THE BREAK-UP OF THE H CHONDRITE PARENT BODY AND THE DELIVERY OF FRAGMENTS TO EARTH. Paul H. Benoit and Derek W.G. Sears. Cosmochemistry Group, Dept. of Chemistry and Biochemistry, University of Arkansas, Fayetteville, AR 72701.

There has been considerable discussion over possible differences between Antarctic meteorites and those from the rest of the world [1]. There is no question that there *are* differences in elemental and isotopic composition [2] and class and size distributions [3] but the interpretation of these differences, complicated by weathering and unrecognized pairing [4,5], is open to question. Induced TL data for non-Antarctic and Antarctic meteorites are very similar *except* that a fairly sizable group of Antarctic H-chondrites have abnormally high peak temperatures (>190 ^{O}C) [6,7]. We found that the H-chondrites with high peak temperatures have cosmic exposure ages of <20 Ma (essentially ˜8 Ma) while the more "normal" group (<190 ^{O}C) have ages >20 Ma [7,8]. We stress that this correspondance is statistically significant and difficult to explain in terms of weathering or pairing [9]. We also found that the unusual group of Antarctic H chondrites has experienced less cosmic ray shielding than other H chondrites [10] and faster post-metamorphic cooling as determined by metallographic methods [11]. We suggested that these differences reflect the inclusion of a group of H-chondrites in the Antarctic collection which have experienced a different thermal history to that of modern falls and that, therefore, the population of meteorites impacting the earth has changed over the time represented in the two collections. Our conclusions were based almost solely on samples from the Main icefield at the Allan Hills. We have now looked at the induced TL data for most of the major meteorite-bearing icefields of the Antarctic in order to see if these TL properties are observed at other icefields and whether there are any changes in TL properties over the timespans represented by the different icefields.

Figure 1 shows induced TL peak temperature vs. peak width plots for H-chondrites from the major icefields; also shown is a similar plot for non-Antarctic H-chondrites originally published in ref 6 but about half the data have recently been remeasured and confirm our earlier data. The regression line through the non-Antarctic data is shown on the Antarctic plots for comparison. Not all the icefields contain meteorites of the unusual high temperature H-chondrite group and, among those that do, the ratio of "high" temperature to "normal" meteorites is not constant. For instance, the Main icefield has a very high proportion of high temperature members (˜60%) but the Farwestern icefield has an even higher proportion (˜75%). Among the Lewis Cliff sites, only the Upper Tongue has a large number of high temperature H-chondrites (˜50%); the Lower Tongue and Meteorite Moraine sites are devoid of such meteorites. The Yamato icefield possesses a significant number of high temperature H-chondrites, but in much smaller proportion to the other fields (˜35%). These proportions are, of course, subject to the errors associated with small numbers. While some pairing is likely, the meteorites in both groups show a great diversity in their TL sensitivities and natural TL values indicating that pairing is not playing a significant role in the distribution of these data.

The flux of H-chondrites with TL peak temperatures >190 ^{O}C has decreased over the time represented by the Antarctic collection to essentially 0% among modern falls. The oldest icefields (i.e. those with the highest terrestrial age meteorites), notably the Allan Hills Main icefield [12] and the Upper Tongue at Lewis Cliff [13], have the highest proportions of high temperature H-chondrites. The Yamato field (T_{age} < 20,000 yrs) has a very small proportion of high temperature members and the Lower Tongue (dated by tephra bands at ˜25,000 yrs, ref. 14) and Meteorite Moraine at Lewis Cliff are essentially equivalent to modern falls. The Farwestern icefield may be an exception to this relationship between T_{age} and proportion of samples with >190 ^{O}C peak temperatures. Since sparse terrestrial age dating and estimated accumulation ages (15) seem to indicate a small average terrestrial age for these meteorites, we suggest that the terrestrial age of most of these meteorites is somewhat greater than suggested by these preliminary indications. We will also be soon examining the database for Elephant Moraine, which appears to consist of intermediate age meteorites [15].

Thus the nature of the H chondrites reaching Earth from the break-up of a H chondrite parent body 8 Ma ago has changed over the history of the Antarctic meteorite stranding surfaces. We suggest that there is a "background" flux of H chondrites with CRE ages >20 Ma, generated by an earlier break-up event, perhaps of an entirely different parent body. Of the meteorites from the parent body involved in the 8 Ma event, to first to reach Earth apparently experienced a different thermal history and were less well shielded from cosmic rays than those currently falling. Most of the proposed mechanisms for the delivery of meteorites to Earth are more effective for smaller objects, so the sorting by thermal history is, in fact, a sorting by size [14]. We presume that either texture or location relative to impact produced the correlation between thermal history and size [11]. A schematic representation of the situation is described in Fig. 2. (NASA Grant NAG 9-81).

