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**A New Type of Sieve Shaker: The Meinzer II®, a
Comparative Study with Rotap® Technology**

by

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A NEW TYPE OF SIEVE SHAKER: THE MEINZER II® , A COMPARATIVE STUDY WITH ROTAP® TECHNOLOGY

by

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ABSTRACT

A new type of sieve shaker, the British-designed Meinzer II ®, is compared to the long-used "industry standard" Rotap ® shaker. Twenty sand-sized sediment sample pair tests were conducted using four different sieving protocols to determine if Meinzer II ® shakers duplicate results from Rotap® shakers. It was found, based on qualitative visual assessments of sample pair cumulative probability distributions, and on quantitative statistical analysis, that Rotap® and Meinzer II ® shakers result in essentially identical outcomes. Furthermore, this conclusion is reached for samples tested with soft or friable sand-sized particles, wherein the Meinzer II ® was found to be gentler than the Rotap ® machines.

INTRODUCTION

The sedimentology laboratory at the Florida Geological Survey (FGS) has for years used Rotap-type sieve shakers to conduct granulometric analyses. These machines, because of their widespread application, longevity of use, and standardized design characteristics, are considered as the standard in grain-size analytical results. Recently, however, the FGS procured two Meinzer II ® sieve shakers recently developed by a British firm. It is the purpose of this work to present a comparative study of the two types of technology.

In geological sedimentologic pursuits, the principal final products required from granulometric analyses are: (1) frequency and cumulative frequency probability plots and (2) moment measures (mean, standard deviation, skewness, kurtosis, etc.) and other statistical measures (the relative dispersion and median). Here, both are considered with statistical measures providing the definitive comparative assessment tool. Variabilities occurring due to the difference in sieve shaker technologies and those inherent in the standard analytic procedures are also discussed.

Rotap® Sieve Shakers

The FGS has historically used two single-stack Rotap ® shakers (Figure 1). Each shaker is configured to hold ½-nest of 8-inch diameter half-height sieves. A full nest of sieves covers the grain-size range from -2.0 φ to 4.0 φ at ¼-phi intervals. Rotap ® shakers are designed to horizontally rotate sieves with a 2" (0.05 m) orbital throw 2.5 to 3.0 cycles per second, while an arm periodically strikes (2.5 to 3.0 times per second) the top of the sieve stack (maximum height of about 1 inch (0.025 m) above the sieves) to create a vertical moment (Figure 1). They are large machines weighing over 180 lbs (82 kg), and generate a highly distracting amount of noise. They are, therefore, housed in a specially designed cabinet 6 ft long by 2.5 ft wide by 4 ft 4 in high (1.8 m L x 0.8 m W x 1.3 m H) which is lined with sound-deadening material. The shakers are also bolted to two 6 by 6 inch (0.15 x 0.15 m) ties which are in turn bolted into the concrete floor. They are located in a garage bay on the ground floor of the FGS building just outside of the sedimentology laboratory. The bay is not air-conditioned, and the motors within the Rotap ® cabinet generate significant heat. Hence, depending on ambient relative

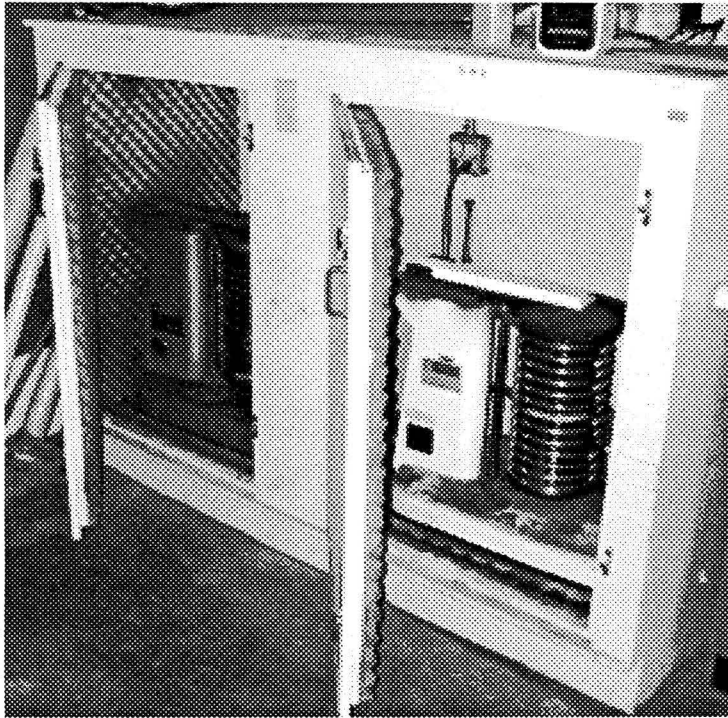


Figure 1. Two Rotap shakers in sound-reducing cabinet at the FGS Sedimentology Laboratory (photo by T. M. Scott).

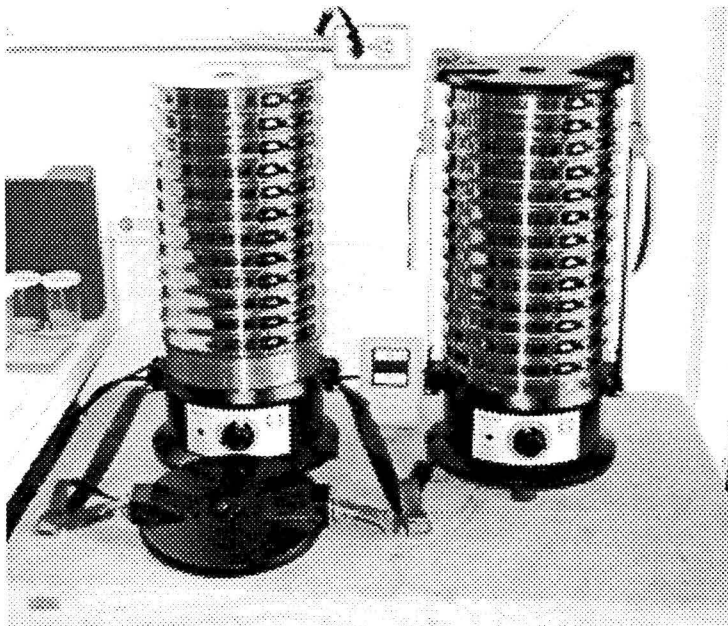


Figure 2. Two Meinzer II shakers in the FGS Sedimentology Laboratory (photo by T. M. Scott).

humidity, there are times when sticky grain problems have precluded sieving until conditions changed (see Balsillie and others, 1997, 1999). Rotap[®] machines can be stressful to sieves and can over time damage them, which occasionally requires their replacement or repair.

Meinzer II[®] Sieve Shakers

The two recently acquired Meinzer II[®] single stack sieve shakers are configured to hold half-height sieves in the same manner as for the Rotap[®] shakers (Figure 2). Other than that there is little resemblance between the two. Meinzer II[®] shakers are fixed amplitude machines with perhaps 0.0066 inches (2.0 mm) of horizontal orbital throw, and 0.01 inches (3.0 mm) of vertical throw. Vibrations are generated at 60 cycles per second. They weigh 36 lbs (16 kg) and have a 10-inch square (0.254-m square) footprint, and comfortably occupy a space 3 ft long by 2 ft wide by 2.5 ft high (0.9 m L x 0.6 m W x 0.8 m H). Hence, they occupy a footprint area 60% smaller than that required for the Rotap[®] machines. Their most endearing characteristic is that they are silent. They also result in much less wear on the sieves. Since they are so light weight they can be easily moved into an air-conditioned environment to control effects of humidity and sticky grain problems, and can be used in the mobile FGS Geolab or on any of the FGS marine research vessels.

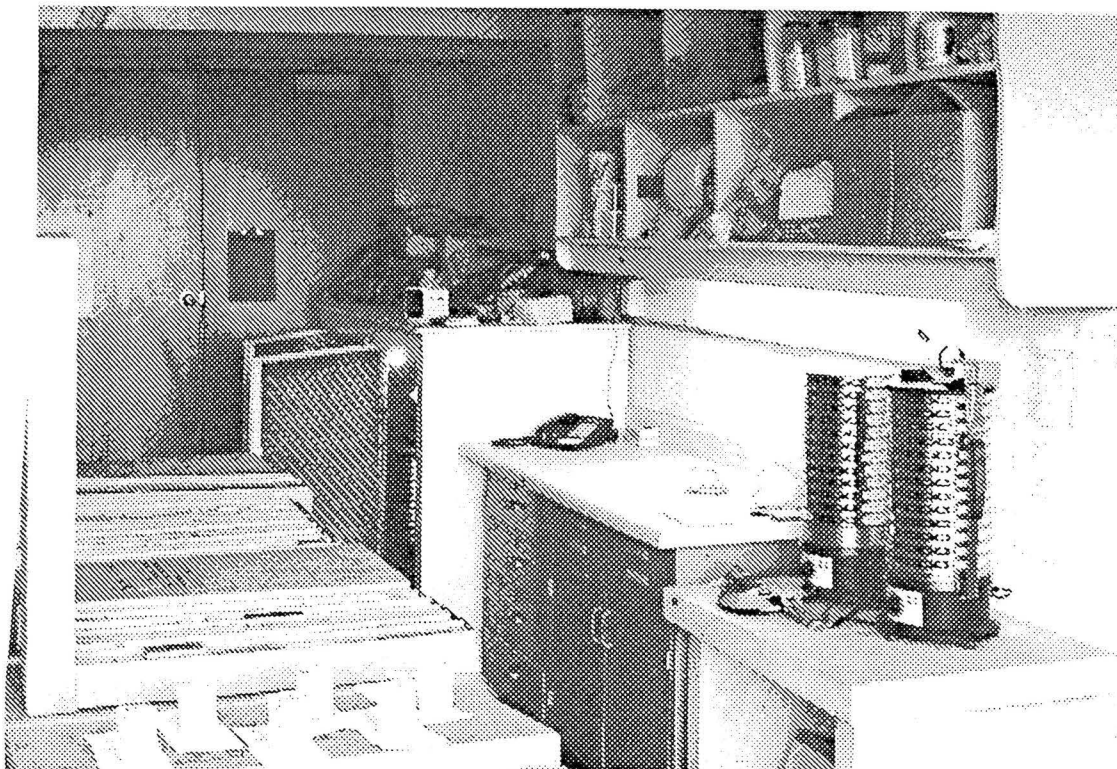


Figure 3. FGS garage bay part of Sedimentology Laboratory with Meinzer II sieve shakers in the right foreground, Rotap cabinet in the center background. (photo by T. M. Scott).

LABORATORY PROCEDURES

Laboratory sieving procedures used in this work are those specified in detail by W. F. Tanner (see Balsillie, 1995). Only basic procedures are mentioned in this work. Standard sieving time for samples was 30 minutes, although we also sieved one sample at various time intervals. The sieve nest ranged from -2.0ϕ (4.0 mm) to 4.0ϕ (0.0625 mm) at $\frac{1}{4} \phi$ intervals, totaling 21 sieves and a pan for collecting any sediment finer than 4.0ϕ . A top-loading Mettler-Toledo PG803 ® balance with accuracy to the nearest 0.001 gram was used for $\frac{1}{4}\phi$ sieve interval mass measurements. The balance is housed in a specially designed case which has enhanced ease and accuracy of tare measurements. Sieves and their contents can be placed on the scale to obtain retained mass, or sieve contents can be transferred to a container (e.g., a 9-inch (0.23-m) diameter pie pan) to obtain tare measurements. In the former case empty sieve weights must be known; in

the latter the mass of the container can be "zeroed-out" by the Mettler-Toledo PG803 ® balance. The latter method was used in this work.

Since the standard for sieving has been the Rotap ® shaker, it should be used first, then the sample should be sieved using the Meinzer II ® shaker. In reality, however, the sequence of sieving a sample, that is whether a sample is processed using the Meinzer II ® shaker first then the Rotap ® shaker, or the Rotap ® shaker first then the Meinzer II ® shaker second, should not make a difference with one exception. This exception centers about the relative energy input levels of the two shaker types and the hardness and friability of the constituent mineralogy of sedimentary particles being sieved. We, in fact, sieved using four protocols as identified in Table 1. Sieving protocols for Rotap→Meinzer and Meinzer→Rotap are straightforward. Speculating that sieving energetics and grain

Table 1. Sieving tests performed.

Sieving Sequence	No. of Samples
Rotap → Meinzer	7
Meinzer → Rotap	13
Meinzer → Rotap → Meinzer	4
Sieving time series	1

friability may play a role, we processed several samples using first the Meinzer II ® shaker. Then the sample was sieved using the Rotap ® shaker to assess its effects on friable grains, followed, once again, by the Meinzer II ® shaker. Hence, the difference between the two Meinzer II ® sieving episodes quantifies the effect of Rotap ® sieving. Finally, the effect of sieving time for one sample at 10-, 15-, 20-, and 30-minutes was evaluated.

RESULTS

Thirteen sand-sized sediment samples (Table 2) were sieved using both Rotap ® and Meinzer II ® sieve shakers, in order to

determine how well the Meinzer II ® shakers duplicate Rotap ® results. These 13 sediment samples were processed using several sieving protocols to result in 20 sets of statistics. Hence, in reality, 20 sample pairs were investigated. Details of granulometric results and frequency plots for sample pairs are provided in Appendix I. These results are from a standardized granulometric analysis using a programmed spreadsheet application developed by Balsillie and others (2002) and Balsillie (2002). Additional statistics for sample pairs are tabulated in Appendix II

At the outset it should be clearly noted that for any single sieving episode, some sediment will invariably be lost. Loss, in all probability, does not occur during sieving, but during the sieve interval mass determination process when sieve contents are transferred to a separate container for weighing. The percent of sediment loss between successive sievings for each sample is plotted in Figure 4. Average sediment loss per sample was close to 1/3 of a percentage point (i.e., 0.32%), attaining maxima of 1% and 2% for samples 4 and 9, respectively. Even the

Table 2. Description of samples used in this study.

Sample Number	Description
1	A quartz and carbonate (shell material) sample from an offshore locale along Florida's east coast (Brevard Co.)
2	Same as sample 10a and 10b; sampled at a different location.
3	Quartz and carbonate (shell material) sand sample from an offshore locale along Florida's east coast (Brevard Co.).
4	All quartz sand sample from a NW Florida Panhandle Gulf Coast beach (Escambia Co.).
5	A predominantly quartz sand sample from a vibrocore taken at the shoreline along North Key off of Cedar Key, Florida Big Bend coast (Levy Co.); depth of sample: 3 feet below mean sea level (MSL).
6	Same core as sample 5; depth of sample 9 feet below MSL.
7	All quartz sand sample from the NW Florida Panhandle Gulf Coast beach.
8	Predominantly quartz sand sample from an Alligator Spit beach south of Tallahassee, Florida (Franklin Co.).
9	Sample comprised of glass beads.
10a and 10b	Unwashed, mostly quartz sand sample (80 to 85%) with 15 to 20% clay from Porter Hole sink, Lake Jackson, Tallahassee, Florida (Leon Co.).
11a and 11b	La Pesca Beach, Mexico, all carbonate shell hash.
12a and 12b	Beach at the mouth of Broad River, Lower Gulf Coast of Florida (Monroe Co.), all carbonate shell hash.
13a, 13b, 13c, 13d, and 13e	Quartz, feldspar, and carbonate material from a beach in Mazatlan, Mexico

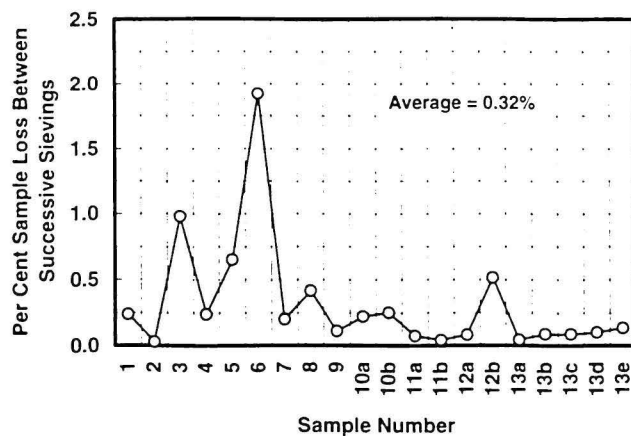


Figure 4. Sample loss between successive sieving episodes for paired sample tests of this study.

maxima, however, were trivial and did not adversely affect comparative analytical outcomes.

The four types of sieving protocols were run for samples tested in this work as outlined in Table 1, explanations of which

follow in appropriate sections. These four protocols were conducted for both sieving behavior of 1/4-phi sieve size fractions to quantify detailed outcomes of sample distributions, and for statistical measures describing the total sample. The former analysis is considered to be necessarily informative; the latter analysis is deemed to be the definitive comparative result. For reference purposes sample ID, sieving sequence, percent sediment loss and sample contents are listed in Table 3.

Distribution Analyses

We first compared Rotap ® and Meinzer II ® sieved sample pair outcomes by inspecting results plotted on arithmetic probability paper (APP). Each tested sample pair is plotted in Figure 5 according to the sieved protocol schedule of Table 3. APP is used because it possesses certain distinct advantages as discussed by Balsillie (1995),

Table 3. Sample I.D., sieving sequence, total percent sediment loss between sievings, and sample content for 20 sieved sample pairs.

Sample No.	#1	#2	% Loss	#2	#3	% Loss	Sieving Time	Content
1	R	M	0.24	---	---	---	30 min	Quartz and Carbonate
2	R	M	0.03	---	---	---	30 min	Quartz
3	R	M	0.98	---	---	---	30 min	Quartz and carbonate
4	M	R	0.24	---	---	---	30 min	Quartz
5	M	R	0.65	---	---	---	30 min	Quartz
6	M	R	1.92	---	---	---	30 min	Quartz
7	M	R	0.20	---	---	---	30 min	Quartz
8	M	R	0.37	---	---	---	30 min	Quartz
9	M	R	0.11				30 min	Glass beads
10a	M	R	0.22	---	---	---	30 min	Quartz and clay
10b	---	---	---	R	M	0.25	30 min	Quartz and clay
11a	M	R	0.08	---	---	---	30 min	Carbonate (shell)
11b	---	---	---	R	M	0.04	30 min	Carbonate (shell)
12a	M	R	0.52	---	---	---	30 min	Carbonate (shell)
12b	---	---	---	R	M	0.08	30 min	Carbonate (shell)
13a	M	R	0.05	---	---	---	10 min	Quartz, feldspar, carbonate
13b	M	R	0.09	---	---	---	15 min	Quartz, feldspar, carbonate
13c	M	R	0.09	---	---	---	20 min	Quartz, feldspar, carbonate
13d	M	R	0.10	---	---	---	30 min	Quartz, feldspar, carbonate
13e	---	---	---	R	M	0.14	30 min	Quartz, feldspar, carbonate

M = Meinzer II ®, R = Rotap ®

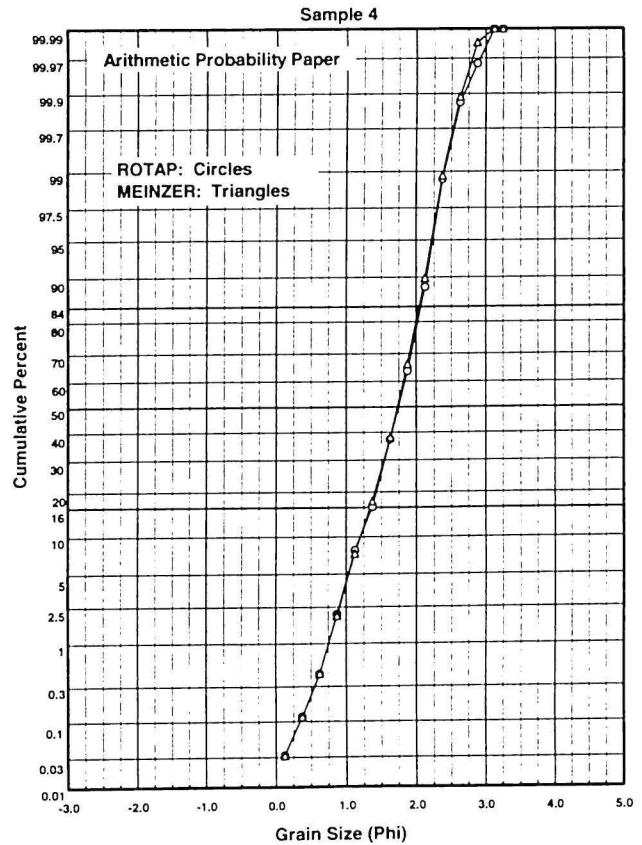
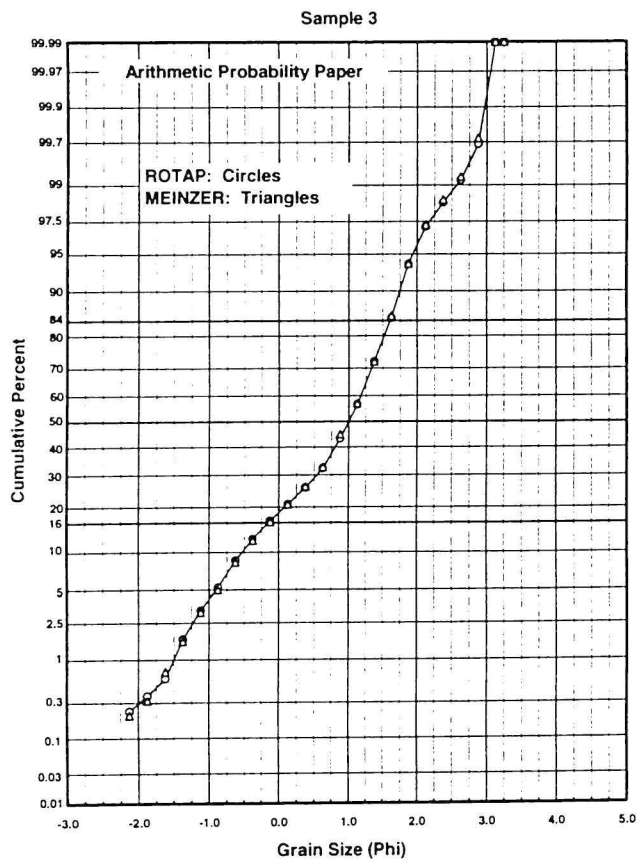
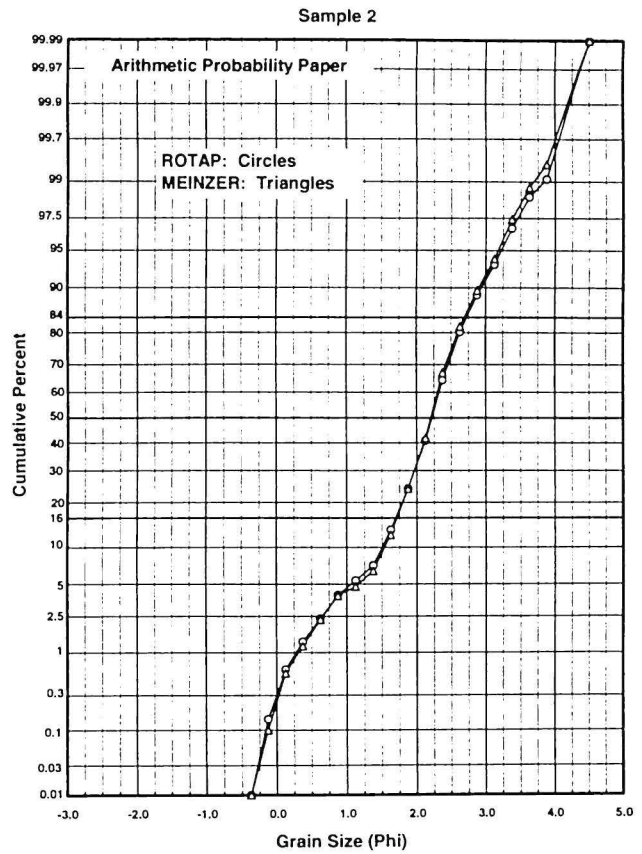
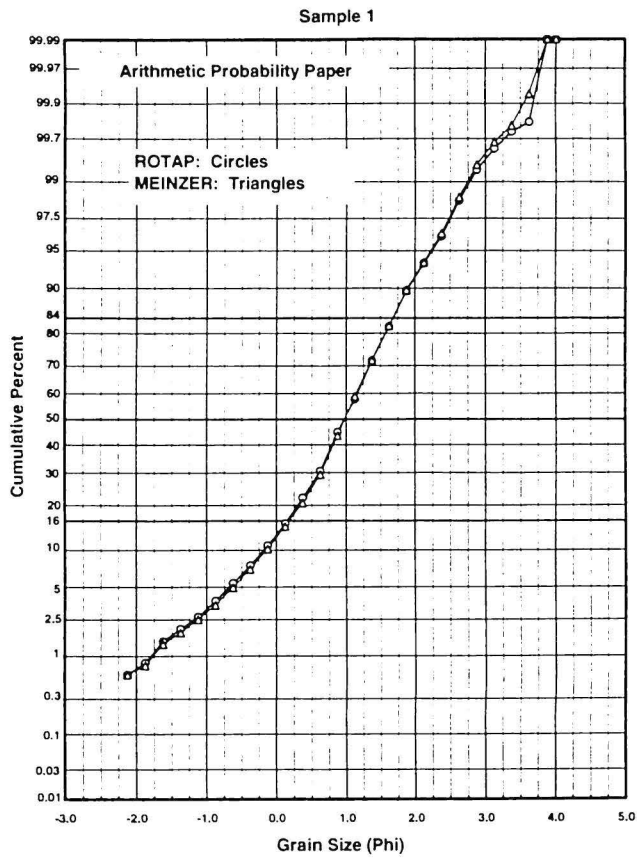


Figure 5. Tested sample pairs on arithmetic probability paper (after a programmed application of Balsillie and others, 2002, and Balsillie, 2002).

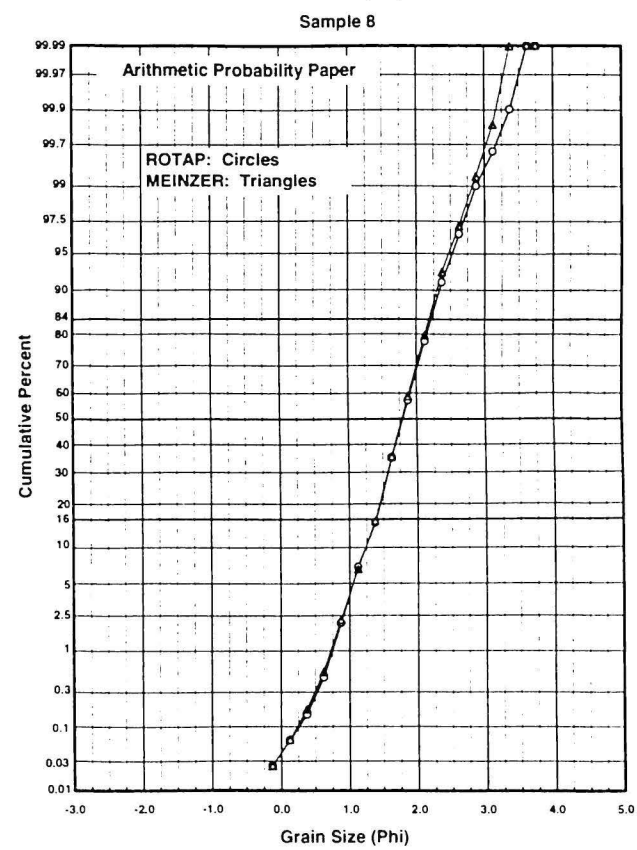
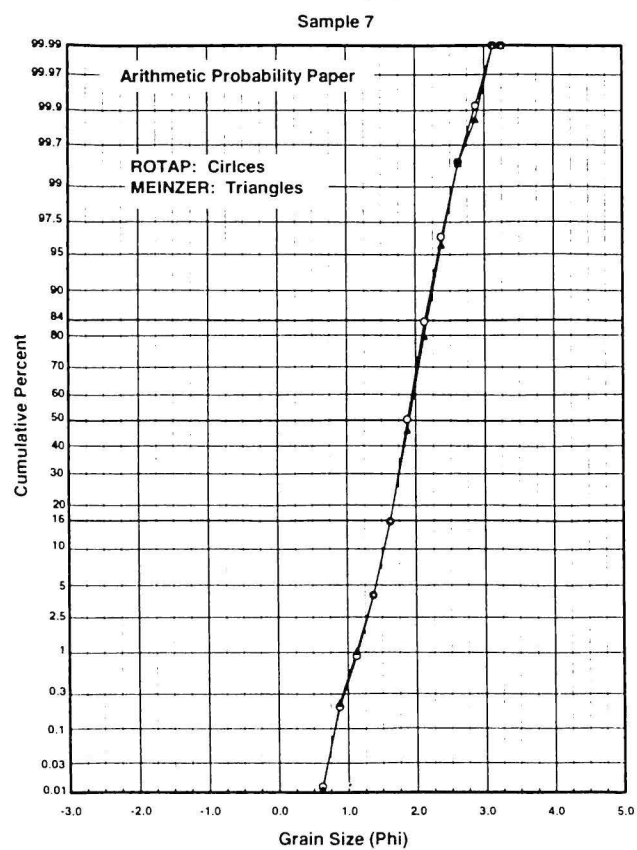
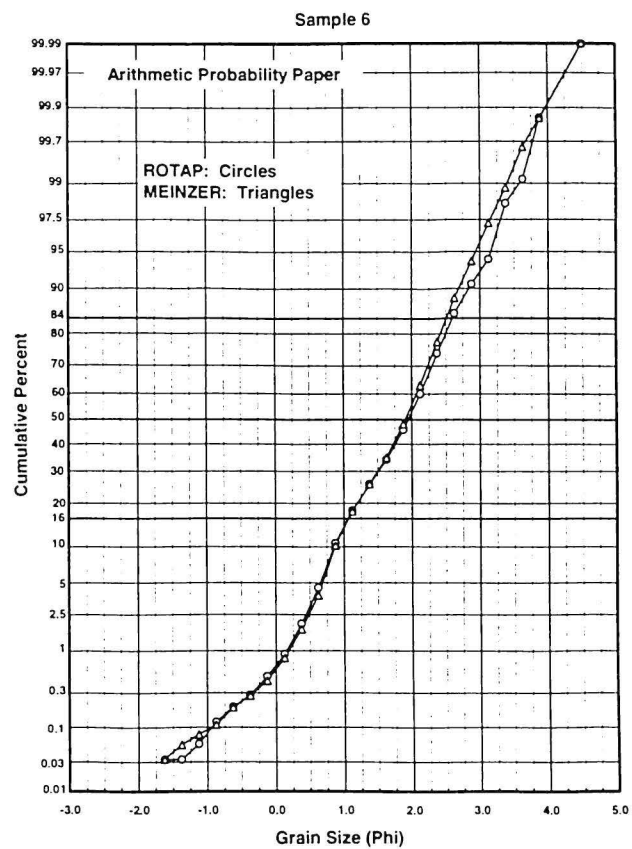
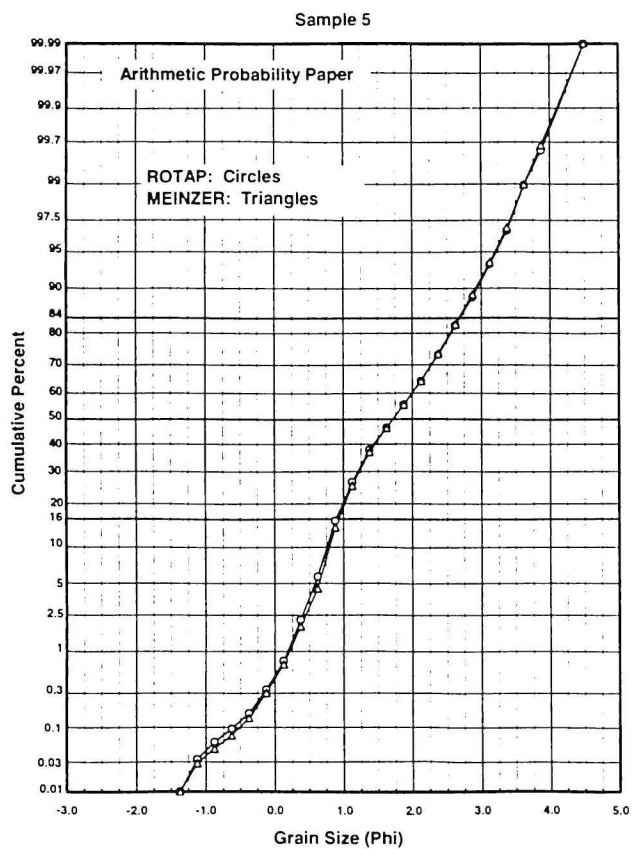


