Carbon, nitrogen and noble gases in diamond separates from the Novo-Urei ureilite

Conference or Workshop Item

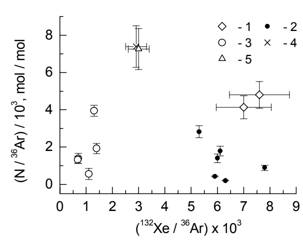
CARBON, NITROGEN AND NOBLE GASES IN DIAMOND SEPARATES FROM THE NOVO-UREI UREILITE.

A. V. Fisenko[1], A. B. Verchovsky[2], L. F. Semjonova[1] and C.T. Pillinger[2]. [1]Vernadsky Institute of Geochemistry and Analytycal Chemistry RAS, Moscow, Russia, anatolii@fis.home.chg.ru. The Open University, Milton Keynes, UK.

The origin of diamond in ureilites is still debating. There are two the most popular explanations: (1) as a result of shock transformation from graphite caused by meteorite impact in the parent bodies [1-4], and (2) in a CVD process in the solar nebula [5-7].

We isolated a sample strongly enriched with diamond from the Novo-Urei ureilite and separated it into two density fractions in a heavy liquid at 2.9 g$\cdot$cm^{-3}. C, N, Ar and Xe have been analyzed simultaneously in the fractions by means of stepped combustion. Purity of the diamonds have been confirmed by Raman spectroscopy showing practical absence of graphite lines but surprisingly double picks for diamond in the range of 1315-1335 cm^{-1} that seems not to be observed in diamonds from other ureilites.

It has been found that concentration of N and noble gases in the less dense fraction (DNU-1) is ~1.5 times higher, than in the complimentary sediment (DNU-2). We believe the difference is due to the presence of aggregates with relatively low density made of smaller grains in DNU-1 compared to DNU-2 which consists mostly of single grains. Isotopic compositions of C (^{13}C~-2‰), N (^{15}N~-95‰) and noble gases as well as the elemental composition of the latter are similar in both fractions and to other diamonds analyzed before [8]. The obtained data together with published before, allow us to conclude that ureilite diamonds are likely formed as a result of shock transformation from graphite and amorphous carbon in the ureilites parent bodies. We also suggest that: (1) Carbonaceous material in the diamond-free ureilite ALH 78019 [9] seems to be contaminated with terrestrial atmospheric nitrogen during weathering since it is enriched with the nitrogen compared to other ureilites (Fig.). Therefore it does not show the light N signature normally observed in the ureilite diamonds. (2) The source of the light N in the ureilites might be presolar nanodiamods (^{15}N up to -350‰) that could be present in the carbonaceous material – precursor of the ureilites carbon.



Element ratios in ureilites. 1- present study; 2, 3 – carbon separates from Antarctic ureilites [10] for bulk (2) and magnetic fractions (3); 4, 5 – HF-HCl fractions of ALH 78019 [9] for total release (4) and without the first 300^{o}C step (5).

References: [1] Lipschutz M.E. 1964. *Science* 143: 1431-1434. [2] Vdovykin G.P. 1970. *Meteoritika* 30: 95-103. [3] Nakamuta Y., Aoki Y. 2000. *Meteorit. Planet. Sci.* 35: 487-493. [4] Valter A.A. et al. 2003. *Geochimia* N10: 1027-1035. [5] Matsuda J., Nagao K. 1989. *Geochim. Cosmochim. Acta* 53: 1117-1121. [6] Matsuda J. et al. 1991. *Geochim. Cosmochim. Acta* 55: 2011-2023. [7] Matsuda J., et al. 1995. *Geochim. Cosmochim. Acta* 59: 4939-4949. [8] Russell S.S. et al. 1993. *24th Lunar and Planet. Sci. Conf.* pp. 1221-1222. [9] Rai V.K., et al. 2002. *Meteorit. Planet. Sci* 37: 1045-1055. [10] Yamamoto T. et al. 1998. *Meteorit. Planet. Sci* 33: 857-870.