THE CHONDRULE SIZE DISTRIBUTION OF BJURBOLE. Karla E. Kuebler and Harry Y. McSween, Jr., Dept. of Geological Sciences, University of Tennessee, Knoxville, TN 37996.

For more than two decades scientists have acknowledged that chondrite groups have distinct size-frequency distributions of chondrules and have inferred a process of aerodynamic (or mass) sorting in the presolar nebula prior to accretion [1, 2, 3, 4]. Data acquisition inevitably requires the observation of the apparent chondrule size distribution in thin section because disaggregation is not always convenient, and is therefore subject to the biases of chondrule sampling during thin sectioning. These biases include: 1) non-equatorial thin sectioning of chondrules, 2) the non-zero thickness of thin sections, and 3) the disproportionate probability of sampling large chondrules.

Because the evaluation of chondrule sorting depends upon the successful conversion of the apparent size distribution to the true size distribution (that achieved by disaggregation), all of these biases must be corrected. While previous models correct for one or another of these biases ([5] for 1, [2] for 1 & 3) a model presented by [6] incorporates all of the above. The aim of the current research is to compare the results of the Eisenhour model with previous models.

By the disaggregation of the Bjurböle (L4) chondrite, Hughes [5] was able to create a histogram showing the percentage of droplet chondrules lying within specific size ranges (or bins) (see Fig. 1, bold histogram). He then attempted to convert the apparent diameters of chondrules measured in thin section into percentages comparable to the disaggregation percentiles. To do this, all chondrules within a specific bin (as measured in thin section) were assumed to sample chondrules whose actual diameters were 0.5 mm larger than the bin. From this it was possible to calculate the expected abundance of chondrules within a given bin. By repeating the procedure for various bin sizes the dashed histogram in Fig. 1 was produced. This was referred to as the "expected thin section data." The percent difference between the disaggregation and expected values (the difference between the solid and dashed histograms) was then used to calculate those values that, when multiplied by the ratio between the disaggregation and expected thin section mean and median yield the "true" values which should have been obtained upon disaggregation. From this Hughes [5] determined that the average diameter (D) of a chondrule measured in thin section is ($\sqrt{2/3}$)D and the median diameter is ($\sqrt{3/4}$)D.

However, the assumption that all chondrules are sectioned randomly is not valid because larger chondrules are preferentially sampled relative to small. Dodd [2] applied empirical correction factors originally derived for terrestrial sandstones to chondrites and obtained mean and median chondrule diameters 10 to 20 % smaller than the diameters measured in thin section. The application of this method, however, is limited because it preserves the functional form of distributions. The method used by Dodd effectively narrows the range of sizes and decreases the mean. With the procedure described by [6], the functional form of distributions is allowed to change, and means may increase or decrease.

The observed diameter of a chondrule varies according to the light used when the measurements are made. When the surrounding matrix is opaque, measurements made in transmitted light represent the smallest diameter of the chondrule in the thin section. Measurements made in reflected light represent the chondrule diameter at the upper surface of the thin section. This difference will be greater for thick sections than thin. Furthermore, the error for small chondrules will be more significant than for large chondrules. For this reason, [6] suggests that all chondrule measurements be made in reflected light.

The thin-section derived chondrule size data from Bjurböle were corrected according to the procedures outlined in [6], where the corrected number of chondrules, N_o', within each size bin is

