ON ORIGIN OF Ne-E IN CHONDRITES; A.K.Lavrukhina and G.K.Ustinova, Vernadsky Institute of Geochemistry and Analytical Chemistry, USSR Academy of Sciences, Moscow, 117334 USSR

Detection of isotopic anomalies in carbonaceous chondrites has changed our notion about the nature of the primordial matter of the solar system, in particular, it has led us to the conception of isotopic and chemical heterogeneity of the protoplanetary nebula /1/. One of the earliest anomaly found in carbonaceous chondrites is Ne component enriched in Ne-22 that failed to be associated with some source in the solar system and probably had a presolar origin /2/. The Ne-22 enriched fractions, or Ne-E, have been separated by step-wise heating when the gas components in different mineral phases are released in the different temperature range. Indeed, Ne-E(L) (Ne-20/Ne-22<0.01; Ne-21/Ne-22<0.001), the carriers (C_α) of which are graphitic grains, is released at $T < 800-1000^\circ C$, and Ne-E(H) (Ne-20/Ne-22<0.2; Ne-21/Ne-22<0.003) with SiC as a carrier associated with spinel is released at $T > 1200^\circ C$ /3/. Such purity of the Ne-E components could be conditioned only to their origin due to decay of radioactive Na-22 ($T_{1/2} = 2.6$ y).

In /4,5/ the Ne-E(L) and Ne-E(H) contents have been measured in the high temperature separations of the Murray and Murchison C2 chondrites, and Ne-E(H) variations in dependence on T and size of SiC grains have been derived. The refractory fractions of the primitive carbonaceous chondrites are supposed to be the most probable relics of the presolar matter /6/. Because SiC is condenced from a gas only if $C/O > 0.83$ /7/ and is consequently observed in C-rich stellar outflows /8/, carbon-rich red giants and O,B stars of the second generation on the Wolf-Rayet stage could be considered as its potential sources /5/. It is precisely that stage of the stellar evolution that is characterized by $C/O > 1$ and by the intensive stellar outflows and winds. In addition, the observed isotopic anomalies of C, N and Si in the carbon grains and SiC are relics of nuclear reactions on that stage. It is natural, therefore, to believe that the supernova that had led to the formation of the solar system was O,B-star of the second generation.

The presence of grains of condenced carbon and SiC in the protosolar matter prompts a natural way to solve the problem of Ne-E origin. Indeed, one may assume that its radioactive precursor Na-22 had been produced in nuclear reactions with energetic particles accelerated at the supernova explosion $4.7 \cdot 10^9$ yr ago. At that final stage of nucleosynthesis the light isotopes Li, Be and B had been produced too that allowed us using their observed abundances /9/ to determine the irradiation parameters /10,11/. According to the most adequate irradiation model /10/, the generation of the elements with energetic particles took place during their acceleration at the front of a shock wave from the supernova explosion when it was passing

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Component	Observ./4,5/	Calcul.
Ne-E(L)	5150-13600	11000
Ne-E(H)	1953- 3780	2422

Table. Observed and calculated amounts of Ne-E(L) and Ne-E(H) in the Murchison C2 chondrite (in 10^{-8} ml/g).

through its expanding shell. In such conditions the nuclear reactions over the whole shell are supposed to be excited by the accelerated particles with some average energy spectrum and integral intensity. The following values of the parameters have been derived /11/: $I_p(>15\ MeV) = 1.62\cdot10^{19}\ cm^{-2}$; $\alpha/p = 1.17\cdot10^{-2}$; $I_\alpha(>15\ MeV/nucl.) = 1.89\cdot10^{17}\ cm^{-2}$; $\gamma=2.5$ as well as the statistically weighted according to the spectrum Na-22 production cross sections from the main target elements.

We considered the Na-22 production on Na, Mg, Al, Si and S and using their cosmic abundances /9/ obtained: $(Na\text{-}22/Na\text{-}23)_o = 1.06\cdot10^{-5}$, i.e., Na-22 ≡ 0.6 atoms/10^6Si or $6\cdot10^{-8}$ Na-22 atoms per one C atom. It means that $3\cdot10^{15}$ Na-22 atoms and after their decay - $11000\cdot10^{-8}$ ml of Ne-22 per 1 g of carbon were formed. This value corresponds to Ne-E(L) maximum content in its carrier (see the Table). Therefore, one may suppose that the Ne-E(L) component was formed owing to capture of Na-22 produced in nuclear reactions with accelerated particles by the grains of condenced carbon in the outer shell of the supernova.

To ascertain the Ne-E(H) origin SiC grains irradiation in the similar model is considered. As obtained, due to the decay of Na-22 produced on SiC in nuclear reactions with energetic particles $2422\cdot10^{-8}$ ml/g of Ne-22 were generated. This magnitude is in the range of Ne-E(H) values observed in SiC of different grain sizes in the C2 chondrites (see the Table). It proves the Ne-E(H) origin in the scenario examined. In addition, we believe that much greater amounts of Ne-E(H) in SiC should be observed. Indeed, at the front of the shock waves with high extent of pressure the spectrum index γ strongly depends on energy and decreases: $\gamma\lesssim2$ /12/. The Ne-E(H) production increases with reducing γ and totals $19110\cdot10^{-8}$ ml/g if $\gamma= 2$, $E_o>10$ Mev, for instance. The questions of the direct production of Ne isotopes are considered in /11/.

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