PRESOLAR GRAPHITE FROM THE MURCHISON METEORITE.

S. AMARI[1], E. ZINNER[1], R. GALLINO[2] and R. S. LEWIS[3]. [1]Laboratory for Space Sciences and the Physics Department, Washington University, St. Louis, MO 63130, USA. E-mail: sa@wuphys.wustl.edu. [2]Dipartimento di Fisica Generale, Universita' di Torino, 10125 Torino, Italy. [3]Enrico Fermi Institute, The University of Chicago, Chicago, IL 60637, USA.

Introduction: Presolar graphite grains from the four Murchison separates, KE3 (1.65–1.72 g/cm^3), KFA1 (2.05–2.10 g/cm^3), KFB1 (2.10–2.15 g/cm^3), and KFC1 (2.15–2.20 g/cm^3) [1] have been extensively studied [2-4]. Isotopic, elemental, and morphological features of presolar graphite depend on density. We have compiled data on ~1,700 graphite grains extracted from Murchison, mainly obtained with secondary ion mass spectrometry, and discuss stellar sources of the grains.

Discussion: In general, grains from KE3 and KFA1 formed in core-collapse supernovae [4, 5], while those from KFB1 and KFC1 formed in asymptotic giant branch (AGB) stars [6]. However, detailed examination reveals differences between the separates [7]. In order to evaluate those differences as well as similarities, we divide the graphite grains into three populations based on their C isotopic ratios. Grains having $10 \leq {}^{12}C/{}^{13}C$ are categorized as Population I, those having $10 < {}^{12}C/{}^{13}C < 200$ as Population II, and those with $\geq {}^{12}C/{}^{13}C$ as Population III.

Population I. Grains of this population are enigmatic. Many of them have normal isotopic ratios except for their extreme C isotopic ratios. However, at least some of the population I grains from all four separates formed in supernovae, showing ^{18}O excesses, ^{25}Mg excesses, high inferred $^{26}Al/^{27}Al$ ratios, and ^{28}Si excesses.

Population II. Many of these grains from KE3 and KFA1 formed in supernovae. A few KFB1 grains with ^{18}O and ^{28}Si excesses undoubtedly have a SN origin. In contrast, no KFC1 grains show typical SN signatures such as ^{18}O and ^{28}Si excesses. Only one grain has $^{29,30}Si$ excesses and Ca and Ti isotopic anomalies, showing a signature of neutron capture. It remains to be seen whether this grain formed in an AGB star or a supernova.

Population III. Only few grains from KE3 and KFA1 belong to this population. The KE3 grains show the highest $^{18}O/^{16}O$ (0.37) and $^{26}Al/^{27}Al$ (0.13) ratios. In contrast, a few KFA1 grains have ^{18}O excesses, with $^{18}O/^{16}O$ ratios much lower than those observed in the KFA1 grains from population II. Most grains from KFB1 and KFC1 are in population III. Grains with excesses of the neutron-rich Si isotopes are often found among KFB1 and KFC1 grains, but the ^{30}Si excesses are much larger than the ^{29}Si excesses, suggesting neutron capture. Although no KFB1 grains show ^{18}O and/or ^{28}Si excesses, two KFC1 grains show ^{18}O and ^{28}Si excesses, respectively: among KFC1 grains, there are a few with a typical supernova signature, but there are none among KFB1 grains.

References: [1] Amari S. et al. 1994. *Geochim. Cosmochim. Acta* 58: 459-470. [2] Amari S. et al. 1995. *Geochim. Cosmochim. Acta* 59: 1411-1426. [3] Hoppe P. et al. 1995. *Geochim. Cosmochim. Acta* 59: 4029-4056. [4] Travaglio C. et al. 1999. *Astrophys. J.* 510: 325-354. [5] Nittler L. R. et al. 1996. *Astrophys. J.* 462: L31-L34. [6] Amari S. et al. 2004. *Meteorit. Planet. Sci.* 39: A13. [7] Amari S. et al. 2004. *35th Lunar Planet. Sci. Conf.* Abstract #2103.