

A core-top survey of Neodymium isotope ratios in the South Atlantic

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An important goal in paleoceanography is to understand past changes in ocean circulation and the ocean's role in climate change. This requires detailed knowledge of the distribution of water masses under different climate states in the past and their changes over time. Paleo-circulation proxies allow such reconstructions, provided their behavior in the ocean with all their benefits and caveats is understood. Neodymium isotope ratios have the advantage over many paleo-water mass tracers because they behave quasi-conservatively in the oceans, that is, their ratios approximately reflect the mixture of source waters, facilitating for the first time predictions about past changes in water mass volume transport. In order to improve the basis for the use of Nd isotopes as paleo-water mass tracer and for robust quantifications of past circulation changes, we have analyzed Nd isotopes on the authigenic ferromanganese oxide fraction of core-top sediments from the Atlantic Ocean, with a focus on the Southern Hemisphere part of the basin. We collected samples from intermediate to bottom water depths and from 43°S to 60°N in the Atlantic. Ninety percent of our authigenic ϵ_{Nd} data match the seawater ϵ_{Nd} distribution well and fall right into the seawater ϵ_{Nd} -salinity array. This confirms the value of ϵ_{Nd} as a water mass tracer and strongly supports its application and merit for the reconstruction of past ocean circulation changes. In cases where authigenic ϵ_{Nd} values diverge from the seawater isotopic composition, ϵ_{Nd} will be measured on fish teeth. The goal is to extend this study to the last glacial maximum in order to obtain a robust picture of the distribution of ϵ_{Nd} and hence Atlantic water masses in the glacial ocean.

Solubilities of synthetic scorodite and ferric arsenate: Implications for stabilization of Arsenic in mining and metallurgical wastes

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Solubility experiments on scorodite and ferric arsenate performed over two decades have produced controversial results. It appears that the complexity of the ferric arsenate compounds used as the starting materials contributed to this controversy. Recently, Langmuir *et al.* [1] reevaluated the published solubility data and determined $\log K_{sp}$ at 25°C as -25.83 ± 0.07 and -23.0 ± 0.3 for scorodite and ferric arsenate, respectively. New experimental data in the pH 5-9 region provided a $\log K_{sp}$ of -25.4 ± 0.5 for scorodite [2]. In order to provide further insights into the solubilities of these compounds, we performed solubility experiments involving well-characterized scorodite and ferric arsenate, synthesized at 70°C. The solubility experiments were performed at 25°C in 0.01 M NaNO₃ solutions at pH 1 to 9. The starting and residual materials were characterized by X-ray powder diffraction (XRD) and X-ray absorption fine structure spectroscopy (XAFS). Characterization results indicate that the presence of minor ferric arsenate in the precipitates can be resolved using XAFS spectra but not from XRD analysis. Our results are in agreement with $\log K_{sp}$ of scorodite determined by Langmuir *et al.* [1]. We calculated $\log K_{sp}$ of ferric arsenate to be -23.9 that is between the values defined by Langmuir *et al.* [1] for amorphous ferric arsenate and partially crystalline scorodite. Implications of the experimental data on arsenic control practices at mine sites and arsenic mobilization from mine tailings will be discussed.

[1] Langmuir *et al.* (2006) *GCA* **70**, 2942-2956. [2] Bluteau & Demopoulos (2007) *Hydrometall.* **87**, 163-177.