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Early Cenozoic landscapes of the central/northern Kenya Rift: Precursors of the Hominin-bearing Turkana Basin

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The central (CKR) and northern (NKR) Kenya Rifts are the most important areas in the Cenozoic East African Rift System for studying a long-lived portion of a rift system. These two segments of the Kenya Rift offer several km-thick piles of sediments and volcanics that illustrate 100 millions years history of rift geodynamics and climate changes. Today, the NKR corresponds to the Lake Turkana Basin, one of the major sites in Africa for the knowledge of the evolution of our early ancestors. The CKR shows a major morphological link with the Turkana Basin as it forms its southern watershed. The complex history of CKR/NKR has been deciphered through numerous academic research programs. Hydrocarbon exploration provided essential subsurface data. The NKR comprises three strings of N-S oriented half-grabens, the oldest known basins being late Paleogene and the most recent being the modern Lake Turkana. To the south, the CKR shows a suite of two N-S oriented half-grabens, the Baringo Basin (late Paleogene-Present) and the Kerio Basin (late Paleogene-upper Miocene).

From the late Paleogene, the NKR/CKR were affected by rift tectonics and volcanic episodes that deeply modified a gentle basement topography inherited from the last phases of Cretaceous rifting. From 100 to 37 Ma, this flat topography was occupied north of L. Turkana by a wide fluvial system imaged by the 600-m thick Lapur Sandstone Formation. To the west, four N-S oriented half-grabens (Lotikipi, Gatome, Lokichar, North Kerio) began to develop. In the CKR, the Kerio-Baringo basins initiated during the same rifting event. These basins were filled during their subsidence

phases by alluvial fan/fluvio-deltaic sediments issued from erosion of low-topography faulted escarpments bounding the basins. Lacustrine sediments alternated with clastic sedimentation, indicating large, deep organic-rich freshwater lakes. Four large lakes 100-km long characterized the NKR from late Paleogene to early-middle Neogene. Tropical climate conditions with high rainfall and tropical forest are revealed by palynological data from the Lokichar Basin. These landscapes were inhabited by abundant reptile and mammal faunas. In the CKR, fault escarpments bounding the Kerio-Baringo half-grabens grew and propagated toward the north within the depressed areas at the south end of NKR. Northward-flowing fluvial systems developed within these basins and contributed to the filling of the Lokichar and N-Kerio lakes.

During this phase of extensive tectonics, effusive volcanism occurred in the NKR/CKR. From 37 to 26 Ma, 2,500 m of lavas covered the northwest end of the NKR, creating new high-topography landscape. Erosion of these topographic highs contributed to southward clastic inputs in the Lokichar and N-Kerio basins. From 23 to 16 Ma, a major volcanic episode induced deep morphological changes in the CKR with the filling of the Kerio-Baringo basins. From middle-late Miocene, new major rifting events brought the CKR to its almost final morphology. In the NKR, rifting created the N-Lokichar and Turkana Basins, precursors of the modern Lake Turkana. The high volcanic topography at the northwest end of the NKR was strongly faulted, forming the western margin (Lapur border fault) of the Turkana Basin. At about 7 Ma, a major climatic change at the scale of East Africa, a result of growing topographies all along the EARS, induced major changes in vegetation and faunas. Water and clastic inputs in Lake Turkana from the southern (Kerio Basin) and western (Lapur escarpment) watersheds contributed to development of wide delta/lake shoreline landscapes that provided hospitable environments for Hominin populations.