Assessing the use of GDGTs as temperature proxies along altitudinal transects in East Africa

A. HUGUET[1]*, S. COFFINET[1], C. OMUOMBO[2], D. WILLIAMSON[3], C. FOSSE[4], C. ANQUETIL[1] AND S. DERENNE[1]

[1]METIS, CNRS/UPMC UMR 7619, Paris, France (*correspondence: arnaud.huguet@upmc.fr)
[2]University of Nairobi, Nairobi, Kenya
[3]LOCEAN, IRD UMR 7159, Bondy, France
[3]Chimie ParisTech (ENSCP), Laboratoire de Spectrométrie de masse, Paris, France

Isoprenoid (iGDGTs) and branched (brGDGTs) are lipids comprising the cell membranes of archaea and some bacteria, respectively. Several indices describe the relationship between GDGT distribution and environmental parameters: the TEX_{86}, based on the relative abundances of iGDGTs, and the MBT and CBT, based on the relative abundances of brGDGTs. To date, the relationship between iGDGT distribution and environmental parameters in soils has only been rarely examined. In this study, brGDGTs and iGDGTs were analysed in 41 surface soils collected along two altitudinal transects, between 500 and 2800 m in Mt. Rungwe (SW Tanzania) and between 1900 and 3300 m in Mt. Kenya (Central Kenya). A linear correlation between the MBT/CBT-derived temperatures and the altitude (R^2 = 0.83) was obtained by combining the results of the two transects. In addition, the MBT/CBT-derived temperature lapse rate (0.5 °C/100 m) fitted with the one determined from in situ measurements. This shows that the MBT/CBT is a robust temperature proxy for East Africa. In Mt. Rungwe soils, a linear correlation (R^2 = 0.50) was found between TEX_{86} and altitude, likely reflecting the adiabatic cooling of air with altitude on iGDGT distribution. This suggests that TEX_{86} might be used to track temperature changes in terrestrial environments in addition to MBT/CBT indices. However, a lower correlation (R^2 = 0.38) between TEX_{86} and altitude was obtained for Mt. Kenya samples. Therefore, additional studies are needed to better understand the environmental factors controlling the iGDGT distribution in soils and to assess the applicability of the TEX_{86} as a temperature proxy in these environments.