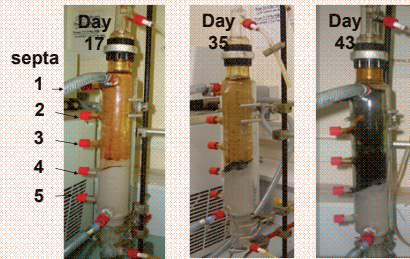
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Background

The objective is to describe with column experiments the coupling between the mineralogical transformations and the microbial processes that accounts for the mobility of arsenic and mercury in shallow aquifers

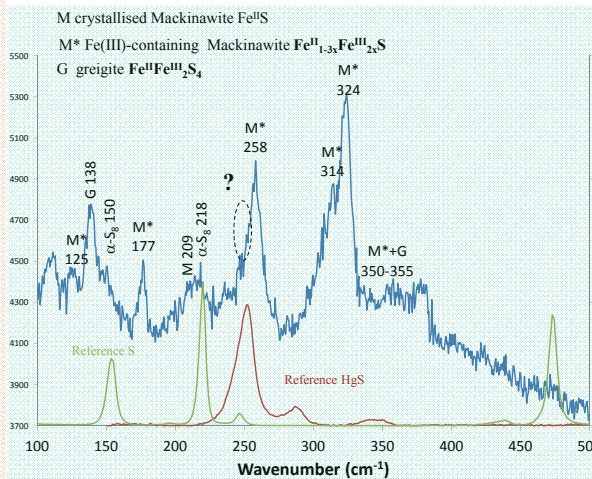
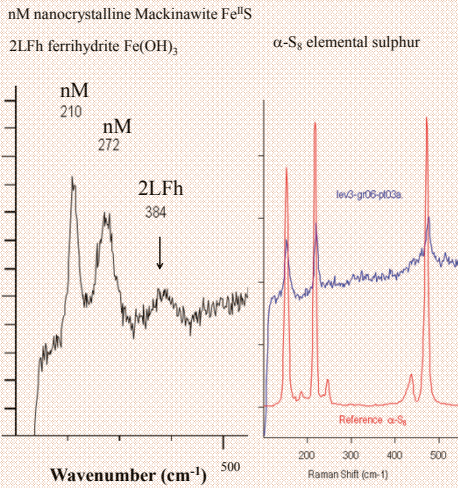
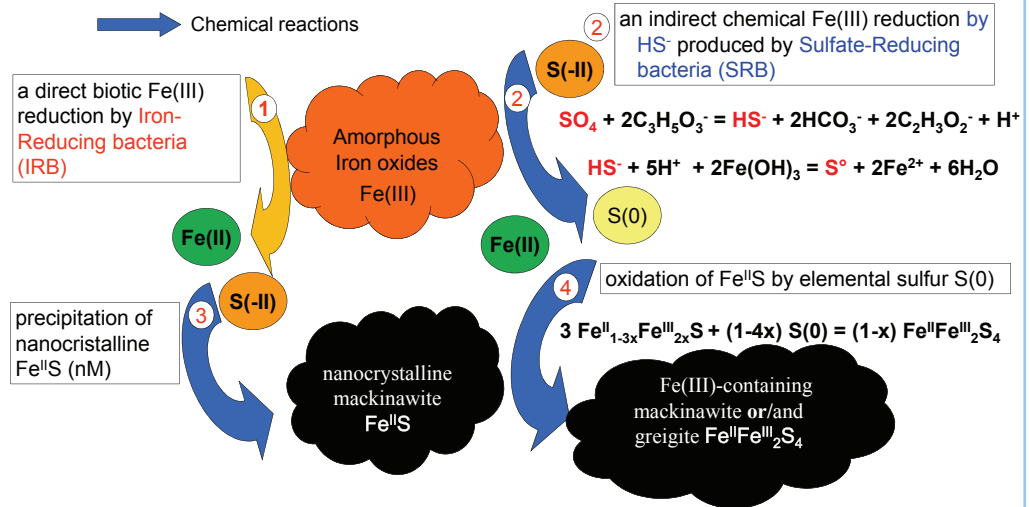
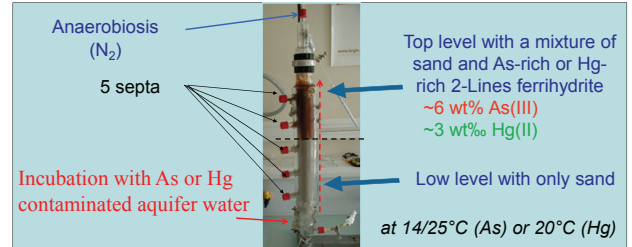
1D column with ascending flow percolation and five septa



