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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), Christine ANQUETIL (1), and Sylvie DERENNE (1)

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

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. Several indices were developed to describe the relationship between GDGT distribution and environmental parameters: the TEX_{86} (tetraether index of tetraethers consisting of 86 carbons), based on the relative abundances of iGDGTs in sediments, and the MBT (methylation index of branched tetraethers) and CBT (cyclisation ratio of branched tetraethers), based on the relative abundance of brGDGTs in soils. The TEX_{86} was shown to correlate well with water surface temperature, and the MBT and CBT with mean annual air temperature (MAAT) and soil pH. The GDGTs are increasingly used as temperature proxies.

In this study, 41 surface soils were sampled along two altitudinal transects, from 500 to 2800 meters in Mount Rungwe (South western, Tanzania) and from 1897 to 3268 meters in Mount Kenya (Central Kenya). MAAT was reconstructed along the two transects using the MBT/CBT proxies. A linear correlation between the MBT/CBT-derived temperatures and the altitude (R^2=0.83) was obtained by combining results of the two transects. The reconstructed temperature lapse rate (0.5 °C/100 m) was consistent with the one determined from temperature measurements at six altitudes. These results show that the MBT/CBT is a suitable and robust temperature proxy in East Africa.

In Mt. Rungwe soil samples, the TEX_{86} index, which was mainly used to reconstruct water surface temperatures until now, was found to vary linearly with altitude (R^2=0.50). Such a relationship between TEX_{86} and altitude in organic soils has also been recently noticed in Mt. Xiangpi, China (Liu et al., 2013; R^2=0.68). The adiabatic cooling of air with altitude could explain the TEX_{86} variation with altitude. If such a relationship is confirmed, the use of the TEX_{86} as a temperature proxy could be extended to soil environments. However, a lower correlation between TEX_{86} and altitude was observed for Mt. Kenya samples, implying that the environmental factors affecting the TEX_{86} values should be further investigated. Moreover, 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 samples, suggesting that the geographical origin of the soils could also 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, W., Wang, H., Zhang, C.L., Liu, Z., He, Y., 2013. Organic Geochemistry 57, 76–83.