EXPOSURE AGES OF L AND LL CHONDRITES. V.A.Alexeev. Vernadsky Inst. of Geochem. and Analyt. Chem., USSR Acad. Sci., Moscow, USSR

We have calculated the He-3, Ne-21, and Ar-38 cosmic-ray exposure ages of 369 non-Antarctic and Antarctic L and LL chondrites in order to study a some regularities of the exposure age distributions of ordinary chondrites. Exposure ages were calculated in the same way as those of H chondrites [1]. The noble gas data are from the compilation by Schultz and Cruse [2]. When more than one analysis was available for a given meteorite, the average age was used.The meteorites with low ratios of cosmogenic He-3 to Ne-21 (<2.5) suggest diffusion loss of rare gases, and therefore these meteorites were excluded.

The ages derived from cosmogenic Ar-38 concentrations were systematically lower than He-3 and Ne-21 ages. This result agrees with previous conclusions [1,3]. A reduction of the proposed by Eugster [4] the Ar-38 production rate by 15% allows to get the best agreement for He-3, Ne-21, and Ar-38 ages. Reproducibility of the age values calculated for different samples of the same meteorite was found about 10% (standard deviation). The obtained distributions of exposure ages of L and LL chondrites (and H chondrites [1] for comparison) are shown in Fig. 1.

As in previous versions (e.g. [5]) there is marked contrast among these classes. The major feature for the H chondrites is a peak at 6-7 Myr, containing about 50% of this class meteorites. On the other hand, the distribution of L chondrite ages may be described on the whole by exponential decreasing of the number of meteorites (N) with increasing of the exposure age (t). By regression analysis we found the parameters of the exponential curve $N_t=N_0\exp(t/\tau)$. Here N_t is number of meteorites with age of t. The τ is life-time of meteoroids - the source of L chondrites. For L chondrites the value of τ was found equal to 34(+5,-4) Myr; the value of N_0 for histogram with step of 1 Myr (Fig. 1) was found equal to 9.4(+1.2,-1.1).

Distribution of H chondrites exposure ages with the exception of 6-7 Myr peak meteorites may also be approximated by exponential curve. The values of τ and N_0 of this curve were found equal to τ=29(+4,-3) Myr and N_0=6.7(+0.9,-0.8). The value of τ for H chondrites coincides with that for L chondrites within one-sigma errors. Thus the sources of ordinary chondrites (Apollo, Amor, and Aten groups) are apparently replenished continiously (at the expense of the asteroid belt?) by cosmic bodies which have the life-time about 30 Myr before capture by the Earth. Also about 50% of H chondrites result from large group of bodies which were formed in catastrophic event about 6-7 Myr ago.

References:

[1] Alexeev V.A.(1991) LPS XXII, 11-12.
[2] Schultz L. and Kruse H.(1989) Meteoritics, 24, 155-172.
[3] Graf Th. and Murti K.(1989) LPS XX, 353-354.
[4] Eugster O.(1988) Geochim. Cosmochim. Acta, 52, 1649-1662.
[5] Crabb J. and Schultz L.(1981) Geochim. Cosmochim. Acta, 45, 2151-2160.

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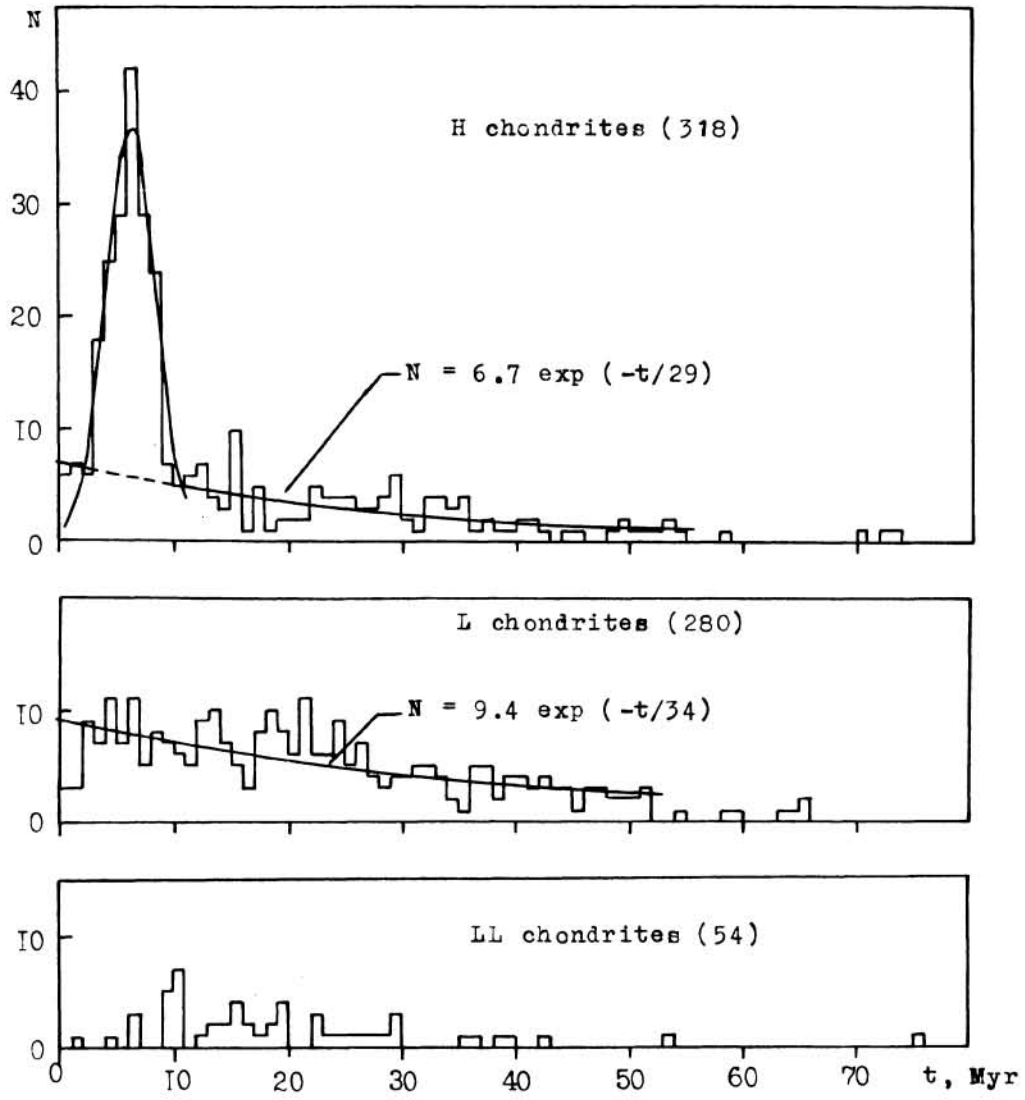

Fig.1 Distributions of the cosmic-ray exposure ages (t, Myr) of H, L, and LL chondrites.