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The influence of K, Th, and U partition coefficients on the thermal evolution of a planet

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Crustal formation processes and the evolution of mantle compositions depend highly on the thermal evolution of a planet's interior. The thermal evolution is strongly influenced by melting processes inside the mantle which trigger the redistribution of radioactive elements from the mantle to the crust. Upon melting, partition coefficients control the degree to which an element will diffuse into the melt. Since partition coefficients vary with temperature, pressure, and composition, the enrichment of trace elements should change with time as well. Despite of this, enrichment factors were widely assumed to be constant in the past for simplicity.

In this study, partition coefficient calculations [1] were carried out and compared with literature values. Based on these results, reasonable partition coefficient values for the radioactive heat-inducing elements K, Th, and U are chosen and incorporated into a thermal evolution model of Mars [2]. We show the impact of the varying factors on crustal evolution and enrichment factors.

[1] Wood, B.J. & Blundy J.D. (2014), ToG, 2, 421-447.

+ [2] Morschhauser, A. et al. (2011), Icarus, 212, 541-558. +

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