SOME RESULTS OF THE COSMIC-RAY INFLUENCE IN ASH CREEK L6 CHONDRITE. V.D.Gorin, V.A.Alexeev, A.I.Ivliev, G.K.Kalinina, L.L.Kashkarov, N.S.Kuyunko, and D.A. Sadilenko; Vernadsky Institute of Geochemistry and Analytical Chemistry, Russian Academy of Sciences, 119991, Moscow, Russia. e-mail: aval37@chgnet.ru

Introduction: The Ash Creek L6 chondrite, formerly known as the West, Texas meteorite, fell the morning of Feb 15, 2009. In total over 270 stones have been recovered; total weight is more than 11 kg. The average weight per stone found is 40.69g however without the three largest finds of 1.7, 1.5, and 1.673 kg the average is 22.77g per stone. We have studied the Ash Creek chondrite in various aspects including measurements of cosmogenic radionuclides with different half-lifes ($T_{1/2}$), induced (by X-ray and gamma-ray) and natural thermoluminescence and tracks of VH nuclei of galactic cosmic rays (GCR) .

Cosmogenic radionuclides: Depending on the moment of sample delivery to a research laboratory, radionuclides with various $T_{1/2}$ values can be measured in meteorites, from ^{24}Na ($T_{1/2}$ = 15 h) to ^{40}K ($T_{1/2} = 1.48\times10^9$ y). It is evident that the cosmogenic radionuclides registered in meteorites with high radiation ages encompass a wide time interval and, consequently, are witnesses of many events in the history of the solar system. Most frequently, the following radionuclides can be analyzed: ^{46}Sc ($T_{1/2}$ = 84.2 days), ^{54}Mn ($T_{1/2}$ = 312 days), ^{22}Na ($T_{1/2}$ = 2.6 y), ^{60}Co ($T_{1/2}$ = 5.26 y), ^{26}Al ($T_{1/2} = 0.74\times10^6$ y), and ^{53}Mn ($T_{1/2} = 3.7\times10^6$ y). They allow to trace both the radiation history of meteorites and the regularities in processes of changes in the heliosphere within the past ~1.5 $T_{1/2}$ of the radionuclides before the fall of meteorites onto the Earth in a time scale of ~10 Ma

For determination of contents of cosmogenic and natural radionuclides in the Ash Creek chondrite, three meteorite samples (total weight 65.84 g) were measured at the low-level scintillation gamma-spectrometer. The high sensitivity for coincident gamma-quanta was achieved by the γ-γ-coincidence method with a dynamic gate [1]. The results of measurements are given in the **Table**. All values of the radioactivity are given for the moment of fall of the meteorite.

The ^{26}Al content in a meteorite close to the average content of this nuclide in L-chondrites (63 ± 6 dpm/kg [2]). This gives the basis for the assumption that cosmic-ray exposure age (T_{cr}) of this meteorite at least more than 1 Ma, i.e. contents of all other measured cosmogenic radionuclides are in equilibrium. Contents of radionuclides in a meteorite are defined not only a degree of shielding of the investigated sample in the meteorite preatmospheric body but also of GCR intensity. The moment of falling of meteorite Ash Creek has fallen to the period of a deep minimum of solar activity and, accordingly, a maximum of the GCR intensity. It is possible this fact explains the high content of ^{54}Mn (180 ± 20 dpm/kg) twice exceeding the average content of this nuclide in the freshly fallen ordinary chondrites (~87 dpm/kg [3]). At the same time, potassium content in the Ash Creek chondrite (740 ± 80 ppm) corresponds to the average content of natural potassium in L-chondrites: 858 ± 50 ppm [4].

Thermoluminescence (TL): The investigation of the TL was carried out with bulk sample of the chondrite. The magnetic fraction of the powdered sample was separated by means of a hand-held magnet. All samples were loaded into caps, 6 mm in

diameter, maid of a nickel foil. Natural (Tl_{nat}) and X-ray (TL_X) and gamma-ray (TL_γ) induced TL were registered by a modernized device [3]. As the standard at registration of curves of TL_X and TL_γ samples of the Dhajala meteorite were used. According to the TL_X and TL_γ values [3, 5], the shock load of the Ash Creek meteorite was estimated as 12 ± 1 GPa. This value correspond to the S3 shock stage.

Results of measurements of Tl_{nat} and TL_γ were used for an estimation of perihelion of the Ash Creek meteorite orbit [3, 6]. In [7] it has been shown that size of an equivalent doze corresponding saved up Tl_{nat} depends on perihelion size of a meteorite. Results of measurements of TL_γ saved up after irradiation of chondrite samples by a doze 1490 Gr allowed us to assume that a perihelion of the Ash Creek meteorite orbit is close to 1 AU like for the majority of meteorites.

Tracks of VH nuclei: The rate of track formation at the irradiation of the cosmic bodies shows a strong dependency on the shielding depth of the sample: at a depth of 40 cm, the density of the tracks of VH nuclei of the GCR decreases in comparison with the surface by eight orders of magnitude [8]. Because of this, tracks are most accurate indicators of the depth of sample occurrence, which can be used to estimate the preatmospheric size and the degree of ablation of meteorites at their passage through the Earth's atmosphere. In order to obtain such information for the Ash Creek chondrite, track investigations were carried out. The preliminary track characteristics were determined in the 18 olivine micrograins with an average size of 30-70 μm. Track density values were found in interval of $(0.6\text{-}8)\times10^5$ cm^{-2}. The average track density value is equal $(2.6 \pm 0.3)\times10^5$ cm^{-2}. Cosmic-ray exposure age of the Ash Creek chondrite are not available. However, it is known the age of the majority of L-chondrites (~90 %) is above 5 Ma. If to accept, that age of the Ash Creek also higher 5 Ma, the found average track density will correspond to preatmospheric radius of this meteorite of R>15 cm and a shielding depth for the one of investigated samples in the preatmospheric body of d>15 cm.

Table. Cosmogenic radionuclide (in dpm/kg) and potassium (in ppm) contents in the Ash Creek L6 chondrite.

^{46}Sc	^{54}Mn	^{22}Na	^{60}Co	^{26}Al	K
25 ± 5	180 ± 20	95 ± 10	41 ± 5	66 ± 7	740 ± 80

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