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Potential sources of Ediacaran strata of Iberia: a review

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Advances in stratigraphy, geochemistry and U-Pb detrital zircon geochronology from Ediacaran strata of Iberia allow for the improved characterisation of crustal growth in the North Gondwana active margin. The formation of Cadomian magmatic arcs and associated back-arc basins that took place in the North Gondwana active margin was a long-term process. Iberia has been placed in the Cadomian belt in currently accepted palaeogeography reconstructions at c. 570–560 Ma, based on the characteristics of Ediacaran strata. The Ediacaran strata of Iberia with outstanding geochemical homogeneity are distributed across three zones of Iberia: (1) Narcea Slates in the Cantabrian and West Asturian Leonese zones (maximum depositional age of c. 600 and 553 Ma); (2) Schist–Greywacke Complex (Lower Series) in the Central Iberian Zone (maximum depositional age of c. 578 to 550 Ma); and (3) Série Negra in the Ossa-Morena Zone (maximum depositional age of c. 590–545 Ma). Pre-Cryogenian detrital zircons found in the Ediacaran strata of Iberia seem to be related to distal sources distributed across three main areas of North Gondwana inland. The oldest detrital zircons probably derive from distal sources such as the West African craton, the Trans-Saharan belt and the Arabian–Nubian Shield, in view of the increase in distance from sedimentary basins. The West African craton is the most likely source for Archean and Palaeoproterozoic detrital zircons, while the Trans-Saharan belt and the Arabian–Nubian shield could provide a source for Tonian and Mesoproterozoic grains. The youngest zircon ages (c. 630–545 Ma), which make up the dominant population in the Ediacaran strata of Iberia, are probably derived from proximal sources as would be the Cadomian magmatic arc system, not excluding the contribution of the Pan-African orogen.

Keywords: back-arc basins; Cadomian belt; Late Neoproterozoic geodynamics; North Gondwana

1. Introduction

Stratigraphic studies, complemented by the geochemistry of siliciclastic rocks and U-Pb geochronology on detrital zircons, are essential for understanding: (1) the provenance of detritus that filled basins; (2) the sequential record of crustal evolution processes that acted in a given region; and (3) the palaeogeography of supercontinents. Assuming a late Neoproterozoic palaeogeographic reconstruction for North Gondwana (Kroner & Stern, 2004), it is worth noting two tectonically active regions (Figure 1): (1) a peripheral region facing the ocean, which includes the east–west (present coordinates) trending Cadomian belt; and (2) an inner region near the cratons, where the north–south trending Trans-Saharan belt and the East African orogen (including part of the Arabian–Nubian shield) are located (Pan-African belt). The Cadomian and Pan-African zircon-forming events in North Gondwana are sometimes indistinguishable because they overlap in time and locally in space (Murphy & Nance, 1991; Nance & Murphy, 1994) (Figure 1).

The Cadomian belt (Iberia, Cadomia and Bohemia) which extends westward to the Avalonian belt (East Avalonia, Carolinia, Florida, Oaxaquia and Maya) resulted from the amalgamation process of magmatic arcs and synorogenic basins in the North Gondwana active margin (peri-Gondwanan terranes; (Linnemann et al., 2004; Linnemann et al., 2004; Linnemann, Pereira, Jeffries, Drost, & Gerdes, 2008; Murphy & Nance, 1991; Nance & Murphy, 1994; Nance et al., 2008).

In Europe, the Cadomian belt includes a pre-Neoproterozoic basement (Icartian gneiss, 2.1 Ga; Inglis et al., 2004; Samson & D'Lemos, 1998), Cryogenian magmatism (c. 755–745 Ma; orthogneisses from the Penthièvre Complex; Nagy, Samson, & D'Lemos, 2002) and Ediacaran sedimentary basins and coeval magmatism reworked by later deformation and metamorphism (Chantraine, Chauval, & Rabu, 1994; D'Lemos, Strachan, & Topley, 1990; Nance et al., 2008). In North Africa, the Trans-Saharan belt and the East Arabian orogen would have been part of an important orogenic system (Transgondwanan Supermountain; Squire, Campbell, Allen, & Wilson, 2006) that resulted from the amalgamation evolving the West African craton, the Saharan Metacraton and the Arabian–Nubian shield, which is known as Pan-African orogeny (Kroner & Stern, 2004). The Trans-Saharan belt consists of pre-Neoproterozoic basement and Neoproterozoic ophiolites tectonically reworked during Cryogenian—Ediacaran times (Kroner & Stern, 2004; Liégeois, Latouche, Boughara, Navez, & Guirad, 2003; Teklay, 2005). The Trans-Saharan belt that includes the Tuareg shield separates the Anti-Atlas (west) of the Saharan Metacraton (east). The Anti-Atlas located has a stratigraphy characterised by a Palaeoproterozoic basement (c. 2.2–2 Ga; Reguibat shield; Thomas et al.,

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