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Re-evaluating the Vingerbreek Member of the Nama Group: No late Ediacaran glaciation recorded on the Kalahari Craton

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The Cryogenian Period (720-635 Ma) is renowned for long-lived, low-latitude 'Snowball Earth' glaciations; however, climate in the Ediacaran Period (635-538 Ma) remains more poorly constrained. Although many (<45) late Ediacaran glacial deposits have been reported from strata spanning a range of paleolatitudes, age constraints and/or published sedimentological evidence for glaciation can be limited. The c. 545 Ma Vingerbreek Member of the late Ediacaran Nama Group hosts purported glacial deposits interpreted to be deposited at mid-low latitudes; paleogeographic reconstructions suggest that Ediacaran strata deposited on/around the Kalahari Craton were deposited at 30-40º south. For ice to reach sea level at these latitudes, Budyko-Sellers-style climate models require an unstable, globally significant cooling interval, which could have come close to tipping the world into another 'Snowball' state. Field-based re-evaluation of purported Vingerbreek glacial deposits demonstrate that deposits previously interpreted as evidence for late Ediacaran glaciation can instead be explained by a combination of 1) misidentified Permo-Carboniferous glacial deposits of the Dwyka Formation and 2) non-glacial Ediacaran-age deposits. These results demonstrate that there is no robust evidence for Ediacaran glaciation on the Kalahari Craton, an important constraint on the global climate state during the early radiation of animals.