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# The effect of mechanical discontinuities on the growth of faults

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The growth of natural faults is controlled by several factors, including the nature of host rocks, the strain rate, the temperature, and the presence of fluids. In this work we focus on the mechanical characteristics of host rocks, and in particular on the role played by thin mechanical discontinuities on the upward propagation of faults and on associated secondary effects such as folding and fracturing. Our approach uses scaled, analogue models where natural rocks are simulated by wet clay (kaolin). A clay cake is placed above two rigid blocks in a hanging wall/footwall configuration on either side of a planar fault. Fault activity is simulated by motor-controlled movements of the hanging wall. We reproduce three types of faults: a 45°-dipping normal fault, a 45°-dipping reverse fault and a 30°-dipping reverse fault. These angles are selected as representative of most natural dip-slip faults. The analogues of the mechanical discontinuities are obtained by precutting the wet clay cake before starting the hanging wall movement. We monitor the experiments with high-resolution cameras and then obtain most of the data through the Digital Image Correlation method (D.I.C.). This technique accurately tracks the trajectories of the particles of the analogue material during the deformation process: this allows us to extract displacement field vectors plus the strain and shear rate distributions on the lateral side of the clay block, where the growth of new faults is best seen. Initially we run a series of isotropic experiments, i.e. experiments without discontinuities, to generate a reference model: then we introduce the discontinuities. For the extensional models they are cut at different dip angles, from horizontal to 45°-dipping, both synthetic and antithetic with respect to the master fault, whereas only horizontal discontinuities are introduced in the contractional models. Our experiments show that such discontinuities control: 1) the propagation rate of faults, which may either accelerate or decelerate depending on the orientation of the discontinuity and the distance with respect to the newly developed faults; 2) the shape of fault-related folds, which changes according to the propagation rate; 3) the partial reactivation of the discontinuity, which affects both the shape of related folds and the development of secondary fractures or faults. In summary, our results suggest that thin, mechanical discontinuities exert a strong influence in the growth pattern of both extensional and contractional systems.