Mineral-organic carbon interactions and their control on derived proxy signals from marine sediments

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The isotopic and quantitative properties of organic carbon (OC), the $U^{k'}_{37}$ ratio from alkenones, and the TEX_{86} ratio from GDGTs are among the most applied paleoclimate proxies from marine cores. As much of the organic matter in marine sediments, these proxy-bearing components associate with mineral surfaces by sorption. Considering that mineral particles might behave in a cohesive or in a sortable manner depending on their size, we aim to assess whether OC, alkenones and GDGTs preferentially associate with specific mineral grain-size fractions and thus, whether the governing hydrodynamic conditions may determine their transport pathways. Our results show that the three components preferentially concentrate in fine silt minerals, which are particularly prone to resuspension. Specific-compound ^{14}C analyses reveal that some of the mineral grain-size fractions contribute to the bulk sediment with pre-aged (i.e., very old) material, pointing to potential temporal biases in the proxy signal derived from bulk sediments. To assess whether large contributions of sortable fractions might influence the proxy signals recorded in bulk sediments, we estimated the alkenone- and GDGT-derived sea surface temperature (SST) from each of the fractions. Significant SST discrepancies among the grain-size fractions and bulk sediment suggest the autochthonous climate signal is influenced by the addition of allochtonous, pre-aged material.