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Evolution of a Neoproterozoic suture in the Iberian Massif, Central Portugal: New U-Pb ages of igneous and metamorphic events at the contact between the Ossa Morena Zone and Central Iberian Zone

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ABSTRACT

A Neoproterozoic suture is exposed at the contact between the Ossa Morena Zone and the Central Iberian Zone, in the Iberian Massif (Central Portugal), the westernmost segment of the European Variscides. Although, the Cadomian magmatic and tectonometamorphic events have been previously documented, their timing is still poorly constrained, particularly in the inner zones of the suture. We used geochronological (ID-TIMS U-Pb) data to establish the sequence of events, isotopic (Rb-Sr, Sm-Nd) data to characterize the magmatic sources and thermodynamic modelling to determine the maximum *P-T* conditions attained during the Cadomian metamorphism. The first event, in the future Ossa Morena Zone, is the onset of island arc magmatism represented mainly by tholeiites with a MORB signature. Their igneous crystallization age is unknown, but they are older than ca. 539 Ma. This magmatic activity was accompanied by deposition of fine-grained sediments in a Neoproterozoic basin. The second event is the evolution of the Cadomian magmatic arc in different stages. The earliest magmatic stage occurs at ca. 692 Ma, which is the oldest igneous age known in the Ossa Morena Zone. It is followed by the generation of subalkaline and peraluminous protoliths at ca. 569 Ma, with the isotopic signature of old crustal sources. The final phase of the arc magmatism (ca. 548–544 Ma) involved mainly partial melting of continental crust. The range of the main magmatic activity must have been between ca. 569 Ma and ca. 544 Ma as mentioned for other areas in the Ossa Morena Zone. A major metamorphic event, recorded in metamorphic monazite, zircon and titanite at ca. 540 Ma, attained upper amphibolite facies conditions close to the transition to granulite facies (7–8 kbar and 640–660 °C). It represents the continental arc accretion of the Ossa Morena Zone with the Iberian Autochthon passive margin (future Central Iberian Zone). The Early Ordovician rocks (ca. 483–477 Ma) were generated from depleted and juvenile sources. These rocks are strongly deformed and with melting features, display metamorphism at amphibolite facies conditions. They are interpreted as related with the Rheic Ocean.

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1. Introduction

The recognition of Neoproterozoic sutures and the knowledge of their early history are crucial to understanding Gondwana assembly and its dynamics, allowing us to constrain the timing of collisional events. Gondwana assembly constitutes a significant part of Neoproterozoic geologic history. Fragments of this evolution are documented in different areas of the Appalachian–Variscan orogen of North

America and southern Europe where a major Neoproterozoic suture has been recognized (e.g. [Murphy et al., 2006](#) and references therein). In the Iberian Massif, Western Europe, this suture is preserved within the Tomar-Badajoz–Córdoba Shear Zone ([Fig. 1a](#)), at the contact between the Ossa Morena and Central Iberian Zones (e.g. [Eguíluz et al., 2000](#); [Ribeiro et al., 1990](#)). Several authors have recognized a complex evolution, as a result of the superposed Cadomian and Variscan orogenic cycles (e.g. [Eguíluz et al., 2000](#); [Quesada and Munhá, 1990](#); [Ribeiro et al., 2009](#)). The age of the amalgamation and suturing process is controversial owing to very intense structural and metamorphic overprinting together with still scarce geochronological data ([López-Guijarro et al., 2008](#)). Previous studies of the area include geological sketch maps ([Conde, 1984](#); [Pereira et al., 1998](#); [Ribeiro et al., 2013](#); [Gonçalves in Teixeira, 1981](#)) and 1: 50 000 geological maps published by the

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