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ORIGINAL PAPER

$^{87}Sr/^{86}Sr$ applied to age discrimination of the Palaeozoic carbonates of the Ossa-Morena zone (SW Iberia Variscides)

N. Moreira[1,2] · J. Pedro[1,2] · J. F. Santos[3] · A. Araújo[1,2] · R. Dias[1,2] · S. Ribeiro[3] · J. Romão[4] · J. Mirão[2,5]

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Abstract

Four distinct Palaeozoic episodes of marine carbonate sedimentation are reported in the Ossa-Morena Zone (SW Iberian Variscides). Among them, the Cambrian and the Devonian episodes are those that are well represented in the Portuguese domains of the Ossa-Morena zone. In this zone, the strong Variscan deformation and metamorphic recrystallization obliterate the biostratigraphic contents of some carbonate local successions and their ages have been based on lithostratigraphic correlations. The $^{87}Sr/^{86}Sr$ values for the Ossa-Morena zone carbonate rocks allow to make an isotopic–lithostratigraphic correlation, based on the comparison between strontium ratios of marine carbonate rocks without chronological data and carbonate rocks with a good age control. Moreover, the established $^{87}Sr/^{86}Sr$ fingerprints of the marine carbonate episodes from Ossa-Morena zone should be simultaneously correlated with the worldwide seawater $^{87}Sr/^{86}Sr$ curve. Despite the interaction of the marine carbonate sedimentation with late secondary dolomitization processes or with high-temperature metamorphic/metasomatic fluids, which increases the primary $^{87}Sr/^{86}Sr$ ratios, this methodology allows to define two main distinct clusters of $^{87}Sr/^{86}Sr$ for the Ossa-Morena zone marine carbonates: a Devonian cluster with strontium ratios lower than 0,708000; and a Cambrian cluster ranging from 0.708777 to 0.708299 ($0.708575 \pm 0{,}000161$), that can reach 0.709227–0.708866 ($0.709087 \pm 0{,}000118$) if incipient late secondary dolomitization or high-temperature metamorphism/metasomatism operated. The obtained $^{87}Sr/^{86}Sr$ isotopic ratios corroborate the lithostratigraphic correlations between the carbonate rocks of Abrantes, Assumar, Estremoz, Viana-Alvito, Ficalho and Escoural successions with the Ovetian–Marianian limestones of Alter-do-Chão–Elvas Succession. Moreover, this methodology allows to establish the isotopic discrimination between the Upper Silurian–Devonian limestones of Ferrarias, Barrancos and Bencatel successions and the marbles of Estremoz Succession.

Keywords Ossa-Morena zone · Carbonate sedimentation · Iberian variscides · $^{87}Sr/^{86}Sr$ ratio

Introduction

The definition of lithostratigraphic successions in strongly deformed metamorphic regions is crucial to constrain their geodynamical evolution. When the paleontological and geochronological data are scarce (or even inexistent), the correlation between lithostratigraphic units is difficult to be established, so it requires some complementary studies.

The presence of carbonate sedimentation in the Phanerozoic is profuse (Mackenzie and Morse 1992) and, consequently, it is usually well represented in the stratigraphic record. The metamorphic processes affecting the carbonates often lead to recrystallization, which could obliterate the biostratigraphic data, create uncertainties about the sedimentation age and increase the complexity of their correlation in metamorphic successions. Therefore, the determination of the strontium isotopic signature ($^{87}Sr/^{86}Sr$) of carbonate

✉ N. Moreira
nmoreira@estremoz.cienciaviva.pt

1 Earth Sciences Institute, Pole of the University of Évora, Rua Romão Ramalho, no. 59, 7000-671 Évora, Portugal

2 Departamento de Geociências da ECTUE, Colégio Luís António Verney, Rua Romão Ramalho, 59, 7000-671 Évora, Portugal

3 GeoBioTtec, Departamento de Geociências and Laboratório de Geologia Isotópica, Universidade de Aveiro, 3810-193 Aveiro, Portugal

4 Laboratório Nacional de Energia e Geologia, UGCG, Estrada da Portela, Apartado 7586, Zambujal, 2720, Alfragide, Portugal

5 Laboratório HERCULES, Instituto de Investigação e Formação Avançada, Largo Marquês de Marialva, 8, Palácio do Vimioso, 7000-089 Évora, Portugal