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THERMOLUMINESCENCE OF JAPANESE ANTARCTIC METEORITES II

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Natural TL (thermoluminescence), the luminescence of a sample that has received no irradiation in the laboratory, reflects the thermal history of the meteorite in space and on Earth. Natural TL data thus provide insights into such topics as the orbits of meteoroids, the effects of shock heating, and the terrestrial history of meteorites. Induced TL, the response of a luminescent phosphor to a laboratory dose of radiation, reflects the mineralogy and structure of the phosphor, and provides valuable information on the metamorphic and thermal history of meteorites. The sensitivity of the induced TL is used to determine petrologic type of type 3 ordinary chondrites.

Then the natural TL of meteorites, along with induced TL data and cosmogenic radionuclide (*e.g.*, ^{26}Al) and noble gas abundance data, have been used to identify potentially paired fragments of Antarctic ordinary chondrites. The TL criteria used by Benoit *et al.* (1992) [1] for pairing Antarctic meteorites were that for two meteorites to be paired 1) natural TL dose at 250 ℃ had to be within 10%, 2) TL sensitivity values had to be within a factor of two, 3) induced TL peak temperatures had to be within 10% and peak widths within 20%. These criteria, based on data for petrographically paired meteorites, were deliberately conservative. As more reliable pairing approach, TL properties within large chondrites were analyzed, taking advantage of the fact that serial samples from these meteorites are known to be paired [2]. Then another set of TL pairing criteria: 1) the natural TL peak height ratios, LT/HT, should be within 20%; 2) that ratios of raw natural TL signal to induced TL signal should be within 1.5; 3) the TL peak temperatures should be within 20 ℃ and peak widths within 10 ℃ was proposed. This new set of TL pairing criteria are less restrictive than previously used.

This time we applied these new TL pairing criteria to TL data of fifteen Japanese Antarctic unequilibrated chondrites, measured under Okayama TL instrument and measuring conditions. The data of them were listed in Table 1. Ratio of natural TL signal (raw data as number of counts) to Dhajala-normalized TL sensitivity vs. natural TL peak height ratio is plotted in Fig.1. Y-794064 and Y-794011 are potentially paired according to the new TL criteria.

The petrographic subtype of these unequilibrated ordinary chondrites were also determined from their TL sensitivity and Y-74660 (LL3) was found to have petrographic types under 3.3.

References: [1] Benoit *et al.* (1992): *J. Geophys. Res.*, **97**, 4629-4648. [2] Ninagawa *et al.* (1998): *Antarctic Meteorite Res.*, **11**, 1-17.

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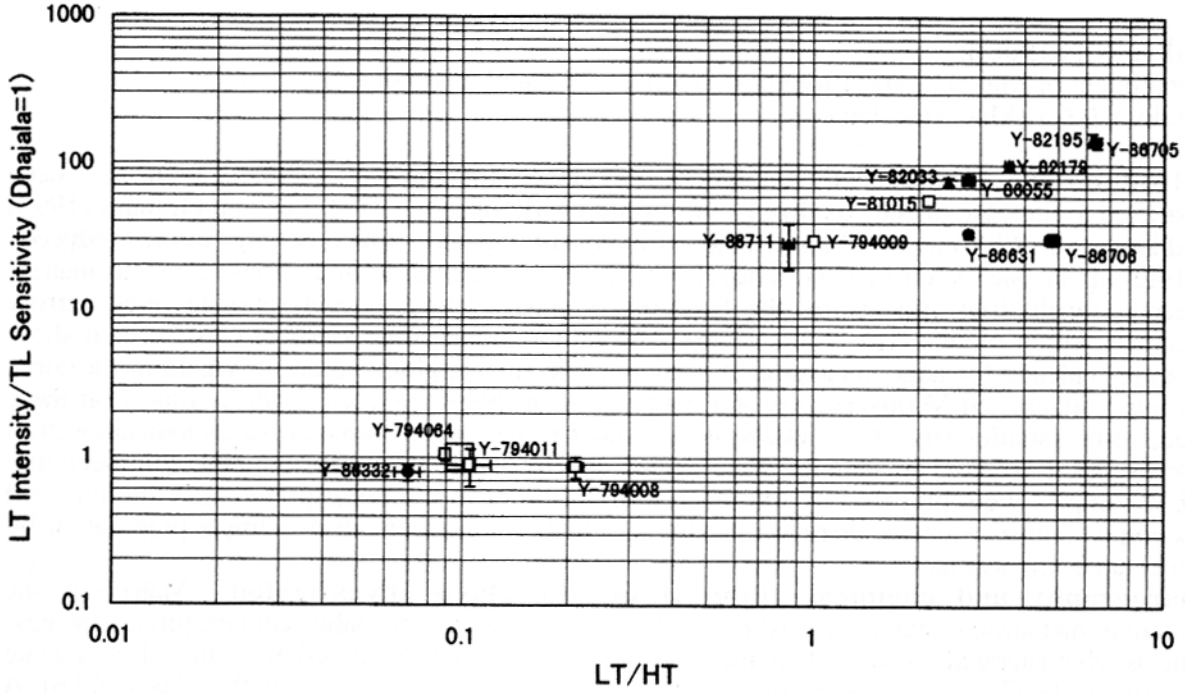

