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East African and Kuunga Orogenies in Tanzania – South Kenya

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Tanzania and southern Kenya hold a key position for reconstructing Gondwana consolidation because here different orogen belts with different tectonic styles interfere. The older, ca. 650-620 Ma East African Orogeny resulted from the amalgamation of arc terranes in the northern Arabian–Nubian Shield (ANS) and continental collision between East African pieces and parts of the Azania terrane in the south (Collins and Pisarevsky, 2005). The change form arc suturing to continental collision settings is found in southern Kenya where southernmost arcs of the ANS conjoin with thickened continental margin suites of the Eastern Granulite Belt. The younger ca. 570-530 Ma Kuunga orogeny heads from the Damara – Zambesi – Irumide Belts (De Waele et al., 2006) over Tanzania - Mozambique to southern India and clashes with the East African orogen in southern-central Tanzania. Two transitional orogen settings may be defined, (1) that between island arcs and inverted passive continental margin within the East African Orogen and, (2) that between N-S trending East African and W-E trending Kuungan orogenies.

The Neoproterozoic island arc suites of SE-Kenya are exposed as a narrow stripe between western Azania and the Eastern Granulite belt. This suture is a steep, NNW stretched belt that aligns roughly with the prominent southern ANS shear zones that converge at the southern tip of the ANS (Athi and Aswa shear zones). Oblique convergence resulted in low-vorticity sinstral shear during early phases of deformation. Syn-magmatic and syn-tectonic textures are compatible with deformation at granulite metamorphic conditions and rocks exhumed quickly during ongoing transcurrent motion. The belt is typified as wrench tectonic belt with horizontal northwards flow of rocks within deeper portions of an island arc.

The adjacent Eastern Granulite Nappe experienced westward directed, subhorizontal, low-vorticity, high temperature flow at partly extreme metamorphic conditions (900°C, 1.2 to 1.4 GPa) (Fritz et al., 2009). Majority of data suggest an anticlockwise P-T loop and prolonged, slow cooling at deep crustal levels without significant exhumation. Isobaric cooling is explained by horizontal flow with rates faster than thermal equilibration of the lower crust. Those settings are found in domains of previously thinned lithosphere such as extended passive margins. Such rheolgically weak plate boundaries do not produce self-sustaining one-sided subduction but large areas of magmatic underplating that enable melt enhanced lateral flow of the lower crust.

Western Granulites deformed by high-vorticity westwards thrusting at c. 550 Ma (Kuunga orogeny). Rocks exhibit clockwise P-T paths and experienced significant exhumation during isothermal decompression. Overprint between Kuungan structures and 620 Ma East African fabrics resulted in complex interference pattern within the Eastern Granulites. The three orogen portions that converge in Tanzania / Southern Kenya have different orogen styles. The southern ANS formed by transcurrent deformation of an island arc root; the Eastern Granulites by lower crustal channelized flow of a hot inverted passive margin; the Western Granulites by lower to mid crustal stacking of old and cold crustal fragments.

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