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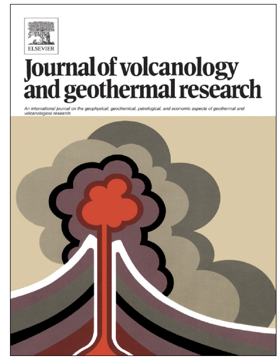

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Domenico Montanari, Marco Bonini, Giacomo Corti, Andrea Agostini, Chiara Del Ventisette

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Forced folding above shallow magma intrusions: Insights on supercritical fluid flow from analogue modelling

Domenico Montanari[1], Marco Bonini[1], Giacomo Corti[1], Andrea Agostini[1] and Chiara Del Ventisette[2]

[1]*Institute of Geosciences and Earth Resources, National Research Council of Italy (CNR), Florence, Italy*
[2]*Earth Sciences Department, University of Florence, Italy.*

Abstract

Magma emplacing at shallow crustal levels may cause significant deformation in the overlying country rock (i.e., forced folding, fracturing and faulting), both at a local and/or regional scale. To get insights into these processes, we investigated in the laboratory the development of forced folds and associated fracture/fault networks. An analogue magma, simulated by polyglycerols, was intruded into a sand pack representing the brittle crust. The scaled analogue models reproduced different 3D deformation structures depending on the model parameters (e.g., magma viscosity, injection rate, volumetric flux, and the rheology and thickness of the host and cover rocks). However, all models support the observation that the emplacement of shallow magmatic bodies may result in the growth of dome-shaped forced folds, and associated development of tensional and compressional deformation in the host-rock. Although the models involve simplifications, these results provide useful hints for geothermal research, as fractures and faults associated with magma emplacement can significantly influence the distribution and migration of superhot geothermal fluids. These structures can therefore be considered potential targets for geothermal and/or ore deposit exploration. In this perspective, the results of analogue models may provide useful geometric constraints for field work, numerical modeling, and particularly seismic interpretation, allowing production and a better understanding of integrated conceptual models concerning the circulation of supercritical fluids.