Goldschmidt 2022 Abstract
https://doi.org/10.46427/gold2022.13114

Distribution of dissolved and soluble Ti along the salinity gradients in the Pará and Amazon estuaries and plume

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Concentrations of Ti were determined in samples collected in the Pará and Amazon estuaries and plume into the Atlantic Ocean, as well as end members including rivers Tocantins, Amazon, Pará and their tributaries and Atlantic seawater. A high-resolution distribution of dissolved Ti along salinity gradients in the mixing zone between the river outflows and waters from the North Brazil Current during several transects was the main topic in this study. Moreover, the Mangrove Belt southeast of the Pará river mouth with its extensive groundwater discharge was also sampled. Samples were taken during an Amazon sampling campaign in September 2012 and during research cruise M147 (GEOTRACES process study GApr11) at the high discharge period in April and May 2018. Different Ti size fractions were investigated by using several filtration steps with pore sizes (0.2 µm and 0.015 µm) and ultrafiltration (10 kDa and 1 kDa) at three selected stations. Figure 1 shows that dissolved Ti behaved non-conservatively along the mixing gradients with strong removal at low salinities and some enrichments at higher salinity ranges. Different end members also showed different Ti concentrations. The results suggest that there were both adsorption and desorption of Ti from suspended particles from both riverine and marine sources or flocculation and aggregation of colloids and particulate matter from end member rivers as well as desorption in the salinity range 5-17. The similarity with phosphate, but not with silicate and nitrate, indicates that Ti is controlled by sorption on, and desorption from, colloidal or particulate Fe. The significant colloidal Ti fraction in the river end member (between 0.2 µm and 10 kDA) was strongly depleted after mixing with seawater where most Ti was found to be in soluble form (Figure 1). This very complex behavior of Ti along the mixing gradient and the dynamic system of the Amazon estuary, which comprises a fifth of the global freshwater flux into the ocean, is the key to controlling the fluxes of Ti into the Atlantic [1].

[1] Schneider, A.B. et al. (2022). Mar. Chem. 238, 104067. https://doi.org/10.1016/j.marchem.2021.104067

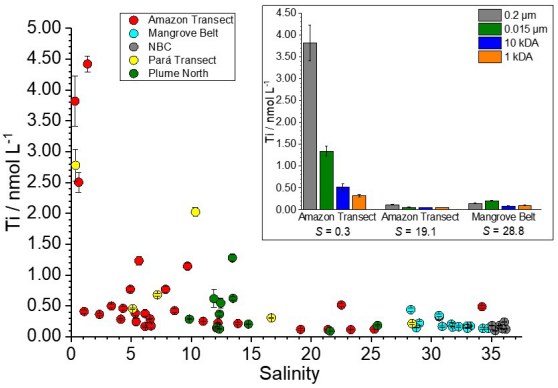

Figure 1: Dissolved Ti (<0.2 µm) along the salinity gradients in samples from the cruise M147. Samples were grouped according to their origin into Amazon Transect, Pará Transect, river plume moving north (Plume North), Mangrove Belt to the southeast of the Pará river mouth, and North Brazil Current (NBC, seawater end member). Titanium concentrations after different pore size filtration and ultrafiltration are shown in the insert.