



Ediacaran and early-palaeozoic bimodal volcanism in the Ossa-Morena Zone, SW Iberian Massif: New clues for intraplate rifting shortly after the Cadomian Orogeny

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ARTICLE INFO

Handling Editor: Federico Lucci

Keywords:

SW Iberia
Meta-volcanic rocks
Rheic
Geochemistry
Rifting

ABSTRACT

This study focuses on bimodal meta-volcanic rocks present in the Iberian Massif, in the Évora-Aracena Metamorphic Belt of the Ossa-Morena Zone (OMZ), near the boundary with the South Portuguese Zone. New petrological, geochemical (whole-rock and Sr–Nd isotopes) and LA-ICP-MS U–Pb zircon geochronology data are presented to track the magmatic evolution of both felsic and mafic rocks and their respective geodynamic setting during the transition between the Cadomian Orogeny and subsequent Palaeozoic rifting events.

Our research shows that the Évora-Aracena Metamorphic Belt (EAMB) in the southwestern OMZ possesses a significant record of the transition between the Cadomian and Variscan cycles. U–Pb geochronological data confirm the existence of both felsic and mafic Ediacaran igneous rocks (546 and 556 Ma, respectively), a novelty in the region. The Cadomian-related felsic rocks show geochemical similarities to meta-felsic rocks formed during the initial phases of the Cambrian rifting event, namely very negative ϵ_{Nd} values (–10.1 to –11.8), depleted HREE patterns and orogenic signatures. Such similarities imply that meta-felsic rocks formed in the earliest stages of the Cambrian Rift-to-Drift event resulted from a shallower melting.

Moreover, meta-felsic rocks formed in the early stages of the Cambrian rifting (525 Ma) present a significant amount of Ediacaran aged zircons, whereas the Cadomian-related counterparts display a few discordant Cambrian ages, likely a consequence of Pb-loss. This indicates that the convergent, subduction-related regime that prevailed during most of the Cryogenian-Ediacaran times along the boundaries of NW Gondwana was swiftly supplanted by a rift-dominated regime during the Cambrian, with no substantial gap between these two thermal events. Meanwhile, meta-felsic rocks formed during the Rift-to-Drift (525–480 Ma) event exhibit progressively higher ϵ_{Nd} values (–5.0 to +3.0), HREE-enrichment, as well as anorogenic signatures, denoting an increasing contribution of mantle-derived melts. This increasing mantle contribution eventually led to the occurrence of bimodal magmatism in the Middle Cambrian Main Rift event. Such Cambrian mafic rocks, unlike the Ediacaran mafic rocks that present flat REE patterns and continental arc signatures, display varying degrees of LREE enrichment and N-MORB to E-MORB signatures.

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