



Late Miocene extension partitioning in the eastern Betics: from W- to E-directed extension between the Sorbas and Vera basins (SE Spain).

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Late Miocene westward-directed extension in the Betics produced elongated core-complexes like Sierra Nevada and the Sierra de Filabres, tilted-block domains and associated basins. This extension represents the superficial manifestation of the rupture of the Tethyan slab and associated edge delamination along a lithospheric transform fault beneath the northern branch of the Gibraltar Arc orogenic system. However, crustal thinning at the eastern Betics occurs progressively towards the east suggesting an eastward-directed extension, probably related to the late Miocene opening of the Algero-Balearic basin. In order to define the kinematics and timing of such a heterogeneous extension at the eastern Betics we have carefully mapped a key area at the transition between the Sorbas and Vera basins.

Field data indicate that extension in the area started at the southern margin of the Vera basin during the Serravallian (13.8 Ma) and continued until the Tortonian (approximately 8 Ma). This extension was characterized by a set of NE- to E-directed normal faults to the east, in the Vera basin, and a set of SW-directed normal faults to the west, towards the Sorbas basin. This opposite-directed extension is segmented by E–W to WNW–ESE strike-slip faults like the North Cabrera dextral transfer fault that accommodates NE- to E-directed extension to the north and SW-directed extension to the south. This structure resulted in westward tilted blocks that lead to Serravallian-Tortonian depocenters deepening towards the east at the Vera basin along the northern side of Sierra Cabrera. Meanwhile, at the western termination of Sierra Cabrera, westward-directed extension migrated SW-ward forming the Sorbas basin during the Tortonian (approximately 9–7.24 Ma). This extension was characterized by a listric fan of SW-directed normal faults highly segmented by E–W to NE–SW transfer. This extensional system produced tiled-blocks defining a Tortonian depocenter at the eastern margin of the Sorbas basin. This westward migration of extension followed very closely the apatite fission track cooling ages obtained from Nevado–Filabride samples exhumed at the Sierra de Filabres core-complex, to the north. These ages range between 15 and 11 Ma, to the east, and between 9.5 and 7.5 Ma, to the west. The westward migration of extension continued during the Messinian and the Quaternary affecting the Níjar basin where a SW-directed normal-fault system occurs.

Heterogeneous extension in the region resulted in different extensional domains both in extension direction and style. These domains are separated by transfer faults as the North Cabrera dextral fault, which accommodated opposite tilted-block domains at the southern margin of the Vera basin. Similarly, the Carboneras sinistral fault separates the Níjar tilted-block domain, to the north, from the Cabo de Gata domain characterized by magmatic accretion upon previously thinned continental crust, to the south.