RADIATION AND SHOCK-THERMAL PARAMETERS OF PALLASITES: RESULTING FROM DIFFERENT COMPACTION HISTORY? **G.V. Kalinina, L.L. Kashkarov, A.I. Ivliev, , A.Ya. Skripnik.** *Vernadsky Institute of Geochemistry and Analytical Chemistry Russian Academy of Sciences, 119991, Moscow, Kosygin Str. 19. cosmo@geokhi.ru. tel.: (095) 137-86-14.*

Introduction: In order to test cosmic radiation condition and shock- thermal history of the pallasites, four meteorites of this class were selected for study. Olivine crystals from the Brenham, Eagle Station, Marjalahti and Omolon were examined by the track and thermoluminescence (TL) methods. The Brenham pallasite is unusual in the two main aspects: (1). Although this meteorite nominally classified as a pallasite, it has a solar type gases rich fraction [1] that was not observed in any other meteorites of this class. (2) Olivine crystal microstructure of the Brenham, probably, reflects the process of brectiation.

Track measuring: In this first-step study we measured tracks in one sample (~0.1 g) of the Brenham pallasite. The tracks might be expected in the meteorite crystals from some sources: U^{238} and extinct Pu^{244} spontaneous fission fragments, and galactic (ρ_{GCR}) and solar (ρ_{SCR}) cosmic-ray very heavy (VH-group) nuclei. The possibility of presence in meteorite matter of the last track-source group is correlated with process of their precompaction solar wind irradiation. The chemically etched tracks, the number of which per crystal was small, 0 to 7, and gave track densities (ρ) ranging for 53 of studied crystals (sizes of ~50-300 μm) in the interval from $\leq 10^3$ cm^{-2} up to $1.5x10^5$ cm^{-2} . Obtained results are shown in Fig. 1 and Table 1. As it seen from the histograms in all three size-group of olivine crystals, the very wide track-density range (up to three order of magnitude) are observe. The main part of grains (totally ~80%) have $\rho \leq 10^3$ cm^{-2}, that corresponds to galactic cosmic ray VH-nuclei. A higher ρ-values can be attributed only to solar cosmic ray VH-nuclei, the total irradiation dose of which in individual olivine grains is not the same. Note the sufficient, near twice, increasing of the mean ρ_{av} for grains of the smallest size-fraction.

On the base of obtained track data it can be assumed, that solar type gases in Brenham material could be due to solar wind ions, implanted during of pre-compaction stage of this meteorite parent-body formation or/and in later regolith stage. However, the last scenario for pallasites is unreal. sizes: mean size-fractions of ≥ 200 μm, 100 – 200 μm and ≤ 100 μm, respectively.

TL measuring: TL has been studied in the same four pallasites. Bulk powder olivine samples by weight of ~2 mg were annualized. For the measurement of artificially induced by 55 KeV X-rays TL it was used TL equipment described earlier [2]. Figure 2 shows the typical TL glow-curve shapes. As it seen in all cases the high temperature (T ≥ 250 ^oC) peak occurs, whereas the very high region (T≥370 ^oC) is essentially depleted in TL glow. Note the significant difference of the glow-curve shapes between Omolon and Murchison meteorites. The first demonstrate presence of high-density point dislocations in the individual olivine grains, that is not observed in second as taken for comparison. TL glow-curve shape for Brenham also differ from other pallasites. The total difference were observed in comparison with TL glow-curves, measured in artificially shocked olivine (our unpublished data). In the latter case (see Fig. 3) the low temperature wide peaks (near 100-200 ^oC) is predominant. Now we can only to note that these preliminary observations indicate artificially induced TL, chiefly characterized the microstructure of the crystals under investigation, are: (a) high variable in different pallasites, and (b) the level of possible shock influence, recorded in pallasites olivine is very low.

Conclusions: (1) The shape of the track-density distribution, observed in the Brenham olivine crystals, supports assumption, that this distribution resembles determined irradiated on pre-compaction stage crystals. These tracks probably represent an addition of the solar cosmic ray VH-nuclei. (2) The existence of difference in the track- and TL-parameters in olivines for different pallasites tells us that a variety of processes were occurred in the pre-compaction history of these meteorites.

Partially the work was supported in RFFI Grant 04-05-64930

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References: [1] Mathew K.J. and Begemann F. (1997) *JGR, 102*, 11,015-11,026. [2] Ivliev A.I. et al. (1995), *Geokhimiya, № 9*, 1367-1377.

