RAMAN SPECTROSCOPY OF ORGANIC MATTER IN ANTARCTIC MICROMETEORITES. P. Haenecour[1,2], C. Floss[1,3], A. Wang[2], and T. Yada[4]. [1]Laboratory for Space Sciences, [2]Department of Earth and Planetary Sciences, [3]Physics Department, Washington University, One Brookings Dr., St. Louis, MO 63130, USA (haenecour@wustl.edu). [4]Japan Aerospace Exploration Agency, Institute of Space and Astronautical Science, Sagamihara, Kanagawa 252-5210, Japan.

Introduction: As in CR chondrites and IDPs [1, 2], isotopic anomalies in several elements (e.g., H, C, N, O, Si) have been reported in Antarctic micrometeorites (AMMs) [3]. Many of these anomalies reflect the presence of presolar grains [4]. However, the origin(s) of the nitrogen isotopic anomalies associated with insoluble organic matter (IOM) still remain unclear. We are carrying out coordinated analysis of ^{15}N-rich organic matter in AMMs to better understand their formation.

Experimental methods: Using the NanoSIMS 50, we identified C and N isotopic anomalies in three fine-grained AMMs (T98H5, T00Iba030, T98G6). We mapped a total surface area of 28,200 µm^2 for ^{12,}C, ^{13}C, ^{12}C^{14}N, ^{12}C^{15}N and ^{28}Si (each image = 20×20 µm^2). The N and C isotopic compositions were normalized to synthetic Si_3N_4 and SiC standards, respectively. We then used the Auger Nanoprobe to characterize the elemental compositions of the ^{15}N-rich hotspots identified. We also acquired Raman spectra of two ^{15}N-rich hotspots in T98H5 with a state-of-the-art inVia© Laser Raman Imaging system [5].

Results and discussion: Like T98G8 [6], T98H5 has a ^{15}N-rich bulk isotopic composition (^{14}N/^{15}N = 215 ± 9) and exhibits large ^{15}N-enrichments. The two other AMMs (T00Iba030 and T98G6) have bulk ^{15}N/^{14}N ratios close to terrestrial and exhibit only a few ^{15}N-rich hotspots.

The Auger spectra indicate the presence of Fe-rich phase(s) (Fe oxide or hydroxide) associated with two of the ^{15}N-rich hotspots. The Raman measurements confirmed the presence of two possible Fe-rich minerals, magnetite and hematite (or heated goethite [7]) associated with polyaromatic carbonaceous matter (D- and G- bands). The spectra also indicate that T98H5 has experienced some thermal metamorphism (I_D/I_G >1). It is not clear whether these iron oxides are primary phases or secondary phases formed by the oxidation of Fe metal grains and sulfides in the upper atmosphere or in the Antarctic ice.

The association of organic matter with iron oxide-hydroxide grains is consistent with a formation by a process similar to the Fischer-Tropsch synthesis. However, no large N isotope fractionations are expected during this process [8]. Recent models indicate that large ^{15}N-enrichments can be produced during formation of ammonia by ion-molecule reactions in the interstellar medium [9]. The ^{15}N-rich organic matter in T98H5 could, thus, have formed in a two-step process: (a) formation of ^{15}N-enriched ammonia and aggregation as ice mantles onto the surfaces of iron-rich grains, followed by (b) the transformation of the ammonia-bearing icy mantles into other organic compounds.

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