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# Mountain front migration in response to fault segment linkage and growth: the Polopos transpressive fault zone, southeastern Betics (SE Spain)

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Here we present new data from the Polopos fault zone (PoFZ), which is formed by three main fault strands, the North and South Gafarillos dextral strike-slip faults (NGF and SGF, respectively), and the North Alhamilla reverse fault (NARF). The PoFZ represents a conjugate fault system to the Carboneras-Palomares sinistral strike-slip fault zones, which developed in a Neogene to Quaternary N/S to NNW/SSE compressive regime. The PoFZ is a dextral-reverse fault system that transfers oblique shortening towards the south in Sierra Cabrera to dextral strike-slip and northwest-directed shortening along the SGF and NARF, respectively. Thus, the fault zone shows helicoidal geometry, dipping towards the north and producing SE-directed shortening to the east in Sierra Cabrera and dipping towards the south with northwest-directed shortening in Sierra Alhamilla. These fault zones with opposing kinematics are linked by the vertical dextral Gafarillos transfer fault segments.

Both geomorphic analysis of the area and fault segmentation mapping show the activity of these fault segments to the south of Sierra de Polopos. The recent or active segments of the Gafarillos fault are linked with western NARF segments. The total length of this combined fault system and associated mountain fronts is approximately 28 km. The western NARF segments dip steeply towards the south and locally show splays that cut through early Tortonian turbidites and Quaternary alluvial fans associated to the north Alhamilla mountain front. The alluvial fan conglomerates define a Quaternary paleo-topographic surface that has been displaced between 150 and 250 m by reverse faulting during the Quaternary.

The active or recent strike-slip Gafarillos type faults define the SGF found to the south of the Polopos-Cabrera antiformal ridge, cutting through the Messinian to Quaternary sedimentary-cover of the Níjar basin. It is a highly segmented strike-slip system with several parallel and oblique fault segments that fan out towards the SE as they approximate the Carboneras sinistral strike-slip fault zone. Fault segments in the South Gafarillos fault zone show both normal and reverse oblique strike-slip regime, locally with both dilatational and antidilational jogs.

During the late Miocene the locus of dextral displacement occurred along the NGF segments that linked to an eastern segment of the NARF. This eastern segment ended in a tipline situated approximately along meridian 2º 7′W. These segments and their associated mountain fronts were sealed by early Messinian temperate carbonates and by Messinian reefs in the northeastern Sierra Alhamilla. Later tectonic displacement in the area migrated southwards, forming the presently active SGF and its linkage with the western segments of the NARF. This process enlarged the fault zone westwards to the present tipline of the NARF located approximately in meridian 2º 20′W.

This fault segment migration shifted uplift from the northern side of Sierra de Polopos during the Messinian to the present active mountain fronts to the south of Sierra de Polopos. Furthermore, it propagated the north Alhamilla mountain front westwards, reactivating the previous fold-related mountain front. This mountain front shift during the Pliocene-early Pleistocene developed new basins draining towards the south, the Feos drainage across the Polopos ridge and the Lucainena one, parallel to the South Gafarillos fault segments.