RADIATION-THERMAL EFFECTS IN THE LUNAR METEORITES EET87521 AND MAC88105 BY THE TRACK AND THERMOLUMINESCENCE DATA IN THE OLIVINE CRYSTALS. ***L.L. Kashkarov, A.I. Ivliev, G.V. Kalinina.*** Vernadsky Institute of Geochemistry and Analytical Chemistry, Russian Academy of Sciences, Moscow, Russia.

The study of lunar meteorites contributes essential data about radiation history of matter on the lunar surface and shock thermal effects due to impact ejection from the Moon. We report here the further [1] results from our fossil track and thermoluminescence (TL) analyses on the olivine grain samples extracted from the two lunar meteorites EET87521 and MAC88105, the matrix chips of which (~ 0,1 g) were obtained from the meteoritic group of the NASA Cosmic Center. The first meteorite is a mixture of mare and highlands components (ratio about 2:1) and second ones is a regolith breccia from the lunar highlands [2].

The results of track density ρ values measurements in the olivine grains (50-200) μm in size, about 50 samples from each meteorite) are presented in Fig. 1. As it seen for the EET87521 ρ values are in interval of (2.10^4 -2.10^6) cm^{-2}, that is out of the statistical range obtained in individual grains. Near 70% of all samples have about the same ρ values of (5.1+1.7) 10^5 cm^{-2}. In a small portion (<10%) of samples was observed gradient ρ from the edge into volume of the grain. For the MAC88105 olivine grains ρ values are in one order of magnitude: (0.5-7.6) 10^5 cm^{-2} and about 90% of all samples lie inside more small ρ interval (3.7-7.6) 10^5 cm^{-2}.

The next conclusions can be obtained from the treatment of these track data: 1) By the total irradiation dose from VH nuclei of cosmic rays (CR), samples of the meteorite EET87521 relate to the regolith matter having a comparatively low degree of exposure, and very low ones for the meteorite MAC88105. 2) The heterogeneous character of the grain ρ values distribution for the EET87521 olivine grains correlates with formation of this breccia from the predominantly mare material that received different solar CR VH nuclei exposure doses during their deposition under thin ($<10^{-2}$ g/cm^2) material layer. 3) For the MAC88105 meteorite olivines track parameters indicate one of the major their source is galactic CR VH nuclei.

One of the main factors influenced on the basic TL parameters and as result on the TL intensity in the different temperature intervals is shock thermal processes that were occurred during all history of the meteorite matter. From this point of view the comparison of the marine and highland lunar meteorite samples was very important. For this was taken the clear olivine grains (size about 200-300 μm), extracted from two lunar meteorites under investigation and also from pallasite Marjalahti for correlation. We present here the some results obtained for the natural TL, X-ray (E = 50 KeV) and gamma-ray (^{137}Cs, E=0,6 MeV) induced artificial TL sensitivity for the same olivine grains. The measured TL glow curves were processed for decomposition on the spectrum with Gauss peaks [3,4] that allow us to represent a curves as a number of the peaks with a constant peak full width at half maximum (FWHM) for the glow curve of each olivine grain. As example results of decomposition calculation for the MAC88105 olivine grain TL glow curves on 10 Gauss peaks are presented in Fig. 2. The summary curve of these peaks gives a good fit to experimental glow curve. For comparison TL in meteorites under investigation an summary TL intensity of second and third peaks ($S_{2,3}$) was taken as low temperature TL, and seventh and eighth peaks ($S_{7,8}$) - high temperature TL. Relation values $S_{2,3}/S_{7,8}$ are showing

in Fig. 3. The TL values are discussed also at specific glow curve temperature interval: low (<200 °C) middle (200-300 °C) and high (300-410 °C). On the base of the certain results (see Fig.2-4) it can be noted: 1) Remarkably similar $S_{2,3}/S_{7,8}$ values for olivine grains from EET87521 and Marjalahti in all cases TL measurements: natural, X- and gamma-ray induced. It can be indicate on the not complete decay of natural high temperature TL in olivine grains from lunar meteorite. 2) Observed difference between EET87521 and MAC88105 can be influenced by a difference in shock and/or thermal histories of these marine and highland lunar meteorites. A degree of reworking more higher for the first that can be resulted in more effective annealing low energy electron traps. 3) Practically all studied samples are shown the nearest results that indicate on absence of any measurable microcrystalline impurities in the studied olivine grains.

References: [1] Kashkarov L.L., Kalinina G.V. Meteoritics, (1995). V. 30, p. 526 [2] Koeberl C. et al. Geochim. Cosmochim. Acta, (1991), V. 55, p.3073. [3] Nikolaev V.L., Rusakov V.S. Messbauerovskye issledovaniya ferritov (1985), MGV (in Russian). [4] Ivliev A.I., Badjukov D.D., Kashkarov L.L. Geochimiya, N 9, p. 1368, 1995.

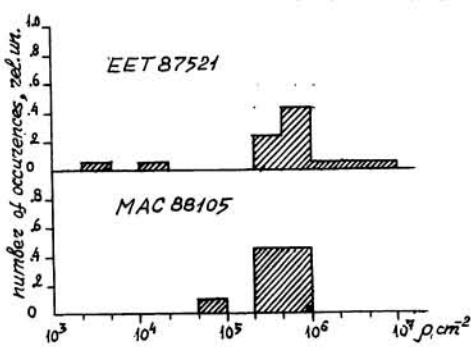

Fig. 1. Histograms of σ values for olivine grains from lunar meteorites EET87521 and MAC88105.

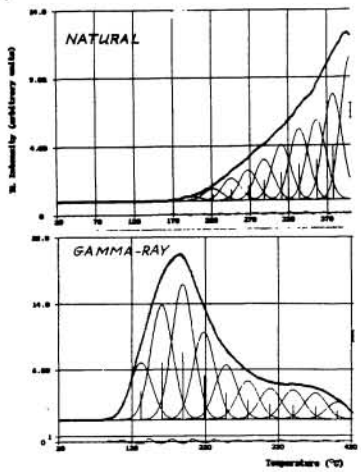

Fig. 2. Natural and artificial induced (by gamma-ray) TL as a function of glow curve temperature for the one olivine grain from lunarmeteorite MAC88105.

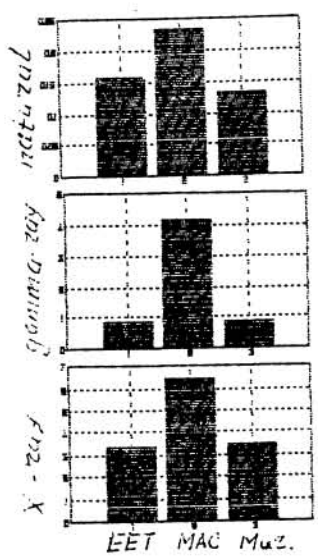

Fig. 3. Natural and artificial induced TL (2+3) and (7+8) peaks ($S_{2,3}/S_{7,8}$) relation values for individual olivine grains from lunar meteorites EET87521, MAC88105 and pallasite Marjalahti.

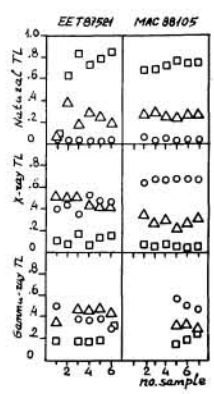

Fig. 4. Related TL intensity values for olivine grains from EET87521 and MAC88105.