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SPECIAL COLLECTION: RATES AND DEPTHS OF MAGMA ASCENT ON EARTH

REVIEW

Experimental constraints on bubble formation and growth during magma ascent: A review†

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ABSTRACT

The number of studies investigating the vesiculation of natural samples and their implications to volcanic degassing and eruption mechanisms has been growing rapidly within the last decades. To interpret the natural rock textures, the geoscience community has produced a range of experimental and theoretical data sets on bubble nucleation, growth, and coalescence in magmatic systems. A robust experimental database is required to calibrate (theoretical and empirical) modeling approaches, which allow the calculation of magma ascent rates from volcanic ejecta mainly by the determination of the bubble number density (*BND*). Although, the available data set is still limited, it already shows that variations in melt (and volatile/fluid) composition can have a significant effect. In this manuscript we (re-)evaluate the existing experimental data set, while focusing mainly on the review and discussion of continuous decompression experiments.

One aim of this review article is to encourage scientists to fill the gaps in the existing experimental data sets and help to acknowledge, use, and further develop the most promising experimental techniques. Therefore, we highlight different methods and discuss their advantages and possible limitations. We also discuss possible ways of how to better account for the influence of melt composition in models, which link *BND* to decompression rate.

Keywords: Bubble nucleation and growth, decompression experiment, magma ascent rates, Review article