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Zircon crystallization thermochemical modeling

Friedrichs, B.*, Schmitt, A.K., Lovera, O.M., Atıcı, G.
*Institute of Earth Sciences, Heidelberg University,
Im Neuenheimer Feld 234-236, D-69120 Heidelberg,
bjarne.friedrichs@geow.uni-heidelberg.de.

Protracted zircon crystallization from intermediate to evolved melts records the thermochemical evolution of magma systems. We refined an existing thermochemical model of zircon crystallization [1], adapting it to our analytical approach to determine both U–Th disequilibrium crystallization ages and trace element contents for both zircon rims and interiors by SIMS. Synthetic zircon crystallization age spectra exhibit concave cumulative probability functions on linear age scale that vary systematically with duration and rate of constant upper crustal magma recharge.

Petrochronological data for two neighboring and active stratovolcanic complexes in Central Anatolia (Turkey) were approximated by thermochemical modeling, revealing ~1–0.5 km^3/ka of near-steady magma recharge for Mt. Hasan, but only ~0.1 km^3/ka of modulated recharge for Mt. Erciyes, as well as contrasting “warm” vs. “cold” magma storage. Also, time-invariant vs. fluctuating zircon compositions are consistent with periodic [2] vs. episodic eruptions [3].

[1] Tierney, C.R. et al. (2016) *Geology 44*, 683–686. [2] Friedrichs, B. et al. (2020) *J. Volcanol. Geotherm. Res. 404*, 107007. [3] Friedrichs, B. et al. (2021) *Quat. Geochronol. 61*, 101129.

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