THERMOLUMINESCENCE AND METAMORPHISM IN CV CHONDRITES.

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One of the effects of metamorphism in meteorites is the production of feldspar, a thermoluminescence (TL) phosphor, through the devitrification of primary chondrule glass [1]. The 105-fold variation in TL sensitivity among the ordinary chondrites reflects this process and has been used successfully to subdivide the petrographic type 3 meteorites into types 3.0–3.9 [2]. Although less pronounced, the variability exhibited by the CO chondrites has also allowed petrographic subdivision of these meteorites [3]. It is possible that the CV chondrites have also experienced a range of metamorphic intensities, although McSween has warned that their petrography does not indicate a simple sequence [4]. On the other hand, Scott et al. show that the homogeneity of matrix olivine increases along the series Kaba, Mokoia, Vigarano, Grosnaja, Allende, which may indicate progressive thermal metamorphism [5]. Here we report TL sensitivity measurements for 12 whole-rock samples of CV chondrites and we suggest petrographic type assignments and discuss their metamorphic history.

TABLE 1. TL sensitivities* (Dhajala = 1) and petrographic type assignments for CV chondrites†.

Meteorite	Class‡	TL Peak 130°C	250°C	350°C	Type
Kaba	CV(O)	<0.01	0.7	1.0	3.0
Leoville	CV(R)	<0.01	1.8	0.9	3.0
Bali	CV(O)	<0.01	0.12	0.2	3.0
Arch	CV(R)	0.014	<0.017	<0.014	3.0
Grosnaja	CV(O)	0.014	n.p.	n.p.	3.0
ALHA 81003	CV	0.012	<0.003	n.p.	3.0
ALHA 84028	CV	0.03	0.012	n.p.	3.2
Efremovka	CV(R)	0.033	0.041	n.p.	3.2
Allende	CV(O)	0.04	0.012	n.p.	3.2
Mokoia	CV(O)	0.05	0.014	n.p.	3.3
Vigarano	CV(R)	0.06	<0.06	<0.05	3.3
Coolidge	CV(R)	1.5	n.p.	n.p.	4

*The error is estimated to be ±50%. n.p. = not present.
†Assuming CO definitions [3].
‡(O) and (R) refer to the oxidized and reduced subgroups of [4].

Samples of bulk powder were ground, the magnetic fraction removed, and the TL of 4-mg aliquots was measured three times for duplicate splits. Averages are given in Table 1. The CV chondrites, like the CO chondrites, generally display three peaks in their glow curves: one at ~130°C, which is sensitive to metamorphism at temperatures below 650°C [3], one at ~250°C, which is metamorphism independent, and one at ~350°C, which might be associated with refractory minerals in CAIs [6]. The TL sensitivities of these samples show a >100-fold range, the lowest being below detection limits (<0.01) and the highest being greater than the Dhajala H3.8 chondrite, which we use as a standard. Six of the 12 samples have TL sensitivities corresponding to type 3.0 if we apply the criteria proposed by Sears et al. to subdivide the CO chondrites (which are similar to those used for the ordinary chondrites) [3]. All but one of the remainder have sensitivities corresponding to minimal metamorphism (types 3.2–3.3). The exception is Coolidge, whose TL, like many other properties [4], indicates that it is petrographic type 4.

Our TL data therefore indicate that, with the exception of Coolidge, the CV chondrites have experienced minimal metamorphism, although evidence for some slight variation is present. Even though Coolidge has been metamorphosed to type 4 levels, like CO chondrites and unlike ordinary chondrites, the temperatures involved were <650°C since the TL peak temperature is still ~130°C. Apparently, the most metamorphosed CV and CO chondrites were metamorphosed for longer times than ordinary chondrites, but at lower temperatures.

References: [1] Guimon et al. (1985) *GCA, 49,* 1515–1523. [2] Sears et al. (1980) *Nature, 287,* 791–795. [3] Sears et al. (1991) *Proc. NIPR Symp. Ant. Met., 4,* 319–343. [4] McSween H. Y. (1977) *GCA, 41,* 1777–1790. [5] Scott et al. (1988) In *Meteorites and the Early Solar System* (Kerridge and Matthews, eds.), 718–745. [6] Guimon R. K. and Sears D. W. G. (1986) *Meteoritics, 21,* 381–382.

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