

Chapter 13

Structure and Variscan evolution of Malpica–Lamego ductile shear zone (NW of Iberian Peninsula)

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13.1 INTRODUCTION

The Malpica–Lamego Ductile Shear Zone (MLDSZ) is a polyphasic structure developed in the NW of the Iberian Peninsula. The northern sector (NW Spain) of this shear zone is associated with a complex geological history that ranges from earlier Variscan to the emplacement of the Variscan nappes (allochthonous). Variscan intracontinental deformation after the allochthonous nappes emplaced, recognizably strike-slip, explains its spatial and structural continuity from the NW (Malpica, Spain) to the South (Lamego, Portugal). Here we focus on the Variscan development of the MLDSZ and characterize, longitudinally, this crustal mega-structure.

At the NW tip of the MLDSZ was considered an area (segment 1) with very good exposure of the Variscan intracontinental strike-slip component on outcrops of the coastline (e.g. Llana-Fúnez 2001). In sequence, we address segment 2, with excellent left-hand kinematic markers (shear band boudins and folds), on a metapelitic rock series (Pamplona and Rodrigues 2011). In the southernmost part of the MLDSZ, strike-slip deformation, emplacement of granitic rocks (segment 3 – based on Simões 2000; and segment 5), regional structures (segment 4: based on Coke et al. 2003), and secondary manifestations of the southern tip of MLDSZ (segment 6) were studied.

Detailed geological mapping was done. Kinematic interpretation of structures in micro- (Passchier and Trouw 2005; Mukherjee 2011) and mesoscale (e.g. Spry 1969; Goscombe and Passchier 2003; Mukherjee and Koyi 2010), quartz c-axis analysis (e.g. Schmid and Casey 1986), thermodynamic conditions inferred from

textural equilibrium (e.g. Winkler 1979), magmatic fabrics (Fernández 1982), and U-Pb geochronology on zircons and monazites (Heaman and Parrish 1991), are integrated.

In order to chronologically define the activity of the MLDSZ and explain the tectonic episodes recorded during the functioning of this structure, the Variscan episodes were viewed as per Dias and Ribeiro (1995) and Dias et al. (2013). This classification was established for the northern sectors of the Variscan orogen of Portugal. However there are alternates (e.g. Noronha et al. 1979; Martínez-Catalán et al. 2008) and uncertainties on the limits of the different phases. Dias and Ribeiro (1995) and Dias et al. (2013) classified this orogeny in four phases: (i) D₁: continental collision and obduction of allochthonous terrains during the Devonian Period; (ii) D₂: structuring of the allochthonous terrains during the Early Carboniferous; (iii) D₃: intracontinental deformation forming crustal shear zones during the Later Carboniferous; (iv) D₄: brittle–ductile to brittle intracontinental deformation and complex fluid activity linked to mineralized shear zones during the Permian.

13.2 GEOLOGICAL SETTING

The MLDSZ is a major crustal structure that has a minimum length of 275 km running NW–SE, parallel to the Variscan belt in the Iberian Peninsula (Fig. 13.1) (Llana-Fúnez and Marcos 2001). Previously, the structure was described in two segments: in the northern part the Malpica–Vigo shear zone (Iglésias and Choukroune

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