NUCLEOSYNTHETIC NE-21 AND OTHER SURPRISES FROM 92 PRESOLAR GRAPHITE GRAINS FROM MURCHISON.

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Introduction: We have analyzed the He, Ne isotopes of 92 individual presolar graphite grains from the high-density (2.15-2.20 g/cm^3) graphite fraction KFC1 of the carbonaceous chondrite Murchison. This work is part of our ongoing investigation of the noble gas content of individual presolar SiC and graphite grains, in order to identify their stellar sources. The C and Si isotopic composition of the analyzed grains has been measured using the NanoSIMS in St. Louis. Noble gases in graphite from the KFC1 fraction have been analyzed before by [1]. They found significant amounts of nucleosynthetic and radiogenic ^{22}Ne, above their detection limit in only 3 out of 46 (7%) of the analyzed grains. Compared to the lower-density KFB1 fraction, where 22% (11 out of 51) [2] to 28% (14 out of 49) [3] of all presolar grains are gas-rich, this is a surprisingly small number.

Samples & Methods: Of the total of 92 grains analyzed, 36 were selected for their extreme C (^{12}C/^{13}C: <20 or >1000) or Si (δ^{29}Si, δ^{30}Si anomalies of +-100‰ or more) isotopic composition, indicating a supernova origin in most cases. Analyzed grains are biased toward larger sizes. Because of the very small gas amounts involved, the analysis was done with an ultra-high-sensitivity mass spectrometer [4] and a low blank extraction line. Detection limits for ^{3}He, ^{4}He, ^{20}Ne, ^{21}Ne and ^{22}Ne (in units of 10^{-15} ccSTP and defined by the 2σ deviation of all 62 blanks) were 0.45, 427, 31, 0.61 and 5.6, respectively.

Results: 1) Eight out of 92 grains (8.7%) have excesses of ^{22}Ne above the detection limit as defined above, and four (4.3%) have an excess over a 3σ detection limit. From the non-detection of a significant ^{20}Ne excess in all eight grains, a ^{20}Ne/^{22}Ne upper limit of (~1 to 5.4) can be derived, excluding a high memory contribution (of atmospheric composition) as explanation for the observed excesses. Ne-22 concentrations in individual grains vary between 1.2 x 10^{-4} and 9.7 x 10^{-3} ccSTP/g. A bulk concentration of 5.9 x 10^{-5} ccSTP/g can be derived for ^{22}Ne, a value similar to the ones given in [1] and [5]. 2) In one grain (that showed no ^{22}Ne excess), we also detected ^{4}He, with a concentration of 6.97 x 10^{-2} ccSTP/g. He-4 from presolar graphite has been detected before in a KFB1 grain by [2]. 3) In one of the eight grains with ^{22}Ne excess, a significant excess of ^{21}Ne was also detected. This has not been observed before in presolar graphite.

Discussion: We will present possible nucleosynthetic sources for all the grains with noble gas excesses. The ^{21}Ne excess observed in one grain cannot be explained by cosmic-ray exposure in the interstellar medium. The most probable explanation is a nucleosynthetic origin. We propose that this grain condensed in the C/O zone of a 15 solar mass supernova [6].

References: [1] Kehm et al. (1996), *Lunar and Planetary Science Conference XXVII* #657. [2] Heck et al (2009) *Astrophysical Journal* 701:1415-1425. [3] Nichols et al. (1994) *Meteoritics* 29(4):510-511. [4] Baur H. (1999) *EOS Trans. AGU* 46, F1118. [5] Amari et al. (1995) *Geochimica and Cosmochimica Acta* 59(7):1411-1426. [6] Rauscher et al. (2002), *Astrophysical Journal* 576/1:323-348.