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THE PANAFRICAN AND CADOMIAN OROGENIES IN NORTH AFRICA AND WESTERN EUROPE

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~ 610 Ma: a critical age for the Iberian consolidation

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Both the Pan-African orogenic cycle and the peri-Gondwanan Cadomian Orogeny took part in the global tectonic event that led to the rearrangement of Gondwana's west-northern block. An approach to determine the nature of Cadomian - Pan-African events using detrital zircons population from Neoproterozoic-Lower Paleozoic (rift-to-drift cycle) stratigraphic record in Iberian Massif is here discussed.

The studies showed that throughout a 120 million-year-old stratigraphic record (late Ediacaran-to-Floian), the main and systematic peak in the detrital zircon age spectra's is at ca. 610Ma. This intriguing peak set the course for further work since it is not fully understood how it came about. Furthermore, the inherited zircon ages recorded in Cambrian to lower Ordovician igneous rocks also fit quite well the Neoproterozoic peaks, with a remarkable peak always placed around 610 Ma. There's no doubt that ~610Ma represents the most prominent period of crustal growth, that is, a critical magmatic burst.

Generally, ~610 Ma is assumed as a main period representative of the Cadomian Arc but this age is in fact a critical age in the Pan-African orogeny. In the internal domains of North Africa (ex. Anti-Atlas), several authors attributed two main stages of magmatic activity in the Anti-Atlas domain in Morocco to the Pan-African orogeny, namely: i) ocean opening followed by subduction-related arc magmatism (790-690 Ma), ii) ocean closure followed by arc–continent collision (690-605 Ma), with peaks at 660 and 615 Ma.

With a few exceptions, in Iberia, nearly all allegedly Cadomian igneous rocks are Late Ediacaran (ca. 600-555 Ma) and it is possible to assume that the igneous rocks cropping in northern Ossa-Morena Zone (Merida-Abrantes Belt) are the only representatives of the Cadomian arc system. Recently, Cryogenian and some other ages have been placed in this range, suggesting that we are possibly detecting representatives of Pan-African events.

Anyway, the key question is why the 610 Ma peak (?) is not suffering a progressive depletion upwards in the stratigraphy, as it would be expected, assuming the erosion and loss of the older igneous sources. Even when other crustal growth periods can be differentiated through other age peaks, the 610Ma peak always prevails throughout the stratigraphic record. This may be related to very low rates of erosion and limited denudation, probably controlled by intense rift-to drift subsidence.

Although lithospheric delamination and/or tectonic erosion probably has played a role in the progressive depletion of the 790-690 Cryogenic arcs, the same scenarios can't be stated for the well-preserved new ca.610 "arc". Since the diminishing of older zircon sources can be related to its burial bellow newer arc intruded material, the perpetuity of ~ 610 Ma can't be explained by this process. Therefore, we are probably leading with two different Arc edifices (the Cadomian and Pan-African arcs are independent in space).

On the other hand, the Ediacaran (~ 610 Ma) zircons, incorporated in the Paleozoic magmas are indirect evidence of Pan-African and Cadomian Magmatism, suggesting those magmas can probably be found entrapped in the lower crust and crust-mantle transition of Central-Iberian Zone and Ossa-Morena Zone.