Abstract

Thrusting sequences: mechanical predictions, analogue validation and application to the Pampa Tril Fold (Agrio FTB, Argentina)

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The objective of this work was to predict thrusting sequences in accretionary wedges or in fold-and-thrust belts based on the theory of limit analysis. The method is first validated by proving that the critical taper, for a simple triangular wedge, is properly captured. It is shown that a perturbation, in the form of a relief added to the critical slope, leads to the localisation of the deformation at the back or the front of the perturbation. This study reveals that weakening of the ramp, accounted for by a decrease of the friction angle, is necessary for each thrust to have a finite life span. The prediction of thrusting sequences show that a decrease of the basal friction leads to an increase of the number of thrusts. An increase of the weakening results in an increase of the life span of a thrust. An inverse study is then carried out to validate the theory by comparing sandbox experimental results with mechanical predictions. This quantitative comparison requires to estimate the intrinsic variability of the experimental results. Therefore, only one experiment repeated 10 times has been studied. A statistical analysis is then conducted to construct the statistical models of each observable. Probabilities distributions for the rheological parameters of the experiment are provided by the inverse problem. These probabilities have been compared to independant measures. The theory if finally applied to the Nankai wedge and to the Tromen and Pampa Tril folds of the Agrio fold-and-thrust belt, Agentina. Two kinematical models have been proposed for this two folds, one in favor of a thick-skinned origin, and another in favor of a shallower décollement. The objective was to provide mechanical arguments to the discussion. It is shown that the thick-skinned model is favored in the case of a fault reactivation. If magmatic material can intrude along faults, the second hypothesis is then preferred.