The effect of pre-existing faults on the development of extensional basins: insights from wet clay experiments

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Most of the present-day extensional systems formed in areas that already experienced an older phase of tectonic activity. Therefore, understanding how a pre-existing structural setting may affect the development of an extensional basin is a crucial interplay to decipher. Depending on the kinematics of these phases, the resulting inherited faults can be extensional, contractional, or transcurrent. Consequently, a new extensional basin forms atop or across pre-existing faults that can dip at a low- (e.g., inherited thrust faults) or high-angle (e.g., inherited extensional faults). Furthermore, the inherited structures can have a non-optimal attitude with respect to the new extensional stress field, thereby determining different instances for reactivation. In this study, we analyzed the impact of dip and strike of inherited faults on the development of an extensional basin using wet clay (kaolin) analogue modeling. We reproduced sixteen different setups by varying the dip (30°, 45°, 60°) and the strike (15°, 30°, 45°, 60°, 75°) of the pre-existing faults that we introduced in the experiments before applying extension. The results show that the orientation of pre-existing faults has a direct effect onto the shape of the new extensional basins. When the pre-existing faults are reused to accommodate the new extensional phase, the formed basins are asymmetric and the rate of growth of the new faults is lower.