# Volatile and trace-element abundances of apatite from the youngest Yellowstone supereruptions

MATTHEW A. COBLE[1]

[1] Stanford-USGS Ion Microprobe Laboratory, Stanford University, Stanford, CA 94305 (coblem@stanford.edu)

Variations in apatite volatile and trace element content reflect magmatic processes, such as fractional crystallization and degassing or recharge of volatile-rich magma prior to eruption. Trace-element concentrations in apatite record melt evolution and are used as a proxy for relative pre-eruptive magma conditions. Volatiles (Li, F, S, Cl) and trace elements (Mg, Mn, Fe, Sr, Y, REE, Hf, U, Th) were measured in-situ by SIMS on apatites from three caldera-forming supereruptions from the Yellowstone Plateau volcanic field: the Huckleberry Ridge Tuff (HRT; 2.1 Ma), Mesa Falls Tuff (MFT; 1.3 Ma), and Lava Creek Tuff (LCT; 0.63 Ma). Apatite occurs predominantly as microphenocrysts (<100 μm) and as inclusions within, or associated with, pyroxene, Fe-Ti oxides, and zircon; phenocrystic apatite are lacking in Yellowstone rhyolitic pyroclasic rocks. Samples are fluorapatite with Cl and F ranging from 1,000-3,000 and 31,000-38,000 ppm, respectively. Sulfur is nearly completely lost from degassing (<10 ppm in apatite) in all samples. Apatites from LCT members A and B are bimodal, with the earlier erupted member A being more chemically evolved. Strong correlations between Sr, La/Y, and Eu/Eu* for all units suggests apatite compositions are controlled by feldspar fractionation in the melt. Apatite OH contents, calculated by difference, are consistent with previous observations that Yellowstone magma are relatively dry. Apatite volatile and trace-element compositions are integrated with melt inclusion compositions to better understand the volatile enrichment and fractionation processes in the Yellowstone magma chambers prior to eruption.