[1] Koeberl and Cassidy (1990) *LPI Tech. Rept.* 90-01. [2] Dennison and Lipschutz (1987) GCA **51**, 741. [3] Wasson *et al.* (1989) GCA **53**, 735. [4] Jarosewich (1990) *LPI Tech. Rept.* 90-01, 54. [5] Takeda (1990) *LPI Tech. Rept.* 90-01, 86. [6] Haq *et al.* (1988) *GCA* **52**, 1679. [7] Sears et al. (1991) GCA **55**, 1193. [8] Schultz et al. (1991) *GCA* **55**, 59. [9] Benoit *et al.* (1991) *Meteoritics* **26**, 157. [10] Sears and Benoit *LPSC XXII*, 1209 [11] Benoit and Sears, *LPSC XXIII*, (this meeting). [10] Nishiizumi *et al.* (1989) *EPSL* **93**, 299. [11] Benoit *et al.* (1991) *JGR* (in press). [12] Fireman (1990) *LPI Tech. Rept.* 90-03, 82. [13] Huss (1990) *Meteoritics* **25**, 41. [14] Wasson (1991) *Science* 249, 900.

Fig. 1

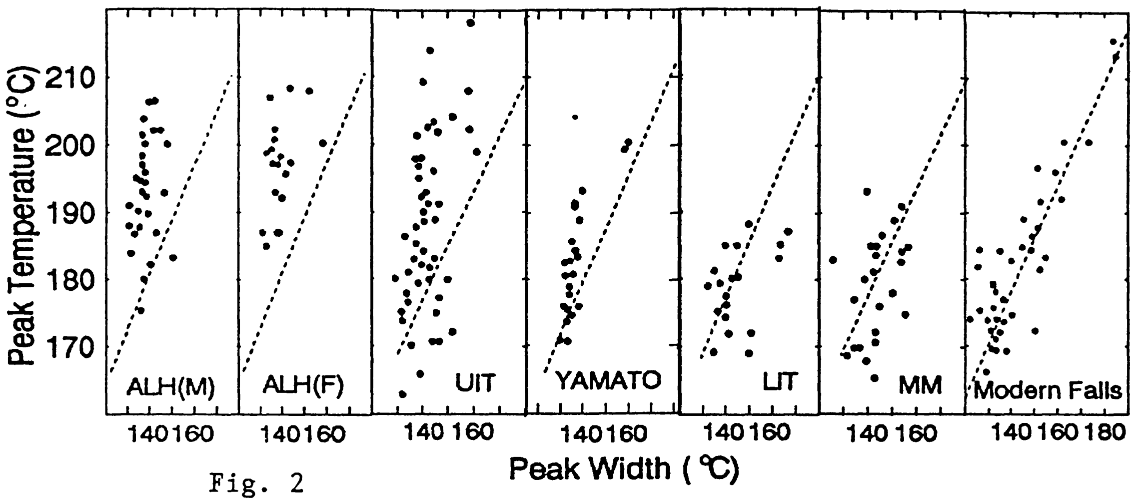

Fig. 2

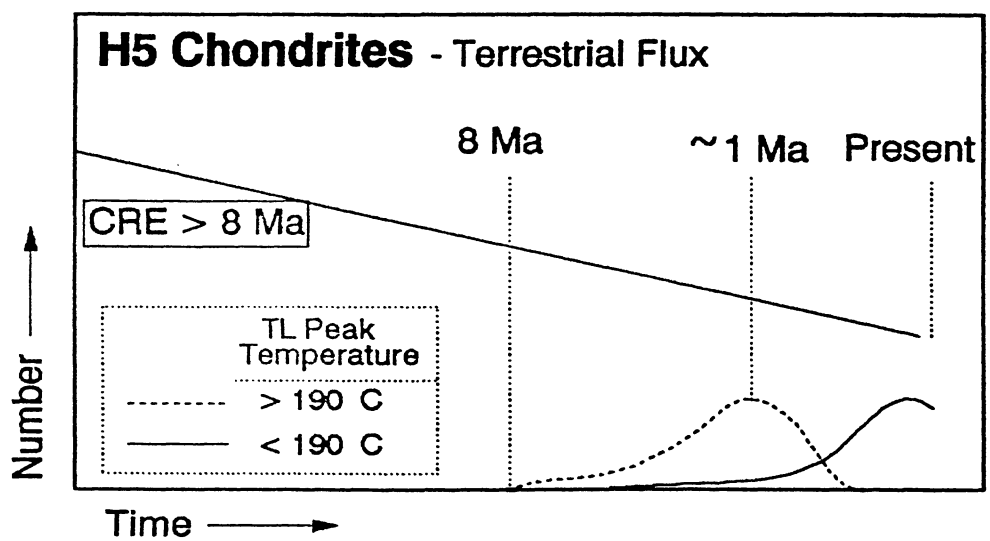

Fig. 1. Induced TL peak temperature vs. peak width for Antarctic and non-Antarctic meteorites. Icefields: ALH(M) = Allan Hills Main; ALH(F) = Allan Hills Farwestern; UIT = Lewis Cliff Upper Ice Tongue; LIT = Lewis Cliff Lower Ice Tongue; MM = Lewis Cliff, Meteorite Moraine.

Fig. 2. Schematic for the flux of H chondrites to Earth, showing two types of material from the 8 Ma break-up and the "background" from breakups at other times.