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Assessing potential lineage-driven biases in Holocene alkenone-based SST reconstructions along the Canadian continental margin

LAURY-ANN DUMOULIN, MARIE ENGEL, EL MAHDI BENDIF AND STEPHANIE KUSCH

Institut des sciences de la mer - Université du Québec à Rimouski

Alkenones are chemotaxonomically specific unsaturated methyl and ethyl ketones produced by haptophyte algae of the order Isochrysidales and are widely used to reconstruct past sea surface temperatures (SST) using the UK'_{37} index. Downcore UK'_{37}-based SST reconstructions from the Laurentian Fan and the Scotian Margin revealed up to 10°C cooling of surface waters over the Holocene. This unusually strong cooling was explained by declining insolation, stronger Labrador Sea convection, and a southward shift of the Gulf Stream. However, salinity and water column stratification can alter haptophyte community structure, and culture studies show that species-specific effects influence SST calibrations. Moreover, the three known Isochrysidales groups produce different alkenone fingerprints. Mixed-species inputs can therefore introduce biases in UK'_{37} reconstructions.

Here, we evaluate the reliability of SST reconstructions along the Canadian continental margin and test whether changes in Isochrysidales community composition could have biased Holocene SST reconstructions. We use alkenone analysis and metagenomics on water column filters obtained across the Scotian Shelf and in downcore sediment records from the Gulf of St. Lawrence and the Scotian Shelf. Our data show that UK'_{37}-based SSTs in present day surface waters are substantially lower than *in situ* measurements. Corresponding metagenomics results indicate that the Isochrysidales community consists of *Gephyrocapsa* (group 3) only. In contrast, downcore samples from the nearby Gulf of St. Lawrence are dominated by Group 1 species and we find no metagenomic evidence for group 3. The downcore SST change corresponds to cooling of 10°C also and we find evidence for community shifts within group 1 downcore. We did not observe any inhibition during the DNA amplification. This observation implies that changes in the Isochrysidales community may have influenced the alkenone-based SST reconstructions.