

Zircon U-Pb ages and Hf isotopes tracking the origin of Permian Paraná Basin ash-fall layers: are they coming from Choiyoi formation?

Mariana de Matheus Marques dos Santos¹, Cláudia Regina Passarelli¹, Miguel Angelo Stipp Basei¹, Antonio Roberto Saad¹, Paulo Roberto dos Santos¹, Oswaldo Siga Júnior¹

(1) Institute of Geoscience - University of São Paulo, Mineralogy and Geotectonics, Rua do Lago, 562, São Paulo, Brazil

In the Paleozoic, during the supercontinent Pangea, the regions furthest from the active margins experienced extensive periods of tectonic stability and large synclines have been formed in south Brazil, Argentina, Paraguay, and Uruguay. In Brazil, volcanic ash and volcanic glass fragments were found in several formations of the Paraná Basin, such as the Rio Bonito, Irati, Rio do Rasto, and Estrada Nova/Teresina.

We present new Hf isotope compositions of zircons previously dated by SHRIMP U-Pb ages ((1),(2)) with an interest in deepening the previous suggestions that the volcanic ash-fall layers and vitroclastic-carrying sediments from the Paraná Basin and the Choiyoi Formation volcanic rocks would have a common origin, in addition to their Permian ages. Hf isotopic measurements were made as closely as possible to the same area of the U-Pb spot in zircon grains.

Thus, representative samples from the Gondwana I Super-sequence in Paraná Basin in Brazil (states of MT, SP, PR, SC, and RS) and Uruguay from ashfall deposits and volcanic particles belonging to the Rio Bonito Formation (BR), Irati Formation (BR) / Mangrullo Formation (UY), Estrada Nova/Teresina Formation (BR), Yaguari Formation (UY), and Rio do Rasto Formations were selected for Hf analysis.

From the Choiyoi Igneous Province, the collected samples in Argentine territory belong to andesitic breccias, continental conglomerates, and dacitic-rhyolitic ignimbrites from the Yacimiento Los Reyunos Formations of the Cochicó Group (lower section of Choiyoi); pyroclastic flows and rhyolitic ignimbrites from Cerro Carrizalito and Água de Los Burros (upper-section of Choiyoi); and sandstones from the El Imperial Formation - sedimentary unit discordantly covered by the Choiyoi succession.

In total, we analyzed 183 spots, of which 129 belonged to formations from Paraná Basin, and 54 from Choiyoi. Preliminary results show that Irati Formation (274.2 ± 1.3 Ma; MSWD = 0.016) and Estrada Nova Formation (268.6 ± 6.4 Ma; MSWD = 0.96) with ϵHf (-7 --> +1) and Hf- T_{DM} Model Ages (1100 --> 1600 Ma) are similar with the Choiyoi samples with (264.5 ± 3.0 Ma; MSWD = 0.47), and ϵHf (-10 --> +5) and major Hf- T_{DM} Model Ages (1100 --> 1500 Ma). Therefore, there is an accordance between zircon U-Pb ages and Hf isotopes of both units. This information supports the hypothesis that they have the same origin with contribution from the peri-Gondwanan magmatism.

Conversely, the zircon ages of Rio Bonito Formation (297.0 ± 64 Ma; MSWD = 1.5) with ϵHf (-3 --> +13) and most Hf- T_{DM} Model Ages (500 --> 1500 Ma) might indicate that the origin of the zircons are older than the volcanism that originated the Permian ash-falls layers found in the other Paraná Basin units. Therefore, they are probably related to an older volcanic episode that is not recognized yet in Paraná Basin. Moreover, the El Imperial Formation with a single Permian zircon volcanogenic grain (298 Ma) and considerable Ordovician population of (453.7 ± 8.1 Ma; MSWD = 2.6) with ϵHf (-10 --> +15) and Hf- T_{DM} Model Ages (1000 --> 1800 Ma) probably correspond to another volcanic event prior to Choiyoi.

Consequently, our results reinforce the previous literature suggestions ((1),(2)) that the Choiyoi volcanic event is the responsible for the presence of the Permian ash-fall layers found in the Paraná Basin units. The refinement of this suggestion will be made by geochemical characteristics of the zircons from both units – Choiyoi and Paraná Basin Permian zircon grains.

(1) Rocha Campos et al. (2011). Gondwana Research, 19-2: 509-523.

(2) Rocha Campos et al. (2019). The Journal of Geology, 127-2.

Financing: First author has a financial funding from FUSP Project 3218. Special thanks to FAPESP 2015/03737-0 which made possible the geochronological analysis and field trips.