

**ABRUPT BIOGEOCHEMICAL AND ENVIRONMENTAL CHANGES DURING THE
LAST 32,000 YEARS IN A TROPICAL LAKE (LAKE MASOKO, TANZANIA)
INFERRED FROM LIPID BIOMARKERS**

Romain de MESMAY^{1,3}, Vincent GROSSI^{1,2}, Pierre METZGER³, David WILLIAMSON⁴,
Stephen KAJULA⁵ and Sylvie DERENNE³

1. *Laboratoire de Microbiologie, Géochimie et Ecologie Marines, UMR CNRS 6117, Centre d'Océanologie de Marseille (OSU), Faculté des sciences de Luminy - case 901, 13288 Marseille cedex 09, France*

2. *Present address : Paléoenvironnements & Paléobiosphère - UMR CNRS 5125 PEPS, Université Claude Bernard Lyon 1, Campus de la Doua, 69622 Villeurbanne cedex, France*

3. *Laboratoire Biogéochimie et écologie des milieux continentaux, UMR CNRS 7618, Ecole Nationale Supérieure de Chimie de Paris, 75231 Paris cedex 05, France*

4. *Centre Européen de Recherche et d'Enseignement des Géosciences de l'Environnement, UMR CNRS 6635, BP 80, 13545 Aix en Provence cedex 04, France*

5. *Institute of Resource Assessment, University of Dar es Salaam, P.O. Box 35097, Dar es Salaam, Tanzania*

Lake Masoko is an oligotrophic Maar Lake (700 m diameter, 38 meters depth) from southern Tanzania that provides one of the most continuous Late Quaternary lacustrine sedimentary records from Africa. Owing to its small catchment area and the absence of river input and surface outlet, Lake Masoko is strongly sensitive to climate changes. Multidisciplinary studies have already detailed Lake Masoko's hydrology, geochemistry, pollens, diatoms, charcoals and phytoliths assemblages (Garcin et al. 2006, and references therein). Here we present biomarker evidence for abrupt changes in this tropical ecosystem during the last glacial-interglacial intervals (i.e. 32 ky B.P.).

The hydrocarbon composition of selected sediment samples from a 30-meters long core revealed a wide variety of botryococcenes that sometimes appeared highly dominant (Figure 1). Whereas some botryococcene structures were found all through the 32,000 years period, others were only detected in a few samples indicating changes with time of the *Botryococcus braunii* communities thriving in the lake. A new C₃₄ botryococcene, fully characterized using NMR data, tetra-unsaturated and containing two cyclohexyl rings, was found as the major hydrocarbon compound around 32 ky BP and during the Younger Dryas (YD, ≈ 12 ky BP). By contrast it was absent during the Last Glacial Maximum period (LGM, ≈ 20 ky BP; Fig. 1). The exclusive occurrence of partially hydrogenated isorenieratene-derivatives during the YD and the LGM indicated that an anoxic photic zone developed in Lake Masoko during glacial periods. This certainly was (in part) responsible for the observed changes in planktonic communities (Figure 1).

The qualitative and quantitative distributions of linear long-chain (C₂₇, C₂₉, C₃₁, C₃₃) alkanes and terpenoids from higher plants also appeared strongly fluctuating between contrasted climatic periods. Interestingly, higher plants biomarkers were nearly absent during

the YD whereas they dominated during the LGM revealing strong variations in both the terrestrial organic matter inputs to the lake and the type of vegetation that developed around it depending on the environmental conditions. Inputs of terrestrial OM to the lake sediments were generally accompanied by an increase in bacterial activity as suggested by the greater abundance of hopanoid compounds in hydrocarbon fractions dominated by higher plants biomarkers.

Unlike biomarkers, C/N values of sediments did not show strong variations between time periods, and did not seem highly indicative of the origin of the OM whereas $\delta^{13}\text{C}$ values of the TOC clearly indicated variations in the isotopic composition of the inorganic carbon pool between the considered geological periods.

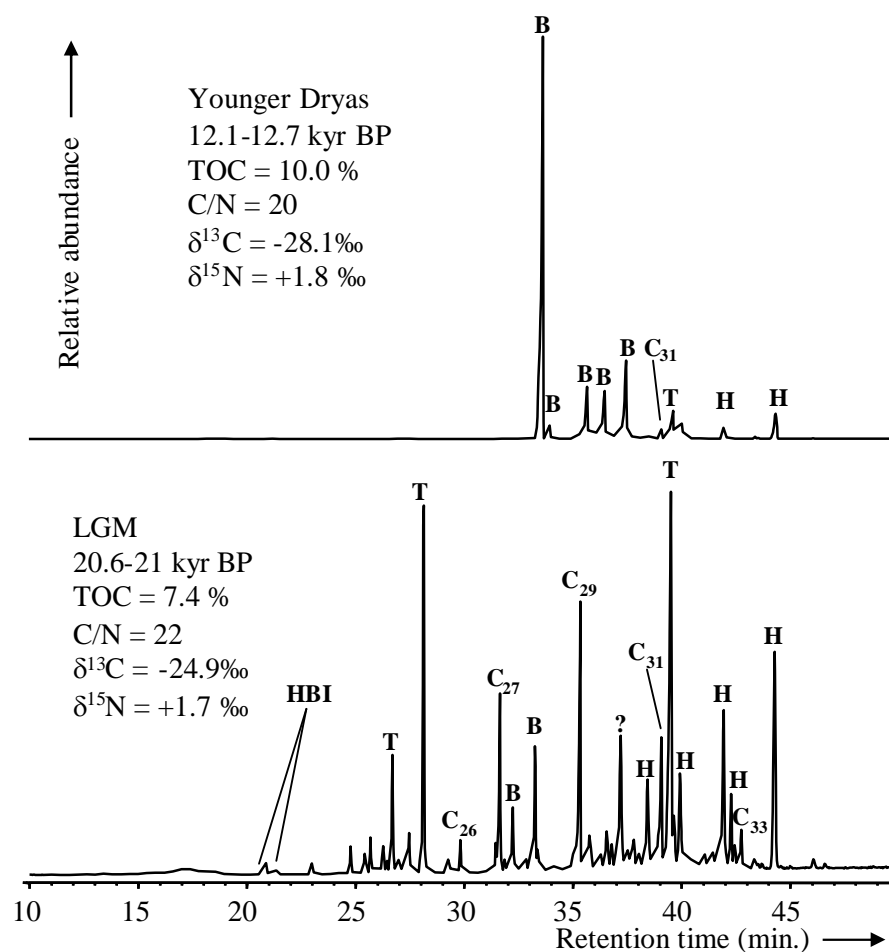


Figure 1. Total Ion Chromatograms of the hydrocarbon fraction of two sedimentary sections (Younger Dryas-top, LGM-bottom) from Lake Masoko. B = botryococenes, H = hopanoids, T = terpenoids, HBI = highly branched isoprenoids.

REFERENCES

- Garcin Y., Williamson D., Taieb M., Vincens A., Mathé P.-E. and Majule A. (2006) Centennial to millennial changes in maar-lake deposition during the last 45,000 years in tropical Southern Africa (Lake Masoko, Tanzania). *Palaeogeography, Palaeoclimatology, Palaeoecology*, **239**, 334-354.