NONDESTRUCTIVE QUANTITATIVE ANALYSIS OF STARDUST TRACKS FROM 3-DIMENSIONAL CONFOCAL LASER MICROSCOPY AND XRF MAPPING. M. Greenberg[1,2], D. S. Ebel[1,3]. [1]Dept. of Earth and Planetary Sciences, American Museum of Natural History, Central Park West at 79th St., New York, NY 10024. [2](mgreenberg@amnh.org), [3](debel@amnh.org).

Introduction: The Stardust mission to comet Wild 2 has provided numerous extraterrestrial particles and resulting 'tracks' of finer particles in melted silica aerogel [1]. We have utilized a combination of Laser Confocal Scanning Microscopy (LCSM) and Synchrotron X-Ray Fluorescence (XRF) to characterize a variety of whole tracks both morphologically and chemically, all in 3-dimensions [2]. The combination of both non-destructive methods provides comprehensive characterization of high value Stardust samples, prior to other destructive analysis methods, collecting a maximum of information.

Samples: Seven keystones containing a total of ten tracks have been imaged with LCSM: T82, T128a, T128b, T128g, T128d, T129, T140, T151, T152, and interstellar candidate track 4. Tracks examined range in length from 35µm to over 4500µm, and span all three types of tracks (A,B,C). LCSM images were taken at the AMNH Microscopy and Imaging Facility using a Zeiss LSM510 and were subsequently deconvolved using SVI Huygens 4.3. Tracks were analyzed using XRF at 18keV at Argonne National Labs' APS facility, GSECARS beamline 13ID.

Results and Discussion: Myriad track features such as particulate deposition, rifling along tracks and radial fractures were observed in 3D visualization of LCSM data. After deconvolution, tracks were outlined manually to fully quantify track geometry [2]. From outlined tracks we calculated track diameters, volumes, skewness from a normal line, radial eccentricity, and radial rotation, all as a function of track depth, using newly developed code. Skewness plots coupled with radial eccentricity and rotation plots quantify any rifling effects that may be present [3]. Further, quantification results indicate a non-linear deposition pattern for tracks, even in type A tracks (carrot), consistent with other 3D analyses [4].

XRF data allows calculation of total track mass and element abundances along tracks [5]. We have acquired and combined XRF and corresponding LCSM data, revealing the full morphological structure and chemical makeup of whole tracks in 3D. In principle, this data can be used to estimate the mass and volatile content of the original impactors that formed these tracks.

References: [1] Burchell M.J. *et al.* (2006) *Ann. Rev. Earth Planet. Sci*. 34: 385-418. [2] Greenberg, M., *et al.* (2009) LPSC *XL*, #2124. [3] Nakamura-Messenger K. *et al.* (2007) *LPSC XXXVIII* #2191. [4] Tsuchiyama, A. *et al.* (2008) *MetSoc 2008* #5336. [5] Lanzirotti A. *et al.* (2008) *Meteor. Planet Sci., 43*, 187-214.