

**INTERSTELLAR GRAPHITE IN MURCHISON: CONTINUED SEARCH FOR ISOTOPICALLY DISTINCT COMPONENTS.** Sachiko Amari<sup>1,2</sup>, Ernst Zinner<sup>1</sup>, and Roy S. Lewis<sup>2</sup>, <sup>1</sup>McDonnell Center for the Space Sciences and the Physics Department, Washington University, St. Louis, MO 63130, <sup>2</sup>Enrico Fermi Institute, University of Chicago, Chicago, IL 60637.

We have measured C-, N-, and O-isotopic ratios of individual graphite grains from the Murchison density fractions KFB1 (2.1-2.15 g/cm<sup>3</sup>) and KFC1 (2.15-2.20 g/cm<sup>3</sup>). According to the C-isotopic composition, KFC1 consists of two populations: one has light C while the other has heavy C (Fig. 1). In addition to these two populations, KFB1 also contains grains whose C-isotopic ratios are approximately normal (Fig. 1). In view of these isotopic distributions it is difficult to understand why the Kr-isotopic compositions of these two separates are so different [1]. In contrast to the lighter density fractions KE1 (1.6-2.05 g/cm<sup>3</sup>) and KFA1 (2.05-2.10 g/cm<sup>3</sup>) [2], the separates KFB1 and KFC1 do not seem to contain many grains with significant <sup>18</sup>O excesses.

Graphite, the carrier of Ne-E(L), is the third type of pre-solar dust identified in primitive meteorites. Four graphite fractions (KE1, KFA1, KFB1, and KFC1) have been extracted from the Murchison meteorite by chemical etching, density and size separation [3]. Noble gas studies [1,4] have shown that there are at least two types of carriers of Ne-E(L), which have different density (1.6-2.15 g/cm<sup>3</sup> vs 2.15-2.20 g/cm<sup>3</sup>) and different Ne-E(L) release temperatures (700 vs 900-1000 °C extraction coil temperature) and two distinct components in the Kr isotopes. Ion microprobe measurements [5,6] have shown that there are differences in the distribution of C isotopic ratios among different fractions.

Two fundamental questions to be addressed are how many populations of grains can be distinguished in these graphite fractions, and whether it is possible to correlate noble gas data with isotopic data obtained with the ion microprobe. To answer these questions, we need to minimize any biases in the selection of grains from the density fractions. For the previous ion probe studies, we tended to select larger (>1.5 μm) grains in order to be able to make as many measurements as possible. This time, we tried to measure all round grains that were found in a selected area on the gold foil on which grains were deposited from suspension. The size distributions in Fig. 1 reflect the difference in selection criteria. However, the distribution of KFB1 is still biased in favor of larger grains since interferences from contamination on the grain mount did not allow us to obtain reliable C-isotopic data on the smallest grains.

We measured C- and N-isotopic ratios in 72 grains from the KFB1 fraction. In the C-isotopic distribution (Fig.1), the population with heavy C is not as distinct as in the previous study. This might be due to the difference in grain size distribution. However, both studies show two populations with normal and with light C. Because of interference problems, N-isotopic ratios were measured in only two thirds of the grains. All are normal except in two grains which have heavy N (<sup>14</sup>N/<sup>15</sup>N=156±6 and 153±19).

We measured 157 grains from KFC1. This fraction has two populations with light and heavy C, the population with normal C is largely missing. Except for this population with normal C in KFB1, the isotopic distributions are similar for these two fractions (Fig. 1), in marked contrast to the <sup>86</sup>Kr/<sup>82</sup>Kr ratios, which are completely different [1]. Since the N contents of KFC1 grains are low (CN<sup>-</sup>/C<sup>-</sup> is down to 4x10<sup>-3</sup>; N is measured as CN<sup>-</sup>), the N-isotopic ratios have large errors. Most of the grains are normal. Six grains have <sup>14</sup>N/<sup>15</sup>N ratios smaller than 195, deviating from the normal ratio of 273 by more than 3σ.

The <sup>16</sup>O/<sup>18</sup>O ratios of selected grains from both fractions are plotted in Figs. 2 and 3 together with previous measurements on grains from the two lighter density fractions, KE1 and KFA1 [2]. In the latter two fractions, excesses in <sup>15</sup>N and <sup>18</sup>O are positively correlated. In this work, all grains with normal N have normal O. Among the grains with N anomalies, one from KFB1 (<sup>14</sup>N/<sup>15</sup>N=156±6) has normal O. We could not measure the other grain with heavy N because of interference problems. Of the six grains with anomalous N from KFC1, two had

interferences from adjacent grains, another three have normal O. The sixth grain (indicated by arrows in Figs. 2 and 3) is somewhat enriched in  $^{18}\text{O}$  ( $^{16}\text{O}/^{18}\text{O}=275\pm 47$ ;  $^{12}\text{C}/^{13}\text{C}=365\pm 43$ ,  $^{14}\text{N}/^{15}\text{N}=93\pm 17$ ). However, in both correlation plots (Figs. 2 and 3) this grain falls outside the trends for the KE1 and KFA1 grains with  $^{18}\text{O}$  excesses (these trends are indicated by broken lines in the figures). Grains with  $^{15}\text{N}$  and  $^{18}\text{O}$  excesses appear to be preferentially concentrated in the low density fractions. While further measurements are desirable to confirm this conclusion and to test the apparent relationship between  $^{15}\text{N}$  and  $^{18}\text{O}$  excesses and high  $^{26}\text{Al}/^{27}\text{Al}$  ratios [2], this pursuit is frustrated by the low abundance of such grains and the lack of extremely clean sample mounts necessary for such studies.

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Fig. 1

