Phase partitioning of transition metals and their isotopes in the particulate load of the Amazon River

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The dissolved load of transition metals in rivers and oceans is commonly isotopically heavy relative to the upper continental crust [1-3]. A possible explanation for this could be the preferential partitioning of light isotopes into secondary phases in the weathering environment. This signal is then transported in the particulate load of rivers, the labile portion, of which may be mobile in the marine environment.

We present results from a detailed study of transition metals and their isotopes for these particulate phases in rivers from the Amazon Basin. Up to 87% of metals are associated with Fe-Mn oxide coatings, in agreement with previous studies [4]. Initial leaching of the most labile Cu and Zn is associated with release of heavy Cu and Zn isotopes (δ^{65}Cu from 0.78 to 1.45‰, δ^{66}Zn from 0.77 to 0.90‰), followed by higher concentrations and lighter signatures associated with Fe-Mn oxides (δ^{65}Cu from -0.35 to 1.11‰, δ^{66}Zn = 0.15 to 0.38‰), consistent with recent studies of soils [5]. In agreement with [2], Cu associated with the oxide fraction is isotopically lighter than the complementary dissolved load ($\Delta_{ox - diss}\delta^{65}$Cu = -0.03 to -1.67‰). In contrast to Cu and Zn, initial Fe dissolution is marked by light isotope enrichment, while higher concentrations and heavier δ^{56}Fe are associated with the oxide phase, in agreement with previous studies [6].

Understanding the dissolved – particulate interaction of transition metals and their isotopes has important implications for oceanic mass balance and application of these systems to Earth history.

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