Goldschmidt 2022 Abstract
https://doi.org/10.46427/gold2022.9268

From Cryogenian to early Cambrian: evolution of the Cadomian arc in the North Gondwana margin (Iberian Massif, Central Portugal)

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In the westernmost segment of the European Variscides (Iberian Massif, Central Portugal) a Neoproterozoic suture is exposed at the contact between the Ossa-Morena Zone (OMZ) and the Central Iberian Zone (CIZ). A sequence of magmatic and tectonometamorphic events related to the Cadomian orogeny was documented in this area between ca. 692 and 540 Ma [1].

The oldest magmatic event occurred at 692 + 77/-60 Ma and is broadly coeval with other igneous events of Cryogenian age recognized in the OMZ and in other domains of the orogen. They are related to the early stages of the Cadomian arc activity. Cryogenian igneous ages are rare in the OMZ and therefore matter of debate. However, detrital zircons with dominant Cryogenian-Ediacaran populations and a peak ≈ 680 Ma were found in the OMZ [2] and provide evidence for an exposed basement with an age within the obtained range of values.

Igneous events at 569 ±3 Ma and 548 ± 4 Ma generated magmas of acid composition and peraluminous character that resulted from partial melting of metasedimentary and meta-igneous crust. The former event is correlated with a major period of magmatism in Cadomia (ca. 580-570). The last magmatic pulse is characterized by the emplacement of magmas at 544.2 ± 1.7 Ma, 544.3 ± 2.5 Ma and 544 ± 2 Ma that were formed by partial melting of meta-igneous lower crust and mantle.

A major metamorphic event occurred under amphibolite facies conditions near the transition to the granulite facies (P = 7–8 kb, T =640–660 °C), close to the Late Ediacaran-Cambrian boundary (ca. 540 Ma). This age is recorded in metamorphic minerals, such as, monazite (540 ± 3 Ma; 540 ± 5 Ma; 539 ± 2 Ma) and zircon (539 ± 3 Ma). It was interpreted to represent the continental collision between two peri-Gondwanan terranes: the OMZ and Iberian Autochthon passive margin (future CIZ). It is broadly coeval with collisional events observed in other areas of Gondwana: Cadomian, Damara, Kaoko and Ribeira Belts and East Antartica.

[1] Henriques et al., 2015: Lithos 220-223, 43-59; [2] Azor et al., 2021: Precambrian Res. 361: 106251