SEARCH FOR ULTRA-CARBONACEOUS PARTICLES IN THE INTERPLANETARY DUST COLLECTION. H. Wiesman[1,2], C. Floss[1,2], P. Haenecour[1,3], and A. Wang.[3]. [1]Laboratory for Space Sciences; [2]Physics Department; [3]Department of Earth & Planetary Sciences, Washington University, St. Louis, MO, USA (Email: floss@wustl.edu)

Introduction: Micrometeorites dominate the flux of extraterrestrial material accreting to the Earth [1] and are an important complement to other types of extraterrestrial samples, such as meteorites and interplanetary dust particles (IDPs). Ultra-carbonaceous Antarctic micrometeorites (UCAMMs) are fine-grained fluffy particles dominated by highly disordered carbonaceous matter [2, 3] enclosing high temperature anhydrous minerals and GEMS-like aggregates [4, 5]. These characteristics and the presence of H and N isotopic anomalies, and abundant presolar grains [4-7], suggest similarities to anhydrous IDPs and certain primitive carbonaceous chondrites.

The presence of these primitive ultra-carbonaceous particles in the Antarctic micrometeorite collection led us to question whether similar particles may be present in the interplanetary dust collection. After collection in the stratosphere, particles on the collectors undergo preliminary SEM-EDX analysis in order to distinguish true IDPs from likely terrestrial contamination. Among the different types of terrestrial contaminants found on the collectors are numerous particles whose spectra suggest that they are dominated by low atomic number (Z) elements that are typically not detectable by EDX methods (e.g., H, C, N, O). Although classified as terrestrial contaminants, some of these particles may in fact be extraterrestrial 'low-Z' IDPs [8], similar to UCAMMs. Here we report the results of a survey of low-Z particles from the JSC cosmic dust collection that we carried out in order to evaluate this possibility.

Experimental: We mounted 22 'low-Z' particles from eight different collectors (L2008, L2009, L2021, L2036, L2047, U2097, U2098, W7190) on high purity Au foil for elemental and isotopic characterization. Secondary electron images and EDX spectra of the particles were obtained with a JEOL 840a SEM equipped with a LaB_6 emitter and a ThermoNoran Si(Li) light element detector.

Several particles, which appeared most similar to UCAMMs or fine-grained IDPs, were chosen for NanoSIMS analysis to search for isotopically anomalous components. Raster ion imaging of the C and O isotopes was carried out in multi-collection mode with a Cs^+ primary ion beam. Analytical methods and data reduction followed standard procedures for presolar grain searches [9].

Raman spectra were obtained on the same particles with a state-of-the-art inVia Laser Raman Imaging system [10] using a 633 nm laser wavelength.

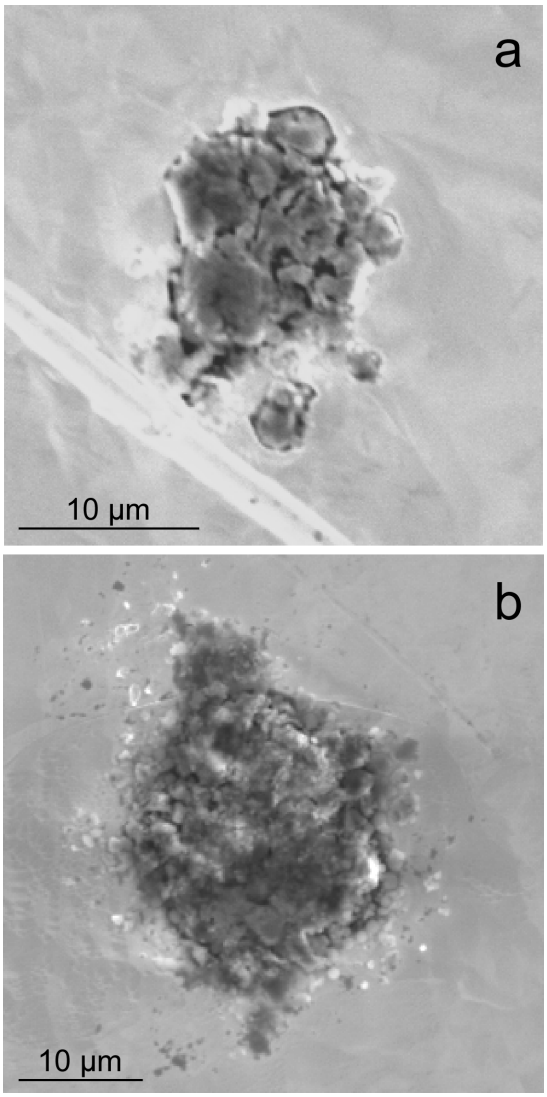

Figure 1. Secondary electron images of 'low-Z' particles L2008 H2 (a) and L2008 C7 (b).

