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Exhumation of high-pressure rocks in northern Gondwana during the Early Carboniferours (Coimbra–Cordoba shear zone, SW Iberian Massif): Tectonothermal analysis and U–Th–Pb SHRIMP *in-situ* zircon geochronology

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ABSTRACT

The Coimbra–Córdoba shear zone (CCSZ) represents a major intra-continental shear zone of the European Variscan orogen. The shear criteria found in metamorphic rocks of the CCSZ are consistent with sinistral transcurrent movements. Isoclinal and open folds with axes parallel to the stretching lineation are responsible for dip variations in the mylonitic foliation, but are related to the same kinematics. In selected outcrops of the Campo Maior unit (SW Iberian Massif, Portugal), boudins of high-pressure mafic granulites, high-grade amphibolites and felsic gneisses with long-axes parallel to the stretching lineation in the surrounded metamorphic rocks, were sampled together with the host migmatites for petrographic, geothermobarometric and U–Th–Pb SHRIMP *in-situ* zircon geochronology analysis. The results show that decompression associated with shearing and partial melting in the CCSZ began under granulite facies conditions during the Variscan orogeny (early Carboniferous: c. 340 Ma.). Peak metamorphic conditions in the mafic granulites (850–880 °C and 14.5–16.5 kbar), were followed by symplectitization at 725–750 °C and 12.5–14.5 kbar. Peak *P–T* conditions were 615–675 °C and 9.5–11.5 kbar in the high-grade amphibolites, 750–850 °C and 11.5–15.5 kbar in the weakly deformed gneisses, and 675–725 °C and 9–11.5 kbar in the sheared migmatites. Subsequently, temperatures and pressures decreased during amphibolite facies metamorphism coeval with mylonitization. Retrograde *P–T* conditions were 550–700 °C and 7–9 kbar in the high-grade amphibolite, 620–640 °C and 6–8 kbar in the gneisses, and 560–610 °C and 5–6.5 kbar in the migmatites. Zircon dating of the migmatites and gneisses indicate Ediacaran (c. 590 Ma) and Ordovician (c. 488–479 Ma) ages for the protoliths, and show that these rocks were part of the northern Gondwana margin with a West Africa Craton signature dominated by Paleoproterozoic (c. 2–1.8 Ga) and Neoproterozoic (c. 664–555 Ma) ages, and a characteristic lack of Mesoproterozoic (c. 0.9–1.7 Ga) ages. These rocks were probably subducted, and subsequently exhumed during the complex processes of Pangea formation. The high temperature–high pressure rocks of the Campo Maior unit were likely displaced by large-scale transcurrent movements within the CCSZ in the early Carboniferous. The CCSZ appears to represent a major shear zone in the SW Iberian Massif connected in some way to the Variscan suture zone.

1. Introduction

A common feature of intra-continental shear zones is that, within high-grade tectonic units, high-pressure and generally high-temperature rocks occur in association with gneisses and migmatites. These host rocks generally show lower pressure mineral assemblages. This reflects the fact that, following peak metamorphic equilibration at deep crustal levels, the high-pressure rocks were tectonically juxtaposed against the lower pressure gneissic and migmatitic host rock at shallower crustal levels as a result of exhumation processes (Cooke and O'Brien, 2001). The close spatial association of the lower pressure host rocks with eclogites and high-pressure granulites has been used to establish a link with convergent plate tectonics settings (Carswell, 1990; O'Brien, 1993, 2001) and suture zones (e.g. Santosh et al., 2009).

A well exposed example of a major intra-continental shear zone with high-temperature/high-pressure rocks in the European Variscan orogen is the Coimbra–Córdoba shear zone (CCSZ, Burg et al., 1981; Pereira and Silva, 2002; Pereira et al., 2008a,b; also named, Badajoz–

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