SHOCK-THERMAL HISTORY OF EREVAN HOWARDITE MATTER ON DATA OF THERMOLUMINESCENCE ANALYSIS OF SILICATE MINERALS

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Earlier studies [1] of thermoluminescence (TL) of Kapoeta howardite have shown that this method allows to obtain the important information about the microstructure peculiarities of individual silicate mineral grains reflecting their shock-thermal history during the regolith stage that preceded the burial of meteorite matter into the parent body volume. The TL measurements of Erevan howardite were carried out for the further investigation the problem and a comparison with TL-parameters of meteorites having the similar formation history and distinguishing by unequal radiation-thermal processing in the regolith environment. The Erevan howardite is a relatively poorly studied complex polymict breccia of impact origin [2] containing some types of clasts [3]. Unlike the Kapoeta howardite, the Erevan bulk matter is characterized, according to noble gas data, by significantly lower irradiation degree by low-energy solar cosmic rays (SCR) and solar wind ions on the unshielded surface of parent body regolith. So the ^{4}He content is up to 10 times lower as compared to the Kapoeta dark portion, and the ratio values of $^{20}Ne/^{22}Ne$ in Erevan and Kapoeta are equal to 7.2 and 12.9 respectively. The track data are in accord with these characteristics: so the observed by us in the Kapoeta silicate minerals maximum track density value due to SCR VH-nuclei reaches ~ $3\cdot10^{8}$ cm^{-2} while this value for Erevan is about 30 times lower [4].

The grains (size up to ~ 200 μm) of two mineral fractions were handpicked under binocular from Erevan bulk sample for TL measurements. 1) Pyroxenes represented by pigeonite and orthopyroxene that are related by their chemical compositions either to Fe-rich (FM=Fe/(Fe+Mg)=60-62%) pyroxenes (that is characteristic of equilibrated eucrites) or to the pyroxenes with FM=44-46% connected with a melt [3]. 2) Plagioclases represented by An within interval of 72-98%.

The results of Erevan TL measurements were considered in comparison with TL data for Kapoeta [1]. The natural TL in bulk samples did not reveal noticeable differences, and this value for separated OPx and Pl fractions with unequal FM and An ratios is characterized by the presence of high-temperature TL in the region of 250-350 °C. The most part of studied samples (~ 70%) of Erevan meteorite showed the natural TL that is close to the background one. The TL induced by ^{137}Cs radioactive source gamma-rays allowed to distinguish in the Kapoeta and Erevan meteorites five and four shapes of glow curves respectively that are not connected with the chemical composition of the samples under study (see Fig. in the given paper and Fig.in [1]). These groups of glow curves are distinguished both by the

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presence of different amount of TL peaks and a change of TL intensity either in low-temperature (< 200 °C) or in high-temperature (> 200 °C) spectrum regions. The repeat measurements of TL induced by gamma-radiation showed the appreciable changes in the glow curve of Kapoeta and the absence of similar changes in studied Erevan meteorite fractions. The obtained data allow to suppose that the revealed variety of glow curve shapes and their changes after repeat gamma-irradiation reflect the microstructure peculiarities in Kapoeta howardite orthopyroxnes caused by the different shock-thermal histories of individual grains at the early stage of this meteorite formation. From this point of view orthopyroxene from Erevan must have been undergone more "soft" and uniform shock-thermal history.

Our investigation of TL induced by X-ray radiation in Erevan meteorite bulk samples heated previously at 500 °C for 6 hours confirms this conclusion. The comparison of TL characteristics between the unannealed and annealed samples showed that the annealed ones are characterized as follows: a) the 2-5 times increase in total TL intensity; b) the appearance of more low-temperature peak at 110 °C along with the 170 °C peak; c) the decrease in TL intensity by (50-100)% in the temperature range of (300-400) °C. Such noticeable changes of TL parameters allow to suggest that, firstly, the most part of Erevan howardite matter was not undergone the shock-thermal influence at temperature up to 500 °C during regolith processing. Secondly, during its all the subsequent history this matter was not also heated up to temperature of about 500 °C that could induce the similar microstructure changes.

References

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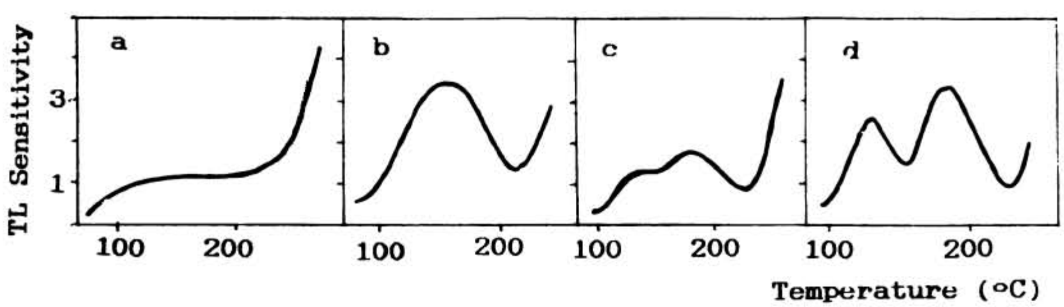

Fig. Induced TL glow curves from Erevan howardite