Germanium/silicon ratio to trace weathering and hydrothermal contribution to element fluxes in river waters from Guadeloupe (FWI)

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Chemical weathering in volcanic islands contributes significantly to the global flux of solutes to the ocean. However, uncertainties remain regarding the hydrothermal contribution to chemical element fluxes in these regions. This impedes accurate estimates of weathering fluxes and associated atmospheric CO_2 consumption [1]. Low Cl/SO_4 and high SO_4/Na in river waters may reflect contributions from active volcanic hydrothermal systems [2]. However, these ratios are not suitable for tracing solute fluxes originating from the weathering of extinct hydrothermal systems. In addition, volcanic islands comprise age gradients of volcanic rocks influencing soil weathering intensity and hence, weathering fluxes to rivers.

Here we measure the germanium/silicon (Ge/Si) ratio in 14 hydrothermal springs and 22 rivers in Basse-Terre island in Guadeloupe, along a north-south age gradient (2.7 Ma to present), to constraint weathering intensity and hydrothermal contribution to river waters.

High Ge/Si ratios in hydrothermal springs (0.3-44.8 µmol/mol) explain the elevated Ge/Si ratios in river waters impacted by the active hydrothermal system of La Soufrière volcano (0.3-5.2 µmol/mol; low Cl/SO_4 and high SO_4/Na). Lower Ge/Si ratios in river waters with low Cl/SO_4 likely reflect weathering of an exctinct hydrothermal system (0.2-0.3 µmol/mol). The Ge/Si ratio of rivers that are not affected by hydrothermal inputs is sensitive to the weathering intensity of the parent andesite: the Ge/Si ratio is higher in rivers draining highly weathered soils (1.0 µmol/mol) than in rivers draining less weathered soils (0.1-0.4 µmol/mol).

[1] Dessert *et al.* (2009) *GCA* **73**, 148-169. [2] Gaillardet *et al.* (2011) *AJS* **311,** 851-94.