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In situ production of brGDGTs in Lake Lugano

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Branched glycerol dialkyl glycerol tetraethers (brGDGTs) are bacterial membrane lipids that commonly occur in soils, as well as in sediments and suspended particulate matter (SPM) of lakes. The distribution of brGDGTs is related with temperature and pH, allowing their use as proxy indicators for the reconstruction of past climatic and environmental conditions. While transfer functions are well-established for brGDGTs derived from soils, still little is known about the links between the composition of aquatically produced brGDGTs and environmental parameters. Also the identity, ecology and carbon substrate of the aquatic source organisms are mostly unknown. We analyzed brGDGTs in the core- and intact polar lipid fractions of SPM from eutrophic Lake Lugano (Switzerland) using an advanced HPLC-MS method, capable of distinguishing between 5 methyl brGDGTs and the recently discovered 6 methyl brGDGT isomers. Our data show large variations in both the concentration and the relative abundances of brGDGTs throughout the water column, with most pronounced compositional changes right at the oxic/anoxic interface: A novel brGDGT isomer, which we discovered recently for the first time in sediments of another Swiss lake (Lake Hinterburg) and which is probably intrinsic to lacustrine environments, occurs exclusively in the anoxic monimolimnion but neither in the oxic mixolimnion nor in catchments soils of Lake Lugano. Furthermore, the brGDGT distribution in the lake's mixolimnion also differs from that in the catchment. This indicates that the brGDGTs present in the water column are dominantly autochthonous and that several distinct brGDGT-producing bacterial communities with different redox requirements can co-exist within the same lake system. Hence, our results provide new insights into the sources and distribution of brGDGTs in lacustrine environments, with important implications for the use of brGDGT-based proxies in paleolimnological studies.