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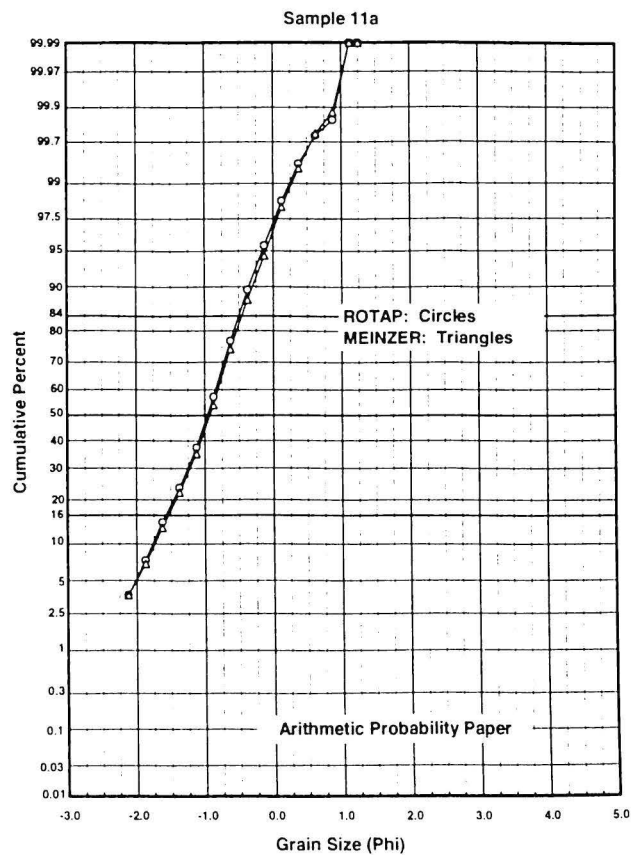
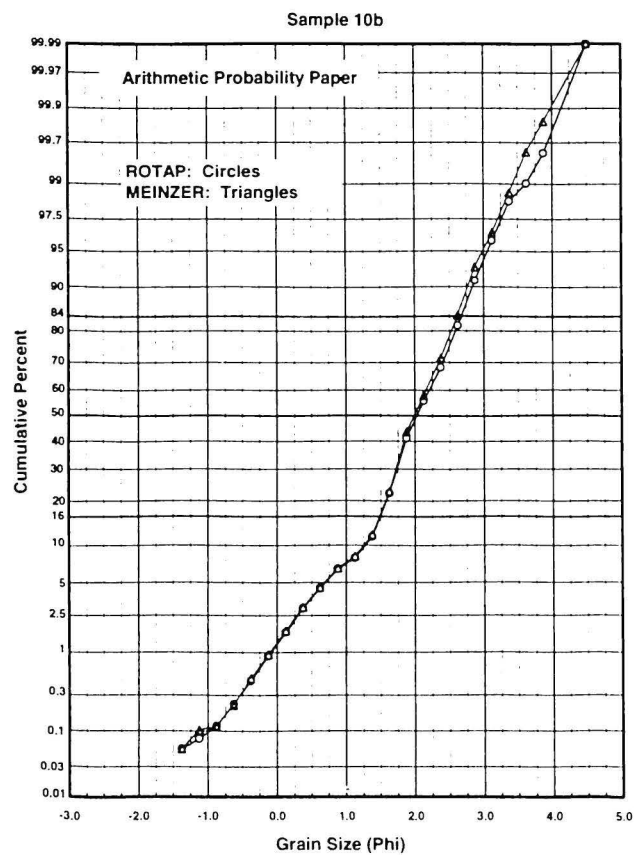
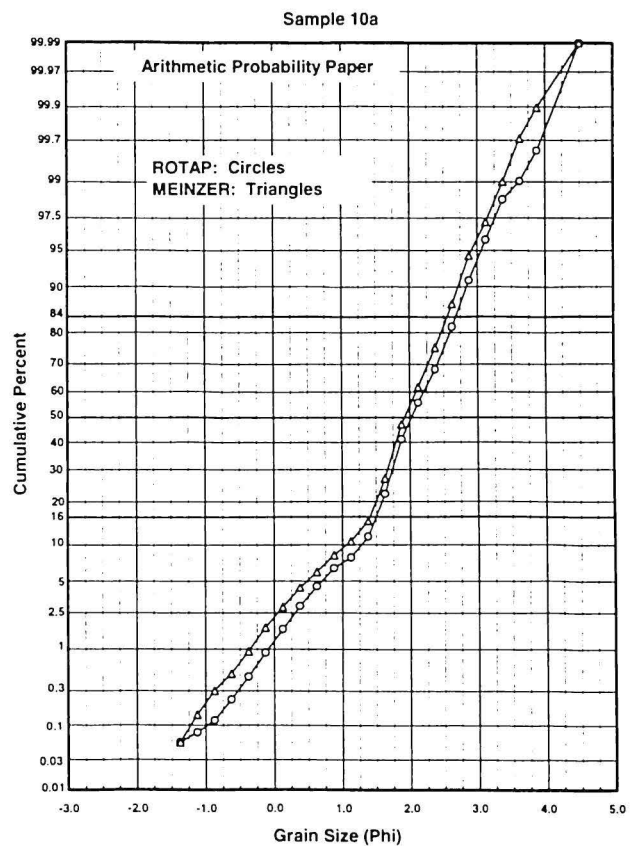
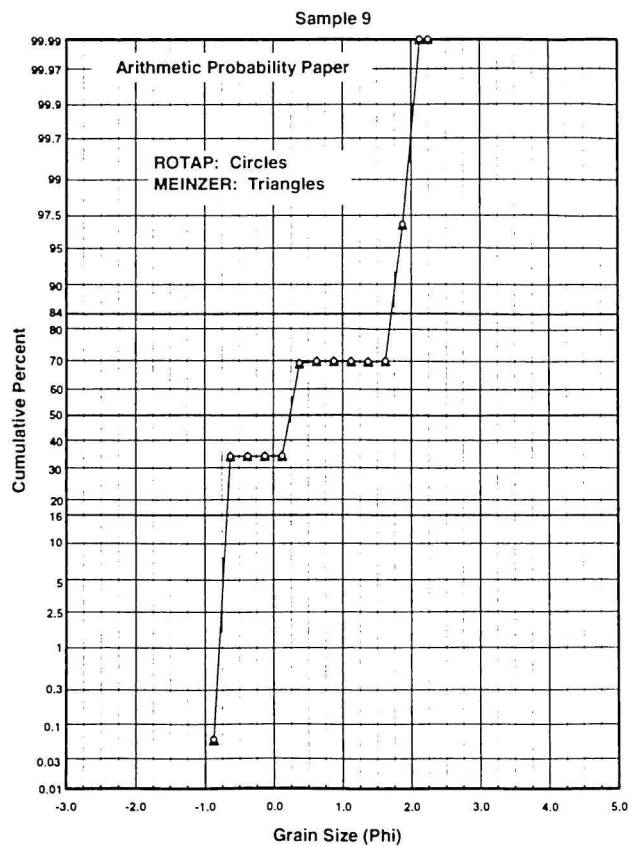


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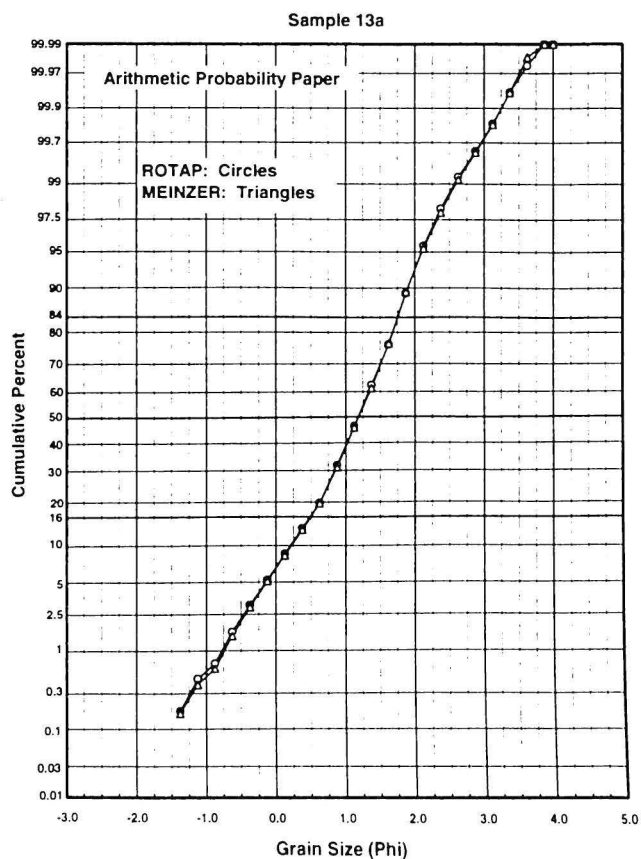
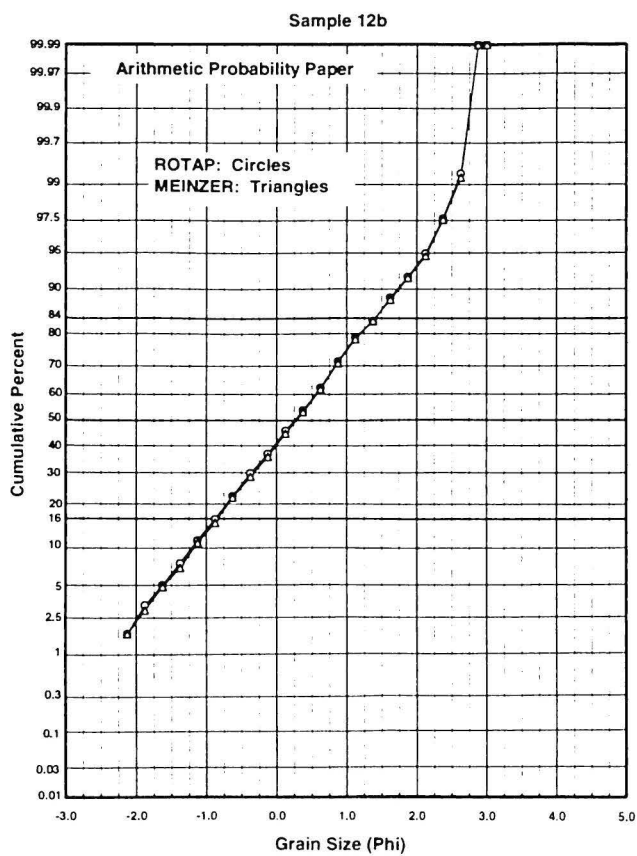
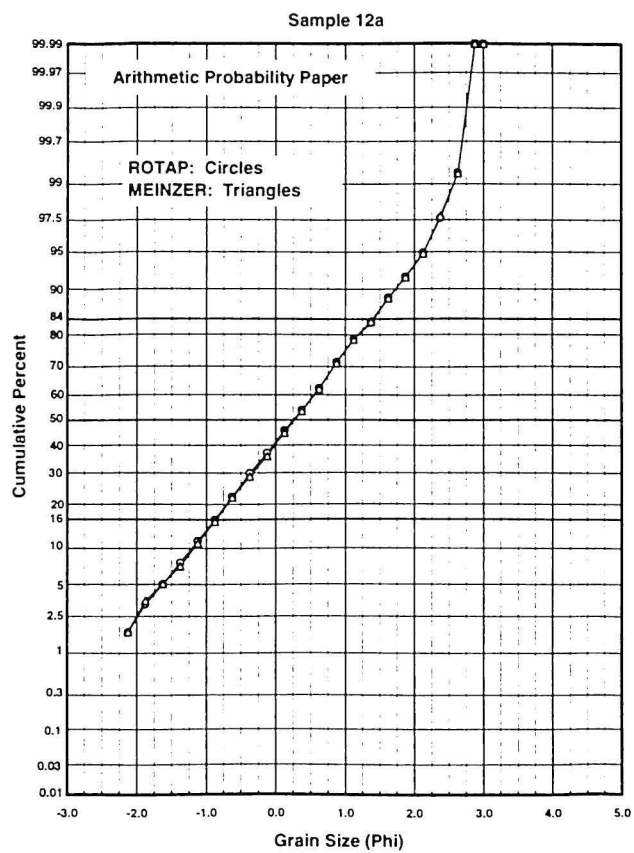
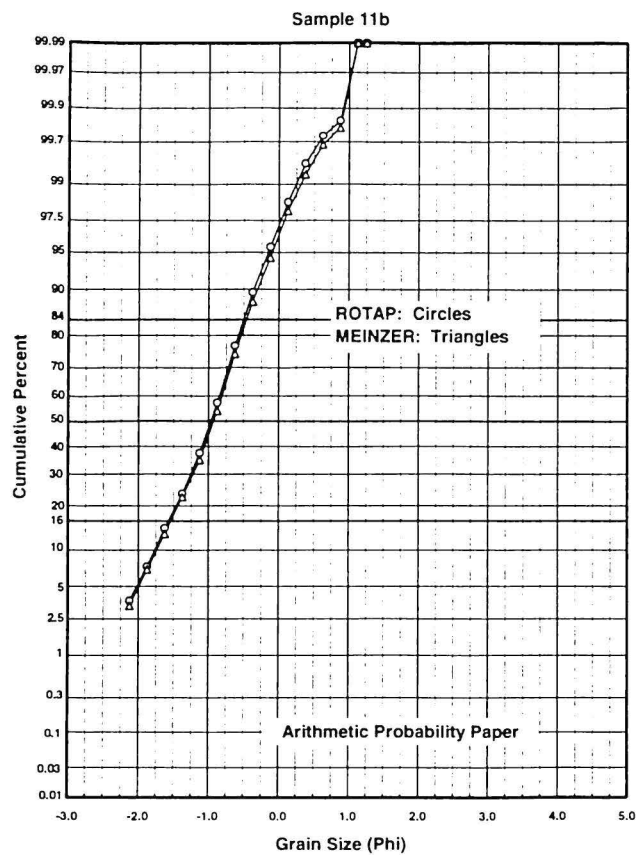


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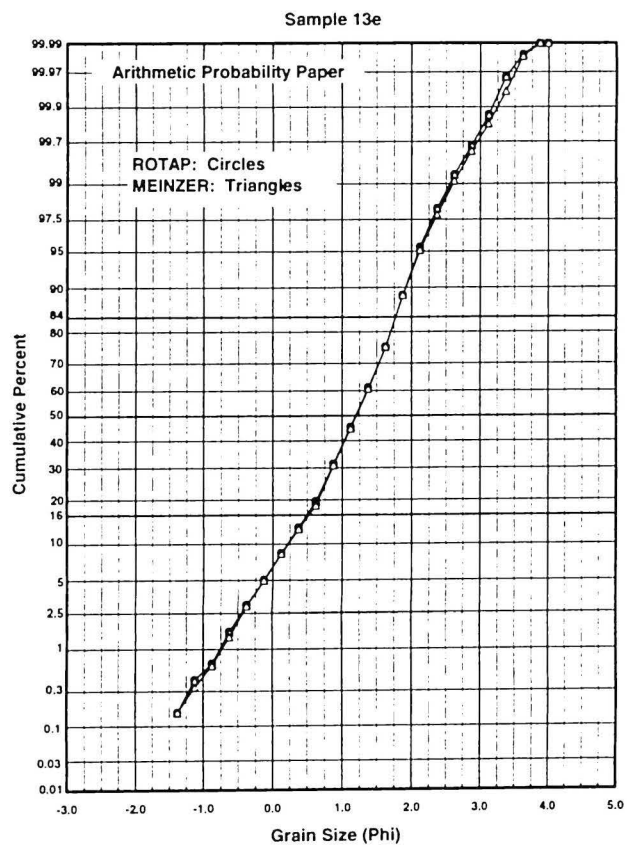
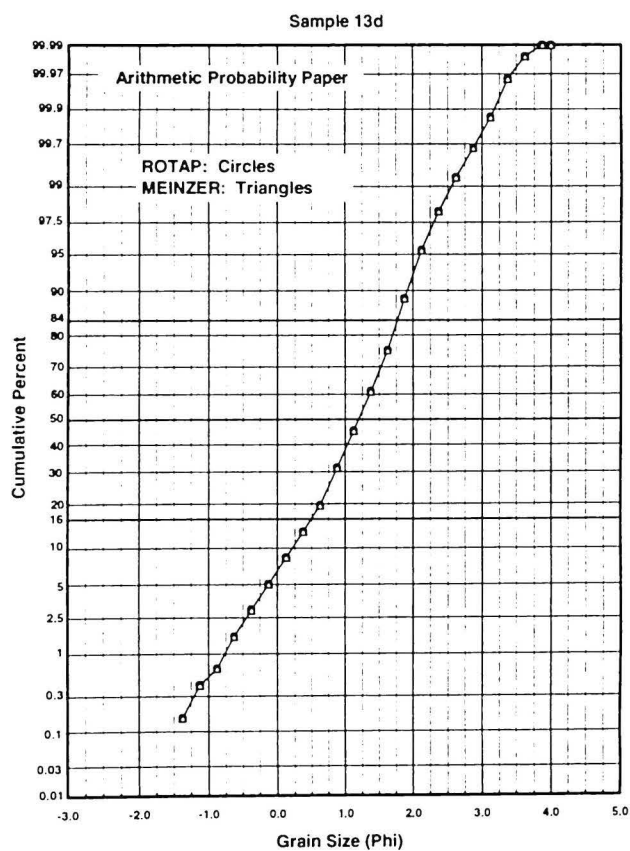
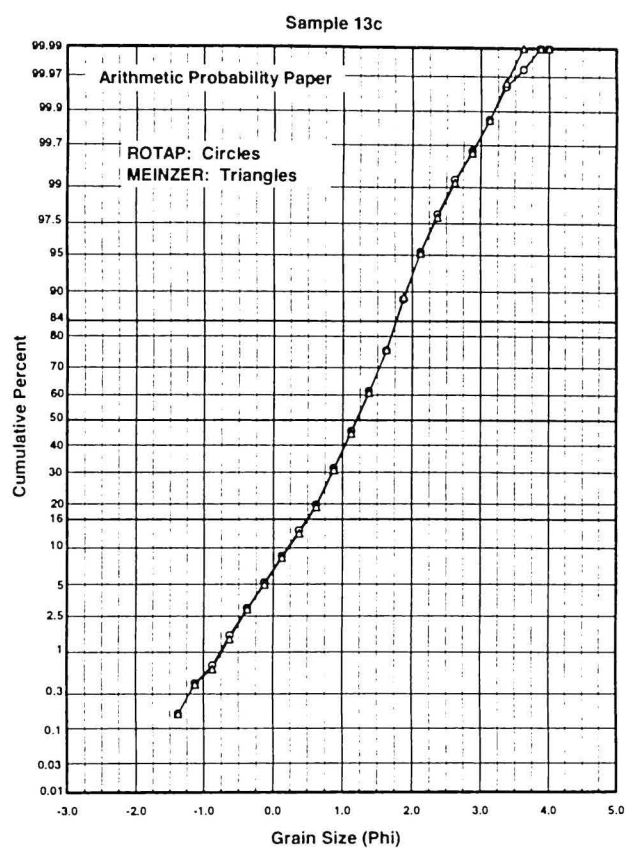
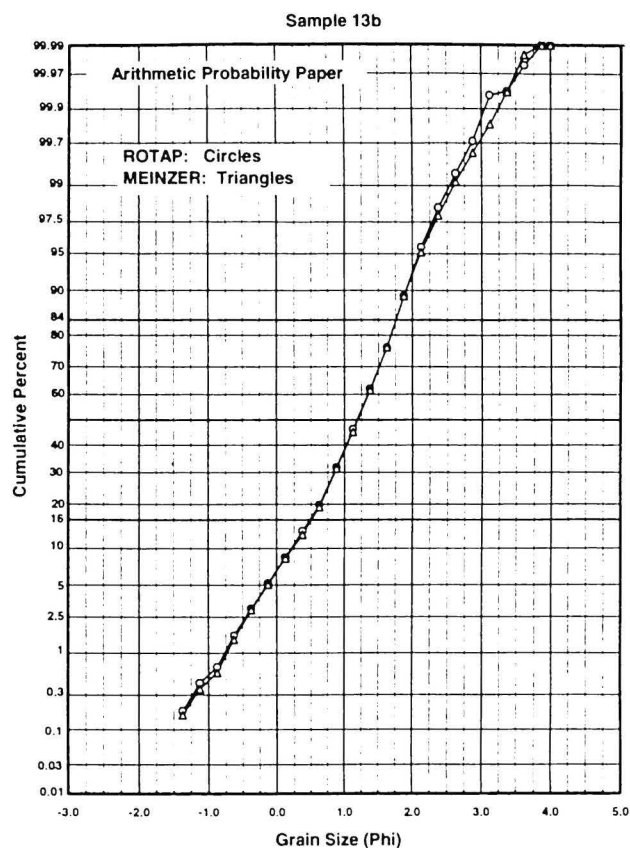


Figure 5. (cont.)

Balsillie and Tanner (1999), and Balsillie and others (2002).

Setting aside for the moment, sieving protocol, the APP plots of Figure 5 can be visually assessed by identifying those samples or those sample segments of sample pair distributions for which there are apparent discrepancies. Results are listed in Table 4. Of the 20 sample pairs, 11 samples resulted in no or insignificant discrepancies (samples 3, 5, 7, 9 11a, 11b, 12a, 12b, 13a, 13d, 13e). Five samples (1, 2, 4, 13b, and 13c) exhibited discrepancy for one ¼-phi interval. Two samples (8, and 10b) had discrepancies in two ¼-phi intervals, and one sample (6) had discrepancies in five ¼-phi intervals. Only one sample (10a) had discrepancies in every ¼-phi interval (to be discussed later), which we can use as a sort of “standard”. Sample 10a had discrepancies from 0.0 to 2.1% of the total sample mass for ¼-phi intervals, averaging 0.66%. In this study a total of 391 ¼-phi intervals exist for the 20 sample pairs; 368 ¼-phi intervals if sample 10a is excluded. With one exception, all discrepancies were significantly less than the mean discrepancy of 0.66%. The one exception was for the 3.25 to 3.50 phi interval of sample 6 with a discrepancy of 2.6%. While this one value is large, it constitutes only 0.27% of all ¼-phi intervals measured excluding sample 10a.

Where there is a discrepancy, it commonly occurs between the 2 φ and 4 φ sieves. While we cannot be absolutely certain, we speculate that the discrepancy occurs not during sieving, but during the weighing process because of the potential loss of fine-grained material when they are transferred from the sieves to the weighing container. As shall be demonstrated, however, these discrepancies are not significant.

Rotap→Meinzer and Meinzer →Rotap protocols yielded straight-forward sieving outcomes as discussed relative to Table 4. In the one instance of time series, weighing of a sample (13a through 13d) at 10-, 15-, 20-, and 30-minute intervals, there was no difference between Rotap ® and Meinzer II ® results.

As previously discussed, Rotap ® shakers appear to be significantly more energetic, while the Meinzer II ® shakers are

Table 4. Visual assessment of cumulative probability plots of Figure 5 where discrepancy is apparent between Rotap ® and Meinzer II ® results.

Sample I.D.	Interval (phi)	Discrepancy (grams)	Discrepancy (% of total sample)
Sample 1	3.50 to 3.75	0.0372	0.0642
Sample 2	3.75 to 4.00	0.0039	0.0102
Sample 3	None	None	None
Sample 4	3.75 to 4.00	0.0001	0.0002
Sample 5	None	None	None
Sample 6	-1.25 to -1.50	0.0091	0.0219
	2.75 to 3.00	0.0495	0.1195
	3.00 to 3.25	0.06	0.1448
	3.25 to 3.50	1.0691	2.5792
	3.50 to 3.75	0.0082	0.0198
Sample 7	None	None	None
Sample 8	3.00 to 3.25	0.0155	0.0266
	3.25 to 3.50	0.0687	0.1174
Sample 9	None	None	None
Sample 10a	Entire Sample	0 to 0.776 (0.2427*)	0 to 2.099 (0.6569*)
Sample 10b	3.50 to 3.75	0.1038	0.281
	3.75 to 4.00	0.1268	0.3432
Sample 11a	None	None	None
Sample 11b	None	None	None
Sample 12a	None	None	None
Sample 12b	None	None	None
Sample 13a	None	None	None
Sample 13b	3.00 to 3.25	0.0071	0.0001
Sample 13c	3.50 to 3.75	0.01	0.0001
Sample 13d	None	None	None
Sample 13e	None	None	None

*Averages for total sample.

gentler. Four samples (10, 11, 12, and 13) were therefore processed with the Meinzer→Rotap→Meinzer protocol sequence. Sample 13 was partially comprised of carbonate material; samples 11 and 12 were exclusively carbonate shell material. Relative to quartz (6.0 on Moh's hardness scale), one would expect carbonate material (calcite has a hardness of 3.0) to abrade or otherwise break-up. Carbonate sediments are of particular concern because of their prolific presence along Florida's Atlantic and lower Gulf coasts, and we have speculated that they may very well abrade or break-up during Rotap® sieving. However, it was discovered that none of samples 11, 12, or 13, however, resulted in any significant difference between Rotap® and Meinzer II® sieving histories (Figure 5).

We located one field sample (10a) in which no pre-sieving sample preparation had been done. Inspection of the sample under a binocular microscope revealed that in addition to quartz sand, the sample contained from 15 to 20% sand-sized clumps of clay. It was found that these clumps could be easily compressed or sliced using a small probe. We reasoned that such soft particles would be ideal to test Rotap® versus Meinzer II® shaker sieving energy levels. The sample was first sieved using the Meinzer II® shakers, then sieved using the Rotap® shakers. The results confirms that the Rotap® shakers are more energetic since it produced finer particles than the first Meinzer II® sieving episode (see sample 10a of Figure 5). Immediately following this first test, the sample was again sieved using the Meinzer II® shakers to complete the Meinzer→Rotap→Meinzer protocol, and sample 10b of Figure 5 resulted in close similarity for both shaker types. In reality, one would remove any silt or clay from a sample and use pipette or other analytical procedures to determine its granulometry. For our purposes, however, it provided an excellent opportunity to assess and confirm that the Meinzer II® shakers are gentler than the Rotap® shakers.

Statistical Analysis

Preceding distribution analyses were largely based on a visual, qualitative assessment. While results are convincing, one can numerically quantify comparative results using statistical measures. Six statistical measures have been assessed in this study. Each measure quantifies some characteristic about the total sample distribution. The first four statistical measures are the mean, standard deviation, skewness, and kurtosis. The mean is a measure of the central tendency of the distribution. The standard deviation (or sorting coefficient) is a measure of the degree of spread of the distribution about the mean. The larger the standard deviation, the larger the spread. The skewness is a measure of asymmetry of the distribution, wherein it may be skewed to the right or left of the mean, or skewed to the fine or coarse end of the distribution. Kurtosis is a measure of the peakedness of the curve, termed platykurtic if flat and leptokurtic if peaked. These four measures constitute, at a minimum, the measures required to define the basic characteristics of a distribution. These measures are termed moment measures because they are calculated using the method of moments as defined in Appendix III. The fifth statistical measure is the relative dispersion. It is simply the mean divided by the standard deviation and is a measure of sample variability. The value of the relative dispersion is that it can be used to compare variability between samples even if there are large differences in magnitudes of both the means and standard deviations (Rees, 1995). The final statistical measure is the median which is not a moment measure. It is the grain size corresponding to the 50th percentile of the cumulative distribution.

Statistical measures for samples processed using Rotap® and Meinzer II® shakers are listed in Table 5. Comparative results for tested sample pairs are plotted in Figure 6 for each of the statistical measures. All correlation coefficients (r) assessing the degree of correlation between Rotap® and

Table 5. Statistical measures for tested samples.

	Mean (ϕ)		Standard Deviation (phi-units)		Skewness		Kurtosis		Relative Dispersion		Median (ϕ)	
	Rotap	Meinzer	Rotap	Meinzer	Rotap	Meinzer	Rotap	Meinzer	Rotap	Meinzer	Rotap	Meinzer
Sample 1	1.0352	1.0457	0.8872	0.8661	-0.5865	-0.6227	4.2094	4.3431	0.8892	0.8797	0.9728	0.9784
Sample 2	2.3266	2.3121	0.6508	0.6210	-0.2343	-0.2956	4.8538	5.0153	0.5516	0.5301	2.2209	2.2045
Sample 3	0.9404	0.9337	0.8980	0.8906	-0.7123	-0.6986	3.1933	3.1879	0.8189	0.8096	0.9993	0.9776
Sample 4	1.8378	1.8224	0.3774	0.3705	-0.5075	-0.4832	3.2189	3.2189	0.2850	0.2785	1.7440	1.7297
Sample 5	1.9055	1.9126	0.8618	0.8411	0.2427	0.2560	2.4061	2.4312	0.5783	0.5636	1.7218	1.7229
Sample 6	2.0139	1.9661	0.7765	0.7223	-0.1638	-0.2385	3.0334	3.2388	0.6238	0.5960	1.9507	1.9067
Sample 7	1.9985	2.0187	0.2901	0.3033	-0.1290	-0.2173	3.7395	3.5425	0.2079	0.2192	1.8733	1.9047
Sample 8	1.9204	1.9029	0.4540	0.4404	0.0156	-0.0720	3.3963	3.3941	0.3262	0.3203	1.7924	1.7794
Sample 9	0.4964	0.4969	1.0241	1.0240	0.3399	0.3401	1.6019	1.6019	0.5915	0.5915	0.2385	0.2383
Sample 10a	2.1516	2.0261	0.7194	0.7319	-0.5449	-0.8297	4.5844	4.8052	0.6830	0.7375	2.0260	1.9233
Sample 10b	2.1516	2.1105	0.7194	0.6951	-0.5449	-0.6666	4.5844	4.6979	0.6830	0.6715	2.0260	1.9867
Sample 11a	-0.8832	-0.8480	0.5586	0.5661	-0.1392	-0.1785	3.0026	2.9685	0.4098	0.4187	-0.9664	-0.9292
Sample 11b	-0.8832	-0.8470	0.5586	0.5673	-0.1392	-0.1319	3.0026	3.0217	0.4098	0.4166	-0.9664	-0.9284
Sample 12a	0.3804	0.3705	1.1197	1.1250	-0.0324	-0.0524	2.4779	2.4385	0.8352	0.8413	0.2686	0.2552
Sample 12b	0.3804	0.3912	1.1197	1.1185	-0.0524	-0.0377	2.4779	2.4686	0.8352	0.8360	0.2687	0.2778
Sample 13a	1.2454	1.2538	0.6962	0.6917	-0.5130	-0.4972	3.6727	3.6620	0.5973	0.5900	1.1814	1.1904
Sample 13b	1.2477	1.2596	0.6923	0.6908	-0.5405	-0.4918	3.6169	3.6537	0.5949	0.5881	1.1854	1.1982
Sample 13c	1.2560	1.2646	0.6981	0.6912	-0.5186	-0.5243	3.5941	3.6547	0.5972	0.5929	1.1958	1.2074
Sample 13d	1.2583	1.2653	0.6949	0.6888	-0.5320	-0.5506	3.6050	3.6719	0.5961	0.5933	1.1976	1.2068
Sample 13e	1.2583	1.2688	0.6949	0.6922	-0.5320	-0.5017	3.6050	3.6557	0.5961	0.5908	1.1976	1.2062

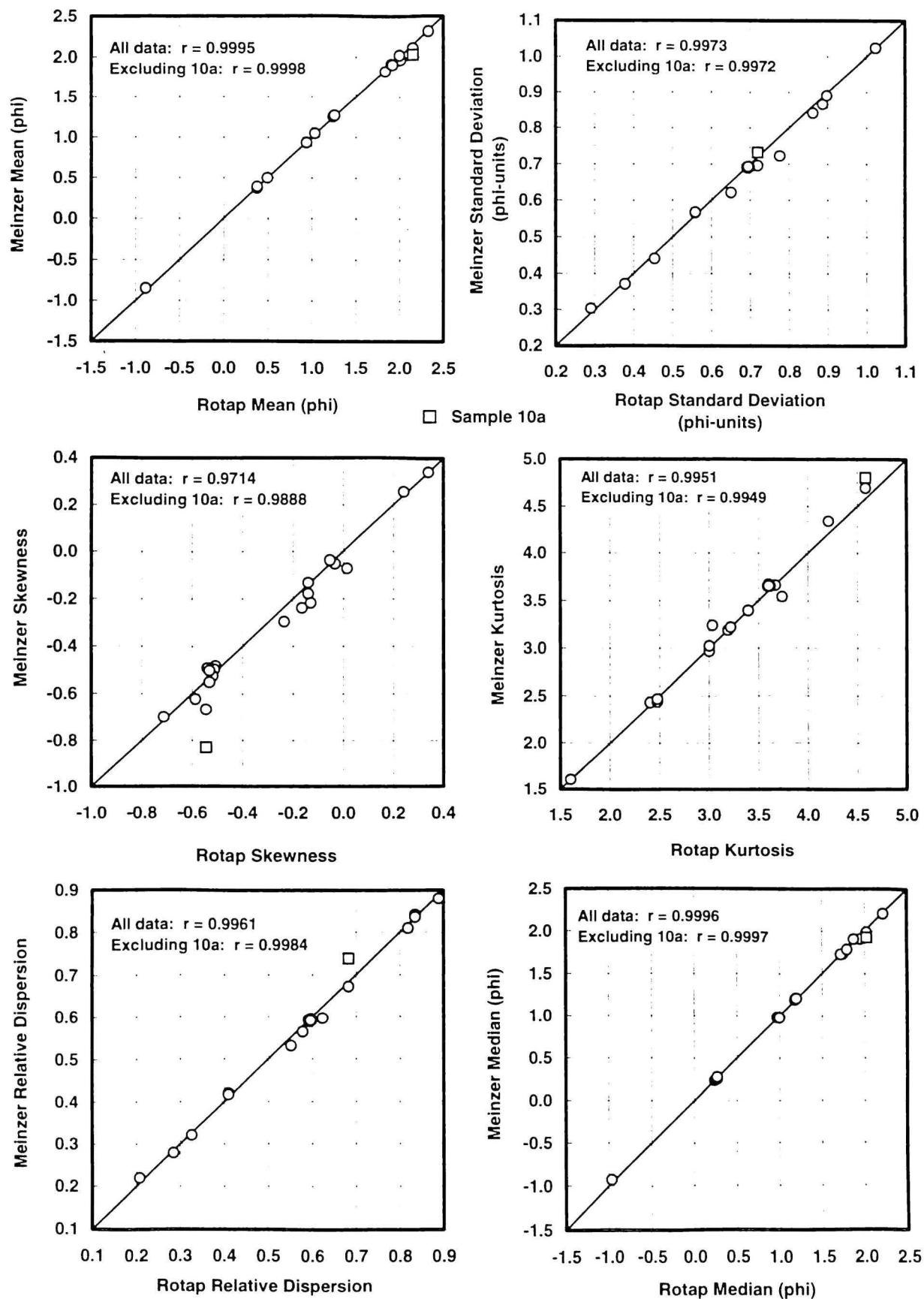


Figure 6. Cross-plots of statistical measures.

Meinzer II ® statistical measures appear to be significantly strong in the statistical sense, ranging from $r = 0.9714$ to $r = 0.9998$. Note that sample 10a (the anonymously introduced clay-bearing test sample pair) is separately addressed in the comparative cross-plots of Figure 6.

Of the moment measures, it is interesting that the lowest correlation occurs for the skewness or third moment measure. We can, in fact, explain why this might be so. Higher moment measures increasingly reach deeper into the tails of a probability distribution, and omit more and more of the central segment. It is critical to understand that it is the tails (not the mode or central part) of the probability distribution that determine the shape of the distribution (Doeglas, 1946; Balsillie and Tanner, 1999). Odd moment measures (e.g., 1st, 3rd, 5th) deal with differences between the tails. Hence, for any slight difference in the distribution tails, the effect is exacerbated and greater variability in skewness values between sample pairs is to be expected. In comparison, even moment measures (e.g., 2nd, 4th, 6th) treat the tails as if they were combined. Hence, for the fourth moment measure or kurtosis, the effect of combining the tails moderates the result and correlations between sample pairs improves. (Balsillie and Tanner, 1999.)

Even with some variability in the skewness, we can present all statistical measures in perspective by plotting them on a single graph. Figure 7 illustrates that the overall variability is slight. The Pearson product-moment correlation coefficient for all 120 data points is 0.9992, establishing nearly perfect correlation.

Finally, regression results between data pairs can be statistically assessed using the F-

test. Specifically, this special case of analysis of variance assesses whether the data sets are or are not different. F-test results are presented in Table 6 for all data, and in Table 7 for all data excluding sample 10a. F_{meas} is the ratio of the larger variance to the smaller variance. F_{cr1} is the statistically critical value. If the ratio of F_{meas} is smaller than F_{cr1} then the conclusion is quantitatively reached that there is no difference between the regression data sets. Hence, from results of both Tables 6 and 7, it is concluded for the data tested in this work that there is, unanimously, no difference between Rotap ® and Meinzer II ® sieved variances of statistical measures. The regression outcomes can also be assessed. Since the value of F_{meas} is smaller than F_{cr2} we can conclude that the correlation between the data and 1:1 fit is significant and not a random event.

