Goldschmidt 2024 Abstract
https://doi.org/10.46427/gold2024.24033

Do coccolith clumped isotopes record sea surface temperatures? A laboratory culture and sediment trap perspective.

ALEXANDER J. CLARK, **STEFANO M. BERNASCONI**, MADALINA JAGGI, ISMAEL TORRES ROMERO AND HEATHER STOLL

ETH Zürich

Presenting Author: stefano.bernasconi@erdw.ethz.ch

Coccolithophores produce skeletal carbonate or coccoliths, which accumulate as sediment. These sediments are an interesting target for paleoclimate reconstructions using carbonate clumped isotopes, as they are widespread across a broad range of latitudes in the Cenozoic. In the last few years many discrepancies among Δ_{47}-temperature calibrations have been resolved across the range of paleoclimate-relevant temperatures (Anderson et al., 2021). However, small differences, on the order of 1-2°C, still persist between temperature calibrations. These discrepancies need to be addressed to enhance the accuracy and robustness of paleoclimate reconstructions (Meinicke et al. 2020; Daeron and Gray 2023).

We will present data from cultures of coccolithophores grown in the laboratory with a temperature range of 6-27°C and from sediment traps with a global distribution covering a temperature range of 20°C. The three cultured species cover a range of growth rates, growth conditions, and species-specific carbon and oxygen vital effects to evaluate if environmental conditions influence their clumped isotope composition. Our culture results indicate that are no species or genus-specific effects on the Δ_{47}-temperature relationship in coccolithophores and we find that varying environmental parameters other than temperature also do not have a significant effect.

The sediment trap results show that the relationship found for laboratory grown coccolith calcite between Δ_{47}-temperature also holds true for ocean-derived coccoliths. Using the culture-based calibration we demonstrate that the coccoliths approximate the temperatures from the estimated production depth better than that of the mixed layer depth, complete photic zone, or the sea surface.

Anderson, N. T., J. R. Kelson, S. Kele, M. Daëron, M. Bonifacie, J. Horita, T. J. Mackey, et al. (2021), *Geophysical Research Letters* 48, e2020GL092069.

Daëron , M., & Gray , W. R. (2023). *Paleoceanography and Paleoclimatology*, 38, e2023PA004660.

Meinicke, N., S.L. Ho, B. Hannisdal, D. Nürnberg, A. Tripati, R. Schiebel, and A.N. Meckler. (2020), *Geochimica et Cosmochimica Acta* 270, 160-183.