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ORIGINAL PAPER

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Transcurrent continental tectonics model for the Ossa-Morena Zone Neoproterozoic–Paleozoic evolution, SW Iberian Massif, Portugal

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Abstract The Ossa-Morena Zone (SW Iberian Massif) was affected by continuous orogen-parallel transcurrent continental tectonics from the Neoproterozoic to the Carboniferous times, involving transtension (TT) and transpression (TP) processes that co-existed together, occurred separately in neighbouring regions by the means of strain partitioning or even worked diachronically. A first stage of transpression TP1 took place during the Late Neoproterozoic–Lower Cambrian as a result of Cadomian arc-continent collisional processes. Structures generated by transtension TT1 from Cambrian to Lower Devonian were related to strong lithosphere stretching responsible for the development of basins controlled by major detachments, tilting, rifting and important tectono–thermal diachronic processes. Denudation phenomena and inhibition of sedimentation related with thermal uplift (asthenosphere upwelling) and consequent subsidence caused by isostatic equilibrium, involving generalized transgressions, were processes responsible for major unconformities. The Variscan TP2-TT2 episodes that followed diachronically TP1-TT1, by maintaining the orogen-parallel transport direction, were concomitant with syntectonic deposition of continental basins in the OMZ and foreland basins in the SPZ. TT2 local transtension and tectonic exhumation of deep crustal rocks along major shear zones, favoured the opening of tectonic troughs filled up by sediments and volcanism. TP2 shortening have generated fold axes parallel to the orogen-strike and composite dissymmetric flower structures.

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Plate tectonic setting: transcurrent continental tectonics

The Earth's lithosphere comprises a puzzle of interlocking plates, where several types of relationships involving relative velocity and orientations of plate boundaries exist (e.g. Moores and Twiss 1995). An inevitable consequence of relative plate motion on a spherical surface is that the convergent and divergent slip vectors are commonly oblique to plate boundaries and to other major deformation zones located within the plates (e.g. Dewey 1975).

Transcurrent zones represent major regional strike-slip fault systems, with many being hundreds of kilometres long, which may have accumulated relatively large amounts of displacement (e.g. Twiss and Moores 1992) generally in parallelism to the orogen-strike. Within these transcurrent zones, displacements along strike-slip faults with bends or step-over geometries and strain partitioning produce a complex internal strain path in which variations in style and kinematic linkage of structures controlled by transpression and transtension may occur (Harland 1971; Sanderson and Marchini 1984).

In this paper, we want to emphasize three main situations of continental transpressional–transtensional tectonics (e.g. Dewey et al. 1998) that were chosen by us to base an alternative reinterpretation of existing data, together with recent information collected during the last decade of our research in the southwestern part of the Iberian Peninsula (Portugal). First, transpression and transtension are not exclusive of collisional orogenic belts, therefore, they may occur widely in a large range of tectonic settings. Transpression (TP) occurs at oblique subduction plate margins in arc and fore-arc regions, at restraining bends of strike-slip displacement zones and in slate belts. Transtension (TT) occurs at oblique subduction margins in arc and back-arc regions, during early