

Persistence and transformation of DOM in marine sediment pore waters examined by ^1H NMR

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Marine sediments are major sources of dissolved organic matter (DOM) to the water column. However, the significance of benthic DOM fluxes in the marine carbon cycle remains unclear, because the chemical composition of porewater DOM has yet to be elucidated. To address this knowledge gap, we used ^1H -NMR to compare and contrast DOM in whole porewater samples collected from three locations along the California margin, USA: two bioturbated sites in the continental shelf offshore central California (Sta. D and K); and anoxic muds from the center of Santa Barbara Basin (SBB), California Borderland. ^1H -NMR spectra of samples from Sta. D and K overlap very closely, but are distinct from spectra of SBB samples in two major ways: (1) DOM in SBB sediments show greater relative abundance of protons attributed to carboxyl-rich alicyclic molecules (CRAM); and (2) DOM from Sta. D and K show greater relative abundance of carbohydrate protons. We hypothesize that these differences arise in part due to differences in prevailing redox conditions within the sediment column. Despite these major differences, several well-resolved peaks appear throughout samples regardless of sampling location. These peaks (tentatively attributed to carbohydrate, protein, peptide, methanethiol) also overlap with resonances reported in DOM extracted from the water column, and hence could indicate DOM components that occur across a wide range of environments. Interestingly, many of these recurring peaks become more prominent with increasing depth in the sediment column, consistent with net production of these moieties during sedimentary organic matter degradation.