A FIRST LOOK AT GRAPHITE GRAINS FROM ORGUEIL: MORPHOLOGY, CARBON, NITROGEN AND NEON ISOTOPIC COMPOSITIONS OF INDIVIDUAL, CHEMICALLY SEPARATED GRAINS.

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Presolar graphite in Murchison has been extensively studied [1, 2, 3]. It is characterized by a unique Ne isotopic composition, known as the Ne-E(L) component. According to studies by Huss and Lewis [4], the concentration of Ne-E(L) in Orgueil is about one order of magnitude higher than in Murchison, when normalized to the matrix. This could be due to a higher presolar graphite abundance in Orgueil, or due to a higher Ne-E concentrations per grain. The Ne isotopic compositions in individual presolar graphite grains from Murchison have been measured before [5, 6, 7]. It was shown, that a third of the grains have detectable excesses in ^{22}Ne, characteristic of the Ne-E(L) component. One grain in a hundred had a ^{22}Ne concentration two orders of magnitude higher than blank.

Our attempt to separate presolar graphite in Orgueil led us to the discovery of an abundant graphite component of apparent solar system origin in this meteorite.

Chemical separation has been carried out according to procedures applied previously to Murchison [2]. Small modifications were necessary due to the higher concentrations of carbonaceous material in Orgueil. After a series of density separations a small amount of material with estimated density of ~1.8 g/cm^3 was isolated. It was futher separated into two size fractions: larger and smaller than 1 μm. Grains larger than 1 μm in diameter were deposited on a gold mount. 317 spherules were then located and identified as graphite by x-ray analysis conducted on a JEOL-840A scanning electron microscope.

Field emission SEM imaging revealed a stunning resemblance of the Orgueil grains to the Murchison presolar graphite. Most of the grains had smooth surface and had evidently the "onion structure" (Fig.1), characteristic of Murchison presolar graphites.

NanoSIMS isotopic analyses of C and N isotopic ratios were conducted on 162 grains in multidetection mode previously described [8]. Carbon isotopic ratios do not differ greatly from solar (Fig. 2) and do not display the large range (more than three orders of magnitude) found in graphite grains from Murchison [9]. ^{14}N/^{15}N ratios are slightly higher than solar (Fig.2).

Finally, we measured neon isotopic compositions in 14 individual grains. A gold mount with deposited graphite grains was placed in a laser extraction cell of the noble-gas mass spectrometer for analysis. Laser extraction was conducted with a Nd-YAG laser operating in CW-mode, with gradually increasing power to prevent grains from jumping from the mount.

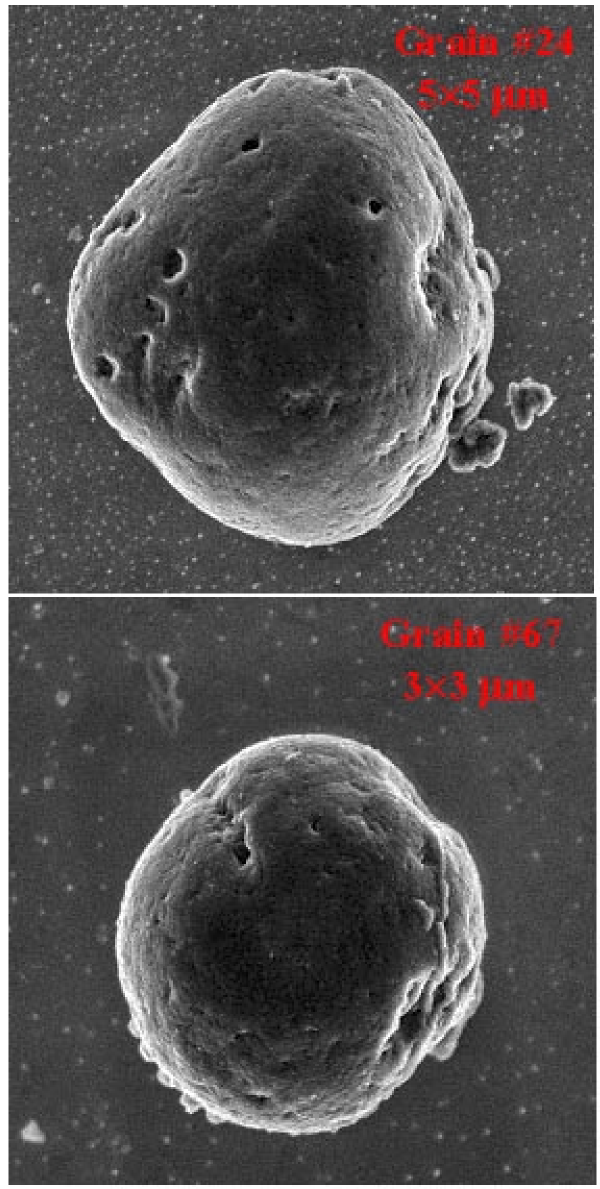

Figure 1. Typical graphite grains from Orgueil.

