Influence of the orientation of cohesive blocks upon the structural grain of fold-and-thrust belts: An appraisal by means of analogue modeling

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Abstract

Analogue sand-box experiments have been set up to illustrate and analyze the control exerted by lithological heterogeneities on the evolution of a model fold-and-thrust belt (FTB). The structural architecture within many FTBs is highly sensitive to pretectonic obstacles (e.g., basement highs or intrusive bodies). To address FTB evolution with emphasis on the latter, we perform a series of experiments that include tabular cohesive blocks surrounded by a layered sandpack of negligible cohesion. Two degrees of cohesion are tested (low vs high cohesion) as well as different geometrical boundary conditions (longer axis parallel vs oblique relative to the main far-field stress). Modeling results show a tendency of sequential faults to avoid rigid obstacles, enhancing frontal accretion and propagation of the deformation front. Structural traces have arcuate patterns in map-view, strongly consistent with the geometry of the underlying block/obstacle. High-cohesion models show major deviations on the structural pattern with respect to models with low-cohesion blocks. We find that the rheological contrasts between rock types have an important effect on the structure of the upper crust, controlled by the degree of the contrast and the geometry (orientation) of the discordant block. An interesting aspect of our results is that orientation of the block plays a considerable role on whether new thrusts cut the block or stresses propagate towards the foreland through the cohesive body. Block obliquity also influences the generation of back-thrusts. These features are compared to natural cases as well as to other physical models of FTBs. We suggest that irregular structural patterns in FTBs may shed light on the presence of buried rock bodies (intrusive bodies, metamorphic complexes or crystalline basement highs) within the components of the deformed rock sequence.

Palabras clave

Palabras clave de autor: Fold-and-thrust belts; Analogue modeling; Obliquity; Rigid blocks; Cohesion; Structure
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