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SIZE SORTING OF CHONDRULES IN EL CHONDRITES: IMPLICATIONS FOR THE ORIGIN OF ENSTATITE CHONDRITES. A. Taunton, P. H. Benoit, and D. W. G. Sears, Cosmochemistry Group, Department of Chemistry and Biochemistry, University of Arkansas, Fayetteville AR 72701, USA.

The size sorting of their components is an important constraint on the formation of chondrites [1,2]. First-order data for chondrule size distributions exist for all the major chondrite classes, the exception being the heavily metamorphosed EL chondrites. However, the recent discovery of the essentially unmetamorphosed EL3 chondrites has enabled us to obtain data for this class (Fig. 1).

The diameters of the chondrules in PCA 91020 and ALH 85119 have a mean of 950 μm and a range of 220–2200 μm, with the cumulative frequency distribution shown in Fig. 1. We confirm earlier suggestions that EL chondrules are appreciably larger than the chondrules of EH chondrites [3]; in fact, EL and EH chondrules overlap with those of LL and CM chondrites [4,5] respectively.

Various scenarios have been proposed for the size sorting of chondrules, all involving aerodynamic processes; Whipple suggested that it may have occurred as the accreting components moved through the nebula gas [1], while several groups have suggested that the chondrules and other components were aerodynamically sorted as they were carried several astronomical units in bipolar outflows [e.g., 2], and we have argued that the components were sorted in thick dust layers on the surface of the accreting parent body mobilized by extensive degassing [7,8]. We argue that the relative fractionation of metal and silicates required the presence of a gravitational field, while the "complementary" composition of the chondrules and matrix and the essentially cosmic composition of the whole chondrites require a highly localized process, both requirements being satisfied by a fluidized regolith. Empirical equations for density and size sorting, developed for chemical engineering applications, quantitatively explain the metal-silicate fractionation and size sorting of the metal and chondrules in the regolith of the parent body of the H, L, and LL chondrites [7,8]. The difference in chondrule sizes between EH and EL chondrites observed in the present work suggests that a similar process might explain the metal-silicate fractionation of the E chondrites.

References: [1] Whipple F. (1972) in *Physical Studies of the Minor Planets*, pp. 251–262. [2] Dodd R. T. (1976) *EPSL, 30*, 281–291. [3] Grossman J. N. (1988) in *Meteorites and the Early Solar System*, pp. 680–696. [4] Huang S. et al. (1996) *Icarus*, in press. [5] Sears D. W. G. et al. (1993) *Meteoritics, 28*, 669–675. [6] Shu F. H. et al. (1996) *Science, 271*, 1545–1552. [7] Huang S. et al. (1994) *Meteoritics, 29*, 475. [8] Huang S. et al. (1996) *JGR Planets*, submitted. [9] Rubin A. E. (1989) *Meteoritics, 24*, 179–189.

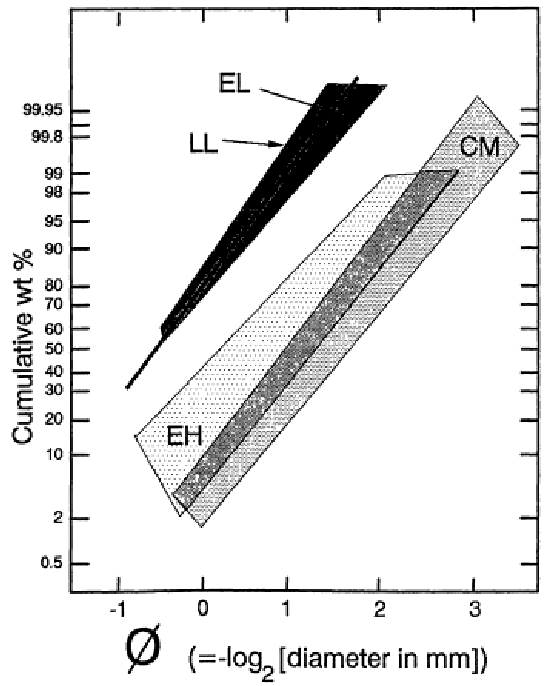

Fig. 1. Cumulative frequency distributions for chondrules from EL chondrites compared with literature data for chondrules from the Semarkona LL [4], Murchison CM [5], and EH [9] chondrites.