Barium stable isotopes as a fingerprint of biological uptake and release: The case of Amazon Basin

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The surface of the Earth is a geochemical reactor where the atmosphere, biosphere, hydrosphere, and lithosphere interact in the so-called "critical zone", extending from rocks to sky. Chemical weathering in the critical zone results in the release of dissolved species then harvested by rivers, which integrate processes products at the scale of their catchment [1]. Some of the controls on weathering have been explored (such as lithology, temperature, erosion rates or source of acidity), but the role of life remains so far elusive, although plants can limit erosion, increased acid production and retain major nutrient elements (Ca, Mg, K), possibly shifting mass budget estimates from rivers.

Here we explore the possibility of using barium (Ba) and its isotopes as a tracer of rock-derived nutrients within the critical zone, as Ba isotopes have been shown to be influenced by biological activity in soils [2]. We set out to extend the use of Ba isotopes as a tracer of biological activity, at the scale of the Amazon Basin, using a mass balance approach between critical zone materials (river sediment and dissolved load). This work also allows us to address the global controls on the dissolved Ba isotope signature delivered to the ocean, which is relavent for the use of Ba isotopes to study paleo-biological productivity [3].

In particular, we calculate the Ba uptake by / release from the biosphere, discuss the possible relationships of the biosphere Ba budget with the denudation regime, and explore ways to include the role of the biosphere as a major element pool when estimating rivers mass budgets.

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[2] Bullen *et al., Chem. Geol*. 422, 25-45, 2016.
[3] Horner *et al., EPSL. 430*, 511-522, 2015.