# Stratification of dissolved organic matter in the upper 2000 m water column of the Mariana Trench

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## Abstract

Fourier transform ion cyclotron resonance mass spectrometry (FT-ICR MS) and absorbance spectroscopy were utilized to investigate the molecular composition of marine dissolved organic matter (DOM) from the upper 2000 m water column of the Mariana Trench. Molecular indices based on the relative abundance of 4699 formulas assigned from FT-ICR MS were analyzed. The degradation index ($I_{DEG}$) varied from 0.645 ± 0.014 in the surface layer to 0.722 ± 0.021 below 500 m, indicating that the DOM in the deep layer was more refractory. This was supported by an increase of aromaticity index ($AI_{mod}$) from 0.200 ± 0.003 in the surface layer to 0.220±0.003 at depths. Multivariate analysis based on both bulk molecular parameters and relative abundance of individual formulas indicated a feature of DOM stratification: the upper layer (5–75 m), middle layer (200 m) and deep layer (500–2000 m). The surface enriched formulas were characterized by higher H/C and lower $AI_{mod}$, while deep-enriched formulas showed lower H/C and higher $AI_{mod}$. Variations in $AI_{mod}$ and H/C for these formulas indicated that extracellular release (mainly from primary production) and photochemical processes strongly affected the DOM composition in euphotic zone, while microbial processes likely exerted a tremendous influence on the DOM composition at all depths. Moreover, strong correlations between spectroscopic indices ($a_{325}$, $S_{275-295}$ and $S_{280-400}$) and FT- ICRMS derived proxies indicated these two approaches can be integrated to provide valuable information on themolecular characterization of open ocean DOM.