$^{40}Ar/^{39}Ar$ incremental heating of single sanidine phenocrysts using the Noblesse 5-collector mass spectrometer

BRIAN R. JICHA[1], BRAD S. SINGER[1] AND PETER E. SOBOL[1]

[1]Department of Geoscience, University of Wisconsin-Madison, Madison, WI 53706 USA
Email: bjicha@geology.wisc.edu; bsinger@geology.wisc.edu; psobol@geology.wisc.edu

Numerous studies of sanidine-bearing lavas and tephras have used the $^{40}Ar/^{39}Ar$ laser total-fusion technique to determine eruption ages, typically using a single-collector mass spectrometer. We employed the incremental heating technique on single sanidine phenocrysts from several samples and commonly used $^{40}Ar/^{39}Ar$ standards using a CO_2 laser, ultra-low blank extraction system, and Noblesse five-collector mass spectrometer. We have developed a two step procedure for multicollector analysis, which requires a peak jump of one amu, but provides accurate determination of the essential isotope ratios. Sample analyses are interspersed with measurements of a standard gas to assess mass bias, intercalibrate between multiple detectors, and gauge instrumental drift over time. Our in-house standard is a mixture of atmospheric Ar and ^{39}Ar and has a $^{40}Ar/^{39}Ar$ ratio of 2:1. Single aliquots from a 0.1 cm^3 pipette give ^{40}Ar signals of ~200,000 cps, commensurate with the sizes of sample unknowns. Significant improvement in the separation of $H^{35}Cl$ and 3 ^{12}C peaks from ^{36}Ar allows for more accurate Ar isotope measurements.

Twelve to fifteen step incremental heating experiments of individual sanidine crystals from the Alder Creek rhyolite yield plateaus that are >97% concordant, which contradicts the results of a recent study by Phillips et al. (2013). Age distribution from the Huckleberry Ridge tuff (HRT) sanidines are more complex. The youngest set of plateau ages (n=10) presumably reflect the eruptive age, but there are also antecrysts with plateau ages that are 9 to 20 ka older than the youngest mode as well as crystals that produced discordant spectra. Anomalously old apparent ages occured for single heating steps within several experiments despite the previous and subsequent steps being concordant. The origin of this phenomena is unknown, but could reflect gas released from micron-scale inclusion phases, melt inclusions, or complex volatiles trapped heterogeneously within the crystals. We will also present results from other voluminous, sandine-bearing eruptions that give highly discordant spectra.