



USEMS - Uncovering the secrets of earthquake: multidisciplinary study of physic-chemical processes during the seismic cycle

Southern Europe and Turkey lie within the highest seismic risk areas in the world. Understanding the physico-chemical processes controlling earthquake generation is essential in seismic hazard assessment. Destructive earthquakes nucleate at depth (10-15 km), therefore monitoring active faults at the Earth's surface, or interpreting seismic waves, yields only limited information on earthquake mechanics. We propose to investigate earthquake processes by:

- 1) installing a new world class high velocity rock friction apparatus to perform experiments under deformation conditions typical of earthquakes;
- 2) studying fossil seismic sources now exhumed at the Earth's surface;
- 3) analyzing natural and experimental fault rock materials using a novel multidisciplinary approach involving state of the art techniques in microstructural analysis, mineralogy and petrology;
- 4) producing new theoretical earthquake models calibrated (and tightly constrained) by field observations, mechanical data from rock-friction experiments and analyses of natural and experimental fault rocks. The integration of such an original and complementary data set shall provide an unprecedented insight into the mechanics of seismic faulting.

The installation of the new dedicated rock friction apparatus will allow the European Union to become a key world player competing at the top scientific level in the study of earthquake mechanics. The proposed study has additional implications for understanding other friction-controlled processes important in Earth sciences and hazard mitigation (e.g., rock landslides). Friction also has broad applications in the industry, including innovative but poorly understood production processes. Our experimental results will help to improve industrial milling techniques and investigate the mechanical-chemical transformations induced during milling. The latter is the basis of a new technique for the production of hydrocarbons and hydrogen from inorganic and organic materials.

ERC Grantee: Giulio Di Toro

Department: Geosciences

Coordinator: Università degli Studi di Padova

Total EU Contribution: Euro 1.992.000

Call ID: ERC-2007-StG

Project Duration in months: 60

Start Date: 01/06/2008

End Date: 01/06/2013

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PROJECTS FUNDED AT THE UNIVERSITY OF PADOVA