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Unravelling Pre-Eruptive dynamics by Micro Raman investigations in Megafeldspars from a large silicic magma system in the Athesian Volcanic Group Mega-Caldera, Southern Alps, Italy.

Michele Cassetta (1), Daniele Morgavi (2), Diego Perugini (2), Maurizio Petrelli (2), Stefano Rossi (2), Francesco Vetere (2), Marco Zanatta (1), and Gino Mariotto (1)

(1) Università Di Verona, Computer Science, Italy, (2) Università degli studi di Perugia, Department of Physics and Geology, Italy

Colossal eruptions of super-volcanoes played a pivotal role in the evolution of Life on Earth causing extinctions and at the same time, providing elements for the rebirth. The triggering mechanisms of these catastrophic events are hidden below super-volcanoes, and they are still obscure both for their complexity and for their rare recurrence. A prominent example of large eruption is that of the Permian magmatic activity belonging to the Athesian Volcanic Group (AG); in the southern Alps (Italy). The study of both magmatic evolution and outcrops age-constraining revealed large volumes (up to 1290 km^3) of rhyodacitic to rhyolitic ignimbrites, emplaced after the double caldera-collapse. Accordingly to a syn-volcanic tectonic activity plutonic and sub-volcanic bodies outlines a temporal evolution of the systems of c.a. 10 Ma. We focused on the Terlano laccolite, that keeps frozen the shortest time-laps between the two consecutive caldera collapses. This sub-volcanic body, structured by a porphyritic groundmass, hosts cm-sized K-feldspar phenocrysts, that are idiomorphic, zoned and geminated. We carried out a detailed micro-Raman investigation of the textures in these megafeldspars. Raman spectra were acquired along a core-to-rim trajectory and show an alternate shift of $\sim$1 – 1.5 cm^{-1} of the I_a and I_b bands is systematically observed. These spectral frames represent the first group and the strongest vibrational mode of the feldspar structure: the ring breathing modes of the four-membered rings of tetrahedra. The order degree between them corresponds to one of the 3 polymorphs, which can be thus discriminated. Moreover, the size of the rings is in turn influenced by the atomic substitutions within them. This induces the shift on the peaks of the Raman spectra that, recurrently recorded along the transects, match to oscillatory zoning of the megafeldspars. Together with micro-Raman, a detailed morphological and chemical study of the textures and the inclusions have been carried out. Combining micro-Raman analysis, chemical investigation and rheological modelling could provide insights into the timescales of reactivation of large caldera systems.