

# Provenance of Cambrian–Ordovician Siliciclastic Rocks of Southwestern Iberia: Insights into the Evolution of the North Gondwana Margin

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**Abstract** This study makes a comparison between the populations of detrital zircons of the Cambrian sandstones from the Ossa–Morena Zone (OMZ) and the Ordovician quartzites from the southern domains of the Central Iberian Zone (S-CIZ) to identify the sediment sources during the development of North Gondwana basins (southwestern Iberia). The U–Pb results obtained for the lower Cambrian sandstones of the OMZ show a remarkable similarity to the detrital zircon ages of greywackes from the underlying OMZ Ediacaran basement (the Série Negra succession). However, there is a greater proportion of Cryogenian grains in the Cambrian rocks, whose main sources are: (1) the late Cadomian magmatic arcs (Ediacaran, ca. 635–545 Ma) which also contributed to filling the late Ediacaran

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basins of the OMZ; and (2) the early Cadomian arcs (Cryogenian, ca. 700–635 Ma). In the Lower Ordovician quartzites of the S-CIZ (the Armorican and Sarnelha formations), the age distribution of detrital zircons overlaps the population of detrital zircons of the underlying S-CIZ Ediacaran basement (the Beiras Group). However, there are some differences in the Sarnelhas quartzites, which have a population of detrital zircons similar to those of the Ediacaran greywackes and Cambrian sandstones of the OMZ. The Cambrian grains found in the Lower Ordovician quartzites fit the ages of magmatism representing the onset of rifting in North Gondwana that is registered in the OMZ but absent from the S-CIZ. The early Ordovician zircon grains are probably related to the magmatic event that preceded the passive margin stage of the Rheic Ocean, and are found in both the CIZ and OMZ.

**Keywords** Southwestern Iberia · Cambrian–Ordovician · Rifting · Zircon · Provenance

In southwestern Iberia, two main sedimentary unconformities can be recognized in the lower Palaeozoic stratigraphy: (1) The lower Cambrian unconformity, with a regional character in the Ossa Morena Zone (OMZ) and expressed locally in the Central Iberian Zone (CIZ), and which was developed during the transition from a late Cadomian active margin to the initial stages of Cambrian intracontinental rifting (Silva and Pereira 2004 and references therein); and (2) the Lower Ordovician unconformity, which was formed during a new period of emersion followed by transgression and significant subsidence in the passive margin of the Rheic Ocean (Silva and Pereira 2004 and references therein).

In the OMZ, the lower Cambrian stratigraphy comprises basal conglomerates, arkosic sandstones, shales, and limestones with associated volcanic–sedimentary complexes dated at ca. 530–526 Ma (e.g., Pereira et al. 2011 and references therein). The lower Cambrian formations unconformably overlie the Série Negra succession (the OMZ Ediacaran basement, Liñán and Quesada 1990).

In the southern domain of the CIZ (S-CIZ) the upper Cambrian–Lower Ordovician formations unconformably overlie the Beiras Group (S-CIZ Ediacaran basement; Sousa 1984). The upper Cambrian–Lower Ordovician stratigraphy consists of: (1) a lower unit with arkosic quartzites and slates with intercalations of conglomerates (the Sarnelhas Formation; Delgado 1908); and (2) an upper unit with massive beds of quartzites and thin layers of metapelites (the Armorican Quartzite Formation; e.g., Oliveira et al. 1992). In the CIZ–OMZ transition zone, the Lower Ordovician stratigraphy, which rests on the Cambrian and Ediacaran strata of the OMZ, includes at the base a ca. 490–480 Ma felsic volcanic–sedimentary complex (the Urra Formation; Solá et al. 2008); this passes gradually upwards to arkosic sandstones, conglomerates (containing pebbles of black cherts derived from the Série Negra succession), and quartzites of the Armorican Quartzite Formation (e.g., Linnemann et al. 2008).

This study aims to characterize U–Pb detrital zircon data from the Cambrian sandstones of the OMZ and those from the Lower Ordovician quartzites from the