

Evidence of Two Alpine Orthogonal Deformations in the Northwestern Rif Chain: Implications on the Convergence of Iberian, African and Alboran Plates

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Mapping and detailed microstructural analyses carried out along the southern bank of the Gibraltar Strait (northernmost Rif belt) allowed us to reconstruct the deformation geometry, the structural stacking pattern of the Flysch nappes as well as the whole tectonic calendar during the pre- , syn- and post-paroxysmal. We would like to give here a special emphasis to the paroxysmal events that strikingly generated two kind of compressional deformations orthogonally crossing each other: one of them was related to a submeridian shortening and generated asymmetric folds and locally north-vergent overlapping. The other was equally induced by a compressional shortening but had an almost equatorial direction and expressed by overturned folds associated with overlapping and ramp structures of a pronounced western and eastern vergences.

These two perpendicular structures can satisfactorily be explained within the context of a stress field involving two compressions directed NNW-SSE and ENE-WSW, respectively. The first compression resulted from the convergence of the Iberian and African plates in an overall NNW direction. The resulting shortening was consumed, mainly by the Betic-Rif deformation, and secondarily by the Middle Atlas chain. This compression seems to have lasted until the post-paroxysmal period and then propagated externwards up to the frontal part of the Rif belt. The second compression was associated to the westward drifting of the Alboran microplate that progressively became trapped between the Iberian and the African plates. The resulting tectonic blockage (that was likely to have been enhanced by the simultaneous European-African convergence) caused the northward subduction of the African plate and the formation of an accretionary prism along the frontal lines of the Alboran terrane, i.e., the future lines of the Gibraltar arc.

This twofold deformational scenario is proposed here as being the principal plate-tectonic mechanism that structured the arcuate Betico-Rifian belt during the Miocene times (late Burdigalian–late Tortonian).

Key words: Flysch nappes, Rif chain, Alboran, orthogonal convergence.