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Volcanic rock properties control sector collapse events

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Volcanoes constructed by superimposed layers of varying volcanic materials are inherently unstable structures. The heterogeneity of weak and strong layers consisting of ash, tephra and lavas, each with varying coherencies, porosities, crystallinities, glass content and ultimately, strength, can promote volcanic flank and sector collapses. These volcanoes often exist in areas with complex regional tectonics adding to instability caused by heterogeneity, flank overburden, magma movement and emplacement in addition to hydrothermal alteration and anomalous geothermal gradients.
Recent studies conducted on the faulting properties of volcanic rocks at variable slip rates show the rate-weakening dependence of the friction coefficients (up to 90% reduction)[1], caused by a wide range of factors such as the generation of gouge and frictional melt lubrication [2]. Experimental data from experiments conducted on volcanic products suggests that frictional melt occurs at slip rates similar to those of plug flow in volcanic conduits [1] and the bases of mass material movements such as debris avalanches from volcanic flanks [3].
In volcanic rock, the generation of frictional heat may prompt the remobilisation of interstitial glass below melting temperatures due to passing of the glass transition temperature at $\sim$650-750 ˚C [4]. In addition, the crushing of pores in high porosity samples can lead to increased comminution and strain localisation along slip surfaces.
Here we present the results of friction tests on both high density, glass rich samples from Santaguito (Guatemala) and synthetic glass samples with varying porosities (0-25%) to better understand frictional properties underlying volcanic collapse events.

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