Having established that Rotap ® and Meinzer II ® variances of statistical measure

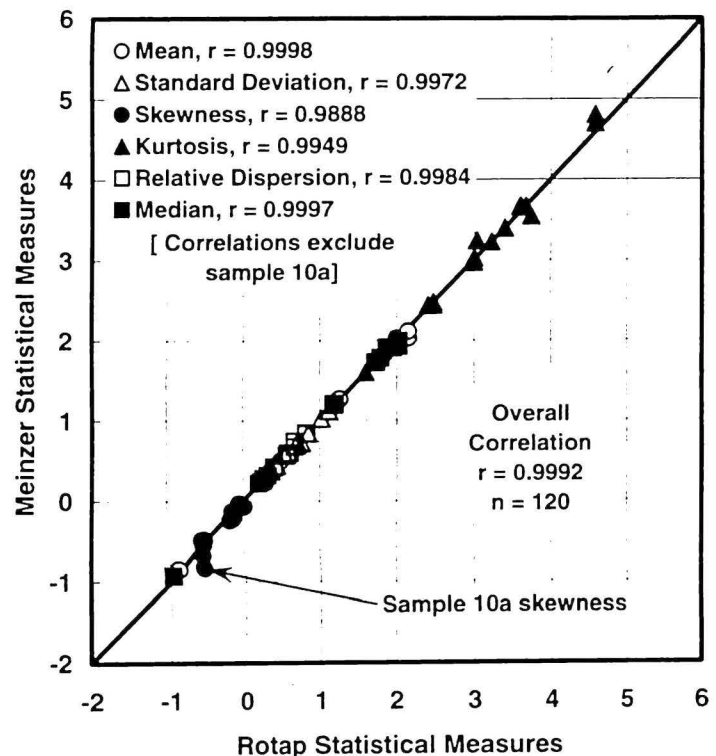


Figure 7. Cross-plot of all statistical measures for Rotap and Meinzer data illustrating the degree of agreement.

Table 6. F-test results for analysis of variance and assessment of regression outcomes for all samples.

	Mean		Standard Deviation		Skewness		Kurtosis		Relative Dispersion		Median	
	Rotap	Meinzer	Rotap	Meinzer	Rotap	Meinzer	Rotap	Meinzer	Rotap	Meinzer	Rotap	Meinzer
Mean	1.2019	1.1963	0.7246	0.7169	-0.2912	-0.3247	3.3938	3.4336	0.5855	0.5833	1.1064	1.1018
Variance	0.9401	0.8978	0.0538	0.0532	0.0887	0.1019	0.5806	0.6377	0.0308	0.0312	0.9369	0.8991
No. Observations	20	20	20	20	20	20	20	20	20	20	20	20
r	0.9995		0.9973		0.9714		0.9951		0.9961		0.9996	
Degrees of freedom	19	19	19	19	19	19	19	19	19	19	19	19
F _{meas}	1.0472		1.0113		1.1488		1.0983		1.0130		1.0420	
F _{crit} ($\alpha = 0.05$, $df_1 = 19$, $df_2 = 19$)	2.1682		2.1682		2.1682		2.1682		2.1682		2.1682	
F _{crit2} ($\alpha = 0.05$, $df_1 = 1$, $df_2 = 19$)	4.3808		4.3808		4.3808		4.3808		4.3808		4.3808	

F_{crit1} - one-tailed test; F_{crit2} - two-tailed test.

Table 7. F-test results for analysis of variance and assessment of regression outcomes for all samples, excluding sample 10a.

	Mean		Standard Deviation		Skewness		Kurtosis		Relative Dispersion		Median	
	Rotap	Meinzer	Rotap	Meinzer	Rotap	Meinzer	Rotap	Meinzer	Rotap	Meinzer	Rotap	Meinzer
Mean	1.1527	1.1510	0.7253	0.7156	-0.2784	-0.2967	4.0379	3.3590	0.5807	0.5747	1.0588	1.0569
Variance	0.8613	0.8310	0.0513	0.0512	0.0910	0.0905	0.6052	0.6617	0.0357	0.0352	0.8577	0.8289
No. Observations	19	19	19	19	19	19	19	19	19	19	19	19
r	0.9998		0.9972		0.9888		0.9949		0.9984		0.9997	
Degrees of freedom	18	18	18	18	18	18	18	18	18	18	18	18
F _{meas}	1.0365		1.0020		1.0055		1.0934		1.0142		1.0347	
F _{crit} ($\alpha = 0.05$, $df_1 = 18$, $df_2 = 18$)	2.2172		2.2172		2.2172		2.2172		2.2172		2.2172	
F _{crit2} ($\alpha = 0.05$, $df_1 = 1$, $df_2 = 18$)	4.4139		4.4139		4.4139		4.4139		4.4139		4.4139	

F_{crit1} - one-tailed test; F_{crit2} - two-tailed test.

Table 8. t-test results for all samples (two-sample t-test assuming equal population variances, $\alpha = 0.05$).

	Mean		Standard Deviation		Skewness		Kurtosis		Relative Dispersion		Median	
	Rotap	Meinzer	Rotap	Meinzer	Rotap	Meinzer	Rotap	Meinzer	Rotap	Meinzer	Rotap	Meinzer
Mean	1.2019	1.1963	0.7246	0.7169	-0.2912	-0.3247	3.3938	3.4336	0.5855	0.5833	1.1064	1.1018
Variance	0.8648	0.8279	0.0488	0.0482	0.0901	0.0991	0.6515	0.7310	0.0345	0.0344	0.8582	0.8250
Observations	20	20	20	20	20	20	20	20	20	20	20	20
r	0.9995		0.9973		0.9714		0.9951		0.9961		0.9996	
Pooled Variance	0.8463		0.0485		0.0946		0.6913		0.0345		0.8416	
Hypothesized Mean Difference	0		0		0		0		0		0	
Degrees of Freedom	38		38		38		38		38		38	
Measured t Stat	0.0192		0.1104		0.3444		-0.1514		0.0382		0.0158	
P(T<=t) two-tail	0.9848		0.9127		0.7325		0.8805		0.9698		0.9875	
t Critical two-tail	-2.0244 and 2.0244		-2.0244 and 2.0244		-2.0244 and 2.0244		-2.0244 and 2.0244		-2.0244 and 2.0244		-2.0244 and 2.0244	

Table 9. t-test results for all samples, excluding sample 10a (two-sample t-test assuming equal population variances, $\alpha = 0.05$).

	Mean		Standard Deviation		Skewness		Kurtosis		Relative Dispersion		Median	
	Rotap	Meinzer	Rotap	Meinzer	Rotap	Meinzer	Rotap	Meinzer	Rotap	Meinzer	Rotap	Meinzer
Mean	1.1527	1.1510	0.7253	0.7156	-0.2784	-0.2967	3.3217	3.3569	0.5807	0.5747	1.0588	1.0569
Variance	0.8613	0.8310	0.0512	0.0512	0.0910	0.0905	0.6052	0.6617	0.0357	0.0352	0.8577	0.8289
Observations	19	19	19	19	19	19	19	19	19	19	19	19
r	0.9998		0.9972		0.9888		0.9949		0.9984		0.9997	
Pooled Variance	0.8462		0.0512		0.0907		0.6335		0.0355		0.8433	
Hypothesized Mean Difference	0		0		0		0		0		0	
Degrees of Freedom	36		36		36		36		36		36	
Measured t Stat	0.0059		0.1330		0.1870		-0.1362		0.0988		0.0062	
P(T<=t) two-tail	0.9954		0.8950		0.8527		0.8924		0.9218		0.9951	
t Critical two-tail	-2.0281 and 2.0281		-2.0281 and 2.0281		-2.0281 and 2.0281		-2.0281 and 2.0281		-2.0281 and 2.0281		-2.0281 and 2.0281	

are not different, we tested means of the statistical measures using a two-sample t-test assuming equal population variances (as established by the F-test). Results are listed in Table 8 for all samples, and in Table 9 for all samples excluding sample 10a. Results show that there is, unanimously, no difference between statistical measures characterizing samples considered in this study.

SIEVING TIME

Sieving time has been a subject of concern through the last half of the last century (Heer, 1939; Shergold, 1946; Swineford and Swineford, 1946; Berthois and Aubert, 1950; Berthois, 1951; Lauer, 1963; Mizutani, 1963; Muller, 1967, etc. The FGS uses a sieving time of 30 minutes. Since two

sieve nests are required to analyze a single sand-sized sample, one-hour of sieving time is required per sample. This does not include weighing time between the two-part sieving history for a sample. If efficiently accomplished, weighing can be accomplished in about 15 minutes for each sieve nest. This results in a total sieving analysis time of 1.5 hours (does not include initial pre-sieving sample preparation, sample washing, or fines pipette analysis, *etc.*).

The matter of sieving time, while fraught with sensitive and conundrum-like vicissitudes, is one that needs to be approached with pragmatic understanding of logistical realities. If the weighing process efficiently requires 15 minutes per nest, one should not be interested in any less than 15 minutes of sieving time. Otherwise sieving time – weighing time lengths are logistically out-of-phase.

Rotap ® machines have horizontal and vertical throws of about 2.5 to 3.0 cycles per second while Meinzer II ® throws are 60 cycles per second. Hence, one might speculate that Meinzer II ® machines are about 20 times more efficient than Rotap ® shakers, and that less sieving time would be required for the former. The problem is that we are not privy to precisely what is happening in each sieve interval during sieving. In the one instance of time series weighing of a sample (13a through 13d) at 10-, 15-, 20-, and 30-minute intervals we saw little difference between 10 minutes and 30 minutes of sieving. However, results from one sample does not adequately assess the matter. The purpose of this paper was to determine whether Meinzer II ® shakers duplicate Rotap ® outcomes. The issue of sieving time requirements remains, therefore, a subject of further research.

CONCLUSIONS

This work has compared a newly developed sieve shaker design – the British designed Meinzer II ® sieve shaker – to the

“industry standard” Rotap ® sieve shaker. Twenty sets of tests were conducted using various sequences or protocols of sieving to assess resulting agreement and the effect of differential sieve shaker energy input on softer mineral components being sieved. As to the latter it was, surprisingly, found that carbonate shell material sieved through both shaker types resulted in essentially identical outcomes, suggesting that grain abrasion or break-down did not occur. However, the Rotap ® did cause the abrasion of soft, friable, sand-sized clay particles comprising a quartzose-clay lacustrine sample. Hence, to some extent the Meinzer II ® shakers are gentler than the Rotap ® machines. Even so, the extent of discrepancy was not significant within the framework of the samples statistically tested in this work.

Both qualitative visual assessments of individual Rotap- and Meinzer-produced outcomes were performed. Qualitative assessments showed little difference between shaker types with the exception of the one anomalously introduced clay-bearing sample. The bottom line, however, is the quantitative statistical analysis of four moment measures, the relative dispersion, and the median from which it can be concluded that Rotap ® and Meinzer II ® shakers result in insignificantly different outcomes. That is, for all practical purposes, they produce the same results.

DISCLAIMER

The citation of trade names in this document does not constitute official Florida Department of Environmental Protection, Florida Geological Survey endorsement of said products. Rather, citation serves only to identify said products at the Florida Geological Survey.

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APPENDIX I

Sample Pair Granulometries

Numerals associated with the samples are those listed in Tables 2 and 3 of the text. Sample pairs are on facing pages to facilitate ease of comparison.

Arithmetic probability plots are after Balsillie and others (2002) and Balsillie (2002). See Table 3 of the text for sieving protocols.

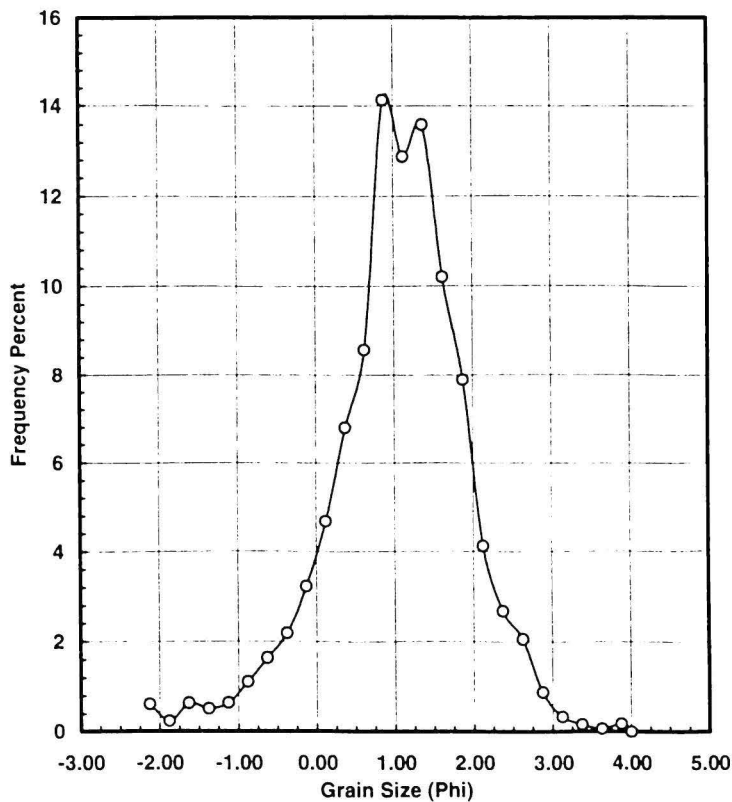
Sample I.D.: ROTAP1

Sample I.D.: ROTAP1		Sampled by:		Start Sieve Size (phi): -2	
Sample Date:		Analyzed by: J. H. Baislie		End Sieve Size (phi): 4	
Total Sample: X		Siliclastic Fraction:		Pan Sieve Size (phi): 4	
Longitude:		Latitude:		Sieve Interval (phi): 0.25	
Surface Elev:		Datum:		Accuracy:	
Sample Depth in Core:		Compaction Corrected?		% Comp.:	
Comments: Carbonate + Silica - FL offshore east coast				Total Mass: 57.872 grams	

[illegible]

Statistical Results			
Measure	Original Data in ϕ Units	Transformed Data	Original Data in Millimeters
Mean:	1.0352 ϕ	0.4879 mm	0.6052 mm
Standard Deviation:	0.8872 phi-units	MV ---	0.5382 mm
Skewness:	-0.5865 NU	MV ---	3.8325 NU
Kurtosis:	4.2094 NU	MV ---	22.3071 NU
Median:	0.9728 ϕ	0.5095 mm	0.5113 mm
Relative Dispersion:	MV ---	--- ---	0.8892 NU

Mean, std dev, skewness and kurtosis calculated using method of moments.
 MV = meaningless value; NU = no units (*i.e.*, dimensionless)
 Transformed data calculated using mm = 2 ϕ



Relative Disperison Scale	
< 0.5	Excellent homogeneity (<i>e.g.</i> beaches)
0.5 to 1.0	Good homogeneity
1.0 to 1.33	Fair homogeneity
> 1.33	Poor homogeneity

Tweak ACUMPLOT X-axis here

X-axis minimum -3

X-axis minimum	0
X-axis maximum	5

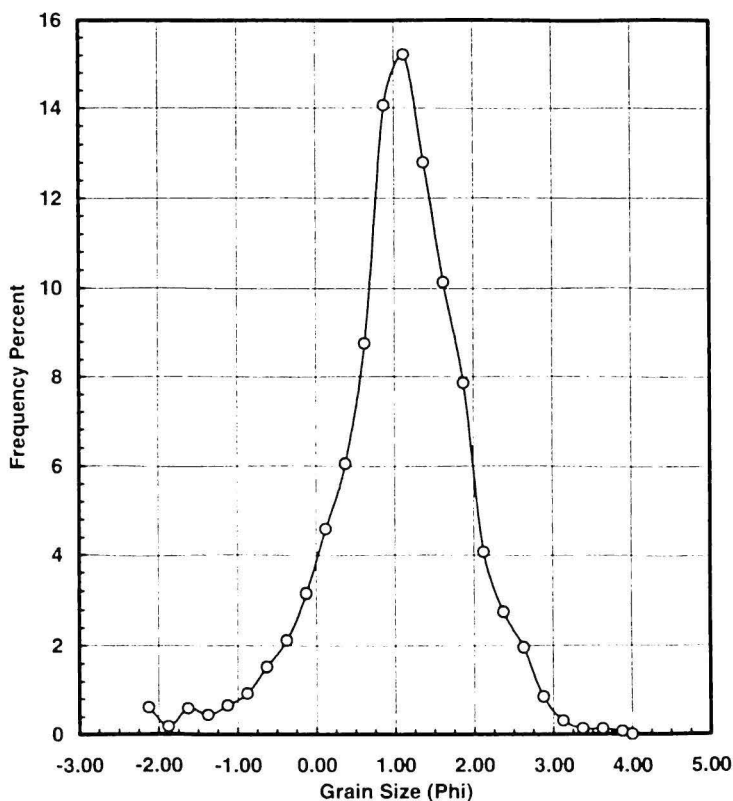
Sample I.D.: MEINZER1

Sample I.D.: MEINZER1		Sampled by:		Start Sieve Size (phi): -2	
Sample Date:		Analyzed by: J. H. Balsillie		End Sieve Size (phi): 4	
Total Sample: X	Siliclastic Fraction:	Carbonate Fraction:		Pan Sieve Size (phi): 4	
Longitude:	Latitude:	Datum:	Sieve Interval (phi): 0.25		
Surface Elev:	Datum:	Accuracy:	# Splits:	0	
Sample Depth in Core:	Compaction Corrected?	% Comp.:	Total Mass: 57.728 grams		
Comments: Carbonate + Silica, FL offshore east coast					

[illegible]

Statistical Results				
Measure	Original Data in ϕ Units	Transformed Data		Original Data in Millimeters
Mean:	1.0457 ϕ	0.4844	mm	0.5957 mm
Standard Deviation:	0.8661 phi-units	MV	---	0.5240 mm
Skewness:	-0.6227 NU	MV	---	3.9866 NU
Kurtosis:	4.3431 NU	MV	---	24.0427 NU
Median:	0.9784 ϕ	0.5075	mm	0.5094 mm
Relative Dispersion:	MV ---	---	---	0.8797 NU

Mean, std dev, skewness and kurtosis calculated using method of moments.
 MV = meaningless value; NU = no units (*i.e.*, dimensionless)
 Transformed data calculated using $mm = 2^\circ$



Relative Disperson Scale	
< 0.5	Excellent homogeneity (<i>e.g.</i> beaches)
0.5 to 1.0	Good homogeneity
1.0 to 1.33	Fair homogeneity
> 1.33	Poor homogeneity

Tweak ACUMPLOT X-axis here

X-axis minimum -2

X-axis maximum	5
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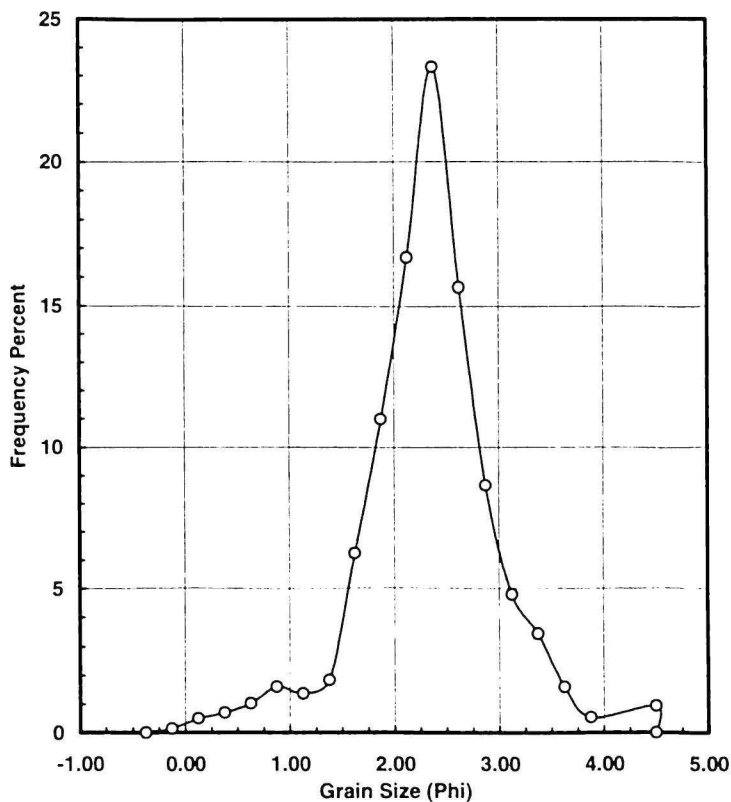
Sample I.D.: ROTAP2

Sample I.D.: ROTAP2		Sampled by:		Start Sieve Size (phi): -0.25	
Sample Date: 6/28/2001		Analyzed by: J. H. Balsillie		End Sieve Size (phi): 4	
Total Sample: X	Siliclastic Fraction:	Carbonate Fraction:		Pan Sieve Size (phi): 5	
Longitude:	Latitude:	Datum:		Sieve Interval (phi): 0.25	
Surface Elev:	Datum:	Accuracy:		# Splits:	0
Sample Depth in Core:	Compaction Corrected?	% Comp.:	Total Mass: 38.82 grams		
Comments: Lake Jackson, Porter Hole Sample, LJ6A					

[illegible]

Statistical Results				
Measure	Original Data in ϕ Units		Transformed Data	Original Data in Millimeters
Mean:	2.3266	ϕ	0.1994 mm	0.2216 mm
Standard Deviation:	0.6508	phi-units	MV ---	0.1222 mm
Skewness:	-0.2343	NU	MV ---	2.8780 NU
Kurtosis:	4.8538	NU	MV ---	14.9141 NU
Median:	2.2209	ϕ	0.2145 mm	0.2153 mm
Relative Dispersion:	MV	---	---	0.5516 NU

Mean, std dev, skewness and kurtosis calculated using method of moments.
 MV = meaningless value; NU = no units (*i.e.*, dimensionless)
 Transformed data calculated using mm = 2°



Relative Disperison Scale	
< 0.5	Excellent homogeneity (<i>e.g.</i> beaches)
0.5 to 1.0	Good homogeneity
1.0 to 1.33	Fair homogeneity
> 1.33	Poor homogeneity

Tweak ACUMPLOTT X-axis here

X-axis minimum -3

X-axis maximum	5
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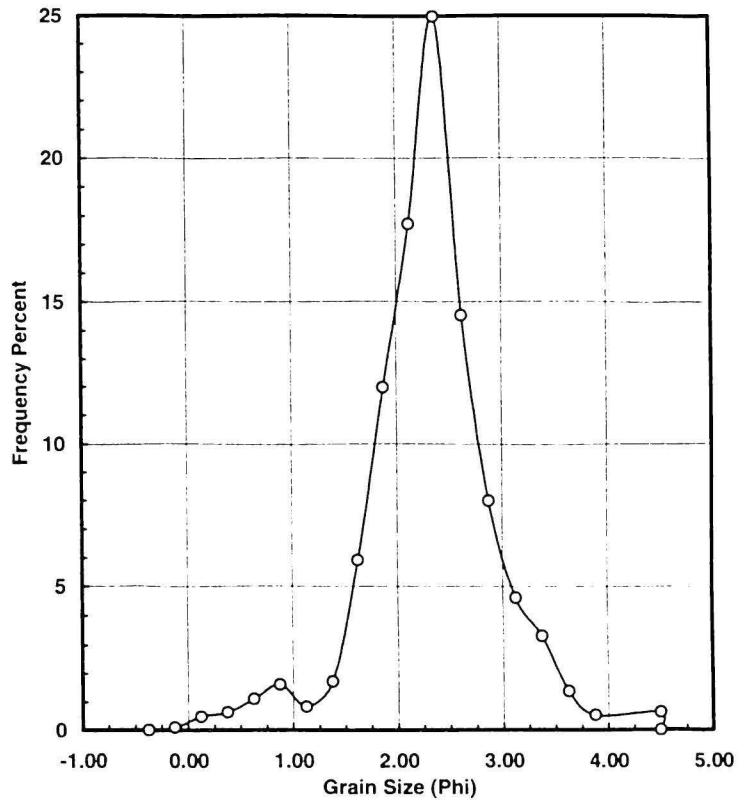
Sample I.D.: MEINZER2

Sample I.D.: MEINZER2		Sampled by:		Start Sieve Size (phi): -0.25	
Sample Date: 6/28/2001		Analyzed by: J. H. Balsillie		End Sieve Size (phi): 4	
Total Sample: X		Siliclastic Fraction:		Pan Sieve Size (phi): 5	
		Carbonate Fraction:		Sieve Interval (phi): 0.25	
Longitude:		Latitude:		Datum:	
Surface Elev:		Datum:		Accuracy:	
Sample Depth in Core:		Compaction Corrected?		% Comp.:	
				Total Mass: 38.809 grams	
Comments: Lake Jackson, Porter Hole sample - LJ6A					

[illegible]

Statistical Results			
Measure	Original Data in ϕ Units	Transformed Data	Original Data in Millimeters
Mean:	2.3121 ϕ	0.2014 mm	0.2219 mm
Standard Deviation:	0.6210 phi-units	MV ---	0.1176 mm
Skewness:	-0.2956 NU	MV ---	2.9504 NU
Kurtosis:	5.0153 NU	MV ---	15.5462 NU
Median:	2.2045 ϕ	0.217 mm	0.2177 mm
Relative Dispersion:	MV ---	--- ---	0.5301 NU

Mean, std dev, skewness and kurtosis calculated using method of moments.
 MV = meaningless value; NU = no units (*i.e.*, dimensionless)
 Transformed data calculated using $\text{mm} = 2^\circ$



Relative Dispersal Scale	
< 0.5	Excellent homogeneity (<i>e.g.</i> beaches)
0.5 to 1.0	Good homogeneity
1.0 to 1.33	Fair homogeneity
> 1.33	Poor homogeneity

Tweak ACUMPLOT X-axis here

X-axis minimum	-2
X-axis maximum	5

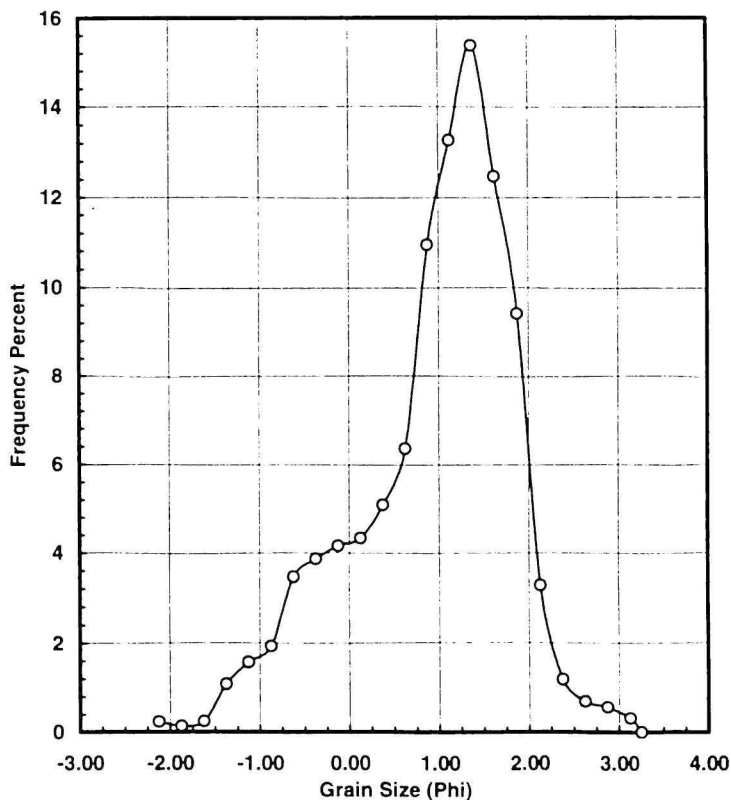
Sample I.D.: ROTAP3

Sample I.D.: ROTAP3		Sampled by:		Start Sieve Size (phi): -2	
Sample Date: 6/28/2001		Analyzed by: J. H. Balsillie		End Sieve Size (phi): 3.25	
Total Sample: X	Siliclastic Fraction:	Carbonate Fraction:		Pan Sieve Size (phi): 3.25	
Longitude:	Latitude:	Datum:		Sieve Interval (phi): 0.25	
Surface Elev:	Datum:	Accuracy:		# Splits:	0
Sample Depth in Core:	Compaction Corrected?	% Comp.:	Total Mass: 46.146 grams		
Comments: Carbonate + Silica Sample					

[illegible]

Statistical Results			
Measure	Original Data in ϕ Units	Transformed Data	Original Data in Millimeters
Mean:	0.9404 ϕ	0.5211 mm	0.6474 mm
Standard Deviation:	0.8980 phi-units	MV ---	0.5302 mm
Skewness:	-0.7123 NU	MV ---	2.6185 NU
Kurtosis:	3.1933 NU	MV ---	12.4049 NU
Median:	0.9993 ϕ	0.5002 mm	0.5021 mm
Relative Dispersion:	MV ---	--- ---	0.8189 NU

Mean, std dev, skewness and kurtosis calculated using method of moments.
 MV = meaningless value; NU = no units (*i.e.*, dimensionless)
 Transformed data calculated using $mm = 2^\circ$



Tweak ACUMPLOTT X-axis here

X-axis minimum -3

X-axis maximum	5
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Relative Dispersal Scale	
< 0.5	Excellent homogeneity (<i>e.g.</i> beaches)
0.5 to 1.0	Good homogeneity
1.0 to 1.33	Fair homogeneity
> 1.33	Poor homogeneity

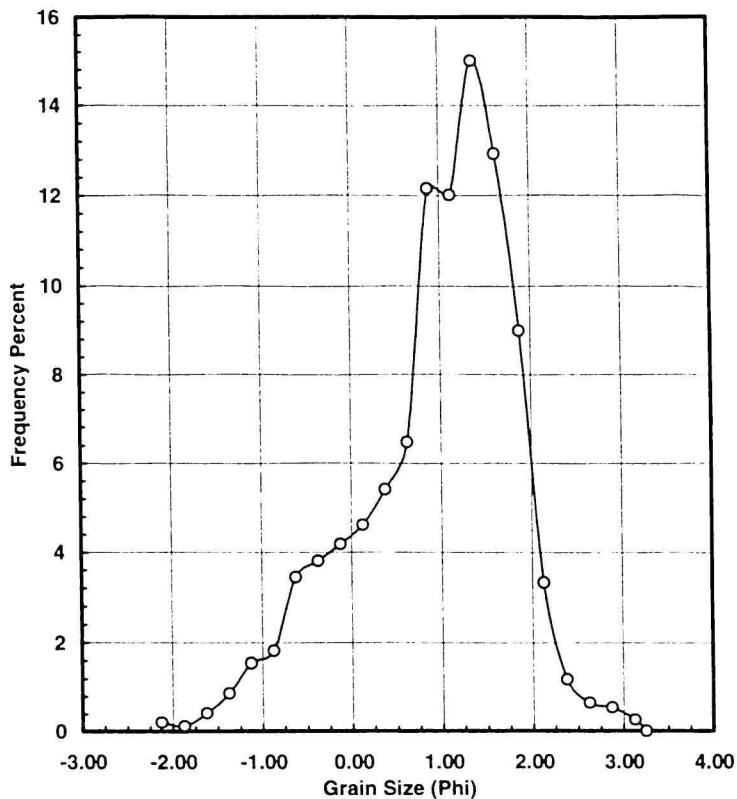
Sample I.D.: MEINZER3

Sample I.D.: MEINZER3		Sampled by:		Start Sieve Size (phi): -2	
Sample Date: 6/28/2001		Analyzed by: J. H. Balsillie		End Sieve Size (phi): 3.25	
Total Sample: X	Siliclastic Fraction:	Carbonate Fraction:		Pan Sieve Size (phi): 3.25	
Longitude:	Latitude:	Datum:	Sieve Interval (phi): 0.25		
Surface Elev:	Datum:	Accuracy:	# Splits:	0	
Sample Depth in Core:	Compaction Corrected?	% Comp.:	Total Mass: 45.698 grams		
Comments: Carbonate + Silica Sample					

[illegible]

Statistical Results				
Measure	Original Data in ϕ Units		Transformed Data	Original Data in Millimeters
Mean:	0.9337	ϕ	0.5235 mm	0.6476 mm
Standard Deviation:	0.8906	phi-units	MV ---	0.5243 mm
Skewness:	-0.6986	NU	MV ---	2.6245 NU
Kurtosis:	3.1879	NU	MV ---	12.4463 NU
Median:	0.9776	ϕ	0.5078 mm	0.5097 mm
Relative Dispersion:	MV	---	---	0.8096 NU

Mean, std dev, skewness and kurtosis calculated using method of moments.
 MV = meaningless value; NU = no units (*i.e.*, dimensionless)
 Transformed data calculated using $mm = 2^{\phi}$



Relative Disperson Scale	
< 0.5	Excellent homogeneity (<i>e.g.</i> beaches)
0.5 to 1.0	Good homogeneity
1.0 to 1.33	Fair homogeneity
> 1.33	Poor homogeneity

Tweak ACUMPLOT X-axis here

X-axis minimum -2

X-axis maximum	5
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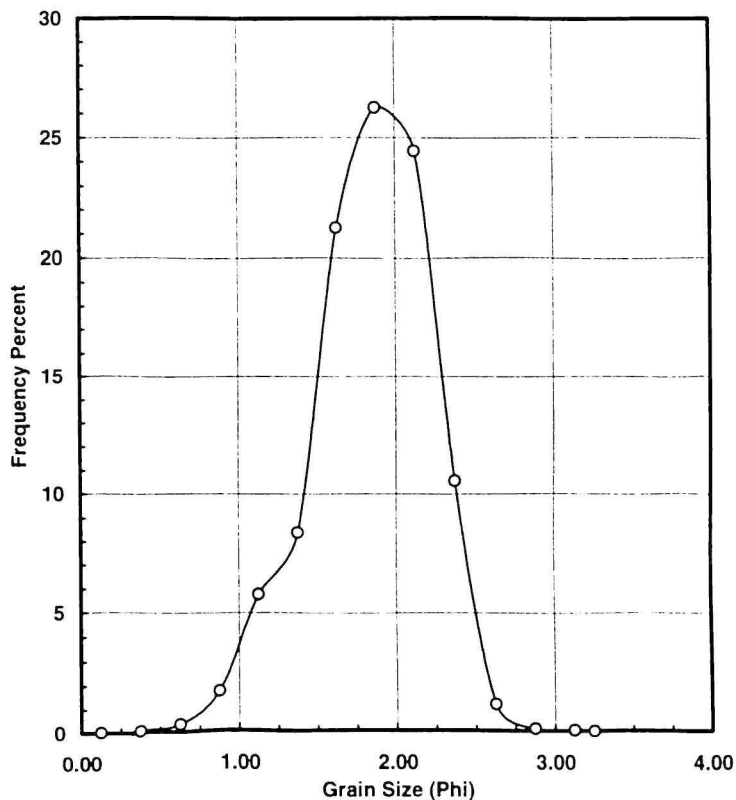
Sample I.D.: ROTAP4

