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A Mid-Paleoproterozoic Apparent Polar Wander Track for the Piedra Alta Terrane (Río de la Plata Craton): Paleogeographic and Geomagnetic Implications

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A b s t r a c t

The Paleoproterozoic is a fascinating period of Earth history. Inception of plate tectonics, first supercontinents, inner core nucleation, eukaryote appearance, atmospheric great oxigenation event and other first order global processes likely ocurred during this period. Reliable and well-dated paleomagnetic data from the Paleoproterozoic is scarce, which hampers global paleogeographic and geodynamic models. The characteristics of the Earth Magnetic field in such old times are also known very schematically due to data paucity. In order to contribute to a better understanding of the Paleoproterozoic paleogeographic, geodynamic and geomagnetic evolution, a systematic paleomagnetic study is being carried out on a series of numerous late to post-tectonic igneous bodies of mid-Paleoproterozoic age exposed in the Piedra Alta terrane of Uruguay, which is considered as the core of the Rio de la Plata craton (e.g., Oyhantçabal *et al*. 2018 and references therein). First results from this research were published by Rapalini *et al*. (2015) who presented a schematic apparent polar wander path for this craton for the late Rhyacian to the early Orosirian, based on three paleomagnetic poles obtained from three of these plutons. They also suggested that when compared with coeval data from the Sao-Francisco, Guyana and West Africa cratons it supported an unorthodox configuration of the hypothetical Atlantica continent. Available U-Pb (both SHRIMP and LA-ICPMS) from several of these igneous bodies strongly suggest that they were intruded in a relatively short period between ca. 2.1 and 2.05 Ga. Further paleomagnetic results on several other plutons are presented. After stepwise AF and/or thermal demagnetization, consistent characteristic magnetic components were isolated from the Cufré-Cerro Albornoz granites (2.086 Ga), Carreta Quemada Gabbro (2.086 Ga), Arroyo Marincho Granite (2.081 Ga) and the yet undated Tía Josefa Tonalite, Arroyo Grande Granite and GM4 pluton. Our results permit to compute individual paleomagnetic poles from

each body that together with those already published from Mahoma (2.1 Ga), Isla Mala (2.076 Ga) and Soca (2.056 Ga) plutons are distributed along a simple track composed of eight poles. It suggests that the Río de la Plata craton was at polar latitudes during the mid-Paleoproterozoic but experiencing a fast displacement and rotation. Only the Tia Josefa pole seems to be an outlier of this single track. Most bodies show a unique polarity, either normal or reverse, which, according to their position along the track, suggest at least five reversals of the Earth Magnetic Field during that time span and a dominant dipolar field. Since all reliable radiometric datings are U-Pb, precise magnetization ages depend on the cooling rates of these bodies. Few thermo-barometric determinations suggesting shallow intrusive levels and old Rb-Sr ages on these igneous bodies falling in the range 1.95–2.1 (with large uncertainties between 50 and 75 Ma) point to a relatively fast cooling. Comparison with coeval poles from other blocks in South America and Africa support the unorthodox Atlantica reconstruction and point to magnetizations ages somewhat 20 to 30 Ma younger than U-Pb ages. Ar-Ar datings on amphibole are under way to better constrain the magnetization ages of these plutons.

Keywords: Paleoproterozoic, Río de la Plata craton, Piedra Alta terrane, Atlantica, paleogeography.

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