PRESOLAR DIAMONDS IN KRYMKA: C, N AND Xe ISOTOPE DATA FROM GRAIN-SIZE SEPARATES AND COMPARISON WITH OTHER METEOROTES. A. B. Verchovsky[1], A. V. Fisenko[2], L. F. Semjonova[2], I. P. Wright[1] and C. T. Pillinger[1], a.verchovsky@open.ac.uk,[1]The Open University, Walton Hall, Milton Keynes MK7 6AA, UK [2]Vernadsky Institute of Geochemistry and Analytical Chemistry RAS, Moscow, Russia.

Introduction: In this study we present the first results from an investigation of C, N and Xe isotopic compositions in a new set of grain-size fractions of presolar diamonds separated from the Krymka (LL3.1) ordinary chondrite. This is the third meteorite which we have analysed in this way; Efremovka (CV3) and Boriskino (CM2) have been analysed previously [1, 2] and are quite different from Krymka in terms of their parent body composition and metamorphic history. Comparison of isotopic data allow us to investigate how metamorphism on different parent bodies has affected the diamonds and gaseous component trapped within them. In addition we can asses whether there are any differences in diamond populations sampled by these bodies. In contrast to similar studies of bulk diamond fractions [3, 4], grain-size separation allows a more detailed and specific investigation due to better resolution of the components present in the diamonds.

Experimental technique: Presolar diamonds have been separated from the bulk Krymka sample using standard techniques (i.e.[5]). Colloidal diamonds then were treated to ultracentrifugation in the way we have described before [1]. Four grain-size fractions were obtained in two sequential ultracentrifugations allowing us to deduce a relative sequence of grain sizes in the fractions. All the fractions, along with the unseparated bulk diamond sample, were analysed for C, N and noble gas isotopes using two static machines described earlier [1, 6].

Results: In a similar way to all results obtained so far for grain-size fractions of presolar diamonds [1, 2], the new samples show a clear systematic dependence of all the noble gas concentrations and isotopic compositions on grain size. For instance, Xe concentrations very by a factor of 4 and $^{136}Xe/^{132}Xe$ ratio by 12% between the coarsest and the finest fractions. Similarly, way C and N isotopic compositions show significant systematic variations with grain size from -18 to -39‰ and from -210 to -320‰ respectively.

Discussion: All the chemical and isotopic similarities suggest that diamonds in meteorites of different groups are basically the same in terms of their origin. Their all contain three components of noble gases (P3, HL and P6 [7]) implanted likely with different energies into the same or similar (in grain-size distribution) diamond populations which have been more or less completely mixed in the solar nebula and uniformly distributed between different parent bodies in the early Solar System. Nebular processing, thermal metamorphism and aqueous alterations on the parent bodies affect the noble gas system in the diamonds mostly by removing the least resistant low temperature P3 component such that its concentration in diamonds is a function of metamorphic grade [3]. Applying such a criterion to diamonds from the three meteorites considered herein (Fig. 1) shows that Krymka is the most processed meteorite as its diamonds have the lowest relative abundance of the P3 component. The least processed material is represented by Boriskino with the highest relative abundance of P3 gases. Efremovka has an intermediate position closer to Krymka than to Boriskino. The curves shown in Figure 1 can be regarded as mixing lines between a pure HL composition with $^{136}Xe/^{132}Xe \approx 0.7$, (equivalent for all the meteorites) and that representing the P3/HL mixing ratio, which is different for each meteorite.

The reason for the variations of C and N isotopic compositions with grain size of diamonds is less well understood. From figs 2 and 3 it can be seen that for diamonds from each meteorite two end-members can be identified which seem to be different in each case. At least this is definitely true for the end-members with relatively heavier composition. It appears that the higher the processing experienced by meteorite, the heavier the isotopic composition of the end-member for both C and N. One of the reasons for the observation could be that thermal metamorphism destroys diamond of certain isotopic compositions. A more attractive explanation, however, is that the

difference in the compositions of the heavy end-members is associated, not with meteorite processing, but rather with meteorite type, i.e. with its chemical composition. In this case we can speculate that material accreted from different parts of the solar nebula contained diamonds with different C isotopic compositions. If so, then most of the diamonds with the heavy end-member isotopic compositions are not associated with Xe-HL since there is no correlation between Xe-HL isotopic composition and the type of meteorites (Fig. 1). As a hypothesis to explore further we propose that these isotopically heavy diamonds (i. e. with $\delta^{13}C \approx$ -14, -23 and -30‰ and $\delta^{15}N \approx$ -180, -210 and -225‰ respectively) could have a Solar System origin [8]. Obviously such a proposal will require further work to substantiate.

References [1] Verchovsky A. B. at al. (1998) Science *281*, 1165-1168. [2] Verchovsky A. B. et al. (1999) LPSC XXX, abstr. 1746. [3] Huss G. R and Lewis R. S. (1994) *Meteoritics, 29*, 811-829. [4] Huss G. R. et al. (2003) GCA 67, 4823-4848. [5] Amari S. et al. (1994) GCA 58, 459-470. [6] Wright I. P. and Pillinger C. T. (1989) US Geol. Bull. 7890, 9-34. [7] Huss G. R and Lewis R. S. (1994) *Meteoritics, 29*, 794-810. [8] Dai Z. R. et al. (2002) Nature 418, 157-159.

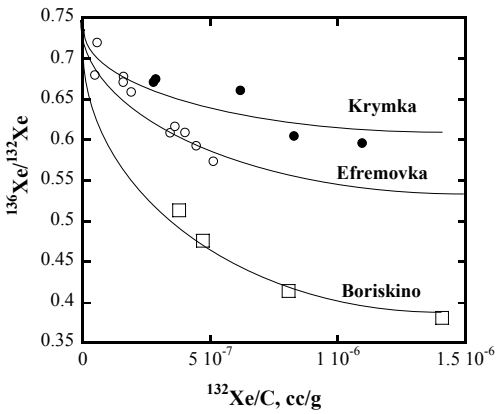

Figure 1. Correlation between Xe concentrations and isotopic compositions in grain-size fractions of presolar diamonds from different meteorites.

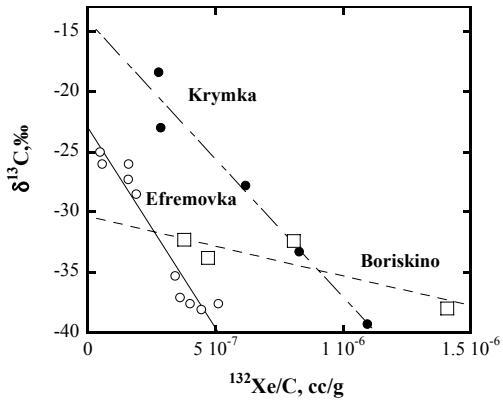

Figure 2. C-Xe three-isotope diagram. Carbon end-members isotopic compositions of the two-components mixtures are different in different meteorites.

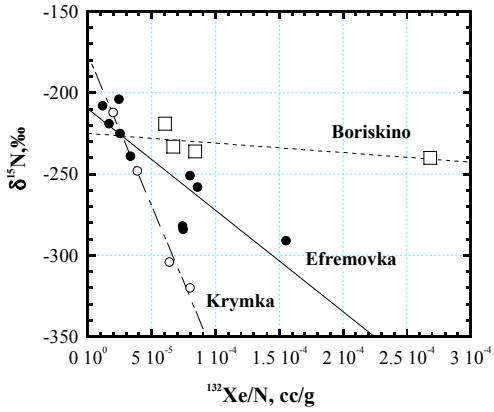

Figure 3. The same as in Figure 2 for N-Xe system.