Goldschmidt 2023 Abstract
https://doi.org/10.7185/gold2023.20114

Building and re-building a super-eruption: ID-TIMS U-Pb geochronology of the Lower and Upper Bandelier Tuff

TRAVIS L STEINER-LEACH[1], BLAIR SCHOENE[1] AND DAWID SZYMANOWSKI[2]

[1]Princeton University
[2]ETH Zurich

Presenting Author: travisls@princeton.edu

Understanding the processes required to build a magmatic system capable of creating a super-eruption is important to understanding the timescales and repose time of catastrophic eruptions to better inform the public of the potential geo-hazard that super-eruptions can pose. The Valles Caldera (New Mexico, USA) provides a unique opportunity to study this process twice over a ~360Ky period, and is the site of two caldera forming super-eruptions that formed the ignimbrites known as the Lower Bandelier Tuff(~1.61Ma) and Upper Bandelier Tuff(~1.26Ma) and initial fallout units of Guaje and Tsankawi pumice. Models of magma chambers suggest that mafic replenishment of a magma chamber is a common trigger for eruption. Data from a high-precision ID-TIMS study of zircon is presented to test the timescales of magma buildup prior to eruption. A LA-ICP-MS study of trace elements in zircon is also presented to show some melt present is highly evolved in smaller volumes of the magma body (Tsankawi and Guaje pumice) with a less-evolved large-volume LBT and UBT magma. Ti-in-Zircon temperatures are higher in the LBT than in the Guaje; a core to rim higher trend is also measured in the LBT/UBT zircons. Many cores of the LBT/UBT zircons show resorbed textures in CL-imaging. Textural and geochemical data show that the Guaje/Tsankawi zircons (highly-evolved) are dissimilar to the rims of the LBT/UBT zircons (less-evolved) which would suggest the difference in modeled ages between the highly-evolved cap (Guaje/Tsankawi) and less-evolved LBT/UBT is the time since separation of the cap, a period of about 15,000 years for the LBT and 30,000 years for the UBT. The remarkable similarities between the zircon record leading up to each super-eruption supports models suggesting that mafic replenishment is a common trigger for melt segregation and super-eruption.