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Stress history and fracture pattern in fault-related folds based on limit analysis: application to the Sub-Andean thrust belt of Bolivia

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A methodology is proposed to construct the stress history of a complex fault-related fold in which the deformation mechanisms are essentially frictional. To illustrate the approach, fours steps of the deformation of an initially horizontally layered sand/silicone laboratory experiment (Driehaus et al., J. of Struc. Geol., 65, 2014) are analysed with the kinematic approach of limit analysis (LA). The stress, conjugate to the virtual velocity gradient in the sense of mechanicam power, is a proxy for the true statically admmissible stress field which prevailed over the structure. The material properties, friction angles and cohesion, including their time evolution are selected such that the deformation pattern predicted by the LA is consistent with the two main thrusting events, the first forward and the second backward once the layers have sufficiently rotated. The fractures associated to the stress field determined at each step are convected on today configuration to define the complete pattern which should be observed. The end results are presented along virtual vertical wells and could be used within the oil industry at an early phase of exploration to prepare drealing operations.