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Textonic styles of Neoproterozoic – early Phanerozoic East African orogens

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The East African Orogen (EAO) stretches from the Sinai Peninsula in the North to Antarctica in the South and is, in East Africa, classically subdivided into the northern Arabian Nubian Shield (ANS) and the southern Mozambique Belt (MB). Based on crustal age domains and structural styles, however, four distinct orogen portions can be distinguished. (1) The northern ANS between Sinai down to the Ariab-Nakasib-Thurwah-Bir Umq suture exhibits major strike slip tectonics related to northward extrusion tectonics. (2) Between this suture and the southernmost occurrences of ophiolite decorated shear zones in northern Kenya, major West-East shortening prevails. Both ANS domains comprise mainly juvenile Neoproterozoic crust with large volumes of island arc magmatics and remnants of ophiolites. This contrasts the MB that contains older reworked continental fragments. (3) Neoproterozoic to early Paleozoic orogeneses in the northern MB between southern Kenya and southern Tanzania incorporated Archean cratonic fragments and Paleoproterozoic crust (1.8-2 Ga Usagaran). (4) In the southern Mozambique of Mozambique Belt and the Irumide Belt of Malawi and Zambia major components of Stenian / Tonian crustal fragments (ca. 1 Ga) were incorporated within the Marrupa and Unango Complexes of Mozambique (Bingen et al, 2009) and the Irumide Belt of Zambia (De Waele et al, 2006). In addition the ages of peak metamorphism differ with predominantly Neoproterozoic ages in the northern MB and Edicaran to lower Cambrian ages in southern MB. This might reflect convergence along different orogenic belts, i.e. the 650–630 Ma Azania Orogeny and the Neoproterozoic/Cambrian Kuunga Orogeny (Collins and Pisarevsky, 2005).
Two end members of contrasting orogen styles define the northern ANS and the northern MB. Transcurrent motion with orogen parallel strike-slip and northward extrusion tectonics dominates the ANS whereas orthogonal collision with west- to northward thrusting characterizes the MB (Fritz et al. 2005). Both, tectonic style and degree of crustal recycling determine the general style of the orogen when displayed in an orogen temperature versus orogen magnitude diagram (TM). Since orogen magnitude translates into operational availability of gravitational forces and orogen temperature into bulk viscosity the TM diagram includes information about dominant mechanisms driving the orogen. The ANS orogen is considered a small and cold orogen with minor crustal thickening driven by plate boundary forces. For the MB between northern Kenya and southern Tanzania / Mozambique, a large and hot collisional orogen is suggested. Granulites with a characteristic branch of isobaric cooling typify a hot and slow cooling lower crust. The orogen style is characterized by low viscosity flow in the lower crust determined by gravitational forces (internal forces).

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