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Lithium distribution and isotopic composition in zircon megacrysts from northeastern Cambodia

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Lithium in zircon has attracted considerable attention for identifying magma sources and as a diffusion chronometer, despite the exact diffusion mechanisms remaining controversial. Extreme Li-isotopic variations within single zircon megacrysts from Quaternary intraplate basaltic volcanoes in the Ratanakiri Volcanic Province of northeastern Cambodia require kinetic Li fractionation, which is further supported by offsets in intracrystalline domain boundaries with different Li and Y abundances detected in scanning ion images. The overall tendency of decreasing Li abundances along with increasing δ^7Li values toward crystal rims indicates diffusion-driven equilibration between zircon and Li-depleted basaltic melt. Diffusion modeling of Li and δ^7Li on domain-boundaries within crystals show pre-eruptive heating timescales of about 18 days. Nearly one to two orders of magnitude longer Li diffusion modeling timescales were computed for crystal rim domains, indicating different modes of Li diffusion in zircon. Lithium isotope compositions for the innermost domains of zircon megacrysts are relatively heavy with δ^7Li values of +12 – +22‰, which provide insights into origin of these zircon megacrysts.

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