

EGU21-13573

<https://doi.org/10.5194/egusphere-egu21-13573>

EGU General Assembly 2021

© Author(s) 2022. This work is distributed under the Creative Commons Attribution 4.0 License.



## Characterising fracture patterns at growing lava domes

**Amy Myers**<sup>1</sup>, Claire Harnett<sup>1</sup>, Michael Heap<sup>2</sup>, Eoghan Holohan<sup>1</sup>, and Thomas Walter<sup>3</sup>

<sup>1</sup>School of Earth Sciences, University College Dublin, Ireland (amy.myers@ucdconnect.ie)

<sup>2</sup>Institut de Physique de Globe de Strasbourg, Université de Strasbourg, France

<sup>3</sup>GFZ German Research Centre for Geosciences, Germany

Volcanic domes form when lava is too viscous to flow away from an active volcanic vent; instead, the lava accumulates into a mound consisting of a hotter, ductile core and a colder, brittle outer layer. An existing lava dome grows when new material is injected into the core of the dome, causing the outer layer to stretch and develop tensile fractures. With continued dome growth, these weaknesses can propagate to form an extensive fracture network and the dome may fail. Collapse events often generate rock falls and debris avalanches, lahars, and high-speed pyroclastic flows, endangering populations residing at the base of a volcano. Since such fractures represent potential failure planes, in this project we aim to understand the role they have in destabilising lava domes.

This project will build on the work published by Harnett et al. (2018), which demonstrates the suitability of a discrete element modelling approach to simulate dome emplacement and evolution. Specifically, this project is designed to:

1. Use high-resolution photogrammetry to characterise the possible fracture states of a dome;
2. Establish up-scaled rock-mass properties by performing geomechanical experiments on both fractured and non-fractured samples of dome rock from prior collapses;
3. Develop a numerical model to investigate how the presence and properties of fracture networks influence dome stability.

The model, developed using PFC, will be used to identify critical fracture states that can signify a dome collapse is likely to occur. Under the current model, parallel bonds simulate the fluid magma core and flat joints simulate the solid talus material. This project will build on this original model by incorporating discrete fracture networks into the smooth-joint model to implement dome fracturing. The new model will look to investigate the effect of a fracture network on a static dome that, when in its unfractured state, is stable under gravity. Additionally, the model will be designed such that inputs can include experimentally derived rock-mass properties. It is hoped that, by incorporating observational and experimental data into a more complex model, the dynamic evolution of fractures in a growing lava dome can be investigated and the ongoing likelihood of a dome collapse event can be assessed.

Harnett, C. E. et al., 2018. *J. Volcanol. Geoth. Res.*, 359: 68-77.