SURVIVAL OF SUBMICRON REFRACTORY PRESOLAR GRAINS IN STARDUST AND STARDUST ANALOG CRATERS. T. K. Croat[1], C. Floss[1], A.T. Kearsley[2] and M.J. Burchell[3]. [1]Laboratory for Space Sciences and Physics Dept., Washington University, St. Louis, MO 63130, USA. tkc@wustl.edu. [2]Dept. of Mineralogy, Natural History Museum, London SW7 5BD, UK. [3]Centre for Astrophysics and Planetary Science, School of Physical Sciences, Univ. of Kent, Canterbury CT2 7NH, UK.

Introduction: The abundance of presolar grains in Wild2 has been revised upward (~600-830 ppm for O-rich presolar grains), based on demonstrated destruction/modification of presolar grains from a well-characterized primitive meteorite upon impact into STARDUST analog Al foils [1]. The mechanism(s) of this process are, however, as yet unknown. Studies of other STARDUST analog Al foils (from firing of refractory minerals into Al foils with a light gas gun) have demonstrated the intact survival of SiC [2] and also suggest that single grain impactors found in smaller (< 1 μm) craters may be better preserved than those in larger ones [2,3]. Here, we present further FIB-TEM studies of 1-2 μm diameter Al foil craters that result from the impact of submicron refractory grains.

Experimental Methods: A mixture of refractory materials (alumina, SiC, Si_3N_4, TiC, TiN, diamond and olivine) was shot at Al 1100 foil at 6.05 km/s with a two stage light gas gun [4]. The resulting foil craters were examined with SEM-EDXS and Auger spectroscopy to characterize surviving projectile material [5]. In this work, FIB sections were taken from four small craters (with diameters from 1.0 to 2.5 microns) that showed evidence of Ti-rich particles, and the crystal structures and chemical compositions of the surviving material were determined with TEM.

Results and Discussion: As expected, the small craters were consistent with single grain impactors and all contained intact crystalline grains. In the Ti-rich craters, electron diffraction and EDXS confirmed surviving TiN and TiC grains (both FCC; 4.3-4.4Å). Grain sizes were consistent with those of the original projectiles and little Ti was detected along crater walls, suggesting that intact survival of the entire refractory projectile is common. When struck by elliptical TiN grains (aspect ratios as high as ~2.5 were present in the projectile mix), the Al crater shape was influenced by the TiN orientation on impact, with craters ranging from bowl-shaped to more carrot-shaped depending on whether the TiN major axis was parallel or perpendicular to the foil, respectively. The Ti-rich and Si-rich [2] crater sizes are 2.5-3.1x larger than the surviving projectile sizes; after adjusting for impactor density, these craters are roughly half the size predicted by [6], and thus show a trend also seen in previous submicron STARDUST analog projectiles [7]. The intact survival of refractory presolar grain analogs suggests that small (~1μm) STARDUST craters are promising targets for the study of the fine fraction of cometary dust. FIB-TEM results from such craters (particularly those with chemical compositions consistent with more refractory phases) will be presented.

References: [1] Floss C. et al. (2013) *Astrophys. J*, 763, 140. [2] Croat T.K. et al. (2013) *Lunar Planet. Sci.* Abstract #2625. [3] Wozniakiewicz P.J. et al. (2012) *Met. Planet. Sci.* 47, 707. [4] Burchell M.J. et al. (1999) *Measurement Science and Technology*, 10, 41. [5] Croat T.K. et al. (2011) *Lunar Planet. Sci.* Abstract #2520. [6] Kearsley A.T. et al (2007) *Met. Planet. Sci.* 42, 191. [7] Price J.C. et al (2010) *Met. Planet. Sci.* 45, 1409.