Low Temperature Thermoluminescence of Ordinary Chondrites.

K. Ninagawa[1], Y. Arima[1], A. Yamaguchi[2], N. Imae[2], and H. Kojima[2], [1]Okayama University of Science, [2]National Institute of Polar Research.

Introduction: Induced TL (thermoluminescence), 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. Thermal metamorphism causes the production of feldspar, the major TL phosphor in ordinary chondrites, by the devitrification of feldspathic mesostasis. TL sensitivity was defined to be induced TL intensity around 150 °C or 80 °C, normalized by Dhajala chondrite. Primitive chondrites of petrologic subtype ≦3.4 with coefficient of variations (σ as a percentage of the mean) over 50%, of fayalite in the olivine have low TL sensitivities under 0.1. The sensitivity was usually used to determine petrologic subtype of unequilibrated ordinary chondrites [1]. On the other hand, TL sensitivity decreases 10-fold after shock-loading to 25-32 GPa [2], and terrestrial weathering makes TL sensitivity decrease 16-fold at maximum in Antarctic chondrites [3]. Then these secondary altered chondrites were reported to have low TL sensitivities, equivalent to primitive chondrites [4]. The induced TL of ordinary chondrites has been measured above room temperature. This time we measured low temperature TL from liquid nitrogen temperature to 350 °C, and examined whether there was difference between primitive chondrites and secondary altered chondrites.

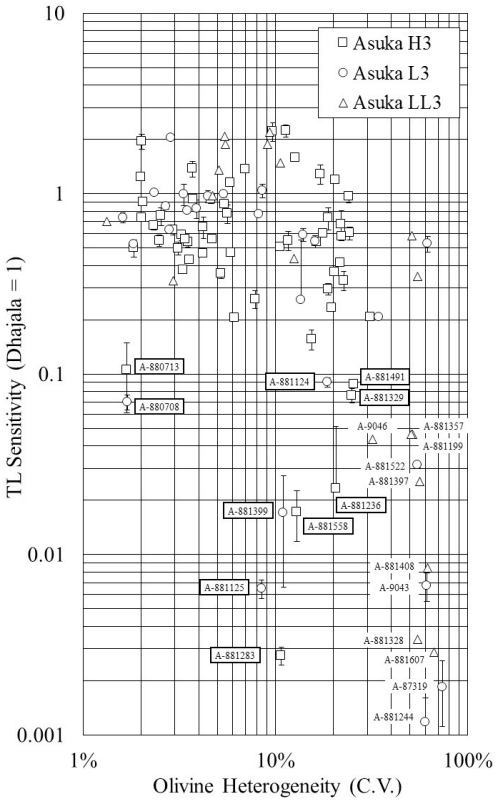

Fig.1 TL sensitivity vs. olivine heterogeneity.

Samples: Twenty-one Asuka ordinary chondrites under 0.1 in TL sensitivities were reported [4]. Ten of them (A 881244 (L3.0), A 87319 (L3.0), A 881607 (LL3.0), A 881328 (LL3.0-3.2), A 9043 (L3.0-3.1), A 881408 (LL3.0-3.2), A 881397 (LL3), A 881522 (L3.3), A881199 (LL3), A881357 (L or LL3.3-3.4)) were primitive chondrite over 50%, of fayalite in the olivine, and eleven of them (A 9046 (LL), A 881491 (H), A 881329 (H), A 881124 (L), A 881283 (H), A 881125 (L), A 881558 (H), A 881399 (L), A 881236 (H), A 880708 (L), A 880713 (H)) were shocked chondrites. Fig.1 shows Dhajala -normalized TL sensitivity vs. olivine heterogeneity of these samples.

Results: There were two peaks around -120 and -80°C lower than room temperature. We could not find clear difference in induced TL glow curves between primitive chondrites and secondary altered chondrites. TL glow curves of a primitive ordinary chondrite of A 87319 (L3.0) and remarkable shocked chondrite of A 881283 (H) is shown in Fig.2. TL glow curves of a primitive ordinary chondrite of A 881397 (LL3.3) and a moderate shocked chondrite of A 880708 (L) in Fig.3.

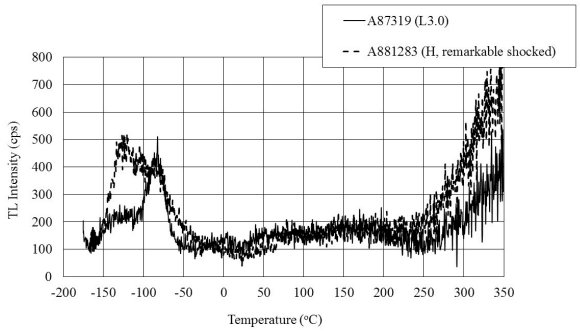

Fig.2. TL glow curves of a primitive ordinary chondrite of A 87319 (L3.0) and remarkable shocked chondrite of A 881283.

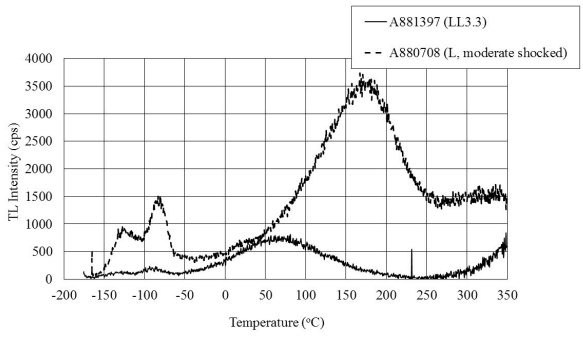

Fig.3. TL glow curves of A 881397 (LL3.3) and moderate shocked chondrite of A 880708. The difference of peak positions at 50 and 150 °C was reflected to disordering of feldspar.