A UNIQUE PRESOLAR GRAPHITE IN THE CO3.0 CHONDRITE LAP 031117.

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Introduction: Over the last 25 years, presolar graphite has been isolated and studied from acid residues of two meteorites, Murchison (CM) and Orgueil (CI) [1-3]. However, presolar graphite has not been identified *in situ* in meteorites. Here we report on the first definitive *in situ* identification of two presolar graphite grains from the CO3.0 chondrite LAP 031117.

Experimental methods: The two grains were identified by NanoSIMS ion imaging during our search for O- and C-anomalous grains in a thin section of LAP 031117, as described in [4]. Subsequently, Auger Nanoprobe elemental spectra and distribution maps (e.g., O, Si, and C) were acquired for the two grains. An inVia© Laser Raman imaging system (532 nm excitation wavelength, 100× objective) was also used to obtain mineralogical information on these grains.

Results and Discussion: Auger Nanoprobe measurements of the two grains (LAP-141 & LAP-149) show that they consist only of carbon (without measurable Si or N peaks), suggesting that they are probably graphitic. The grains are relatively small with diameters of about 500 nm and 1 µm, respectively. Raman analysis of LAP-149 confirmed that it is graphite, with a spectrum similar to presolar graphite from Murchison [5].

LAP-149 is characterized by one of the lowest $^{12}C/^{13}C$ ratios (2.04 ± 0.02) measured in presolar graphite; only one other grain, a high-density graphite from Murchison [2], has a similarly low $^{12}C/^{13}C$ ratio. The oxygen isotopic composition of LAP-149 is solar within errors. The origin(s) of presolar graphite and SiC grains with extremely low $^{12}C/^{13}C$ ratios (< 10) is still unclear, and several stellar origins have been proposed, including novae [6], Type II supernovae [7], J-type stars [3], and/or post-AGB stars [8]. We will measure the nitrogen and silicon isotopes to further constrain its stellar origin. The other grain, LAP-141, has a $^{12}C/^{13}C$ ratio (537 ± 25) similar to the majority of graphite grains which originated from AGB stars [2, 3].

Although CO3.0 chondrites (e.g., ALHA77307, LAP 031117, DOM 08006) are primitive meteorites characterized by high presolar silicate abundances [4], a noble gas study showed that they have extremely low abundances of presolar graphite (~0.08 ppm in ALHA77307 [9]). Based on the two grains identified, the total fine-grained area mapped (68,500 µm^2) and a matrix abundance of about 30%, we estimated a bulk presolar graphite abundance of 5 ± 3 ppm for LAP 031117. While our estimate is associated with large uncertainties, it is almost two orders of magnitude higher than the abundance measured by [9]. We will discuss several possibilities that might explain this discrepancy (e.g., laboratory processing or noble gas loss [10])

References. [1] Amari et al. (1990) Nature 345, 238. [2] Amari et al. (2014) GCA 133, 479. [3] Jadhav et al. (2013) GCA 113, 193. [4] Haenecour et al. (2015) LPSC XLVI, #1160. [5] Wopenka et al. (2013) GCA 106, 463. [6] Jose et al. (2004) ApJ 612, 414. [7] Nittler & Hoppe (2005) ApJ 631, L89. [8] Jadhav et al. (2013) ApJL 777, L27. [9] Huss et al. (2003) GCA 67, 4823. [10] Davidson et al. (2014) GCA 139, 248.