Sample I.D.: ROTAP4		Sampled by:		Start Sieve Size (phi): 0.25	
Sample Date:		Analyzed by: A. A. Dabous		End Sieve Size (phi): 3.25	
Total Sample: X	Siliclastic Fraction:	Carbonate Fraction:		Pan Sieve Size (phi): 3.25	
Longitude:	Latitude:	Datum:		Sieve Interval (phi): 0.25	
Surface Elev:	Datum:	Accuracy:		# Splits:	0
Sample Depth in Core:	Compaction Corrected?	% Comp.:	Total Mass: 45.534 grams		
Comments: All quartz sample - NW FL panhandle coast					

[illegible]

Statistical Results			
Measure	Original Data in ϕ Units	Transformed Data	Original Data in Millimeters
Mean:	1.8378 ϕ	0.2797 mm	0.2897 mm
Standard Deviation:	0.3774 phi-units	MV ---	0.0826 mm
Skewness:	-0.5075 NU	MV ---	1.4167 NU
Kurtosis:	3.2189 NU	MV ---	6.3854 NU
Median:	1.7440 ϕ	0.2985 mm	0.2997 mm
Relative Dispersion:	MV ---	--- ---	0.2850 NU

Mean, std dev, skewness and kurtosis calculated using method of moments.
 MV = meaningless value; NU = no units (i.e., dimensionless)
 Transformed data calculated using $mm = 2^\phi$



Tweak ACUMPLOT X-axis here

X-axis minimum -3

X-axis maximum	5
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Relative Disperson Scale	
< 0.5	Excellent homogeneity (<i>e.g.</i> beaches)
0.5 to 1.0	Good homogeneity
1.0 to 1.33	Fair homogeneity
> 1.33	Poor homogeneity

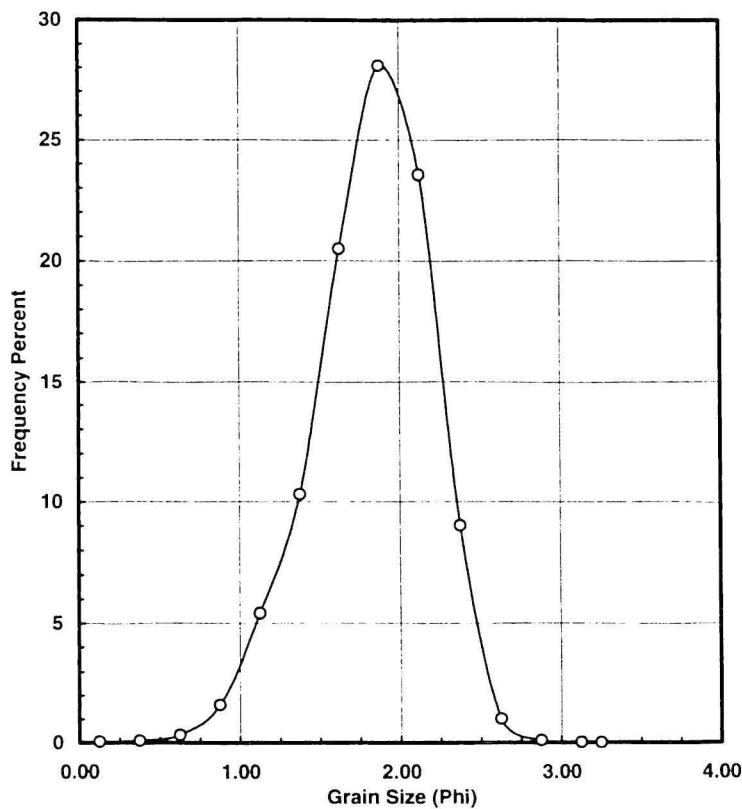
Sample I.D.: MEINZER4

Sample I.D.: MEINZER4		Sampled by:		Start Sieve Size (phi): 0.25	
Sample Date:		Analyzed by: A. A. Dabous		End Sieve Size (phi): 3.25	
Total Sample: X		Siliclastic Fraction:		Pan Sieve Size (phi): 3.25	
Longitude:		Latitude:		Sieve Interval (phi): 0.25	
Surface Elev:		Datum:			
Sample Depth in Core:		Accuracy:		# Splits: 0	
Compaction Corrected?		% Comp.:		Total Mass: 45.642 grams	
Comments: All quartz sample - NW FL panhandle coast					

[illegible]

Statistical Results				
Measure	Original Data in ϕ Units		Transformed Data	Original Data in Millimeters
Mean:	1.8224	ϕ	0.2827 mm	0.2924 mm
Standard Deviation:	0.3705	phi-units	MV ---	0.0815 mm
Skewness:	-0.4832	NU	MV ---	1.3934 NU
Kurtosis:	3.2189	NU	MV ---	6.4250 NU
Median:	1.7297	ϕ	0.3015 mm	0.3026 mm
Relative Dispersion:	MV	---	---	0.2785 NU

Mean, std dev, skewness and kurtosis calculated using method of moments.
 MV = meaningless value; NU = no units (*i.e.* , dimensionless)
 Transformed data calculated using $mm = 2^\phi$



Tweak ACUMPLOT X-axis here

X-axis minimum -2

X-axis maximum	5
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Relative Disperson Scale	
< 0.5	Excellent homogeneity (<i>e.g.</i> beaches)
0.5 to 1.0	Good homogeneity
1.0 to 1.33	Fair homogeneity
> 1.33	Poor homogeneity

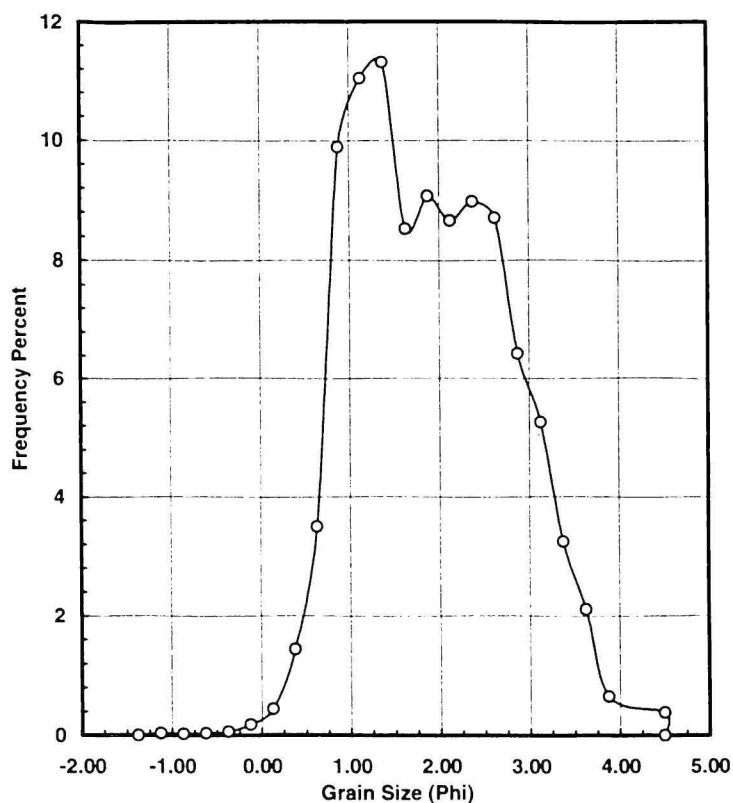
Sample I.D.: ROTAP5

Sample I.D.: ROTAP5		Sampled by:		Start Sieve Size (phi): -1.25	
Sample Date:		Analyzed by: J. H. Balsille		End Sieve Size (phi): 4	
Total Sample: X	Siliclastic Fraction:	Carbonate Fraction:		Pan Sieve Size (phi): 5	
Longitude:	Latitude:	Datum:		Sieve Interval (phi): 0.25	
Surface Elev:	Datum:	Accuracy:		# Splits:	0
Sample Depth in Core:	Compaction Corrected?	% Comp.:		Total Mass: 43.981 grams	
Comments: NKC1P3					

[illegible]

Statistical Results			
Measure	Original Data in ϕ Units	Transformed Data	Original Data in Millimeters
Mean:	1.9055 ϕ	0.2669 mm	0.3145 mm
Standard Deviation:	0.8618 phi-units	MV ---	0.1819 mm
Skewness:	0.2427 NU	MV ---	1.4240 NU
Kurtosis:	2.4061 NU	MV ---	9.3306 NU
Median:	1.7218 ϕ	0.3032 mm	0.3042 mm
Relative Dispersion:	MV ---	--- ---	0.5783 NU

Mean, std dev, skewness and kurtosis calculated using method of moments.
 MV = meaningless value; NU = no units (*i.e.*, dimensionless)
 Transformed data calculated using $mm = 2^\circ$



Relative Dispersal Scale	
< 0.5	Excellent homogeneity (<i>e.g.</i> beaches)
0.5 to 1.0	Good homogeneity
1.0 to 1.33	Fair homogeneity
> 1.33	Poor homogeneity

Tweak ACUMPLOT X-axis here

X-axis minimum	-3
X-axis maximum	5

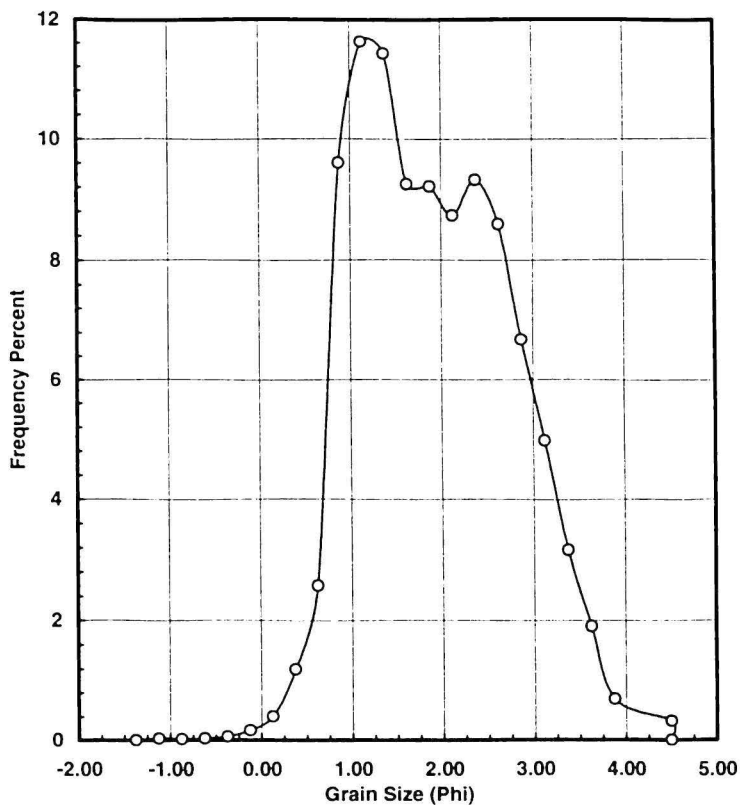
Sample I.D.: MEINZER5

Sample I.D.: MEINZER5		Sampled by:		Start Sieve Size (phi): -1.25	
Sample Date:		Analyzed by: J. H. Balsillie		End Sieve Size (phi): 4	
Total Sample: X	Siliclastic Fraction:	Carbonate Fraction:		Pan Sieve Size (phi): 5	
Longitude:	Latitude:	Datum:		Sieve Interval (phi): 0.25	
Surface Elev:	Datum:	Accuracy:		# Splits:	0
Sample Depth in Core:	Compaction Corrected?	% Comp.:		Total Mass: 44.266 grams	
Comments: Cedar Key sample - NKC1P3					

[illegible]

Statistical Results				
Measure	Original Data in ϕ Units	Transformed Data	Original Data in Millimeters	
Mean:	1.9126 ϕ	0.2656 mm	0.3105 mm	
Standard Deviation:	0.8411 phi-units	MV ---	0.1750 mm	
Skewness:	0.2560 NU	MV ---	1.4029 NU	
Kurtosis:	2.4312 NU	MV ---	9.4211 NU	
Median:	1.7229 ϕ	0.3029 mm	0.3040 mm	
Relative Dispersion:	MV ---	--- ---	0.5636 NU	

Mean, std dev, skewness and kurtosis calculated using method of moments.
 MV = meaningless value; NU = no units (*i.e.*, dimensionless)
 Transformed data calculated using $mm = 2^{\phi}$



Relative Disperson Scale	
< 0.5	Excellent homogeneity (<i>e.g.</i> beaches)
0.5 to 1.0	Good homogeneity
1.0 to 1.33	Fair homogeneity
> 1.33	Poor homogeneity

Tweak ACUMPLOT X-axis here

X-axis minimum	-2
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X-axis maximum	5
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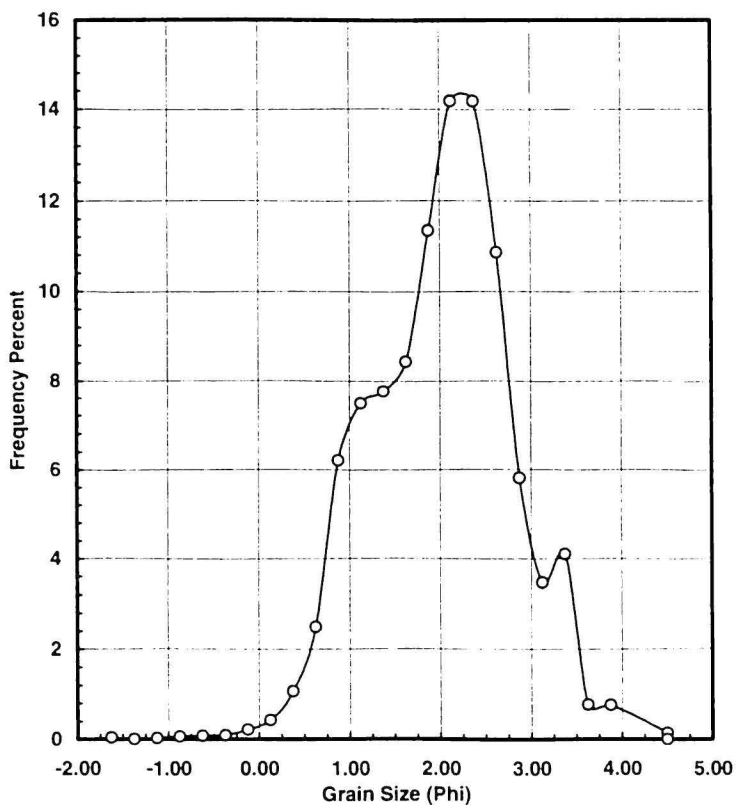
Sample I.D.: ROTAP6

Sample I.D.:	ROTAP6	Sampled by:		Start Sieve Size (phi):	-1.5
Sample Date:	6/28/2001	Analyzed by:	J. H. Balsillie	End Sieve Size (phi):	4
Total Sample:	X	Siliclastic Fraction:		Pan Sieve Size (phi):	5
Longitude:		Latitude:		Sieve Interval (phi):	0.25
Surface Elev:		Datum:			
Sample Depth in Core:		Accuracy:		# Splits:	0
		Compaction Corrected?		% Comp.:	
Comments:	NKC1P9			Total Mass:	41.451 grams

[illegible]

Statistical Results				
Measure	Original Data in ϕ Units		Transformed Data	Original Data in Millimeters
Mean:	2.0139	ϕ	0.2476 mm	0.2865 mm
Standard Deviation:	0.7765	phi-units	MV ---	0.1787 mm
Skewness:	-0.1638	NU	MV ---	3.3416 NU
Kurtosis:	3.0034	NU	MV ---	33.3148 NU
Median:	1.9507	ϕ	0.2587 mm	0.2595 mm
Relative Dispersion:	MV	---	---	0.6238 NU

Mean, std dev, skewness and kurtosis calculated using method of moments.
 MV = meaningless value; NU = no units (*i.e.*, dimensionless)
 Transformed data calculated using $mm = 2^3$



Tweak ACUMPLOT X-axis here

X-axis minimum -3

X-axis maximum	5
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Relative Dispersal Scale	
< 0.5	Excellent homogeneity (<i>e.g.</i> beaches)
0.5 to 1.0	Good homogeneity
1.0 to 1.33	Fair homogeneity
> 1.33	Poor homogeneity

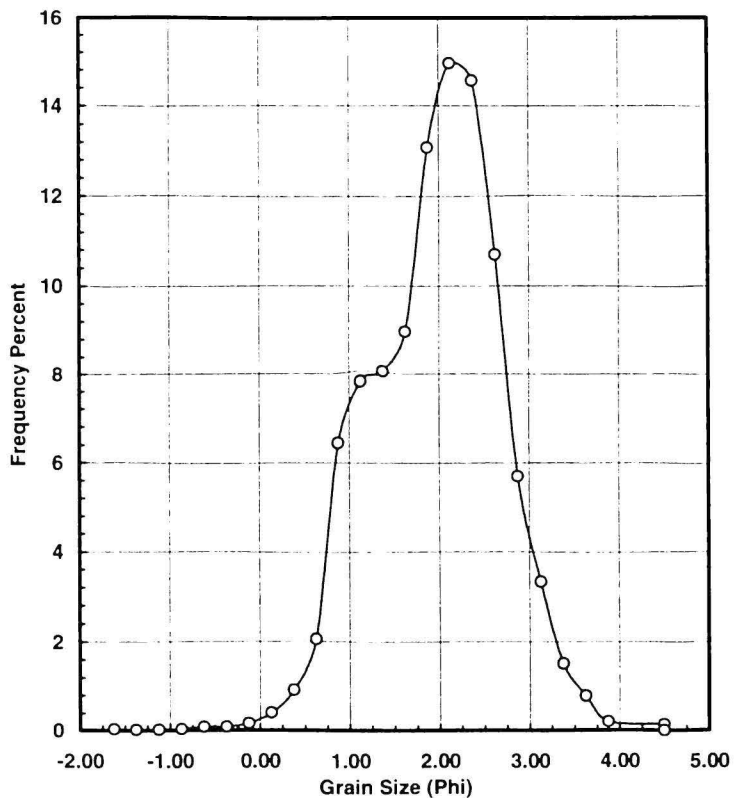
Sample I.D.: MEINZER6

Sample I.D.: MEINZER6		Sampled by:		Start Sieve Size (phi): -1.5	
Sample Date: 6/28/2001		Analyzed by: J. H. Balsillie		End Sieve Size (phi): 4	
Total Sample: X		Siliclastic Fraction:		Pan Sieve Size (phi): 5	
Longitude:		Latitude:		Sieve Interval (phi): 0.25	
Surface Elev:		Datum:		Accuracy:	
Sample Depth in Core:		Compaction Corrected?		% Comp.:	
Comments: NKC1P9				Total Mass: 40.67 grams	

[illegible]

Statistical Results				
Measure	Original Data in ϕ Units		Transformed Data	
				Original Data in Millimeters
Mean:	1.9661	ϕ	0.2559	mm
Standard Deviation:	0.7223	phi-units	MV	---
Skewness:	-0.2385	NU	MV	---
Kurtosis:	3.2388	NU	MV	---
Median:	1.9067	ϕ	0.2667	mm
Relative Dispersion:	MV	---	---	---

Mean, std dev, skewness and kurtosis calculated using method of moments.
 MV = meaningless value; NU = no units (i.e., dimensionless)
 Transformed data calculated using $mm = 2^\phi$



Tweak ACUMPLOT X-axis here

X-axis minimum -2

X-axis maximum	5
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Relative Disperison Scale	
< 0.5	Excellent homogeneity (<i>e.g.</i> beaches)
0.5 to 1.0	Good homogeneity
1.0 to 1.33	Fair homogeneity
> 1.33	Poor homogeneity

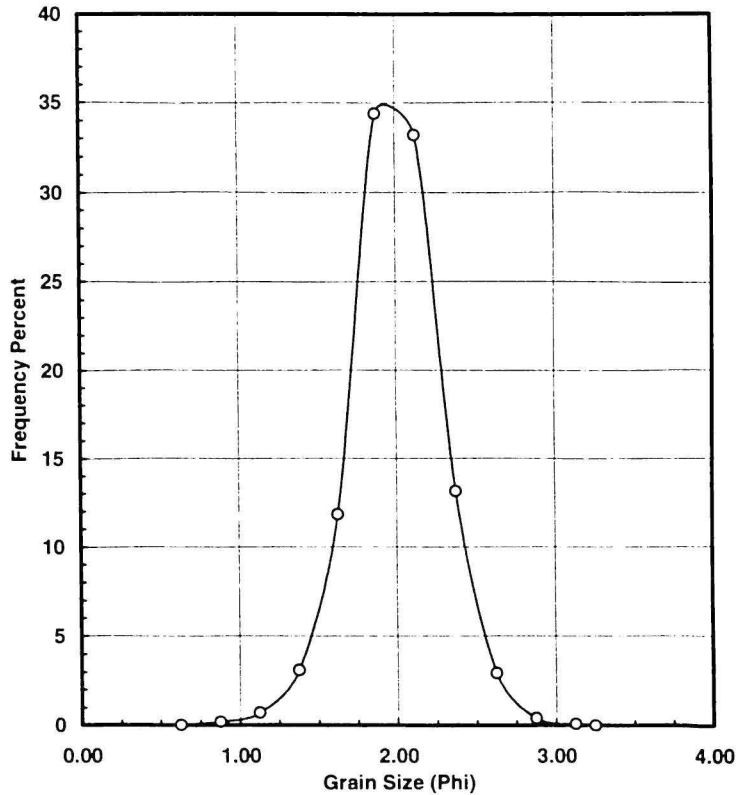
Sample I.D.: ROTAP7

Sample I.D.: ROTAP7		Sampled by:		Start Sieve Size (phi): 0.75	
Sample Date: 6/28/2001		Analyzed by: J. H. Balsillie		End Sieve Size (phi): 3.25	
Total Sample: X		Siliclastic Fraction:		Pan Sieve Size (phi): 3.25	
		Carbonate Fraction:		Sieve Interval (phi): 0.25	
Longitude:		Latitude:		Datum:	
Surface Elev:		Datum:		Accuracy:	
Sample Depth in Core:		Compaction Corrected?		% Comp.:	
Comments: All quartz, NW FL panhandle				Total Mass: 33.144 grams	

[illegible]

Statistical Results			
Measure	Original Data in ϕ Units	Transformed Data	Original Data in Millimeters
Mean:	1.9985 ϕ	0.2503 mm	0.2553 mm
Standard Deviation:	0.2901 phi-units	MV ---	0.0531 mm
Skewness:	-0.1290 NU	MV ---	1.0331 NU
Kurtosis:	3.7395 NU	MV ---	5.8428 NU
Median:	1.8733 ϕ	0.273 mm	0.2730 mm
Relative Dispersion:	MV ---	--- ---	0.2079 NU

Mean, std dev, skewness and kurtosis calculated using method of moments.
 MV = meaningless value; NU = no units (*i.e.*, dimensionless)
 Transformed data calculated using $\text{mm} = 2^\circ$



Tweak ACUMPLOT X-axis here

X-axis minimum	-3
X-axis maximum	5

Relative Disperison Scale	
< 0.5	Excellent homogeneity (<i>e.g.</i> beaches)
0.5 to 1.0	Good homogeneity
1.0 to 1.33	Fair homogeneity
> 1.33	Poor homogeneity

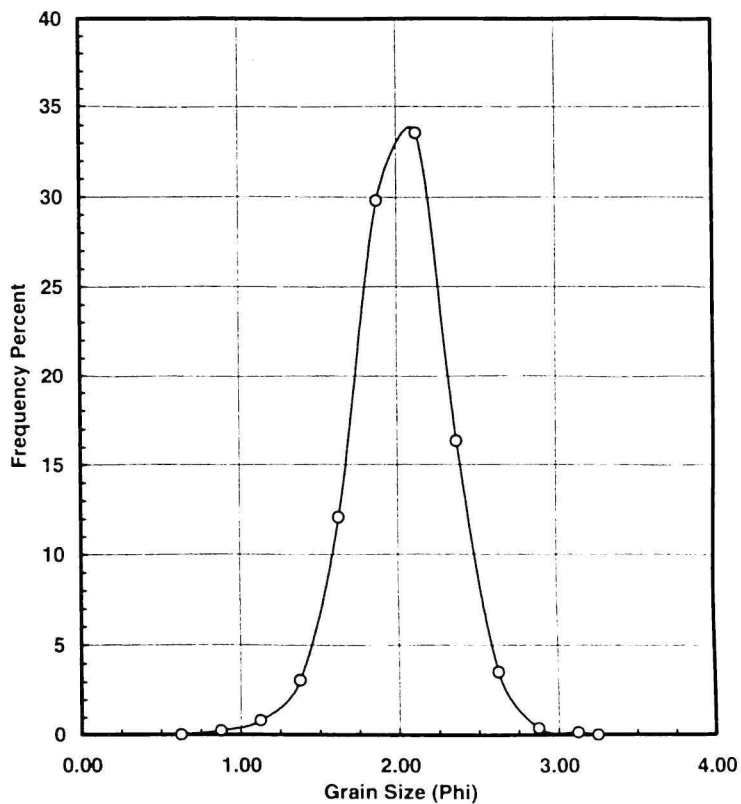
Sample I.D.: MEINZER7

Sample I.D.:	MEINZER7	Sampled by:	Start Sieve Size (phi): 0.75		
Sample Date:	6/28/2001	Analized by:	End Sieve Size (phi): 3.25		
Total Sample:	X	Siliclastic Fraction:	Carbonate Fraction:	Pan Sieve Size (phi): 3.25	
Longitude:		Latitude:	Datum:	Sieve Interval (phi): 0.25	
Surface Elev:		Datum:	Accuracy:	# Splits:	0
Sample Depth in Core:		Compaction Corrected?	% Comp.:	Total Mass:	33.077 grams
Comments:	All quartz, NW FL panhandle				

[illegible]

Statistical Results			
Measure	Original Data in ϕ Units	Transformed Data	Original Data in Millimeters
Mean:	2.0187 ϕ	0.2468 mm	0.2522 mm
Standard Deviation:	0.3033 phi-units	MV ---	0.0553 mm
Skewness:	-0.2173 NU	MV ---	1.0856 NU
Kurtosis:	3.5425 NU	MV ---	5.6529 NU
Median:	1.9047 ϕ	0.2671 mm	0.2675 mm
Relative Dispersion:	MV ---	--- ---	0.2192 NU

Mean, std dev, skewness and kurtosis calculated using method of moments.
 MV = meaningless value; NU = no units (i.e., dimensionless)
 Transformed data calculated using $mm = 2^\phi$



Tweak ACUMPLOT X-axis here

X-axis minimum -2

X-axis maximum	5
----------------	---

Relative Disperson Scale	
< 0.5	Excellent homogeneity (<i>e.g.</i> beaches)
0.5 to 1.0	Good homogeneity
1.0 to 1.33	Fair homogeneity
> 1.33	Poor homogeneity

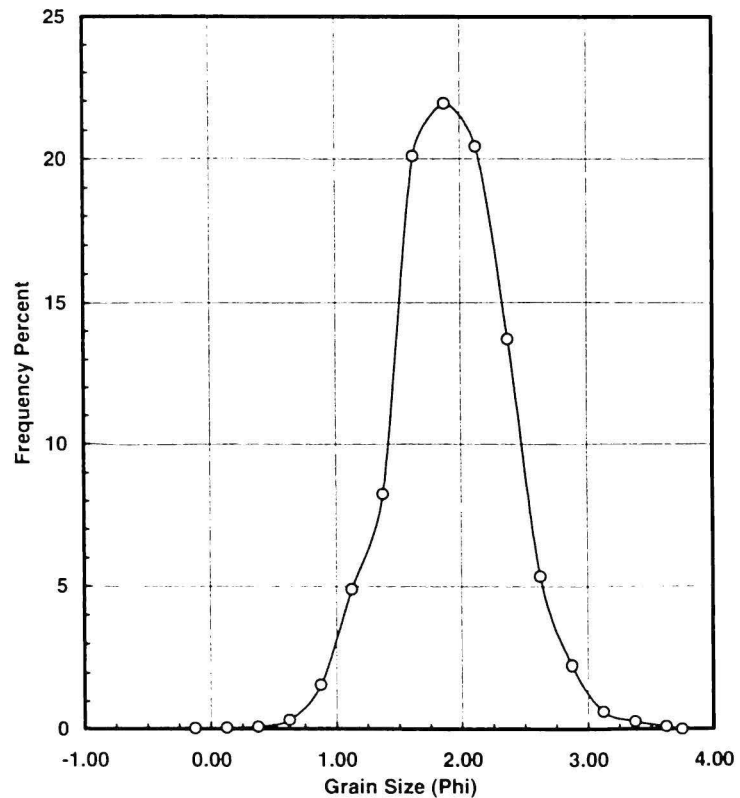
Sample I.D.: ROTAP8

Sample I.D.: ROTAP8		Sampled by:		Start Sieve Size (phi): 0	
Sample Date: 6/28/2001		Analyzed by: J. H. Balsillie		End Sieve Size (phi): 3.75	
Total Sample: X	Siliclastic Fraction:	Carbonate Fraction:		Pan Sieve Size (phi): 3.75	
Longitude:	Latitude:	Datum:		Sieve Interval (phi): 0.25	
Surface Elev:	Datum:	Accuracy:	# Splits:	0	
Sample Depth in Core:	Compaction Corrected?	% Comp.:	Total Mass: 58.23 grams		
Comments: ASCE1-1					

[illegible]

Statistical Results			
Measure	Original Data in ϕ Units	Transformed Data	Original Data in Millimeters
Mean:	1.9204 ϕ	0.2642 mm	0.2774 mm
Standard Deviation:	0.4540 phi-units	MV ---	0.0905 mm
Skewness:	0.0156 NU	MV ---	1.2676 NU
Kurtosis:	3.3963 NU	MV ---	7.1173 NU
Median:	1.7924 ϕ	0.2887 mm	0.2897 mm
Relative Dispersion:	MV ---	--- ---	0.3262 NU

Mean, std dev, skewness and kurtosis calculated using method of moments.
 MV = meaningless value; NU = no units (*i.e.*, dimensionless)
 Transformed data calculated using $mm = 2^\circ$



Tweak ACUMPLOTT X-axis here

X-axis minimum	-3
X-axis maximum	5

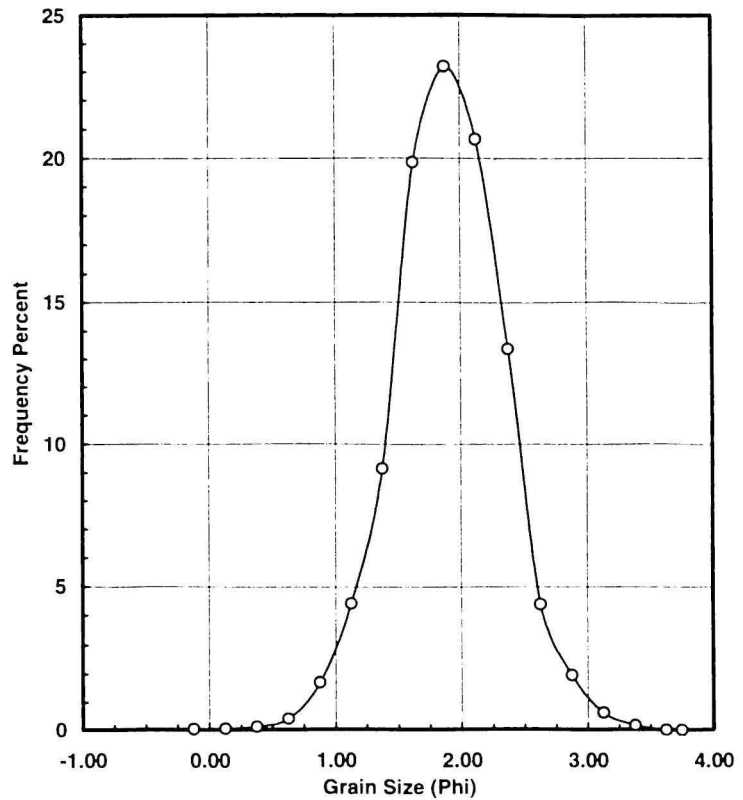
Relative Dispersal Scale	
< 0.5	Excellent homogeneity (<i>e.g.</i> beaches)
0.5 to 1.0	Good homogeneity
1.0 to 1.33	Fair homogeneity
> 1.33	Poor homogeneity

Sample I.D.: MEINZER8

Sample I.D.: MEINZER8		Sampled by:		Start Sieve Size (phi): 0	
Sample Date: 6/28/2001		Analyzed by: J. H. Balsillie		End Sieve Size (phi): 3.75	
Total Sample: X		Siliclastic Fraction:		Pan Sieve Size (phi): 3.75	
Longitude:		Latitude:		Sieve Interval (phi): 0.25	
Datum:		Datum:			
Surface Elev:		Accuracy:		# Splits: 0	
Sample Depth in Core:		Compaction Corrected?		% Comp.: 58.472 grams	
Comments: ASE1-1					

[illegible]

Statistical Results			
Measure	Original Data in ϕ Units	Transformed Data	Original Data in Millimeters
Mean:	1.9029 ϕ	0.2674 mm	0.2801 mm
Standard Deviation:	0.4404 phi-units	MV ---	0.0897 mm
Skewness:	-0.0720 NU	MV ---	1.3607 NU
Kurtosis:	3.3941 NU	MV ---	7.5757 NU
Median:	1.7794 ϕ	0.2913 mm	0.2924 mm
Relative Dispersion:	MV ---	--- ---	0.3203 NU
Mean, std dev, skewness and kurtosis calculated using method of moments. MV = meaningless value; NU = no units (<i>i.e.</i> , dimensionless) Transformed data calculated using $\text{mm} = 2^{\circ}$			



X-axis minimum	-2
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X-axis maximum	5
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Relative Disperson Scale	
< 0.5	Excellent homogeneity (<i>e.g.</i> beaches)
0.5 to 1.0	Good homogeneity
1.0 to 1.33	Fair homogeneity
> 1.33	Poor homogeneity

