

ISOTOPIC ANALYSIS OF PRESOLAR GRAPHITE FROM THE KFB1 MURCHISON SEPARATE.

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Introduction: Presolar graphite grains extracted from the Murchison meteorite have a range of density (1.6–2.2g/cm³) [1]. Low-density graphite grains (1.65-1.72g/cm³) are larger (up to 20µm) and have higher trace element concentrations than higher-density graphite grains. Consequently, the former have been well studied and isotopic ratios of the grains analyzed with ion probe indicate that they formed in supernovae [2, 3]. In contrast, only few isotopic analyses of trace elements in grains from the second highest density fraction KFB1 (2.10–2.15g/cm³) exist. In this study, we measured N and Si isotopic ratios of 170 KFB1 grains in multi-detection mode with the NanoSIMS at Washington University. Carbon and O isotopic ratios of these grains had previously been analyzed [4].

Results and Discussion: Of 7 grains with ¹⁸O excesses (solid circles in Fig. 1), five show ²⁸Si excesses, grain 061 a moderate ²⁹Si excess and ³⁰Si deficit, and grain 636 ²⁹Si and ³⁰Si excesses. These Si isotopic features, together with the ¹⁸O excesses, are indicative of the grains’ supernova origin [2, 3]. Twenty-two grains (squares) have ³⁰Si values higher than 50‰ and ¹²C/¹³C ratios between 122 and 1531. Their ³⁰Si excesses are much more pronounced than their ²⁹Si excesses, suggesting that the grains formed in low-metallicity asymptotic giant branch (AGB) stars. Similar Si isotopic features are also observed in high-density graphite separates (2.02-2.12g/cm³) from the Orgueil meteorite [5].

Grains from KFB1 show two distinct populations: grains with ¹²C/¹³C < 20 and those with ¹²C/¹³C > 20, with median ratios of 10 and 308, respectively. Many of the latter grains, namely those with ¹²C/¹³C > 100, most likely formed in low-metallicity AGB stars as discussed above. The origin of the former, however, remains enigmatic. In contrast to their ¹²C/¹³C ratios, their ¹⁸O/¹⁶O and Si isotopic ratios are normal within errors.

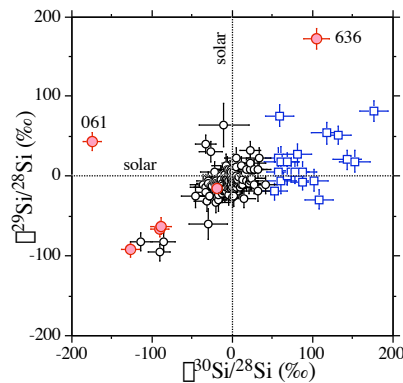


Fig. 1. Silicon isotopic ratios of KFB1 graphite grains. A grain with $\delta^{29}\text{Si}/^{28}\text{Si} = -346 \pm 7\text{‰}$ and $\delta^{30}\text{Si}/^{28}\text{Si} = -501 \pm 7\text{‰}$ is not shown.

References: [1] Amari S. et al. 1994. *Geochim. Cosmochim. Acta* 58:459-470. [2] Amari S. et al. 1995. *Astrophys. J.* 447: L147-L150. [3] Travaglio C. et al. 1999. *Astrophys. J.* 510: 325-354. [4] Amari S. et al. 2005. Abstract #1867. 36th Lunar & Planet. Sci. Conf. [5] Jadhav M. et al. 2005. this volume.