Evolution of the Nile River Since 70 Ma: Implications on the Source-to-Sink Systems

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Abstract

The Nile River, the longest river in the world, crosses today a set of two former endorheic systems (with the Ugandese and Sudanese rifts as local base levels) to end to the exorheic system of the Egyptian Margin along its ~7000 km courses. The question of the source of sediment of the Nile River is of primary importance for the knowledge of the reservoir on both the Levant and Herodotus Basins. The main interests of this system are (1) very long (several thousands of kilometres) wavelength undulations between uplifting and subsiding domains that might be related to mantle dynamics, and (2) the timing and cause of evolution from endorheic to exorheic systems and their consequences on the source-to-sink (S2S) systems. We here proposed a new model for the Nile catchment evolution since the uppermost Cretaceous time based on integrated geomorphological and stratigraphical studies of both relief and basins (Albert and Sudanese Rifts, Egyptian Margin). (1) After several marine flooding events of Campanian to Maastrichtian age, a significant deformation occurred around the Cretaceous-Paleogene boundary (66 Ma) with the uplift of the Darfur-Ennedi-Uweinat domains (modern western limit of the Nile catchment) and the formation of a main large pediplain inherited from the last continental depositions in Sudan. (2) The former pediplain was flooded up to the northern Sudan during late Paleocene time (58-57 Ma) reaching a subtle high bounding northward the endorheic Sudanese Basins. Consequently, during lower and middle Eocene carbonate platforms were widely deposited in Egypt to the south until the divide with the shallow Hudi Lake extending in northeastern Sudan. (3) The first evidence of a fluvial system (“Pre-Eonile” according to Said, 1981) started during late Eocene (~37 Ma) with large channel incisions on top of the carbonate platform. This was coeval with the second uplift of the Uweinat Dome and the emplacement of alkaline magmatic rocks (48-32 Ma). (4) During middle to late Miocene (~10 Ma), a major uplift at north-eastern Africa scale resulted in major incisions of the Eocene limestone where the modern Nile is located today. (5) The Nile captured first the Sudanese endorheic system during the Early Pliocene (~4 Ma). (6) Finally, the Nile captured the Ugandese endorheic system through Lake Albert and Victoria in the Middle-Late Pleistocene (less than 1 Ma). The relative contribution of four main sources (Proterozoic basement, Nubian Sandstones, Ethiopian volcanics, Uweinat magmatism) during the growth of the Nile catchment will be discussed.