

CHEMICAL EQUILIBRIA BETWEEN MINES GALLERIES WATERS AND NEO-FORMED As-Fe BEARING MATERIALS.

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In natural environment, As is known to have affinity with iron oxides. Arsenic in surface river waters is mainly present as As (V) and As (III). It is potentially mobile during water-sediment interactions. In sediments, mobility of arsenic is affected by its physical and chemical forms as well as by environmental conditions (1). Especially, specific arsenates adsorption on iron oxides is favored by low pH (3 – 4).

In an abandoned mine in the French Massif Central, an As-Fe bearing ore was extracted. The tailings are located above different runoff drainage waters issued from the former galleries and others natural streams. Waters are characterized by low pH and high Eh values. They are charged in dissolved species, especially in Fe and As which precipitated when the Eh-pH conditions change (Table 1). These waters flow into a main stream in which high amounts of As and Fe were measured. Activities were calculated for Fe(II), Fe(III), As(III), As(V) and solid/solution equilibrium were established.

Very large amounts of iron oxyhydroxides precipitates, yellowish brown color, also containing small quantities of As, Si, Al and S, were observed on the stream-bed. The XRD analyses do not show crystalline forms and the microprobe analyses of these precipitates show a high degree of hydration. Waters chemical analyses show that Fe and As concentrations change with time but finally the impact on the main stream is relatively low due to successive dilutions.

These informations allowed us to estimate the fate and behavior of As and Fe in such conditions as well as understand the potential release of these elements in waters and sediments.

Table 1 : Waters characteristics (---- : not analyzed or under limit of detection)

	Date	Galleries outlet	Ru	outlet + ru = (1)	Crozafon	Crozafon + (1)
As	02/03/99	0.114	0.005	0.184	-----	-----
	31/08/99	0.0173	-----	-----	0.007	0.0122
	25/11/99	0.0147	0.023	0.015	-----	-----
Fe	29/02/00	0.197	0.009	0.0604	-----	0.0096
	02/03/99	219	2.7	42.43	-----	4.8
	31/08/99	51.29	-----	-----	0.2	10.61
	25/11/99	39.61	2.63	19.01	0.14	3.36
Eh	29/02/00	85.91	1.61	30.88	0.68	7.79
	31/08/99	476	-----	-----	250	527
	25/11/99	481	551	545	355	510
	29/02/00	535	538	530	300	495
	02/03/99	2.80	3.2	2.85	-----	3.68
E.C.	31/08/99	3.13	-----	-----	6.48	3.16
	25/11/99	3.09	3.2	3.12	5.88	3.71
	29/02/00	2.74	2.98	3.02	6.43	3.2
	02/03/99	1750	476	1520	-----	350
	31/08/99	1199	-----	-----	34	479
	25/11/99	936	619	606	42	165
	29/02/00	1610	619	857	38.3	311

1 - Mok W.M. and Wai C.M. (1994) in *Arsenic in the environment, part I : cycling and characterization*. Edited by Jerome O. Nriagu. JOHN WILEY & SONS, INC, New York, Chichester, Brisbane, Toronto, Singapore.