Geophysical Research Abstracts
Vol. 14, EGU2012-6150, 2012
EGU General Assembly 2012

Effect of fluid overpressure on thrust wedges deformation - insight from sandbox models

A. Pons (1) and R. Mourgues (2)

(1) Laboratoire de Géologie, ENS - CNRS, paris, France (apons@geologie.ens.fr), (2) UMR CNRS 6112, Université du Maine, 72085 Le Mans Cedex 09, France.

Elevated pore pressures are commonly invoked as a key factor for thrust wedges deformation. Even in the well-known and widely used critical taper model of an accretionary wedge, they are introduced as a first-order parameter. This parameter is the Hubbert-Rubey pore pressure ratio λ. Despite the fact that the importance of fluid overpressure is not discussed and that more and more field measurements focus on quantifying pressure distributions, either numerical or analogue modelers are a few to take into account fluid pressure in their modeling. In the critical taper model, fluid overpressure reduces frictional resistance at the base and many experimenters used low frictional materials to create basal detachments. But fluid overpressures also act as body forces on the whole wedge in addition to that of gravity and this second effect was never experimentally confirmed.

In this work, we performed scaled experiments in which compressed air is used as the pore fluid, to understand how fluid pressure controls the first stages of thrusting. The models were built with non-cohesive sand in their upper part and glass microbeads for the décollement to insure the weakness of the detachment. Both materials have similar permeabilities and as we applied horizontally varying fluid pressureat the base of the model, the pore pressure ratio λ was almost constant in the whole wedge. We found a good match with the critical taper model predictions.
Combining these experiments with an optical image correlation technique (particle imaging velocimetry - PIV), we were able to follow the strain in the model during the entire duration of the shortening. In particular, we studied the propagation of the décollement and highlighted a strong influence of the pressure ratio, λ, on the activation rate of the décollement. Indeed, higher the overpressure is, faster the propagation of the décollement is. Moreover, we found that the distance to the critical taper condition, which depends on both values of topographic angle, α and pressure ratio, λ plays a major role in the strain localization. For example, in case of wedges deforming by thrusting, closer to the critical taper conditions the wedge is, more diffuse the thrusts are.