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Rare Earth Element partition coefficients in the North Atlantic (GEOVIDE cruise, GEOTRACES GA01)

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Partition coefficients (Kd) are a key parameter in models. Kd represents the ratio of the particulate concentration of a given element on its dissolved concentration multiplied by the suspended particle mass (SPM). This parameter constraints the repartition of a given element between the dissolved and the particulate phases. In most of the published studies on Rare Earth elements (REE), it is adjusted to obtain the best fit between modelized and observed dissolved concentrations [1]. Actually, field Kd measurements are very scarce so far, especially because of the lack of data either on SPM or on simultaneous measurements of dissolved and particulate REE.

In this study, REE Kd were determined along the GEOVIDE section using dissolved Rare Earth (DREE) concentrations and previously published particulate REE (PREE, [2]). SPM was determined by calculation using concentrations of the elements constituting the main particulate phases [3], already published for GEOVIDE. PREE/DREE ratios were also caluclated, allowing us to identify the role of SPM values in the Kd variations. Results show that Kd decrease along the REE series, which is consistent with their decreasing affinity for particles. The only exception is Ce which present the higher Kd, in agreement with its higher affinity for particles. The measured Kds are minimum at the surface, and tend to increase with depth, but important variations are observed in the first 400 m, that can reach an order of magnitude. Below 400 m, the increase with depth follows a power law. Kd calculated in this study are higher than the Kd used in models that are taken constant with depth. It highlights the need to i) reevaluate Kd values in models ii) consider Kd variations with depth to manage to model REE distributions both at the surface and at depth that fit better with observations.

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