MULTI-PROXY INVESTIGATION OF LATE HOLOCENE CLIMATIC VARIATIONS IN A TROPICAL MAAR LAKE (LAKE MASOKO, SW TANZANIA)

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Tropical East African lakes have been the object of numerous paleoclimatic studies over the last 20 years (e.g., Gasse, 2000). Most of these reconstructions focused on the hydrological regime variation over long timescales using geological (e.g. paleoshorelines, magnetic susceptibility) or geochemical proxies (e.g. diatom assemblages and their isotopic composition). Nevertheless, little is known about the extent and consequences of rapid environmental changes in tropical East Africa. This question becomes a primary concern as impacts of climate change have already been reported in the region (Tierney et al., 2010; Williamson et al., 2014). Moreover, contrasting paleoclimatic records were often obtained from nearby lakes, suggesting complex and heterogeneous climatic conditions over East Africa and/or potential overprint of the primary climatic signal by some endogenous environmental parameters (such as nutrient availability, production location), which may also impact the paleo-proxies.

A 2.7-meter-long core covering the last 4000 years (cal. BP) was sampled in 2007 in the centre of Lake Masoko. The Masoko crater lake is located in the southwest of Tanzania, in the Rungwe Volcanic Province. Elemental (total organic carbon, TOC, and total nitrogen, TN), isotopic ($\delta^{13}C$ of TOC and $\delta^{15}N$ of TN) and molecular analyses (*n*-alkanes, glycerol dialkyl glycerol tetraethers (GDGTs) and long chain diols) were performed at high resolution (ca. every 3 cm) along the core to determine vegetation and temperature changes over time.

Archaeal and bacterial GDGTs (iGDGTs and brGDGTs, respectively) as well as long chain diols were simultaneously analysed according to the protocol by Becker et al. (2015), enabling the reconstruction of three independent temperature records. The iGDGT and long chain diol temperature records are mostly in agreement, except for the deepest part of the core (from 4000 to 3000 yr BP) and show a high variability (Fig 1a-b). Additionally, three periods can be deduced in the long chain diol record but are absent in the iGDGT record: (i) a rather warm period from 4000 to 2700 yr BP with large variations in temperatures around 21 °C, (ii) a colder period from 2700 to 1600 yr BP with temperatures around 19 °C followed by (iii) a warmer period from 1600 to 500 yr BP with temperatures again around 21 °C. The brGDGT-based temperatures (Fig 1c) closely track the long chain diol-based ones for the most recent period, i.e. from 1600 yr BP to present, but are warmer for the older period (from 4000 to 1600 yr BP). The long chain diol temperature record shows best matches with temperature record from the surrounding area (Kyambangunguru swamp, Coffinet, 2015) suggesting that long chain diols result in the most reliable reconstruction. The discrepancy with the iGDGT and brGDGT records highlights the complexity of the signals related to these compounds. BrGDGTs can notably be produced in the lake and/or in the catchment area. Changes in the relative proportion of lacustrine vs. soil-derived brGDGTs over time may thus have biased the temperature record. The average chain length distributions of *n*-alkanes and $\delta^{13}C$ of TOC co-vary along the core, suggesting the predominance of open grasslands over the last 4000 yrs BP but the resurgence

of a forested environment in the area from 2700 to 1700 yrs BP. This is in agreement with previous palynological studies in the same lake (Vincens et al., 2003) and points to more humid conditions during this period. These results will be complemented with the analysis of the hydrogen isotopic composition of *n*-alkanes (δ^2H_{wax}), allowing the reconstruction of the hydrological regime of the region. Ultimately, this record may help to determine the joint impact of temperature and hydrology on vegetation changes during the late Holocene.

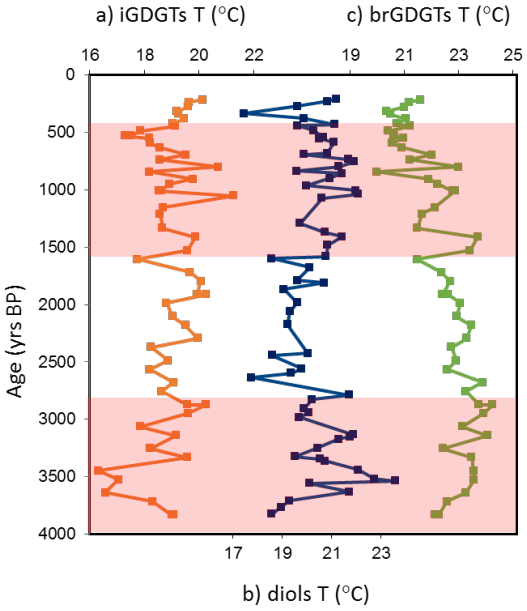

Figure 1. *a) iGDGT, b) long chain diol and c) brGDGT based temperature records of the last 4000 yrs BP in lake Masoko (Tanzania).*

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