Septum	1	2	3	4	5
	Mixture Sand/2Lfh			Sand	
Thioarsenic	+	+	++	-	-
<i>dsrAB</i> gene	+	+	+	+	+

(-) absence, (+) presence, (++) strong presence

Yellow arrow: Biotic reactions
Blue arrow: Chemical reactions



Raman Analysis

Ar laser (514.5 nm) in As exp.

Nanocrystalline mackinawite, residual amorphous 2-Lines ferrihydrite and elemental sulphur are characterized by their Raman bands.

He-Ne laser (632.8 nm) in Hg exp.

Crystallised Fe(III)-containing mackinawite, greigite Fe^{II}Fe^{III}₂S₄ and probably elemental sulphur are characterized by their Raman bands.

A broad shoulder band at around 252 cm⁻¹ could be attributed either to mackinawite, greigite or/and cinnabar HgS.

Conclusions

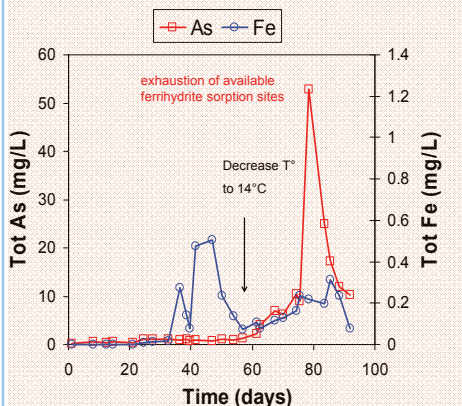
In As exp., As release is controlled mainly by the complexation with the sulfides (Thioarsenic) and the sorption on residual amorphous ferrihydrite

In Hg exp., Hg release is controlled either by sorption on sulfides like Fe(III)-containing mackinawite, greigite or/and precipitation of cinnabar HgS

Références

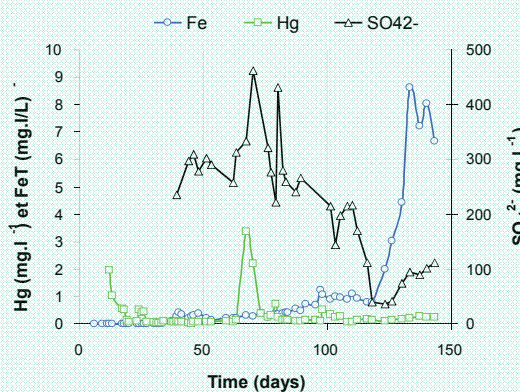
Locatelli A., Dumont E., Joulian C., Crouzet C., Garrido F., Burnol A., Battaglia-Brunet F. (2010) Mobilization of arsenic linked to sulfate-reducing activity in artificial aquifer. In "Arsenic in geosphere and Human diseases", Jean J.-S., Bundschuh J. and Bhattacharya P. Eds., Taylor & Francis Group, London. pp. 242-244.
Bourdoiseau, et al. The transformation of mackinawite into greigite studied by Raman spectroscopy. *J. Raman Spectrosc.* 2011, 42, 496-504

Mobility of As



15 % of As and only 0.001 % of Fe released after 100 d

Mobility of Hg



Hg is NOT released even after 150 d and Fe release