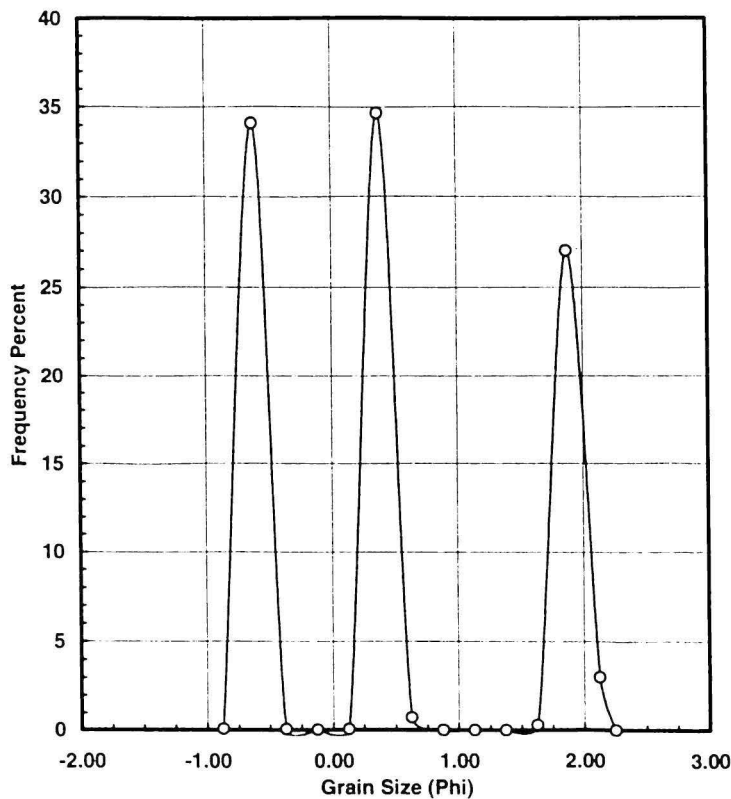
Sample I.D.: ROTAP9

Sample I.D.: ROTAP9		Sampled by:		Start Sieve Size (phi): -0.75	
Sample Date: 6/28/2001		Analyzed by: J. H. Balsille		End Sieve Size (phi): 2.25	
Total Sample: X	Siliclastic Fraction:	Carbonate Fraction:		Pan Sieve Size (phi): 2.25	
Longitude:	Latitude:	Datum:		Sieve Interval (phi): 0.25	
Surface Elev:		Datum:		Accuracy:	
Sample Depth in Core:	Compaction Corrected?	% Comp.:	# Splits:	0	Total Mass: 67.79 grams
Comments: Carbonate + Silica Sample					

[illegible]

Statistical Results				
Measure	Original Data in ϕ Units		Transformed Data	Original Data in Millimeters
Mean:	0.4964	ϕ	0.7089 mm	0.8818 mm
Standard Deviation:	1.0241	phi-units	MV ---	0.5216 mm
Skewness:	0.3399	NU	MV ---	0.2018 NU
Kurtosis:	1.6019	NU	MV ---	1.4865 NU
Median:	0.2385	ϕ	0.8476 mm	0.8508 mm
Relative Dispersion:	MV	---	---	0.5915 NU

Mean, std dev, skewness and kurtosis calculated using method of moments.
 MV = meaningfulless value; NU = no units (*i.e.*, dimensionless)
 Transformed data calculated using $mm = 2^\circ$



Tweak ACUMPLOT X-axis here

X-axis minimum	-3
X-axis maximum	5

Relative Disperison Scale	
< 0.5	Excellent homogeneity (<i>e.g.</i> beaches)
0.5 to 1.0	Good homogeneity
1.0 to 1.33	Fair homogeneity
> 1.33	Poor homogeneity

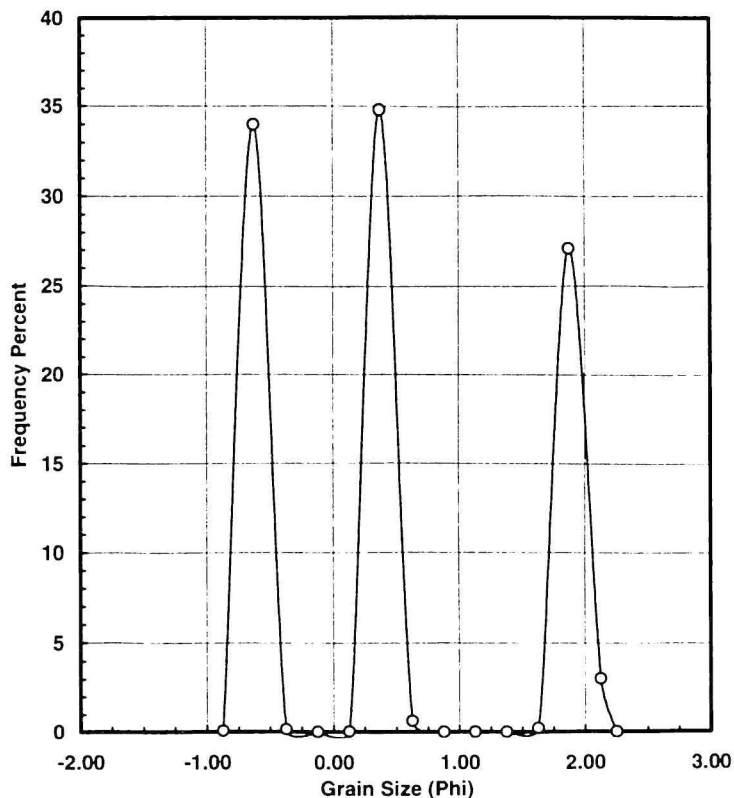
Sample I.D.: MEINZER9

Sample I.D.: MEINZER9		Sampled by:		Start Sieve Size (phi): -0.75	
Sample Date: 6/28/2001		Analyzed by: J. H. Balsillie		End Sieve Size (phi): 2.25	
Total Sample: X		Siliclastic Fraction:		Pan Sieve Size (phi): 2.25	
Longitude:		Latitude:		Sieve Interval (phi): 0.25	
Datum:		Datum:			
Surface Elev:		Accuracy:		# Splits: 0	
Sample Depth in Core:		Compaction Corrected?		% Comp.: Total Mass: 67.867 grams	
Comments: Carbonate + Silica Sample					

[illegible]

Statistical Results			
Measure	Original Data in ϕ Units		Transformed Data
			Original Data in Millimeters
Mean:	0.4969	ϕ	0.7086 mm
Standard Deviation:	1.0240	phi-units	0.5213 mm
Skewness:	0.3401	NU	0.2021 NU
Kurtosis:	1.6019	NU	1.4883 NU
Median:	0.2383	ϕ	0.8477 mm
Relative Dispersion:	MV	---	0.5915 NU

Mean, std dev, skewness and kurtosis calculated using method of moments.
 MV = meaningfulness value; NU = no units (*i.e.*, dimensionless)
 Transformed data calculated using $mm = 2^\phi$



Tweak ACUMPLOTT X-axis here

X-axis minimum	-3
X-axis maximum	5

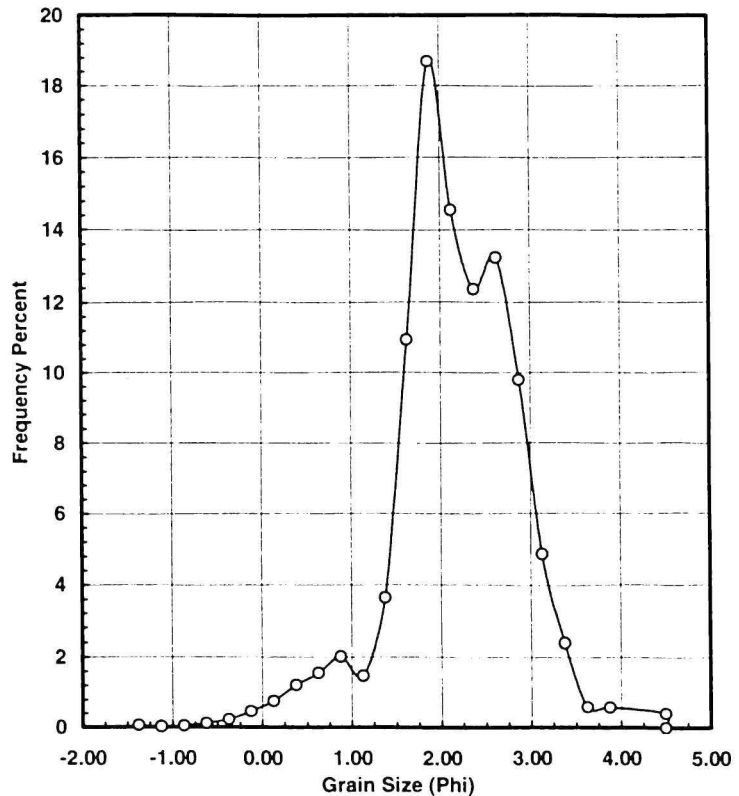
Relative Disperison Scale	
< 0.5	Excellent homogeneity (<i>e.g.</i> beaches)
0.5 to 1.0	Good homogeneity
1.0 to 1.33	Fair homogeneity
> 1.33	Poor homogeneity

Sample I.D.: ROTAP10a

Sample I.D.: ROTAP10a		Sampled by:		Start Sieve Size (phi): -1.25	
Sample Date: 6/28/2001		Analyzed by: J. H. Balsillie		End Sieve Size (phi): 4	
Total Sample: X		Siliclastic Fraction:		Pan Sieve Size (phi): 5	
		Carbonate Fraction:		Sieve Interval (phi): 0.25	
Longitude:		Latitude:		Datum:	
Surface Elev:		Datum:		Accuracy:	
Sample Depth in Core:		Compaction Corrected?		% Comp.:	
				Total Mass: 36.941 grams	
Comments: Lake Jackson, Porter Hole sample - LJ4A					

[illegible]

Statistical Results			
Measure	Original Data in ϕ Units	Transformed Data	Original Data in Millimeters
Mean:	2.1516 ϕ	0.2251 mm	0.2580 mm
Standard Deviation:	0.7194 phi-units	MV ---	0.1762 mm
Skewness:	-0.5449 NU	MV ---	4.2696 NU
Kurtosis:	4.5844 NU	MV ---	35.3593 NU
Median:	2.0260 ϕ	0.2455 mm	0.2464 mm
Relative Dispersion:	MV ---	--- ---	0.6830 NU
Mean, std dev, skewness and kurtosis calculated using method of moments. MV = meaninglessness value; NU = no units (<i>i.e.</i> , dimensionless) Transformed data calculated using $\text{mm} = 2^\circ$			



Relative Disperson Scale	
< 0.5	Excellent homogeneity (<i>e.g.</i> beaches)
0.5 to 1.0	Good homogeneity
1.0 to 1.33	Fair homogeneity
> 1.33	Poor homogeneity

Tweak ACUMPLOT X-axis here

X-axis minimum -3

X-axis maximum	5
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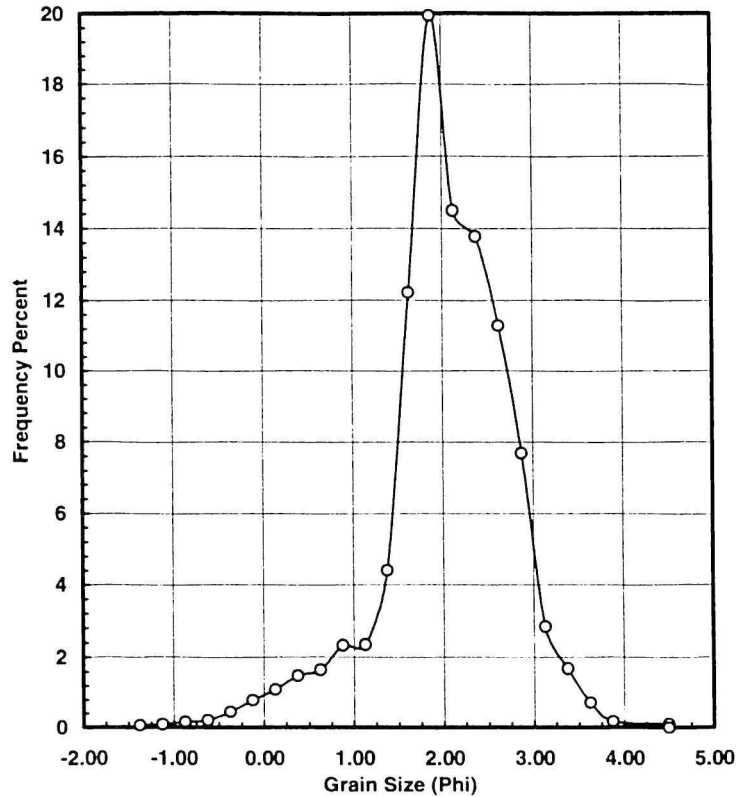
Sample I.D.: MEINZER10a

Sample I.D.: MEINZER10a		Sampled by:		Start Sieve Size (phi): -1.25	
Sample Date: 6/28/2001		Analyzed by: J. H. Balsillie		End Sieve Size (phi): 4	
Total Sample: X		Siliclastic Fraction:		Pan Sieve Size (phi): 5	
Longitude:		Latitude:		Datum:	
Surface Elev:		Datum:		Accuracy:	
Sample Depth in Core:		Compaction Corrected?		% Comp.:	
Comments:		Lake Jackson, Porter Hole sample - LJ4A		Total Mass: 36.935 grams	

[illegible]

Statistical Results			
Measure	Original Data in ϕ Units	Transformed Data	Original Data in Millimeters
Mean:	2.0261 ϕ	0.2455 mm	0.2848 mm
Standard Deviation:	0.7319 phi-units	MV ---	0.2100 mm
Skewness:	-0.8297 NU	MV ---	4.0630 NU
Kurtosis:	4.8052 NU	MV ---	27.8526 NU
Median:	1.9233 ϕ	0.2637 mm	0.2643 mm
Relative Dispersion:	MV ---	--- ---	0.7375 NU

Mean, std dev, skewness and kurtosis calculated using method of moments.
 MV = meaningless value; NU = no units (*i.e.*, dimensionless)
 Transformed data calculated using $\text{mm} = 2^\circ$



Tweak ACUMPLOTT X-axis here

X-axis minimum	-2
X-axis maximum	5

Relative Disperison Scale	
< 0.5	Excellent homogeneity (<i>e.g.</i> beaches)
0.5 to 1.0	Good homogeneity
1.0 to 1.33	Fair homogeneity
> 1.33	Poor homogeneity

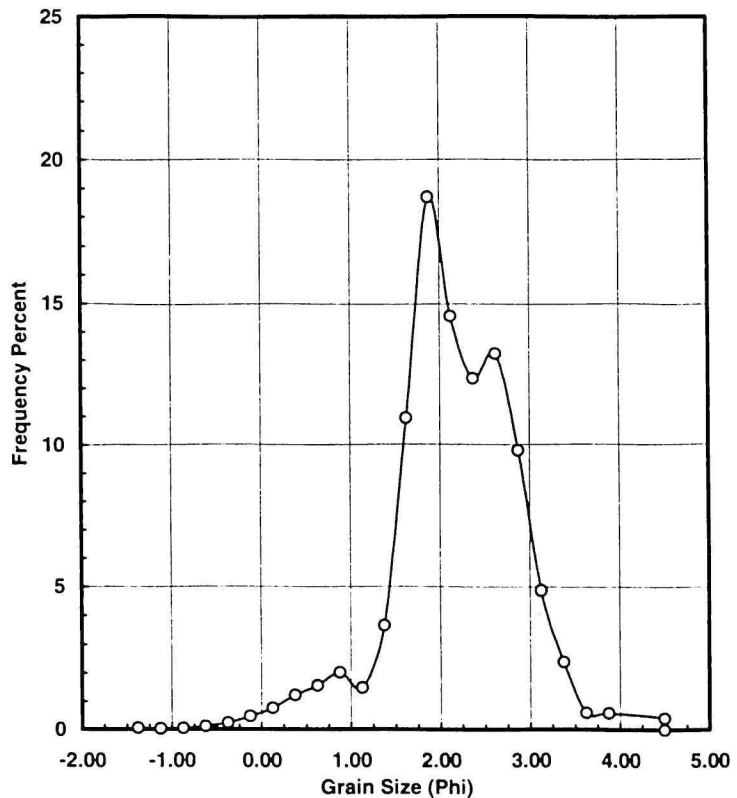
Sample I.D.: ROTAP10b

Sample I.D.: ROTAP10b		Sampled by:		Start Sieve Size (phi): -1.25	
Sample Date: 6/28/2001		Analyzed by: J. H. Balsillie		End Sieve Size (phi): 4	
Total Sample: X		Siliciclastic Fraction:		Pan Sieve Size (phi): 5	
		Carbonate Fraction:		Sieve Interval (phi): 0.25	
Longitude:		Latitude:		Datum:	
Surface Elev:		Datum:		Accuracy:	
Sample Depth in Core:		Compaction Corrected?		% Comp.:	
Comments:		Lake Jackson, Porter Hole sample - LJ4A		Total Mass: 36.941 grams	

[illegible]

Statistical Results				
Measure	Original Data in ϕ Units		Transformed Data	Original Data in Millimeters
Mean:	2.1516	ϕ	0.2251 mm	0.2580 mm
Standard Deviation:	0.7194	phi-units	MV ---	0.1762 mm
Skewness:	-0.5449	NU	MV ---	4.2696 NU
Kurtosis:	4.5844	NU	MV ---	35.3593 NU
Median:	2.0260	ϕ	0.2455 mm	0.2464 mm
Relative Dispersion:	MV	---	---	0.6830 NU

Mean, std dev, skewness and kurtosis calculated using method of moments.
 MV = meaningless value; NU = no units (*i.e.*, dimensionless)
 Transformed data calculated using $mm = 2^{\phi}$



Tweak ACUMPLOT X-axis here

X-axis minimum -3

X-axis maximum	5
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Relative Disperison Scale	
< 0.5	Excellent homogeneity (<i>e.g.</i> beaches)
0.5 to 1.0	Good homogeneity
1.0 to 1.33	Fair homogeneity
> 1.33	Poor homogeneity

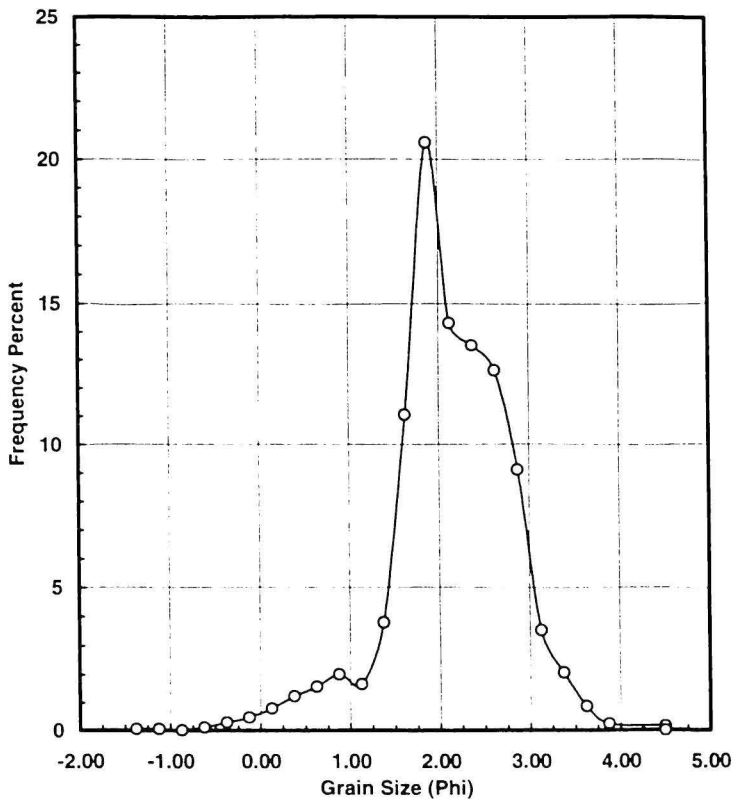
Sample I.D.: MEINZER10b

Sample I.D.: MEINZER10b		Sampled by:		Start Sieve Size (phi): -1.25	
Sample Date: 6/28/2001		Analyzed by: J. H. Balsillie		End Sieve Size (phi): 4	
Total Sample: X		Siliclastic Fraction:		Pan Sieve Size (phi): 5	
Longitude:		Latitude:		Sieve Interval (phi): 0.25	
Surface Elev:		Datum:		Accuracy:	
Sample Depth in Core:		Compaction Corrected?		% Comp.:	
Comments:		Lake Jackson, Porter Hole sample - LJ4A		# Splits: 0	
				Total Mass: 36.85 grams	

[illegible]

Statistical Results				
Measure	Original Data in ϕ Units	Transformed Data		Original Data in Millimeters
Mean:	2.1105 ϕ	0.2316	mm	0.2636 mm
Standard Deviation:	0.6951 phi-units	MV	---	0.1770 mm
Skewness:	-0.6660 NU	MV	---	4.3654 NU
Kurtosis:	4.6979 NU	MV	---	36.4509 NU
Median:	1.9867 ϕ	0.2523	mm	0.2532 mm
Relative Dispersion:	MV ---	---	---	0.6715 NU

Mean, std dev, skewness and kurtosis calculated using method of moments.
 MV = meaningless value; NU = no units (*i.e.*, dimensionless)
 Transformed data calculated using mm = 2[°]



Tweak ACUMPLOT X-axis here

X-axis minimum	-2
X-axis maximum	5

Relative Disperson Scale	
< 0.5	Excellent homogeneity (<i>e.g.</i> beaches)
0.5 to 1.0	Good homogeneity
1.0 to 1.33	Fair homogeneity
> 1.33	Poor homogeneity

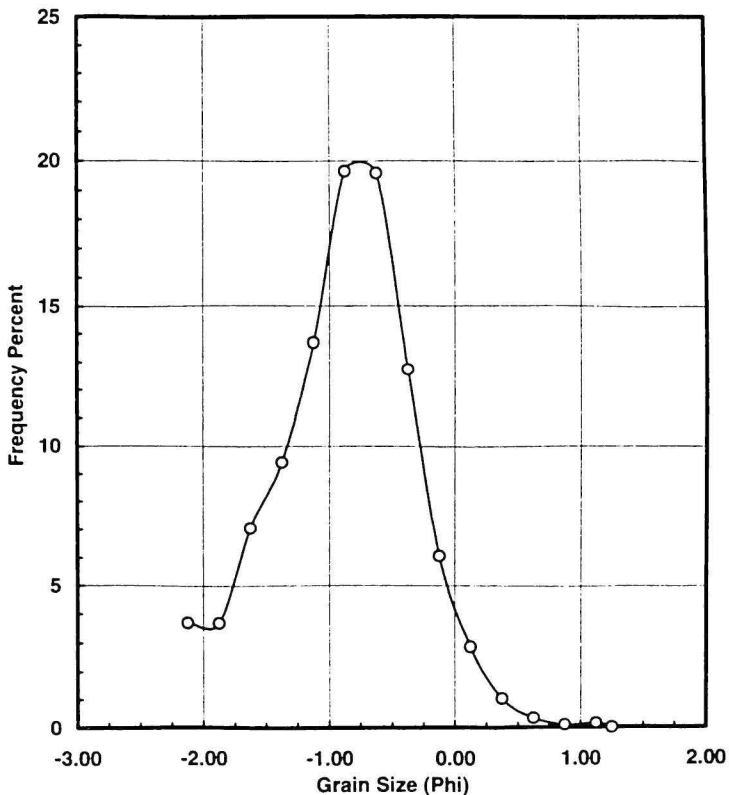
Sample I.D.: ROTAP11a

Sample I.D.: ROTAP11a		Sampled by:		Start Sieve Size (phi): -2	
Sample Date: 6/28/2001		Analyzed by: J. H. Balsillie		End Sieve Size (phi): 1.25	
Total Sample: X		Siliclastic Fraction:		Pan Sieve Size (phi): 1.25	
Longitude:		Latitude:		Sieve Interval (phi): 0.25	
Datum:		Accuracy:		# Splits: 0	
Sample Depth in Core:		Compaction Corrected?		% Comp.: Total Mass: 46.617 grams	
Comments: Carbonate + Silica Sample					

[illegible]

Statistical Results			
Measure	Original Data in ϕ Units	Transformed Data	Original Data in Millimeters
Mean:	-0.8832 ϕ	1.8444 mm	1.9873 mm
Standard Deviation:	0.5586 phi-units	MV ---	0.8144 mm
Skewness:	-0.1394 NU	MV ---	1.1567 NU
Kurtosis:	3.0026 NU	MV ---	4.0475 NU
Median:	-0.9664 ϕ	1.954 mm	1.9609 mm
Relative Dispersion:	MV ---	--- ---	0.4098 NU

Mean, std dev, skewness and kurtosis calculated using method of moments.
 MV = meaningless value; NU = no units (*i.e.*, dimensionless)
 Transformed data calculated using $mm = 2^\phi$



Tweak ACUMPLOT X-axis here

X-axis minimum -3

X-axis maximum	5
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Relative Disperson Scale	
< 0.5	Excellent homogeneity (<i>e.g.</i> beaches)
0.5 to 1.0	Good homogeneity
1.0 to 1.33	Fair homogeneity
> 1.33	Poor homogeneity

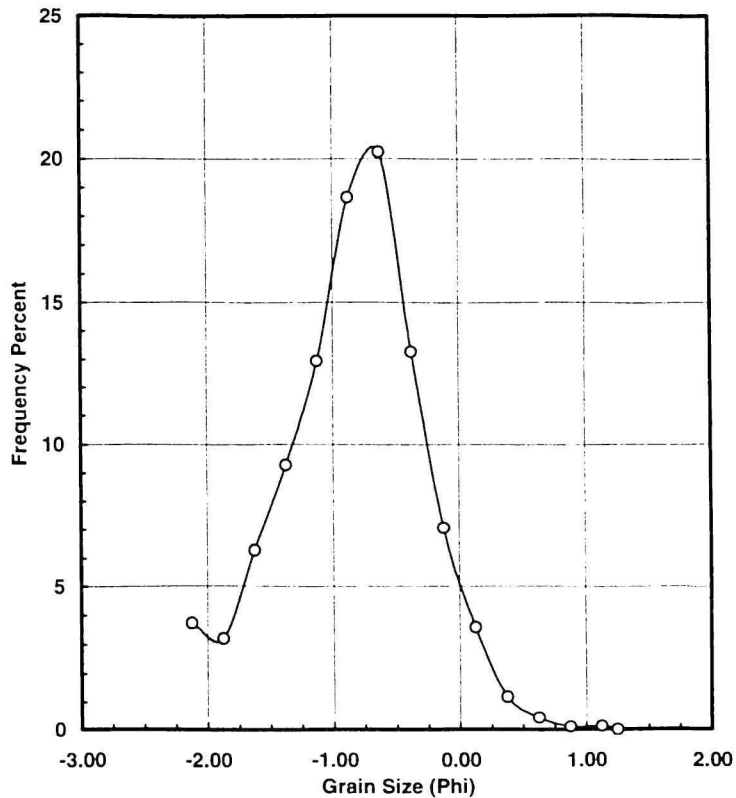
Sample I.D.: MEINZER11a

Sample I.D.: MEINZER11a		Sampled by:		Start Sieve Size (phi): -2	
Sample Date: 6/28/2001		Analyzed by: J. H. Balsillie		End Sieve Size (phi): 1.25	
Total Sample: X		Siliclastic Fraction:		Pan Sieve Size (phi): 1.25	
Longitude:		Latitude:		Sieve Interval (phi): 0.25	
Surface Elev:		Datum:		Accuracy:	
Sample Depth in Core:		Compaction Corrected?		% Comp.:	
Comments: Carbonate + Silica Sample				# Splits: 0	
				Total Mass: 46.582 grams	

[illegible]

Statistical Results				
Measure	Original Data in ϕ Units		Transformed Data	Original Data in Millimeters
Mean:	-0.8480	ϕ	1.8000 mm	1.9441 mm
Standard Deviation:	0.5661	phi-units	MV ---	0.8141 mm
Skewness:	-0.1785	NU	MV ---	1.2171 NU
Kurtosis:	2.9685	NU	MV ---	4.2536 NU
Median:	-0.9292	ϕ	1.9042 mm	1.9092 mm
Relative Dispersion:	MV	---	---	0.4187 NU

Mean, std dev, skewness and kurtosis calculated using method of moments.
 MV = meaningless value; NU = no units (i.e., dimensionless)
 Transformed data calculated using $mm = 2^{\phi}$



Relative Disperison Scale	
< 0.5	Excellent homogeneity (<i>e.g.</i> beaches)
0.5 to 1.0	Good homogeneity
1.0 to 1.33	Fair homogeneity
> 1.33	Poor homogeneity

Tweak ACUMPLOT X-axis here

X-axis minimum -3

X-axis maximum	2
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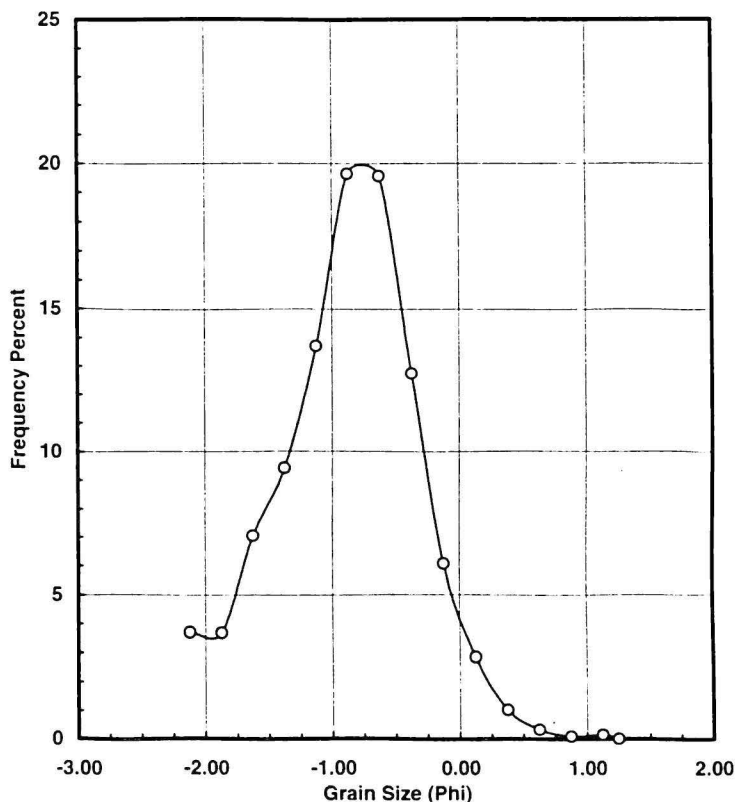
Sample I.D.: ROTAP11b

Sample I.D.: ROTAP11b		Sampled by:		Start Sieve Size (phi): -2	
Sample Date: 6/28/2001		Analyzed by: J. H. Balsillie		End Sieve Size (phi): 1.25	
Total Sample: X	Siliclastic Fraction:	Carbonate Fraction:		Pan Sieve Size (phi): 1.25	
Longitude:	Latitude:	Datum:		Sieve Interval (phi): 0.25	
Surface Elev:	Datum:	Accuracy:		# Splits:	0
Sample Depth in Core:	Compaction Corrected?	% Comp.:	Total Mass: 46.617 grams		
Comments: Carbonate + Silica Sample					

[illegible]

Statistical Results			
Measure	Original Data in ϕ Units	Transformed Data	Original Data in Millimeters
Mean:	-0.8832 ϕ	1.8444 mm	1.9873 mm
Standard Deviation:	0.5586 phi-units	MV ---	0.8144 mm
Skewness:	-0.1394 NU	MV ---	1.1567 NU
Kurtosis:	3.0026 NU	MV ---	4.0475 NU
Median:	-0.9664 ϕ	1.954 mm	1.9609 mm
Relative Dispersion:	MV ---	--- ---	0.4098 NU

Mean, std dev, skewness and kurtosis calculated using method of moments.
 MV = meaningless value; NU = no units (i.e. , dimensionless)
 Transformed data calculated using $mm = 2^\phi$



Relative Dispersison Scale	
< 0.5	Excellent homogeneity (<i>e.g.</i> beaches)
0.5 to 1.0	Good homogeneity
1.0 to 1.33	Fair homogeneity
> 1.33	Poor homogeneity

Tweak ACUMPLOTT X-axis here

X-axis minimum -3

X-axis maximum	5
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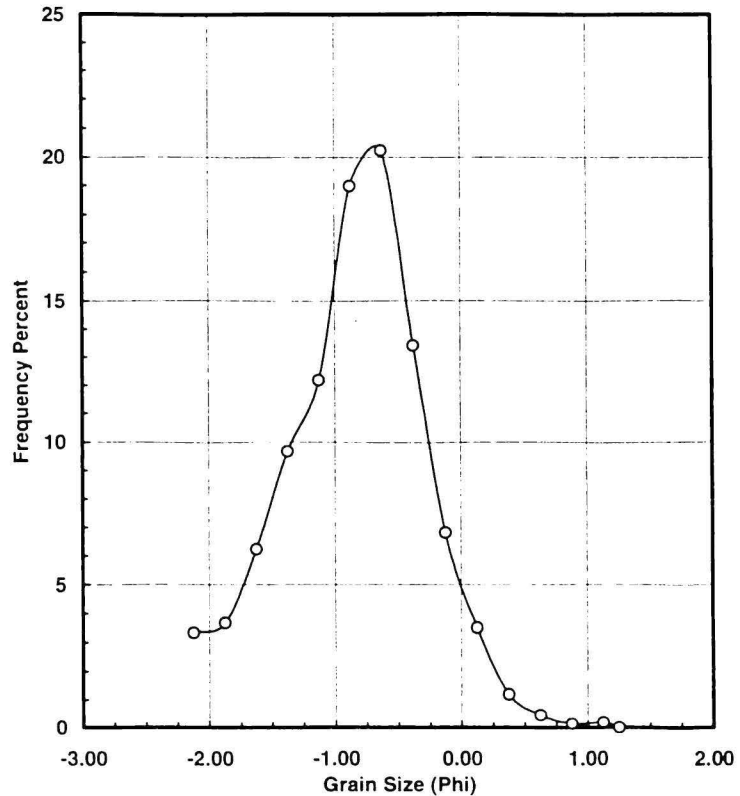
Sample I.D.: MEINZER11b

Sample I.D.: MEINZER11b		Sampled by:		Start Sieve Size (phi): -2	
Sample Date: 6/28/2001		Analyzed by: J. H. Balsillie		End Sieve Size (phi): 1.25	
Total Sample: X		Siliclastic Fraction:		Pan Sieve Size (phi): 1.25	
		Carbonate Fraction:		Sieve Interval (phi): 0.25	
Longitude:		Latitude:		Datum:	
Surface Elev:		Datum:		Accuracy:	
Sample Depth in Core:		Compaction Corrected?		% Comp.:	
Comments: Carbonate + Silica Sample				Total Mass: 46.598 grams	

[illegible]

Statistical Results			
Measure	Original Data in ϕ Units	Transformed Data	Original Data in Millimeters
Mean:	-0.8470 ϕ	1.7988 mm	1.9426 mm
Standard Deviation:	0.5673 phi-units	MV ---	0.8092 mm
Skewness:	-0.1319 NU	MV ---	1.1806 NU
Kurtosis:	3.0217 NU	MV ---	4.1496 NU
Median:	-0.9284 ϕ	1.9031 mm	1.9081 mm
Relative Dispersion:	MV ---	--- ---	0.4166 NU

Mean, std dev, skewness and kurtosis calculated using method of moments.
 MV = meaningless value; NU = no units (*i.e.* , dimensionless)
 Transformed data calculated using $\text{mm} = 2^\circ$



Relative Disperison Scale	
< 0.5	Excellent homogeneity (<i>e.g.</i> beaches)
0.5 to 1.0	Good homogeneity
1.0 to 1.33	Fair homogeneity
> 1.33	Poor homogeneity

