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Deciphering the timing of the LPIA in southern Gondwana using U-Pb CA-TIMS geochronology

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The Late Paleozoic Ice Age (LPIA) spans the latest Devonian through Late Permian, with glaciations recorded across Gondwana. Reconstructing the timing and extent of the glaciations depends on the availability of precise and accurate age control in order to correlate near and far-field glaciogenic sediments across basins and continents. We present single zircon U-Pb CA-TIMS ages from a suite of volcaniclastic strata intercalated with near and far-field glaciogenic deposits of latest Carboniferous to Early Permian age in the Paraná, Karoo and Kalahari basins in southern Brazil and Africa, respectively. The zircon age inventory of individual volcanic layers is in many cases complex due to the occurrence of inheritance and xenocrysts as well as, in some cases, the effects of Pb loss despite the application of aggressive chemical abrasion prior to analysis, making the data interpretation challenging. These complexities where unrecognized in previous studies as result of lower resolution geochronological techniques and resulted in compromised reconstructions.

The new U-Pb zircon ages seem to suggest that the final demise of LPIA ice in the Paraná, Karoo and Kalahari basins is diachronous and at least in part, related to latitudinal position. Individual deglaciation events in each basin are in sync across these basins suggesting an additional driver, and there is emerging evidence that changes in the extent and the synchronous nature of deglaciation in these areas mimic fluctuations in atmospheric pCO_2. Current efforts are aimed at integrating our findings with records from both low and high latitude sedimentary archives in order to test our hypothesis of a greenhouse gas forced glaciation with the goal of refining the underlying mechanisms that drive the LPIA. Deglaciation sequences in the Paraná, Karoo and Kalahari basins can now be reconstructed with a resolution as low as ca 200 ka, higher order fluctuations down to the few ka level are still difficult to reconstruct and require the detailed study of cyclic sedimentary sequences in combination with high-resolution geochronology.