REE-concentrations of cpx and grt of mantle peridotites: New distribution coefficients from South African lherzolites

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Discrepancies in rare earth element (REE)-distribution coefficients exist between data collected from natural minerals and experimental run products. To solve this incoherence and to work out the factors controlling trace element distribution behaviour is the aim of our study. We calculate a new set of cpx/grt REE-distribution from in-situ measurements of grt-bearing mantle peridotites from South Africa. Major element traverses of whole-grains were measured in detail with a Jeol 8900RL electron microprobe. REE were measured with a secondary ion mass spectrometer (SIMS). In comparison to whole grain REE-distribution data sets the advantage of our method is the avoidance of micro-inclusions and altered parts of the minerals and the textural control of the measured minerals.

We present results from kimberlite-hosted, on-cratonic grt peridotites of the Kaapvaal craton, which equilibrated between 3.5 and 7.0 GPa, positively correlated with temperatures between 800 and 1400° C. The xenoliths have depleted whole rock compositions. Most grts are fractured, but show homogeneous major element compositions. Only in some samples are the outermost rims altered to kelyphites. Most of the analysed cpx also have homogeneous major elements without zoning. The grt are extremely depleted in LREE, whereas the cpx is slightly enriched in LREE and depleted in HREE. Some of the cpx show more variation with lower REE-concentrations in rims. Cpx in one sample occurs in vein-like distribution, reflecting possible inhomogeneity of the mantle. However these cpx have the same major and trace element composition as cpx adjacent to grt. No chemically distinct second generation of cpx has been found in this sample, which may suggest diffusive equilibration.

The new REE-distribution data set will be compared to data from other natural samples and some experimentally produced grt and cpx to enlarge the studied temperature and pressure range and evaluate the possible influence of P and T on REE-distribution and thereby on melting calculations.