

# Antimony isotope fractionation during iron(II)-mediated oxidation of antimony(III) by dissolved oxygen

JIANMING ZHU<sup>1</sup>, DECAN TAN<sup>2</sup>, HAI-BO QIN<sup>2</sup> AND HONGFEI LIAO<sup>1</sup>

<sup>1</sup>State Key Laboratory of Geological Processes and Mineral Resources, China University of Geosciences(Beijing), Beijing 100083, China

<sup>2</sup>State Key Laboratory of Environmental Geochemistry, Institute of Geochemistry, Chinese Academy of Sciences, Guiyang, 550081, China

Presenting Author: jmzhu@cugb.edu.cn

Antimony (Sb) is a toxic and carcinogenic element that was declared a priority pollutant by the Environmental Protection Agency of the United States. In aquatic environmental systems, Sb mainly exists in two oxidation states: Sb (III) and Sb (V). However, Sb (III) is unstable and easily oxidized to Sb (V) by oxidants such as the dissolved O<sub>2</sub>, H<sub>2</sub>O<sub>2</sub>, and manganese oxides in the environment. Therefore, studying Sb isotope fractionation caused by Sb (III) oxidation is significant for tracing the Sb geochemical cycle in aquatic systems and other scenarios.

Currently, Sb isotope fractionation in aqueous systems mainly focuses on adsorption processes, while Sb isotope fractionation in redox processes needs to be better reported. Here, Sb isotope fractionation during the oxidation of Sb (III) to Sb(V) was investigated through the dissolved O<sub>2</sub>, H<sub>2</sub>O<sub>2</sub>, and oxidation reaction catalyzed by Fe (II) under different experimental conditions, including pH (2, 4, 6, and 8), Fe(II) concentration (20, 40 and 60 μM/L) and ion strength (0.01, 0.05 and 0.1 mol/L NaCl). When the above oxidants oxidize Sb (III) to Sb(V), the concentration of Sb (III) gradually decreases with the increase of reaction time and follows the first-order kinetic equation. The oxidation rate of Sb (III) increases with pH decrease, and the heavy Sb isotope (<sup>123</sup>Sb) is enriched in reactant Sb (III) while the light isotope (<sup>121</sup>Sb) tend to be accumulated in Sb(V), presenting a kinetic isotope fractionation. These results contradict the observation of the U(IV) oxidation by dissolved O<sub>2</sub> [1]. The probable reason is that the kinetic isotope fractionation is predominated while the equilibrium isotope exchange is limited during oxidation. Fitting the experimental data using the Rayleigh fractionation model, the  $\epsilon^{123/121}\text{Sb}_{\text{product-reactant}}$  is estimated to be  $-0.50 \pm 0.06\%$ , unaffected by pH, ionic strength, and Fe(II) concentrations.

This work was supported the National Natural Science Foundation of China (No.41973018).

[1] Wang et al., (2015), GCA, 150, 160-170.