Development of local orthorhombic fabrics within a simple-shear dominated sinistral transpression zone: the Arronches sheared gneisses (Iberian Massif, Portugal)

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Abstract: The Coimbra–Cordoba shear zone (Iberian Massif), characterized by simple-shear dominated sinistral transpression, exposes several outcrops of strongly sheared peralkaline gneisses surrounded by mica schists and amphibolites. These gneisses are included in the Arronches Tectonic Unit, a thick unit of mylonitic rocks with a steep foliation and an associated gently plunging stretching lineation parallel to the fold axes. Strain partitioning is testified by widely spaced anastomosing shear bands around less-strained domains and by the existence of different shearing domains ranging from relatively 'less-strained' and coarse-grained mylonites to highly strained and fine-grained ultramylonites.

Three shearing domains defined by textural and structural changes resulted from progressive deformation and increasing strain, which leads to increased mylonitization of gneisses. This is revealed by the increased modal percentage of the matrix and the decreased percentage of porphyroclasts, accompanied by evolution from orthorhombic to monoclinic fabrics: Conjugate Shearing Domain (**CSD**), Intermediate Sinistral Domain (**ISD**), and Sinistral Domain (**SD**).

This contribution shows that in a simple-shear sinistral dominated transpression zone with a well-developed and widespread monoclinic fabric, it is possible to find mechanical conditions to produce local orthorhombic fabrics. In the Arronches gneisses a local strain regime exists in apparent contradiction with the bulk deformation regime.

Structural analysis on mylonitic gneisses is widely used to characterize deformation in high-strain ductile shear zones. These strongly foliated and lineated rocks usually display fine-grained mylonitic textures, derived from an original coarser-grained rock as a result of distinct deformation mechanisms (e.g. White *et al.* 1980; Tullis *et al.* 1982; Knipe 1989; Passchier & Trouw 1996).

Mylonites located along anastomosing narrow planar shear zones with associated strain partitioning, have been described over a wide range of scales (e.g. Carreras *et al.* 1980; Hanmer 1988; Hudleston 1999; Carreras 2001). They normally contain fabric elements with a monoclinic symmetry (Berthé *et al.* 1979; Platt & Vissers 1980; Gapais & White 1982; Simpson & Schmid 1983; Hanmer & Passchier 1991). An important feature of these ductile shear zones is the existence of strain partitioning into domains with different strain gradients (e.g. Bell 1981) leading to the existence of highly variable fabrics related to different strain states through which the rock passes during progressive deformation (e.g. Twiss & Moores 1992; Means 1994). This type of partitioning related to progressive deformation may explain the local preservation of less-strained rocks preserving earlier stages of formation of mylonitic fabrics, surrounded by highly intense stages of mylonitization with ultramylonites. The distinction of shearing domains where the imposed bulk strain path is simultaneously distributed in a coaxial component (orthorhombic fabric), mainly outside the shear zone, and a non-coaxial component (monoclinic fabric) as a result of increased strain within the shear zone (e.g. Wenk *et al.* 1987), constitutes a general assumption for shear zones that is questioned in this case of the Arronches gneisses. This study describes a variety of textures and structures that define distinct shearing domains formed simultaneously as a consequence of increased strain in the Arronches gneisses. When strain softening is introduced to these rocks, their behaviour is accompanied by the development of local orthorhombic fabrics (conjugate shear planes), as can be observed in directly comparable experiments with analogue material by Mancktelow (2002). Increasing strain softening promotes the development and

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