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Tectonothermal analysis of high-temperature mylonitization in the Coimbra–Córdoba shear zone (SW Iberian Massif, Ouguela tectonic unit, Portugal): Evidence of intra-continental transcurrent transport during the amalgamation of Pangea

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Abstract

Mylonites in pelitic and quartzofeldsphatic gneisses from the Ouguela tectonic unit (Coimbra–Córdoba shear zone, SW Iberian Massif) have been studied as an example of high-temperature ductile deformation associated with transcurrent tectonics. Detailed microstructural and *P–T* analysis indicates that ductile deformation evolved from a metamorphic peak at approximately 650–750 °C and 7.5–9.5 kbar (quartzofeldsphatic gneisses) and 730–790 °C and 7.5–9.5 kbar (pelitic gneisses) to retrograde conditions at 500–575 °C and 4.5/5.5–6.5/7.5 kbar (quartzofeldsphatic gneisses) and 525–600 °C and 3.5/4.5–5.5/7.5 kbar (pelitic gneisses). Following the metamorphic peak, exhumation was very fast. The *P–T* trajectory, which does not reach the curve for granite melting, is distinct that of isothermal decompression. Instead, the progressive and contemporaneous decrease in pressure and temperature was a direct response to strong heat dissipation along the contacts between the ascending slice and the adjacent blocks. The horizontal component of exhumation path, calculated for middle and shallower crustal levels, sum to ca. 57 km to 94 km (for the pressure peak). Assuming this offset acted in the Viséan during a time interval of ca. 9 Ma, the estimated exhumation horizontal slip rate is in the order of 6.3 to 10.4 mm/yr, which corresponds to an exhumation oblique-slip exhumation rate of 6.6 to 10.7 mm/yr (for ductile deformation). These values indicate that the transcurrent tectonic displacements accommodated by these mylonitic are similar to those of modern intra-continental shear zones, such as the still active Karakoram Fault (8.3 mm/yr) in the Himalayas. The Coimbra–Córdoba shear zone is therefore a typical intra-continental transcurrent zone with ten-to-one hundred kilometre along-strike mass movement of material that aided the exhumation of deep crustal rocks. Study of this large-scale structure in the SW Iberian Massif is therefore central to models of orogenic deformation during the amalgamation of Pangea.

Keywords: High-grade mylonites; Transcurrent continental tectonics; Exhumation; Iberian Massif

1. Introduction

The estimation of metamorphic *P–T* conditions, when used together with structural studies, is a powerful tool for gaining insight into the tectonic evolution of orogenic belts. Thermal modelling of crustal growth processes related to the heat distribution in active orogens, (including thermal conductivity, mantle heat-flow, crustal thickening, uplift and exhumation; e.g. England and Thompson, 1984; Thompson and England, 1984) has been successfully used to interpret the tectonic context of pressure–temperature conditions in ancient mountain belts. In the case of deeply eroded shear zone systems, microstructural analysis (microstructures and their relationship to mineral assemblages) and estimates of the *P–T* conditions of dynamically recrystallized rocks provide essential information for

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