

Faster = Stronger? decompression rates vs eruption parameters at Stromboli volcano

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Magma ascent rate is a complex yet crucial parameter to understand eruption dynamics. We quantified this parameter using the volatile diffusion in melt embayments and bubble number density (BND) techniques for seven of the most explosive major and paroxysmal eruptions at Stromboli volcano in the last 600 years. Such volcano is well documented, closely monitored, and produced pyroclasts from a large number of eruptions with different magnitudes while having the same magma composition and eruption vent. It is an ideal test site. We measured water diffusion profiles by Raman spectroscopy, SIMS and nanoSIMS and fitted these profiles using the EMBER^[1] diffusion software. BND measurements were obtained from analysis of electron microscopy images using the FOAMS^[2] software. Our result show extremely rapid decompression rates amongst the highest recorded by this technique to date. Ascent rate of the volatile-rich 'golden pumices', 'low porphyric', phase from 5-6 km depth during paroxysmal eruptions may be less than a minute. We explore possible correlation between ascent rate and eruption parameters such as plume height and eruption volume and intensity.

[1] Georgeais, G., Koga, K. T., Moussallam, Y. & Rose-Koga, E. F. Magma decompression rate calculations with EMBER: A user-friendly software to model diffusion of H₂O, CO₂ and S in melt embayments. *Geochem Geophys Geosyst* (2021) doi:10.1029/2020GC009542.

[2] Shea, T. *et al.* Textural studies of vesicles in volcanic rocks: An integrated methodology. *Journal of Volcanology and Geothermal Research* 190, 271–289 (2010).