Ni and δ^{60}Ni controls by colloidal complexation and secondary oxide precipitation: new insights from the Amazon Basin

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Observations for Ni, like for many other transition metals, suggest that the dissolved load of oceans (<0.45µm) is isotopically heavier than the dissolved load of rivers, themselves isotopically heavier than the upper continental crust (UCC) [1-3]. One possible solution to this budgetary problem would be the presence of isotopically light sinks in the particulate equivalent of the dissolved phase of both oceans and rivers.

We present results from a multi-season study of different transport phases within the Amazon River. The dissolved phase (<0.45µm) was membrane filtered while tangential flow was used to separate colloidal (>1kDA, <0.45µm) from truly dissolved (<1kDa) material. Furthermore, the particulate fraction (>0.45µm) was sequentially extracted to isolate discrete particulate phases (e.g. organic material and Fe-Mn oxides).

Nickel is enriched in the colloidal phase, which, in association with the precipitation of secondary Fe-Mn oxides, controls its mobility and isotopic signature. Colloidal and truly dissolved Ni are not isotopically distinct from each other but do show contrasts between weathering regimes. Less intense chemical weathering is associated with dissolved fractions similar to previously measured average world rivers [3], while intense chemical weathering is associated with isotopically light dissolved fractions, similar to average UCC [4]. During the Amazon dry season, dissolved load δ^{60}Ni is controlled by the precipitation of isotopically light Ni with Fe-Mn oxides, the magnitude of which is a function of the fraction of Ni precipitated and the pH. At the highest pH of the Amazon, 7.5, the river's δ^{60}Ni reaches 1.4‰, equivalent to the modern average deep ocean.

[1] Archer and Vance (2008) *Nature Geoscience* 1, 597-600. [2] Vance et al., (2008) *EPSL*, 274, 204-213. [3] Cameron and Vance (2014) *EPSL*, 128, 195 – 211. [4] Cameron et al., (2009) *PNAS*, 106, 10944-10948.