Tweak ACUMPLOT X-axis here

X-axis minimum -3

X-axis maximum	2
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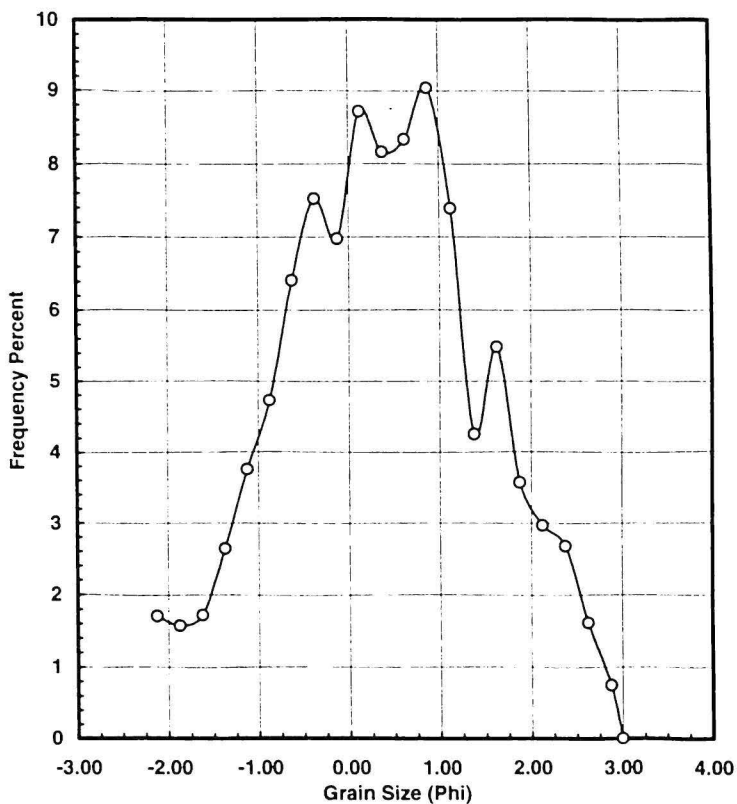
Sample I.D.: ROTAP12a

Sample I.D.: ROTAP12a		Sampled by:		Start Sieve Size (phi): -2	
Sample Date: 6/28/2001		Analyzed by: J. H. Balsillie		End Sieve Size (phi): 3	
Total Sample: X	Siliclastic Fraction:	Carbonate Fraction:		Pan Sieve Size (phi): 3	
Longitude:	Latitude:	Datum:		Sieve Interval (phi): 0.25	
Surface Elev:		Datum:		Accuracy:	
Sample Depth in Core:		Compaction Corrected?		% Comp.:	
Comments: Carbonate + Silica Sample				Total Mass: 34.338 grams	

[illegible]

Statistical Results			
Measure	Original Data in ϕ Units	Transformed Data	Original Data in Millimeters
Mean:	0.3705 ϕ	0.7735 mm	1.0345 mm
Standard Deviation:	1.1250 phi-units	MV ---	0.8640 mm
Skewness:	-0.0324 NU	MV ---	1.8047 NU
Kurtosis:	2.4385 NU	MV ---	6.4515 NU
Median:	0.2552 ϕ	0.8379 mm	0.8410 mm
Relative Dispersion:	MV ---	--- ---	0.8352 NU

Mean, std dev, skewness and kurtosis calculated using method of moments.
 MV = meaningless value; NU = no units (i.e., dimensionless)
 Transformed data calculated using $mm = 2^\phi$



Tweak ACUMPLOT X-axis here

X-axis minimum -3

X-axis maximum	5
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Relative Disperson Scale	
< 0.5	Excellent homogeneity (<i>e.g.</i> beaches)
0.5 to 1.0	Good homogeneity
1.0 to 1.33	Fair homogeneity
> 1.33	Poor homogeneity

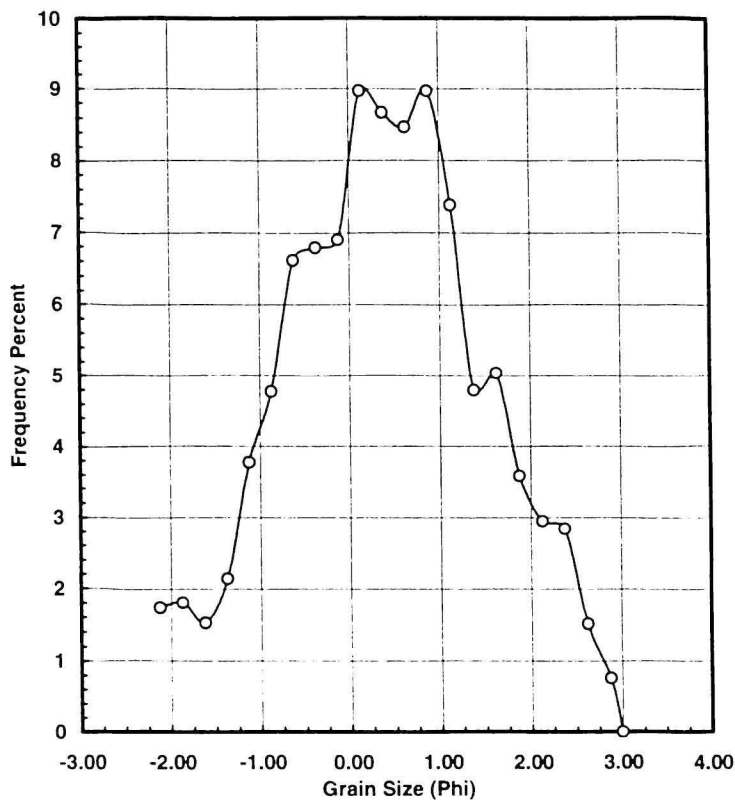
Sample I.D.: MEINZER12a

Sample I.D.: MEINZER12a		Sampled by:		Start Sieve Size (phi): -2	
Sample Date: 6/28/2001		Analyzed by: J. H. Balsillie		End Sieve Size (phi): 3	
Total Sample: X	Siliclastic Fraction:	Carbonate Fraction:		Pan Sieve Size (phi): 3	
Longitude:	Latitude:	Datum:		Sieve Interval (phi): 0.25	
Surface Elev:	Datum:	Accuracy:		# Splits:	0
Sample Depth in Core:	Compaction Corrected?	% Comp.:		Total Mass:	34.366 grams
Comments: Carbonate + Silica Sample					

[illegible]

Statistical Results				
Measure	Original Data in ϕ Units	Transformed Data	Original Data in Millimeters	
Mean:	0.3804 ϕ	0.7682 mm	1.0266 mm	
Standard Deviation:	1.1197 phi-units	MV ---	0.8637 mm	
Skewness:	-0.0524 NU	MV ---	1.8588 NU	
Kurtosis:	2.4779 NU	MV ---	6.6692 NU	
Median:	0.2686 ϕ	0.8301 mm	0.8332 mm	
Relative Dispersion:	MV ---	--- ---	0.8413 NU	

Mean, std dev, skewness and kurtosis calculated using method of moments.
 MV = meaningless value; NU = no units (*i.e.* , dimensionless)
 Transformed data calculated using $mm = 2^\circ$



Tweak ACUMPLOT X-axis here

X-axis minimum -3

X-axis maximum	3
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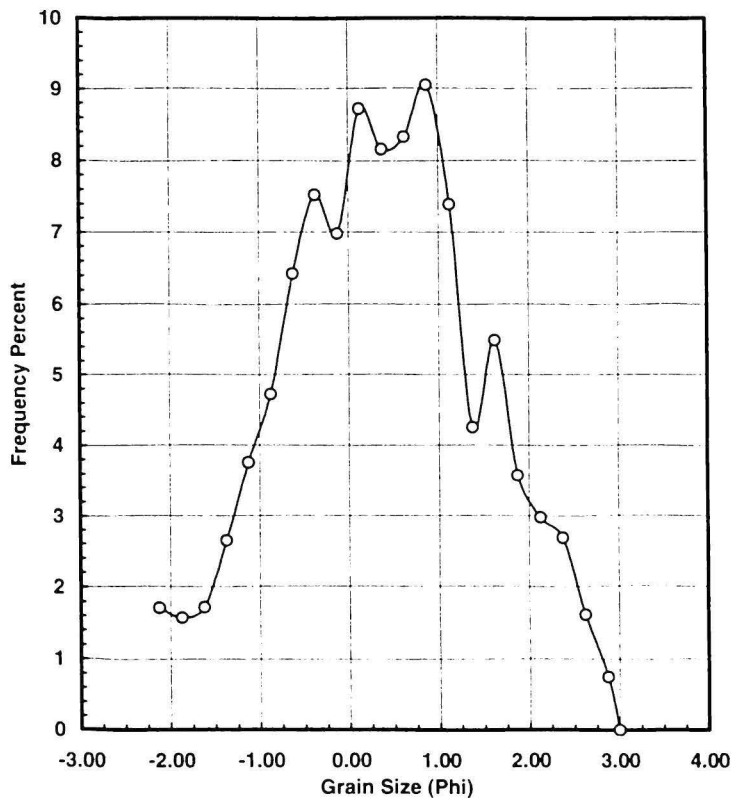
Relative Disperison Scale	
< 0.5	Excellent homogeneity (<i>e.g.</i> beaches)
0.5 to 1.0	Good homogeneity
1.0 to 1.33	Fair homogeneity
> 1.33	Poor homogeneity

Sample I.D.: ROTAP12b

Sample I.D.: ROTAP12b		Sampled by:		Start Sieve Size (phi): -2	
Sample Date: 6/28/2001		Analyzed by: J. H. Balsillie		End Sieve Size (phi): 3	
Total Sample: X	Siliclastic Fraction:	Carbonate Fraction:		Pan Sieve Size (phi): 3	
Longitude:	Latitude:	Datum:		Sieve Interval (phi): 0.25	
Surface Elev:		Datum:		Accuracy:	
Sample Depth in Core:		Compaction Corrected?		% Comp.:	
				Total Mass: 34.338 grams	
Comments: Carbonate + Silica Sample					

[illegible]

Statistical Results				
Measure	Original Data in ϕ Units	Transformed Data		Original Data in Millimeters
Mean:	0.3705 ϕ	0.7735	mm	1.0345 mm
Standard Deviation:	1.1250 phi-units	MV	---	0.8640 mm
Skewness:	-0.0324 NU	MV	---	1.8047 NU
Kurtosis:	2.4385 NU	MV	---	6.4515 NU
Median:	0.2552 ϕ	0.8379	mm	0.8410 mm
Relative Dispersion:	MV ---	---	---	0.8352 NU
Mean, std dev, skewness and kurtosis calculated using method of moments. MV = meaningful value; NU = no units (<i>i.e.</i> , dimensionless) Transformed data calculated using $mm = 2^{\phi}$				



Tweak ACUMPLOT X-axis here

X-axis minimum	-3
X-axis maximum	5

Relative Disperison Scale	
< 0.5	Excellent homogeneity (<i>e.g.</i> beaches)
0.5 to 1.0	Good homogeneity
1.0 to 1.33	Fair homogeneity
> 1.33	Poor homogeneity

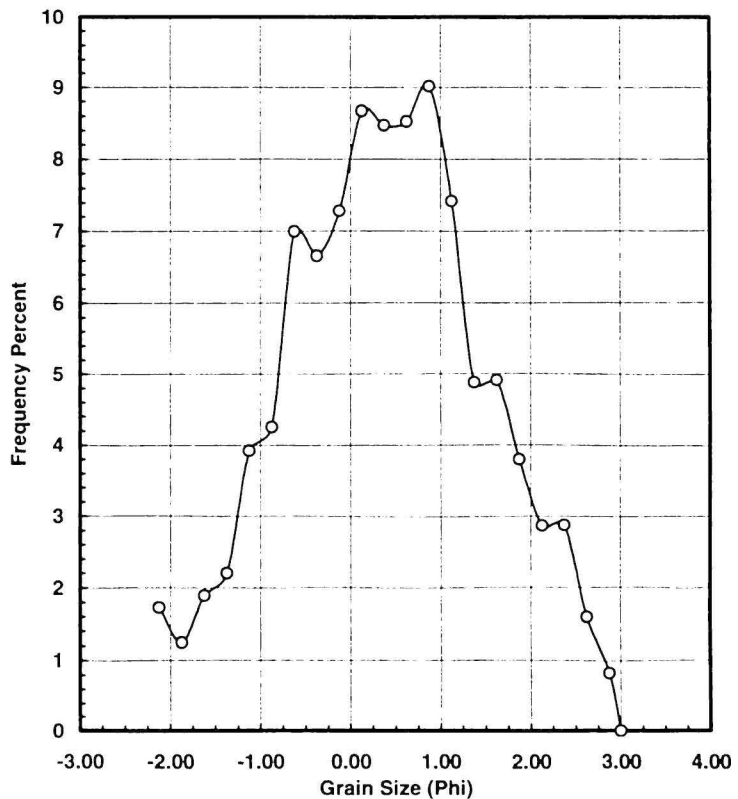
Sample I.D.: MEINZER12b

Sample I.D.: MEINZER12b		Sampled by:		Start Sieve Size (phi): -2	
Sample Date: 6/28/2001		Analyzed by: J. H. Balsillie		End Sieve Size (phi): 3	
Total Sample: X		Siliclastic Fraction:		Pan Sieve Size (phi): 3	
		Carbonate Fraction:		Sieve Interval (phi): 0.25	
Longitude:		Latitude:		Datum:	
Surface Elev:		Datum:		Accuracy:	
Sample Depth in Core:		Compaction Corrected?		% Comp.:	
				Total Mass: 34.515 grams	
Comments: Carbonate + Silica Sample					

[illegible]

Statistical Results			
Measure	Original Data in ϕ Units	Transformed Data	Original Data in Millimeters
Mean:	0.3912 ϕ	0.7625 mm	1.0172 mm
Standard Deviation:	1.1185 phi-units	MV ---	0.8504 mm
Skewness:	-0.0377 NU	MV ---	1.8552 NU
Kurtosis:	2.4686 NU	MV ---	6.7546 NU
Median:	0.2778 ϕ	0.8248 mm	0.8278 mm
Relative Dispersion:	MV ---	--- ---	0.8360 NU

Mean, std dev, skewness and kurtosis calculated using method of moments.
 MV = meaningless value; NU = no units (*i.e.*, dimensionless)
 Transformed data calculated using $mm = 2^{\phi}$



Tweak ACUMPLOT X-axis here

X-axis minimum	-3
X-axis maximum	3

Relative Dispersal Scale	
< 0.5	Excellent homogeneity (<i>e.g.</i> beaches)
0.5 to 1.0	Good homogeneity
1.0 to 1.33	Fair homogeneity
> 1.33	Poor homogeneity

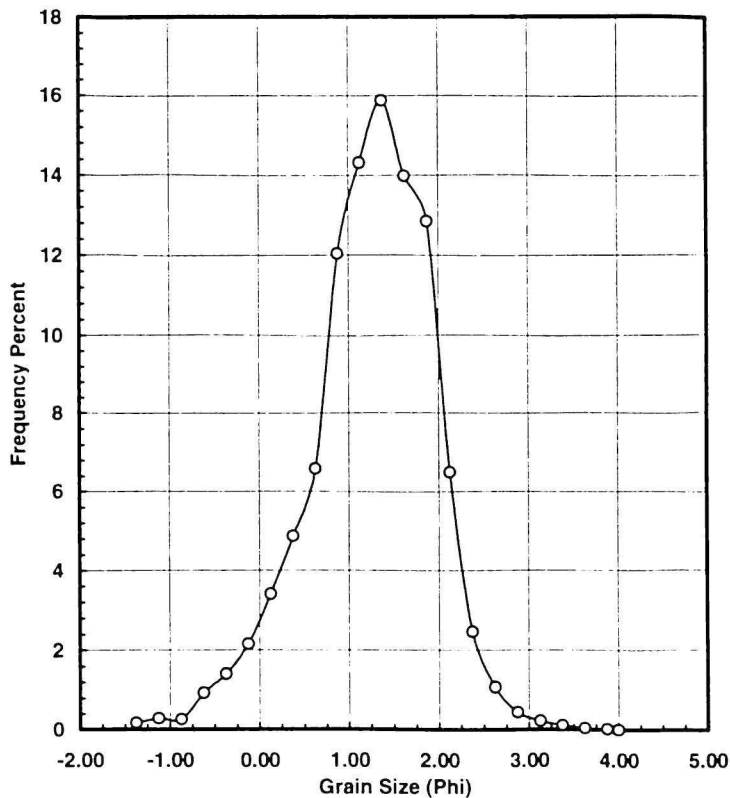
Sample I.D.: ROTAP13a

Sample I.D.: ROTAP13a		Sampled by:		Start Sieve Size (phi): -1.25	
Sample Date: 6/28/2001		Analyzed by: A. A. Dabous		End Sieve Size (phi): 4	
Total Sample: X	Siliclastic Fraction:	Carbonate Fraction:		Pan Sieve Size (phi): 4	
Longitude:	Latitude:	Datum:		Sieve Interval (phi): 0.25	
Surface Elev:		Datum:		Accuracy:	
Sample Depth in Core:		Compaction Corrected?		% Comp.:	
Comments: Carbonate + Silica Sample				# Splits: 0	
				Total Mass: 65.809 grams	

[illegible]

Statistical Results				
Measure	Original Data in ϕ Units		Transformed Data	Original Data in Millimeters
Mean:	1.2454	ϕ	0.4218	mm
Standard Deviation:	0.6962	phi-units	MV ---	0.2857 mm
Skewness:	-0.5130	NU	MV ---	2.6686 NU
Kurtosis:	3.6727	NU	MV ---	13.9535 NU
Median:	1.1814	ϕ	0.4409	mm
Relative Dispersion:	MV	---	---	0.5973 NU

Mean, std dev, skewness and kurtosis calculated using method of moments.
 MV = meaningless value; NU = no units (*i.e.*, dimensionless)
 Transformed data calculated using $mm = 2^\circ$



Relative Dispersal Scale	
< 0.5	Excellent homogeneity (<i>e.g.</i> beaches)
0.5 to 1.0	Good homogeneity
1.0 to 1.33	Fair homogeneity
> 1.33	Poor homogeneity

Tweak ACUMPLOTT X-axis here

X-axis minimum -3

X-axis maximum	5
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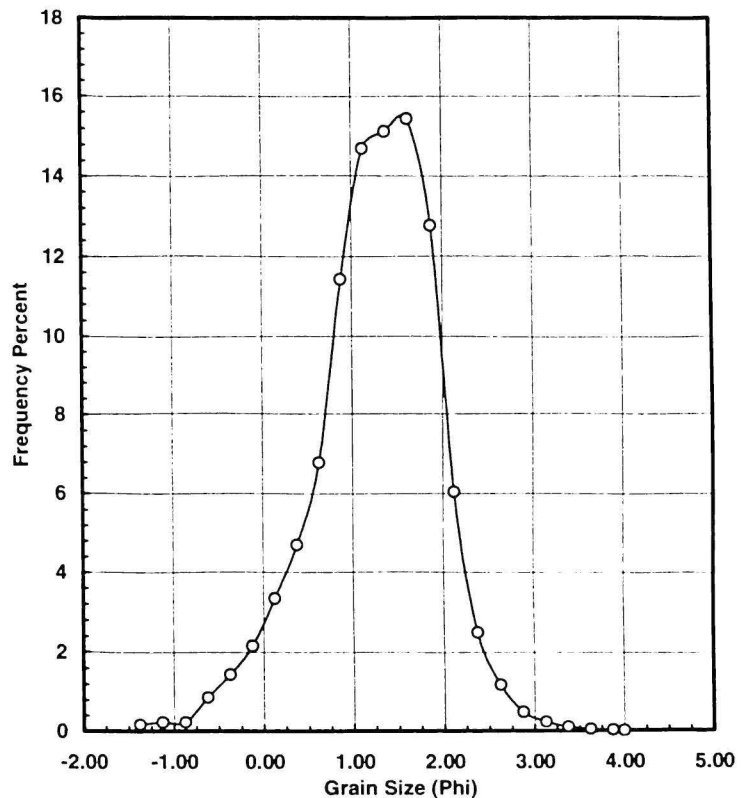
Sample I.D.: MEINZER13a

Sample I.D.: MEINZER13a		Sampled by:		Start Sieve Size (phi): -1.25	
Sample Date: 6/28/2001		Analyzed by: A. A. Dabous		End Sieve Size (phi): 4	
Total Sample: X		Siliclastic Fraction:		Pan Sieve Size (phi): 4	
Longitude:		Latitude:		Sieve Interval (phi): 0.25	
Datum:		Accuracy:		# Splits: 0	
Surface Elev:		Datum:		Total Mass: 65.779 grams	
Sample Depth in Core:		Compaction Corrected?		% Comp.:	
Comments: Carbonate + Silica Sample					

[illegible]

Statistical Results			
Measure	Original Data in ϕ Units	Transformed Data	Original Data in Millimeters
Mean:	1.2538 ϕ	0.4193 mm	0.4745 mm
Standard Deviation:	0.6917 phi-units	MV ---	0.2799 mm
Skewness:	-0.4972 NU	MV ---	2.6327 NU
Kurtosis:	3.6620 NU	MV ---	13.8428 NU
Median:	1.1904 ϕ	0.4382 mm	0.4394 mm
Relative Dispersion:	MV ---	--- ---	0.5900 NU

Mean, std dev, skewness and kurtosis calculated using method of moments.
 MV = meaningless value; NU = no units (*i.e.*, dimensionless)
 Transformed data calculated using $\text{mm} = 2^\phi$



Tweak ACUMPLOT X-axis here

X-axis minimum	-2
X-axis maximum	5

Relative Disperson Scale	
< 0.5	Excellent homogeneity (<i>e.g.</i> beaches)
0.5 to 1.0	Good homogeneity
1.0 to 1.33	Fair homogeneity
> 1.33	Poor homogeneity

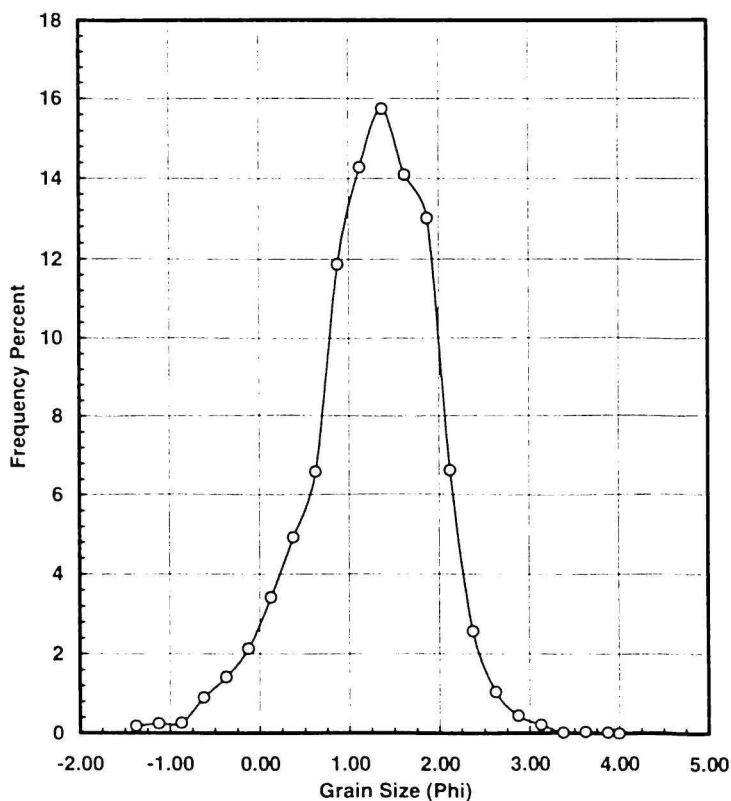
Sample I.D.: ROTAP13b

Sample I.D.: ROTAP13b		Sampled by:		Start Sieve Size (phi): -1.25	
Sample Date: 6/28/2001		Analyzed by: A. A. Dabous		End Sieve Size (phi): 4	
Total Sample: X	Siliclastic Fraction:	Carbonate Fraction:		Pan Sieve Size (phi): 4	
Longitude:	Latitude:	Datum:		Sieve Interval (phi): 0.25	
Surface Elev:	Datum:	Accuracy:		# Splits:	0
Sample Depth in Core:	Compaction Corrected?	% Comp.:		Total Mass:	65.695 grams
Comments: Carbonate + Silica Sample					

[illegible]

Statistical Results			
Measure	Original Data in ϕ Units	Transformed Data	Original Data in Millimeters
Mean:	1.2477 ϕ	0.4211 mm	0.4770 mm
Standard Deviation:	0.6923 phi-units	MV ---	0.2838 mm
Skewness:	-0.5405 NU	MV ---	2.6660 NU
Kurtosis:	3.6169 NU	MV ---	14.0201 NU
Median:	1.1854 ϕ	0.4397 mm	0.4409 mm
Relative Dispersion:	MV ---	--- ---	0.5949 NU

Mean, std dev, skewness and kurtosis calculated using method of moments.
 MV = meaningless value; NU = no units (i.e., dimensionless)
 Transformed data calculated using $mm = 2^\phi$



Tweak ACUMPLOT X-axis here

X-axis minimum -3

X-axis maximum	5
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Relative Dispersison Scale	
< 0.5	Excellent homogeneity (<i>e.g.</i> beaches)
0.5 to 1.0	Good homogeneity
1.0 to 1.33	Fair homogeneity
> 1.33	Poor homogeneity

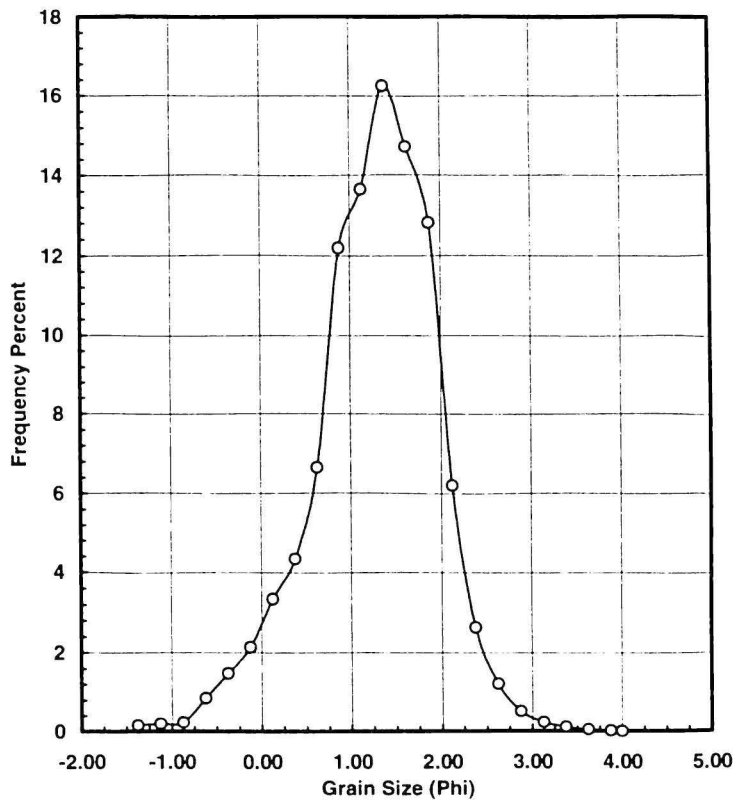
Sample I.D.: MEINZER13b

Sample I.D.: MEINZER13b		Sampled by:		Start Sieve Size (phi): -1.25	
Sample Date: 6/28/2001		Analyzed by: A. A. Dabous		End Sieve Size (phi): 4	
Total Sample: X		Siliclastic Fraction:		Pan Sieve Size (phi): 4	
		Carbonate Fraction:		Sieve Interval (phi): 0.25	
Longitude:		Latitude:		Datum:	
Surface Elev:		Datum:		Accuracy:	
Sample Depth in Core:		Compaction Corrected?		% Comp.:	
Comments: Carbonate + Silica Sample				# Splits: 0	
				Total Mass: 65.753 grams	

[illegible]

Statistical Results			
Measure	Original Data in ϕ Units	Transformed Data	Original Data in Millimeters
Mean:	1.2596 ϕ	0.4177 mm	0.4724 mm
Standard Deviation:	0.6908 phi-units	MV ---	0.2778 mm
Skewness:	-0.4918 NU	MV ---	2.6227 NU
Kurtosis:	3.6537 NU	MV ---	13.7941 NU
Median:	1.1982 ϕ	0.4358 mm	0.4371 mm
Relative Dispersion:	MV ---	--- ---	0.5881 NU

Mean, std dev, skewness and kurtosis calculated using method of moments.
 MV = meaningless value; NU = no units (i.e., dimensionless)
 Transformed data calculated using $mm = 2^{\phi}$



Tweak ACUMPLOT X-axis here

X-axis minimum	-2
X-axis maximum	5

Relative Disperison Scale	
< 0.5	Excellent homogeneity (<i>e.g.</i> beaches)
0.5 to 1.0	Good homogeneity
1.0 to 1.33	Fair homogeneity
> 1.33	Poor homogeneity

Sample I.D.: ROTAP13c

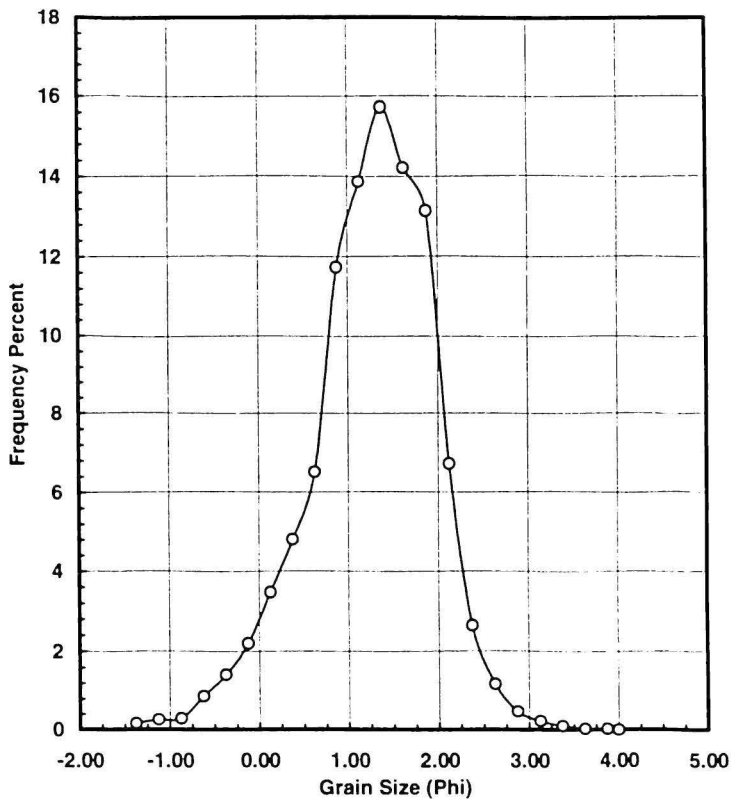
Sample I.D.: ROTAP13c		Sampled by:		Start Sieve Size (phi): -1.25	
Sample Date: 6/28/2001		Analyzed by: A. A. Dabous		End Sieve Size (phi): 4	
Total Sample: X		Siliclastic Fraction:		Pan Sieve Size (phi): 4	
Longitude:		Latitude:		Sieve Interval (phi): 0.25	
Surface Elev:		Datum:		Accuracy:	
Sample Depth in Core:		Compaction Corrected?		% Comp.:	
Comments: Carbonate + Silica Sample				Total Mass: 65.632 grams	

[illegible]

Statistical Results			
Measure	Original Data in ϕ Units	Transformed Data	Original Data in Millimeters
Mean:	1.2560 ϕ	0.4187 mm	0.4750 mm
Standard Deviation:	0.6981 phi-units	MV ---	0.2837 mm
Skewness:	-0.5186 NU	MV ---	2.6223 NU
Kurtosis:	3.5941 NU	MV ---	13.6117 NU
Median:	1.1958 ϕ	0.4366 mm	0.4378 mm
Relative Dispersion:	MV ---	--- ---	0.5972 NU

Mean, std dev, skewness and kurtosis calculated using method of moments.
 MV = meaningless value; NU = no units (*i.e.*, dimensionless)

Transformed data calculated using $\text{mm} = 2^{\phi}$



Tweak ACUMPLOT X-axis here

X-axis minimum	-3
X-axis maximum	5

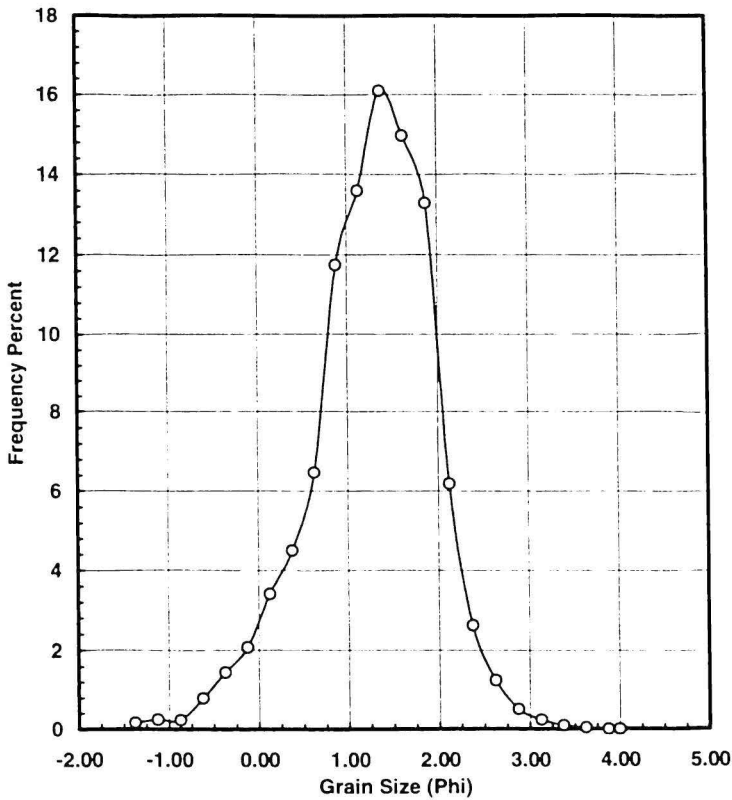
Relative Disperson Scale	
< 0.5	Excellent homogeneity (<i>e.g.</i> beaches)
0.5 to 1.0	Good homogeneity
1.0 to 1.33	Fair homogeneity
> 1.33	Poor homogeneity

Sample I.D.: MEINZER13c

Sample I.D.: MEINZER13c		Sampled by:		Start Sieve Size (phi): -1.25	
Sample Date: 6/28/2001		Analyzed by: A. A. Dabous		End Sieve Size (phi): 4	
Total Sample: X	Siliclastic Fraction:	Carbonate Fraction:		Pan Sieve Size (phi): 4	
Longitude:	Latitude:	Datum:		Sieve Interval (phi): 0.25	
Surface Elev:	Datum:	Accuracy:		# Splits:	0
Sample Depth in Core:	Compaction Corrected?	% Comp.:	Total Mass: 65.574 grams		
Comments: Carbonate + Silica Sample					

