

Fractionation of $^{238}\text{U}/^{235}\text{U}$ during weathering and hydrothermal alteration

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Recently, fractionation of $^{238}\text{U}/^{235}\text{U}$ has been observed between oxic and anoxic oceanic environments [1]. To use U isotopes as a proxy to constrain mass fluxes or the redox evolution of the oceans [2], we need detailed information on the U isotope mass balance. However, U isotope fractionation during continental weathering and transport to the oceans, as well as during hydrothermal alteration (the second most important sink for U) is yet unknown.

Here, we analysed $\delta^{238}\text{U}$ of water samples from rivers of different climatic conditions, granites of different localities, five different hydrothermal fluids from the Juan de Fuca Ridge and altered oceanic crust from the Bermuda Rise, Reykjanes Ridge and Pigafetta Basin

Large rivers display an average $\delta^{238}\text{U}$ of -0.24‰ (relative to CRM-112A) which is very similar to the average value of granites ($\delta^{238}\text{U} = -0.30\text{‰}$) and basalts ($\delta^{238}\text{U} = -0.28\text{‰}$), indicating that in average only minor U isotope fractionation occurs during weathering and transport. Only smaller rivers display larger U isotope variations (between 0.01 and -0.28‰) likely monitoring U isotope variations of their bed rocks. The hydrothermal waters display a tight range of $\delta^{238}\text{U}$ (-0.28 and -0.50‰) around the seawater value of $\delta^{238}\text{U} = -0.37\text{‰}$ (modified after [1]), however, at much lower U concentration levels (0.08 to 0.24 ppb) compared to that of seawater (3.3 ppb, [1]). Also, most of the analyzed altered basalts have $\delta^{238}\text{U}$ similar to that of fresh basalts ($\delta^{238}\text{U} = -0.42$ to -0.23‰), with two notable exceptions (0.18 and 0.31 ‰). Accordingly, removal of U from the ocean water during hydrothermal alteration of the oceanic crust appears not to result in significant U isotope fractionation in most cases.

[1] Weyer *et al.* (2008) *GCA* **72**, 345–359. [2] Montoya-Pino *et al.* (2010) *Geology* **38**, 315–318.

Geochemistry in a boreal stream after a major forest fire — Implications for a changing climate

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In August 2006, a major wildfire burned 15 km² of boreal forest land near Harads, a town in the north of Sweden. The purpose of this work was to examine wildfire effects on surface water geochemistry in a boreal catchment.

In 2007, increased dissolved output of major elements Ca, K, Mg, Na and elevated conductivity was measured in a stream draining the burnt area. Repeated measurements in 2009 showed a considerable decrease in conductivity and post-fire release of major elements from the burned catchment, which was interpreted as regression towards pre-fire conditions.

A nearby stream not draining the burned area was used as a reference. Conductivity and concentrations of Ca, K, Mg & Na were 1.5 – 7 times lower compared to the burnt creek in 2007. The 2009 re-measurements showed equivalent levels of Ca & Na concentrations and conductivity in both creeks but K & Mg concentrations were still higher in the burnt creek.

The elevated concentrations in the burnt creek in 2007 were interpreted to originate from leaching ash and remainders of burnt organic material on the forest floor. The maintained elevation of K & Mg concentrations in 2009 is likely to be caused by inhibited plant uptake as the biomass was severely reduced by the fire.

Diurnal specific transport rates ($\mu\text{mol}/\text{m}^2$) in the burnt creek were 1.8 – 2.6 times higher in 2007 compared to 2009. This implies there is a potential for increased transport of major elements from boreal areas since it is likely that wildfire frequency and the extent of burned area will increase according to current climate change scenarios [1].

[1] Soja *et al.* (2007) *Global and Planetary Change* **56**, 274–296.