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Nanocrystals formation, the elephant in the laboratory

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Nanocrystals are recently discovered components in magmas and silicate melts used as analogues of volcanic melts in the laboratory. While their origin in magmas has yet to be resolved, recent experiments have shown that their formation can increase the melt viscosity and trigger the nucleation of a high number density of bubbles. These two processes are known to be decisive in the eruptive style transition.

Experimental and analytical evidence has shown that nanocrystals formation occurs in timescales ranging from milliseconds to minutes, often under experimental conditions that for decades were considered peculiar to pure liquids. This raises the question of our knowledge, real or otherwise, of magma properties. This uncertainty then reverberates in numerical modelling of volcanic eruptions since – for example – magma viscosity and volatile solubility are known to be key properties in defining the expected eruptive scenario. Ultimately, nanocrystals formation can thus influence both magma dynamics and our ability to predict volcanic eruptions on a probabilistic basis.

Here I will explore studies on nanocrystals formation and magma properties. I will show the combination of ex- and in-situ methodologies to capture the effect of nanocrystals on magma viscosity and degassing. I will compare emerging observations with results from past studies and identify questions that I believe need to be answered. Although considerable progress has been made toward characterizing magma properties, I will discuss that there is still much work to be done, especially on how to measure properties in the laboratory and observe in situ magma dynamics at realistic conditions. Finally, I will share my perspective on how through a multidisciplinary effort we can achieve a general understanding of the processes that lead to nanocrystals formation, their impact on magma properties and thereby volcanic eruptions.