Potential of GDGTs as temperature proxies along altitudinal transects in East Africa

Sarah COFFINET[1], Arnaud HUGUET[1], Christine OMUOMBO[2], David WILLIAMSON[3], Céline FOSSE[4], Christelle ANQUETIL[1] and Sylvie DERENNE[1]

[1] METIS, CNRS/UPMC UMR 7619, Paris, France.
[2] University of Nairobi, Nairobi, Kenya
[3] IRD, LOCEAN UMR 7159, Bondy, France
[4] ENSCP, Laboratoire de Spectrométrie de Masse, Paris, France

Contact: sarah.coffinet@upmc.fr

Résumé:

Glycerol dialkyl glycerol tetraethers (GDGTs) are lipids of high molecular weight and include the isoprenoid GDGTs (iGDGTs) produced by Archaea and the branched GDGTs (brGDGTs) produced by unknown bacteria. Indices were developed to describe the relationship between GDGT distribution and environmental parameters: the TEX_{86}, based on the relative abundances of iGDGTs in sediments, correlates with water surface temperature while the MBT and CBT, based on the relative abundance of brGDGTs in soils, correlate with mean annual air temperature (MAAT) and soil pH.

In this study, 41 surface soils were sampled along 2 altitudinal transects, from 500 to 2800 m in Mt. Rungwe (SW Tanzania) and from 1897 to 3268 m in Mt. Kenya (Central Kenya). MAAT was reconstructed along the 2 transects using the MBT/CBT proxy and a linear correlation with altitude was obtained. The reconstructed temperature lapse rate (0.5 °C/100 m) was consistent with the one determined from MAAT measurements at 6 altitudes inferring that the MBT/CBT is a suitable and robust temperature proxy in East Africa.

The TEX_{86} index was also found to vary linearly with altitude along the 2 transects. A similar correlation was recently noticed in soils in Mt. Xiangpi, China (Liu et al., 2013). The adiabatic cooling of air with altitude could explain the TEX_{86} variation with altitude. If such a relationship is confirmed, its use as a temperature proxy could be extended to soils. However a given TEX_{86} value was shown to correspond to a much higher altitude (ca. 1800 m higher) for Mt. Xiangpi soils (Liu et al., 2013) than for Mt. Rungwe and Mt. Kenya samples, suggesting that the geographical origin of the soils could impact the TEX_{86} values. Therefore, a better understanding of the environmental mechanisms controlling the iGDGTs distribution in soils is needed prior any application of the TEX_{86} as a temperature proxy in these environments.

REFERENCES :

Liu et al., 2013. Organic Geochemistry 57, pp. 76-83