DATING OF MARTIAN METEORITES: CHARACTERIZATION OF LUMINESCENCE FROM A MARTIAN SOIL SIMULANT AND MARTIAN METEORITES. D. Banerjee[1], M. Blair[1], D.W.G. Sears[2] and S.W.S. McKeever[1], Arkansas-Oklahoma Center for Space & Planetary Sciences, [1]Department of Physics, Oklahoma State University, Stillwater, OK 74078, USA: [2]Department of Chemistry, University of Arkansas, Fayetteville, AR 72701, USA.

Introduction: The search for past and present environments on Mars that could have supported life will be assisted by *in-situ* measurements and future sample return missions which provide a chronology of water activity and aeolian processes, and establish the age of geomorphological features on Mars.

With the current focus on *in-situ* studies, Lepper and McKeever(1) proposed using luminescence dating techniques to help construct a geological history of Mars over the last one million years. New luminescence dating procedures(2,3) could provide ages for several depositional environments, and analysis of the dose distributions among aliquots from a sample might help in inferring the nature of the depositional environments(4). In this paper, we characterize the luminescence signals from polymineral fine-grains of a Martian soil simulant, JSC Mars-1, and the bulk fraction of an SNC Martian meteorite (ALH 77005,74).

TL studies: The TL glow curve of JSC Mars-1 shows a single broad peak between ~100°C and 370°C, with the maximum intensity at around 270°C. The martian meteorite ALH 77005,74 has a TL glow curve with two peaks (Fig. 1). The first peak can be observed between the temperatures ~80°C and 160°C with the maximum at ~140°C, while the second broad peak ranges from 180°C to at least 400°C (the maximum annealing temperature) with a peak near 340°C. Many Martian meteorites have peaks at ~120°C, suggesting that feldspar is in the low temperature ordered state. The presence of broad peaks in such samples could be a consequence of a single broad peak (due to a distribution of charge trapping states) or the superposition of several smaller peaks.

OSL studies: To determine the maximum dose estimable using blue stimulated luminescence signal, the SAR method(2,3) was used to generate blue stimulated luminescence growth curves for JSC Mars-1 (Fig. 2) and ALH 77005,74 (Fig 3). For JSC Mars-1, the *theoretical* maximum estimable dose for blue optical stimulation is ~7500 Gy, which corresponds to an age of 3.75 Ma assuming a typical dose-rate for terrestrial environments. The theoretical maximum estimable dose for the ALH 77005,74 sample is ~2500 Gy, implying an upper age limit of 1.25 Ma.

For any dose estimation procedure such as SAR, a fundamental test is to demonstrate that a known dose can be recovered in the laboratory. To this end, dose recovery experiments were performed for the blue stimulated luminescence signals from the JSC Mars-1 and the ALH 77005,74 sample. The equivalent dose ratios (measured/given) for JSC Mars-1 were 0.96 and 0.84 for two different aliquots, and the corresponding ratio for ALH 77005, 74 was 0.98. The results of these experiments show that a known dose can be estimated to within 5% for both these samples.

Conclusions: The thermoluminescence and blue stimulated luminescence signals from the JSC Mars-1 and the Martian meteorite ALH 77005,74 have been characterized in this study. Dose recovery experiments show that radiation doses given in the laboratory can be estimated to within 5% using single-aliquot procedures. The blue stimulated luminescence growth curves suggest that the maximum theoretical estimable dose is ~7500 Gy for the JSC Mars-1 sample, and ~2500 Gy for the ALH 77005,74 sample.

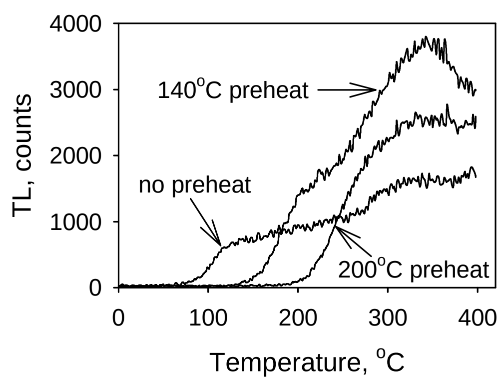

Figure 1: TL glowcurve of ALH 77005,74. The curves were produced after a 300 Gy dose. The three graphs represent the TL immediately after irradiation, after a 140°C preheat, and after a 200°C preheat as indicated.

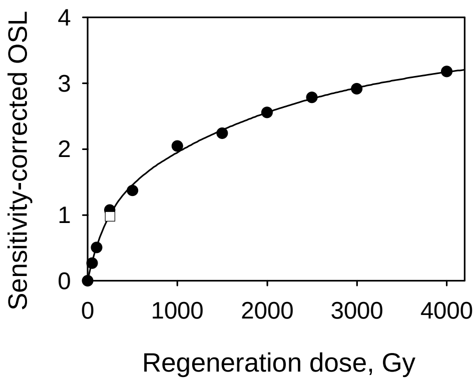

Figure 2: Sensitivity-corrected dose-response curve for the fine-grain fraction of JSC Mars-1. The signals have been integrated over the first 1 s of stimulation. The open circle represents a repeat of the first regeneration dose.

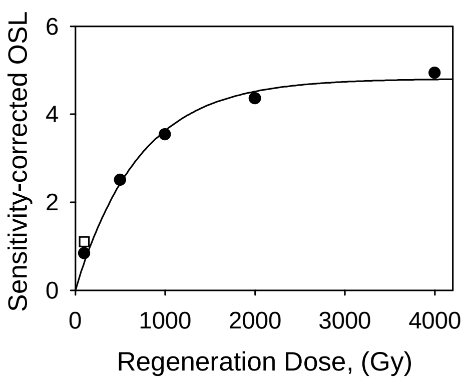

Figure 3: Sensitivity-corrected dose-response curve for ALH 77005,74.

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