RADIATION HISTORY OF LUNAR MICROBRECCIAS AND LITHIC CHONDRULES FROM WESTON METEORITE BY TRACK DATA; L.L. Kashkarov, L.I. Genaeva, L.S. Tarasov, G.V. Baryshnikova; V.I. Vernadsky Institute of Geochemistry and Analytical Chemistry, USSR Academy of Sciences, Moscow, USSR.

We have previously reported (1) the preliminary results of track studies of Weston meteorite chondrules. In this paper the results of further, more detailed investigation of the lithic chondrules from this meteorite as well as of the lunar microbreccias are discussed. The data strengthen our earlier conclusion that part of the chondrules from Weston meteorite have been formed in the process analogous to formation of breccias.

The material under study consisted of 67 lithic chondrules from Weston meteorite and 14 samples of microbreccias from different depths of Luna 16 and Luna 24 sites. The lithic meteorite chondrules of rounded shape and lunar microbreccias of both rounded and angular shape are illustrated in Fig. 1. The sizes of objects under investigation were 0.5 - 1.5 mm. Mineralogical-petrographic examination of lithic chondrules in polished thin section indicates that these chondrules are microporphyritic and fine-grained granular structures (with plots of micropoikilitic structure). Only one chondrule with microbreccia structure was observed. Microporphyritic lithic chondrules consist of phenocrysts of olivine and pyroxene, which are set in microcrystalline groundmass. The granular chondrules are monomineralic, they consist of crystals of olivine or pyroxene. The lunar microbreccias consist of dark and dark-grey host phase and inclusions of olivine, pyroxene and feldspar fragments with sizes from a few tens of microns to about 0.5 mm.

The track parameters were measured for the olivine and pyroxene crystals. The next radiation characteristics for the low energy VH-nuclei of the solar cosmic rays were obtained. 1) Parameter N_H/N is fraction of track rich grains ($\geqslant 10^8$track.cm^{-2}) in given lithic chondrule or lunar microbreccia. For studied samples of lithic chondrules the values of N_H/N range from 0 to 0.55. As example photomicrograph of the polished etched section of chondrule with the microbreccia structure is given in Fig. 2. The value of N_H/N is maximum for this chondrule. For studied samples of lunar microbreccias the values of N_H/N reached 0,9. 2). The values of track densities measured with a scanning electron microscope in irradiated crystals of the lithic chondrules are less 5×10^8 track$\cdot$cm^{-2}. Some crystals of the lunar microbreccias exceeded ~10^9 track.cm^{-2}.3). The track density gradient observed for individual microcrystals indicates that these objects were irradiated under practically unsheilded conditions. The values of gradient reached about the same maximum value for both the lithic chondrules and for the lunar microbreccias, that corresponds to spectral index of the VH-nuclei energy spectrum γ=3 characteristic for the modern solar cosmic rays. The crystals with high track density and track density gradient were discovered in the internal regions of some lithic chondrules as well as inside microbreccias (Figs. 2,3).

The following suggestions will be regarded on the basis of the obtained data. 1) The irradiation degree for the lithic chondrules is essentially lower than that for the lunar microbreccias The maximum value of N_H/N=0,55 was obtained in the lithic microbreccia chondrule. The values of N_H/N for the lunar microbreccias are sufficiently higher and about the same for all investigated samples. These particularities may be due: a) by different irradiation degree of the separate parts of the regolith matter, or b) by different degree of the thermal metamorphism in the brecciation process of the already highly irradiated chondritic matter. 2) The formation processes of the Weston lithic chondrules, containing solar flare irradiated crystals were similar to the processes of impact formation of microbreccia on the lunar regolith, and consist of next stages. a) Irradiation of the matter on the surface of the parent body regolith. b) Brecciation of the matter as a result of the impact events was occurred without heating of compacted matter up to

