

C, N AND NOBLE GASES IN DIFFERENT pH AND GRAIN SIZE FRACTIONS OF PRE-SOLAR DIAMONDS FROM BORISKINO CHONDRITE. A. B. Verchovsky¹, A. V. Fisenko², L. F. Semenova², I. P. Wright¹ and C. T. Pillinger¹, ¹PSSRI, Open University, Walton Hall, Milton Keynes, MK7 6AA, UK, ²Vernadsky Institute of Geochemistry and Analytical Chemistry RAS, 19 Kosygin str. Moscow, 117975, Russia.

Introduction: Recently it has been shown that pre-solar diamonds extracted from meteorites can be separated into grain-size fractions by means of ultracentrifugation [1,2]. It transpires that grains of different sizes have distinct carbon, nitrogen and noble gas isotope signatures. In addition, noble gas concentrations vary by orders of magnitude [3], which has been explained by ion implantation [4]. We believe that grain-size analysis offers the best hope of understanding the nature of the isotopically and genetically different components acquired by diamonds during their irradiation history. It is already well established that the behavior of nanometre diamonds in solution (and during ultracentrifugation, in particular) is determined by their charge, which depends on the number of acid groups on their surfaces [5]. To investigate whether parameters such as particle grain size and/or number of defects on their surfaces are affected by solution chemistry, we have extended the grain-size separation technique to combine ultracentrifugation with colloidal separations at different pH.

Experimental: The starting material was a diamond colloid isolated from Boriskino (CM2). This diamond was centrifuged (700g, 6h) at pH~3 to produce a supernatant (designated as BD-1) and a sediment. The sediment was then transferred into solution at pH~3.8 and centrifuged (700g, 6h) to produce two further fractions (supernatant BD-2) and sediment. The sediment was repeatedly centrifuged (700g, 6h) at pH > 5 to produce supernatant (fraction BD-3) and another sediment. Each fraction was then put into solution at pH>5 and ultracentrifuged simultaneously (10⁵g for 4 h) to produce samples of sediment and supernatant (designated a and b). These were then analysed by MS-86 [6] for carbon isotopes and Finesse [7] for C, N and noble gases. Herein we present the results for BD-1a, BD-1b, BD-3a and BD-3b.

Results: As in previous studies [1,2] grain-size fractions a/b for BD-1 and BD-3 showed differences in concentrations and isotopic compositions of all elements analysed. However, we also observed smaller but significant differences between BD-1 and BD-3 (Figure). For some parameters ([Ar], [Xe] and Xe isotopes) these differences are in keeping with the variations observed between a and b which suggests that pH separation is sensitive to grain sizes. In contrast, variations in nitrogen isotopes and [⁴He] between BD-1 and BD-3 are at odds with simple grain

size separation. It seems that other properties, such as the presence of defects, for instance, might play a role during pH separation, indicating that these diamonds could represent a different population. In particular, the data in the Figure indicate that in addition to two major diamond populations - (i) the carrier of Xe-HL with relatively heavy carbon isotopic composition (δ¹³C>-25‰) and (ii) the carrier of Xe-P3 with light carbon (δ¹³C<-41‰) - a third population might be present, possibly the carrier of Xe-P6, with an intermediate δ¹³C.

References: [1] A. V. Fisenko et al. (1998) *Geochimica*, N5, 1372 (in Russian); [2] A. B. Verchovsky et al. (1998), *Science*, 282, 1165; [3] A. B. Verchovsky et al. (1999) LPSC XXX, abstr.#1746; [4] A. B. Verchovsky et al. (2001) *Nuclear Physics*, A688, 106c; [5] R. S. Lewis and E. Anders (1988) LPSC XIX, 679; [6] I. P. Wright and C. T. Pillinger (1989), *U.S. Geol. Bull.* 1990; [7] A. B. Verchovsky et al. (1997) *MAPS* 32, A131.

