The Cambro-Ordovician Paleogeographic Position Of The Ossa-Morena Zone: tectonomagmatic and geochronological evidence

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The paleoposition of the Iberian massif zones prior to amalgamation continues to be a subject of considerable debate. Bea et al. (2010) proposed a new Cambro-Ordovician position for the Central Iberian Zone (CIZ), north of the Saraha Metacraton. The Cantabrian Zone (CZ) and Galicia Tra-Os-Montes Zone (GTMZ) basal units were apparently also in a similar position at that time (Díez-Fernández et al., 2010; Fernández-Suárez et al., 2014). Here we consider the position of the Ossa-Morena Zone (OMZ) in relation to the birth of the Rheic Ocean and subsequent amalgamation of Iberia.

The OMZ preserves evidence of a complex tectono-magmatic evolution, including late Neoproterozoic Cadomian orogenesis (650-550 Ma), Cambro-Ordovician rifting (540-450 Ma), and Variscan orogenesis (390-305 Ma). These episodes are recorded in OMZ magmatic events.

The period from 540 to 520 Ma marked a transition from collision, as recorded in the Cadomian continental magmatic arc, to rifting. The main Early Cambrian magmatism (530-525 Ma) comprises peraluminous to metaluminous granites produced during initiation of extension. This is evidenced by abundant A_2-type magmatism. Coincident with this was the generation of crust-contaminated, E-MORB-like basic magmas. In the main OMZ rift stage (520-500 Ma) mafic magmatism progressed from E-MORB (517-512 Ma) to OIB, and alkaline to tholeiitic (512-505 Ma). Associated, coeval, felsic S-type and A-type magmatism was also prevalent. Further spreading at 490-470 Ma, resulted in generation of N- and T-MORB mafic rocks. In the late Cambrian–early Ordovician basalts, coincidence of Nd model and crystallization ages indicates new crust formation related to asthenospheric upwelling and proto-ocean basin development. Coeval felsic magmatism was peraluminous and alkaline.

Neoproterozoic to Cambrian OMZ sedimentary rocks, e.g. Serie Negra, have a Nd model age of *c*. 1.7 Ga, as does the OMZ Cambro-Ordovician crust-derived magmatism. This is older than the *c*. 1.5 Ga model age of CIZ Neoproterozoic metasedimentary rocks and Ordovician orthogneisses. Along the northern Gondwana margin the most westerly Anti-Atlas, West African craton, has a Nd model age of around *c*. 1.0 Ga; the easterly Sahara metacraton *c*. 1.5 Ga and the central Tuareg Shield *c*. 1.7 Ga.

The OMZ detrital zircons have Ediacaran, Cryogenian, Paleoproterozic and Archean ages but show a Mesoproterozoic gap with an absence of a *c*. 1.0 Ga cluster. The CIZ detrital zircon ages have a similar distribution to the OMZ but also include a *c*. 1.0 Ga cluster and so correlate well with the Sahara metacraton (Bea et al., 2010). The OMZ detrital zircons also

have late Cryogenian-Tonian and Archean populations that are more scarce in the Anti-Atlas, West African Craton than in the Tuareg Shield. Furthermore, Paleoproterozoic ages of 1.9-1.5 Ga are typical in the OMZ Cambrian sedimentary rocks, this age distribution matches the Tuareg Shield rather than the Anti-Atlas, West African Craton.

In terms of Nd model and detrital zircon ages, the OMZ shows greatest affinity with the Tuareg Shield north Gondwana terrane. Our new Tuareg Shield-associated paleogeographic position for the OMZ fits well with other published work in which the Iberian Massif zones were located along the north Gondwana passive margin fringe but further east (present-day coordinates) than previously thought.

The magmatism pattern and the new Cambro-Ordovician paleogeographic position of the OMZ is temporally and compositionally consistent with a west-east rifting propagation, such as such as the Ethiopia Rift-Red Sea margin (Pearce, 2008). In both contexts there is a progression from E-MORB tholeiitic to OIB-like alkaline and finally N-MORB with a declining crustal input over a period of some 30 Ma. The Cambro-Ordovician magmatic expression is weaker in the more easterly CIZ (Bea et al., 2007) and in parautochthonous units from GTOMZ (Montero et al., 2009; Díez-Fernandez et al., 2012) than in the OMZ. This is consistent with an eastward-propagating rift which was, we suggest, a 'Gondwana-ward' Rheic Ocean branch, that was apparently preserved in the Badajoz–Cordoba sinistral transpressive shear zone during the Ordovician–Devonian juxtaposition of the OMZ and the CIZ.

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