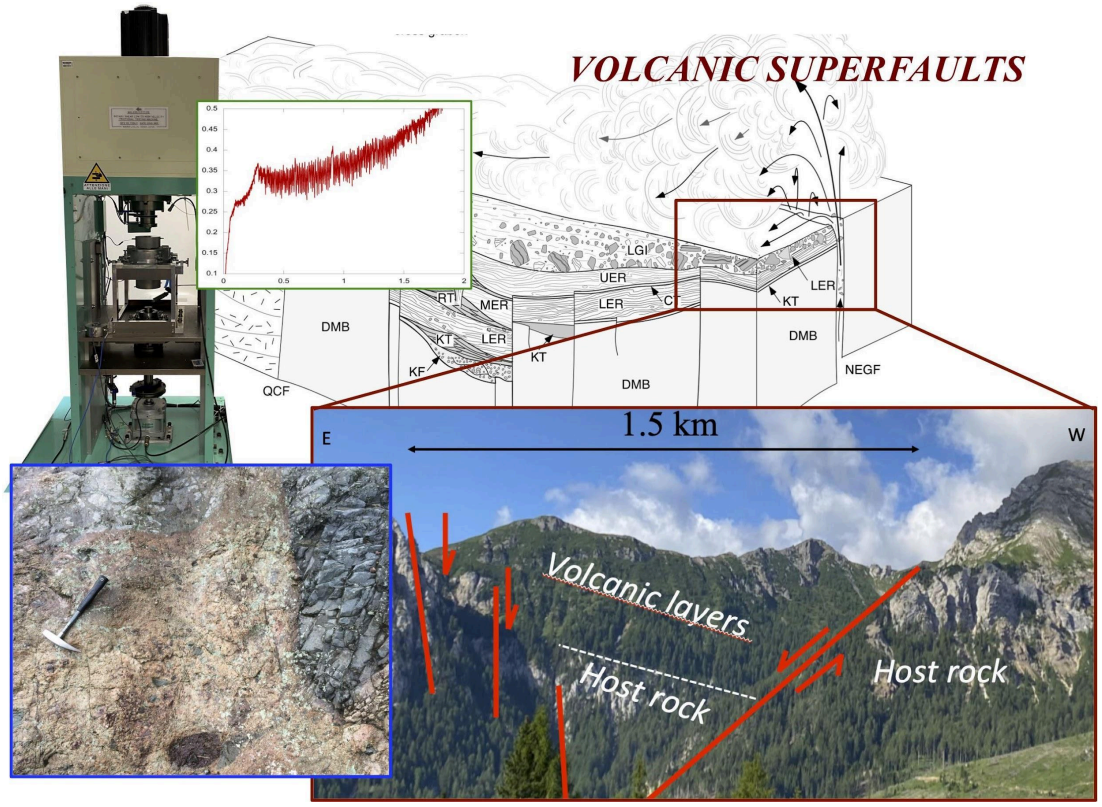
Volcanic Caldera faults: a field and experimental investigation

(Proposer: Prof. Telemaco Tesei)

Active volcanic calderas, such as the currently unresting Campi Flegrei, present among the greatest geological risks on the planet.

Catastrophic collapse, typically associated to Plinian and ultra-Plinian eruptions, occur via the failure of a roof pendant into the magmatic chamber at shallow crustal levels. This collapse triggers or is triggered by failure of ring faults at the edge of the calderas which may potentially control the rate of eruption and evolution of the caldera itself. Moreover, volcanic unrest in calderas typically involves inflation, uplift and prolonged seismic sequences localized both in the caprock/floor of the caldera and at the ring fault systems, which may precede eruptions.

The study of earthquake and fault mechanics in the context of active volcanoes is technically challenging from an experimental point of view, because of the high temperature and hydrothermal conditions that are difficult to replicate in the laboratory. Moreover, it is difficult to directly access the deep roots of caldera faults to study the natural processes of faulting and fluid-deformation interaction. This project aims at studying the internal structure and mechanisms of volcanic faults analyzing both ancient (Monte Cinto, Corsica) and modern (Bolsena, Campi Flegrei) examples caldera faults in the field at different crustal levels. To understand the failure mechanics of these faults, the Student will combine field observations with the experimental study of the natural volcanic rocks at elevated Temperature and fluid-rich conditions, leveraging the state-of-the-art experimental and analytical facilities of the Department of Geosciences. These include the unique hydrothermal rotary shear apparatus for mechanical tests, and FEG-SEM microscope for microstructural investigations.



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