[illegible]

Statistical Results				
Measure	Original Data in ϕ Units	Transformed Data	Original Data in Millimeters	
Mean:	1.2646 ϕ	0.4162 mm	0.4711 mm	
Standard Deviation:	0.6912 phi-units	MV ---	0.2793 mm	
Skewness:	-0.5243 NU	MV ---	2.6680 NU	
Kurtosis:	3.6547 NU	MV ---	14.1112 NU	
Median:	1.2074 ϕ	0.4331 mm	0.4345 mm	
Relative Dispersion:	MV ---	--- ---	0.5929 NU	
Mean, std dev, skewness and kurtosis calculated using method of moments. MV = meaningless value; NU = no units (<i>i.e.</i> , dimensionless) Transformed data calculated using mm = 2°				



Relative Disperson Scale	
< 0.5	Excellent homogeneity (<i>e.g.</i> beaches)
0.5 to 1.0	Good homogeneity
1.0 to 1.33	Fair homogeneity
> 1.33	Poor homogeneity

Tweak ACUMPLOT X-axis here

X-axis minimum -2

X-axis maximum	5
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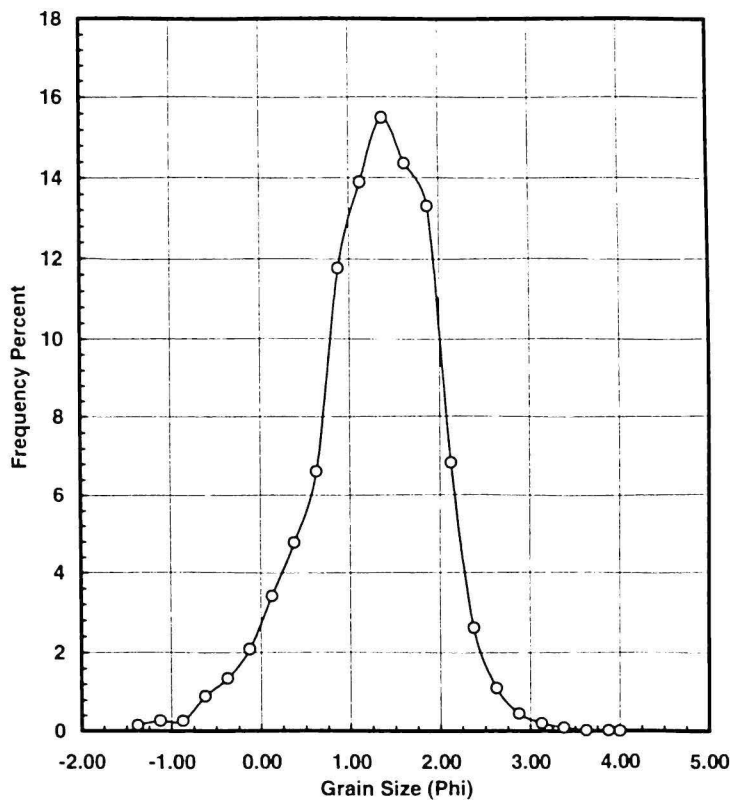
Sample I.D.: ROTAP13d

Sample I.D.: ROTAP13d		Sampled by:		Start Sieve Size (phi): -1.25	
Sample Date: 6/28/2001		Analyzed by: A. A. Dabous		End Sieve Size (phi): 4	
Total Sample: X	Siliclastic Fraction:	Carbonate Fraction:		Pan Sieve Size (phi): 4	
Longitude:	Latitude:	Datum:		Sieve Interval (phi): 0.25	
Surface Elev:		Datum:		Accuracy:	
Sample Depth in Core:		Compaction Corrected?		% Comp.:	
Comments: Carbonate + Silica Sample				# Splits: 0	
				Total Mass: 65.708 grams	

[illegible]

Statistical Results			
Measure	Original Data in ϕ Units	Transformed Data	Original Data in Millimeters
Mean:	1.2583 ϕ	0.4180 mm	0.4738 mm
Standard Deviation:	0.6949 phi-units	MV ---	0.2824 mm
Skewness:	-0.5320 NU	MV ---	2.6448 NU
Kurtosis:	3.6050 NU	MV ---	13.7890 NU
Median:	1.1976 ϕ	0.436 mm	0.4373 mm
Relative Dispersion:	MV ---	--- ---	0.5961 NU

Mean, std dev, skewness and kurtosis calculated using method of moments.
 MV = meaningless value; NU = no units (*i.e.*, dimensionless)
 Transformed data calculated using $mm = 2^{\phi}$



Tweak ACUMPLOT X-axis here

X-axis minimum -3

X-axis maximum	5
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Relative Dispersal Scale	
< 0.5	Excellent homogeneity (e.g. beaches)
0.5 to 1.0	Good homogeneity
1.0 to 1.33	Fair homogeneity
> 1.33	Poor homogeneity

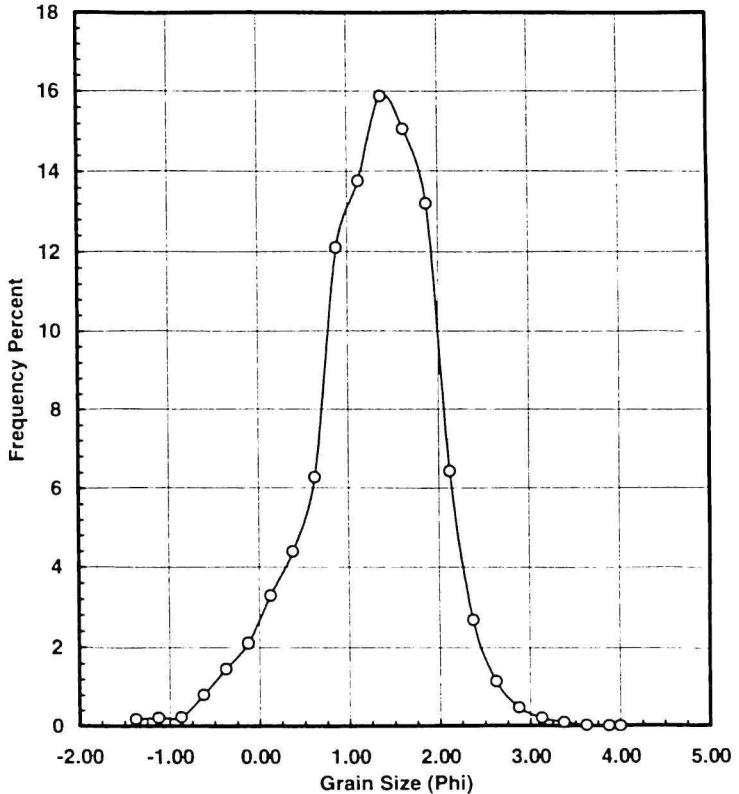
Sample I.D.: MEINZER13d

Sample I.D.: MEINZER13d		Sampled by:		Start Sieve Size (phi): -1.25	
Sample Date: 6/28/2001		Analyzed by: A. A. Dabous		End Sieve Size (phi): 4	
Total Sample: X	Siliclastic Fraction:	Carbonate Fraction:		Pan Sieve Size (phi): 4	
Longitude:		Latitude:		Sieve Interval (phi): 0.25	
Surface Elev:		Datum:		Accuracy:	
Sample Depth in Core:		Compaction Corrected?		% Comp.:	
Comments: Carbonate + Silica Sample		Total Mass:		65.774 grams	

[illegible]

Statistical Results			
Measure	Original Data in ϕ Units	Transformed Data	Original Data in Millimeters
Mean:	1.2653 ϕ	0.4160 mm	0.4705 mm
Standard Deviation:	0.6880 phi-units	MV ---	0.2792 mm
Skewness:	-0.5506 NU	MV ---	2.7051 NU
Kurtosis:	3.6719 NU	MV ---	14.4376 NU
Median:	1.2068 ϕ	0.4332 mm	0.4346 mm
Relative Dispersion:	MV ---	--- ---	0.5933 NU

Mean, std dev, skewness and kurtosis calculated using method of moments.
 MV = meaningless value; NU = no units (*i.e.*, dimensionless)
 Transformed data calculated using $\text{mm} = 2^\circ$



Tweak ACUMPLOT X-axis here

X-axis minimum	-2
X-axis maximum	5

Relative Disperson Scale	
< 0.5	Excellent homogeneity (<i>e.g.</i> beaches)
0.5 to 1.0	Good homogeneity
1.0 to 1.33	Fair homogeneity
> 1.33	Poor homogeneity

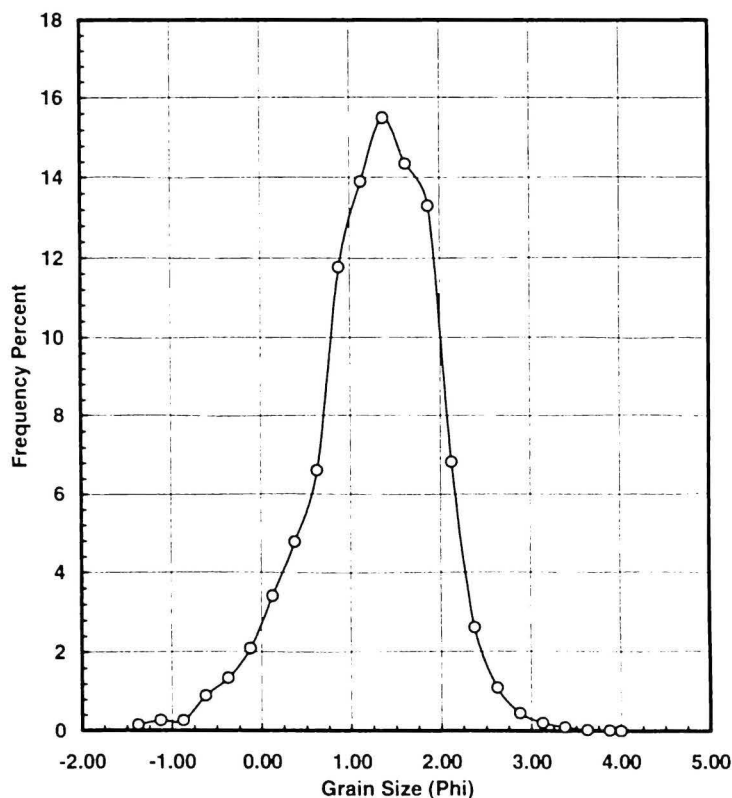
Sample I.D.: ROTAP13e

Sample I.D.: ROTAP13e		Sampled by:		Start Sieve Size (phi): -1.25	
Sample Date: 6/28/2001		Analyzed by: A. A. Dabous		End Sieve Size (phi): 4	
Total Sample: X	Siliclastic Fraction:	Carbonate Fraction:		Pan Sieve Size (phi): 4	
Longitude:	Latitude:	Datum:		Sieve Interval (phi): 0.25	
Surface Elev:	Datum:	Accuracy:		# Splits:	0
Sample Depth in Core:	Compaction Corrected?	% Comp.:		Total Mass:	65.708 grams
Comments: Carbonate + Silica Sample					

[illegible]

Statistical Results				
Measure	Original Data in ϕ Units		Transformed Data	Original Data in Millimeters
Mean:	1.2583	ϕ	0.4180 mm	0.4738 mm
Standard Deviation:	0.6949	phi-units	MV ---	0.2824 mm
Skewness:	-0.5320	NU	MV ---	2.6448 NU
Kurtosis:	3.6050	NU	MV ---	13.7890 NU
Median:	1.1976	ϕ	0.436 mm	0.4373 mm
Relative Dispersion:	MV	---	---	0.5961 NU

Mean, std dev, skewness and kurtosis calculated using method of moments.
 MV = meaningless value; NU = no units (*i.e.*, dimensionless)
 Transformed data calculated using $mm = 2^\circ$



Relative Disperison Scale	
< 0.5	Excellent homogeneity (<i>e.g.</i> beaches)
0.5 to 1.0	Good homogeneity
1.0 to 1.33	Fair homogeneity
> 1.33	Poor homogeneity

Tweak ACUMPLOT X-axis here

X-axis minimum -3

X-axis maximum	5
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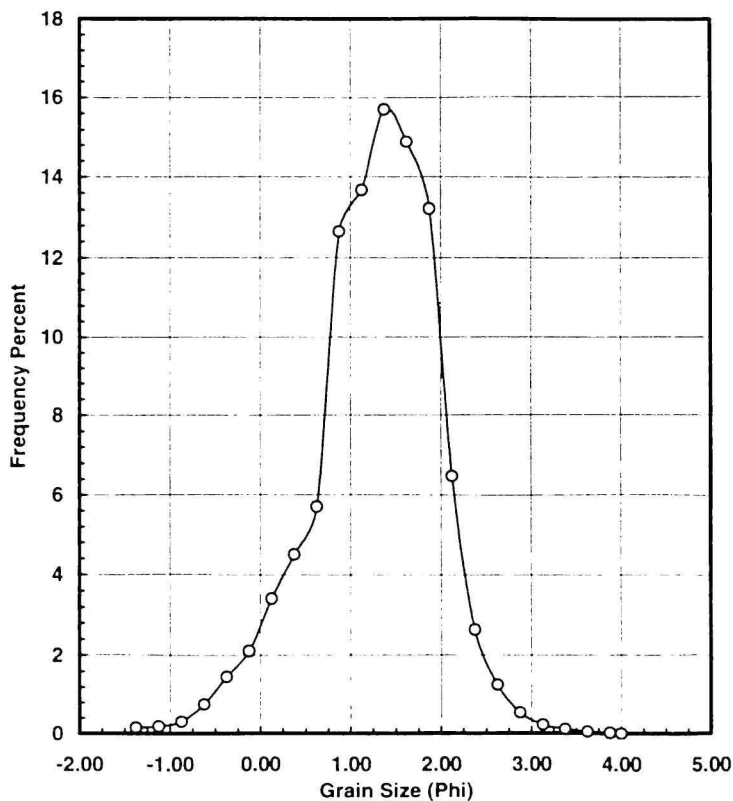
Sample I.D.: MEINZER13e

Sample I.D.: MEINZER13e		Sampled by:		Start Sieve Size (phi): -1.25	
Sample Date: 6/28/2001		Analyzed by: A. A. Dabous		End Sieve Size (phi): 4	
Total Sample: X		Siliclastic Fraction:		Pan Sieve Size (phi): 4	
Longitude:		Latitude:		Sieve Interval (phi): 0.25	
Datum:		Accuracy:		# Splits: 0	
Surface Elev:		Datum:		Total Mass: 65.797 grams	
Sample Depth in Core:		Compaction Corrected?		% Comp.:	
Comments: Carbonate + Silica Sample					

[illegible]

Statistical Results				
Measure	Original Data in ϕ Units		Transformed Data	Original Data in Millimeters
Mean:	1.2688	ϕ	0.4150 mm	0.4697 mm
Standard Deviation:	0.6922	phi-units	MV ---	0.2775 mm
Skewness:	-0.5017	NU	MV ---	2.6283 NU
Kurtosis:	3.6557	NU	MV ---	13.7832 NU
Median:	1.2062	ϕ	0.4334 mm	0.4348 mm
Relative Dispersion:	MV	---	---	0.5908 NU

Mean, std dev, skewness and kurtosis calculated using method of moments.
 MV = meaningless value; NU = no units (*i.e.*, dimensionless)
 Transformed data calculated using $mm = 2^\circ$



Tweak ACUMPLOTT X-axis here

X-axis minimum	-2
X-axis maximum	5

Relative Disperison Scale	
< 0.5	Excellent homogeneity (<i>e.g.</i> beaches)
0.5 to 1.0	Good homogeneity
1.0 to 1.33	Fair homogeneity
> 1.33	Poor homogeneity

APPENDIX II
ADDITIONAL SAMPLE STATISTICS

SAMPLE 1

Sieve Size (phi)	Sieve Midpoint (phi)	ROTAP				MEINZER				Absolute Difference (grams)	Percent of Total Sample (%)	Statistics for Column to Left
		Mass (grams)	Corrected Mass (grams)	Freq Weight %	Cumulative Weight %	Mass (grams)	Corrected Mass (grams)	Freq Weight %	Cumulative Weight %			
-2.0000	-2.1250	0.3550	0.3550	0.6134	0.6134	0.3550	0.3559	0.6150	0.6150	0.0009	0.0015	Avg = 0.2163 % Std = 0.4842 % Max = 2.3395 %
-1.7500	-1.8750	0.1350	0.1350	0.2333	0.8467	0.1010	0.1013	0.1750	0.7899	0.0337	0.0583	
-1.5000	-1.6250	0.3690	0.3690	0.6376	1.4843	0.3430	0.3439	0.5942	1.3841	0.0251	0.0434	
-1.2500	-1.3750	0.2970	0.2970	0.5132	1.9975	0.2600	0.2606	0.4504	1.8345	0.0364	0.0628	
-1.0000	-1.1250	0.3740	0.3740	0.6463	2.6438	0.3830	0.3840	0.6635	2.4979	0.0100	0.0172	
-0.7500	-0.8750	0.6420	0.6420	1.1093	3.7531	0.5410	0.5423	0.9372	3.4351	0.0997	0.1722	
-0.5000	-0.6250	0.9470	0.9470	1.6364	5.3895	0.8830	0.8852	1.5296	4.9647	0.0618	0.1068	
-0.2500	-0.3750	1.2640	1.2640	2.1841	7.5736	1.2250	1.2281	2.1220	7.0867	0.0359	0.0621	
0.0000	-0.1250	1.8660	1.8660	3.2244	10.7980	1.8200	1.8245	3.1527	10.2394	0.0415	0.0716	
0.2500	0.1250	2.7100	2.7100	4.6827	15.4807	2.6510	2.6576	4.5922	14.8316	0.0524	0.0905	
0.5000	0.3750	3.9250	3.9250	6.7822	22.2629	3.4960	3.5047	6.0560	20.8876	0.4203	0.7262	
0.7500	0.6250	4.9570	4.9570	8.5655	30.8284	5.0580	5.0706	8.7618	29.6494	0.1136	0.1963	
1.0000	0.8750	8.1790	8.1790	14.1329	44.9613	8.1130	8.1332	14.0538	43.7032	0.0458	0.0791	
1.2500	1.1250	7.4550	7.4550	12.8819	57.8432	8.7870	8.8089	15.2214	58.9246	1.3539	2.3395	
1.5000	1.3750	7.8710	7.8710	13.6007	71.4439	7.3890	7.4074	12.7997	71.7243	0.4636	0.8010	
1.7500	1.6250	5.9040	5.9040	10.2018	81.6457	5.8510	5.8656	10.1355	81.8598	0.0384	0.0664	
2.0000	1.8750	4.5650	4.5650	7.8881	89.5338	4.5330	4.5443	7.8523	89.7121	0.0207	0.0358	
2.2500	2.1250	2.3850	2.3850	4.1212	93.6550	2.3520	2.3579	4.0743	93.7864	0.0271	0.0469	
2.5000	2.3750	1.5460	1.5460	2.6714	96.3264	1.5910	1.5950	2.7560	96.5424	0.0490	0.0846	
2.7500	2.6250	1.1870	1.1870	2.0511	98.3775	1.1300	1.1328	1.9575	98.4999	0.0542	0.0936	
3.0000	2.8750	0.5140	0.5140	0.8882	99.2656	0.4970	0.4982	0.8609	99.3608	0.0158	0.0272	
3.2500	3.1250	0.1940	0.1940	0.3352	99.6008	0.1790	0.1794	0.3101	99.6709	0.0146	0.0251	
3.5000	3.3750	0.0920	0.0920	0.1590	99.7598	0.0750	0.0752	0.1299	99.8008	0.0168	0.0291	
3.7500	3.6250	0.0360	0.0360	0.0622	99.8220	0.0730	0.0732	0.1265	99.9272	0.0372	0.0642	
4.0000	3.8750	0.1030	0.1030	0.1780	100.0000	0.0420	0.0421	0.0728	100.0000	0.0609	0.1052	
SUMS:		57.8720	57.8720			57.7280	57.8720			3.1291	5.4069	
						0.2494	% loss	3.2191/57.872 =		0.0541		

SAMPLE 2

Sieve Size (phi)	Sieve Midpoint (phi)	ROTAP				MEINZER				Absolute Difference (grams)	Percent of Total Sample (%)	Statistics for Column to Left
		Mass (grams)	Corrected Mass (grams)	Freq Weight (%)	Cumulative Weight (%)	Mass (grams)	Corrected Mass (grams)	Freq Weight (%)	Cumulative Weight (%)			
-0.2500	-0.3750	0.0010	0.0010	0.0026	0.0026	0.0010	0.0010	0.0026	0.0026	0.0000	0.0000	Avg = 0.3960 % Std = 0.4784 % Max = 1.6634 %
0.0000	-0.1250	0.0540	0.0540	0.1391	0.1417	0.0380	0.0380	0.0979	0.1005	0.0160	0.0412	
0.2500	0.1250	0.1920	0.1920	0.4946	0.6363	0.1850	0.1851	0.4767	0.5772	0.0069	0.0179	
0.5000	0.3750	0.2730	0.2730	0.7032	1.3395	0.2440	0.2441	0.6287	1.2059	0.0289	0.0745	
0.7500	0.6250	0.3960	0.3960	1.0201	2.3596	0.4270	0.4271	1.1003	2.3062	0.0311	0.0802	
1.0000	0.8750	0.6220	0.6220	1.6023	3.9619	0.6230	0.6232	1.6053	3.9115	0.0012	0.0030	
1.2500	1.1250	0.5330	0.5330	1.3730	5.3349	0.3230	0.3231	0.8323	4.7437	0.2099	0.5407	
1.5000	1.3750	0.7140	0.7140	1.8393	7.1741	0.6680	0.6682	1.7213	6.4650	0.0458	0.1180	
1.7500	1.6250	2.4170	2.4170	6.2262	13.4003	2.2960	2.2967	5.9162	12.3811	0.1203	0.3100	
2.0000	1.8750	4.2640	4.2640	10.9840	24.3843	4.6430	4.6443	11.9637	24.3449	0.3803	0.9797	
2.2500	2.1250	6.4740	6.4740	16.6770	41.0613	6.8740	6.8759	17.7124	42.0573	0.4019	1.0354	
2.5000	2.3750	9.0490	9.0490	23.3101	64.3715	9.6920	9.6947	24.9736	67.0308	0.6457	1.6634	
2.7500	2.6250	6.0770	6.0770	15.6543	80.0258	5.6420	5.6436	14.5379	81.5687	0.4334	1.1164	
3.0000	2.8750	3.3540	3.3540	8.6399	88.6656	3.1000	3.1009	7.9878	89.5565	0.2531	0.6520	
3.2500	3.1250	1.8600	1.8600	4.7913	93.4570	1.7900	1.7905	4.6123	94.1689	0.0695	0.1790	
3.5000	3.3750	1.3360	1.3360	3.4415	96.8985	1.2800	1.2804	3.2982	97.4671	0.0556	0.1433	
3.7500	3.6250	0.6250	0.6250	1.6100	98.5085	0.5320	0.5322	1.3708	98.8379	0.0928	0.2392	
4.0000	3.8750	0.2120	0.2120	0.5461	99.0546	0.2080	0.2081	0.5360	99.3739	0.0039	0.0102	
5.0000	4.5000	0.3670	0.3670	0.9454	100.0000	0.2430	0.2431	0.6261	100.0000	0.1239	0.3192	
SUMS:		38.8200	38.8200			38.8090	38.8200			2.9206	7.5235	
						0.0283	% loss	2.920619/38.82 =		0.0752		

SAMPLE 3

Sieve Size (phi)	Sieve Midpoint (phi)	ROTAP				MEINZER				Absolute Difference (grams)	Percent of Total Sample (%)	Statistics for Column to Left
		Mass (grams)	Corrected Mass (grams)	Freq Weight %	Cumulative Weight %	Mass (grams)	Corrected Mass (grams)	Freq Weight %	Cumulative Weight %			
-2.0000	-2.1250	0.1070	0.1070	0.2319	0.2319	0.0940	0.0949	0.2057	0.2057	0.0121	0.0262	Avg = 0.2420 %
-1.7500	-1.8750	0.0630	0.0630	0.1365	0.3684	0.0530	0.0535	0.1160	0.3217	0.0095	0.0205	Std = 0.3533 %
-1.5000	-1.6250	0.1120	0.1120	0.2427	0.6111	0.1920	0.1939	0.4201	0.7418	0.0819	0.1774	Max = 1.2595 %
-1.2500	-1.3750	0.5000	0.5000	1.0835	1.6946	0.3990	0.4029	0.8731	1.6150	0.0971	0.2104	
-1.0000	-1.1250	0.7240	0.7240	1.5689	3.2636	0.7060	0.7129	1.5449	3.1599	0.0111	0.0240	
-0.7500	-0.8750	0.8880	0.8880	1.9243	5.1879	0.8300	0.8381	1.8163	4.9761	0.0499	0.1081	
-0.5000	-0.6250	1.6000	1.6000	3.4673	8.6551	1.5720	1.5874	3.4400	8.4161	0.0126	0.0273	
-0.2500	-0.3750	1.7840	1.7840	3.8660	12.5211	1.7400	1.7571	3.8076	12.2237	0.0269	0.0584	
0.0000	-0.1250	1.9210	1.9210	4.1629	16.6840	1.9100	1.9287	4.1796	16.4033	0.0077	0.0167	
0.2500	0.1250	2.0000	2.0000	4.3341	21.0181	2.1110	2.1317	4.6195	21.0228	0.1317	0.2854	
0.5000	0.3750	2.3450	2.3450	5.0817	26.0998	2.4740	2.4983	5.4138	26.4366	0.1533	0.3321	
0.7500	0.6250	2.9330	2.9330	6.3559	32.4557	2.9610	2.9900	6.4795	32.9161	0.0570	0.1236	
1.0000	0.8750	5.0500	5.0500	10.9435	43.3992	5.5550	5.6095	12.1559	45.0720	0.5595	1.2124	
1.2500	1.1250	6.1240	6.1240	13.2709	56.6701	5.4890	5.5428	12.0115	57.0835	0.5812	1.2595	
1.5000	1.3750	7.0980	7.0980	15.3816	72.0517	6.8560	6.9232	15.0028	72.0863	0.1748	0.3788	
1.7500	1.6250	5.7530	5.7530	12.4670	84.5187	5.9080	5.9659	12.9284	85.0147	0.2129	0.4614	
2.0000	1.8750	4.3520	4.3520	9.4309	93.9496	4.1110	4.1513	8.9960	94.0107	0.2007	0.4349	
2.2500	2.1250	1.5140	1.5140	3.2809	97.2305	1.5220	1.5369	3.3306	97.3412	0.0229	0.0497	
2.5000	2.3750	0.5480	0.5480	1.1875	98.4181	0.5440	0.5493	1.1904	98.5317	0.0013	0.0029	
2.7500	2.6250	0.3220	0.3220	0.6978	99.1158	0.3000	0.3029	0.6565	99.1881	0.0191	0.0413	
3.0000	2.8750	0.2620	0.2620	0.5678	99.6836	0.2510	0.2535	0.5493	99.7374	0.0085	0.0185	
3.2500	3.1250	0.1460	0.1460	0.3164	100.0000	0.1200	0.1212	0.2626	100.0000	0.0248	0.0538	
SUMS:		46.1460	46.1460			45.6980	46.1460			2.4564	5.3232	
						0.9782	% loss	2.4564/46.146 =		0.0532		

SAMPLE 4

Sieve Size (phi)	Sieve Midpoint (phi)	ROTAP				MEINZER				Absolute Difference (grams)	Percent of Total Sample (%)	Statistics for Column to Left
		Mass (grams)	Corrected Mass (grams)	Freq Weight (%)	Cumulative Weight (%)	Mass (grams)	Corrected Mass (grams)	Freq Weight (%)	Cumulative Weight (%)			
0.2500	0.1250	0.0150	0.0150	0.0329	0.0329	0.0150	0.0150	0.0329	0.0329	0.0000	0.0001	Avg = 0.5812 % Std = 0.7467 % Max = 1.9279 %
0.5000	0.3750	0.0380	0.0381	0.0835	0.1164	0.0380	0.0380	0.0833	0.1161	0.0001	0.0002	
0.7500	0.6250	0.1440	0.1443	0.3162	0.4326	0.1480	0.1480	0.3243	0.4404	0.0037	0.0080	
1.0000	0.8750	0.7620	0.7638	1.6735	2.1061	0.7300	0.7300	1.5994	2.0398	0.0338	0.0741	
1.2500	1.1250	2.6290	2.6352	5.7737	7.8798	2.4690	2.4690	5.4095	7.4493	0.1662	0.3642	
1.5000	1.3750	3.8160	3.8251	8.3806	16.2604	4.7050	4.7050	10.3085	17.7578	0.8799	1.9279	
1.7500	1.6250	9.6750	9.6979	21.2479	37.5082	9.3490	9.3490	20.4833	38.2411	0.3489	0.7645	
2.0000	1.8750	11.9490	11.9773	26.2419	63.7502	12.8180	12.8180	28.0838	66.3249	0.8407	1.8419	
2.2500	2.1250	11.1310	11.1574	24.4455	88.1956	10.7480	10.7480	23.5485	89.8734	0.4094	0.8970	
2.5000	2.3750	4.8120	4.8234	10.5679	98.7636	4.1110	4.1110	9.0071	98.8804	0.7124	1.5609	
2.7500	2.6250	0.5030	0.5042	1.1047	99.8682	0.4610	0.4610	1.0100	99.8905	0.0432	0.0946	
3.0000	2.8750	0.0430	0.0431	0.0944	99.9627	0.0430	0.0430	0.0942	99.9847	0.0001	0.0002	
3.2500	3.1250	0.0170	0.0170	0.0373	100.0000	0.0070	0.0070	0.0153	100.0000	0.0100	0.0220	
SUMS:		45.5340	45.6420			45.6420	45.6420			3.4485	7.5556	
		0.2372	% loss					3.4485/45.642 =		0.0756		

SAMPLE 5

Sieve Size (phi)	Sieve Midpoint (phi)	ROTAP				MEINZER				Absolute Difference (grams)	Percent of Total Sample (%)	Statistics for Column to Left
		Mass (grams)	Corrected Mass (grams)	Freq Weight %	Cumulative Weight %	Mass (grams)	Corrected Mass (grams)	Freq Weight %	Cumulative Weight %			
-1.0000	-1.1250	0.0150	0.0151	0.0341	0.0341	0.0130	0.0130	0.0294	0.0294	0.0021	0.0047	Avg = 0.2043 %
-0.7500	-0.8750	0.0120	0.0121	0.0273	0.0614	0.0090	0.0090	0.0203	0.0497	0.0031	0.0070	Std = 0.2471 %
-0.5000	-0.6250	0.0150	0.0151	0.0341	0.0955	0.0120	0.0120	0.0271	0.0768	0.0031	0.0070	Max = 0.9171 %
-0.2500	-0.3750	0.0270	0.0272	0.0614	0.1569	0.0260	0.0260	0.0587	0.1355	0.0012	0.0027	
0.0000	-0.1250	0.0790	0.0795	0.1796	0.3365	0.0750	0.0750	0.1694	0.3050	0.0045	0.0102	
0.2500	0.1250	0.1960	0.1973	0.4456	0.7822	0.1810	0.1810	0.4089	0.7139	0.0163	0.0368	
0.5000	0.3750	0.6330	0.6371	1.4393	2.2214	0.5310	0.5310	1.1996	1.9134	0.1061	0.2397	
0.7500	0.6250	1.5380	1.5480	3.4970	5.7184	1.1420	1.1420	2.5799	4.4933	0.4060	0.9171	
1.0000	0.8750	4.3510	4.3792	9.8929	15.6113	4.2500	4.2500	9.6010	14.0943	0.1292	0.2919	
1.2500	1.1250	4.8550	4.8865	11.0389	26.6501	5.1460	5.1460	11.6252	25.7195	0.2595	0.5863	
1.5000	1.3750	4.9750	5.0072	11.3117	37.9618	5.0590	5.0590	11.4286	37.1481	0.0518	0.1169	
1.7500	1.6250	3.7500	3.7743	8.5264	46.4883	4.0930	4.0930	9.2464	46.3945	0.3187	0.7200	
2.0000	1.8750	3.9900	4.0159	9.0721	55.5604	4.0760	4.0760	9.2080	55.6025	0.0601	0.1359	
2.2500	2.1250	3.8100	3.8347	8.6628	64.2232	3.8630	3.8630	8.7268	64.3293	0.0283	0.0640	
2.5000	2.3750	3.9500	3.9756	8.9812	73.2043	4.1260	4.1260	9.3209	73.6502	0.1504	0.3398	
2.7500	2.6250	3.8300	3.8548	8.7083	81.9126	3.8030	3.8030	8.5912	82.2414	0.0518	0.1171	
3.0000	2.8750	2.8300	2.8483	6.4346	88.3472	2.9560	2.9560	6.6778	88.9193	0.1077	0.2432	
3.2500	3.1250	2.3100	2.3250	5.2523	93.5995	2.2050	2.2050	4.9812	93.9005	0.1200	0.2710	
3.5000	3.3750	1.4250	1.4342	3.2400	96.8395	1.4030	1.4030	3.1695	97.0700	0.0312	0.0706	
3.7500	3.6250	0.9300	0.9360	2.1145	98.9541	0.8430	0.8430	1.9044	98.9744	0.0930	0.2102	
4.0000	3.8750	0.2900	0.2919	0.6594	99.6135	0.3100	0.3100	0.7003	99.6747	0.0181	0.0409	
5.0000	4.5000	0.1700	0.1711	0.3865	100.0000	0.1440	0.1440	0.3253	100.0000	0.0271	0.0612	
SUMS:		43.9810	44.2660			44.2660	44.2660			1.9893	4.4939	
		0.6480	% loss					1.9893/44.266 =		0.0449		

