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High-resolution hydroclimate of Southeastern Africa: A 1.3 million record of lake level variability from Lake Malawi (Nysasa) Scientific Drill Core

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Variations in the transport of moisture in the tropical latitudes play a critical role in the global energy budget, and on geologic timescales, such changes have markedly influenced continental landscapes, migratory pathways, and biological evolution. We present a 1.3 million year (Myr) record of continental hydroclimate and lake-level variability derived from drill core data from Lake Malawi (Nyasa), East Africa (9°-15° S). Over the studied interval, we observe dramatic shifts in effective moisture, resulting in large-scale changes in one of the world's largest lakes and most diverse freshwater ecosystems. Drill core proxy records indicate 24 lake level drops of more than 200 m during the Late Quaternary, including fifteen lowstands when water levels were more than 400 m lower than modern. A major shift is observed at the Mid-Pleistocene Transition (MPT), consistent with far-field climate forcing, which separates vastly different hydroclimate regimes prior to and after ~800 thousand years ago. Before 800 ka, lake levels were lower, indicating a climate drier than today, and water levels changed frequently. Following the MPT high-amplitude lake level variations dominate the record. From 800-100 ka, a deep, often over-filled lake occupied the basin, indicating a wetter climate, but these highstands were interrupted by prolonged intervals of extreme drought. A persistent drought interval in the middle late-Pleistocene reduced lake level by more than 550 m in Lake Malawi (Nyasa), and geophysical data from Lake Tanganyika indicate similar lowstands at this time. Periods of high lake level are observed during times of high eccentricity. The extreme hydroclimate variability exerted a profound influence on the endemic species in the rift valley, and on cichlid fish species in particular; the geographically extensive habitat reconfiguration provided novel ecological opportunities, enabling new populations to differentiate rapidly to distinct species.

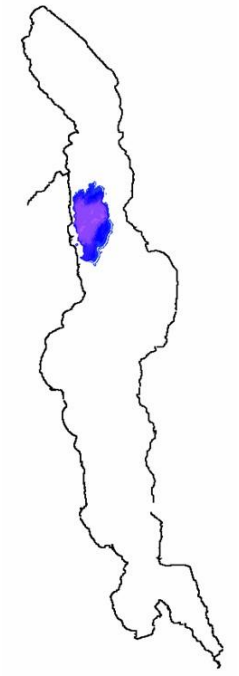

Figure 1: Extent of Lake Malawi (Nyasa) in the middle late-Pleistocene.

References:

[1] Lyons RP et al. 2015 Proceedings of the National Academy of Sciences 112: 15568-15573

[2] Scholz CA et al, 2007 Proceedings of the National Academy of Sciences 104:16416–16421.