On the Pan-african Transition of the Arabian–nubian Shield from Compression to Extension: Evolution of the Neoproterozoic Pan-african Belt in Egypt

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The Egyptian basement complex of the Eastern Desert and Sinai consist of Neoproterozoic juvenile crust developed in the northeastern part of the Arabian–Nubian Shield The most prominent feature of this crust is the presence of dismembered ophiolites, metamorphosed volcano-sedimentary successions and calc-alkaline I-type intrusive complexes. Current idea on the tectonic evolution of these orogenic terrains points to an essential role of convergent processes, through the formation of intra-oceanic island arc system, subsequent ocean closure, amalgamation of the arc complexes and accretion to continental crust, followed by crustal thickening.

Subduction at continental margins led to accretion of island-arcs and ophiolite remnants in the Mozambique Ocean and the amalgamation of accreted terrains onto east Gondwana continental block. Terrane accretion in the ANS took place along north to east trending arc–arc sutures developed between 700 and 800 Ma. The arc accretion marked the closure of Mozambique Ocean, and was responsible for fast continental crustal growth and lithosphere thickening of the juvenile ANS crust.

The juvenile accreted ANS crust collided with pre-Neoproterozoi continental blocks of west Gondwana at 750–650 Ma along arc–continental sutures. Collision ceased at ca. 615–600 Ma and the extensional collapse of the thickened lithosphere took place at ca. 600–560 Ma. Extensional or gravitational collapse led to extension and thinning of the Arabian–Nubian Shield crust, which continued until approximately 530Ma. Extensional collapse follows continental collision and is controlled mainly by lithospheric delamination and slab breakoff (passive rifting) and not by rifting controlled by the ascent of the asthenospheric mantle material (active rifting).

Post-collisional mainly high-K calc-alkaline suite of 620–580 Ma (the Dokhan volcanics and latest phases of the Egyptian younger granites) that overlaps the alkaline suite of ~600–470 Ma (post-collisional and anorogenic A-type granites) for ~20 m.y. The temporal transition from medium-K through high-K calc-alkaline to alkaline magmatism is correlated with the change in tectonic regime