Correlated analyses of D- and 15N-rich carbon grains from CR2 chondrite EET 92042

Conference or Workshop Item

CORRELATED ANALYSES OF D- AND ^{15}N-RICH CARBON GRAINS FROM CR2 CHONDRITE EET 92042.

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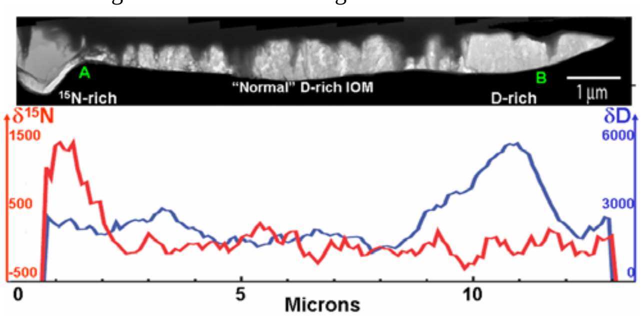
Introduction: Insoluble organic matter (IOM) and matrix from primitive carbonaceous chondrites carry isotope enrichments ($\delta D \leq 20000‰$, $\delta^{15}N \leq 3200‰$) that are comparable to those in interplanetary dust particles [1, this work]. Hence, primitive organics that formed in the protosolar cloud (PSC) – or maybe in the cold outer regions of the protoplanetary disk – survived accretion and planetary processing on the asteroids, the parent bodies of the chondrites. Most D and ^{15}N anomalies are spatially uncorrelated, indicating that distinct processes produced them. While various reactions in the PSC can account for the D enrichments [2], the ^{15}N anomalies cannot be explained by existing models [3]. Alternative mechanisms, possibly within the solar system [4], have to be considered. Identifying the isotopically anomalous carriers will help to understand the earliest evolution of organic matter from PSC to the solar system.

Results: SIMS analyses of CR2 chondrite EET 92042 IOM [5] revealed two isotopically anomalous, micron-size discrete carbon grains ("A" with $\delta^{13}C \sim -113‰$ and $\delta^{15}N \sim 1150‰$; "B" with $\delta D \sim 6000‰$, Fig.). Grains and intermediate IOM ($\delta D \sim 2200‰$) were thinned and extracted by FIB-SEM [6] and examined by transmission electron microscopy (Fig.). EDS and electron diffraction patterns show that all analyzed matter is C-rich and amorphous. ^{15}N-rich grain A is monolithic C with trace Si; D-rich grain B is porous organic C with traces of Si and S. The intermediate IOM is also porous organic C and contains nm-size Fe-Ni, chromite and Ca-rich grains. C- and N-XANES spectroscopy proves the hydro-carbonaceous, non-graphitic character of the IOM and indicates distinct N bonding states for grains A and B. On-going EELS, NanoSIMS, and synchrotron IR micro-spectroscopic analyses will characterize the isotopic compositions of additional elements, and the chemical structural variation and bonding states of the C-bearing molecules.



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