THERMOLUMINESCENCE PROPERTIES OF SYNTHETIC FELDSPARS: IMPLICATIONS FOR CHONDRITE THERMAL HISTORIES. **Kyle R. Guimon*, Gary E. Lofgren+ and Derek W.G. Sears*. * Department of Chemistry, University of Arkansas, Fayetteville, AR, 72701. + SN 4, NASA Johnson Space Center, Houston, TX 77058.**

Several classes of meteorite show systematic variations in their thermoluminescence (TL) properties which are related to their metamorphic or shock histories (1-3). These variations are usually associated with differences in the amount and nature of feldspar. Annealing experiments have proved of considerable value in interpreting these variations (2-5). Thus changes in TL sensitivity are known to be caused by the formation or destruction of feldspar and changes in the TL peak temperature and width are related to the relative proportions of feldspar in the high (disordered) and low (ordered) forms. However, a complete, quantitative interpretation of such meteorite data is limited by uncertainties over the composition and history of their feldspar. We have therefore studied the TL properties of feldspars which have been synthesized from a gel using the methods of ref. 6.

40 mg samples were hydrothermally annealed in the manner described by ref. 7 for 2-1000 h at 500 and 850°C, and for 200 h at 400-850°C. Compositions close to the feldspar of equilibrated ordinary chondrites were synthesized ($Ab_{84}Or_{6}An_{10}$, 8). The degree of disorder in the synthetic feldspar was determined by XRD; del ($2\theta(131)-2\theta(1\bar{3}1)$) equals 1.3° and 2.0° for the ordered and disordered forms, respectively (9). TL measurements were made as in Refs. 1-3.

The results are shown in Figs. 1 and 2. The TL peak temperature is strongly dependent on the annealing temperature, varying steadily from about 235°C after annealing at 800-850°C to about 145°C after annealing at 400°C (Fig.1). All feldspars in the series were in an intermediate state of disorder, although there is some indication that del decreases by 0.03-0.05 as the annealing temperature decreased. There is no time-dependence in the peak temperature or the del parameter for the samples annealed at 850°C, while samples annealed at 500°C showed a small time-dependence in peak temperature but none in their del parameter (Fig. 2).

The present data indicate that the TL peak temperature is governed entirely by thermal history, and thus has palaeothermometry applications of the sort previously discussed (4). It also seems that, while possibly related to disordering, the TL changes are not directly caused by disordering. Consistent with this, we have previously shown that activation energies for the TL changes are appreciably smaller than for disordering (4). The time-dependence in the peak temperature of the samples annealed at 500° may be related to the tendency of the peak temperature-width data for types 3.3-3.5 to correlate within the cluster of meteorites whose phosphor is nominally in the "low" form (i.e. peak temperatures around 140°C and widths around 100°C, figure 8 in Ref. 4). This may suggest possibilities for palaeothermometry for type 3 ordinary chondrites on a finer scale than previously discussed.

TL OF SYNTHETIC FELDSPARS

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1. Sears et al. (1982) GCA 46, 2471; 2. Hasan et al. (1986) GCA 50, 1031; 3. Keck & Sears (1986) LPSC XVII, 412; 4. Guimon et al. (1985) GCA 49, 1515; 5. Guimon et al. (1986) GCA, submitted; 6. Luth & Ingamells (1965) Amer. Min. 50, 255; 7. Lofgren (1971) Bul. Geol. Soc. Amer. 82, 111; 8. Van Schmus & Ribbe (1968) GCA 32, 1327; 9. Smith (1956) Min. Mag. 59, 345. (Supported by NASA grants NAG 9-81 and NGT 04-002-800).

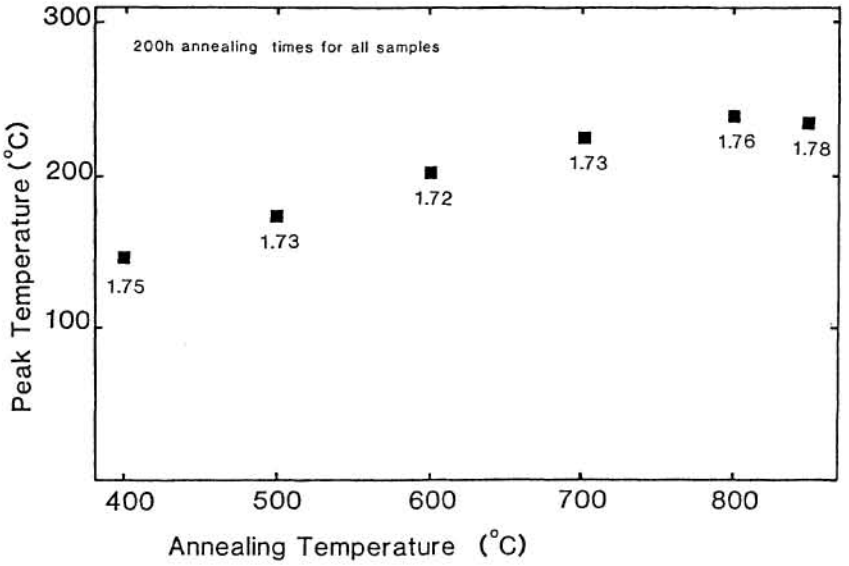

Fig. 1 TL peak temperature vs. annealing temperature for synthetic feldspars. The values by each datum refer to the del parameter (1.3 and 2.0° correspond to the ordered and disordered forms, respectively, with a standard error of 0.02 for all del values).

Fig. 2 TL peak temperature vs. annealing time for synthetic feldspars annealed at 500 and 850°C. The values by each datum refer to values for the del parameter with standard error of 0.02 for all del values.