

Massive production of dissolved organic nitrogenous compounds from the Guaymas Basin sediment at elevated temperature

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Dissolved organic nitrogen (DON) is the second largest pool of reduced nitrogen in the ocean. Like dissolved organic carbon, water column DON decreases with increasing depth [1], indicating biotic production in surface ocean as the main source [2]. The role of marine sediments and benthic biogeochemical processes to DON cycling remains poorly constrained. Here we present the observation of massive DON production from sediment in the Guaymas Basin upon heating under anoxic conditions. In sediment slurry experiments (12–90 °C, 192 days) to simulate the natural condition of diagenetic heating, the DON content increased logarithmically from 100 µM at 12 °C to 10 mM at 90 °C, coinciding with increasing trends of NH₄⁺ and total hydrolyzable dissolved amino acids (THDAA) with temperature. At 90 °C, THDAA accounted for up to 43% of the increase in DON; control experiments with sterilized sediment confirmed that the THDAA production was an abiotic process. Ultrahigh resolution mass spectrometric analysis of the dissolved organic extracts obtained with solid-phase extraction cartridges showed the presence of abundant N-bearing compounds with high H/C and low O/C ratios in heated samples. Our results suggest that heat is an efficient geological process in releasing particle-bound nitrogenous compounds, which may nurture the microbial community in the seafloor or, when transported by the upward migrating fluid, fuel the ecosystems at the sediment-bottom water interface.

[1] Bronk (2002) In: Hansell and Carlson (eds.), *Biogeochemistry of Marine Dissolved Organic Matter*, 153-247. [2] McCarthy et al (1998) *Science* **281**, 231-234.