EVALUATION OF 3-HYDROXY FATTY ACIDS AS A TEMPERATURE AND PH PROXY IN TANZANIAN SOILS

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Paleoclimate studies are chiefly carried out for marine environments because environmental proxies were mainly developed and used for oceanic settings. Branched glycerol dialkyl glycerol tetraethers (brGDGTs) have been the object of growing interest, as they are to date the only available organic proxies which can be used for terrestrial paleoclimate reconstruction. The development of new environmental proxies complementary to brGDGTs is required to improve the reliability and accuracy of terrestrial environmental reconstruction. 3-Hydroxy fatty acids (3-OH FAs), membrane lipids predominantly produced by Gram-negative bacteria, could be used as such a proxy. Their relative abundance was recently shown to vary with mean annual air temperature (MAAT) and pH in soils from Mt. Shennongjia (China; Wang et al., 2016). The aim of this study was to test the applicability of 3-OH FAs as a temperature and pH proxy for 21 soils from between 520 and 2800 m along Mt. Rungwe (SW Tanzania). In all the samples the 3-OH FAs varied between 10 and 26 carbons, with odd and normal chain compounds dominant over even, *iso* and *anteiso* homologs. The ratio of the summed *iso* and *anteiso* to the total amount of *normal* 3-OH FAs (RIAN index) was significantly negatively correlated with pH for Mt. Rungwe soils (R^2 0.43). Similarly, the *anteiso* to *normal* 3-OH FA ratios of the C_{15} and C_{17} compounds (RAN_{15} and RAN_{17} indices, respectively) were strongly negatively correlated with MAAT along Mt. Rungwe. When combined with data from Mt. Shennongjia, a strong linear correlation between RIAN and pH was observed (R^2 0.55; RMSE 0.52). Similarly, global calibrations between MAAT and RAN_{15} / RAN_{17} indices were obtained (R^2 0.70 and RMSE 3.9 °C for RAN_{15}; R^2 0.75 and RMSE 3.6 °C for RAN_{17}). These results strengthen the potential of 3-OH FAs as a temperature and pH proxy for soils.

Reference: Wang C., Bendle J., Yang Y., Yang H., Sun H., Huang J., Xie S., 2016. Org. Geochem. 94, 21-31.