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# Cracking magmas

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Explosive eruptions are commonly preceded by accelerations in discharge rate and seismic energy released by fracturing. Understanding the propagation of cracks in rapidly deforming magmas is thus needed to adequately describe the physics of explosive eruptions. In this study dome lavas from volcán de Colima (Mexico) are deformed at 900-980 °C under high stresses (up to 50 MPa) in a uniaxial press, and crack propagation is monitored in situ by a couple of fast-acquisition, acoustic emission (AE) sensors. The obtained 1-D AE profile associated with crack propagation is then compared to a series of strain-step experiments as well as to the developed, 3-D crack network imaged after some experiments via high-resolution (30 $\mu$m) neutron tomography.

We observe that uniaxial deformation is initially characterized by extensional cracks propagating inward from the margin of the cylindrical samples. As microscopic cracks grow and link up, a set of transversal, conjugate shear fractures developed from the inner tips of the extensional cracks. Alike the transition to explosive eruptions, the experimental transition of microscopic to macroscopic failure is accompanied by accelerations in strain rate and released AE energy. Inversion of the acceleration rate of released AE energy following the failure forecast method is used to track and predict macroscopic failure of magma. We estimate that accurate failure prediction can be made within $\sim$40 % of the critical strain at failure. Our findings suggest that shear fractures dominate as an acoustic precursor when macrocopic failure is approached.