A NOTE ON THIN SECTION MECHANICAL ANALYSIS[1]

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The thin section technique of mechanical analysis is the only way to study grain-size distribution in indurated sediment where the grains are too firmly cemented to be disaggregated. Like all other techniques of size analysis, the thin section technique faces the problem of how to define size.

Particle size, when ascertained by microscopic measurement, is stated either in terms of the "projected diameter", or in terms of one of the so-called "statistical" diameters (Herdan, 1953, p. 65). Heywood (1946) has shown that where mean size is concerned, only Feret's statistical diameter can be said to be significantly different from the rest, viz., (1) mean projected diameter calculated from area measurement by planimeter, (2) and (3) diameter by comparison with calibrated circles, transparent and opaque, and (4) Martin's statistical diameter; the differences between the latter four are not significant. Consequently it follows that the exact determination of the profile area by planimeter has no definite advantage over the less laborious ways of determination, which indeed justifies the use of the other techniques.

According to the writer Martin's statistical diameter, with a slight modification, can be used to obtain an idea about the sphericity distribution along with size distribution. Martin's (1923, p. 61) statistical diameter (fig. 1) is defined as the mean length of a line intercepted by the profile boundary which approximately bisects the area of the profile. The bisecting line is taken parallel to a fixed direction irrespective of the orientation of each particle. The modification suggested by the author is that instead of one such line, two lines at right angles are taken and the respective diameters M.D. and S.D. are measured and noted as long-diameter and short-diameter, depending on their relative values. Both the long-diameter and short-diameter for each grain are measured and cumulative curves are drawn showing each type of distribution (fig. 2), phi-scale being conventionally used on abscissa. The mean size, M_z (Folk and Ward, 1957), is calculated for each type of distribution and a plot is made (for the formation under study) showing M_z (short) *vs* M_z (long). The nature of the plot is critically examined to arrive at a picture of sphericity distribution.

[1] Manuscript received April 9, 1962.

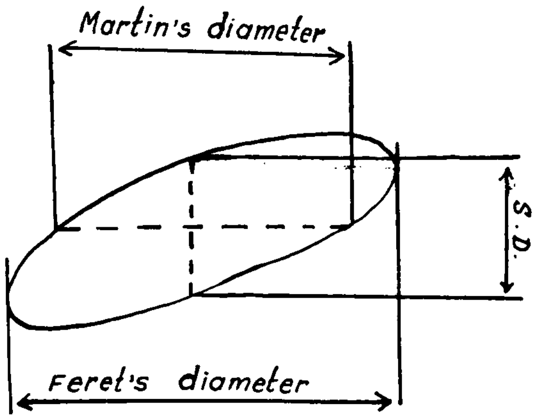

FIG. 1.—Diagram showing Feret's diameter, Martin's diameter, and secondary diameter.

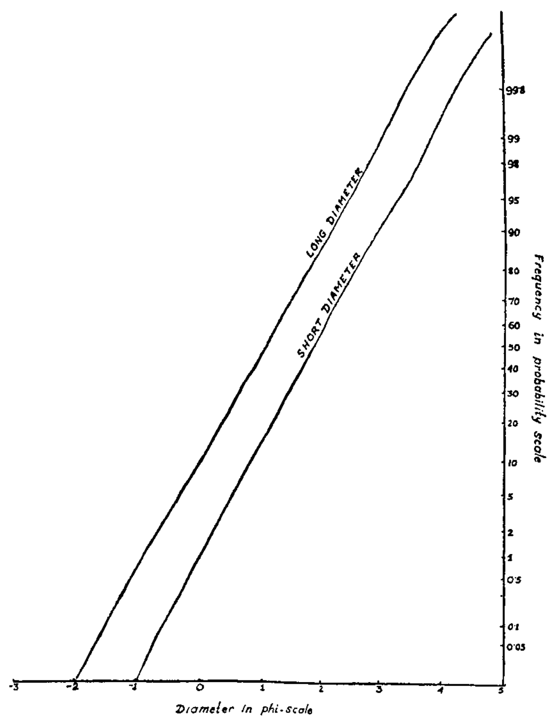

FIG. 2.—Size distribution curve for a particular sample.

From the scatter diagram of the plot a line of best fit is drawn. The latter may take several forms depending on the sphericity distribution. Let us consider four ideal cases as illustrated in figure 3:

Case I—This line is in the 45° position, i.e., there is no difference between M_z (long) and M_z (short), or in other words all the grains are approximately spherical.

Case II—The distance of this line from 45°-line gives a rough idea about the amount of non-sphericity. The mean of the ratios between M_z (long) and M_z (short) will give the mean value of sphericity. The parallelism between line II and line I suggests that sphericity in coarser grades (lower phi values) is less than that in finer grades, because the ratio between M_z (long) and M_z (short) is greater in the former case.

Case III—A line having this type of slope will mean that the sphericity is more or less uniform over all size grades.

Case IV—The amount of sphericity is low in coarser grades, while in finer grades the grains have a tendency to become spherical.

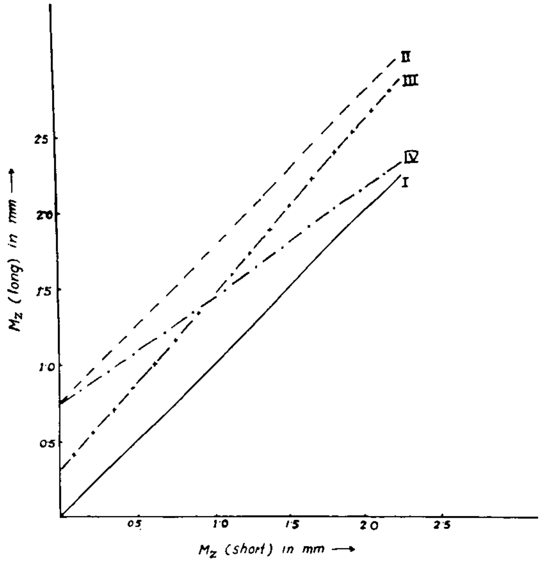

FIG. 3.—Diagram showing different types of relationship between M_z (short) and M_z (long).

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Reprinted from the Journal of Sedimentary Petrology for March, 1964