

A NEW MEASURE OF THE METAMORPHIC HISTORY OF ORDINARY CHONDRITES

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In a study of the thermoluminescence (TL) sensitivity** of 29 ordinary chondrites, we have discovered that there is a strong relationship between TL sensitivity and metamorphic history, as predicted by Liener and Geiss in 1968. Our 11 meteorites of type 5 and 6 cover a range in TL sensitivity of ≤ 10 and type 5 cannot be distinguished from type 6. Our four type 4 specimens cover a similar range, but tend to have values of about half that of the higher types. Type 3 sensitivity values cover a range of ~ 1000 , being comparable with type 4 only at the top end of this range.

Table 1
TL sensitivity (normalized to Dhajala)
and petrologic subtypes of type 3 chondrites

Meteorite	TL Sens.	Sub type
Bremervörde	2.6	3.9
Dhajala	1.0	3.8
Mezö-Madaras	0.9	3.7
Hedjaz	0.82	3.7
Khohar	0.44	3.6
Parnallee	0.42	3.6
Ngawi	0.25	3.6
Tieschitz	0.23	3.6
Sharps	0.071	3.4
Chainpur	0.078	3.4
Manych	0.070	3.4
Bishunpur	0.0054	3.1
Krymka	0.0027	3.0
Semarkona	0.0045	3.0

The type 3 meteorites display strong relationships between TL sensitivity and i) PMD of the fayalite content of the olivine, ii) PMD of the Co in the Kamacite, iii) percent matrix crystallization

**TL emitted by a sample which has had its natural TL removed by heating to 500 °C, and then given a standard laboratory test dose of radiation.

and iv) Feo/(FeO+MgO) in matrix normalized to whole-rock. Furthermore, their bulk carbon and primordial ³⁶Ar contents show a relationship with TL sensitivity and, like TL sensitivity, display a range of values in type 3 ≥ 10 times that displayed in the three higher petrologic types put together. It seems, therefore, that there is some justification for subdividing type 3. For various reasons, we propose a decimal-numerical nomenclature; viz., types 3.0-3.9. In defining these subtypes we have allowed for meteorites more equilibrated than those which we examined (e.g. Carraweena).

The mineral normally responsible for producing TL in meteorites is feldspar. From our study, we conclude that the TL sensitivity value is particularly sensitive to the extent of devitrification of feldspathic glass and this is why it shows such a large range in type 3 chondrites. Our data are consistent with the observations of Van Schmus and Wood, that in type 4 the glass has largely, though not completely, devitrified, whilst in types 5 and 6 it is entirely crystalline.