Goldschmidt 2026 Abstract
https://doi.org/10.46427/gold2026.35722

Microbial processes suppress antimony release during stibnite weathering under suboxic condition

TING LU[1,2], ZENGPING NING[1,2] AND XIAO ENZONG[3]

[1]Institute of Geochemistry, Chinese Academy of Sciences
[2]University of Chinese Academy of Sciences
[3]Guangzhou University

This study investigates the geochemical behavior of antimony (Sb) during the suboxic weathering of stibnite through both chemical and microbial processes. Our study revealed that microbial process suppresses the stibnite dissolution compared to chemical processes, contrasting with established models of Sb geochemical behaviors in oxic environments. In early stages, chemical weathering group (AS) and a microbial weathering group (BS) achieved comparable aqueous Sb concentrations (~0.2 mM), yet through divergent mechanisms: AS formed passivating s′enarmontite (Sb_2O_3) coatings via rapid surface oxidation, while BS established biofilms that phys[1]ically decoupled Sb release from oxidative dissolution. In latestages, a paradigm shift occurred: AS exhibited 3-fold higher aqueous Sb (~0.6 mM) compared to BS, with >95 % Sb(V) due to Fe(II)/Fe(III) redox cycling. This process enhanced Sb(III) oxidation kinetics and promoted Sb(V)-Fe(III) oxyhydroxide coprecipitation, confirmed by XPS spectra. In contrast, BS maintained stable Sb levels (0.2 mM) with limited Sb(V) accumulation (58 %). Microbial consortia sequestered Fe(II) through enzymatic reduction, disrupting iron redox cycling and reducing Sb release. This “biogenic passivation” mechanism stabilized Sb, differing from oxic systems where biofilms typically accelerate Sb(III) oxidation. The findings improve predictions of Sb mobility in suboxic environments and suggest biofilm-mediated strategies for Sb pollution control.