EGU2020-9323, updated on 17 Jan 2022
https://doi.org/10.5194/egusphere-egu2020-9323
EGU General Assembly 2020

Hydrological basin connectivity in a low-latitude rift: the impact of the Holocene African Humid Period (AHP) on fluvial activity and species dispersal in the Kenya Rift, East African Rift System (EARS)

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As a result of sustained tectonic and magmatic processes throughout the latter half of the Cenozoic, the eastern branch of the EARS exhibits an extensional tectonic system with pronounced relief contrasts, constituting both corridors and barriers for species dispersal. The tectono-magmatic history has generated a region of highly variable topography that results in widely varying amounts of rainfall and vegetation cover. Today, the generally dry eastern branch of the EARS hosts numerous sub-basins and adjacent local high-relief areas that are hydrologically isolated, with unique microclimates, vegetation types, faunas and superposed surface processes. However, during episodes of climate change with a trend toward more humid conditions, many of these basins hosted freshwater lakes that were hydrologically connected. These areas have repeatedly exhibited freshwater conditions and likely served as gateways and migration corridors mainly for aquatic organisms, in particular fish, facilitating population expansion, dispersal and gene flow.

Here, we analyze the manifold manifestations of the AHP in Kenya and adjacent sectors of the EARS to establish the timing and spatial extent of a paleo-drainage system documented by lake shorelines, deltas, overflow channels and sediments. These vestiges of fluvial connectivity in the rift have emerged as analogs for recurrent Pleistocene episodes with high lake levels and inter-basin linkage that repeatedly connected equatorial basins with regions to the north and south, respectively. For example, fossil evidence for the Pleistocene occurrence of the Nile crocodile (*Crocodylus niloticus*) as far south as equatorial Lake Bogoria (Kenya) and its present occurrence in the now closed Lake Baringo basin indicate fluvial connectivity over several degrees of latitude during more humid episodes in the past. Similarly, the occurrence of more than a dozen of the same fish species in the presently unconnected Lakes Albert and Turkana is likely due to a mutual connection during the AHP when Lake Turkana was overflowing into the White Nile.

Taken together, the divergent fossil and modern faunal evidence and geomorphic and sedimentological evidence of contrasting hydrological conditions between the wet AHP and the present, suggest that the conditions during the AHP provides a template of fluvial connectivity and potential dispersal patterns for earlier humid phases during the Plio-Pleistocene.