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Kinematics of the Torcal Shear Zone: transpressional tectonics shaping orogenic curves in the northern Gibraltar Arc.

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Structural trend line patterns of orogenic arcs depict diverse geometries resulting from multiple factors such as indenter geometry, thickness of pre-deformational sequences and rheology of major decollement surfaces. Within them, salient-recess transitions often result in transpressive deformation bands.

The Gibraltar Arc results from the Neogene collision of a composite metamorphic terrane (Alboran Domain, acting as a relative backstop) against two foreland margins (Southiberian and Maghrebian Domains). Within it, the Western Gibraltar Arc (WGA) is a protruded salient, 200 km in length cord, closely coinciding with the apex zone of the major arc.

The WGA terminates at two transpressional zones. The main structure in the northern (Betic) end zone is a 70 km long and 4-5 km wide brittle deformation band, the so-called Torcal Shear Zone (TSZ).

The TSZ forms a W-E topographic alignment along which the kinematic data show an overall dextral transpression. Within the TSZ strain is highly partitioned into mainly shortening, extensional and strike-slip structures. The strain partitioning is heterogeneous along the band and, accordingly, four distinct sectors can be identified.

i) The Peñarrubia-Almargen Transverse Zone (PATZ), located at the W-end of the TSZ presents WNW-ESE folds and dextral faults, together with normal faults that accommodate extension parallel to the dominant structural trend. WNW ESE dextral faults might be related with synthetic splays at the lateral end of the TSZ. ii) The Sierra del Valle de Abdalajís (SVA) is characterized by WSW-ENE trending folds and dextral-reverse faults dipping to SSE, and NW-SE normal faults. The southern boundary of the SVA is a dextral fault zone. iii) The Torcal de Antequera Massif (TAM) presents two types of structural domains. Two outer domains located at both margins characterized by E-W trending, dextral strike-slip structures, and an inner domain, characterized by en echelon SE-vergent open folds and reverse shear zones as well as normal faults accommodating fold axis parallel extension. iiii) The Sierra de las Cabras-Camorolos sector, located at the E-end of the TSZ, is divided into two structural domains: a western domain, dominated by N120ºE dextral strike-slip faults, and an eastern domain structured by a WSW-ENE thrust system and normal faults with extension subparallel to the direction of the shortening structures. TSZ displacement at the lateral tip of this sector seems to be mainly accommodated by NNE trending thrusts in the northern TSZ block.

The TSZ induces the near vertical extrusion of paleomargin rock units within the deformation band and the dextral deflection of the structural trend shaping the lateral end of the WGA salient.

Our results suggest the TSZ started in the Upper Miocene and is still active. Moreover, the TSZ trends oblique to regional transport direction assessed both by field data and modelling. The estimated WNW-ESE far-field velocity vector in the TAM and the SVA points to the importance of the westward drift of the Internal Zones relative to the external wedge and fits well with the overall WGA kinematic frame. Nor the WGA salient neither the TSZ can be fully explained by the single Europe-Africa plate convergence.