Symes S., Benoit P.H., Sears H. and Sears D.W.G. (1991) Natural thermoluminescence and anomalous fading: terrestrial age, transit times,and perihelia of lunar meteorites. *Meteoritics*, **26**, 399-400.

Natural thermoluminescence and anomalous fading: Terrestrial age, transit times and perihelia of lunar meteorites. S. Symes, P. H. Benoit, H. Sears, and D. W. G. Sears. Cosmochemistry Group, Dept. of Chemistry and Biochemistry, University of Arkansas, Fayetteville, AR 72701, USA.

The last few years have seen the identification of no less than 11 meteorites which are almost certainly from the moon. Several of these meteorites (Y-791197, Y-82192 and ALHA81005) have been studied by Sutton (1–3) using thermoluminescence (TL). We have recently completed a detailed study of the natural and induced TL properties of MAC88104/5 and four achondrites (Kapoeta, LEW85303, PCA82502, and Serra de Mage). We here discuss these data, with special regard to the terrestrial and space history of lunar meteorites, as revealed by TL.

In general, the level of natural TL of all the lunar meteorites measured thus far is lower (at a glow curve temperature of ~250 °C) than most ordinary chondrites and achondrites. Possible explanations for this are 1) longer than average terrestrial ages 2) recent reheating (*e.g.*, by a low perihelion orbit) 3) short transit/exposure times or 4) high rates of anomalous fading. There is a fair degree of disagreement on terrestrial ages for lunar meteorites, MAC88104/5 in particular (4–6), but these ages are, in general, no greater than those of most achondrites.

We have experimentally determined rates of anomalous fading for MAC88104/5, four basaltic achondrites, and a chondritic control (Bruderheim). We found, as expected (7), that Bruderheim, with predominantly disordered feldspar, showed only slight degrees of thermal fading in the low temperature portions of its glow curve. The other samples, containing predominantly ordered feldspar, faded significantly throughout their glow curves. Most samples, including MAC88104/5, faded faster in lower temperature portions of their glow curves, but LEW85303 and Kapoeta appear to fade at the same rate throughout their glow curves. Absolute rates of fading are fairly similar at higher glow curve temperatures for all our samples.

We have found, after extrapolating our fading rates to long time spans, that the natural TL level of MAC88104/5 is too low to be caused solely by anomalous fading without requiring a terrestrial age in excess of 10^7 years, which is far higher than all the isotopic ages. However, anomalous fading is probably the major factor giving achondrites and lunar meteorites slightly lower average natural TL levels than chondrites. We conclude therefore that either MAC88104/5 has experienced a recent low perihelion orbit/reheating or that it has a short transit/radiation exposure history. If the latter is the case, our data show that the transit times are 2.0 and 1.8 ka for MAC88104/5, respectively. This compares well with the short exposure times (2.5 ka, ALHA81005; 19 ka Y791197) found by Sutton (1–3) for other lunar meteorites, and we suggest that, despite their compositional and textural differences, MAC88104/5 and ALHA81005 may have been ejected from the moon in the same event.

We will also report new data for two other lunar meteorites: Y82192 and a lunar mare meteorite EET87521. Supported by NASA grant 9-81 and NSF grant DPP8817569. References: (1) Sutton (1986) *Proc. 10th Symp. Ant. Met.*, NIPR Spec. Pub. **41**, 133. (2) Sutton (1986) *Meteoritics* **21**, 520. (3) Sutton and Crozaz (1983) *Geophys. Res. Lett.* **10**, 809. (4) Eugster (1989) *Science* **245**, 1197. (5) Vogt *et al.* (1991) *GCA*, submitted. (6) Nishiizumi *et al.* (1991) *GCA*, in press. (7) Hasan *et al.* (1986) *J. Lumin.* **34**, 327.