

# The multistage crystallization of zircon in calc-alkaline granitoids: U–Pb age constraints on the timing of Variscan tectonic activity in SW Iberia

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Received: 22 July 2014 / Accepted: 22 January 2015  
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**Abstract** CL imaging and U–Th–Pb data for a population of zircons from two of the Évora Massif granitoids (Ossa-Morena Zone, SW Iberia) show that both calc-alkaline granitoids have zircon populations dominated by grains with cores and rims either showing or not showing differences in Th/U ratio, and having ages in the range ca. 350–335 Ma (Early Carboniferous). Multistage crystallization of zircon is revealed in two main growth stages (ca. 344–342 Ma and ca. 336–335 Ma), well represented by morphologically complex zircons with cores and rims with different ages and different Th/U ratios that can be

explained by: (1) crystallization from melts with different compositions (felsic peraluminous to felsic-intermediate metaluminous;  $0.001 < \text{Th}/\text{U} \text{ ratio} < 0.5$ ) and (2) transient temperature fluctuations in a system where anatectic felsic melts periodically underwent injection of more mafic magmas at higher temperatures. The two studied calc-alkaline granitoids do not include inherited zircons (pre-Carboniferous), probably because they were formed at the highest grade of metamorphism ( $T > 837 \text{ }^\circ\text{C}$ ; granulite facies) and/or because they were derived from inheritance-poor felsic and mafic rocks from a previous cycle, as suggested by the internal structures of zircon cores. These Variscan magmatic rocks with crystallization ages estimated at ca. 336–335 Ma are spatially and temporally related to high-temperature metamorphism, anatexis, processes of interaction between crustal- and mantle-derived magmas and intra-orogenic extension that acted in SW Iberia during the Early Carboniferous.

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**Keywords** Igneous zircon · U–Th–Pb SHRIMP data ·  
Crustal- and mantle-derived magmas · Intra-orogenic  
extension · Early Carboniferous · Ossa-Morena Zone

## Introduction

The suture of the Rheic Ocean in SW Iberia, resulting from the collision of two continental blocks during the amalgamation of Pangea (Laurussia and Gondwana), is located at the boundary between the Ossa-Morena and South Portuguese zones (Eden 1991; Quesada et al. 1994; Díaz Azpiroz et al. 2006; Ribeiro et al. 2010; Braid et al. 2011; Pereira et al. 2012a, b). One of the most important discussions surrounding the Variscan orogen of SW Iberia concerns the tectonic setting of Early Carboniferous