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A folded Himalayan-style collisional-orogen model for the origin of the Limpopo belt in South Africa: Implications for reconstructing an amalgamated Archean craton

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The ENE-trending Limpopo high-grade metamorphic belt (LB) in South Africa consists of the Central Zone (CZ) bounded by steep strike-slip shear zones against the Northern and Southern Marginal Zones that are in turn bounded by margin-parallel thrusts. The origin of the LB was related to (1) the N-S Kaapvaal-Zimbabwe collision, (2) accretion of a collage of exotic terranes against the Kaapvaal and Zimbabwe cratons, (3) westward indentation of the CZ as a colliding block over the combined Kaapvaal-Zimbabwe craton (KZC), and (4) modification of a 2.6 Ga Kaapvaal-Zimbabwe collisional zone by 2.0 Ga right-slip faulting. The above models encounter two main issues: (a) the LB and its neighboring cratons preserve no records of a magmatic arc(s), and (b) contradictory strike-slip senses are observed in nearby localities of the same strike-slip shear zones. Here we propose a Himalayan-Tibetan-style model and envision that the combined KZC acted like India and a craton located east (present coordinate), termed here as the "missing craton" (MC), acted like Asia. East-dipping oceanic subduction created a magmatic arc along the western margin of the MC. The subduction led to ocean closure and the E-W KZC-MC collision at ~2.0 Ga. The collision initiated a crustal-scale east-dipping thrust (here termed the Main Limpopo Thrust or MLT), much like the Main Central Thrust in the Himalaya, along the eastern margin of the KZC. The MLT carried a shelf sequence and its 2.6 Ga basement over the KZC; the internal thickening of the thrust sheet led to widespread anatexis, similar to that observed in the Himalaya. The MLT was folded into an east-trending synclinorium after the termination of the KZC-MC collision. Thus, the strike-slip shear zones bounding the CZ were tilted MLT and the opposite shear senses in the same "strike-slip" zones were created by local eastward back-thrusting during regional westward motion on the MLT. Following the folding, rifting and continental break-up occurred along the KZC-MC suture zone, causing the "missing craton" carrying the > 2.0 Ga magmatic arc to have drifted away. The same continental breakup event may have also caused exhumation of the Limpopo belt, causing the folded thrust sheet to tilt to the south. Thus, the current erosion surfaces define the keel of the Limpopo collision zone. Our model raised several new questions that will be addressed in the talk: (1) where is the missing craton? (2) what tectonic processes caused LB folding? (3) how did the 2.0 Ga and 2.6 Ga tectono-metamorphic events impact the formation of the LB? Answering these questions has important implications for reconstructing Archean continents: the building blocks of all supercontinents in Earth's history.