SYNCHROTRON FOURIER TRANSFORM INFRARED SPECTROSCOPY ON FRAGMENTS OF INTER-PLANETARY DUST PARTICLES (IDPS).

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Introduction: IDPs are among the most primitive materials available for laboratory analysis and contain pristine material essentially unaltered since solar system formation [1]. As >80 % may originate from comets [2], they allow the study of comets in the laboratory without sample return [3]. Our ultimate goal will be the (destructive) examination of the heavy noble gases in IDPs to assess the volatile contents in comets [4]. Before we will perform various correlated analyses including Raman spectroscopy [5] to identify the material that is most likely of cometary origin.

Here we present preliminary FTIR results from a first set of IDP fragments. The IDP analyses yield large spectral variations in the organic matter.

Experimental: Without any sample preparation, several fragments (typically 3-4 to up to 10 µm diameter) were split off bulk IDPs on NASA glass slides and transferred onto KBr windows. All particles were analyzed with the FTIR microscope at the ALS Berkeley (~600-4000 cm^{-1}) in mapping mode with diffraction-limited spatial resolution [6]. The IDPs were not pressed to allow removal for future NanoSIMS analysis.

Results and Discussion: Four IDPs from collector L2036 clusters 4 and 20 show the typical aliphatic hydrocarbon signatures observed earlier [e.g., 7,8]. Two of those may also indicate primary amine functionality, as one IDP from L2006. Both Raman [5] and FTIR spectroscopy of L2011 cluster 1 IDP fragments suggest only little OM, consistent with their non-chondritic-porous, metal-rich nature. A fragment from a L2005 cluster 26 IDP did not yield IR bands for OM above the detection limit, whereas another fragment shows the typical Raman parameters indicative of disordered C. Comet Grigg-Skjellerup collection IDPs were analyzed so far as two fragments of a L2054 cluster 1 IDP. Whilst one fragment does not yield IR results for OM above detection limit, the other shows potentially the signature of NO_2 compounds, but no aliphatic hydrocarbon bands. Raman spectroscopy on a different fragment indicates particularly disordered OM. One IDP from L2006 suggests carbonate.

These analyses will be supplemented by SEM and NanoSIMS examinations of both the fragments analyzed here by FTIR and their main IDP masses to determine chemistry and mineralogy, and the presence of isotopically anomalous organic matter and presolar grains. The preliminary tentative detection of carbonate, NO_2, primary amine and widespread aliphatic hydrocarbon (CH_2 and CH_3 stretch) functionality in the IDPs is consistent with their primitive, essentially unheated character and their origin from a variety of parent bodies including comets, where the OM did not experience homogenization and destruction.

References: [1] Bradley J.P. 2003. *Treatise on Geochemistry - Vol. 1*:689-711. [2] Nesvorný D. et al. 2010. *Astrophys. J.* 713: 816-836. [3] Busemann H. et al. 2009. *EPSL* 288:44-57. [4] Busemann H. et al. 2010. *41st LPSC* Abstract #1947. [5] Spring, N.H. and H. Busemann. 2011. *M&PS* 46: this volume. [6] Bajt S. et al. 2009. *M&PS* 44:471-484. [7] Matrajt G. et al. 2005. *Astron. Astrophys.* 433:979-995. [8] Flynn G.J. et al. 2003. *GCA* 67:4791-4806.