



The role of pore fluids on deforming volcanic rocks: an experimental study

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Pore fluids play an important role on the process of the deformation of rocks. Not only it affects the mechanical properties and the elastic velocities of the material, but it is also responsible in the generation of a whole kind of seismicity, characterized by lower frequency and longer tail (i.e. Long Period, LP, and Hybrid events) than the Volcano-Tectonic (VT) signals, generated by simple shear. While great progress has been made in understanding VT events, LPs, Hybrid signals and the transition between these types of activity are not fully understood yet. This study, aiming in particular on the transition between VT and Hybrid events, shows the results of triaxial experiments on a volcanic rock, run both in dry and wet conditions, to better understand the role of the pore fluids on the final stage of the deformation tests, when the sample is approaching failure. This is achieved through a servo-controlled triaxial testing machine and a state-of-the-art acoustic emissions (AEs) kit, composed by an array of 12 piezoelectric sensors surrounding the sample and by both a “triggered” unit, where the events are recorded only if a certain threshold is reached, and a “continuous” unit, where the data is recorded from the beginning to the end of the acquisition, fundamental when the AEs grow exponentially and the triggered unit cannot store at the same rate.

The use of sensors of different dominant frequency allows us to better investigate the events occurring as the sample is approaching failure. In both conditions we observe a decrease of the dominant frequency of the seismic activity, due to two different processes: in dry conditions the coalescence of fractures, eventually leading to the major shear zone, creates relatively low-frequency VT events; the same occurs in wet conditions, but the movement of fluids, eased by the merging of the cracks, generates hybrid events. These two type of seismicity are then distinguished in terms of their source mechanism components, where the low-frequency VTs are characterized by a higher DC component, while hybrid events show a greater CLVD one. These results may have a great impacts in the failure forecasting models, not only in volcanic settings, but wherever the pore fluids play an important role on the stability of the rock mass.