EGU21-6309
https://doi.org/10.5194/egusphere-egu21-6309
EGU General Assembly 2021

Modelling of interactions between dykes, inclined sheets and faults at Santorini volcano

Kyriaki Drymoni[1], John Browning[2,3], and Agust Gudmundsson[1]
[1]Department of Earth Sciences, Queen's Building, Royal Holloway University of London Egham, Surrey TW20 0EX, UK
[2]Department of Mining Engineering and Department of Structural and Geotechnical Engineering, Pontificia Universidad Católica de Chile, Santiago, Chile
[3]Centro de Excelencia en Geotermia de los Andes (CEGA), Chile

Dykes and inclined sheets are known occasionally to exploit faults as parts of their paths, but the conditions that allow this to happen are still not fully understood. Here we report field observations from a well-exposed dyke swarm of the Santorini volcano, Greece, that show dykes and inclined sheets deflected into faults and the results of analytical and numerical models to explain the conditions for deflection. The deflected dykes and sheets belong to a local swarm of 91 dyke/sheet segments that was emplaced in a highly heterogeneous and anisotropic host rock and partially cut by some regional faults and a series of historic caldera collapses, the caldera walls providing, excellent exposures of the structures. The numerical models focus on a normal-fault dipping 65° with a damage zone composed of parallel layers or zones of progressively more compliant rocks with increasing distance from the fault rupture plane. We model sheet-intrusions dipping from 0˚ to 90˚ and with overpressures of alternatively 1 MPa and 5 MPa, approaching the fault. We further tested the effects of changing (1) the sheet thickness, (2) the fault-zone thickness, (3) the fault-zone dip-dimension (height), and (4) the loading by, alternatively, regional extension and compression. We find that the stiffness of the fault core, where a compliant core characterises recently active fault zones, has pronounced effects on the orientation and magnitudes of the local stresses and, thereby, on the likelihood of dyke/sheet deflection into the fault zone. Similarly, the analytical models, focusing on the fault-zone tensile strength and energy conditions for dyke/sheet deflection, indicate that dykes/sheets are most likely to be deflected into and use steeply dipping recently active (zero tensile-strength) normal faults as parts of their paths.