

Lava Creek Tuff Love

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Yellowstone caldera's most recent supereruption generated ~1000 km³ of rhyolitic ash-fall and ignimbrites. Together the deposits are named the Lava Creek Tuff, but the eruptive sequence is separated into Lava Creek Tuff A and B based on stratigraphic and compositional differences. Primary among these differences is the presence of Fe-rich amphibole as the mafic phase in Lava Creek Tuff A. Hydrous mineral phases are very rare at Yellowstone, thus amphibole in Lava Creek Tuff A may indicate a unique petrologic condition prior to the supereruption. To better understand the pre-eruptive storage conditions of both of the Lava Creek Tuff magmas, we collected pumice clasts from the unwelded basal ignimbrite of Lava Creek Tuff A and the unwelded basal fall of Lava Creek Tuff B. We were restricted to unwelded ignimbrite because no fall deposits of Lava Creek Tuff A are described in the literature or field trip guides. We hope to identify outcrops in future field work. We crushed pumice clasts from both units and handpicked crystals to produce mineral separates. We then analyzed plagioclase (Ab_n), sanidine (Or₅₃₋₆₂), amphibole (Al=1.4), fayalite (F₄₋₆₂), clinopyroxene (Wo₀₋₂₄En₅₋₃₃Fs₅₂₋₆₂), and Fe-Ti oxides using an electron microprobe. Fe-Ti oxides in both units have pronounced exsolution lamellae and cannot be used for thermometry. Thermobarometry and Rhyolite-MELTS modeling using glass and mineral compositions suggest the magma was stored at 800±50 °C and <250 MPa. We also analyzed the volatile contents of experimentally homogenized quartz-hosted melt inclusions using Fourier Transform Infrared Spectroscopy. Melt inclusions from the Lava Creek Tuff A and B contained up to 4.2 wt.% H₂O and 60 ppm CO₂ and 4.0 wt.% H₂O and 10 ppm CO₂, respectively. Such volatile contents indicate storage pressures up to 150 MPa and are similar to the volatile contents of the Huckleberry Ridge Tuff [Myers et al 2016]. The storage conditions of the Lava Creek Tuff A and B were indistinguishable despite the presence of amphibole in A. We identify one new difference between the units. Quartz crystals from Lava Creek Tuff A occur as euhedral bipyramids with 30% of the crystals pervasively riddled with tortuous reentrants. Glass-filled reentrants are relatively common in volcanic quartz globally and across the Yellowstone system. Embayments in Lava Creek Tuff A quartz; however, are empty. They may represent the pre-eruptive presence of bubbles.