Bio-geochemical cycles in acidic soils from a granitic watershed

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To assess transfers between vegetation, waters and minerals we studied soil litter, trees, acidic soils and soil solutions from a small granitic watershed (http://ohge.u-strasbg.fr). Leaching experiments have been preformed on soils in order to recover the adsorbed elements or those fixed in acid soluble mineral phases such as Fe- hydroxides and phosphates. The isotope data of the leachates point to the presence of important quantities of litter derived elements. With the exception of the litter, the soil (upper 50cm) is depleted in Ca due to dissolution of apatite and plagioclase. Rhabdophane appears as secondary replacement mineral of apatite. It caught up some of the mobilized LREE. The leached Ca has been removed out of this soil by soil solutions and plant uptake. Ca and Mg cycles in the upper soil profile are dominated by the vegetation causing Ca and LREE depletion in the soil solutions. Some of the LREE depletion might also be due to precipitation of rhabdophane. At the watershed scale the biological Ca removal flux is of the same order of magnitude as the weathering flux. The Sr isotopic data further indicate that also ion exchange plays a role in the transfer and migration of Ca, Mg and K. The Na cycle, however, is dominated by mineral/ solution interactions with little influence of ionic exchanges. We therefore distinguish between 1) mainly "biogenic" elements like Ca, Mg, Sr and Ba (entering the vegetation cycle) and 2) elements like Na or Al which are mainly controlled by mineral dissolution. The knowledge of all these processes finally allows to understand the geochemical signatures of stream water (especially their seasonal variations) and to evaluate the weathering rates at a watershed.

Episodic, mafic crust formation in the Slave craton, Canada

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Hf model ages of zircons provide information on the timing of new crust extraction from mantle. However, many model ages are hybrid due to mixing in the sedimentary environment. Zircons with mantle $\delta^{18}O$ values (5.0-5.6‰) [1] are more likely to preserve Hf model ages that reflect actual crust forming events.

Hf and O isotopes have been analysed in 3.9-2.8 Ga detrital zircons from the ~2.8 Ga Mesoarchean cover succesion in the Slave craton, Canada [2]. The zircons with mantle-like δO^{18} form two linear arrays in zircon crystallization age versus initial εHf plots consistent with two episodes of crust formation at ~3.45 Ga and ~3.75 Ga. Slopes of the linear arrays correspond to $^{176}Lu/^{177}Hf$ ratios of ~0.022 suggesting that the sources of the magmas from which zircons crystallized was mafic in composition. The zircons with the lowest initial εHf through time all have elevated $\delta^{18}O$ values, but they also scatter around a linear array with the slope corresponding to $^{176}Lu/^{177}Hf$ ratio of ~0.022 consistent with mafic crust deriavtion from the mantle at ~4.4-4.5 Ga. Zircons that crystallized during crust formation and crustal recycling events both show a range of initial εHf and often elevated $\delta^{18}O$ consistent with derivation of magmas from heterogenous crust composed of both unaltered, igneous and weathered, probably sedimentary rocks. Mafic crust generated in three episodes in the Slave Province was the source of magmas throughout the Archean, and zircons from Gondwana indicate that similar unaltered mafic crust could have had even longer residence times of over 1.5 Ga [3].

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[1] Valley *et al.* (2005) *Contrib. Min.Pet.* **150**, 561–580. [2] Sircombe *et al.* (2001) *EPSL* **189**, 207-220. [3] Kemp *et al.* (2006) *Nature* **439**, 580-583.