Laser extraction time depended on the size of the particular grain analyzed. We heated each grain additionally for 5 seconds after it had melted to ensure complete release of neon. Released gases were exposed to freshly deposited Ti-film getter, separated from the active components on charcoal at the temperature of liquid nitrogen. Finally, neon isotopic compositions were measured by high transmission ion-counting mass-spectrometry [10]. Graphite grains were analyzed according the blank-sample-blank scheme. Ne results are shown in Fig. 3. Evidently there is no measurable excess of ^{22}Ne in any of analyzed graphite grains. There is a slight tendency of decreasing ^{22}Ne in both graphite and blanks.

Our neon, carbon and nitrogen isotopic analyses confirmed that, despite their “presolar” appearance, the low density graphite grains from Orgueil studied here are undoubtly of solar system origin.

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References: [1] Anders E. and Zinner E. (1993) *Meteoritics* 28, 490-574. [2] Amari S. et al. (1994) *GCA* 58, 459-470. [3] Amari S. et al. (1995) *GCA* 59, 1411-1426. [4] Huss G. R. and Lewis R. S. (1995) *GCA* 59, 115-160. [5] Nichols R. H. Jr. (1992) Ph.D. thesis, Washington University. [6] Nichols R. H. Jr. et al. (1992) *LPSC* 23, 989-990 (abs.). [7] Nichols R. H. Jr. et al. (1994) *Meteoritics* 29, 510-511 (abs.). [8] Amari S. et al. (2002) *LPSC XXXIII*, Abstract #1205 [9] Hoppe P. et al. (1995) *GCA 59*, 4029-4056 [10] Hohenberg C. M. (1980) *Rev. Sci. Instr. 51*, 1075-1082.

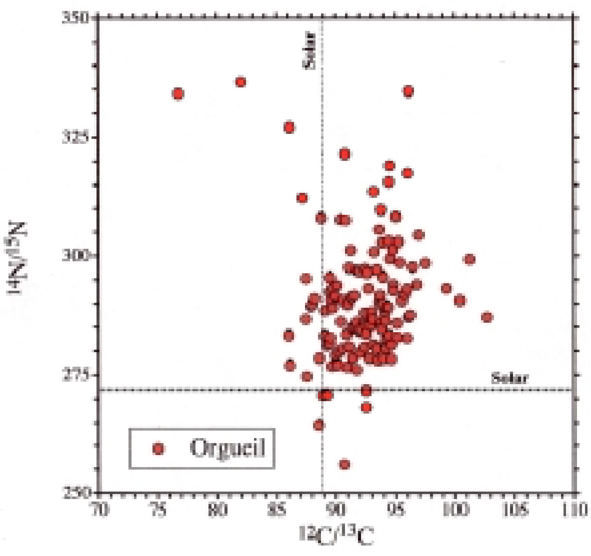

Figure2.

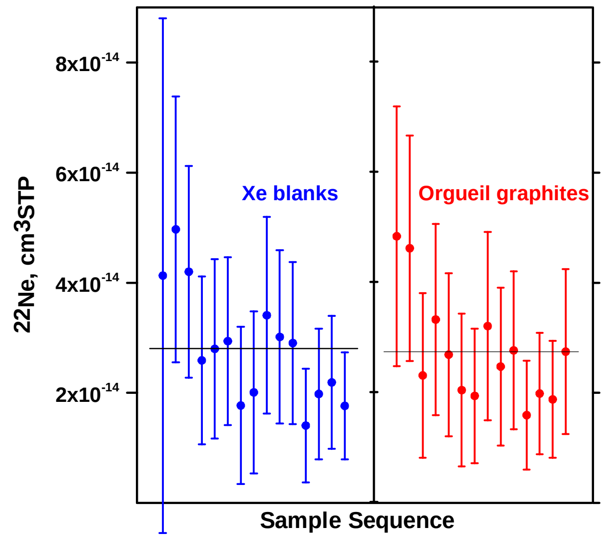

Figure 3.