

EGU24-5948, updated on 15 Jul 2024

<https://doi.org/10.5194/egusphere-egu24-5948>

EGU General Assembly 2024

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Hydrothermal alteration of lava domes: coupled contribution of experimentation and thermodynamic modelling

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Flank collapse represents a significant hazard at explosive volcanoes. Hydrothermal alteration is considered to promote volcano instability, but there are few data and models to robustly assess this hypothesis. In the framework of the Mygale ANR project, a multidisciplinary approach that combines geological data, geophysical and geochemical techniques, laboratory measurements, and modelling is proposed to assess the role of alteration on the stability of La Soufrière de Guadeloupe (France). We focus here on the benefit of combining time-series and flow-through experiments with thermodynamic and kinetic modelling for constraining the alteration process below the lava dome of La Soufrière. Flow-through experiments under pressure and temperature provide in-situ permeability data during ongoing alteration of pristine andesite. Thermodynamic modelling is essential for evaluating the fluid phase composition driving rock alteration at depth. Kinetic modelling is precious for predicting the alteration sequence on timescales longer than experimentally achievable. Eventually combining such geophysical and geochemical data on natural and experimental samples will allow to propose a large-scale 4D numerical model to assess the influence of alteration on volcano stability and improve monitoring of volcano instability.