Floodplain versus mountains in the Li continental cycle: a model view

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The lithium isotopic composition (δ^7Li) of the river water is a potential tracer of the silicate weathering processes on continents. The Li released by primary mineral dissolution is incorporated during secondary clay minerals precipitation solution. This occurs with an isotopic fractionation strongly enriching the dissolved phase in ^{7}Li.

Understanding how weathering reactions and Li transportation to the littoral affect the isotopic signature of rivers is a precondition of any interpretation of the seawater δ^7Li evolution. Given the recent advances in the monitoring of large watersheds (Ganges, Amazon, Congo), it is now clear that the Li riverine signal cannot be interpreted straightforward. The spatial variability of continental-sized watershed must be modeled as accurately as possible before the δ^7Li can be used as a global weathering signal.

We build a spatially-resolved numerical model simulating the lithium isotopic composition of river water. The spatial resolution is 0.5°x0.5°, designed for large continental-scale watersheds. The model accounts for climatic and topographic conditions, erosion rates and inundated areas. It simulates for each grid element the dissolution of primary minerals, the precipitation of secondary phases and the interaction between riverine water and secondary minerals in flooding areas (accounting for Rayleigh distillation).

Applying our model to the Amazon basin, we found that the evolution of the δ^7Li of the Southern tributaries of the Amazon river can be explained by a weathering limited regime in uplands and Rayleigh distillation in flooding plains, as previoulsy proposed by Dellinger et al. [1], without caring for other factors such as the lithology. But the δ^7Li of the northern tributaries cannot be explained by this simple scenario. Indeed, high δ^7Li are reported at the outlet of the uplands, in the absence of flooding plains. For this part of the Amazon watershed, other parameters seems to control the riverine δ^7Li, potentially the lithology (possible contribution from evaporite dissolution). Given this contrasted behavior between northern and southern tributaries, our model study emphasized the complexity of interpreting the oceanic δ^7Li as a direct tracer of weathering processes in the past.

[1] Dellinger, Gaillardet, Bouchez, Calmels & Louvat (2015) *Geochim. Cosmochim. Ac* **164**, 71–93