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Climate variability during the Late Paleozoic Ice Age in the southwestern Gondwana: records of orbital and millennial-scale cycles in the Carboniferous rhythmite of the Paraná Basin

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The Late Paleozoic Ice Age (LPIA), one of the best known and prolonged glaciation events in Earth's history, resulted in the widespread deposition of glacial sediments over Gondwana (Crowell, 1999). Some of the most important LPIA deposits of the multiple glacial-deglacial episodes (Isbell et al., 2003) were preserved in the Itararé Group of the Paraná Basin (Brazil). This unit presents continental and marine glacially-influenced deposits formed by advances and retreats of glaciers and consists in an opportunity to better understand the mechanisms forcing climate shifts during the LPIA. In low latitudes, the deposition of the Carboniferous cyclothems was controlled by long- and short-eccentricity (Davydov et al., 2010). In high latitudes, orbital-scale climate cycles may also be preserved in the sedimentary succession. We aim to recognize whether or not orbital and millennial-scale climate cycles are preserved in the sedimentary succession of a core drilled in the southeastern border of the Paraná Basin. Here, we present the first cyclostratigraphic study based on X-ray fluorescence records from a 27 m-long interval of LPIA rhythmites of the Rio do Sul Formation (top of the Itararé Group). The sedimentary succession is composed of lithological couplets of fine-grained siliciclastic sediments, locally displaying subtle plane-bedding. Such rhythmites are characterized by abrupt contacts between couplets and normal grading internally. TiO_2 and Fe_2O_3 vary in phase and display well-defined cyclicities in the stratigraphic domain. The TiO_2 series presents millennial and orbital scale periodicities. Variations in the concentrations of the analyzed terrigenous components are likely indicative of glacial-interglacial changes, reflected by advances and retreats of glaciers under drier and wetter climate conditions, respectively. Here we show that these high latitude glacial-interglacial cycles were probably paced by short-eccentricity, as previously suggested for Carboniferous cyclothems in low latitude deposits, and highlight the importance of millennial-scale climate cycles forcing high latitudes glacial-related deposits, similar to patterns seen in Pleistocene records.

References:

Crowell, J. C. (1999). Pre-Mesozoic Ice Ages: Their Bearing on Understanding the Climate 375

System. Geologic Society of America Memoir 192, pp. 1–112.

Davydov, V. I., Crowley, J. L., Schmitz, M. D., & Poletaev, V. I. (2010). High-precision U-Pb zircon age calibration of the global Carboniferous time scale and Milankovitch band cyclicity in the Donets Basin, eastern Ukraine. Geochemistry, Geophysics, Geosystems, 11.

Isbell, J. L., Miller, M. F., Wolfe, K. L., & Lenaker, P. A. (2003). Timing of late Paleozoic glaciation in Gondwana: Was glaciation responsible for the development of Northern Hemisphere cyclothems? In Geologic Society of America Special Paper 370, pp. 5–24.