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# Molecular-level dynamics of refractory dissolved organic matter

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Refractory dissolved organic matter (DOM) accounts for most of the global oceanic organic carbon inventory. Processes leading to its formation and factors determining its stability are still largely unknown. We hypothesize that refractory DOM carries a universal molecular signature. Characterizing spatial and temporal variability in this universal signature is a key to understanding dynamics of refractory DOM.
We present results from a long-term study of the DOM geo-metabolome in the open North Sea. Geo-metabolomics considers the entity of DOM as a population of compounds, each characterized by a specific function and reactivity in the cycling of energy and elements. Ten-thousands of molecular formulae were identified in DOM by ultrahigh resolution mass spectrometry analysis (FT-ICR-MS, Fourier-Transform Ion Cyclotron Resonance Mass Spectrometry). The DOM pool in the North Sea was influenced by a complex interplay of processes that produced, transformed and degraded dissolved molecules. We identified a stable fraction in North Sea DOM with a molecular composition similar to deep ocean DOM. Molecular-level changes in this stable fraction provide novel information on dynamics and interactions of refractory DOM.