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# A comparison between Tenerife pre- and post-caldera phonolitic magmas using experimental petrology: implications for eruptions dynamics and hazard assessment.

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The use of experimental petrology techniques, in combination with traditional petrological studies, can provide constraints on the pre-eruptive conditions of magmas.

This information can help to estimate several constitutive parameters (viscosity, diffusion, bubble nucleation and bubble growth) that control magma behaviour and eruption dynamics, thus permitting to compare between different volcanic eruptions.

Two different samples from two explosive eruptions from Tenerife (Canary Islands) have been studied using experimental petrology. One sample is a phonolitic pumice from the 190 ka El Abrigo caldera-forming eruption, and contains the following mineral phases: sanidine + biotite + magnetite + sphene + sodalite/hauyne + clinopyroxene. The other sample is a phonolitic obsidian from the 2 Ka sub-plinian eruption of Montaña Blanca, on the flanks of the post-caldera Teide-Pico Viejo complex; the sample has the following mineral phases: anorthoclase+biotite+magnetite+illmenite+apatite+pyroxene. The experiments have been performed in cold seal pressure vessels (CSPV) with rapid-quench device varying P, T, $fO_2$ and water content (saturated and undersaturated). For the El Abrigo sample, crystallization experiments were run at pressures of 500 to 2500 bars, temperatures of 700-900ºC, $fO_2$: NNO-NNO+1 and water contents from saturated to undersaturated conditions. Run products include the following mineral phases: sanidine/anorthoclase+biotite+magnetite+clinopyroxene+sphene+apatite+nepheline. For

the Montaña Blanca obsidian crystallization and reversal experiments were run at $fO_2$: FQM-NNO+1, pressures of 100-2550 bars, temperatures of 700-925ºC, at water saturated conditions and with a mixture of $H_2O$+$CO_2$ simulating water undersaturated conditions; observed mineral include: Anorthoclase + clinopyroxene + biotite + magnetite + ilmenite + apatite.

The results obtained to date suggest that the roof of the El Abrigo magma chamber was occupied by a high evolved phonolite with low crystal content ($<$5%), which was at $\approx$ 765ºC, $\approx$ 1100 bars, 3-4.5% of $H_2O$ and $fO_2$ between NNO-NNO+1, whereas in the Montaña Blanca magma chamber the uppermost part was occupied by a phonolitic layer at $\approx$ 755-800ºC, $\approx$ 1500 bars, $fO_2 \approx$ FQM-1, 3-4.5% $H_2O$.

Taking into account the new experimental results and the existing petrological data we deduce that in both cases the corresponding magma chambers were compositionally and rheologically zoned, from felsic (top) to mafic (bottom) phonolitic magmas, and water undersaturated. This implies that overpressure due to replenishment, rather than oversaturation in a closed system, is the most suitable eruption trigger in both cases.