COSMIC-RAY EXPOSURE HISTORY OF THE EREVAN HOWARDITE MATTER BY TRACK DATA. *L.L.Kashkarov, N.N.Korotkova.* V.I.Vernadsky Institute of Geochim. and Analyt. Chemistry, Russian Academy of Sciences.

Achondrites are one of the most important meteorite types whose matter retained the traces of shock-thermal and radiation influence in regolith environments on their parent body surfaces [1]. Study of tracks of solar (SCR) and galactic cosmic rays (GCR)- in silicate minerals of poorly studied Erevan howardite [2] has been carried out aimed at further investigation the radiation-thermal conditions of formation of these meteorites. The meteorite was found in ~ 1911 [2] as an individual stone ~500 g by weight partially covered with fusion crust. It is an impact polymict breccia having the K-Ar age of 4.0 10^9 years. The estimated meteorite effective exposure age (T_{RAD}) based on its ^{21}Ne content [3] and ^{21}Ne production rate in howardites [4] is equal to 32.10^6 years. The significantly lower value of T_{RAD} = 22.10^6 years has been obtained on the basis of ^3He content [2]. The great discrepancy in T_{RAD} values can be caused by greater losses of ^3He produced at regolith stage as compared to those of ^{21}Ne.

116 grains of plagioclase (Pl) and 94 grains of pyroxene (Px) handpicked from the Erevan howardite crushed bulk sample (N 15199 in meteorite Committee collection of RAN) have been studied. The mounted in epoxy and polished crystals were etched in following conditions: Pl in boiling solution, $NaOH:H_2O=3:4$, 15 min and Px in boiling solution, $NaOH:H_2O=3:2$, 90-100 min. The measurements of track density (ρ, cm^{-2}) and track length projections (l, μm) observed on the etched crystal surfaces have been made by means of optical microscope. The VH-nuclei galactic cosmic ray (GCR) tracks having ρ values within (1-10) 10^6 cm^{-2} were found in all the Pl and Px crystals under study (see Fig.1 a,b). The mean $\bar{\rho}$ values for Pl and Px grains are equal to (4,3$\pm$0,4) 10^6 cm^{-2} and (2,5$\pm$0,3) 10^6 cm^{-2} respectively, and the difference is due to unequal efficiency of registration of VH-nuclei by given minerals. In 17 Pl grains two track generations were revealed: (I)-very short ($l \lesssim 2$ μm) tracks naving ρ_I=(9.6$\pm$0.5) 10^6 cm^{-2} and (II)-tracks having ρ_{II}=(5,5$\pm$0,5) 10^6 cm^{-2} and practically unannealed lengths ($l \simeq$ 5-6 μm). The part of a Pl crystal containing such tracks is presented in Fig.2 microphotograph. As it is seen in Fig.1c, the ρ value distribution in these crystals is bimodal and their $\bar{\rho}$ mean values are beyond the scope of 3σ. On this base and the appreciable difference in track lengths we can suggest that the tracks of the I-st and II-nd generations were formed at different stages of Erevan howardite evolution. The I-st group tracks can be caused by earlier "surface" radiation by SCR and the II-nd group tracks were produced by GCR VH-nuclei at later regolith stage when the crystals were buried at the depth more at least several centimeters, and during irradiation of the meteoroid body in cosmic space. The shortening of I-st group tracks can be due to their longer and more complex history.

The ρ distribution in the volume of each Pl and Px crystal under study is uniform. The ρ value gradient from the crystal

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surface to its depth was found only in about 2% of Pl grains. The flat shape of gradients can be explained by partial shielding of crystals with thin layer of substance (thickness about some microns) during their exposure on the regolith surface.

The obtained data indicate that the Erevan howardite matter has been undergone the relatively moderate processing in the environments of parent body regolith. This conclusion was drawn on the ground of comparison of obtained track parameters with those for highly irradiated Kapoeta howardite [1] and also Pesyanoe [5] and Norton County [6] achondrites having quite different radiation histories.

References .[1] Goswami J.N., Lal D., Wilkening L.L.(1984) Space Sci.Rev.,37,p.111. [2] Kvasha L.G., Skripnik A.Ya. et al. (1978) Meteoritika, v.37, p.80. [3] Levskij L.K., Fedorova I.V. et al.(1971) Geochimiya, N 5, p.515. [4] Cressy P.J., Bogard D.D. (1976), Geochim.Cosmochim.Acta. 40, p.749. [5] Kashkarov L.L., Genaeva L.I. (1993) Meteoritika, v.50, p.95. [6] Genaeva L.I., Kashkarov L.I., Perelygin V.p. (1985), v.44, p.100.

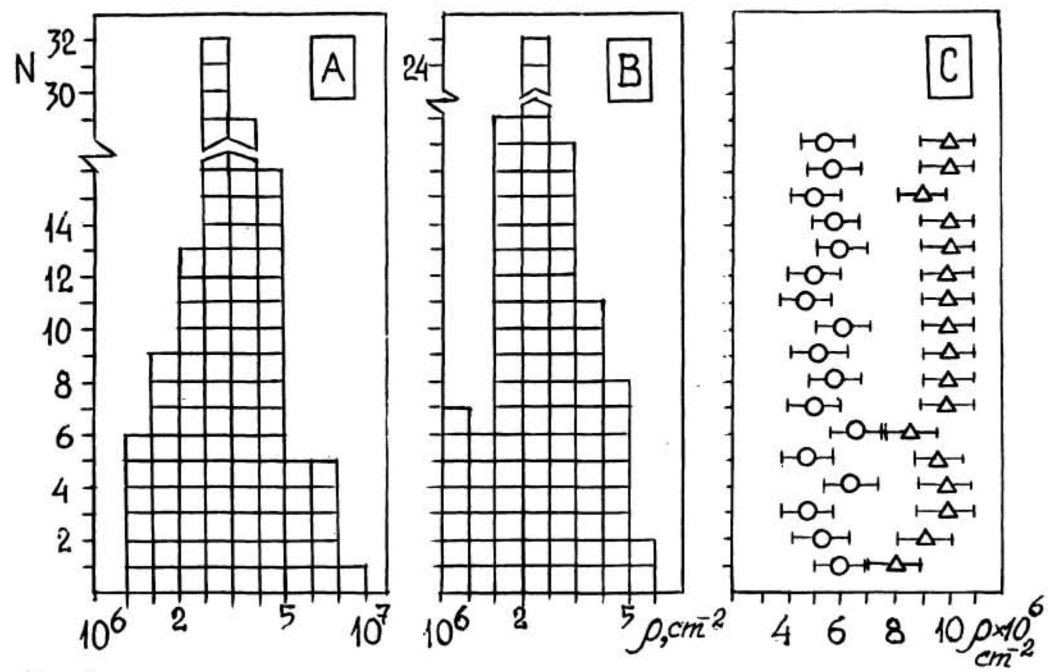

Fig.1

Fig.2