

Bacterial community structure regulates the lacustrine brGDGT response to temperature

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Branched glycerol dialkyl glycerol tetraethers (brGDGTs) are membrane lipids globally present in peatlands, soils and lakes [1]. Empirical studies show that the relative methylation of brGDGTs (MBT^{5Me} index) in sediments responds to temperature and this proxy is increasingly used for paleoclimate reconstructions [2]. However, the methylation response has not been determined experimentally, and the bacterial producers of the brGDGTs remain largely unknown. In order to test the methylation response and gain insight into the microbial community responsible for brGDGT production, we conducted a series of laboratory microcosm incubations of lake water. Both brGDGTs and amplicon sequence variants (ASVs) were analyzed. Our results provide the first experimental evidence that the relative methylation of lacustrine brGDGTs varies with temperature, and further suggest that much of the change in MBT^{5Me} at higher temperatures can be attributed to increases in tetramethylated brGDGTs. Principal Coordinates Analysis of the beta diversity of the microbial communities also shows a strong temperature influence. Correlation analysis identifies a strong link between the changes in brGDGTs and three loosely related microbial communities, mostly composed of members of the Proteobacteria phylum. Notably, we do not find any significant relationships between brGDGT methylation and representatives of Acidobacteria [3]. The groups we identify appear to be correlated with temperature, preferring a cold (9 °C), a medium (18-27 °C), or a “hot” (35 °C) environment. Based on our results, we propose that, in our samples, brGDGT methylation represents a community-regulated response to water temperature, rather than an adaptation that occurs within one or several bacterial species.

[1] Weijers, J. W., et al. (2006) *EMI*, **8**, 648-657. [2] De Jonge, C., et al. (2014) *GCA*, **141**, 97-112. [3] Damsté, J. S. S., (2018) *Org. Geochem.*, **124**, 63-76.