

# Antimony release and isotope fractionation during leaching of stibnite (Sb<sub>2</sub>S<sub>3</sub>): An experimental study

ANDREAS BENJAMIN KAUFMANN<sup>1</sup>, MARINA LAZAROV<sup>1</sup>, JURAJ MAJZLAN<sup>2</sup> AND STEFAN WEYER<sup>1</sup>

<sup>1</sup>Leibniz University Hannover, Germany

<sup>2</sup>University Jena, Germany

Presenting Author: [m.lazarov@mineralogie.uni-hannover.de](mailto:m.lazarov@mineralogie.uni-hannover.de)

In the Earth's crust, antimony (Sb) accumulates in ore deposits with stibnite as the most common Sb mineral. During weathering of the primary ores, Sb is released in the environment and forms secondary minerals. Although Sb bioavailability and transport mechanisms in soils, water, and sediments were investigated ([1] and ref. therein), only limited experimental data are available [2] [3] and the use of Sb isotope fractionation in such environments has not yet been explored.

We have performed leaching experiments with three reagents: 0.5 M HNO<sub>3</sub>, 0.05 M HCl, and 0.1 M oxalic acid on stibnite powder (0.1 g Sb) to test antimony release and isotopic fractionation. Duration of each experiment was from 10 minutes to up to 7 days at room temperature and pressure. Element concentration and isotope composition was determined for each cut. During the first 5 hours, stibnite in all reagents progressively released up to 70 µg Sb, resulting in ~0.1 ‰ higher δ<sup>123</sup>Sb in leachates than in the starting material. Until the end of the experiment, both HCl and oxalic acid constantly leached less than 100 µg of Sb, but continued to fractionate Sb isotopes by up to 0.4 ‰. In contrast, HNO<sub>3</sub> continuously dissolved up to 500 µg Sb without significant Sb isotope fractionation.

It appears that slow Sb leaching with weak acids results in the preferential mobilisation of heavier Sb isotope, potentially due to partial re-equilibration of leachate and residue. A stronger acid, such as HNO<sub>3</sub>, quantitatively dissolves stibnite and does not generate isotope fractionation.

We also measured δ<sup>123</sup>Sb in secondary Sb minerals and observed variations from -0.5 ‰ to +0.3 ‰. Only a part of this range can be explained by weak acid leaching, thus generating solutions with higher δ<sup>123</sup>Sb. Redox changes and kinetic processes during precipitation of secondary minerals may also contribute to the observed light isotopic signatures.

[1] Herath et al.(2017) Environmental Pollution 223, 545-559

[2] Biver & Shotyk (2012) Geochimica et Cosmochimica Acta 79, 127-139

[3] Biver & Shotyk (2013) Geochimica et Cosmochimica Acta 109, 268-279