Geophysical Research Abstracts
Vol. 21, EGU2019-2693, 2019
EGU General Assembly 2019

Oblique rifting in the northern Red Sea and its tectonic products: the geodynamics of Tiran Straits

Yossi Mart (1), John Hall (2), and Dina Vachtman (3)

(1) Haifa University, Maritime Studies, Haifa, Israel (yossimart@gmail.com), (2) Geological Survey of Israel, Jerusalem, Israel (jkh1@012.net.il), (3) Equinor ASA, Fornebu, Norway (dvac@statoil.com)

The Straits of Tiran, which separate the northern Red Sea from the Gulf of Elat (‘Aqaba), and Sinai Peninsula from NW Arabia, are set on a precipitous submarine horst that is located between Hume Deep (1400 m) in northernmost Red Sea and Tiran Deep (1400 m), in the southernmost Gulf of Elat. The horst trends NNE-SSW and is constrained by two sets of large normal faults. Structural settings that resemble the two precipitous deeps separated by a ridge were encountered repeatedly in the domain of the East African Rifts and were attributed to oblique rifting. Series of structural experiments of oblique extension emphasized that such systems of tectonic stresses produce unique series of structures that are not intermediate versions between lateral and extensional displacements. It seems that an element of rotation is introduced into the displacement due to the obliquity, which could be the cause of the structural uniqueness. Sand box and centrifuge experiments show that 30o oblique extension is likely to produce segmented rift setting, where the component of lateral offset disrupts the continuity of the rifting and generates a series of offset grabens. Where the lateral offset between these grabens is minor, they tend to merge as the deformation increases, but larger offsets would endure to become transform faults. The experiments show further that initial offset of the grabens is such setting does not change with the continuation of the deformation, and commonly tends to produce an elevated transfer zone between the widening grabens along the regional rift zone.
Consequently, evidence was encountered that the rifting that encompasses the Gulf of Elat and its elevated flanks was extended obliquely, and that the horst that was encountered in the Straits of Tiran seems to be a mature transfer zone. Similar structural transfer zones were repeatedly encountered to separate between axial grabens along regional rifts in East Africa and also along the Mid-Ocean Ridge. The Tiran transfer zone could indicate that the geodynamic regime of oblique extension, which prevails in the northern Red Sea, extends into Elat Rift. Tiran horst is structurally associated with the arcuate system of grabens and elongated salt diapirs that were encountered in the bathyal northern Red Sea, which swings from the Red Sea NW-SE orientation to the N-S trend of Elat Rift. The age of the initiation of the rifting and the contemporaneous ascent of its margin was dated to the Pliocene, and extensive series of coralline terraces and by non-branching fluvial system on Tiran Island suggested an even younger age.