Arsenic Solid State Speciation in Industrially Contaminated Materials Using Microfocused (µ)
XANES and XRF
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Introduction: We investigated the arsenic solid state speciation [oxidation states (III and V) and arsenic precipitate phases] in industrially arsenic contaminated materials using in-situ µ-XANES and µ-XRF. The areas are rich in Ca and S due to disposal of the residual sulfuric acid neutralized by lime. The spatial resolution (≈15µm) from microfocused techniques have provided important information on different arsenic oxidation states in heterogeneous soil matrices. While As(V) is predominant in the samples (pH ≅ 6 and Eh<-150mV) where Fe, Ca and Ba are rich, mixtures of As(III and/or V) were detected where Ba, Ca, Fe are not concentrated. The distribution of As(V) becomes more pronounced in oxidized samples(Eh >-50mV) and it is also associated with Fe and Ba, indicating an As(V) adsorption complex and/or Ba-As(V) precipitates. The position of As(III) excitation energy (<11871eV) was similar to that of As(III)-sulfide minerals, indicating the presence of orpiment (As₂S₃) and/or realgar (AsS) like minerals instead of As(III) adsorption complexes on metal hydroxides (see figures below).

Fig. 1 Elemental mapping of arsenic Contaminated Soils (pH ≅ 6.5 and Eh ≅ -150mV)
[AS]$_1$ ≅75ppm[S]$_1$ > 450000ppm[Ba]$_1$ ≅ 2000ppm[Fe]$_1$≈74000ppm

Fig. 2 As K edge Xanes spectra at different soil matrices