

CATASTROPHE IN THE SPACE: 500 or 300 Myr AGO? V.A.Alexeev.
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Analysis of the distribution of the He-4 and He-3 contents in L chondrites showed the parent body of these meteorites underwent the catastrophic collision in the space 290 ± 40 Myr ago (considerable difference with date of Heymann, 1967: 520 ± 60 Myr). Production ratio of cosmogenic He-4 and He-3 in stone meteorites is 8 ± 1 (appreciable higher of Heymann's value of 5.2 ± 0.3).

A great number of L chondrites have low K-Ar and, especially, U,Th-He ages, down to a few hundred million years. Many of such meteorites have a symptoms of strong shock and reheating. Heymann [1] studied distribution of He-4 and He-3 in a number of such L chondrites and calculated that (1) parent asteroid of L chondrites underwent 520 ± 60 Myr ago the catastrophic collision and (2) cosmogenic He-4/He-3 production ratio equal to 5.2 ± 0.3 .

Quite a number of new determinations of content of rare gas isotopes and thorough data compilation [2] allow to consider this problem again.

We have analysed the distribution of He-4 contents vs. He-3 contents in those L chondrites which have (1) K-Ar age less than 1.5 Gyr (just this age region shows K-Ar age peak resulted from losses of radiogenic Ar-40 at collision); (2) the Ne-20/Ne-22 ratio less than 1.2 (to avoid the meteorites with trapped solar He-4); and (3) deflection of cosmogenic He-3/Ne-21 ratio less than 20% below the line of $(\text{He-3/Ne-21})_c = 21.77(\text{Ne-22/Ne-21})_c - 19.32$ [3] (to exclude the meteorites with diffusion losses of He-3 and, consequently, He-4). 56 L chondrites answer these boundary conditions: 22 falls, 21 non-Antarctic finds, and 13 Antarctic finds. Distribution of the He-4 vs. He-3 in non-Antarctic finds are shown in Fig. Least-squares fitting of a straight line of $\text{He-4} = A + B(\text{He-3})$ was made according to York [4]. If all He-4 was removed at collision then the point of intersection of this line with axis of ordinates will give the quantity of radiogenic He-4 accumulated at U,Th decay after catastrophic outgassing event.

The B coefficient gives the cosmogenic He-4/He-3 production ratio. Obtained data are given in the Table.

We can see the time of catastrophic event is the same for different groups of meteorites (within the limits of error) and is on an average 290 ± 40 Myr. The B coefficient is 8 ± 1 . These values are significantly different from those of Heymann [1]. The main reason of this discrepancy is the nonvalid use in [1] of several meteorite data and especially of the Farmington meteorite data. High value of Ne-20/Ne-22 ratio in this meteorite (9.4 [2, 5]) indicates on high content of the trapped gas of solar composition and hence there is high probability of presence of solar He-4 in this meteorite. Because the Farmington meteorite has very low He-3 content (only $0.06 \text{ E-}8$ cc STP/g [1]) the coefficient of A will practically be the same as the He-4 content in this meteorite and therefore superfluous (solar) He-4 will increase the calculated time of catastrophe and will decreased the coefficient of B.

Minimal values of Ar-40 - Ar-39 ages for low-temperature plateau of L chondrites are in agreement with our result (for example, the Wittekrantz L5 chondrite has the low-temperature plateau Ar-40 - Ar-39 age of 300 ± 30 Myr [6], and so on). Higher low-temperature plateau ages may be stipulated by retention of some radiogenic Ar-40 at outgassing event. So, retention of only 1.4% of Ar-40 accumulated before collision 300 Myr ago changes age up to 520 Myr.

Possible, the catastrophe in the space near 300 Myr ago was responsible for the biotic crisis on the Earth on the Permian/Triassic boundary (about 240 Myr ago) or (and) Carboniferous/Permian boundary (about 290 Myr ago) as a result of fall on the Earth at this time(s) of one or several big cosmic bodies.

Table. Coefficients of A and B in the equation of straight line of $\text{He-4} = A + B(\text{He-3})$ and U, Th-He ages (T) corresponding to values of A.

L chondrites	B	A, E-8 cc STP/g	T, Myr
Falls	9.4 ± 0.8	74.5 ± 6.3	260 ± 20
Non-Antarctic finds	6.8 ± 0.6	98.2 ± 7.7	340 ± 30
Antarctic finds	6.5 ± 0.9	91.0 ± 0.9	320 ± 70
All	$8 \pm 1(2\sigma)$	83.7 ± 4.7	$290 \pm 40(2\sigma)$

References

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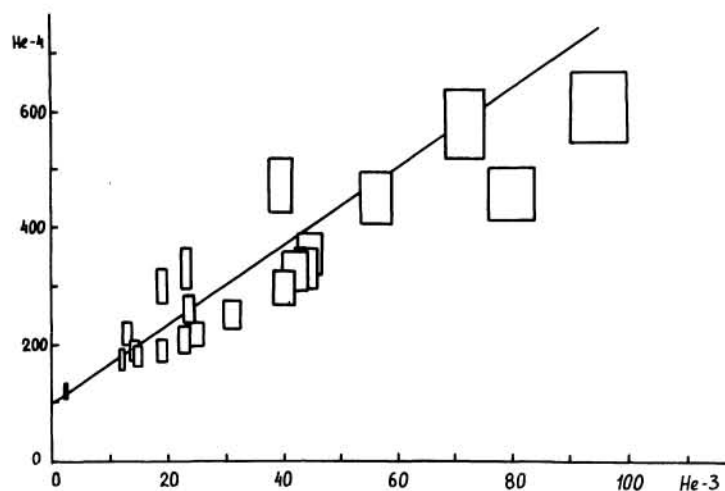


Fig. He-4 vs. He-3 (E-8 cc STP/g) in non-Antarctic finds.