

Sedimentary and chemical weathering fluxes at the outlet of the granitic Strengbach catchment (Vosges massif, Eastern France)

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Understanding the relationship between chemical weathering and physical erosion rates is an important issue of Surface and Environmental Science. The determination of the relationships and parameters controlling chemical weathering and physical erosion can be achieved, among others, by comparing weathering and erosion fluxes measured at the outlet of small experimental watersheds. Astonishing is the fact, that numerous studies of chemical weathering fluxes exist and that only a few focused on erosion fluxes. This is for instance the case for the Strengbach catchment, for which geochemical budgets have been established since the mid 80ties but physical erosion rates only since very recently.

The aim of this study is to assess the physical erosion rate of the granitic Strengbach catchment (0.8 km², Vosges Massif, Eastern France) with the dissolved flux carried by the streamlet.

The results show that the erosion rate (about 5 T. km². yr⁻¹) is at least equivalent to the chemical weathering rate and could be twice depending on the weathering rate retained corrections (atmospherical, biological). They also indicate that the erosion rate based on the lonely suspended matters calculation induces an underestimation of about 30%.

On the basis of this work, it appears that the weathering and erosion budgets determined on the Strengbach catchment do not differ significantly from other granitoids catchments studied previously.

Marine Mo isotope inventory: The role of igneous rock weathering

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The marine isotope inventory strongly depends on fractionation processes during continental rock weathering and subsequent river transport. Concerning molybdenum (Mo), the riverine contribution accounts for the largest part of the marine budget (e.g. [1]). Models of oceanic Mo cycling thus strongly depend on understanding continental processes causing Mo isotope fractionation.

This study investigates the effect of igneous crustal rock weathering on aquatic $\delta^{98/95}\text{Mo}$ signals by comparing stream water and bedrock (basalt, granite, gneiss) Mo isotope data to results of laboratory leach experiments. Stream waters analyzed here are enriched in the heavy isotopes, a result in line with findings of previous studies [2-4]. To date, weathering of magmatic rocks has not been associated with resolvable Mo fractionation, as their $\delta^{98/95}\text{Mo}$ show little variability ($\delta^{98/95}\text{Mo} = -0.1$ to 0.3% , [5]). Incongruent mineral weathering and/or adsorption/resorption processes are the most likely factors to have caused the observed signals, while soil retention and adsorption of light Mo to the particulate load play a secondary role. This interpretation, based on water and bedrock samples, is supported by data of bedrock leach experiments, where leach solutions show a moderate fluctuation in $\delta^{98/95}\text{Mo}$ between 0.5 and 1% . This is nearly identical to the variability found in the stream waters (0.6-1.1%). Sulfide oxidation was proposed to be an important factor controlling stream water Mo isotopic composition in a catchment underlain by sedimentary rocks [4]. Considering that silicate rocks may contain sulfides with variable isotope signatures, their incongruent dissolution could generate the observed aqueous $\delta^{98/95}\text{Mo}$ signals.

[1] McManus *et al.* (2002) *Geochem. Geophys. Geosyst.* **3**, 1078. [2] Archer & Vance (2008) *Nature Geosci.* **1**, 597-600. [3] Pearce *et al.* (2010) *EPSL* **295**, 104-114. [4] Neubert *et al.* (2011) *EPSL* **304**, 180-190. [5] Siebert *et al.* (2003) *EPSL* **211**, 159-171.