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Carbonatites and alkaline magmas are key pieces of the deep carbon cycle and constitute one of the principal resources of rare metals including REE. Several experimental studies have tackled the rare metal partitioning between immiscible carbonate and silicate liquids (Martin *et al.* 2013; Veskler *et al.* 1998, 2012). They show negative to massive enrichments in the carbonate liquid. However, no prevailing cause has been clearly isolated as such enrichments can be ruled by experimental conditions (P, T, fO_2), melt compositions (water and alkali contents), or technical issues such as unequilibrated experiments.

The aim of this study is to simulate, by HP-HT experiments in the nephelinite-carbonatite system, crystal fractionation and immiscibility between carbonate and silicate liquids, in order to assess the factors ruling REE enrichment during the differentiation of alkaline magmas.

Thirty experimental charges were synthetized using piston-cylinder and internally heated pressure vessel. The partitioning of REE between carbonate liquids, silicate liquids and crystals (pyroxene, calcite, nephelinite, perovskite, titanite) has been characterized. REE partition coefficients between carbonate and silicate liquid increase while Ca partition coefficient increases, suggesting that both have the same behavior. Also, the more the silicate liquid is polymerized, the more REE are concentrated into carbonate liquids. The Ca partition coefficient has been thus calibrated by an empirical model based on the silicate melt composition.

This study reveals the optimum conditions for which carbonatite melts get enriched by >10 times with respect to the residual silicate melts. This predictive approach may serve as guide for prospection of REE-enriched carbonatites.

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Veskler, I.V., Dorfman, A.M., Dulski, P., Kamenetsky, V.S., Danyushevsky, L.V., Jeffries, T. & Dingwell, D.B. 2012: Partitioning of elements between silicate melt and immiscible fluoride, chloride, carbonate, phosphate, and sulfate melts, with implications to the origin of natrocarbonatite. Geochimica et Cosmochimica Acta 79, 20-40.