



A ~1.3Ma paleoecological record from scientific drilling at Lake Malawi, East Africa

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Long records of Quaternary ecological and climatic change are critical to understanding the range of potential responses of ecosystems to environmental forcing. Here we present an integrated lake and watershed paleoecological analysis from drill core records obtained by the Lake Malawi Drilling Project, documenting extraordinary fluctuations in climate, hydrology and ecosystem response for the southern tropics of Africa. High resolution lacustrine and terrestrial paleoecology and sedimentology data sets from these Early Pleistocene-Holocene drill cores provide the most complete record of this duration currently available from Africa. Time series analyses of these records demonstrate strong orbital forcing of regional hydroclimate that drives high-amplitude changes in Malawi ecosystems. Prior to ~600ka we also observe a secondary overprint of watershed processes involving river capture or diversion that may have a tectonic origin. We observe shifts between more arid conditions (shallow alkaline and well mixed lake, with discontinuous desert vegetation) and more humid environments (deep, stratified, freshwater lake with dense forest). These broadly synchronous changes in lake paleoecology, lake sedimentology, and watershed vegetation demonstrate the major role of climate in regulating this system. Transitions between these lake/watershed state extremes is often very abrupt, suggesting that the combined lake/watershed repeatedly passed through hydroclimate thresholds, with important implications for the evolution of the lake's endemic biodiversity and ecosystem. The tempo of lake/watershed state fluctuations changes at the Mid-Pleistocene Transition, altering from one of higher frequency/lower amplitude variability prior to 900ka to lower frequency/higher amplitude variability after that time.