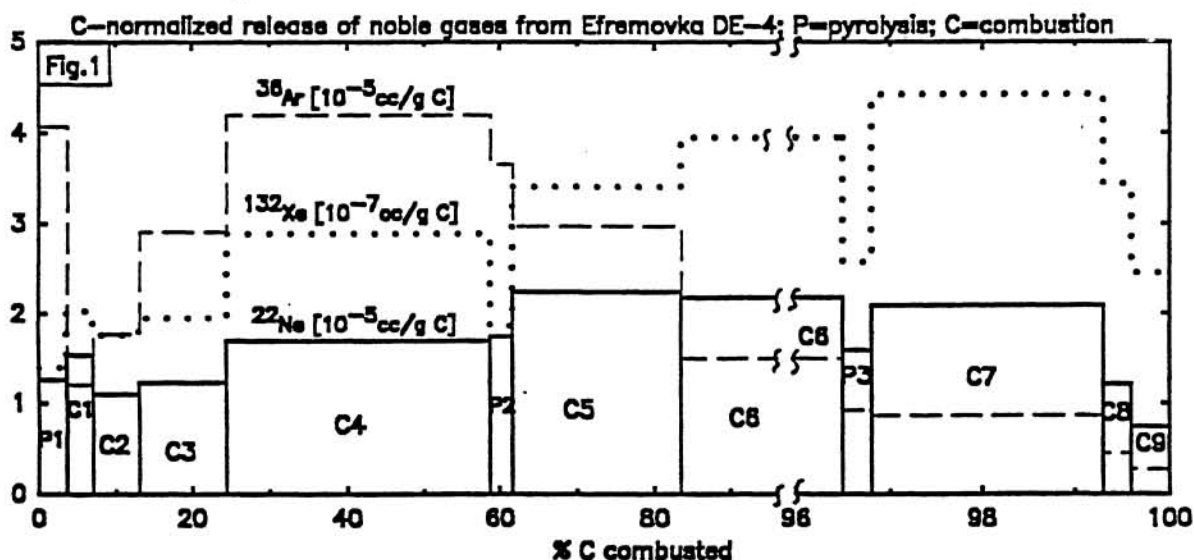


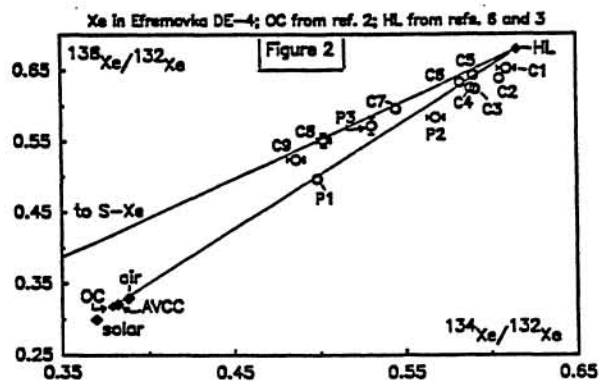
**MULTICOMPONENT NOBLE GAS STRUCTURE IN DIAMOND-RICH ACID RESIDUES FROM EFREMOVKA CV3 CARBACEOUS CHONDRITE; A.B. Verchovsky<sup>1,2</sup>, A.V. Fisenko<sup>1</sup>, L.F. Semjonova<sup>1</sup>, Yu.A. Shukolyukov<sup>1</sup>, U. Ott<sup>2</sup>, and F. Begemann<sup>2</sup>; <sup>1</sup>Vernadsky Institute of Geochemistry and Analytical Chemistry, USSR Academy of Sciences, Kosygin str. 19, Moscow 117975, USSR; <sup>2</sup>Max-Planck-Institut für Chemie (Otto-Hahn-Institut), Saarstr. 23, D-6500 Mainz, F.R.G..**

Abundances and isotopic compositions of all noble gases in acid-insoluble residues of the Efremovka CV3 carbonaceous chondrite have been measured. Analysis of Efremovka appeared to be of interest because one of the presolar carrier phases (SiC) of isotopically unusual noble gases present in most primitive meteorites including C1's, C2's, primitive ordinary and primitive enstatite chondrites, appears to be missing in some CV3 meteorites, including Grosnaja and the well-studied Allende meteorite [1].

In addition to HF/HCl, the residues were treated with oxidizing acids (HClO<sub>4</sub>) and, in some cases, other acids such as H<sub>2</sub>SO<sub>4</sub> and H<sub>3</sub>PO<sub>4</sub>. According to X-ray analysis the dominant phase in all samples was diamond. Minor amounts of graphite and amorphous carbon were present as well. For the extraction of the noble gases a combination of stepped pyrolysis and stepped combustion was used. The amounts of C combusted in each step were inferred from the total pressure created by the combustion products, since CO and/or CO<sub>2</sub> are the main gaseous phases [2]. The release patterns of the noble gases, when compared to each other and the production of CO/CO<sub>2</sub> indicate an inhomogeneous distribution among the carrier phases (Fig. 1).



