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Geochemical behavior of rare earth elements and other trace elements in the Amazon River

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Rivers transport large amounts of dissolved and suspended particulate material from the catchment area to the oceans and are a major source of trace metals to seawater. The Amazon River is the world's largest river and supplies approximately 20% of the oceans' freshwater (Molinier et al., 1997). However, the behavior of trace elements, especially particle-reactive elements such as the rare earth elements (REE), within the river as well as in the estuary is not well constrained and rather little is known about their transport mechanisms. This study aims at understanding the transport properties of particle-reactive elements in the Amazon River and some of its major tributaries, including the Rio Solimões, Rio Negro, Tapajos, Xingu and Jari Rivers. Samples were taken at 12 stations, seven of which were located in the Amazon mainstream, while the other five stations sampled its tributaries. To account for the effects of variable discharge, the samples were collected during periods of high and low discharge. We present data for major and trace elements, including REE, of the dissolved and suspended load of these samples.

First results indicate that the shale-normalized REE pattern of the dissolved load (filtered through 0.2 μm membranes) of the Amazon mainstream and the Rio Solimões confirm earlier studies (Elderfield et al., 1990; Gerard et al., 2003) and show an enrichment of the middle REE relative to the light and heavy REE (LaSN/GdSN: 0.25 – 0.32; GdSN/YbSN: 1.54 – 1.78). In contrast to the Amazon mainstream and the Rio Solimões, which are considered to be whitewater rivers, blackwater rivers, such as the Rio Negro, have a flat REE pattern with higher REE concentrations than whitewater rivers. The third water-type found in the Amazon Basin is clearwater, e.g. Rio Tapajos, with REE patterns in between those of the other two types, i.e. LaSN/GdSN: 0.55 – 0.70; GdSN/YbSN: 1.26 – 1.55. A similar behavior can be identified for other major and trace elements. While elements such as Ca, Mg, Sr or U are relatively high in whitewater rivers, their concentrations are generally lower in clearwater rivers and lowest in blackwater rivers. In contrast, elements including Si, Rb and Cs have their highest concentrations in blackwater rivers, intermediate concentrations in clearwater rivers and their lowest concentrations in whitewater river.

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