

Identification of the processes of nucleation, propagation, and arrest of seismic ruptures in carbonate rocks through field and laboratory studies

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Numerous earthquakes in mountain belts (Apennines and Southern Alps in Italy, Hellenidis in Greece, Eastern margin of Tibet in China, etc.) occur in thick carbonate sequences. Despite the large number of field (geological, seismological, etc.) and laboratory studies, there is still a fundamental lack of understanding of the mechanical and tribochemical processes that lead to the nucleation, propagation and arrest of seismic ruptures in carbonates. For example, several processes of enhanced fault weakening during seismic slip in carbonates have been proposed, often associated with decarbonation processes, including CO₂-fluid pressurisation, powder lubrication, thermal decomposition and flash heating, grain-boundary sliding aided by diffusion creep, frictional melting, but (1) the process remains undefined and, (2) the complex interactions between faults and fluids (CO₂, H₂O) have not yet been systematically explored. The processes remain unknown, partly because of the difficulty in distinguishing, in microstructural and geochemical/mineralogical studies, evidences of specific coseismic deformation processes from those associated solely with a rise in temperature in the slip zone or with post-seismic fluid-rock interaction.

The PhD student will use (1) field investigations of seismogenic faults outcropping in the central Apennines (Italy) and, (2) state-of-the-art experimental and microanalytical facilities installed at the HP-HT laboratories (INGV Rome-Italy) and Rock Mechanics Lab (University of Padua-Italy) to determine the chemical-physical processes associated with the nucleation, propagation and arrest of seismic ruptures in carbonates. The main objective is to provide a new insight into the processes that cause destructive earthquakes in carbonate rocks based on solid field and laboratory observations.



Polished fault surface in carbonates from the seismogenic Monte Venere Fault Zone (Central Apennines, Italy)

Funds:

Giulio Di Toro: DI_T_FAS25_02 Di Toro & DOR