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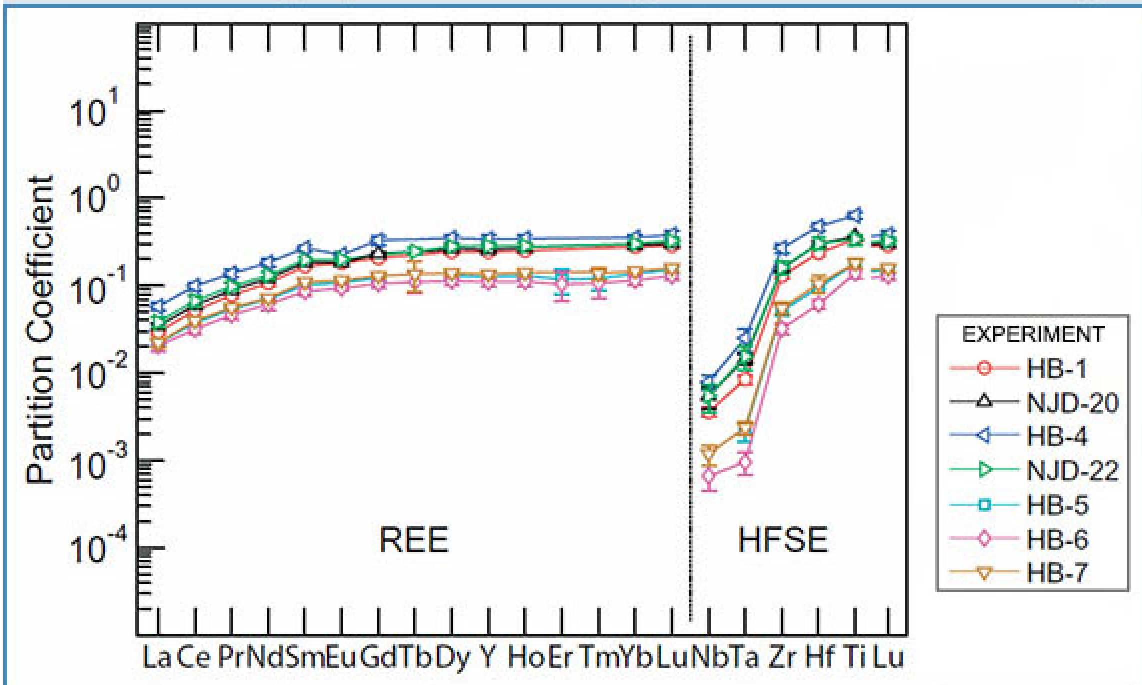
Partition Coefficients in Fe-rich Systems: Relevance to the Lunar Mantle

Diverse magmas were produced early in the history of the Moon (see **PSRD** article for a summary: ***Chips Off an Old Lava Flow***); the results of partial melting of compositionally-diverse regions in the lunar mantle. To learn more about partial melting, melt transport, and melt-rock interactions that occured in the geochemically heterogeneous lunar mantle researchers turn to laboratory experiments. Part of this work involves measuring ***partition coefficients*** of elements between common rock forming minerals and coexisting melt. Element partioning is a function of temperature, pressure, and mineral and melt compositions.

Seven Partitioning Experiments with Augite and Fe-rich Basaltic Magma



(From Dygert *et al.*, 2014, *Geochimica et Cosmochimica Acta*, v. 132, p. 170-186, doi: 10.1016/j.gca.2014.01.042.)

Partition coefficients determined in the lab by Dygert and coauthors for rare earth elements (REE) and high field strength elements (HFSE) between augite and nominally anhydrous, Fe-rich basaltic melt. Error bars are 2σ. Experimental run conditions ranged from 0.8–2.2 GPa and temperatures of 1050–1220 ^{o}C. The starting compositions were chosen to represent end-stage melt compositions in the lunar magma ocean. Partition coefficient less than 1 shows that the element prefers to remain in the melt.

A team from Brown University, Nick Dygert, Yan Liang, Chenguang Sun, and Paul Hess, report the results of seven experiments in which they determined new ***clinopyroxene***-basaltic melt partition coefficients for 37 elements (21 are shown in the figure). Their experiments used starting materials with compositions analogous to Fe-rich, basaltic magma in the lunar ***magma ocean*** during the end-stages of crystallization. Dygert and coauthors discuss implications of the variations they see in partition coefficients, comparisons of experimental data with model results (such as lunar magma ocean cumulate compositions calculated by MAGFOX; see PSRD article: ***The Igneous SPICEs Suite: Old Programs with a New Look***), and the need for careful selection of partition coefficients for Fe-rich systems. This work is relevant to the Moon and other planetary bodies for which we want to better understand thermal evolution, magma chemistry, and differentiation.

See Reference:

· Dygert, N., Liang, Y., Sun, C., and Hess, P. (2014) An Experimental Study of Trace Element Partitioning Between Augite and Fe-rich Basalts, *Geochimica et Cosmochimica Acta,* v. 132, p. 170-186, doi: 10.1016/j.gca.2014.01.042. [***abstract***]

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