Paleomagnetism of the Neoproterozoic Araras Group (~600 Ma), Brazil: new implications for the Snowball Earth hypothesis

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Abstract.

Palaeomagnetic study of the carbonates that ubiquitously cap glacial deposits may constrain the latitudinal extent of Neoproterozoic glaciations and the duration of the greenhouse recovery. We present the first palaeomagnetic data on the Neoproterozoic cap carbonates covering the Amazon craton, which are folded along the Paraguay Belt. Samples collected at deformed beds along the Paraguay Belt present a single-polarity secondary magnetization acquired by the end of the Brasiliano orogeny (540–520 Ma). Pyrrhotite and magnetite are identified as the principal magnetic carriers by SEM observations and characteristic magnetic properties. The remagnetization is probably acquired during hydrocarbon migration whose reducing chemical conditions has enabled the formation of secondary iron and sulfide oxides. The comparison of the corresponding paleomagnetic pole with well-dated poles from Gondwana permits to date the fluid migration. In the cratonic area, a dual polarity component was isolated in dolostones at the base of the sequence. The presence of a stratabound reversals stratigraphy, along with high unblocking temperatures, strongly suggests that this magnetization is primary. Both SEM observations and magnetic analyses indicate detrital hematite as the unique magnetic carrier in favor of a detrital remanence magnetization (DRM) acquisition. This result implies a low palaeolatitude (22+6/-5°) for the Amazon block just after deposition of Puga diamictites. In addition, the presence of multiple reversals across the first 20 m of the cap carbonate sequence suggests that their sedimentation must have spanned hundreds of thousands of years at least, much more than previewed by the original snowball Earth hypothesis.

Key-words: Amazon craton, Neoproterozoic, paleomagnetism, hydrocarbons, snowball Earth, DRM.