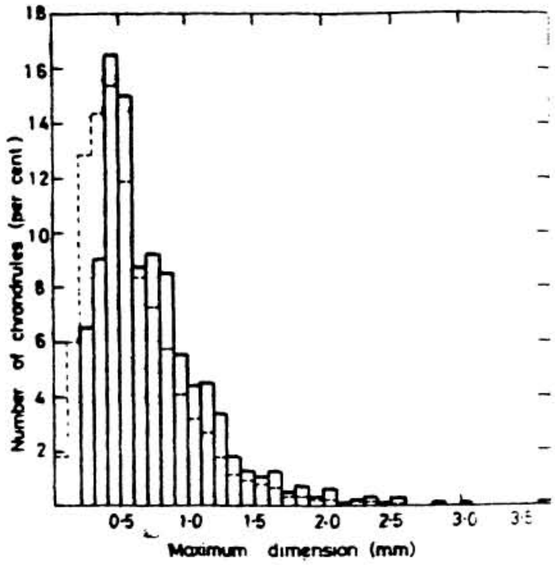
$$N_o' = \frac{2}{\left(d_u + d_l\right)} \frac{d_u}{\left(d_u^2 - d_l^2\right)^{1/2}} \left[N_o - \sum_{i=1}^{\infty} N_i' \left\{ \frac{\left(D_i^2 - d_l^2\right)^{1/2} - \left(D_i^2 - d_u^2\right)^{1/2}}{D_i} \right\} \right] \qquad (1)$$

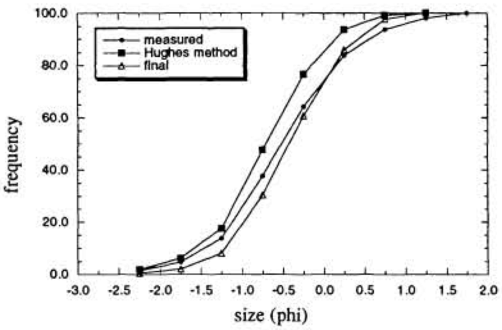
where N_o is the uncorrected number of chondrules in a bin; D_i and N_i' are the mean diameters and corrected abundances, respectively, of larger bins; and d_u and d_l are the upper and lower boundaries, respectively, of bin N_o. The data were corrected bin by bin starting with the largest size bin and proceeding to the smallest. All summations were truncated at $i = 5$.

A histogram of the results is presented (total chondrules measured=210), where the black columns represent the apparent thin section size distribution, and the Hughes [5] and Eisenhour [6] corrected distributions are represented by the shaded and clear columns, respectively (Fig. 2). Cumulative frequency curves of the apparent size distribution, the Hughes, and Eisenhour corrections are also presented (Fig. 3).

In reality, the correction procedures differ from one thin section to another, depending on variables such as section thickness, relative chondrule sizes, and ease of chondrule observation. Results from Bjurböle indicate that the method of [6] provides better agreement with disaggregation data than previous methods. However, the resulting chondrule size distribution is not in complete agreement with the disaggregation data and may reflect difficulties associated with chondrule identification.

References: [1] Dodd R.T. (1967) *EOS*, 48, 159. [2] Dodd R.T. (1976) *EPSL*, 30, 281-291. [3] King T.V.V. and King E.A. (1979) *Meteoritics*, 14, 91-96. [4] Rubin A.E. and Grossman J.N. (1987) *Meteoritics*, 22, 237-251. [5] Hughes D.W. (1978) *EPSL*, 38, 391-400. [6] Eisenhour D. D. (1996) *Meteoritics* (in press).





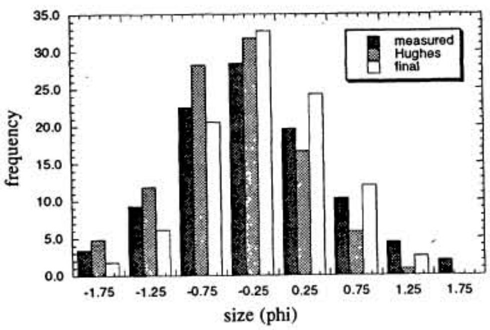


Fig. 1. (upper left) Histogram showing the percentages of droplet chondrules in Bjurböle that have the maximum dimensions lying within a specific size range (bin). The bold histogram is from disaggregation results and the dashed shows the thin section results that would be expected according to his method (from Hughes, 1978).

Fig. 2. (upper right) Cumulative size frequency plot of chondrule distributions as measured in thin section, according to the Hughes model, and according to the Eisenhour model.

Fig. 3. (lowrer left) Histogram of the chondrule size frequencies as measured in thin section (black columns), according to the Hughes and Eisenhour methods (shaded and clear, respectively).