# NANOSIMS AND AUGER ANALYSIS OF IMPACT CRATERS FROM THE GENESIS 'ALUMINUM KIDNEY'.

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**Introduction:** Studies of impact craters from spacecraft in low-Earth orbit [e.g., 1] typically regard any impact residue whose overall composition is not roughly chondritic as 'likely man-made'. This represents a significant sample bias and means that natural particles with non-chondritic compositions are likely to be overlooked when man-made debris is likely to be present. The 'aluminum kidney' of the Genesis spacecraft contains several impact craters identified by optical surveys [2-4]. Because the Genesis collector was only exposed to bombardment while the spacecraft was positioned at the Sun-Earth Lagrange point L1, all impacting particles can be assumed to be from natural particles. The Genesis craters therefore represent a unique opportunity to study impact debris without any prior compositional bias. Here we report the results of our initial investigation of two craters from the polished aluminum collector.

**Experimental:** The craters studied here come from subsamples 50684,10 and 50684,12 and are about 140 and 115 µm in diameter, respectively. NanoSIMS C and O ion imaging was carried out according to previously established procedures for Stardust impact craters [e.g., 5]; a total area of 13,575 $\mu m^2$ was mapped in the two craters. Auger spectra and elemental distribution maps were acquired using established protocols [6].

**Results and Discussion:** As the samples were not cleaned prior to allocation [3], both of the craters and the surrounding Al foil are covered with abundant particulate matter. Auger analyses show the presence of K, Mg, Si and O (in addition to Al), likely representing sediment from the Utah landing site [3]. Auger analyses of the crater rims were done prior to NanoSIMS mapping, and covered relatively large areas (30 to 315 $\mu m^2$). These spectra contain the same suite of elements seen in the grains, but in addition often also show peaks for S and F. After the NanoSIMS analyses, additional Auger measurements focused on individual grains located within areas that had been imaged by the NanoSIMS. In addition to Al and O, most spectra still contain peaks for K; Mg and Si are less common, while S and F are essentially absent.

We identified one isotopically anomalous region on the rim of the crater from subsample 50684,10; the grain is enriched in $^{17}O$, with close-to-solar $^{18}O/^{16}O$ ($^{17}O/^{16}O = 4.67 \pm 0.08 \times 10^{-4}$; $^{18}O/^{16}O = 2.01 \pm 0.02 \times 10^{-3}$), consistent with an AGB/RGB star origin [7]. Auger analysis showed no elements other than Al, O and C; it is, thus, possible that the grain sputtered away during the imaging measurement. Apart from this isotopically anomalous O signature, to date we have not identified any material associated with the two craters that can definitively be ascribed to an extraterrestrial origin. We will focus our future efforts on characterizing the bottoms of the craters, as these may be more likely to preserve residues from the impactor particles.

**References:** [1] Stadermann et al. (1994) NASA CP, 3275, 461. [2] Love and Alton (2006) Icarus 184, 302. [3] Rodriguez et al. (2008) LPS XXXIX, #2063. [4] Rodriguez et al. (2008) LPS XLVII, #1968. [5] Stadermann et al. (2008) MAPS 43, 299. [6] Stadermann et al. (2009) MAPS 44, 1033. [7] Nittler et al. (2008) ApJ 682, 1450.