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Mechanisms controlling explosive-effusive transition of Teide-Pico Viejo complex dome eruptions.

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The Teide-Pico Viejo (PT-PV) stratovolcanoes constitute one of the major potentially active volcanic complexes in Europe. PT-PV was traditionally considered as non-explosive system however, recent studies (ie. García et al. 2014) have pointed out that the explosive character of phonolitic magmas, including plinian and subplinian eruptions and generation of pyroclastic density currents, have also been significant within the last 30 kyr volcanological record. This explosive activity is mostly associated to satellite dome vents, like the one studied in this work, Pico Cabras. Dome-forming eruptions usually present sudden transitions between explosive and effusive activity. A better knowledge of this type of eruptions and about the main mechanisms controlling the changes in eruptive dynamics is required to undertake a comprehensive volcanic hazard assessment of Tenerife Island. In this study, we conduct a petrological and mineral characterization of the different eruption phases of Pico Cabras (pumice and lava flow samples for the explosive and effusive activity, respectively) with the aim of determining the factors that control these changes in the volcanic activity. Products were characterized with Scanning Electrom Microscope, and mineral phases, glass and volatile species (F, Cl) were analysed with electron microprobe and micro-XRF. The pre-eruptive conditions of the magma (pressure, temperature and water dissolved in the magma) were determined first by using available geothermobarometers, geohygrometers (Masotta et al., 2013; Mollo et al., 2015) and compared to those retrieved by using available phase equilibria experiments from the literature (ie. Andújar and Scaillet, 2012).

Our results suggest the presence of a compositionally stratified magma chamber at 1 kbar±0.5kbar prior to Pico Cabras eruption in which the differences in the eruptive styles are controlled by the temperature and the amount of volatiles dissolved in the melt. The explosive phase is related to the upper part of the magma chamber at 725ºC±25ºC and 3,5-5 wt% H_2O and the effusive phase with the main body of the chamber at 880ºC±30ºC and 2,5-3 wt% H_2O. Feldspar zonations show that overturn events occurred in the different layers of the magma chambers ("self-mixing") and suggest that the eruption was triggered by underplating of mafic magma without magma mixing. Chemical composition of some feldspars from the explosive phase are equivalent to those found in El Abrigo eruption, the last caldera-forming episode (ca. 190 ka), demonstrating that PT-PV volcanic system is still capable of producing evolved and very explosive magmas.

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