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Analogue modelling for localization of deformation in the extensional pull-apart basins: comparison with the west part of NAF, Turkey

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Analogue modelling remains one of the best methods for investigating progressive deformation of pull apart systems in strike slip faults that are poorly known. Analogue model experiments for the North Anatolian Fault (NAF) system around the Sea of Marmara are extremely rare in the geological literature. Our purpose in this work is to monitor the relation between the horizontal propagation and branching of the strike slip fault, and the structural and topographic expression resulting from this process. These experiments may provide insights into the geometric evolution and kinematic of west part of the NAF system. For this purpose, we run several 3D sand box experiments, appropriately scaled. Plexiglass sheets were purposely cut to simulate the geometry of the NAF. Silicone was placed on the top of these to simulate the viscous lower crust, while the brittle upper crust was simulated with pure dry sand. Dextral relative fault motion was imposed as well using different velocities to reproduce different strain rates and pull apart formation at the releasing bend. Our experiments demonstrate the variation of the shear zone shapes and how the master-fault propagates during the deformation, helping to cover the gaps between geodetic and geologic slip information. Lower crustal flow may explain how the deformation is transferred to the upper crust, and stress partitioned among the strike slip faults and pull-apart basin systems. Stress field evolution seems to play an interesting role to help strain localization. We compare the results of these experiments with natural examples around the western part of NAF and with seismic observations.