

Isotope exchange and chemical transport mechanism of water-rock interaction

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A new mechanism of oxygen isotope exchange by grain boundary migration coupled with grain boundary diffusion is proposed based on quartzite-fluid infiltration experiments, cathodoluminescence and a new SIMS isotope mapping technique. The ^{18}O -enriched water was infiltrated into synthesized quartzites at lower-crustal condition. The ^{18}O abundance was much more enriched than expected from volume diffusion in quartz. Large contiguity due to small ($< 4\%$) fluid fraction and large ($\sim 60^\circ$) dihedral angle is against dominant role of dissolution-precipitation. Isotope and CL distribution indicates that migration of the grain boundaries enriched in ^{18}O by grain boundary diffusion is responsible for the rapid isotope enrichment.