Precise timing of environmental changes across the Younger Dryas interval in the Cariaco Basin revealed by molecular stratigraphy at sub-annual resolution

LARS WÖRMER[1]*, BRENNA BOEHMAN[1], JENNY WENDT[1], GERALD HAUG[2, 3], KAI-UWE HINRICHS[1]

[1] MARUM – Center for Marine Environmental Sciences, Univ. of Bremen, Bremen, Germany
[2] Max-Planck-Institute for Chemistry, Mainz, Germany
[3] Geological Institute, Department of Earth Sciences, ETH Zürich, Zürich, Switzerland
* correspondence: lwoermer@marum.de

Microbial lipids deposited and preserved in marine sediments offer valuable information on past environments. Originating from organisms that once inhabited the water column, they provide clues on environmental properties such as temperature, nutrient availability or redox conditions in their biological producers' habitat. Having recently developed Mass Spectrometry Imaging (MSI) of such sedimentary biomarkers [1-3] we can now retrieve this information from undisturbed sediment sequences with sub-mm resolution.

We applied MSI to the investigation of the Youger Dryas (YD) cold interval and its imprint on sediments from the Cariaco Basin. The Cariaco Basin provides a continuous sequence of anually varved sediments that span the transitions from the Bølling-Allerød to the YD and into the Holocene. It thus offers a unique opportunity to investigate the effect of abrupt climate change on the tropical ocean.

Long chain alkenones inform the exact timing and magnitude of sea surface temperature (SST) cooling during the YD, while long chain fatty acids were used to evidence the extremely rapid vegetation change in the drainage area of the Basin and the shift between dominance of marine and terrestrial sources. We also discuss thaumarchaeal-based proxies and hypothesize that SST ist not the main agent driving their modulation in times of major changes in water column characteristics.

The extremely high resolution of the MSI approach (100 µm) results in ~monthly resolution, and thus allows to precisely time duration and sequence of environmental changes during the onset and termination of YD, as well as to describe the weakening of high frequency cyclicity throughout this event.

[1] Wörmer et al. (2014) *PNAS* 111, 15669-1567 [2] Alfken et al (2019) *Org. Geochem*. 127, 81-91 [3] Wörmer et al. (2019) *Org. Geochem*. 127, 136-145