Geophysical Research Abstracts
Vol. 17, EGU2015-6251, 2015
EGU General Assembly 2015

Slow Decompression Experiments on Volatile- and Crystal-Bearing Analogue Magmas: Effects of Physical Properties and Decompression Rate.

Laura Spina, Corrado Cimarelli, Bettina Scheu, Danilo Di Genova, and Donald Bruce Dingwell
Ludwig-Maximilians-Universität München, Munich, Germany (laura.spina@min.uni-muenchen.de)

We performed decompression experiments in a shock tube system. Silicon oil was used as a proxy for basaltic melt, and saturated with 10 MPa of Argon for 72h, then slowly decompressed under controlled conditions. The dynamics of exsolved volatiles were studied through video image analysis, supported by recordings of the pressure state within the system.

In order to investigate the role of the fluid physical properties on the decompressive response of the analogue samples, different series of experiments were performed. 1) Pure liquids with viscosities ranging from 1 to 1000 Pa s were used to map the liquid response. 2) Increasing amounts of micrometric spherical particles were added to the liquid to evaluate the effect of crystal fraction. 3) The role of crystal shape was examined by using particles with different aspect ratios. 4) Finally, the effects of saturation time and pressure were evaluated in a series of experiments, performed with shorter saturation time (24 h), over a range of saturation pressures. The rheology of mixtures bearing different amount of particles with different shapes was characterized through concentric cylinder measurements.

In order to analyze the dynamics of the decompressed fluid, we tracked the variation of gas volume fraction through time. Accordingly, three different stages have been recognized in the multiphase mixtures evolution. Indeed at the beginning the fluid arises with a slow ascent rate. During this phase bubble nucleation is observed. As bubbles grow to form a foam layer at the top of the fluid column, ascent rate increase sharply. Finally the sample stops its ascent toward the surface, and coalescence phenomena become dominant, inducing periodical oscillation of the foam layer. The extent and timing of each phase depends strongly on the particle content and shape, as well as –for pure fluid- on the initial viscosity.

Experimental decompressions provide us the possibility of individually quantifying the contribution of such fundamental factors on the general behavior of the ascending fluid, providing a map of the mutual relationship among textural build up and initial condition.