Compound-specific carbon isotopes reveal distinct organic carbon sources through the Shuram Excursion from the Sultanate of Oman

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The Ediacaran Period (635-542 Ma) was associated with dramatic climatic fluctuations and biological innovation prior to the Cambrian radiation of bilaterian animals. The chemostratigraphic record of marine carbonates captures a global dramatic $\delta^{13}C$ carbon isotope excursion to extremely negative values (*ca.* -12‰), known as the 'Shuram excursion' that cannot be explained by common carbon isotope mass balance frameworks.

Examination of the carbon isotopic composition of discrete bulk carbon phases reveal a decoupled signature between the carbonate and total organic carbon through the excursion [1]. Thermally immature sedimentary rocks were obtained for organic geochemical investigation from a subsurface well and represent a deeper water (outer shelf) facies within the eastern flank of the South Oman Salt Basin.

Bulk organic carbon isotopes and lipid biomarkers show compositional and source input variation throughout the excursion [1] but none of the major bulk organic phases (bitumen and kerogen) are coupled with the Shuram excursion in carbonate. The carbon isotopic values of individual *n*-alkanes and mid-chain monomethyl alkanes (mid-chain MMAs) were then measured using gas chromatography-isotope ratio mass spectrometry.

The MMAs are depleted in $\delta^{13}C$ by, on average, 1.5‰ relative to *n*-alkanes, yet both these compounds are depleted up to 5-7‰ relative to the bulk organic phases of TOC, bitumen, and kerogen during the Shuram excursion. The very depleted $\delta^{13}C$ values of extractable long chain ($>C_{20}$) *n*-alkanes and MMAs (as low as -40‰) provides the first compelling evidence for autotrophs utilising light dissolved inorganic carbon (DIC) during the Shuram excursion. Such large variations within organic matter are uncommon and may reflect source mixing between two isotopically distinct pools of organic carbon.

[1] Lee *et al* 2013. *Geobiology* **11**(5), 406-419.