



Role of structural inheritances and major transfer fault-zones in the tectonic history of the Alboran Basin (Western Mediterranean)

Menchu Comas (1), Ana Crespo-Blanc (2), and Juan Carlos Balanya (3)

(1) Instituto Andaluz de Ciencias de la Tierra, CSIC-Granada University, Geomarine Sciences, Granada, Spain (mcomas@ugr.es, +34 958 552620), (2) Departamento de Geodinámica, Facultad de Ciencias, University of Granada, Granada, Spain (acrespo@ugr.es), (3) Departamento de Sistemas Físicos, Químicos y Naturales, Pablo Olavide University, Sevilla, Spain (jcbalrou@upo.es)

The geodynamic evolution of the Gibraltar Arc System (GAS), which involves the origin and development of the Alboran back-arc basin, occurred during the Neogene related to the westward moving of the Alboran Domain (the Betic-Rifean hinterland) within a context of NNW-SSE plate-tectonic convergence. In this contribution we document shallow-crustal structures, deformation partitioning, and the different structural domains from the tectonic framework beneath the Alboran Sea. Furthermore, we focus the critical role of inherited crustal structures and major transfer faults within a coherent sequence of Miocene to Recent deformation phases.

Early Miocene extensional processes conditioned substantial thinning and the exhumation of the metamorphic Alboran Domain before the opening of the Alboran Basin. Beneath the Alboran Sea, an ENE-SSW directed back-arc extension (from about 16 to 8.5 Ma, late Burdigalian to late Tortonian) affected both the metamorphic basement (the crustal Alboran Domain) and the overlying Miocene sedimentary units. This extension resulted in major low-angle normal faults, and NNW-SSE trending grabens connected by ENE-SSW transtensional transfer-faults, both happening in concomitance with the westward migration (around 200 km) of the Alboran Domain. The geometry of the extensional structures constrains the manner, timing and amount of the coeval crustal thinning. In the late Tortonian (about 8.5 Ma) a dominant N-S directed compressional phase caused inversions of former extensional faults, discrete folding, and strike-slip faulting. This compressional event triggered the spectacular West Alboran shale-diapirism from over-pressured basal units. At the South and Eastern Alboran and at the transition to the Algeria basins, a pervasive period of NW-SE directed compressional deformation (from about 7 Ma onwards) that affected the whole basin is patent. Long lasting compressional conditions since the late Tortonian resulted in a dramatic structural reorganization (N-S shortening) of the basin, which encompass wrench tectonics, margin rotations, sub-basin inversions, bending of former extensional structures, and further shale-tectonics. The recent NW-SE and NE-SW trending conjugate wrench-fault system that bound the actual structural domains observed offshore locates over major transfer-faults zones from the Miocene extension. The rotated segments of basin-margins and concomitant structural bending, as well as changes in the tectonic regimen of the transfer-fault systems are expressive of the aftermath of superimposed extensional and compressional processes in the Alboran Basin.

The spatial and temporary evolution of the tectonic deformation documented by geological and geophysical observables in the Alboran Sea basin provides new insights into the critical role of the tectonic heritage and major transfer fault-zones in the geodynamic history of the GAS.

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