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The impact of sedimentary oxic degradation on alkenones and long chain alkyl diols in the Arabian Sea Oxygen Minimum Zone: implications for $U^{K'}_{37}$ and LDI temperature proxies

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The influence of oxygen on lipid biomarker preservation is still an unresolved scientific topic. Thus, this is an important issue when we apply organic proxies for reconstructing environmental conditions. Long chain alkenones and alkyl diol concentrations and distributions have been studied in nine surface sediments (0-0.5 cm) from 900 to 3000 m water depth on the Murray Ridge. This seamount protrudes into one of the largest oxygen minimum zones located in the Arabian Sea. Different bottom water oxygen concentrations (<3 to 83 μmol L^{-1}) and oxygen exposure times characterized the surface sediments, which are in close lateral proximity and therefore expected to produce similar algal biomass. This allows us to determine the impact of sedimentary oxic degradation on recently deposited organic compounds.

Long chain alkenone concentrations in the surface sediments generally decreased with increasing water depth suggesting increased degradation. Concentrations of long chain alkyl diols decreased with increasing oxygen exposure time, but values increased again in the two deepest sediments with the longest exposure oxygenated conditions. We also identified long chain keto-ols, which have previously been proposed as oxic degradation products of long chain diols. However, the 1,15-keto-ol/diol ratio did not substantially change with depth, suggesting that keto-ol formation did not take place in the sediment but in the water column.

The $U^{K'}_{37}$ derived temperatures showed insignificant variations, between 27.4° and 27.7°C but the Long chain Diol Index (LDI) showed a remarkable linear negative correlation with the oxygen exposure time. The change in LDI values is caused by a more rapid degradation of the C_{30} 1,15-diol compared to the C_{28} and C_{30} 1,13-diols. The overall changes correspond to a substantial variation in reconstructed temperature of ca. 3.5°C. This suggests that oxic degradation may affect temperature reconstruction using the LDI, while the $U^{K'}_{37}$ seems less affected in this marine setting. Therefore, care has to be taken when LDI is applied in sediments underlying OMZs or where bottom water oxygen concentrations have varied substantially over time.