



Early late Pleistocene megadroughts in Africa: evidence of extreme aridity from Lake Malawi

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Recent drill core results from the Lake Malawi drilling project, coupled with records from elsewhere, demonstrate the occurrence of extraordinarily severe and protracted episodes of drought across Africa during the early part of the late Pleistocene. The severity of drought dramatically exceeded records of arid phases from the Last Glacial Maximum in parts of tropical/subtropical Africa.

Response to severe aridity at Lake Malawi in the early Late Pleistocene is detailed by multiple lines of evidence. Seismic and sedimentological records indicate that during the height of the megadrought period, the lake surface was as much as 600 meters below modern elevations. Extreme differences in the lake level prior to ~70,000 years ago are evident in paleo-lake proxies that reflect the lake environment and those of the surrounding region. Fossil diatom assemblages are strikingly different from the modern flora; species with vastly different preferences in lake depth, mixing frequency, and water chemistry than what currently exists in the dilute waters of the deep central basin are abundant. Major shifts in fossil diatom flora are corroborated by simultaneous, equally-large shifts in the fossil ostracode faunal assemblages; intermediate

water depth intervals, marked by stressed, juvenile-dominated assemblages alternate with extremely low lake stands characterized by coated valves of alkalophilic species. The most arid phases were also marked by generally cooler temperatures in the surrounding watersheds. Evidence of this is provided by charcoal and pollen recovered from the core material; within the Lake Malawi watershed Zambezian-type woodland was replaced by semi-desert, where vegetation cover and fuel load was insufficient to maintain fire.

These intervals of pronounced tropical African aridity are broadly evident in other parts of tropical Africa; sediment records from Lakes Tanganyika (East Africa) and Bosumtwi (West Africa) also show a coinciding dramatic rise in lake level after ~70,000 years ago. The potential impacts of this megadrought period on early human settlement and migration are substantial; archaeological data shows that occupation sites in both northern and southern Africa are common during the this period, but are rare and restricted to high elevations in tropical Africa. However, they become much more common throughout tropical Africa after the termination of the maximum megadrought period, ~90,000 years ago.