



Cadomian magmatism and metamorphism at the Ossa Morena/Central Iberian zone boundary, Iberian Massif, Central Portugal: Geochemistry and P – T constraints of the Sardeal Complex

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ARTICLE INFO

Article history:

Received 28 January 2016

Accepted 2 November 2016

Available online 09 November 2016

Keywords:

North Gondwana

Continental arc

Geochemistry

Petrogenesis

Oxygen isotopes

ABSTRACT

A well preserved Cadomian basement is exposed in the Iberian Massif, Central Portugal, at the Ossa Morena/Central Iberian zone boundary, which allows the determination of reliable geochemical data. A sequence of Cadomian and Variscan magmatic and tectonometamorphic events has been already described for this area and are documented in other areas of the Avalonian–Cadomian orogen. However, the geochemical information concerning the Cadomian basement for this area is still limited. We present whole rock geochemical and oxygen isotopic information to characterize the igneous protoliths of the Sardeal Complex, located within the Tomar–Badajoz–Córdoba Shear Zone, and identify their tectonic setting. We use detailed petrography, mineral chemistry and P – T data to characterize the final Cadomian tectonometamorphic event. The Sardeal Complex contains orthogneiss and amphibolite units. The protoliths of the orthogneiss are calc-alkaline magmas of acid composition and peraluminous character that were generated in an active continental margin in three different stages (ca. 692 Ma, ca. 569 Ma and ca. 548 Ma). The most significant processes in their petrogenesis are the partial melting of old metasedimentary and meta-igneous crust at different crustal levels and the crystal fractionation of plagioclase, alkali feldspars, apatite, zircon and Fe–Ti oxides. The protoliths of the amphibolite, older than ca. 540 Ma, are tholeiitic and calc-alkaline magmas of basic composition that display N-, T- and E-MORB affinities. They were generated in an active continental margin. Crustal contamination and fractional crystallization of hornblende and diopside were involved in their petrogenesis. However, the fractional crystallization was not significant. The magmatic activity recorded in the Sardeal Complex indicates the existence of a long-lived continental arc (ca. 692–540 Ma) with coeval felsic and mafic magmatism. The final stage of the Cadomian metamorphism is usually represented in other areas of the Cadomian basement as a LP–HT metamorphic event. However, the P – T data obtained by thermodynamic modelling indicates medium pressure/high temperature conditions at ca. 540 Ma. These data suggest that the Sardeal Complex represents a deeper level of the exhumed Cadomian basement where the final stage of the Cadomian metamorphism was recorded.

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1. Introduction

A linear belt of Andean type generated by the Avalonian–Cadomian orogeny was active from the Late Proterozoic to the early Paleozoic at the Northern edge of Gondwana. Its fragments are preserved in the Avalonian and Cadomian terranes of north-eastern North America and Western Europe (e.g. Nance et al., 1991). Cadomian terranes of Western

Europe are recognized in the northern Armorican Massif (e.g. D'Lemos et al., 1990), the Bohemian Massif (e.g. Linnemann et al., 2008a) and the Iberian Massif (e.g. Eguíluz et al., 2000 and references therein; Ordoñez-Casado, 1998 and references therein; Ribeiro et al., 2009 and references therein). In the Iberian Massif, the Cadomian basement crops out at the Ossa Morena/Central Iberian zone boundary, in the Tomar–Badajoz–Córdoba Shear Zone (Fig. 1a) (e.g. Eguíluz et al., 2000; Henriques et al., 2015; Ribeiro et al., 1990, 2009) and at the Olivenza–Monesterio Antiform (e.g. Ordoñez-Casado, 1998 and references therein). However, information on the geochemical and P – T conditions of these rocks is limited due to intense Cadomian and Variscan polymetamorphism (e.g. Dallmeyer and Quesada, 1992; Henriques et al., 2015; Ordoñez-Casado, 1998) and alteration.

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