Journal of African Earth Sciences 201 (2023) 104887

Contents lists available at ScienceDirect

Journal of African Earth Sciences

journal homepage: www.elsevier.com/locate/jafrearsci

Cadomian arc recycling along the northern Gondwana margin: Source-inherited composition of Miaolingian rift-related rhyolitic rocks (Ossa-Morena Zone, SW Iberia)

M.F. Pereira [a,*], C. Gama [a], I. Dias da Silva [b], J.M. Fuenlabrada [c], M. El Houicha [d]

[a] Instituto de Ciências da Terra, Departamento de Geociências, ECT, Universidade de Évora, Apt.94, 7002-554, Évora, Portugal
[b] Instituto Dom Luiz, Faculdade de Ciências da Universidade de Lisboa, Campo Grande, 1749-016, Lisboa, Portugal
[c] Unidad de Geocronología (CAI de Ciencias de la Tierra y Arqueometría), Universidad Complutense de Madrid, Spain
[d] Chouaib Doukkali University Faculty of Sciences, Earth Sciences Department, BP.20, 2400, El Jadida, Morocco

ARTICLE INFO

Handling Editor: Dr Mohamed Mohamed G Abdelsalam

Keywords:
Cambrian rhyolitic magmatism
Calc-alkaline signature
Source-inheritance composition
Cadomian arc recycling

ABSTRACT

Rhyolites and rhyolitic tuffs of the Freixo-Segóvia Volcanic-Sedimentary Complex of the Cambrian of the Ossa-Morena Zone (Variscan belt, SW Iberia) were analyzed for petrography, major and trace element geochemistry, Sm–Nd isotopes and U–Pb zircon geochronology in order to deduce magma sources. New U–Pb zircon age data indicate that Freixo-Segóvia rhyolitic rocks, previously assigned to the Terreneuvian, formed during the Miaolingian (ca. 509-505 Ma). These rhyolitic rocks exhibit calc-alkaline signature, LREE enrichment, nearly flat HREE patterns, negative Eu, Nb and Ti anomalies, and are chemically similar to the bulk continental crust. Freixo-Segóvia rhyolitic rocks have negative to slightly positive $\varepsilon Nd_{(T)}$ values (−2.8; 0.5) resulting in T_{DM} model ages (1.0–1.3 Ga) that overlap the range defined by Terreneuvian Malcocinado andesites, formed in the transition of the Cadomian (West-African) arc to continental rifting in northern Gondwana margin. Based on the Sm–Nd isotopic data, the Freixo-Segóvia rhyolitic rocks may have resulted from of partial melting of andesitic crust. The presence of Ediacaran-age zircon in the Freixo-Segóvia rhyolitic rocks indicates inheritance from the Cadomian arc. Inherited zircon grains with West African affinity were probably transferred into the rhyolitic magma from an older igneous source formed in the Cadomian arc. Based on their major and trace element composition, combined with isotopic and geochronological data, the Freixo-Segóvia rhyolitic rocks record recycling of arc crust during a Late Cambrian rifting event along the northern Gondwana margin. The transition from Cadomian accretion to peri-Gondwana break-up leading to the opening of the Rheic Ocean is also known in other parts of the Variscan belt.

1. Introduction

Determining the processes responsible for crustal growth is crucial for enabling a better understanding of how it has evolved throughout the Earth's history, involving the series of supercontinent cycles (Nance et al., 2014). While accretionary orogens play a key role in the assembly of supercontinents, rifting leads to their fragmentation. The episodes of magmatism that take place during the transition from active margin to rifting may have both crustal- or mantle-derived sources (Cawood et al., 2009). Mantle-derived magmas represent additions of ancient and juvenile components to the continental crust.

The composition of felsic magmas derived from crustal recycling depends not only on the chemical composition of the source rocks, but also on the interaction with coeval crustal- or mantle-derived magmas with different compositions, some with origins in the lithospheric mantle. The source-inherited composition of a felsic igneous rock can be determined by a combination of petrography, whole-rock geochemistry (Rudnick and Gao, 2003), Sm–Nd isotopes (DePaolo, 1988), and zircon U–Pb dating (Corfu, 2013).

In this paper, field, petrographic, geochemical and isotopic (Sm–Nd) information from a key area of SW Iberia (Ossa-Morena Zone, OMZ) is presented and discussed aiming at unraveling the magma source of rhyolitic rocks. This study is concerned with the Cambrian felsic volcanism that took place after the termination of the Cadomian orogeny which has been assigned to Terreneuvian and interpreted as rift-related (Sánchez-García et al., 2010). The aim is to update OMZ

* Corresponding author.
E-mail address: mpereira@uevora.pt (M.F. Pereira).

https://doi.org/10.1016/j.jafrearsci.2023.104887
Received 7 November 2022; Received in revised form 10 February 2023; Accepted 15 February 2023
Available online 22 February 2023
1464-343X/