Rare earth elements leaching experiments from plutonic and metamorphic rocks with desferrioxamine B solution

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The rare earth elements and yttrium (REY) present low solubility during the water-rock interaction. The presence of ligands, their type and concentration influence the overall solubility of the REY. The coherent behavior of the REY results from their trivalent state and similar ionic radius. Under certain conditions Ce^{3+} can be oxidized to Ce^{4+}, which is decoupled from the group, producing anomalies compared to its neighbors. The controls of such process are still under investigation. Leaching experiments applied to igneous rocks with desferrioxamine B (DFOB), one of the biogenic siderophile species found in natural environments, resulted in positive Ce anomalies in the extracts, independent of the lithotypes textures and mineralogical composition [1]. In the present study, similar experiments were carried out with plutonic igneous and metamorphic rocks sampled on the Atibaia and Jaguari rivers sub-basins (São Paulo State, Brazil). The studied rock samples contain ∑REY between 400 and 540 $\mu g \cdot g^{-1}$ and their chondrite normalized REY patterns are moderate to strongly enriched in light over heavy REY. The overall REY extracted from rock samples ranged between 0.43 and 12.5 $\mu g \cdot g^{-1}$ or 0.01 to 4.1%, varying with the element and rock type. The whole amount of DFOB extracted REY normalized to bulk rock presented variable fractionation. The main observed features are more enriched middle and HREE patterns compared to the bulk rocks, La depletion, and positive Ce anomalies. Such results are related to the different stability constants among the REY-DFOB complexes. Negative Eu anomalies, when present in the rock samples, also appeared proportionally in the extracts.

The results of this study essentially confirm previous conclusions of Kraemer *et al*. (2015), evidencing the capacity of DFOB in mobilizing the REY and producing Ce anomalies in the liquid phase. But our results also suggest that the REY extracted amounts and their fractionation compared to bulk rock depend on the REY-bearing minerals of the rock.

[1] Kraemer *et al*. (2015) *Geochim. Cosmochim. Acta* **165**, 263-279.