

## **Biogenic Mineral Precipitation during Antimony bearing Ferrihydrite bioreduction**

ASFAW ZEGEYE<sup>1,\*</sup>, CROSBY S. CHANG<sup>2</sup>, MUSTAPHA  
ABDELMOULA<sup>3</sup> AND HAUET THOMAS<sup>2</sup>

<sup>1</sup> Université de Lorraine-CNRS LIEC UMR 7360,  
Vandoeuvre-Lès-Nancy 54506 France (\* correspondance  
asfaw.zegeye@univ-lorraine.fr)

<sup>2</sup> Université de Lorraine-CNRS IJL UMR 7198, Vandoeuvre-  
Lès-Nancy 54506 France

<sup>3</sup> Université de Lorraine-CNRS, LCPME UMR 7564, Villers-  
Lès-Nancy 54600

Fe(III) oxide such as ferrihydrite are ubiquitous in sediments and soils and due to their large surface area and reactive surface properties, they can be important sorbents of metal and metalloid such as antimony (Sb). Sorption and co-precipitation are considered to be the predominant processes by which most of the metals are scavenged by iron oxides, although co-precipitation appears to be more efficient for the removal of metals from solution. However, co-precipitated metals can be released to the surrounding environment as a direct or indirect consequence of dissimilatory iron reduction (DIR), which is a microbial reduction process of geochemical importance in natural systems. Even if DIR is often implicated in the remobilization of metals, the subsequent bio-mineralization processes can lead to their sequestration into secondary mineral products. Therefore, the aim of our study was to investigate Sb behavior during DIR. Sb-bearing ferrihydrites, with variable Sb/(Fe+Sb) molar ratios, were synthesized by coprecipitation and incubated with an iron reducing bacteria, *Shewanella oneidensis* MR1. Chemical analysis were undertaken to monitor the rate and the extent of the bioreduction and the mobilisation of Sb. Mössbauer analysis were carried out to characterize the bulk cation properties of the biogenic minerals at different temperatures. The spectra were fitted to obtain the iron oxidation state and thus the mineralogic signature of the mineral. Measurements of the magnetization with respect to applied magnetic field were also carried out at room and low temperature and coercivity, saturation magnetization and remanence data obtained from hysteresis loops. The results revealed that the presence of Sb impacted the extent of reduction but no significant difference was measured in the rate of Fe(III) reduction. Although, the precipitation of biogenic magnetite was evidenced independently of the initial Sb/(Fe+Sb) molar ratios, the biogenic magnetites displayed variable structural and magnetic properties implying an incorporation of Sb in their crystallographic structure.