CARBON IN STARDUST FLIGHT AEROGEL BY XANES SPECTROSCOPY.

S. Wirick[1], G. J. Flynn[2], S. Sandford[3], D. Frank[4], A. Westphal[5], M. Zolensky[4]. [1]Physics Dept., SUNY StonyBrook, NY. E-mail: swirick@bnl.gov. [2]Physics Dept., SUNY Plattsburgh, NY. [3]NASA Ames Research Center, Moffett Field, CA. [4]NASA JSC, Houston TX. [5]Space Science Lab., UC Berkeley, CA.

Introduction: Stardust aerogel contains from one-quarter to a few weight-percent carbon as a manufacturing contaminant. This carbon occurs mostly in a simple Si-CH3 bond [1]. A description of the carbon-silicon bonding in the aerogel can be found in [2]. Most carbon analyses to date have not been on aerogel from the flight collector. To investigate possible contamination of this aerogel, nine picokeystones were cut from tiles 61 and 103 of the flight tray. Three picokeystones were cut from the comet facing side and six were cut from the backside of the tiles. Care was taken to not cut any keystones from track areas.

Samples and Methods: To check that the extraction was not a source of any organic carbon, a picokeystone was cut from flight spare aerogel. This aerogel is stored at Johnson Space Center under dry nitrogen. All picokeystones were sandwiched between two, 3 mm silicon nitride windows and stored in a dark, boil-off nitrogen purged box. Samples were kept in a helium environment during analysis. A scanning transmission X-ray microscope located at the National Synchrotron Light Source at Brookhaven National Laboratory was used to analyze the 10 picokeystones. Only areas approximately 5 microns in from the edges of the picokeystones were thin enough for carbon X-ray absorption near-edge structure (XANES) analysis. A total of six approximately 5 µm x 70 µm areas along the edge of each picokeystone were analyzed.

Results: Carbon XANES spectra collected from the flight spare aerogel have one spectrum from an area 5 µm x 70 µm that is similar to a spectrum reported [3]. There are 6 different carbon XANES spectra from this picokeystone. Two of the spectra have sharp absorption peaks at an energy of 288.3 eV, the bonding environment at this energy general involves a C=O bond. The other 4 spectra have very little sharp absorption features and one of the spectra is very similar to a silicon carbide carbon XANES spectrum. The other three spectra are also likely the result of different Si-C bonds. Excluding spectra already seen in the flight spare aerogel, we found at least 10 different carbon XANES spectra in the comet tray aerogel. Of these ten spectra, only one is from a possible Si-C bond. The other nine spectra have sharp, pi bond absorption peaks occurring at energies around 285 (C=C), 286.5, 287.0, 288.3, and 288.9 eV, with some of the spectra having only a 285 eV absorption which is commonly assigned to C=C in a ring bonding environment. Spectra are similar to spectra reported for Stardust particles [1,3,4]. The spatial variability is on the size scale of a few microns.

Conclusion: The Si-C bonding environment of Stardust aerogel is complicated and work needs to be done on the Si edge with spatial resolution of a few hundred nanometers to investigate this. Some of the carbon spectra found in the aerogel from the comet tray could be the result of radiation damage to the original aerogel from high energy X-rays and also from terrestrial oxidation of carbon in this aerogel.

References: [1] Sandford S. A., et al. (2006) , *Science* 314, 1720-1724. [2] Sandford et al. (2010) *MAPS*, in press. [3] Cody G. et al. (2008) *MAPS* 43, 353-365, [4] Wirick, S. et al. (2009) *MAPS* 44, 1611-1626