Geophysical Research Abstracts
Vol. 15, EGU2013-9778, 2013
EGU General Assembly 2013

Sub-horizontal channel flow: an exhumation mechanism during the Gondwana collision

Tamer Abu-Alam (1,2) and kurt Stüwe (1)

(1) Graz Univ., Austria (tamer.abu-alam@uni-graz.at), (2) Tanta University, Egypt, Faculty of Science, Geology Department, Tanta, Egypt

The Arabian-Nubian Shield is made up of juvenile crust which was formed due to arc-arc accretion during the East- and West-Gondwana collision (Pan-African event) and the closing of the Mozambique Ocean. Thus the shield is composed of ophiolitic and volcanic material with oceanic affinity. However rocks with continental affinity can be found as high grade metamorphic complexes that were exposed from underneath the arc-related rocks during the late stages of the Pan-African event. Two tectonic models explain the exhumation mechanism of these metamorphic complexes. The first model is exhumation as core complexes in extension setting. This model appears to pertain to the metamorphic complexes of the Eastern Desert of Egypt. The second model is exhumation in oblique transpressional regime as it was found – for example – for the Feiran-Solaf complex of Sinai Peninsula. These models are correct with regard to the structural elements in the outer zones of the metamorphic complexes, which formed during the final exhumation mechanism during the later stages of the deformation history (e.g. D_3 of the Feiran complex). However the models cannot explain the sub-horizontal lineations that formed during the early deformation phases and are still recorded in the core of the metamorphic complexes (e.g. D_1 of the Feiran-Solaf complex). Here we propose sub-horizontal channel flow as a mechanism to exhume the metamorphic complexes and a mechanism that can account for both types of structural elements as part of one exhumation history. We suggest that the rocks flowed horizontally at mid-crustal levels to the NW of the Arabian-Nubian Shield. The front of the channel flows was then exhumed to the Earth surface in a transpression regime. This middle crustal flow will produce extensional tectonic regime in the upper crust (i.e. σ_3 is horizontal and oriented in the NW-SE direction). This extensional setting produces low-angle detachments which assisted the middle crustal rocks to be exhumed as tectonic windows of the Eastern Desert of Egypt. The complexes then can be exhumed completely to the Earth surface in either extensional or oblique transpressional regime depend on the orientation of the principle stresses. Examples from Saudi Arabia will be presented during the EGU2013 to demonstrate this new tectonic model.