Pushing the limits of Ra/Th Dating: Applications using very few or single crystals in young volcanic systems

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Ra/Th dating offers age constraints encompassing a critical time range for magmagenesis and magma differentiation with high potential for better assessing volcanic-related risks at dangerous and active volcanic systems worldwide. Such age assessments critically rely on constraining Ra partitioning into relevant magmatic phenocrysts. We present a new model for determining Ra partition coefficients using partition co-efficients of alkali elements in the same material to be dated in determining D_{Ra} for common phenocrysts such as sanidine in rhyolitic and trachytic magmas. Resulting ages originating from D_{Ra} from this model are consistent with assumed or actual eruption ages at Changbaihsan volcano (China/N. Korea). Our intent however is to date single crystals in young lavas erupted from active, and potentially active volcanic systems, similar to what is achieved in single crystal $^{40}Ar/^{39}Ar$ studies, in order to parse outlier ages from crystal ages (e.g.,, resulting from xenocrysts). As such, our current results focus on crystal separates commonly ~15 mg,that are composed of multiple crystals (4-15 individual crystals). We will present initial evaluations using single or pairs of crystals to determine the range of ages present in single lavas where these age ranges can better elucidate 1) age outliers and 2) the age range of phenocryst crystallization and age intervals of crystallization. If successful, results have great potential for constraining crystal residence ages, magma residence times and eruption mechanisms, especially for magma systems characterized by excess argon resulting in inaccurate $^{40}Ar/^{39}Ar$ ages.

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