

Neoproterozoic magmatism and metamorphism at the northern margin of Gondwana: Ossa Morena/Central Iberian zone boundary (Central Portugal)

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In the westernmost part of Europe, a major Neoproterozoic suture has been recognized at the Ossa Morena/Central Iberian zone boundary and the existence of a Cadomian basement has been documented in the geological literature. However, the lack of geochronological data for the basement, particularly in Portuguese areas, limited understanding of the timing of igneous and metamorphic events along the northern edge of Gondwana. We present new geochronological and isotopic data (U-Pb, ID-TIMS method; Sm-Nd) that define a sequence of geological events important to the understanding of the assembly of Gondwana. The study area is located in near Abrantes Central Portugal, at the Ossa Morena/Central Iberian Zone boundary. The rock sequence comprises three lithostratigraphic units from base to top: the Série Negra unit, the Sardeal complex and the Mouriscas complex. The Série Negra is a volcano-sedimentary succession, deformed and metamorphosed under low to medium-grade conditions. It comprises metavolcanic rocks, volcanoclastic rocks, metagreywacke, phyllite, schist with interbedded black chert, greenschist and amphibolite and rhyodacite intrusions. The protoliths of the amphibolite were generated by island arc magmatism. This event can be related to back-arc spreading documented in other areas of the Cadomian basement. The Sardeal complex consists of deformed metamorphic rocks of igneous origin (quartzo-feldspathic schist, orthogneiss, migmatite and amphibolite) and minor rhyodacite intrusions of Carboniferous age (~ 308 Ma). The geochronological results indicate a major felsic igneous event between ~ 692 and 548 Ma that generated protoliths of subalkaline and peraluminous character on an active continental margin. Strong negative ϵNd_t isotopic signatures (-5.2 to -8.1) and old T_{DM} model ages (1.53 to 1.69 Ga) are consistent with old crustal sources, which have been observed in other Cadomian-type terranes. This event can be correlated with the arc-related magmatism in Cadomia. Paleoproterozoic and Neoproterozoic inherited zircons (1.7–2.8 Ga) suggest a West African craton provenance, in agreement with Late Neoproterozoic reconstructions that place the Ossa Morena adjacent to the West African craton. Amphibolites interbedded in the Sardeal complex are older than ~ 539 Ma and were generated in a Precambrian island arc. The Mouriscas complex is a deformed and metamorphosed igneous mafic complex that includes amphibolites with an igneous crystallization age of ~ 544 Ma and metatexite, diatexite, protomylonite trondhjemite and garnet amphibolite. Isotopic data indicate sub-continental lithospheric sources and crustal contamination by old crustal rocks ($T_{\text{DM}}=1.51$ to 1.81) in intra-plate and active continental margin settings. This magmatic event represents the final phase of Cadomian arc magmatism in the area. A major metamorphic event is recorded in the Sardeal complex amphibolite by metamorphic zircon and titanite and in the orthogneisses by metamorphic monazite (~ 540 Ma). It represents accretion of the peri-Gondwanan terrain (Ossa Morena) to the Iberian autochthonous passive margin. The collisional event caused partial melting of orthogneiss, with formation of migmatite and metamorphism at amphibolite facies conditions, close to the transition to granulite facies (P=7-8 kb, T=640-660°C).