

Characteristics of the dissolved organic matter in Mariana Trench sediments

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It has been suggested that hadal trenches are depocenters of organic matter and hotspots for microbial activities. Here, we analyzed the concentrations of porewater dissolved organic carbon (DOC) as well as fluorescence spectroscopy of porewater dissolved organic matter (DOM) from the shallow sediments of the axis (10900 m) and flank (6000 m) of the southern Mariana Trench. The average DOC concentration at the trench axis site (332 μM) is higher than that at the flank site (258 μM), although both sites do not have clear down-core trend. This suggests intensified organic matter mineralization at the trench axis site compared to the flank site, which is consistent with our in-situ incubation results showing higher total oxygen uptake rate at the trench axis site than the flank site. Furthermore, three-dimensional fluorescence spectroscopy shows three major peaks at both sites corresponding to the terrestrial humic-like material (peak A), the marine humic-like material (peak M), and the protein-like material (peak B). The fluorescence intensities of both terrestrial humic and marine humic-like materials as well as the total fluorescence intensity increase with depth at the trench axis site and are all significantly higher than those at the flank site. In addition, the trench axis site shows higher values of the humification coefficient (HIX) and specific ultraviolet absorbance at 254 nm (SUVA₂₅₄). These observations also indicate a stronger microbial metabolism at the trench axis site, which produced and accumulated more refractory DOC than the flank site. This is the first study that examines the features of porewater DOM in the hadal zone, which provides additional supports for the argument that microbial activities are enhanced at the trench axis.