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# Biomarker (brGDGT) degradation and production in lacustrine surface sediments: Implications for paleoclimate reconstructions.

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Branched glycerol dialkyl glycerol tetraethers (brGDGTs) are a class of biomarker lipids that can be conserved over long timescales in lake sediments. Produced throughout the lake water column before settling and incorporation in the sedimentary archive, they are used to reconstruct lake water temperature changes through time. However, it is not clear how degradation and/or production of these compounds in the surface sediments influences the brGDGT signal and the reconstructed temperature record.

Here we present the core lipid ("fossil") and intact polar lipid ("recently produced") signal of brGDGT lipids in 8 short cores collected in 4 Swiss lakes, covering a eutrophic gradient. In eutrophic conditions (Lake Baldegg), a clear subsurface (20-35 cm blf) maximum in intact polar lipids is observed (15-20%), whereas the most surficial sediments (0-2 cm blf) show the lowest percentage of IPL lipids (<5%). Our data indicates that tetramethylated brGDGT lipids are produced in the subsurface. As the bacterial community has been reconstructed in all cores, using 16S rRNA gene distribution, we observe that this production is coeval with an increase in the relative abundance of OTUs in the phyla Acetothermia, Aminicenantes, Caldiserica and Spirochaetes. Hexamethylated brGDGTs are encountered in increased amounts in most surficial sediments (0-2 cm bsf), but are degraded further downcore. Both degradation and in-situ production cause the reconstructed temperatures based on the surface sediments to be 2 □ colder than those from the subsurface.

In sediments where degradation and subsurface production of brGDGT lipids occurs, this has the potential to impact paleoclimate reconstructions. A colder $MBT'_{5ME}$ signal in surface sediments has indeed been observed in several studies (i.e. Tierney et al., 2012; Miller et al., 2018, Martin et al., 2020). Furthermore, a distinct brGDGT signal in surface sediments has a possible impact on existing lacustrine calibration datasets, as these are based on surface sediments.

References:

Tierney et al. (2012), GCA 77, p561-581. Miller et al. (2018), CoP 14 (11), p1653-1667. Martin et al. (2020), QSR 228, 106109.