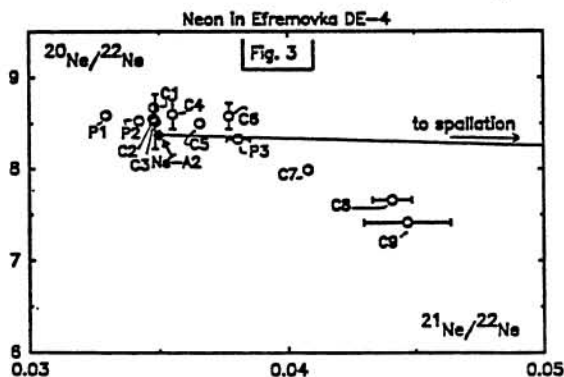
Xenon data reveal the presence of at least three noble gas components in the Efremovka residues. As an example, a <sup>136</sup>Xe/<sup>132</sup>Xe diagram for the *raw* data (not yet corrected for the relative sensitivity factors) is shown in Fig. 2 for DE-4, a coarse fraction. The dominant component is HL-Xe, with an isotopic composition (after correction) consistent with earlier estimates of either the 'pure' (<sup>130</sup>Xe-free) component [2,3] or the inferred actual endmember equal to the average of the most extreme compositions measured in diamond-rich samples from a variety of meteorites from several classes, which contains a finite admixture of a 'normal' (planetary or solar) component [1]. HL-Xe is primarily released by combustion of its host phase (diamond; [4]).



The second component is most conspicuous in the

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first precombustion pyrolysis steps (Fig. 2). It is characterized by lower  $^{134,136}\text{Xe}/^{132}\text{Xe}$  ratios and most likely represents an isotopically 'normal' component such as solar, AVCC or ordinary Xe as measured in largely HL-Xe free ordinary chondrites (OC in Fig. 2; [2,5]). Finally, the high temperature combustion steps also show lower  $^{136}\text{Xe}/^{132}\text{Xe}$  ratios than HL-Xe, but the data points show a trend differing from the one for the low temperature pyrolysis data points. Their array in Fig. 2 can be explained in terms of mixing between HL- and s-process Xe ( $^{136}\text{Xe}/^{132}\text{Xe} = ^{134}\text{Xe}/^{132}\text{Xe} = 0$ ). Hence SiC, the inferred host phase of s-process Xe [6], is present in Efremovka. This adds Efremovka to the CV3's Leoville and Vigarano, which are also reported to contain SiC, in contrast to the apparent absence in Allende and Grosnaja [1].



The Ne data (shown for DE-4 in Fig. 3) confirm this conclusion. The higher temperature combustion fractions show lower  $^{20}\text{Ne}/^{22}\text{Ne}$  and higher  $^{21}\text{Ne}/^{22}\text{Ne}$  ratios than Ne-A2, the trapped neon in the presolar diamonds [7], but they do not fall on a mixing line between trapped Ne-A2 and spallogenic Ne. Rather, these data are best explained as a mixture between Ne-A2 and a pseudocomponent made up of Ne-E and spallogenic Ne released in constant proportions. This type of behavior has also been found in the analysis of a similar residue from the Inman enstatite chondrite where it has been explained as being due to a chemical reaction between the carrier

phase of Ne-E (SiC) and other phases containing spallogenic  $^{21}\text{Ne}$  whereupon both types of gases are released simultaneously [8]. A similar effect could also account for the  $^{38}\text{Ar}/^{36}\text{Ar}$  ratios in the high temperature (660-810°C) combustion steps, which are significantly higher (up to 0.25) than previously seen in Ar released together with HL-Xe. (Although Ar associated with s-process-Kr, -Xe can formally account for the observations [9], this explanation seems unlikely from a comparison of the elemental abundance ratios in the s-component observed in very pure SiC samples from the Murchison meteorite [10]). The inferred ratio of spallogenic  $^{38}\text{Ar}$  to spallogenic  $^{21}\text{Ne}$  (~2) suggests an acid-resistant and Mg-poor, Fe-rich phase such as chromite as the principal source of the spallogenic component.

Another observation that suggests chemical reactions occurring at elevated temperatures between the different phases is the fact that in the pyrolysis steps a substantial buildup of pressure (presumably also due to  $\text{CO}/\text{CO}_2$ ) and release of noble gases (Fig. 1) occurred. Noble gases released in these steps were also dominated by HL-Xe (Fig. 2) and the associated components in the other noble gas elements. Some slight differences in the elemental and isotopic patterns, however, exist, when compared to the previous and following combustion steps. They can be explained in terms of the three components detailed above.

The implications of the release of 'planetary-type' gases in these pyrolysis steps is not clear at present. It seems to occur at lower temperature than in the pyrolysis of unoxidized HF/HCl residues from other CV3 meteorites, in which this (or a compositionally similar) component is dominant. A possible explanation might be release from oxide minerals the contribution of which to the noble gas budget is masked in less oxidized samples by the more abundant gases in carbonaceous material. Or it could be due to release from previously unaccessible phases (carbonaceous - cf. [11] - or other), that became accessible to gas release after combustion of some carbonaceous matter. Measurements in progress of the isotopic composition of C and N released from the Efremovka residues in conjunction with the noble gases may help shed light on this question.

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