# Compound-specific isotope analysis of cyanobacterial pure cultures and microbial mats: effects of photorespiration?

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Microbial mats are considered modern homologs of Precambrian stromatolites. The carbon isotopic compositions of organic matter and biomarker lipids provide clues to the depositional environments of ancient mat ecosystems. As the source of primary carbon fixation for over two billion years, an understanding of cyanobacterial lipid biosynthesis, associated isotopic discriminations, and the influence of physiological factors on growth and isotope expression is essential to help us compare modern microbial ecosystems to their ancient counterparts. Here, we report on the effects of photorespiration (PR) on the isotopic composition of cyanobacteria and biomarker lipids, and on potential PR effects associated with the composition of various microbial mats.

The high light, high $O_2$ and limiting $CO_2$ conditions often present at the surface of microbial mats are known to support PR in cyanobacteria. The oxygenase function of ribulose bisphosphate carboxylase/oxygenase can result in photoexcretion of glycolate and subsequent degration by heterotrophic bacteria. We have found evidence which supports an isotopic depletion (increased apparent $\varepsilon$) scaled to $O_2$ level associated with growth of *Phormidium luridum* at low $CO_2$ concentrations (<0.04%). Similar to previous studies [1,2], isotopic differences between biomass and lipid biomarkers, and between lipid classes were positively correlated with overall fractionation, and should provide a means of estimating the influence of PR on overall isotopic composition of microbial mats.

Several examples of microbial mats growing in the hydrothermal waters of Yellowstone National Park [1,3] and the hypersaline marine evaporation ponds at Guerrero Negro, Baja Sur Mexico will be compared with a view to PR as a possible explanation of the relatively heavy C-isotope composition of hypersaline mats.

**References**

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