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Insights on identifying Archean segments tectonically embedded in the Transbrasiliano Lineament: methodology and implications in Central Brazil

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Abstract

Gamma-ray spectrometric responses of Archean rocks were studied in order to define a characteristic signature for these rocks. As the half-life of the most frequent Thorium isotope (^{232}Th) is more than 3 times longer relative to the Uranium isotope (^{238}U), a low response of radiation intensity in the spectral range of decay series of Uranium relative to that of Thorium is expected for Archean rocks. Based on this theoretical aspect, associated with gamma-ray spectrometric responses parametrically studied in several Archean areas of Brazil, gamma-ray and magnetometric structural interpretation, follow-up field studies, micropetrography, lithogeochemistry, and geochronology (U-Pb in zircon), it was possible to define and identify previously unidentified Archean rocks (2.84 Ga) tectonically imbricated amid Neoproterozoic magmatic arc terrains. In order to evaluate the applicability of the proposed methodology, three samples were analyzed, but only one provided more accurate results. The tonalite sample was analyzed for U-Pb (LA-ICPMS). Data from zircon grains were pooled

into two age groups, both with Pb loss to ~550 Ma, and 3 grains of 3269 Ma ($^{207}\text{Pb}/^{206}\text{Pb}$), 586 and 513 Ma ($^{206}\text{Pb}/^{238}\text{U}$). The main group are from crystals with core and rich in inclusions (24 spots) and their data regression indicates the upper intercept (UI) of 2840 ± 11 Ma. The second group data (8 spots - crystals with few inclusions and discrete OZ) indicates the UI of 2088 ± 27 Ma. UI are interpreted as magmatic and deformational ages, respectively. The isolated ages probably represent crustal contamination and metamorphic age. Many domains with gamma-spectrometric signatures of low uranium relative to thorium and elongated geometry occur along the NE direction in the south-central portion of the Brasília Orogen. Some of these signatures correspond to the responses of known Archean rocks, such as the Goiás Block and the Serra Azul Complex, aligned along the NE direction of the Transbrasiliano Lineament. Additionally, this study has identified another trend-aligned crustal segment with this type of signature along the Moiporá-Novo Brasil transcurrent fault, which is associated with the Transbrasiliano Lineament system. At some places, Archean-Paleoproterozoic terrains tectonically imbricated amid younger orogens are expected to occur during crustal accretionary processes. It supports the hypothesis that the Transbrasiliano Lineament is responsible for shearing the Archean blocks with a common origin. It can also elucidate a connection of these tectonically fragmented blocks along the Transbrasiliano and Moiporá-Novo Brasil lineaments, suggesting that the tectonic activity along the lineaments led to the transportation of the aligned terrain fragments, which initially could have been part of the presently covered Paranapanema block. Identifying another structurally aligned portion with the known ones suggests that these fragmented parts form a common block. The possible interpretations and discussions relate to the possibility of these fragments retaining the exact genesis and, in addition, being representatives of the closest and most structurally aligned Archean block, the Paranapanema Block. We propose a new identification of Archean inlayers amid the Neoproterozoic arc country rocks. It is suggested that these crustal segments were originally a part of the same ancient terrain. During the Neoproterozoic, these segments separated due to structural activity and proximity to the Paranapanema Block gravimetric boundary. This discovery has geotectonic implications regarding the magnitude of the Transbrasiliano Lineament and its potential to fragment large Archean blocks and arrange them aligned within the Tocantins Province.

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Track

- 3. Crustal evolution of the Archean blocks and Proterozoic orogens

Keywords

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