PRELIMINARY EXAMINATION OF AL FOIL I1077W,1 FROM THE STARDUST INTERSTELLAR COLLECTOR.

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Introduction: Preliminary examination of Al foils from the NASA Stardust Interstellar Dust Collector Tray is now underway. The interstellar dust flux is poorly constrained both in particle count and velocity, but calculations suggest that the entire surface of all exposed foils should contain on the order of craters from micron to sub-micron sized particles. Foils from the Cometary Tray, in contrast, can contain ~100 or more such craters per foil. This makes the level of effort required to identify an interstellar crater much high than that of cometary craters, but also the potential scientific value of each crater higher. Thus, efforts to-date have focused on rapid, non-destructive identification of craters through automated imaging of the foils with a scanning electron microscope (SEM).

Methods: For imaging of foil I1077w,1 we used a JEOL 7101f, variable-pressure, field-emission SEM, equipped with EDAX Genesis mapping system at the Naval Research Lab. Per preliminary examination protocol [2], prior to examination of the interstellar foil we verified that the carbon-build-up rate on a test sample during imaging due to hydrocarbons in the sample chamber was at acceptably low levels. For foil mapping, the microscope voltage was set to 15 kV with a nominal probe current of < 1 nA. The images were collected at a magnification of 1500× which corresponds to 40 nm/px, so that craters as small as 200 nm could be detected. Each 8-bit image is 2048 ×1600 pixels (82 × 64 μm). Approximately 2600 images were required to cover the entire area of this short (1 mm × 12 mm) foil. The focus and brightness and contrast levels were optimized manually at intervals of < 2 mm length, as surface debris caused automated routines to be unreliable. Images of the whole foil were collected, and are now being searched manually and with automated software [3].

Results: Two craters have been identified definitively after searching ~ 1200 of the images. An oblique 1.4 μm × 1.8 μm crater was detected manually, and a 1.1 μm symmetrical crater was detected by the automated software [3]. Both craters are possible interstellar grain impacts.

References: [1] Westphal A. et al. (2008) LPSC XXXIX, #1855; [2] Kearsley A. T. et al. (2010) LPSC XLI, #1593; [3] Ogliore R. C., et al. (2010) this volume.