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Triangle Zones as Mechanical Gages for Fold-Thrust-Belts

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Fault vergence in fold-and-thrust belts and accretionary prisms is characterized by mainly forward verging thrusts and pop-up structures, and only few examples exist where backthrusting dominates. However, backthrusting and triangle zones are known from most if not all fold-thrust belts in the world. The circumstances under which backthrusts instead of forethrusts form are still incompletely understood and a systematic study of parameters that may control backthrusting is still missing. This is unfortunate, because triangle zones form gages that may provide providing tight constraints on fold-thrust belt mechanics.
In this contribution, we present numerical models of fold-thrust belts, focusing on different aspects of their mechanics, and particularly triangle zones. In a wedge-mechanical framework, we test the influence of décollement strength, dip, presence of multiple décollements, and the effect of syn-tectonic sedimentation. While models corroborate the idea that décollement strength and basal dip may control thrust vergence, comparison with natural examples indicates this cannot be the only explanation for the formation of backthrusts. Additionally, syn-tectonic sedimentation, rheological changes across strike, or structural inheritance may play a role. We apply our findings to the Alpine-Carpathian belt, using a compilation of structures along strike the entire fold-thrust belt.

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