

Diatom assemblages from Chew Bahir, Ethiopia: High-resolution snapshots of Late Pleistocene and Holocene climate variability in a ~600 ka sequence

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Abstract

Chew Bahir (4°40'N, 36°50'E; 600 m asl) is a playa basin in southern Ethiopia located between the Main Ethiopian and Kenyan rifts. It is classified as an 'amplifier' lake, with a seasonally inundated basin floor covering an area ~ 30 km E-W and 70 km N-S. Palaeo-shorelines indicate profound hydrological changes occurred during the Late Quaternary, hypothesised to be linked to changes in the location of the principal wind systems and air masses (ie. Intertropical Convergence Zone and the Congo Air Boundary) . The sedimentary archive from this basin provides an opportunity to develop a continuous record of terrestrial tropical climatic variability through multiple glacial cycles and to explore the links between climate and human evolution and dispersal in eastern Africa.

In December 2014, parallel sedimentary cores were drilled as part of the Hominin Sites and Paleolakes Drilling Project through the International Continental Drilling Program, with a composite splice sequence ~ 290 m in depth developed. A chronological framework based on a combination of optically stimulated luminescence, argon-argon and radiocarbon dating, further supported by tephrochronology, indicates the palaeoenvironmental record extends back more than 600 kyr. The diatom record from Chew Bahir would be expected to highlight changes in salinity and water chemistry in

response to hydroclimatic fluctuations and provide an important component of the multi-proxy record. Initial assessment of core material revealed a lack of biological remains and that diatoms were not preserved through most of the sequence, except for three short (~1 - 3 m) sections of core, centred around ~2 m, ~70 m and ~85 m composite depth. The Chew Bahir palaeoenvironmental record is therefore reliant on geochemical and physical proxies throughout much of the sequence. The three short sections of well-preserved diatoms do however provide valuable supporting evidence for palaeoenvironmental interpretations of more continuous proxy data such as the oxygen isotope record from carbonates. Furthermore, analysis of diatom assemblages from contiguous 2 cm samples through well-preserved sections provides high-resolution snapshots of climatic variability during the three intervals.

In the uppermost, Holocene section, there is a clear shift from a freshwater, planktonic assemblage dominated by *Stephanodiscus* and *Aulacoseira* species to more saline lake conditions represented by *Nitzschia fonticola* and subsequently *Thalassiosira* cf. *faurii*. This increase in salinity charts the end of the African Humid Period and progressive lake level lowering. The earlier phases of good diatom preservation in the Late Pleistocene reveal fluctuating lake levels with more diverse assemblages including some freshwater benthic species as well as some intervals rich in planktonic taxa of moderate salinity such as *Cylotella meneghiniana*. The diatom data from Chew Bahir, where present, indicate that the basin responded rapidly to changing moisture availability with distinct changes in salinity of lake waters.