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Deconstructing carbon and nitrogen isotope signals, Earth's organic matter through a prism.

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Our field has traditionally relied upon the assumption that the stable isotope compositions of bulk organic matter are derived from the contemporary environment and therefore provide concrete information about the environment of deposition. However, the organic matter in rocks and sediments can be derived from heterogeneous sources including materials distributed across a basin, extending back to the land, incorporating aged organic matter from soils or derived from uplifted shales or metamorphic rocks, as well as from migrating petroleum. If we peer into the details of sedimentary OM and disperse its signal into multiple well-characterized components, can we use the spectrum of data to reconstruct key parameters in the ancient carbon and nitrogen cycles. What else can we learn about the geochemistry and ecology of the ancient environment from multi-dimensional isotope datasets? In addition, what information are we losing by relying on bulk analysis to reconstruct critical components of the carbon and nitrogen cycles? I will present new data on the carbon and nitrogen isotope composition of sedimentary organic matter that has been separated into its respective, physically separable components (e.g. microfossils, spores, kerogens, terrestrial organic matter, extracts, specific compounds and skeletal materials), much the way a prism separates light into a spectrum. By deconstructing the organic matter contained within ancient rocks and focused through the lens of a modern sedimentary system we will be able follow carbon from source, through preservation, to proxies for environmental and ecological signals.