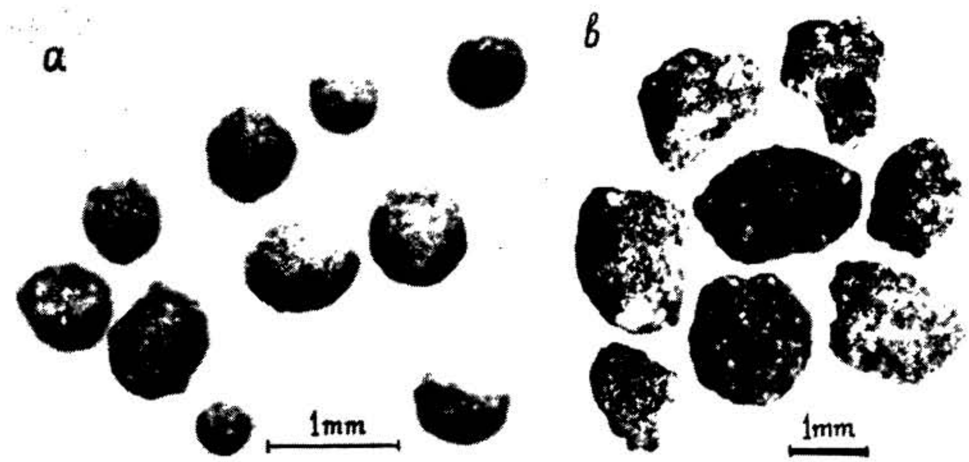
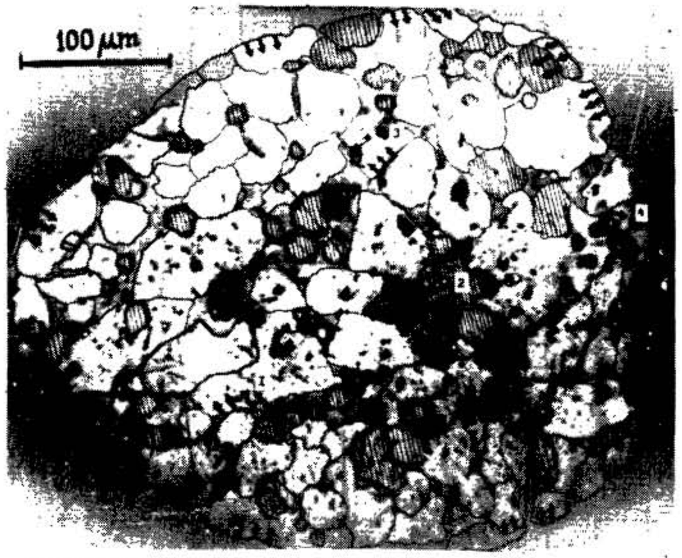


Fig. 1. Samples of Weston meteorite chondrules - (a) and microbreccias from "Luna 16", "Luna 24" cores - (b).

temperature of 600-700°C (2). More higher heating must cause the complete or partial track annealing in these crystals. c) Abrasion and rolling of the surface of the lithic chondrules as an individual object by intensive mixing in the regolith. d) Subsequently multiple reirradiation of some chondrules in the upper regolith layer. This pattern is confirmed by observation of the track density gradients in the near surface region of separate chondrules. 3) Including into the parent meteorite body also without essential heating of matter.



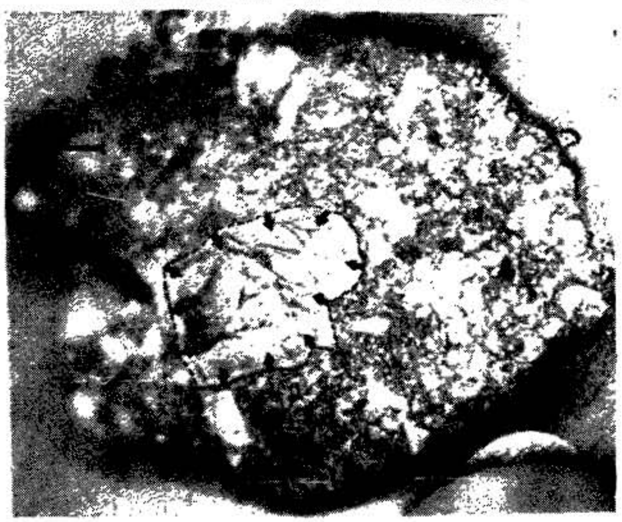


Fig. 2. Polished section of lithic chondrule from Weston meteorite with microbreccia structure. The hatched grain represents the olivine crystals. The rest are pyroxene crystals. The directions of track density gradients in the individual crystals are indicated by the needles.

Fig. 3. Polished section of microbreccia sample 24184,4-6. Gradient of track density in olivine grain is marked by needles. Tracks are conserved in this grain during brecciation while the grain is cracked.

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