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Sedimentary record of relay zone evolution, Central Corinth Rift (Greece): Role of fault propagation and structural inheritance.

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Relay zones along rift border fault systems form topographic lows that are considered to allow the transfer of sediment from the footwall into hanging wall depocentres. Present knowledge focuses on the modifications of drainage patterns and sediment pathways across relay zones, however their vertical motion during growth and interaction of faults segments is not well documented. 3D models of fault growth and linkage are also under debate.

The Corinth rift (Greece) is an ideal natural laboratory for the study of fault system evolution. Fault activity and rift depocentres migrated northward during Pliocene to Recent N-S extension. We report on the evolution of a relay zone in the currently active southern rift margin fault system from Pleistocene to present-day. The relay zone lies between the E-W East Helike (EHF) and Derveni faults (DF) that lie just offshore and around the town of Akrata. During its evolution the relay zone captured the antecedent Krathis river which continued to deposit Gilbert-type deltas across the relay zone during fault interaction, breaching and post linkage phases. Moreover our work underlines the role that pre-existing structure in the location of the transfer zone.

Offshore fault geometry and kinematics, and sediment distribution were defined by interpretation and depth conversion of high resolution seismic profiles (from Maurice Ewing 2001 geophysical survey). Early lateral propagation of the EHF is recorded by synsedimentary fault propagation folds while the DF records tilted block geometries since initiation. Within the relay zone beds are gradually tilted toward the basin before breaching. These different styles of deformation highlight mechanical contrasts and upper crustal partition associated with the development of the Akrata relay zone.

Onshore detailed lithostratigraphy, structure and geomorphological features record sedimentation across the subsiding relay ramp and subsequent footwall uplift after breaching. The area is characterised by the successive deposition of the northward prograding Platanos Gilbert-type delta (Middle group; deposited in hangingwall of the Pirgaki-Mamoussia fault) and the NE to E prograding Akrata Gilbert-type delta (Upper group). The Akrata Gilbert-type delta records progressive rotation and lengthening of the relay ramp as the East Helike fault and Derveni fault propagated laterally (from around 0.8 Ma) and started to overlap. The relay ramp was then breached by the Krathis fault (around 0.45 Ma) and the latter reactivated a NW-SE oriented inherited structure. Onshore-offshore correlation and profile restoration of the Upper group demonstrate the presence of this pre-existing structure (detachment fault?) below the Akrata relay zone that was responsible for significant eastward thickening in early rift sediments (Lower to Middle group). Our evolution model is consistent with the ‘isolated fault’ model where a fault array initially develops from growth of kinematically independent fault segments and fault displacement gradually accumulates during pre- and post-linkage stages. Despite the prominent control of pre-existing fabrics on the location of the transfer zone, lateral fault propagation and interaction can be well documented.