

Paper Number: 4621

**Metamorphic and structural evidence in the Arabian–Nubian Shield for mid-crustal sub-horizontal channel flow during Pan-African exhumation**

Abu-Alam, T.A.<sup>1</sup> and Grosch, E.G.<sup>2</sup>

<sup>1</sup>Norwegian Polar Institute, Tromsø - Norway

<sup>2</sup>Geology Department, Rhodes University, Grahamstown, South Africa

---

The Arabian–Nubian Shield consists of an island arc succession that was tectonically accreted as juvenile crust during closure of the Mozambique Ocean and suturing of East and West Gondwana. High-grade upper amphibolite facies metamorphic rocks were exhumed from underneath the arc succession forming tectonic windows. A geological profile across a set of these tectonic windows in NW Saudi Arabia, Sinai, Eastern Desert of Egypt, and in the Butana area in Sudan was studied. The metamorphic rocks are characterized by clockwise  $P$ – $T$  paths with peak metamorphic conditions of about  $P = 6$ – $8$  kbar and  $T = 650$ – $750$  °C. The internal parts of the tectonic windows have horizontal foliation accompanied by horizontal lineation. The horizontal foliation is overprinted by a younger foliation in the outer parts. The outer parts of the windows are bounded by vertical to sub-vertical foliation planes with lineations indicate strike-slip movements. In the Eastern Desert of Egypt, the strike-slip foliation planes bound the tectonic windows from the eastern and western sides while the northern and the southern boundaries were interpreted as low-angle detachments. The presence of extensional structures in the Eastern Desert of Egypt indicates that these metamorphic rocks were exhumed as metamorphic core complexes that formed in an extensional tectonic stress regime. While in Sinai, the Butana area and in NW Saudi Arabia, the absence of extensional structures and the presence of compressional tectonic elements indicate that these metamorphic rocks were exhumed in a transpressional regime. Both models (i.e. extension and transpression models) can be used to explain the exhumation stage after the peak metamorphism, but they fail to explain the early tectonic history, which is recorded in the core of the windows. A sub-horizontal channel flow model is proposed here as a mechanism to exhume the metamorphic rocks in both extension and transpression regimes. We suggest that the rocks flowed horizontally at mid-crustal levels to the NW of the Arabian–Nubian Shield. This flow was responsible for the formation of the horizontal foliation. The front of the channel flows was then exhumed to the Earth surface in a transpression regime, whereas the mid-crustal flow will produce an extensional tectonic regime in the upper crust. This extensional setting produces low-angle detachments that assisted the mid-crustal rocks to be exhumed as core complexes.

