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The making of a sandstone colossus: Tectonically and climatically induced flushing of 'Nubian' sands in the Early Paleozoic

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Massive 'Nubian' sandstones of Cambro-Ordovician age drape most of the Arabian and northern African tectonic plates and preserve a sensitive record of how continental margins evolve under greenhouse conditions. These strata also contain important aquifers, petroleum reservoirs, and archaeological monuments such as Petra, and they were formed by a geologically sudden and long-lasting influx of >500,000 km3 of predominantly quartz sand. The cause and timing of this continent-scale sedimentation event were so far unknown. Here we constrain the depositional history of these strata and hypothesize that poleward migration of the Gondwanan supercontinent out of the horse latitudes caused a five-fold increase in sedimentation rates and buildup of one of the largest epicratonic sand wedges in earth history. Geohistorical sedimentation and subsidence modeling of these sandstones is presented, based on sedimentologic, biostratigraphic, basement paleotopographic, facies, and tectonic dip analyses of a well-preserved paleoslope-axial transect of 542-462 million-year-old strata in Jordan. This region experienced a $\sim$25 m/Ma increase in sedimentation rate over $\sim$30 Ma, concomitant with near-equilibrium plate subsidence response. Sedimentary rocks in the studied sequences exhibit coeval compositional variations that suggest a change in sedimentation style from immature to ultramature clastics. Our results are internally consistent with movement of a continent from an arid subtropical high toward a wet subpolar low, which would have caused widespread flushing of hypermature sands sourced from the interior of the African-Nubian Shield toward the continent margin.