Fig. 1 Ratio of natural TL signal to Dhajala-normalized TL sensitivity vs. natural TL peak height ratio.

Table 1 TL data for fifteen Japanese Antarctic unequilibrated chondrites

Meteorite	Class	Natural TL		Induced TL				LT Int. /TL Sens. ($x10^3$)	Pairing
		LT/HT	LT Intensity (10^3 counts)	TL Sensitivity* (Dhajala=1)	Peak Temp. (°C)	Width (°C)	TL Subtype		
Y-74660	LL3			0.0020 ± 0.0003	133 ± 0	148 ± 7	3.0		
Y-86711	LL3	0.85 ± 0.03	2.2 ± 0.7	0.08 ± 0.01	174 ± 6	150 ± 16	3.4-3.5	29 ± 10	
Y-82033	LL3	2.42 ± 0.01	78.4 ± 2.4	1.01 ± 0.05	167 ± 0	158 ± 0	3.7-3.8	78 ± 4	
Y-82179	LL3	3.61 ± 0.09	20.3 ± 0.1	0.201 ± 0.004	163 ± 0	146 ± 1	3.5-3.6	101 ± 2	
Y-82195	LL3	6.24 ± 0.05	146.8 ± 5.5	0.98 ± 0.09	166 ± 1	158 ± 0	3.7-3.8	150 ± 14	
Y-86332	L3	0.07 ± 0.01	0.3 ± 0.0	0.325 ± 0.009	143 ± 5	145 ± 1	3.6	0.8 ± 0.1	
Y-86055	L3	2.77 ± 0.11	55.0 ± 0.5	0.69 ± 0.05	162 ± 2	131 ± 2	3.7	80 ± 6	
Y-86631	L3	2.77 ± 0.07	16.3 ± 0.2	0.48 ± 0.01	120 ± 2	135 ± 2	3.7	34 ± 1	
Y-86706	L3	4.80 ± 0.24	27.2 ± 1.9	0.87 ± 0.06	102 ± 4	103 ± 1	3.7-3.8	31 ± 3	
Y-86705	L3	6.45 ± 0.02	41.1 ± 1.0	0.29 ± 0.02	151 ± 2	139 ± 0	3.6	144 ± 13	
Y-794064	H3	0.09 ± 0.00	0.5 ± 0.0	0.51 ± 0.02	153 ± 0	147 ± 1	3.7	1.0 ± 0.1	○
Y-794011	H3	0.11 ± 0.02	0.3 ± 0.1	0.38 ± 0.02	148 ± 1	147 ± 2	3.6	0.9 ± 0.3	○
Y-794008	H3	0.21 ± 0.01	0.4 ± 0.1	0.428 ± 0.006	155 ± 0	146 ± 1	3.6	0.9 ± 0.1	
Y-794009	H3	1.00 ± 0.00	38.0 ± 0.1	1.26 ± 0.04	154 ± 0	130 ± 1	3.8	30 ± 1	
Y-81015	H3	2.14 ± 0.02	27.1 ± 0.8	0.48 ± 0.02	162 ± 1	138 ± 8	3.6-3.7	57 ± 3	

* Intensity of Dhajala is supposed to be $5.9x10^3$ cps.