Geophysical Research Abstracts
Vol. 18, EGU2016-15532, 2016
EGU General Assembly 2016


# Permeability during densification of viscous droplets

Fabian Wadsworth (1), Jérémie Vasseur (1), Ed Llewellin (2), Katherine Dobson (1), Jenny Schauroth (1), Michael Heap (3), Jamie Farquharson (3), Bettina Scheu (1), Jackie Kendrick (4), Yan Lavallée (4), Felix von Aulock (4), and Donald B. Dingwell (1)

(1) LMU, Munich, Germany (fabian.wadsworth@min.uni-muenchen.de), (2) Durham University, Durham, U.K., (3) Institut de Physique de Globe de Strasbourg, Strasbourg, France, (4) University of Liverpool, Liverpool, U.K.

Fragmentation of magma can yield a transiently granular material, which can subsequently weld back to a fluid-continuum. This process results in dramatic changes in the porosity of the material, which impacts its fluid permeability. We collate published data for the porosity and permeability of volcanic and synthetic materials which have undergone this process to different amounts. By discriminating data for which good microstructural information are provided, we use simple scaling arguments to collapse the data in both the still-granular, high porosity region, and the fluid-continuum low porosity region, such that a universal description can be provided. This allows us to describe the microstructural meaning of permeability scaling, and to infer the controls on the position of this transition between dominantly granular (dispersion) and dominantly fluid-continuum materials. Fractures in coherent magmas are thought to be a primary degassing pathway in high viscosity systems. As a specific application, we consider transiently granular magma being transported through and deposited in these fractures. We finally present a physical model for the kinetics of porosity changes in arrays of viscous droplets and compare this with our experimental data. The combination of the physical model for the evolution of porosity with the scaling between porosity and permeability permits us to describe the evolution of permeability during densification. We anticipate that this will be a useful tool for predicting the longevity of degassing pathways in granular filled cracks, both in conduits and shallow lava domes, as well as during the sedimentation of exceptionally hot ignimbrites undergoing compaction and welding.