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Oblique basin inversion and strain partitioning in back-arc context: example from the Moroccan Alboran Margin (Western Mediterranean)

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The Neogene and Quaternary directions of extension recorded in the Mediterranean back-arc basins are oblique to the Africa-Eurasia convergence direction (Jolivet and Faccenna, 2000). In those basins, particularly in the Alboran basin, strike-slip tectonics is favored by the obliquity of coeval extension and compressional deformations, first with a transtensive style that switches to a transpressive mode during the Quaternary. Northwards the Betic Cordillera and southward, the Rifian and the Atlas belts bound the Alboran domain. Transtensional and transpressional episodes deform the Alboran domain and create rotating micro-blocks delimited by a major left lateral NE-SW Miocene transtensional shear zone, a.k.a. the Trans Alboran Shear Zone (TASZ). We present new evidences of strain partitioning affecting the South Alboran Margin (Western Mediterranean) during the end of the Neogene and Quaternary. We use seismic data and high-resolution bathymetry (EM710 multibeam echo sounder) from the MARLBORO-1 (12-channel streamer and Air Gun source), SARAS (single channel Sparker and TOPAS systems) and MARLBORO-2 (single channel Sparker source) surveys.

The pre-Messinian deformation and the geometry of the Messinian Erosional Surface (MES) and Plio-Quaternary deposits in the deep basin, developed during a regional extensional back-arc setting, evidence late Miocene to Quaternary folding and left-lateral shearing along the South Alboran Ridge. Around 2.58-1.81 My, the sedimentary shelves of volcanic edifices near the Boudinar and Nekor peripheral sub-basins highlight localized subsidence. At present-day, the NNE-SSW left-lateral Al-Idrissi shear zone delimits westwards the youngest micro-block boundary. Non-cylindrical hinge axes of Pliocene folds are interpreted as evidences of a wrench component of the deformation, which seems maximum to the northern flank of the South Alboran Ridge and decreases toward the Nekor Fault.

The observed basin geometries and inversion process could then be controlled by slip boundary conditions and structural inheritance from the older transtensive stage. A gradual disorientation and rotation of the Miocene TASZ could explain the gradients in the wrench component of deformation and the switch from Miocene TASZ to NNE-SSW striking fault around the Gelasian. The present-day discontinuous strain partitioning supposes: (1) a mechanical coupling between Alboran and Rif-Atlasic units that favors a perpendicular shortening and onshore rock uplifting and (2) decoupling boundaries into the Alboran block characterized by the inherited TASZ. In summary, we propose that the style of the crustal deformation of the overriding Alboran domain can be better explained by micro-block deformation under continuous convergence than by a change in the convergence direction.