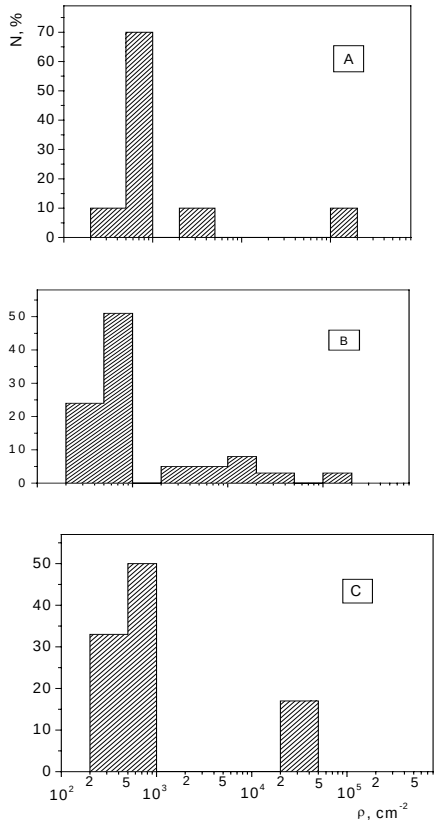

Fig. 1. Track-density distribution in the Brenham olivine crystals: A, B, C – different crystal.

Table 1. Track parameters in the Brenham olivine grains.

Crystal fraction	N grains	N tracks	S, 10^{-2} cm2	$\rho_{\varpi\alpha}01,^{3}$ cm2
A	10	57	1.4	4.1 ± 0.5
B	37	56	1.5	3.7 ± 0.5
C	6	8	0.12	7.0 ± 2.5

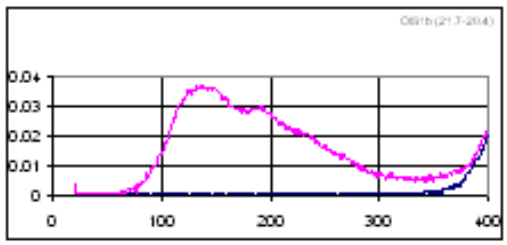

Fig. 3. The induced by X-ray TL glow curve in the experimentally shock loaded olivine sample under pressure about 20-30 GPa.

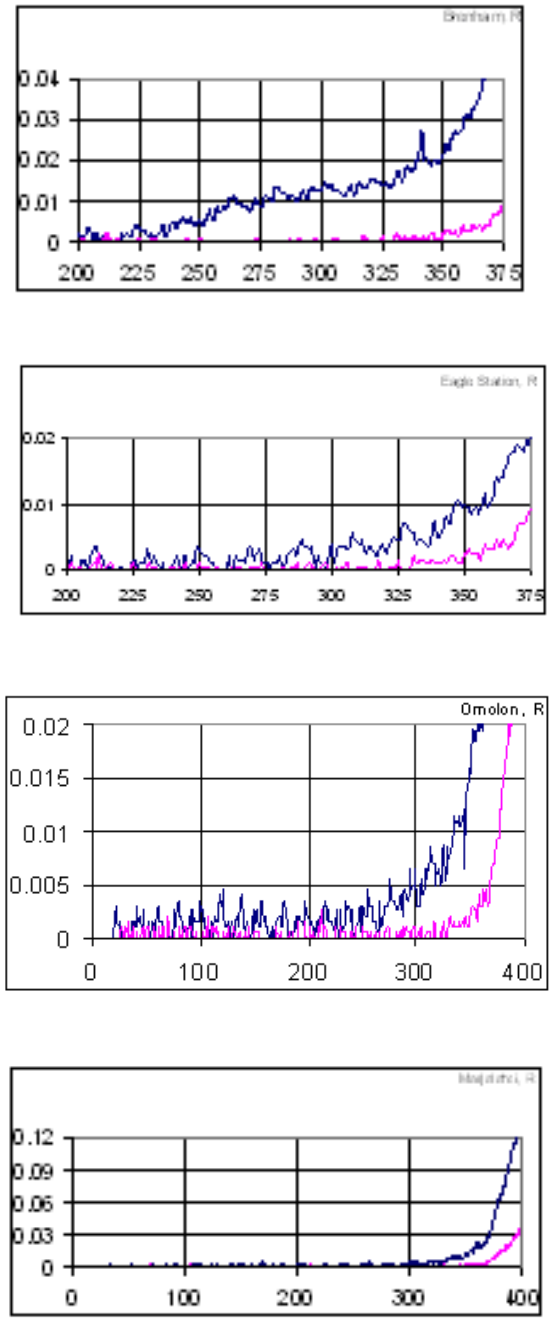

Fig. 2. The TL induced by X-ray irradiation in olivine from pallasites Brenham, Engle Station, Omolon and Marjalahti.