Geophysical Research Abstracts
Vol. 18, EGU2016-584-1, 2016
EGU General Assembly 2016

Analogue modelling of the effect of topographic steps in the development of strike-slip faults

Ricardo Tomás (1), João C. Duarte (1,2,3), Filipe M. Rosas (1,2), Wouter Schellart (3), and Vincent Strak (3)

(1) Universidade de Lisboa, Faculdade de Ciências, Departamento de Geologia, Campo Grande, Ed. C6, Piso 4, 1749-016 Lisbon, Portugal, (2) Instituto Dom Luiz, Campo Grande, Ed. C1, Piso 2, 1749-016 Lisboa, Portugal, (3) School of Earth, Atmosphere and Environment, Monash University, Melbourne, VIC 3800, Australia

Strike-slip faults often cut across regions of overthickened crust, such as oceanic plateaus or islands. These morphological steps likely cause a local variation in the stress field that controls the geometry of these systems. Such variation in the stress field will likely play a role in strain localization and associated seismicity. This is of particular importance since wrench systems can produce very high magnitude earthquakes. However, such systems have been generally overlooked and are still poorly understood.

In this work we will present a set of analogue models that were designed with the objective of understanding how a step in the morphology affects the development of a strike-slip fault system. The models consist of a sand-cake with two areas with different thicknesses connected by a gentle ramp perpendicular to a dextral strike-slip basal fault. The sand-cake lies above two basal plates to which the dextral relative motion was imposed using a stepping-motor.

Our results show that a Riedel fault system develops across the two flat areas. However, a very asymmetric fault pattern develops across the morphological step. A deltoid constrictional bulge develops in the thinner part of the model, which progressively acquires a sigmoidal shape with increasing offset. In the thicker part of the domain, the deformation is mostly accommodated by Riedel faults and the one closer to the step acquires a relatively lower angle. Associated to this Riedel fault a collapse area develops and amplifies with increasing offset. For high topographic steps, the propagation of the main fault across the step area only occurs in the final stages of the experiments, contrary to what happens when the step is small or inexistent.

These results strongly suggest a major impact of the variation of topography on the development of strike-slip fault systems. The step in the morphology causes variations in the potential energy that changes the local stress field (mainly the vertical component), which changes the patterns of fault segmentation, as observed in our results. Such changes certainly have an impact in fault rupture and consequent seismic hazard. Furthermore, we compare the outcomes of these experiments with natural examples, as well as with numerical models.