Crustal fault flexure implies shallow shaking and deep relaxation in the Corinth Rift

Gino De Gelder*[1], David Fernandez Blanco[1], Robin Lacassin[1], and Rolando Armijo[1]

[1]Tectonique et mécanique de la lithosphère – Institut de Physique du Globe de Paris – France

Abstract

Its extremely high extension rates and well-preserved morphology make the Corinth rift (Greece) an exceptional area to study deformation mechanisms of a young rift system on a range of timescales. Late Pleistocene activity of large, mainly N-dipping normal faults has resulted in an E-W trending half-graben, with a broad uplifted footwall along the Gulf's southern margin. The flexural footwall uplift pattern of these faults is recorded in the flights of marine terraces, which have been created by Quaternary sea-level cycles and uplifted along the Gulf's southern margin. To constrain its deformation pattern, we analysed the extensive terrace sequence between Xylokastro and Corinth using 2m-resolution digital elevation models developed from Pleiades satellite imagery. We then depth-converted a multi-channel seismic section north of the Xylokastro terraces, in which Quaternary sea-level cycles also mark flexural subsidence of the hanging wall. The onshore-offshore profile of the fault geometry and its associated deformation pattern reveals the long-term flexural wavelength and uplift/subsidence ratio, which we reproduce with fault modeling. We use PyLith, an open-source finite element code, to simulate 240 ka of cumulative earthquake cycles for a steep-dipping planar fault to the brittle-ductile transition in 3- and 5-layer lithospheric-scale models. These models indicate that the coseismic elastic flexure pattern, created during those cycles within the elastic upper crust, should alternate with relatively deep post-seismic viscous relaxation in the basal part of the lower crust and/or in the upper mantle. Given the quality and uniqueness of the dataset in the Corinth Rift, we propose that this deformation mechanism may be typical for all young rift systems.

*Speaker