

Tracing fluid-rock interactions in acid-sulfate vent fluids from back-arc basins and island arcs with Mg, Li and B isotope ratios

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The interplay between slab-derived fluxes, mantle wedge dynamics, and seafloor volcanism leads to a diverse spectrum of chemical and isotopic compositions of submarine vent fluids in back-arc basins and submerged island arcs. We analysed boron (B), lithium (Li), and magnesium (Mg) isotope ratios in acid-sulfate (magmatic) fluids from a back-arc basin (Manus Basin) and island arcs (Kermadec Arc, Tonga trench) in the Western Pacific to further understand the factors controlling chemical and isotopic compositions of these fluids in such environments.

Acid-sulfate-type fluids show $\delta^7\text{Li}$ values (+14.0 and +30‰) and $\delta^{11}\text{B}$ values (+23.0 to +38.6‰) lower than seawater. These values are higher than those of nearby black smoker-type fluids, indicating that contributions of B and Li from the volcanic basement are minor in the acid-sulfate fluids. Mg concentrations in most acid-sulfate fluids are depleted or close to seawater (52.4mmol/kg), with $\delta^{26}\text{Mg}$ values resembling seawater (-0.87‰). Fluids from the Kermadec arc, in contrast, have much higher Mg concentrations (~52 to 96 mmol/kg) and a broader range of $\delta^{26}\text{Mg}$ values, between -0.91‰ and -0.64‰.

These data support the idea that Mg in acid-sulfate fluids is commonly seawater-derived [1]. However, additional Mg in some fluids is evidently leached from the volcanic basement. Correlations of aqueous silica concentrations with B and $\delta^{11}\text{B}$ imply that leaching of B is strongly controlled by reaction temperature during water-rock interaction. In contrast, leaching of Li is independent of temperature, and Li isotope ratios in acid-sulfate fluids instead trace the intensity of basement alteration.

[1] Seewald et al. (2015) *GCA* **163**, 178-199.