International Meeting

July 1st, 2021 (*online*)

THE PANAFRICAN AND CADOMIAN OROGENIES IN NORTH AFRICA AND WESTERN EUROPE

J. Javier Álvaro, Martim Chichorro and Gabriel Gutiérrez-Alonso (eds.)

Inspecting zircon populations of the Iberian Pyrite Belt: tracking the Cadomian record of the South Portuguese Zone

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The palaeogeographic location of the southernmost zone of the Iberian Massif, the South Portuguese Zone (SPZ), prior to the amalgamation of Pangaea is still a matter of debate. In this work, we attempt to track its palaeogeographic setting during the final stages of the Cadomian Cycle. This is a challenging task as rocks older than middle Devonian have not yet been found.

A compilation of published U-Pb geochronological data of the SPZ shows a strong Cadomian signature (25-50%) in both Devonian and Carboniferous detrital rocks. For the present work we only considered the zircon population of: (i) the Phyllite-Quartzite Group (PQG) of Middle to Upper Devonian (fossil record age) - quartzites from PQ Formation and Ronquilho Formation; and (ii) the felsic volcanic rocks of the overlying Volcanic Sedimentary Complex (VSC), which contain sparse pre-Devonian inherited zircons, that are of utmost value for provenance studies of deeper unknown rocks.

The most important pre-Devonian spectrum of PQG is a broad curve (540-770 Ma; ~ 50%) with a conspicuous peak at 600-630 Ma, which is consistent with the Cadomian Orogeny. The same feature can be observed in the volcanic rocks, as main inherited fractions are of Cadomian age (560-699 Ma; n = 13/36).

Interestingly, the pre-Ordovician spectrum in the PQG is rather similar to the OMZ and Meguma Cambrian rocks. This may suggest that the PQG source rocks were related to peri-Gondwana terranes close to both Meguma and/or Ossa-Morena.

The SPZ rocks show a lowermost Devonian peak in the PQG (~ 417 Ma; 1-2%) and considerable inherited Silurian ages in the volcanic rocks (~ 420-440 Ma; n=6/36), strongly suggesting that SPZ has affinities with the paleo-continent Laurasia. Noteworthy, these ages also suggests that Silurian rocks are a potential source for the SPZ rocks.

Both PQG rocks and volcanic rocks present lower Cambrian peaks (~ 530-535 Ma; ~ 1-3%; 528-545 Ma, n = 5/36, respectively), probably related to continental rift magmatism (Rheic opening). Inherited ~ 462 Ma to ~ 502 Ma ages (n = 4/25) may reflect late-stage rifting/drifting similar to the Iberian Toledanian phase.

PQG has late Tonian-Stenian populations (0.85-1.2 Ga; 4-6%), that may reflect a Sahara metacraton influence. Contrary to the detrital rocks, important ~ 1.3-1.4 Ga ages (n = 2/36) and ~1 Ga (n=2/36) recovered in the volcanic rocks strongly suggest an Avalonian-related source. However, these grains are also relevant in Meguma Silurian rocks; therefore also a potential source for the inherited zircons.

African craton orogenies are well-identified in detrital rocks. These show an important record of Eburnean-related (1.8-2.2 Ga; 25-30 %), with a peak at 2.1 Ga, and dispersed Liberian-Leonian-related grains (~2.4-3.4 Ga; 4-6 %). Eburnean and Liberian-Leonian grains were also identified in felsic rocks (~2.1 Ga, n = 2/36; 2.6 Ga; n = 2/36).

This zircon record allows us to state that PQG rocks are very similar to Cambrian metasediments of the OMZ and Meguma, suggesting a possible link during the Devonian, whereas for the inherited zircons a link to Avalonia is more probable. Although, further paleogeographic inferences for the SPZ are difficult to make, the zircon record confirms the importance of Cadomian orogenic rocks in the build-up of the SPZ crust.