The Buried Grand Canyon in Egypt: Structural controls on the Neogene River Nile

Ali Abdelkhalek, Jonas Kley, Mohamed Hammed, and Ahmed Saied Ali
Göttingen University, Geoscience Centre, Structural Geology and Geodynamics, Göttingen, Germany (aabdell@gwdg.de)

The origin and intricate history of the River Nile are still widely disputed. Some studies have claimed that the present course of the Nile has formed at ~7-5 Ma, while others have suggested a much longer evolution. We proposed earlier that the southern and central segments of the River Nile in Egypt have originally evolved along a NW trending short-lived rift that was formed by NE-SW extension at ~25-23 Ma, and abandoned at an early stage. Here we focus on the development of the northern segment of the river, which we interpret as having both a relatively young age (~7-6 Ma) and different tectonic evolution. Gravity models and 3D seismic and well data show the presence of a deeply buried canyon west of the northern modern River Nile, 120 km southwest of Cairo, and approximately parallel to its present-day valley with a predominant NNE-NE course. The U-shaped canyon is up to 13 km wide and attains a maximum depth of around 1,900 meters, about as deep as the Grand Canyon of the Colorado River in Arizona, USA. The canyon was cut into a rising plateau along deep-seated NNE to NE-striking faults that formed at ~90-80 Ma as secondary shears to the main structures of the WNW oriented Cretaceous Beni-Suef rift and possibly have been reactivated at ~14 Ma with the origin of the Gulf of Aqaba-Dead Sea NNE sinistral transform plate boundary. The deeply incised canyon formed as a result of severe erosion due to significant sea level drop and desiccation of the Mediterranean in late Miocene time (Messinian Crisis ~7-6 Ma), which was accompanied by continued progressive uplift of the north-eastern Egyptian terrain[KJ1]. [2] The ancestral river excavated and widened a vast braided channel[3] that cut deeply into Turonian-Campanian sediments in the Beni-Suef basin. The canyon attained its maximum depth by ~5 Ma, and subsequently it was filled by six successive clastic-dominated units of different fluvial facies.[4]