Centennial to millennial changes in maar-lake deposition during the last 45,000 years in tropical Southern Africa (Lake Masoko, Tanzania)

Authors: Yannick Garcina, David William sona, Maurice Taieb, Annie Vincensa, Pierre-Etienne Mathéa, Amos Majuleb

Abstract

The Masoko maar (southern Tanzania) provides one of the most continuous Late Quaternary lacustrine sedimentary records from Africa. A detailed chronostratigraphic framework coupled with sedimentological and magnetic measurements allows us to construct a 30-year resolution continuous sedimentary sequence covering the last 45,000 years and to address local depositional environment and climate variability in the tropical Southern Africa. Based on present-day observations and measurements, our results indicate that the low-field magnetic susceptibility of the sediment is highly controlled by climate-driven processes (wind-stress and/or lake-level amplitude changes) acting on the titanomagnetite-rich shoreline reservoir. The tephra- and turbidite-free magnetic susceptibility record is strongly modulated by a persistent multi-decadal to centennial variability (~80 to 200 years), probably linked to the Gleissberg and Suess cycles of solar activity. At lower frequency, the variability of deposition is controlled by the precessional cycle and its harmonics, suggesting a dominant multi-millennial forcing of low-latitude insolation on climatic changes in tropical Southern Africa. Inferred wetter conditions during the Last Glacial Maximum and the Younger Dryas at Masoko (9°S) indicate southward shifts of the Intertropical Convergence Zone associated with the North Atlantic glacial dynamics, and/or contrasted hydrological changes in the Rungwe highlands compared to the neighbouring areas. Finally, former regional transfer function between diatom assemblages and water chemistry suggested drier conditions during the Last Glacial Maximum at Lake Masoko [Barker, P., Williamson, D., Gasse, F., Gibert, E., 2003. Climatic and volcanic forcing revealed in a 50,000-year diatom record from Lake Massoko, Tanzania. Quaternary Research 60, 368–376]. In this context, further climate-proxy data (such as pollen) and hydrobiological studies in small, deep lakes are needed to support our alternative interpretation of the Masoko record.

Key words: Lake Masoko, Rungwe, Southern Africa, Late Quaternary, Intertropical Convergence Zone, Precession, Solar cycles,Magnetic susceptibility