Hf and Nd isotope systematics in the particulate, nanoparticulate and truly dissolved load of Amazonian rivers

GILA MERSCHEL[1,3], MICHAEL BAU[1], KATJA SCHMIDT[1], CARSTEN MÜNKER[2], ELTON L. DANTAS[3]

[1]Jacobs University Bremen, Bremen, Germany
[2]Universität zu Köln, Köln, Germany
[3]Universidade de Brasilia, Brasilia, Brazil

River sediments, but also water samples, have widely been used for provenance studies using radiogenic isotopes, as these samples naturally integrate the geology of the entire catchment. While Hf and Nd isotope systems are coupled during magmatic processes, they are decoupled at the Earth's surface, which is reflected in the related isotopic composition of riverine sediments or water. We analyzed Nd isotopes in suspended sediments, 0.2 μm- and 1kDa-filtered (dissolved and truly dissolved, resp.) water samples from the Amazon River and five of its tributaries. In addition, we analyzed Hf isotopes in the suspended particles, the dissolved load (<0.2 μm) and the truly dissolved load (<1 kDa) of the Rio Solimoes, the Amazon's largest tributary draining the Andes, and the Rio Negro, an organic (nano)particle-rich river draining the rainforest of northern Amazonia.

In the latter two rivers, a strong particle size-dependent difference in Hf isotope compositions occurs. □Hf values get more radiogenic as the filter size decreases, which can be related to the size-dependent sorting of Hf-rich minerals, e.g. zircons, resistant to weathering. In contrast, the Nd isotopic composition of Amazonian rivers reflects that of their catchment geology. Tributaries draining the Precambrian Brazil and Guyana Shields show very unradiogenic □Nd values of -19 to -25, whereas the Rio Solimoes draining the Andes shows a more radiogenic □Nd signal of only -7. The Nd isotopic composition of the Amazon is dominated by its Andean tributaries and averages at -8. Although Nd isotopes are believed to not being fractionated by Earth surface processes, significant differences of 1.3 – 1.9 □-units can be observed between the dissolved and suspended load in the Amazon River and its main tributary, the Rio Solimoes. In these rivers, the dissolved load is more radiogenic than the suspended sediment, which is likely due to incongruent weathering and related mineral sorting in the Andean headwaters. In contrast, the organic rich shield rivers do not show a difference between the truly dissolved, dissolved and suspended load, as the Nd in all these pools is controlled by organic (nano)particles, which allows continuous exchange and re-equilibration between these pools.