STARDUST IN THE SUTTER'S MILL METEORITE.

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Introduction: The Sutter's Mill meteorite (SM) is a CM chondrite breccia with a large diversity of characteristics in mineralogy and chemistry, reflecting a complex processing history on its parent body [1]. Clear evidence for rapid terrestrial alteration has been found [1,2]. This exemplifies how important it is to distinguish terrestrial alteration from parent body processing when interpreting observations from C chondrites. Parent-body processing also alters presolar grain abundances in meteorites [3,4]. We are thus interested in characterizing the inventory of presolar grains in SM. Our ultimate goal is to quantify the effect of the different kinds of alteration in SM on the basis of presolar grain abundances.

Samples & Methods: Specimen SM01 (FM Me6061) was the first fragment found, just two days after the April 22, 2012 meteorite fall, and was among several SM samples donated to the Field Museum by T. Boudreaux. SM01 was not exposed to rain, in contrast to SM47 (FM Me5799) which was found nine days after the fall [1]. Polished epoxy mounts of SM01 and SM47 were produced with diamond lapping films and high-purity isopropanol in order to minimize exposure to water. Fine-grained matrix areas in rims of larger objects were screened with SEM/EDS for Si hotspots indicative of the presence of SiC [5]. These areas were then analyzed with the Washington University NanoSIMS with a Cs^+ primary beam to search for isotopic anomalies in C and O.

Results & Discussion: We found a total of seven presolar grains in 7,800 μm^2 of matrix. Three presolar mainstream SiC grains were detected in SM47 ($^{12}C/^{13}C$=56.9±4.4, 59.8±4.8, 57.4±1.9). In SM01 we found two mainstream SiC grains ($^{12}C/^{13}C$=66.5±2.2 and 78.0±1.2), one probable C-anomalous nanoglobule ($^{12}C/^{13}C$ = 83.8±0.5) and one probable oxide grain ($^{17}O/^{16}O=7.2\pm0.2\times10^{-4}$; $^{18}O/^{16}O=1.86\pm0.03\times10^{-3}$). Matrix-normalized abundances of probable C-nanoglobules and oxides in SM01 are 36 ppm and 7.5 ppm, respectively. This suggests SM is not as primitive as Acfer 094 or other meteorites with high presolar silicate abundances. SiC abundances are 21 and 49 ppm for SM01 and SM47, respectively, similar to values reported for primitive chondrites [6,7]. Our total SiC abundance is ~8× higher than what was estimated from Ne-E concentrations of bulk SM [8]. Such discrepancies have been observed for CR chondrites [6,7] but not for CM chondrites [6]. Degassing of SiC in the parent body [6] or ISM are plausible explanations, which would be also supported by the observation that only a fraction of presolar SiC is rich in Ne-E [9]. More matrix will be searched in order to improve abundance estimates and quantify the effect of alteration on presolar grain abundances.

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