Comparative Study of Alkenone Production in Contrasting Surface Water Environments in the North Pacific Ocean

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Unsaturation patterns ($U^{K'}_{37}$) in long-chain alkenones of phytoplankton origin, most notably represented by the haptophyte *Emiliania huxleyi* (Ehux), have proven remarkably valuable for purposes of paleoceanographic sea surface temperature reconstruction. Globally, $U^{K'}_{37}$ measured in recent ocean sediments correlates highly with the 'mean annual' SST (maSST) of overlying surface waters. The linear equation defining the relationship is statistically the same as the calibration determined for the first Ehux strain carefully examined in laboratory cultures. Despite the promise of this finding, however, certainty of predictions made using this paleoceanographic technique is not yet assured. For example, we now know that other marine alkenone-producing haptophytes, even other Ehux strains, can display quite different quantitative $U^{K'}_{37}$ responses to growth temperature (gT). There is also evidence that $U^{K'}_{37}$ is not just set by gT but is affected perhaps significantly by non-thermal physiological factors such as nutrient and light availability. Thus, scatter noted in the global $U^{K'}_{37}$-maSST calibration, which corresponds to a prediction uncertainty of $\pm 3^{o}$C, is a concern that cannot be overlooked and warrants further investigation in the modern ocean.

We have determined alkenone standing stock and alkenone production rate throughout and alkenone export from the euphotic zone in three distinct regions of the same ocean: 1) the permanently stratified subtropical north Pacific; 2) the seasonally stratified subarctic north Pacific; and 3) the seasonally upwelling influenced Gulf of California. Alkenone production rate was determined using *in situ* compound-specific ^{13}C incubations [1]. We discuss our results in terms of where in the euphotic zone the fossil alkenone signal preserved in sediment originates and if non-thermal physiological factors significantly affect $U^{K'}_{37}$ temperatures.

References

[1] Prahl F.G. et al. (2005) *DSR-II* **52,** 699-719.