ALTERNATIVE COMPOSITION OF NOBLE-GAS COMPONENTS IN THE NANODIAMONDS.

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Introduction: The contents analysis of the noble-gas components in nanodiamond-rich fractions (NRF) of some meteorites at substitute of the Xe-HL component by the excesses of light and heavy isotopes of Xe (farther this component is denoted as (H+L)) in the nanodiamonds (ND) from *r*- and *p*-processes showed that the noble gases of P3, (H+L), and P6 components are contained in individual populations of the nanodiamond grains [1]. The results of the same analysis are shown here on the data of the released Xe from NRF at T≥ 900 °C that is after the onset of intensive graphitization of the ND. For the analysis were used the Xe data for NRF bulk of various meteorites [2] and high-precision the Xe data for NRF fractions of the Murchison CM2 [3], and the Allende CV3 [4] meteorites. It is note, the content of noble-gas components were determined by normalizing the calculated ^{130}Xe/^{132}Xe, ^{134}Xe/^{132}Xe, and ^{136}Xe/^{132}Xe ratios respectively to their measured values.

Results and Discussion: The main results of the analysis are: (1) the contents of noble gas components in all NRF are in P3>P6>>(H+L) sequence; (2) the Xe-P3/Xe-(H+L) ratio is almost constant for NRF bulk of the unequilibrium meteorites of lowest petrologic types, with the exception of the Leoville (CV3.0) meteorite (Fig. 1a). Hence, the increase of Xe-P3 and Xe-(H+L) contents in these meteorites are results of "gas-free" ND loss in a result of weak metamorphism; (3) with increase of the meteorites petrologic types the Xe-P3/Xe-(H+L) ratio decreases with increase of the Xe-(H+L) content (Fig. 1a). For the Xe-P6/Xe-(H+L) ratios are observed an inverse correlation (Fig. 1a). The different retention of the P3, P6, and (H+L) components in the NRF of these meteorites is probably the result of different thermal and oxidative stability of their carriers during the thermal metamorphism. This difference is especially evident for the Indarch EH3-4 meteorite (Fig. 1a); (4) the ^{136}Xe/^{132}Xe ratios for the mix of P3+(H+L) components within the limits of (1-2) σ are same during the stepwise pyrolysis of NRF bulk from the Orgueil and Indarch meteorites, and also of the LD4 and LD7 fractions of the Murchison meteorite except for the first stage of pyrolysis of these fractions (Fig. 1b). Hence, the release kinetics of noble gases of the P3 and (H+L) components is almost the same during pyrolysis of these NRF and this indicates on similar the distributions of these gases in the ND grains. At the same time, the average values of the ^{136}Xe/^{132}Xe ratio for a mix of these components from NRF of the Orgueil and Indarch meteorites are significantly different: 0.629±0.010 and 0.758±0.015, respectively. This difference and almost constant values of the ^{136}Xe/^{132}Xe ratio during pyrolysis of the ND above 1000 °C are factors for the following assumptions: (a) the ratios of noble-gas carriers, i.e. populations of the diamond grains, in formation zone of the EH and carbonaceous meteorites were different. This assumption is unlikely, because the relation of noble-gas components in the NRF of the Qingzhen (EH3) and Indarch (EH3-4) meteorites differs significantly; (b) the initial ratio of the populations of diamond grains changed in result of destruction of the ND grains during thermal metamorphism, at that the destruction of the population grains with P3 component were in more extent than (H+L) component grains; (5) significant changes of the ^{136}Xe/^{132}Xe ratio at mixing of all the three noble gas components, especially in high-temperature region (Fig. 1c) indicate on a higher thermal stability of the population grains with P6 component.

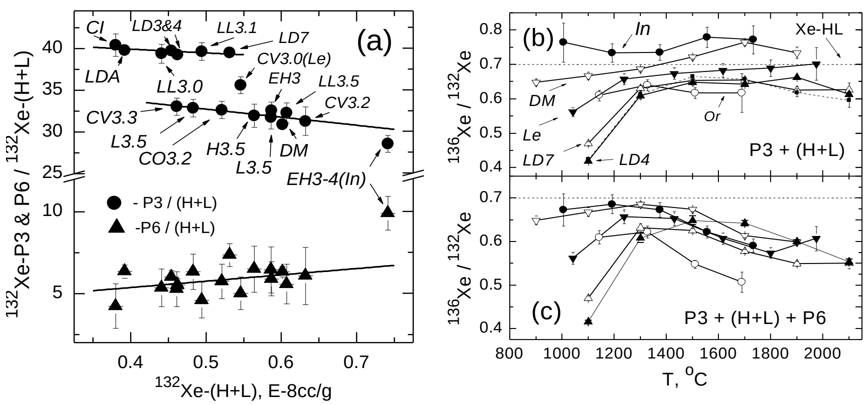

Fig. 1. Dependences of the Xe component ratios on the ^{132}Xe-(H+L) contents (a) and of the ^{136}Xe/^{132}Xe ratios on the pyrolysis temperature (b, c) for NRF. Notations: Or - Orgueil (CI); In-Indarch EH3-4; DM – NRF fraction of the Allende (CV3.2); LD (A,3,4,7) – NRF fractions of the Murchison CM2; Le - Leoville CV3.0.

Conclusion: The use of Xe excesses from *p*- and *r*- processes instead of the Xe-HL component has led to that each of the P3, (H+L), and P6 components must be in individual population of nanodiamond grains, and the initial ratio of these populations in the some NRF changed due to thermal metamorphism of the meteorites parent bodies.

References: [1] Fisenko A. et al. (2018) *LPS XLIX*, Abstract #1104. [2] Huss G. R. and Lewis R. S. (1994) *Meteoritics*, 29, 791-810. [3] Lewis R. et al. (1988) *LPS XIX*, 679-680. [4] Lewis R. S. (1994) *LPS XXV*, 793-794.