Zinc dynamic across the Rio Negro basin: constraints from Zn isotopes

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The global Zn cycle at the Earth's surface is today well described [1]. Its is strongly impacted by interactions with biological and/or mineral constituents and unfortunately, mechanisms that control these interactions and consequently Zn transport in ecosystems like soils or rivers remain poorly documented.

This study describes the Zn behaviour along the Negro River, the 7th world river according to its discharge. Its high amount of organic matter, its acidic pH and the highly weathered soils on which it runs make the Rio Negro a perfect candidate to examine Zn interactions and transport across an entire basin. To trace sources [2] and/or chemical processes [3,4] we have analyzed Zn isotope compositions, in river particles and colloids (5kDa-0.2 μm) from the Rio Negro and tributaries as well as in soil profiles during two hydrological periods. Two distinct Zn dynamic are observed.

A/ In colloids, a constant δ^{66}Zn signature in time and throughout the basin (0.15±0.05 ‰), reveals a lack of fractionation during Zn complexation on organic colloids whatever their origin.

B/ In river particles, the δ^{66}Zn signature is more variable and can reflect a mixing between: ***1)*** waters draining podzol with a similar δ^{66}Zn than in colloids due to the organic nature of the particles. ***2)*** lateritic outputs providing light δ^{66}Zn (-0.3±0.1 ‰) and inherited from crystalline Zn found in kaolinite clay derived from laterites.

So, in the basin, Zn isotopes prove that altered soils are the direct Zn suppliers in the Negro River. As most of the Zn is transferred as organic colloids (95%), and independently of distinct weathering conditions, podzol and laterites provide a Zn colloidal material fairly constant in terms of concentration and Zn isotopic signature to the Amazon River.

[1] Rauch et al. (2009) Glob. Biogeochem. Cy, 23(2), [2] Chen et al. (2008) ES&T, 42(17), [3] Jouvin et al. (2009) ES&T, 43(15), [4] Guinoiseau et al. (2016) ES&T, 50(4).