Protracted Crystallization of Bishop Tuff Zircon Revealed by Serial Section U-Pb Dates

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The >600 km^3 Bishop Tuff (BT) is an important benchmark in geochronology as well as a valuable source of insights into the evolution of voluminous explosive eruptions. A weighted mean $^{206}Pb/^{238}U$ date of 767.1±0.9 ka for a BT zircon population analyzed by TIMS [1] is, however, distinctly younger than a mean 850 ka pre-eruption age previously obtained by SIMS dating [2]. To confirm or refute these older ages, our work employed rim and interior SIMS U-Pb analyses performed during the same analytical session, running conditions optimized for minimal Pb contamination and matrix interferences, verification of age accuracy against a Quaternary age zircon standard, and a comparison between annealed and non-annealed grains. Rim dates on early- and late-erupted BT zircon average 766±7 ka (2σ; MSWD=0.86), and dates on annealed and non-annealed grains are indistinguishable. The mean rim dates are in excellent agreement with an Ar/Ar eruption age of 767.4±2.2 ka calibrated against an astronomically tuned FCs age of 28.172 Ma [3] and corroborate the importance of near-eruption aged zircon growth. Dates obtained at ~10 μm depth (representing <60% crystal growth in most cases) average 794±10 ka (MSWD=1.50), and are 28 ka older than rim dates obtained in the same analytical session. These corroborate previous evidence for zircon residence times of several tens of ka [2,4]. A possible scenario for evolution of the BT and the dynamics of zircon crystallization is as follows: (1) zircon nucleation and relatively rapid growth tens of ka before eruption; (2) significant decrease or cessation of zircon growth altogether; followed by (3) mantling of earlier zircon cores by rejuvenation and renewed BT zircon growth during the lead-up to eruption.

[1] Crowley *et al* (2013) *Geology* **35,** 1123-1126. [2] Simon and Reid (2005) *EPSL* **235**, 123-140. [3] Rivera *et al* (2011) *EPSL* **311**, 420-426. [4] Chamberlain *et al* (2013) *J. Petrol.* in press.