

THE NATURAL THERMOLUMINESCENCE OF ANTARCTIC METEORITES:
SOME COMPARISONS WITH NON-ANTARCTIC METEORITES; Fouad A. Hasan and
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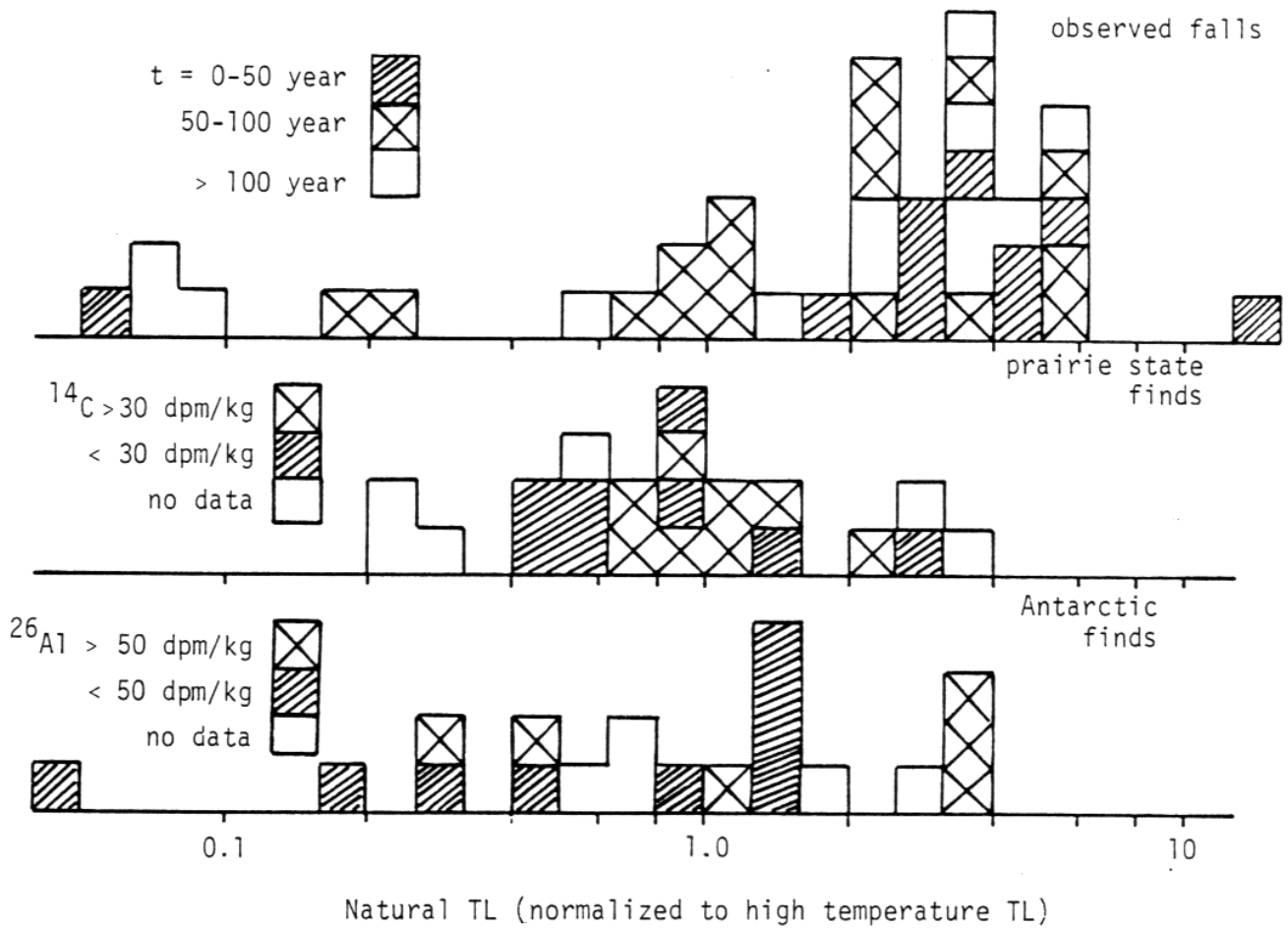
Several studies have shown that the level of natural thermoluminescence (TL) in meteorites can be related to their terrestrial age (1,2,3) and other events which affect their thermal and radiation history (4,5,6). A new method of terrestrial age determination is especially desirable for the Antarctic meteorites, but the complexity of the TL mechanism and uncertainty about terrestrial storage temperatures has made this difficult (7,8). However, there are significant differences in the natural TL of Antarctic and non-Antarctic meteorites which may provide insights into their history.

The figure shows histograms of the natural TL levels - normalized to the relatively stable high temperature TL to remove effects of TL sensitivity differences caused by metamorphism, shock (9,10) and weathering - for observed falls(4), Prairie State finds of known C-14 content (1,11) and Antarctic meteorites. The falls have natural TL values which spread over >2 orders of magnitude (0.05-25), the majority falling in the relatively small range of 1.6-6.3. The Prairie State and the Antarctic finds have very similar distributions, skewed to lower values than the falls (predominantly 0.16-4.0).

It has been argued that the spread between 1.6 and 6.3 displayed by the falls reflects differences in shielding effects and terrestrial age, but the 'tail-off' to very low values is too large to be explained this way and may reflect a heating event within the last 10^{*6} years, such as close solar passage (4,5). Much of the spread observed in the TL values for the finds must be caused by similar factors. The skewing to lower values is most plausibly interpreted in terms of longer mean terrestrial ages for the finds and the similarity in the distributions for the Antarctic and Prairie State finds is attributable to the lower terrestrial ages and higher mean storage temperatures for the latter.

- 1) Sears and Durrani (1980) EPSL 46, 159.
- 2) Melcher (1981) GCA 45, 615.
- 3) McKeever (1982) EPSL 58, 419.
- 4) McKeever and Sears (1980) Mod. Geol. 7, 137.
- 5) Melcher (1981) EPSL 52, 39.
- 6) Sears (1975) EPSL 26, 97.
- 7) McKeever and Townsend (1982) GCA 46, 1997.
- 8) Sears (1981) Nature 293, 433.
- 9) Sears et al. (1980) Nature 287, 791.
- 10) Sears (1980) Icarus 44, 190.
- 11) Boeckl (1972) Nature 236, 25.

Hasan, F.A. and Sears, D.W.G. (1985) The natural thermoluminescence of Antarctic meteorites: Some comparisons with non-Antarctic meteorites. Workshop on Antarctic Meteorites, Mainz, July 1985.



Histograms showing the natural TL levels for observed falls, prairie state finds and Antarctic finds, with known terrestrial ages, C-14 and Al-26 content, respectively.