Production and Preservation of Novel Bacteriohopanepolyols Under Extreme Environmental Euxinia

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Mahoney Lake (BC, Canada) represents an extreme end-member of photic zone euxinia (PZE), one of very few places on Earth to study this phemonemon. It is a relatively small, density stratified, highly-saline and sulfidic lake. Vigorous sulfate reduction by sulfate reducing bacteria in the hypolimnion (below ca. 7m water depth) supports one of the largest populations of phototrophic purple sulfur bacteria (PSB) on Earth, at the interface between oxic and anoxic/euxinic conditions. We have studied the production, fate, and preservation of bacteriohopanepolyol (BHP) molecules in this environment using APCI-LC-TOF-MS/MS.

There are distinct differences among the BHP compositions in oxic, suboxic, and euxinic water column conditions. BHP compositions within the sediments mostly reflect those of the lower, euxinic, water column. Upper water column samples contain unsaturated bacteriohopanetetrol, likely from photosynthetic cyanobacteria, but this molecule is not present below 8m depth. Aminotriol, linked to methanotrophs and sulfate reducing bacteria, is mostly present below the chemocline and in the sediments.

The most common BHP found in the deep water column and sediments has a molecular ion with m/z 710. It elutes shortly before aminotriol (m/z 714) and has fragment ions which are also four mass units lighter than aminotriol (m/z 650 and 590, c.f. 654 and 594; confirmed via MS/MS). We believe that the euxinic Mahoney Lake samples may contain the first example of a double-unsaturated aminotriol BHP.

We propose that microbes living in the extreme euxinic conditions of Mahoney Lake are generating a high concentration of novel BHP structures. Work to identify the source organisms of these BHPs is ongoing.