Shallow crustal magma residence times and storage conditions revealed through in situ zircon chemistry at the Pastos Grandes Caldera Complex in SW Bolivia

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The Pastos Grandes Caldera Complex in the Central Andes of southwest Bolivia provides the unique opportunity to study a young volcanic terrain along with its associated plutonic record. Studying both records together can expound the relationship between volcanic activity and pluton emplacement and evolution. The multicyclic caldera has erupted over 2500 km ^{3} of high K dacite and rhyolite ignimbrite from at least two caldera-forming supereruptions depositing the 5.45 +/- 0.02 Ma Chuhuilla, and the 2.89 +/- 0.01 Ma Pastos Grandes Ignimbrites (PGI). The much younger Chascon dome (85-94 ka) formed inside the margins of the Pastos Grandes Caldera and contains granodiorite plutonic xenoliths. Similar xenoliths have also recently been discovered in the intracaldera facies of the PGI. Together, the ignimbrites, post-collapse lava domes, and xenoliths provide a complete view of the magmatic cycles associated with a silicic, caldera-forming, eruption.

U-Pb zircon crystallization ages of the ignimbrites, collected via SIMS, reveal the pre-eruption magmatic histories. Weighted average U-Pb zircon ages from the Chuhuilla and PGI are 6.04 +/- 0.06 Ma (MSWD = 2.53; n = 45) and 3.36 +/- 0.037 Ma (MSWD = 5.79; n = 64), respectively. From a comparison of the zircon crystallization and eruption ages, minimum residence times of magmas associated with the ignimbrites are 0.59 Ma and 0.47 Ma for the Chuhuilla and PGI, respectively.

The plutonic xenoliths of the Chascon dome have a weighted average zircon crystallization age of 2.64 +/- 0.906 Ma (MSWD = 4.54; n = 54). Preliminary trace element concentrations, collected from the same spots as the U-Pb data, provide a chronologic view of magma chemistry and conditions in the ignimbrites and xenoliths. REE patterns are nearly identical in both the PGI and the xenoliths representing the remnant pluton. Many other elements such as Th, Hf, and Ti also remain constant with time. The uniform Ti concentrations indicate that temperature and composition remained uniform (650-700 C) throughout the span of zircon crystallization during the Pastos Grandes magma cycle. Collectively, these data connote that the xenoliths represent remnant magma after the PGI and record a total magmatic cycle time (minimum) of 1.60 Ma.

Post-collapse lava domes yield zircon crystallization ages in agreement with both the PGI and the plutonic xenoliths, suggesting that they represent effusive "leaks" from the solidifying post-climactic pluton.

Granodiorite xenoliths present in the intracaldera facies of the PGI likely represent the remnant magma after eruption of the Chuhuilla Ignimbrite. These xenoliths are currently under investigation, and can provide an integrated view into the magmatic evolution of a multi-cycle caldera system.