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A myriad of melt inclusions: a synchrotron microtomography study of melt inclusions and vapour bubbles from Colli Albani (Italy)

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Melt inclusions provide a window into the inner workings of magmatic systems. Both mineral chemistry and volatile distributions within melt inclusions can provide valuable information about the processes modulating magma ascent and preceding volcanic eruptions. Many melt inclusions host vapour bubbles which can be rich in CO_2 and H_2O and must be taken into consideration when assessing the volatile budget of magmatic reservoirs. These vapour bubbles can be the product of differential volumetric contraction between the melt inclusion and host phase during an eruption or indicate an excess fluid phase in the magma reservoir. Thus, determining the distribution of volatiles between melt and vapour bubbles is integral to our fundamental understanding of melt inclusions, and by extension the evolution of volatiles within magmatic systems.

A large dataset of 79 high-resolution tomographic scans of clinopyroxene and leucite phenocrysts from the Colli Albani Caldera Complex (Italy) was recently acquired at the German Electron Synchrotron (DESY). These tomograms allow us to quantify the volume of melt inclusions and associated vapour bubble both glassy and microcrystalline melt inclusions. Notably, in the glassy melt inclusions the vapour bubbles exist either as a single large vapour bubble in the middle of the melt inclusion or as several smaller vapour bubbles distributed around the edge of the melt inclusion. These two types of melt inclusions can coexist within a single crystal. We suggest that the occurrence of these rim- bubbles is caused by one of two exsolution pathways, either pre-entrapment and bubble migration or post entrapment with preferential exsolution at the rims. By combining the analysis of hundreds of melt inclusions with the chemistry of the host phase we aim to unveil magma ascent rates and distribution of excess fluids within the magmatic system of Colli Albani, which produced several mafic-alkaline large volume ignimbrites.