

## Stable isotope fractionation during net transfer reactions

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The stable isotope composition of phases produced by net transfer reactions in closed systems is modelled typically using batch and/or Rayleigh fractionation. This assumes that all phases are in isotopic equilibrium. However, several studies have shown that only the reaction products are in isotopic equilibrium (e.g. [1]), at least in contact metamorphic environments. We also have documented disequilibrium in wollastonites surrounding quartz nodules in a calcite matrix at the northern Hunter Mountain Batholith contact aureole (Death Valley NP, California).

Hence a model that takes the mechanism of the wollastonite forming reaction into account was developed. The oxygen isotope composition of wollastonites is modelled through local instantaneous oxygen isotope mass balance calculations. This approach assumes that the isotopic composition of wollastonite is only dependent on the initial values of the reactants and equilibrium oxygen isotope fractionation between product phases at the given temperature. The model predicts most of the measured  $\delta^{18}\text{O}$  values of wollastonite reaction rims to within  $\pm 1\%$ , even though the wollastonite compositions vary at Hunter Mt. by almost 10%.

We have attempted to reproduce the kinetic isotope fractionation in the laboratory by strongly overstepping the wollastonite reaction. To this end we sealed calcite and quartz, which are isotopically in disequilibrium, into gold capsules. The capsule is afterwards placed in a cold-seal hydrothermal bomb at 1 kbar, and temperatures corresponding to the wollastonite field. After quench,  $\text{CO}_2$  was extracted in a vacuum line.  $\text{CO}_2$ , calcite and wollastonite were analysed for their isotopic composition. First results indicate that similar kinetic isotope fractionations are produced.

[1] Müller *et al.* (2004) *Geology* **32**, 821-824.

## REE distribution in zircons from lamproites in Panozero complex of sanukitoids (Karelia, NW Russia)

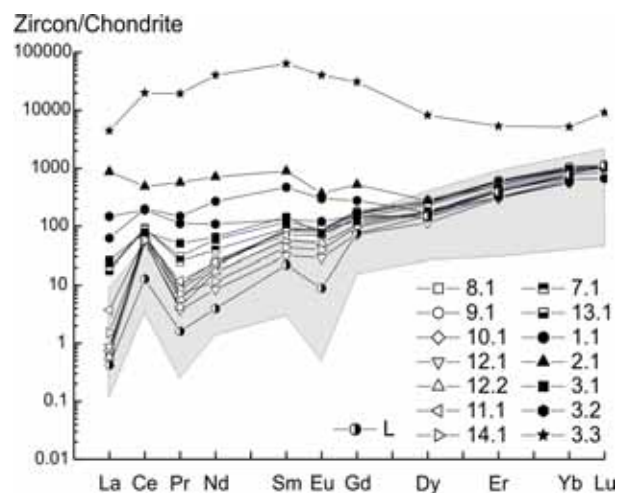
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Zircons from Archean lamproites (SHRIMP-II age  $2757 \pm 7$  Ma [1]) were analyzed by ion microprobe Cameca IMS-4f (Jaroslavl branch of PhTI RAS, Russia) for REE and trace element concentrations. Some zircons show strong alteration by mantle metasomatic fluids (or melts) resulted in enrichment in LREE, Ca, Al, Fe, Ti, Sr, Ba. Small domain of zircon ( $40 \times 10 \mu\text{m}$ ) contains huge content of REE total up to 55,000 ppm as a result of reworking former melt inclusion.



**Figure 1:** Chondrite-normalised [2] REE analytical data for zircons from lamproites in Panozero complex of sanukitoids (Karelia, NW Russia). White symbols – non-altered zircons; filled symbols – altered by metasomatic fluids zircons; stars – abnormal altered domain of zircon. Shaded area – published in [3] REE data for zircon from lamproites of Australia and Ukraine (L - average value).

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[1] Sergeev *et al.* (2007) *Doklady Earth Sci.* **413A**, 420-423.

[2] McDonough & Sun (1995) *Chem. Geol.* **120**, 223-253.

[3] Belousova *et al.* (2002) *CMP* **143**, 602-622.