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Neoproterozoic glaciations in South America: “Snowball Earth” and “Phantom glacial” records.

Daniel Poiré, Lucía Gómez-Peral, and Julia Arrouy

Centro de Investigaciones Geológicas, CONICET-UNLP-Natural Science Faculty and Museum, Argentina (dgpoire@yahoo.com.ar)

Neoproterozoic diamictite rocks as tillites or glaciomarine deposits have been recorded as the product of regional glaciations around the world, according to the “Snowball Earth” hypothesis. However, in some parts of the planet, contemporaneous non-glaciogenic sedimentary rocks have also been observed related to sedimentation in non-glacial environments but influenced by planetary glaciation, which was named “Phantom glacial”, in a “Slushball Earth” scenario. In the first model, the glacial mass covered the entire planet during the glaciation times, meanwhile in the “slushball” hypothesis that Earth was not completely frozen during periods of extreme glaciations. “Phantom glacial” evidence is recognized mainly by the development of regional karstic unconformities related to drastic sea level changes, trends in δ13C and phosphogenesis events. Neoproterozoic successions in South America are recorded in many areas of Brazil, Paraguay, Bolivia, Uruguay, and Argentina. Some of these units show glaciogenic formations like those observed in the Puga and Serra Azul formations in the Northern Paraguay Belt (Brazil) in agreement with their accumulation in a Snowball Earth context. However, in other cases, tillites or other glaciomarine deposits are absent, which may indicate a distant position (tropical) regarding the ice cap, as occurs in the Tandilia System (Argentina) related to a “Phantom glacial” context. In this contribution, we show the comparison between direct and indirect evidence of glaciations in the Neoproterozoic successions of South America. The Puga and Serra Azul formations in the Paraguay Belt and Sierras Bayas Group in the Río de la Plata Craton have been chosen to describe the “Snowball Earth” and “Phantom glacial” models, respectively. By means of multiproxy analysis, it is also possible to indicate changes in paleoclimate conditions in both cases. The presence of Puga Formation tillites and Serra Azul Formation dropstones are considered to be direct evidence of the extreme climatic conditions during a deposition in glaciation times. Meanwhile, more subtle evidence such as regional unconformities related to drastic sea level changes, trends in δ13C, events of phosphogenesis, constitute, among others, the tools to indicate the influence of Neoproterozoic global glaciations during the deposition of the sedimentary units at the Tandilia System.