# µm-Scale molecular stratigraphy in Santa Barbara Basin sediment

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Mass spectrometry imaging (MSI) reveals the µm-scale spatial distribution of organic target molecules on sample surfaces. Initially developed in life sciences, it has recently proven its potential for ultra-high resolution paleoclimate research. For example, high-frequency variations of sea surface temperature (SST) could be reconstructed by analysis of diagnostic sedimentary lipids [1]. Improvements in sample preparation make it feasible to prepare sequential thin (20 to 100 µm) sediment slices for 2-dimensional µm-scale multiproxy biomarker analyses.

We applied MSI to the upper ~30 cm of varved sediments from the Santa Barbara Basin off California, resulting in a 200 µm scale multiproxy record for the last century. Two SST proxies (CCaT and $U^{K'}_{37}$, shown for the uppermost ~5 cm in Fig. 1) were recorded. The alkenone-based $U^{K'}_{37}$ resolves yearly SST variations, whereas the GDGT-based CCaT reflects lower frequency variations potentially linked to El Niño-Southern Oscillation (ENSO) variability. In combination with other biomarker data that are indicative of redox conditions or terrigenous input, we can explore the interdependence between inter-annual SST variation, ENSO variability and ecological changes in the water column with unprecedented temporal resolution.

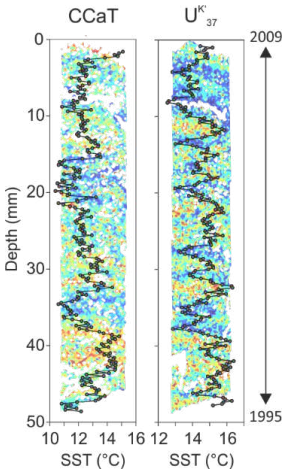


**Figure 1:** 2-Dimensional mass spectrometric imaging of GDGT-based CCaT and alkenone-based $U^{K'}_{37}$ proxies for sea surface temperature (SST) with corresponding downcore profiles at 200 µm resolution for the uppermost ~5 cm of Santa Barbara Basin box core SPR0901-02BC. The width of the analysed sections is ~0.8 cm.

[1] Wörmer et al. 2014 *PNAS* **111,** 15669-15674.