Goldschmidt 2022 Abstract
https://doi.org/10.46427/gold2022.9669

Rise in the ^{15}N-to-^{14}N Ratio of Otolith-bound Organic Matter Associated with Late Cretaceous Cooling

ZIXUAN C. RAO[1], JESSICA A. LUEDERS-DUMONT[1,2], GARY L. STRINGER[3], ALFREDO MARTINEZ-GARCIA[4], GERALD H. HAUG[5,6] AND DANIEL M. SIGMAN[1]

[1]Princeton University
[2]Smithsonian Tropical Research Institute
[3]University of Louisiana at Monroe
[4]Max Planck Institute for Chemsitry
[5]Max Planck Institute for Chemistry
[6]ETH Zurich

Presenting Author: zrao@princeton.edu

The nitrogen isotopes ($\delta^{15}N$) of the organic matter preserved in fossil otoliths are a promising tool for reconstructing past changes in environmental conditions and trophic level. We analyzed the $\delta^{15}N$ of fossil otolith-bound organic matter in Late Cretaceous *Eutawichthys maastrichtiensis*, *E. zideki* and *Pterothrissus sp.* otoliths from three different localities along the U.S. east coast. Despite morphological signs of alteration of the otolith biomineral material, there is no significant difference in otolith-bound organic matter $\delta^{15}N$ between well-preserved and poorly preserved otoliths. Both genera showed a ~4‰ increase in otolith-bound organic matter $\delta^{15}N$ from Campanian (10.89 ± 1.02‰ in *Eutawichthys* spp. and 11.08 ± 0.79‰ in *Pterothrissus* sp.) to Maastrichtian (14.87 ± 1.25‰ and 14.78 ± 0.80‰). The similarity of the change in two separate genera argues against a trophic level change. Moreover, the proximity of the deposits and other geographic considerations argue against the locations of the host sedimentary deposits as the cause. Rather, the N isotopic change is best interpreted as an environmental (i.e., "baseline") signal at the regional scale or greater. The lower $\delta^{15}N$ in the Campanian may be a consequence of its warmer climate, consistent with warming-correlated declines in foraminifera-bound $\delta^{15}N$ during the Cenozoic. More specifically, our otolith data are consistent with the foraminifera-based finding that warmer conditions are associated with a lower global rate of water column denitrification. This interpretation is speculative, and $\delta^{15}N$ measurements from other fossil types and other regions are called for. Nevertheless, the large, coherent signal observed in this first study suggests that the nitrogen isotopes of fossil otoliths hold important information about the ocean and marine ecosystems over the Earth history.