Goldschmidt 2025 Abstract
https://doi.org/10.7185/gold2025.29693

Effect of temperature on stable H and O isotope composition of a freshwater bacterioplankton

ANNA MICANOVA[1,2,3], MICHAELA MARIA SALCHER[3] AND TRAVIS B MEADOR[1,3]

[1]University of South Bohemia
[2]Johannes Kepler Universität Linz
[3]Biology Centre CAS

Microbial communities play a crucial role in biogeochemical processes, yet their responses to environmental conditions remain complex and poorly constrained. Stable isotope fractionation serves as a powerful tool for investigating biogeochemical cycling and ecological changes by providing insights into environmental stressors, such as climate change, as has been demonstrated by the temperature dependent fractionation of $^{2/1}$H incorporated into algal lipids [1]. Until now, there is little evidence extending such isotope systematics to the microbial loop. In this study, we investigated the growth signals of *Limnohabitans*, a cosmopolitan freshwater pelagic prokaryote, under controlled temperature conditions (8, 16, and 24 °C) in deuterium- and ^{18}O-enriched media to track isotope water incorporation into biomass. Distinct isotopic fractionation patterns were observed for biomass incorporation of water hydrogen (-43.5 > $^{2}\varepsilon$ > -12.3‰) and oxygen (23.6 > $^{18}\varepsilon$ > 27.3‰) and were higher in magnitude at the optimal growth temperature (16°C). These $^{2}\varepsilon$ values are lower than reported for algal lipids [1], which may, in part, be explained by the incorporation of H from organic sources into *Limnohabitans* biomass. This notion is supported by relatively low water-H assimilation factor (a_w) determined for the bacterioplankton (0.3-0.5), which were temperature dependent and possibly related to metabolic demands. This study additionally reports among the first $^{18}\varepsilon$ values for bacterioplankton, which were consistently positive and similar to that reported for cellulose and other sugars formed in leaves. Our findings highlight the importance of cultivation techniques for improving the investigation of stable isotope signals in the environment and the role of microbial communities in aquatic ecosystems. Further understanding of stable H and O isotope fractionation by bacterioplankton can provide deeper insights into their metabolic demand and growth and thereby offer a new tool to estimate microbial contributions to aquatic C cycling.

[1] Sachse, D., et al. (2012). Molecular paleohydrology: Interpreting the hydrogen-isotopic composition of lipid biomarkers from photosynthesizing organisms. Annual Review of Earth and Planetary Sciences, 40(1), 221–249. https://doi.org/10.1146/annurev-earth-042711-105535