Results: As expected, C and/or O were dominant elements in virtually all of the EDX spectra obtained; many of the spectra also displayed the presence of Na. Other elements found in some of the particles included Al, Si, Fe, Mg and occasionally K, Ca, or S. From our set of 22 particles, we selected seven for further analysis on the basis of their textures and/or elemental compositions (Figs. 1, 2). Four of the particles have EDX spectra dominated by C, with essentially no other elements present; texturally, they either consist of aggregates of fine-grained particles or have smooth uniform morphologies. The other three particles have

typical 'chondritic' spectra [11], with abundant Fe, Mg, Al and Si, in addition to C and O; S is also present in two of them. All three are aggregates of fine- to medium-grained particles. Particles whose EDX spectra contain Na or K are likely to be terrestrial in origin and were not considered further.

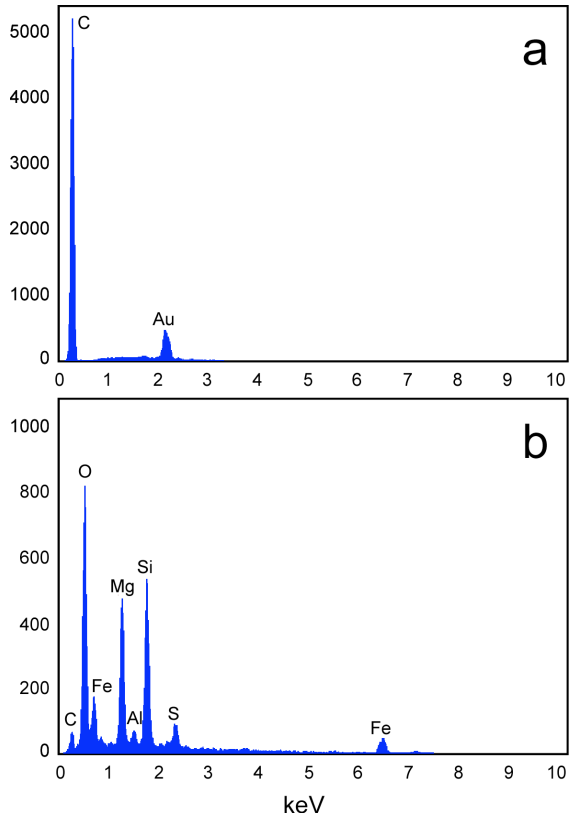

Figure 2. Energy dispersive X-ray spectra of 'low-Z' particles L2047 B12 (a) and L2008 H2 (b).

The Raman spectra show that all of the particles contain prominent first-order D and G band peaks (Fig. 3). In four of the particles the peaks have sharp and narrow features indicative of disordered graphite [e.g., 12]; these particles also exhibit second-order C peaks at 2662 cm^{-1}. These are the same four particles whose EDX spectra consist primarily of C (e.g., Fig. 2a).

The D and G band peaks in the other three particles are broader and resemble those of meteoritic insoluble organic matter (IOM) [13-15]. These particles all have chondritic spectra (e.g., Fig. 2b) and fine-grained textures (e.g., Fig. 1). Two different regions of particle L2008 H2 were measured. In addition to the D and G band peaks, one of the spectra (H2–1) exhibits a peak at 669 cm^{-1}, consistent with the presence of phyllosilicates. The other spectrum (H2–2) has a small peak at 2139 cm^{-1}, which may indicate a –CN functional group [e.g., 15].

NanoSIMS ion imaging did not show the presence of any isotopic anomalies for either C or O.

Conclusions: Our survey showed that, as expected, many of the particles classified as 'low-Z' appear to be terrestrial contaminants. However, several particles have characteristics that are consistent with an extraterrestrial origin. Specifically, L2008 C7, L2008 H2, and L2047 E39 have chondritic elemental compositions, fine-grained textures, and Raman spectra indicating the presence of IOM. However, the lack of presolar grains or other isotopically anomalous components precludes a definitive categorization of these particles. We will carry out additional NanoSIMS ion imaging in order to look for isotopic anomalies in C, N and H similar to those observed in UCAMMs, as well as many primitive IDPs.

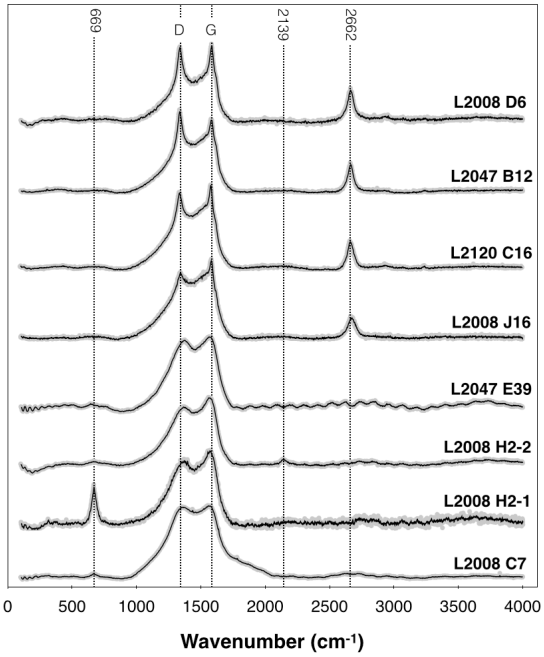

Figure 3. Raman spectra of 'low-Z' particles.

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