Rare earth elements in water of Atibaia and Jaguari rivers basins (SE Brazil)

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Dissolved rare earth elements (REE) in river water may display a relatively wide range of concentrations, which depend primarily on water-rock interaction, biogeochemical weathering processes, and water composition. This study aimed to find at which extent the silicate rock lithologies and land uses affect the REE concentrations in river water upstream and downstream the interconnected dams of Cantareira System (São Paulo State, Brazil), one of the world most significant water supply systems. We measured the REE concentrations in forty-seven river water samples collected during the dryer and wetter seasons of the year 2016. The pH values were circumneutral, and other parameters (electric conductivity, major ions and dissolved organic carbon) increased downstream. River water turbidity values were between twice and trice higher during the raining season compared to the dryer one. The ∑REE concentrations in filtered samples (<0.22 μm) varied between 134-1846 ng/L (median 414 ng/L) and 141-476 ng/L (median 301 ng/L), for samples of the wet and dry periods, respectively. We attributed such results and positive Ce anomalies in about 80% samples to colloidal particles present in filtered water samples. We show that such signatures can derive from sediment/soil dispersion in water. Jaguari river basin comprises mainly granitoids while metamorphic rocks are predominant in the area of Atibaia river basin, which water samples (~39%) presented light REE enrichment (shale-normalized La/Yb ratios) a similar REE fractionation trend of surrounding rock samples that contain some accessory allanite and apatite. Comparatively, the light REE enrichment observed for Jaguari basin rocks is less frequent in its water samples, which may result from its less weatherable REE containing minerals. Most water samples presented positive Eu anomalies, which source are the rocks of the area and some show high Y/Ho ratios that indicate inputs related to fertilizers. The urbanized stretches of the rivers recurrently exhibited small anthropogenic positive Gd anomalies. Overall, the results indicate diffuse and punctual sources of pollution in the water bodies, including a subtle shift from the natural levels of some REE at the catchment-scale.