Geophysical Research Abstracts
Vol. 18, EGU2016-12523, 2016
EGU General Assembly 2016

Modeling along-axis variations in fault architecture in the Main Ethiopian Rift: implications for Nubia-Somalia kinematics

Asfaw Erbello (1), Giacomo Corti (2), Federico Sani (3), and Tesfaye Kidane (4)

(1) Adama Science and Technology University, School of Applied Natural Sciences, Department of Applied Geology, Adama (Ethiopia), (2) Consiglio Nazionale delle Ricerche, Istituto di Geoscienze e Georisorse, Florence (Italy), (3) Università degli Studi di Firenze, Dipartimento di Scienze della Terra, Florence (Italy), (4) Department of Earth Sciences, Faculty of Science, Addis Ababa University,Addis Ababa (Ethiopia)

The Main Ethiopian Rift (MER), at the northern termination of the East African Rift, is an ideal locale where to get insights into the long-term motion between Nubia and Somalia. The rift is indeed one of the few places along the plate boundary where the deformation is narrow: its evolution is thus strictly related to the kinematics of the two major plates, whereas south of the Turkana depression a two-plate model for the EARS is too simplistic as extension occurs both along the Western and Eastern branches and different microplates are present between the two major plates. Despite its importance, the kinematics responsible for development and evolution of the MER is still a matter of debate: indeed, whereas the Quaternary-present kinematics of rifting is rather well constrained, the plate kinematics driving the initial, Mio-Pliocene stages of extension is still not clear, and different hypothesis have been put forward, including: polyphase rifting, with a change in direction of extension from NW-SE extension to E-W extension; constant Miocene-recent NW-SE extension; constant Miocene-recent NE-SW extension; constant, post-11 Ma extension consistent with the GPS-derived kinematics (i.e. roughly E-W to ESE-WNW).
To shed additional light on this controversy and to test these different hypothesis, in this contribution we use new crustal-scale analogue models to analyze the along-strike variations in fault architecture in the MER and their relations with the rift trend, plate motion and the resulting Miocene-recent kinematics of rifting. The extension direction is indeed one of the most important parameters controlling the architecture of continental rifts and the relative abundance and orientation of different fault sets that develop during oblique rifting is typically a function of the angle between the extension direction and the orthogonal to the rift trend (i.e. the obliquity angle). Since the trend of the MER varies along strike, and consequently it is characterized by a variable obliquity angle (i.e. kinematics) along its length, the analysis of fault architecture and its variations are able to provide significant insights into the plate kinematics responsible for rift development and evolution. Our models thus reproduce the overall geometry of the ~600km-long MER with its along-strike variation in orientation to test the above-described hypothesis of rift evolution. Analysis of model results in terms of statistics of fault length and orientation, and deformation architecture and its comparison with the MER suggests that rift has likely developed under a constant, post-11 Ma extension oriented roughly E-W (N97.5°E), consistent with recent plate kinematics models.