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Evolution and Opening of the Campi Flegrei super-volcano magma chamber.

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Differentiation mechanisms and timescale controlling over-pressuring and opening of magma chambers are crucial issues for volcanic risk evaluation, particularly in densely populated areas. Campi Flegrei high-risk active super-volcano produced a tens of eruptions with VEI ranging between 1 and 7. Here we analyzed the chemical composition of minerals and glass-matrixes of most explosive and effusive eruptions in order to reconstruct pre-eruptive compositional, thermal and pressure gradients as well as mechanisms and timing of evolution towards critical conditions and eruption.

Our geochemical and isotopical data has revealed the pre-eruptive and eruptive conditions of the crustal magma chambers located at different depth between 5-8 km and at below 10 km which produced the different eruptions. Eruptions occur by sudden opening and withdrawal of magma chamber close to over-saturation conditions. Our textural data indicate that moderate to long magma rise times, calculated in the order of few days, produce open-degassing responsible for moderately explosive to effusive activity. Short magma rise times, calculated in the order of few hours, result in closed–system degassing that allow explosive fragmentation when the volume of growing bubble reaches a fixed threshold. Vesicularity and water content measured on matrix glass of pumice indicate that this process occurs at pressure of 10-30 MPa. In these conditions, degassing, fragmentation and in turn the eruptive style is strongly influenced by initial conditions in the magma chamber (volatile content, temperature, pressure) instead of decompression rate. Our inferences on the rise processes timing retrieved from CSD data for CF rocks, allow us to make some speculation about a possible reliable forecast of magmatic activity in the order of tens of hours before

eruptions.