SHOCK-THERMAL HISTORY OF KAPOETA HOWARDITE MATTER ON DATA OF THERMOLUMINESCENCE ANALYSIS OF INDIVIDUAL MINERAL GRAINS

A.I. Ivliev[1], L.L. Kashkarov[1], and Yu.Yu. Korotkova[2]. [1]V.I. Vernadsky Institute of Geochem. and Analyt. Chemistry, Russian Academy of Sciences. [2]Moscow State University, Faculty of Geology, Moscow, Russia

The artificially induced thermoluminescence (TL) was measured in OPx grains from Kapoeta howardite. TL glow curves for individual OPx grains are significantly distinguished from each other both by their shape and TL sensitivity: 5 groups of OPx grains were characterized. The observed variety of glow curves of OPx grains could be caused by their distinct shock-thermal events at the regolith stage of meteorite parent body formation.

Now TL method is widely applied to the study of formation history of meteorite parent bodies [1-3] because of its very high sensitivity. At the same time the complex relation between TL parameters and a number of factors such as chemical composition as well as microinclusions, and defects in mineral grains was reported. Devitrification of meteorite glasses resulting in plagioclase formation [4] could take place both at the shock-thermal events and at the thermal ones only. Therefore it is very important to find a possibility to use the TL characteristics for study the shock-thermal influence only. In this case we suggest that under the same thermal conditions any alterations in crystals will be far less manifested than in glasses.

In the present work the TL characteristics of OPx have been determined in order to elucidate a possibility of TL method application to study of its shock-thermal history. The Kapoeta howardite was chosen as a polimict breccia affected by multiple shock-thermal treatment in the parent body regolith [5]. About 100 transparent monomineral OPx grains were picked out from the bulk meteorite sample weighing ~ 100 mg. All these ~ 50-100 μm-sized grains were divided into 7 groups on the base of their chemical, microstructure and colour analyses. The transparent light yellowish OPx fragments compose the dominant part of grains in all groups. The chemical composition of this OPx ranges within very narrow values according to microprobe analysis data: $Mg_{1.38-1.68}$ $Fe_{0.32-0.58}$ $Si_{1.98-1.99}$ O_8.

The natural TL was measured in crushed samples as small as ~ 10 μm in size. Then these samples were irradiated by ^{137}Cs source gamma-rays up to dose of 160 krad. The artificially induced TL was measured twice in each sample. The glow curves were graphically treated to reveal peaks in Gaussian distribution of TL intensity. Mathematical treatment of OPx TL spectra showed the following results. 1. Among all the crystals under study at least five groups were found (see Fig.) distinguishing both by the different numbers of selected TL peaks and TL intensity change observed after the first TL measurement in low <(180-200 °C) as well as in high >(180-200 °C) temperature intervals. The examples of the most typical cases are given in the table. It is evident that the ratio value of $R=I_{TL(>200)}/I_{TL(<200)}$ can be both more than 1 (samples 1f, 5f) and less than 1. 2. The peak (T_{PEAK}) temperature selected in low-temperature part of glow curve is

within the range of (172-184 °C) for all samples, and the full width of peaks at half the maximum (FWHM) ranges from 48 to 78 °C. 3. The TL measurements after reirradiation of the same samples show that: a) the lower T_{PEAK} (145-155 °C) were revealed in some samples; b) the several-times rise of TL sensitivity for the same samples (5b) was observed whereas it remained practically constant for the other ones; c) the TL intensity relation in different temperature intervals was significantly affected for some samples: the increase of TL in high-temperature region for the sample 3d by a factor of several times and decrease of that by a factor of ~ 2 for other fragments (e.g. 5f) were observed; d) there is no correlation between the TL parameters and the contents of the main rockforming elements.

On the base of obtained data we can suggest that the observed variety of TL characteristics for Kapoeta howardite individual OPx grains can reflect the peculiarities of their microstructure caused by distinct shock-thermal history at the regolith stage of meteorite parent body formation. The diversity of changes of TL parameters obtained under reirradiation leading both to increase and decrease of TL storage probability in different samples confirms this supposition.

References. 1. Sears, D.W.G. et al. (1980) Nature, **287**, 791. 2. Guimon, R.K. and Sears, D.W.G. (1986) Meteoritics, **21**, 381. 3. Kashkarov, L.L. and Kashkarova V.G. (1989) Meteoritics, **24**,284. 4. Guimon, R.K. et al. (1985) GCA, **49**, 1515. 5. Wilkening, L.L. (1973) GCA, **37**, 1985.

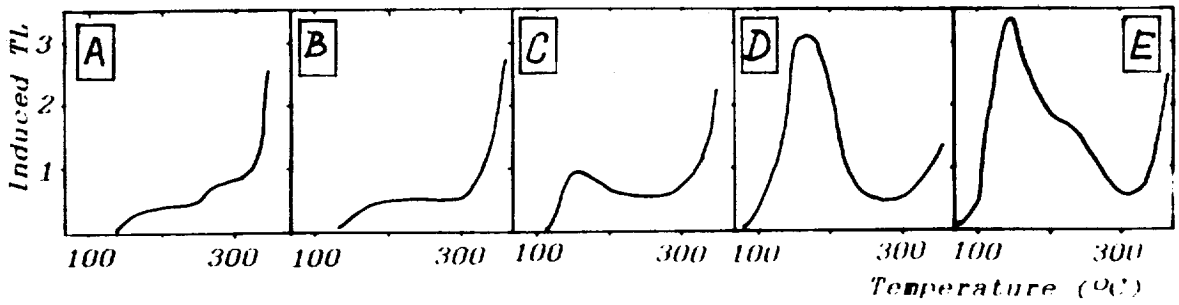

Fig. Induced TL glow curves from the orthopyroxene grains.

Table. TL glow curve parameters for Kapoeta OPx grains.

		First irradiation			Second irradiation		
Group	Sample	T_{PEAK}	FWHM	R	T_{PEAK}	FWHM	R
A	1f	184	57	1			
		230	48	1.58:			
		285	38	1.14			
		320	42	1.14			
B	5c	184	75	1	189	71	1
		230	23	0.20	247	30	0.35
		282	38	0.28	285	44	0.44
		290	25	0.23	323	19	0.45
C	3d	184	65	1	148	64	1
		243	54	0.4	200	54	0.67
		286	49	0.23	247	38	0.35
		>324	-	0.18	>263	-	0.80
D	5b	184	73	1	148	59	1
		>220	-	0.78	188	72	1.30
E	5f	178	52	1	180	82	1
		232	39	0.38	221	33	0.26
		273	43	0.31	255	35	0.15D
		308	31	0.32	277	23	0.08
		347	41	0.18	300	21	0.07