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


1DTM, Carnegie Institution of Washington DC. 2Naval Research Laboratory Washington DC, 3Lawrence Livermore National Laboratory, Livermore CA, 4GL, Carnegie Institution of Washington DC, USA. (busemann@dtm.ciw.edu)

Introduction: Insoluble organic matter (IOM) and matrix from primitive carbonaceous chondrites carry isotope enrichments (δD≤2000‰, δ15N≤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 15N anomalies are spatially uncorrelated, indicating that distinct processes produced them. While various reactions in the PSC can account for the D enrichments [2], the 15N 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 δ13C~−113‰ and δ15N ~1150‰; "B" with δD~6000‰, Fig.). Grains and intermediate IOM (δD ~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. 15N-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 microspectroscopic analyses will characterize the isotopic compositions of additional elements, and the chemical structural variation and bonding states of the C-bearing molecules.