SAMPLE 6

Sieve Size (phi)	Sieve Midpoint (phi)	ROTAP				MEINZER				Absolute Difference (grams)	Percent of Total Sample (%)	Statistics for Column to Left
		Mass (grams)	Corrected Mass (grams)	Freq Weight (%)	Cumulative Weight (%)	Mass (grams)	Corrected Mass (grams)	Freq Weight (%)	Cumulative Weight (%)			
-1.5000	-1.6250	0.0140	0.0140	0.0338	0.0338	0.0140	0.0143	0.0344	0.0344	0.0003	0.0006	Avg = 0.3560 % Std = 0.6072 % Max = 2.5792 %
-1.2500	-1.3750	0.0001	0.0001	0.0000	0.0338	0.0090	0.0092	0.0221	0.0566	0.0091	0.0219	
-1.0000	-1.1250	0.0100	0.0100	0.0241	0.0579	0.0090	0.0092	0.0221	0.0787	0.0008	0.0020	
-0.7500	-0.8750	0.0250	0.0250	0.0603	0.1182	0.0120	0.0122	0.0295	0.1082	0.0128	0.0308	
-0.5000	-0.6250	0.0310	0.0310	0.0748	0.1930	0.0330	0.0336	0.0811	0.1893	0.0026	0.0064	
-0.2500	-0.3750	0.0370	0.0370	0.0893	0.2823	0.0350	0.0357	0.0861	0.2754	0.0013	0.0032	
0.0000	-0.1250	0.0880	0.0880	0.2123	0.4946	0.0660	0.0673	0.1623	0.4377	0.0207	0.0500	
0.2500	0.1250	0.1780	0.1780	0.4294	0.9240	0.1640	0.1671	0.4032	0.8409	0.0109	0.0262	
0.5000	0.3750	0.4450	0.4450	1.0736	1.9975	0.3750	0.3822	0.9221	1.7630	0.0628	0.1515	
0.7500	0.6250	1.0350	1.0350	2.4969	4.4945	0.8360	0.8521	2.0556	3.8185	0.1829	0.4413	
1.0000	0.8750	2.5750	2.5750	6.2122	10.7066	2.6190	2.6693	6.4396	10.2582	0.0943	0.2275	
1.2500	1.1250	3.1000	3.1000	7.4787	18.1853	3.1610	3.2217	7.7723	18.0305	0.1217	0.2936	
1.5000	1.3750	3.2130	3.2130	7.7513	25.9366	3.2640	3.3267	8.0256	26.0561	0.1137	0.2743	
1.7500	1.6250	3.4940	3.4940	8.4292	34.3659	3.6480	3.7181	8.9698	35.0258	0.2241	0.5405	
2.0000	1.8750	4.6990	4.6990	11.3363	45.7022	5.3190	5.4212	13.0784	48.1043	0.7222	1.7422	
2.2500	2.1250	5.8800	5.8800	14.1854	59.8876	6.0820	6.1988	14.9545	63.0588	0.3188	0.7691	
2.5000	2.3750	5.8800	5.8800	14.1854	74.0730	5.9210	6.0347	14.5586	77.6174	0.1547	0.3733	
2.7500	2.6250	4.5010	4.5010	10.8586	84.9316	4.3500	4.4335	10.6958	88.3133	0.0675	0.1627	
3.0000	2.8750	2.4100	2.4100	5.8141	90.7457	2.3160	2.3605	5.6946	94.0079	0.0495	0.1195	
3.2500	3.1250	1.4390	1.4390	3.4716	94.2173	1.3530	1.3790	3.3268	97.3346	0.0600	0.1448	
3.5000	3.3750	1.7000	1.7000	4.1012	98.3185	0.6190	0.6309	1.5220	98.8567	1.0691	2.5792	
3.7500	3.6250	0.3210	0.3210	0.7744	99.0929	0.3230	0.3292	0.7942	99.6508	0.0082	0.0198	
4.0000	3.8750	0.3190	0.3190	0.7696	99.8625	0.0850	0.0866	0.2090	99.8598	0.2324	0.5606	
5.0000	4.5000	0.0570	0.0570	0.1375	100.0000	0.0570	0.0581	0.1402	100.0000	0.0011	0.0026	
SUMS:		41.4511	41.4511			40.6700	41.4511			3.5414	8.5436	
						1.9206	% loss	3.5414/41.4511 =		0.0854		

SAMPLE 7

Sieve Size (phi)	Sieve Midpoint (phi)	ROTAP				MEINZER				Absolute Difference (grams)	Percent of Total Sample (%)	Statistics for Column to Left
		Mass (grams)	Corrected Mass (grams)	Freq Weight %	Cumulative Weight %	Mass (grams)	Corrected Mass (grams)	Freq Weight %	Cumulative Weight %			
0.7500	0.6250	0.0030	0.0030	0.0091	0.0091	0.0020	0.0020	0.0060	0.0060	0.0010	0.0030	Avg = 0.8430 %
1.0000	0.8750	0.0630	0.0630	0.1901	0.1991	0.0730	0.0731	0.2207	0.2267	0.0101	0.0306	Std = 1.5542 %
1.2500	1.1250	0.2350	0.2350	0.7090	0.9082	0.2690	0.2695	0.8133	1.0400	0.0345	0.1042	Max = 4.5801 %
1.5000	1.3750	1.0350	1.0350	3.1227	4.0309	1.0240	1.0261	3.0958	4.1358	0.0089	0.0269	
1.7500	1.6250	3.9170	3.9170	11.8181	15.8490	3.9910	3.9991	12.0658	16.2016	0.0821	0.2477	
2.0000	1.8750	11.3970	11.3970	34.3863	50.2353	9.8590	9.8790	29.8062	46.0078	1.5180	4.5801	
2.2500	2.1250	11.0010	11.0010	33.1915	83.4269	11.1100	11.1325	33.5883	79.5961	0.1315	0.3968	
2.5000	2.3750	4.3490	4.3490	13.1215	96.5484	5.4080	5.4190	16.3497	95.9458	1.0700	3.2282	
2.7500	2.6250	0.9780	0.9780	2.9508	99.4992	1.1690	1.1714	3.5342	99.4800	0.1934	0.5834	
3.0000	2.8750	0.1370	0.1370	0.4133	99.9125	0.1280	0.1283	0.3870	99.8670	0.0087	0.0264	
3.2500	3.1250	0.0290	0.0290	0.0875	100.0000	0.0440	0.0441	0.1330	100.0000	0.0151	0.0455	
SUMS:		33.1440	33.1440			33.0770	33.1440			3.0734	9.2728	
						0.2026	% loss	3.0734/33.144 =		0.0927		

SAMPLE 8

Sieve Size (phi)	Sieve Midpoint (phi)	ROTAP				MEINZER				Absolute Difference (grams)	Percent of Total Sample (%)	Statistics for Column to Left
		Mass (grams)	Corrected Mass (grams)	Freq Weight %	Cumulative Weight %	Mass (grams)	Corrected Mass (grams)	Freq Weight %	Cumulative Weight %			
0.0000	-0.1250	0.0150	0.0151	0.0258	0.0258	0.0150	0.0150	0.0257	0.0257	0.0001	0.0001	Avg = 0.3206 %
0.2500	0.1250	0.0220	0.0221	0.0378	0.0635	0.0230	0.0230	0.0393	0.0650	0.0009	0.0016	Std = 0.3893 %
0.5000	0.3750	0.0480	0.0482	0.0824	0.1460	0.0640	0.0640	0.1095	0.1744	0.0158	0.0270	Max = 1.2603 %
0.7500	0.6250	0.1900	0.1908	0.3263	0.4723	0.2260	0.2260	0.3865	0.5610	0.0352	0.0602	
1.0000	0.8750	0.9270	0.9309	1.5920	2.0642	0.9830	0.9830	1.6811	2.2421	0.0521	0.0892	
1.2500	1.1250	2.8520	2.8639	4.8978	6.9620	2.5830	2.5830	4.4175	6.6596	0.2809	0.4803	
1.5000	1.3750	4.8090	4.8290	8.2586	15.2207	5.3610	5.3610	9.1685	15.8281	0.5320	0.9099	
1.7500	1.6250	11.7030	11.7516	20.0979	35.3186	11.6080	11.6080	19.8522	35.6803	0.1436	0.2457	
2.0000	1.8750	12.7690	12.8221	21.9286	57.2471	13.5590	13.5590	23.1889	58.8692	0.7369	1.2603	
2.2500	2.1250	11.8970	11.9464	20.4310	77.6782	12.0730	12.0730	20.6475	79.5167	0.1266	0.2164	
2.5000	2.3750	7.9750	8.0081	13.6957	91.3739	7.8180	7.8180	13.3705	92.8872	0.1901	0.3252	
2.7500	2.6250	3.1160	3.1289	5.3512	96.7251	2.5670	2.5670	4.3901	97.2773	0.5619	0.9611	
3.0000	2.8750	1.3200	1.3255	2.2669	98.9919	1.1420	1.1420	1.9531	99.2304	0.1835	0.3138	
3.2500	3.1250	0.3720	0.3735	0.6388	99.6308	0.3580	0.3580	0.6123	99.8427	0.0155	0.0266	
3.5000	3.3750	0.1580	0.1587	0.2713	99.9021	0.0900	0.0900	0.1539	99.9966	0.0687	0.1174	
3.7500	3.6250	0.0570	0.0572	0.0979	100.0000	0.0020	0.0020	0.0034	100.0000	0.0552	0.0945	
SUMS:		58.2300	58.4720			58.4720	58.4720			2.9439	5.0347	
						0.4156	% loss	2.9439/58.472 =		0.0503		

SAMPLE 9

Sieve Size (phi)	Sieve Midpoint (phi)	ROTAP				MEINZER				Absolute Difference (grams)	Percent of Total Sample (%)	Statistics for Column to Left
		Mass (grams)	Corrected Mass (grams)	Freq Weight %	Cumulative Weight %	Mass (grams)	Corrected Mass (grams)	Freq Weight %	Cumulative Weight %			
-0.7500	-0.8750	0.0400	0.0400	0.0590	0.0590	0.0410	0.0410	0.0604	0.0604	0.0010	0.0014	Avg = 0.0497 %
-0.5000	-0.6250	23.1170	23.1433	34.1009	34.1599	23.0710	23.0710	33.9944	34.0548	0.0723	0.1065	Std = 0.0505 %
-0.2500	-0.3750	0.0370	0.0370	0.0546	34.2145	0.0990	0.0990	0.1459	34.2007	0.0620	0.0913	Max = 0.1286 %
0.0000	-0.1250	0.0100	0.0100	0.0148	34.2292	0.0010	0.0010	0.0015	34.2022	0.0090	0.0133	
0.2500	0.1250	0.0220	0.0220	0.0325	34.2617	0.0150	0.0150	0.0221	34.2243	0.0070	0.0104	
0.5000	0.3750	23.5070	23.5337	34.6762	68.9379	23.6210	23.6210	34.8048	69.0291	0.0873	0.1286	
0.7500	0.6250	0.4930	0.4936	0.7272	69.6651	0.4250	0.4250	0.6262	69.6554	0.0686	0.1010	
1.0000	0.8750	0.0000	0.0000	0.0000	69.6651	0.0000	0.0000	0.0000	69.6554	0.0000	0.0000	
1.2500	1.1250	0.0000	0.0000	0.0000	69.6651	0.0000	0.0000	0.0000	69.6554	0.0000	0.0000	
1.5000	1.3750	0.0000	0.0000	0.0000	69.6651	0.0000	0.0000	0.0000	69.6554	0.0000	0.0000	
1.7500	1.6250	0.1990	0.1992	0.2936	69.9587	0.1500	0.1500	0.2210	69.8764	0.0492	0.0725	
2.0000	1.8750	18.3000	18.3208	26.9951	96.9538	18.3900	18.3900	27.0971	96.9735	0.0692	0.1020	
2.2500	2.1250	2.0650	2.0673	3.0462	100.0000	2.0540	2.0540	3.0265	100.0000	0.0133	0.0197	
		67.7900	67.8670			67.8670				0.4389	0.6466	
		0.1136	% loss					.43885/67.867 =		0.0065		

SAMPLE 10a

Sieve Size (phi)	Sieve Midpoint (phi)	ROTAP				MEINZER				Absolute Difference (grams)	Percent of Total Sample (%)	Statistics for Column to Left
		Mass (grams)	Corrected Mass (grams)	Freq Weight (%)	Cumulative Weight (%)	Mass (grams)	Corrected Mass (grams)	Freq Weight (%)	Cumulative Weight (%)			
-1.2500	-1.3750	0.0210	0.0210	0.0568	0.0568	0.0210	0.0210	0.0569	0.0569	0.0000	0.0000	Avg = 0.6569 %
-1.0000	-1.1250	0.0080	0.0080	0.0217	0.0785	0.0310	0.0310	0.0839	0.1408	0.0230	0.0623	Std = 0.6814 %
-0.7500	-0.8750	0.0140	0.0140	0.0379	0.1164	0.0590	0.0590	0.1597	0.3005	0.0450	0.1218	Max = 2.0994 %
-0.5000	-0.6250	0.0420	0.0420	0.1137	0.2301	0.0770	0.0770	0.2085	0.5090	0.0350	0.0948	
-0.2500	-0.3750	0.0870	0.0870	0.2355	0.4656	0.1680	0.1680	0.4549	0.9639	0.0810	0.2193	
0.0000	-0.1250	0.1700	0.1700	0.4602	0.9258	0.2930	0.2930	0.7933	1.7571	0.1230	0.3331	
0.2500	0.1250	0.2810	0.2810	0.7607	1.6865	0.4070	0.4071	1.1019	2.8591	0.1261	0.3413	
0.5000	0.3750	0.4490	0.4490	1.2155	2.9019	0.5490	0.5491	1.4864	4.3455	0.1001	0.2709	
0.7500	0.6250	0.5740	0.5740	1.5538	4.4558	0.6090	0.6091	1.6488	5.9943	0.0351	0.0950	
1.0000	0.8750	0.7430	0.7430	2.0113	6.4671	0.8540	0.8541	2.3122	8.3065	0.1111	0.3009	
1.2500	1.1250	0.5430	0.5430	1.4699	7.9370	0.8640	0.8641	2.3392	10.6457	0.3211	0.8693	
1.5000	1.3750	1.3460	1.3460	3.6436	11.5806	1.6250	1.6253	4.3996	15.0453	0.2793	0.7560	
1.7500	1.6250	4.0380	4.0380	10.9309	22.5116	4.5110	4.5117	12.2133	27.2587	0.4737	1.2824	
2.0000	1.8750	6.9080	6.9080	18.7001	41.2117	7.3660	7.3672	19.9431	47.2018	0.4592	1.2431	
2.2500	2.1250	5.3760	5.3760	14.5529	55.7646	5.3540	5.3549	14.4957	61.6976	0.0211	0.0572	
2.5000	2.3750	4.5610	4.5610	12.3467	68.1113	5.0900	5.0908	13.7810	75.4785	0.5298	1.4343	
2.7500	2.6250	4.8870	4.8870	13.2292	81.3405	4.1710	4.1717	11.2928	86.7714	0.7153	1.9364	
3.0000	2.8750	3.6190	3.6190	9.7967	91.1372	2.8430	2.8435	7.6973	94.4687	0.7755	2.0994	
3.2500	3.1250	1.8010	1.8010	4.8753	96.0126	1.0480	1.0482	2.8374	97.3061	0.7528	2.0379	
3.5000	3.3750	0.8830	0.8830	2.3903	98.4029	0.6230	0.6231	1.6867	98.9928	0.2599	0.7036	
3.7500	3.6250	0.2200	0.2200	0.5955	98.9984	0.2680	0.2680	0.7256	99.7184	0.0480	0.1301	
4.0000	3.8750	0.2180	0.2180	0.5901	99.5885	0.0660	0.0660	0.1787	99.8971	0.1520	0.4114	
5.0000	4.5000	0.1520	0.1520	0.4115	100.0000	0.0380	0.0380	0.1029	100.0000	0.1140	0.3086	
SUMS:		36.9410	36.9410			36.9350	36.9410			5.5814	15.1090	
						0.0162	% loss	5.5814/36.941 =		0.1511		

SAMPLE 10b

Sieve Size (phi)	Sieve Midpoint (phi)	ROTAP				MEINZER				Absolute Difference (grams)	Percent of Total Sample (%)	Statistics for Column to Left
		Mass (grams)	Corrected Mass (grams)	Freq Weight %	Cumulative Weight %	Mass (grams)	Corrected Mass (grams)	Freq Weight %	Cumulative Weight %			
-1.2500	-1.3750	0.0210	0.0210	0.0568	0.0568	0.0210	0.0211	0.0570	0.0570	0.0001	0.0001	Avg = 0.3370 % Std = 0.4985 % Max = 1.8806 %
-1.0000	-1.1250	0.0080	0.0080	0.0217	0.0785	0.0170	0.0170	0.0461	0.1031	0.0090	0.0245	
-0.7500	-0.8750	0.0140	0.0140	0.0379	0.1164	0.0040	0.0040	0.0109	0.1140	0.0100	0.0270	
-0.5000	-0.6250	0.0420	0.0420	0.1137	0.2301	0.0400	0.0401	0.1085	0.2225	0.0019	0.0051	
-0.2500	-0.3750	0.0870	0.0870	0.2355	0.4656	0.1030	0.1033	0.2795	0.5020	0.0163	0.0440	
0.0000	-0.1250	0.1700	0.1700	0.4602	0.9258	0.1700	0.1704	0.4613	0.9634	0.0004	0.0011	
0.2500	0.1250	0.2810	0.2810	0.7607	1.6865	0.2920	0.2927	0.7924	1.7558	0.0117	0.0317	
0.5000	0.3750	0.4490	0.4490	1.2155	2.9019	0.4530	0.4541	1.2293	2.9851	0.0051	0.0139	
0.7500	0.6250	0.5740	0.5740	1.5538	4.4558	0.5770	0.5784	1.5658	4.5509	0.0044	0.0120	
1.0000	0.8750	0.7430	0.7430	2.0113	6.4671	0.7380	0.7398	2.0027	6.5536	0.0032	0.0086	
1.2500	1.1250	0.5430	0.5430	1.4699	7.9370	0.6080	0.6095	1.6499	8.2035	0.0665	0.1800	
1.5000	1.3750	1.3460	1.3460	3.6436	11.5806	1.3930	1.3964	3.7802	11.9837	0.0504	0.1365	
1.7500	1.6250	4.0380	4.0380	10.9309	22.5116	4.0680	4.0780	11.0393	23.0231	0.0400	0.1084	
2.0000	1.8750	6.9080	6.9080	18.7001	41.2117	7.5840	7.6027	20.5807	43.6038	0.6947	1.8806	
2.2500	2.1250	5.3760	5.3760	14.5529	55.7646	5.2750	5.2880	14.3148	57.9186	0.0880	0.2381	
2.5000	2.3750	4.5610	4.5610	12.3467	68.1113	4.9780	4.9903	13.5088	71.4274	0.4293	1.1621	
2.7500	2.6250	4.8870	4.8870	13.2292	81.3405	4.6520	4.6635	12.6242	84.0516	0.2235	0.6051	
3.0000	2.8750	3.6190	3.6190	9.7967	91.1372	3.3560	3.3643	9.1072	93.1588	0.2547	0.6895	
3.2500	3.1250	1.8010	1.8010	4.8753	96.0126	1.2960	1.2992	3.5170	96.6757	0.5018	1.3584	
3.5000	3.3750	0.8830	0.8830	2.3903	98.4029	0.7550	0.7569	2.0488	98.7246	0.1261	0.3415	
3.7500	3.6250	0.2200	0.2200	0.5955	98.9984	0.3230	0.3238	0.8765	99.6011	0.1038	0.2810	
4.0000	3.8750	0.2180	0.2180	0.5901	99.5885	0.0910	0.0912	0.2469	99.8480	0.1268	0.3432	
5.0000	4.5000	0.1520	0.1520	0.4115	100.0000	0.0560	0.0561	0.1520	100.0000	0.0959	0.2595	
SUMS:		36.9410	36.9410			36.8500	36.9410			2.8637	7.7520	
						0.2469	% loss	2.8637/36.941 =		0.0775		

SAMPLE 11a

Sieve Size (phi)	Sieve Midpoint (phi)	ROTAP				MEINZER				Absolute Difference (grams)	Percent of Total Sample (%)	Statistics for Column to Left
		Mass (grams)	Corrected Mass (grams)	Freq Weight %	Cumulative Weight %	Mass (grams)	Corrected Mass (grams)	Freq Weight %	Cumulative Weight %			
-2.0000	-2.1250	1.7220	1.7220	3.6939	3.6939	1.7340	1.7353	3.7225	3.7225	0.0133	0.0285	Avg = 0.4573 %
-1.7500	-1.8750	1.7160	1.7160	3.6811	7.3750	1.4890	1.4901	3.1965	6.9190	0.2259	0.4845	Std = 0.3654 %
-1.5000	-1.6250	3.2860	3.2860	7.0489	14.4239	2.9190	2.9212	6.2664	13.1854	0.3648	0.7826	Max = 0.9856 %
-1.2500	-1.3750	4.3900	4.3900	9.4172	23.8411	4.3180	4.3212	9.2697	22.4550	0.0688	0.1475	
-1.0000	-1.1250	6.3890	6.3890	13.7053	37.5464	6.0270	6.0315	12.9385	35.3935	0.3575	0.7668	
-0.7500	-0.8750	9.1530	9.1530	19.6345	57.1809	8.6870	8.6935	18.6488	54.0423	0.4595	0.9856	
-0.5000	-0.6250	9.1170	9.1170	19.5572	76.7381	9.4180	9.4251	20.2181	74.2604	0.3081	0.6609	
-0.2500	-0.3750	5.9420	5.9420	12.7464	89.4845	6.1770	6.1816	13.2605	87.5209	0.2396	0.5141	
0.0000	-0.1250	2.8280	2.8280	6.0665	95.5510	3.2810	3.2835	7.0435	94.5644	0.4555	0.9770	
0.2500	0.1250	1.3290	1.3290	2.8509	98.4019	1.6700	1.6713	3.5851	98.1495	0.3423	0.7342	
0.5000	0.3750	0.4760	0.4760	1.0211	99.4230	0.5550	0.5554	1.1914	99.3409	0.0794	0.1704	
0.7500	0.6250	0.1540	0.1540	0.3304	99.7533	0.2000	0.2002	0.4294	99.7703	0.0462	0.0990	
1.0000	0.8750	0.0450	0.0450	0.0965	99.8498	0.0530	0.0530	0.1138	99.8841	0.0080	0.0172	
1.2500	1.1250	0.0700	0.0700	0.1502	100.0000	0.0540	0.0540	0.1159	100.0000	0.0160	0.0342	
SUMS:		46.6170				46.5820	46.6170			2.9847	6.4026	
						0.0751	% loss	2.985/46.619 =		0.0640		

SAMPLE 11b

Sieve Size (phi)	Sieve Midpoint (phi)	ROTAP				MEINZER				Absolute Difference (grams)	Percent of Total Sample (%)	Statistics for Column to Left
		Mass (grams)	Corrected Mass (grams)	Freq Weight %	Cumulative Weight %	Mass (grams)	Corrected Mass (grams)	Freq Weight %	Cumulative Weight %			
-2.0000	-2.1250	1.7220	1.7220	3.6939	3.6939	1.5500	1.5506	3.3263	3.3263	0.1720	0.3690	Avg = 0.4822 % Std = 0.4223 % Max = 1.5338 %
-1.7500	-1.8750	1.7160	1.7160	3.6811	7.3750	1.7080	1.7087	3.6654	6.9917	0.0080	0.0172	
-1.5000	-1.6250	3.2860	3.2860	7.0489	14.4239	2.9040	2.9052	6.2320	13.2237	0.3820	0.8194	
-1.2500	-1.3750	4.3900	4.3900	9.4172	23.8411	4.5050	4.5068	9.6678	22.8915	0.1150	0.2467	
-1.0000	-1.1250	6.3890	6.3890	13.7053	37.5464	5.6740	5.6763	12.1765	35.0680	0.7150	1.5338	
-0.7500	-0.8750	9.1530	9.1530	19.6345	57.1809	8.8470	8.8506	18.9858	54.0538	0.3060	0.6564	
-0.5000	-0.6250	9.1170	9.1170	19.5572	76.7381	9.4310	9.4348	20.2391	74.2929	0.3140	0.6736	
-0.2500	-0.3750	5.9420	5.9420	12.7464	89.4845	6.2500	6.2525	13.4126	87.7055	0.3080	0.6607	
0.0000	-0.1250	2.8280	2.8280	6.0665	95.5510	3.1730	3.1743	6.8093	94.5148	0.3450	0.7401	
0.2500	0.1250	1.3290	1.3290	2.8509	98.4019	1.6370	1.6377	3.5130	98.0278	0.3080	0.6607	
0.5000	0.3750	0.4760	0.4760	1.0211	99.4230	0.5550	0.5552	1.1910	99.2189	0.0790	0.1695	
0.7500	0.6250	0.1540	0.1540	0.3304	99.7533	0.2120	0.2121	0.4550	99.6738	0.0580	0.1244	
1.0000	0.8750	0.0450	0.0450	0.0965	99.8498	0.0650	0.0650	0.1395	99.8133	0.0200	0.0429	
1.2500	1.1250	0.0700	0.0700	0.1502	100.0000	0.0870	0.0870	0.1867	100.0000	0.0170	0.0365	
SUMS:		46.6170				46.5980	46.6170			3.1470	6.7508	
						0.0408	% loss	3.147/46.617 =		0.0675		

SAMPLE 12a

Sieve Size (phi)	Sieve Midpoint (phi)	ROTAP				MEINZER				Absolute Difference (grams)	Percent of Total Sample (%)	Statistics for Column to Left
		Mass (grams)	Corrected Mass (grams)	Freq Weight %	Cumulative Weight %	Mass (grams)	Corrected Mass (grams)	Freq Weight %	Cumulative Weight %			
-2.0000	-2.1250	0.5870	0.5875	1.7095	1.7095	0.5950	0.5950	1.7314	1.7314	0.0075	0.0219	Avg = 0.2050 % Std = 0.2157 % Max = 0.7307 %
-1.7500	-1.8750	0.5400	0.5404	1.5726	3.2821	0.6210	0.6210	1.8070	3.5384	0.0806	0.2344	
-1.5000	-1.6250	0.5910	0.5915	1.7211	5.0032	0.5240	0.5240	1.5248	5.0631	0.0675	0.1964	
-1.2500	-1.3750	0.9070	0.9077	2.6414	7.6446	0.7360	0.7360	2.1417	7.2048	0.1717	0.4997	
-1.0000	-1.1250	1.2890	1.2901	3.7539	11.3985	1.2950	1.2950	3.7683	10.9731	0.0049	0.0144	
-0.7500	-0.8750	1.6220	1.6233	4.7236	16.1221	1.6400	1.6400	4.7722	15.7452	0.0167	0.0485	
-0.5000	-0.6250	2.2040	2.2058	6.4185	22.5406	2.2730	2.2730	6.6141	22.3593	0.0672	0.1956	
-0.2500	-0.3750	2.5830	2.5851	7.5223	30.0629	2.3340	2.3340	6.7916	29.1509	0.2511	0.7307	
0.0000	-0.1250	2.3950	2.3970	6.9748	37.0377	2.3720	2.3720	6.9022	36.0531	0.0250	0.0726	
0.2500	0.1250	2.9920	2.9944	8.7134	45.7511	3.0820	3.0820	8.9682	45.0212	0.0876	0.2548	
0.5000	0.3750	2.8010	2.8033	8.1571	53.9082	2.9790	2.9790	8.6685	53.6897	0.1757	0.5113	
0.7500	0.6250	2.8600	2.8623	8.3290	62.2372	2.9110	2.9110	8.4706	62.1603	0.0487	0.1416	
1.0000	0.8750	3.1050	3.1075	9.0425	71.2796	3.0830	3.0830	8.9711	71.1314	0.0245	0.0714	
1.2500	1.1250	2.5370	2.5391	7.3883	78.6679	2.5410	2.5410	7.3939	78.5253	0.0019	0.0056	
1.5000	1.3750	1.4590	1.4602	4.2489	82.9169	1.6480	1.6480	4.7954	83.3207	0.1878	0.5465	
1.7500	1.6250	1.8850	1.8865	5.4895	88.4064	1.7320	1.7320	5.0399	88.3606	0.1545	0.4497	
2.0000	1.8750	1.2260	1.2270	3.5704	91.9768	1.2310	1.2310	3.5820	91.9426	0.0040	0.0116	
2.2500	2.1250	1.0220	1.0228	2.9763	94.9531	1.0140	1.0140	2.9506	94.8932	0.0088	0.0257	
2.5000	2.3750	0.9210	0.9218	2.6822	97.6353	0.9760	0.9760	2.8400	97.7332	0.0542	0.1579	
2.7500	2.6250	0.5540	0.5545	1.6134	99.2486	0.5180	0.5180	1.5073	99.2405	0.0365	0.1061	
3.0000	2.8750	0.2580	0.2582	0.7514	100.0000	0.2610	0.2610	0.7595	100.0000	0.0028	0.0081	
SUMS:		34.3380	34.3660			34.3660				1.4793	4.3045	
		0.0815	% loss					1.479/34.366 =		0.0430		

SAMPLE 12b

Sieve Size (phi)	Sieve Midpoint (phi)	ROTAP				MEINZER				Absolute Difference (grams)	Percent of Total Sample (%)	Statistics for Column to Left
		Mass (grams)	Corrected Mass (grams)	Freq Weight (%)	Cumulative Weight (%)	Mass (grams)	Corrected Mass (grams)	Freq Weight (%)	Cumulative Weight (%)			
-2.0000	-2.1250	0.5870	0.5900	1.7095	1.7095	0.5950	0.5950	1.7239	1.7239	0.0080	0.0232	Avg = 0.2799 %
-1.7500	-1.8750	0.5400	0.5428	1.5726	3.2821	0.4280	0.4280	1.2400	2.9639	0.1120	0.3245	Std = 0.2355 %
-1.5000	-1.6250	0.5910	0.5940	1.7211	5.0032	0.6530	0.6530	1.8919	4.8559	0.0620	0.1796	Max = 0.8257 %
-1.2500	-1.3750	0.9070	0.9117	2.6414	7.6446	0.7600	0.7600	2.2019	7.0578	0.1470	0.4259	
-1.0000	-1.1250	1.2890	1.2956	3.7539	11.3985	1.3520	1.3520	3.9171	10.9749	0.0630	0.1825	
-0.7500	-0.8750	1.6220	1.6304	4.7236	16.1221	1.4670	1.4670	4.2503	15.2253	0.1550	0.4491	
-0.5000	-0.6250	2.2040	2.2154	6.4185	22.5406	2.4140	2.4140	6.9941	22.2193	0.2100	0.6084	
-0.2500	-0.3750	2.5830	2.5963	7.5223	30.0629	2.2980	2.2980	6.6580	28.8773	0.2850	0.8257	
0.0000	-0.1250	2.3950	2.4073	6.9748	37.0377	2.5110	2.5110	7.2751	36.1524	0.1160	0.3361	
0.2500	0.1250	2.9920	3.0074	8.7134	45.7511	2.9920	2.9920	8.6687	44.8211	0.0000	0.0000	
0.5000	0.3750	2.8010	2.8154	8.1571	53.9082	2.9240	2.9240	8.4717	53.2928	0.1230	0.3564	
0.7500	0.6250	2.8600	2.8747	8.3290	62.2372	2.9430	2.9430	8.5267	61.8195	0.0830	0.2405	
1.0000	0.8750	3.1050	3.1210	9.0425	71.2796	3.1110	3.1110	9.0135	70.8330	0.0060	0.0174	
1.2500	1.1250	2.5370	2.5501	7.3883	78.6679	2.5610	2.5610	7.4200	78.2529	0.0240	0.0695	
1.5000	1.3750	1.4590	1.4665	4.2489	82.9169	1.6830	1.6830	4.8761	83.1291	0.2240	0.6490	
1.7500	1.6250	1.8850	1.8947	5.4895	88.4064	1.6940	1.6940	4.9080	88.0371	0.1910	0.5534	
2.0000	1.8750	1.2260	1.2323	3.5704	91.9768	1.3100	1.3100	3.7955	91.8325	0.0840	0.2434	
2.2500	2.1250	1.0220	1.0273	2.9763	94.9531	0.9900	0.9900	2.8683	94.7009	0.0320	0.0927	
2.5000	2.3750	0.9210	0.9257	2.6822	97.6353	0.9930	0.9930	2.8770	97.5779	0.0720	0.2086	
2.7500	2.6250	0.5540	0.5569	1.6134	99.2486	0.5500	0.5500	1.5935	99.1714	0.0040	0.0116	
3.0000	2.8750	0.2580	0.2593	0.7514	100.0000	0.2860	0.2860	0.8286	100.0000	0.0280	0.0811	
SUMS:		34.3380	34.5150			34.5150				2.0290	5.8786	
		0.5155	% loss					2.029/34.515 =		0.0588		

SAMPLE 13a

Sieve Size (phi)	Sieve Midpoint (phi)	ROTAP				MEINZER				Absolute Difference (grams)	Percent of Total Sample (%)	Statistics for Column to Left
		Mass (grams)	Corrected Mass (grams)	Freq Weight (%)	Cumulative Weight (%)	Mass (grams)	Corrected Mass (grams)	Freq Weight (%)	Cumulative Weight (%)			
-1.2500	-1.3750	0.1150	0.1150	0.1747	0.1747	0.1080	0.1080	0.1642	0.1642	0.0070	0.0000	Avg = 0.0003 % Std = 0.0006 % Max = 0.0024 %
-1.0000	-1.1250	0.1870	0.1870	0.2842	0.4589	0.1480	0.1481	0.2250	0.3892	0.0389	0.0001	
-0.7500	-0.8750	0.1700	0.1700	0.2583	0.7172	0.1520	0.1521	0.2311	0.6203	0.0179	0.0000	
-0.5000	-0.6250	0.6110	0.6110	0.9284	1.6457	0.5690	0.5693	0.8650	1.4853	0.0417	0.0001	
-0.2500	-0.3750	0.9280	0.9280	1.4101	3.0558	0.9530	0.9534	1.4488	2.9341	0.0254	0.0001	
0.0000	-0.1250	1.4170	1.4170	2.1532	5.2090	1.4190	1.4196	2.1572	5.0913	0.0026	0.0000	
0.2500	0.1250	2.2410	2.2410	3.4053	8.6143	2.1980	2.1990	3.3415	8.4328	0.0420	0.0001	
0.5000	0.3750	3.2020	3.2020	4.8656	13.4799	3.0890	3.0904	4.6960	13.1288	0.1116	0.0003	
0.7500	0.6250	4.3360	4.3360	6.5888	20.0687	4.4710	4.4730	6.7970	19.9258	0.1370	0.0003	
1.0000	0.8750	7.9210	7.9210	12.0363	32.1050	7.5140	7.5174	11.4231	31.3489	0.4036	0.0010	
1.2500	1.1250	9.4210	9.4210	14.3157	46.4207	9.6650	9.6694	14.6931	46.0420	0.2484	0.0006	
1.5000	1.3750	10.4430	10.4430	15.8687	62.2894	9.9470	9.9515	15.1218	61.1639	0.4915	0.0012	
1.7500	1.6250	9.2020	9.2020	13.9829	76.2722	10.1540	10.1586	15.4365	76.6004	0.9566	0.0024	
2.0000	1.8750	8.4500	8.4500	12.8402	89.1124	8.3980	8.4018	12.7670	89.3674	0.0482	0.0001	
2.2500	2.1250	4.2820	4.2820	6.5067	95.6191	3.9770	3.9788	6.0460	95.4134	0.3032	0.0008	
2.5000	2.3750	1.6230	1.6230	2.4662	98.0854	1.6430	1.6437	2.4978	97.9112	0.0207	0.0001	
2.7500	2.6250	0.7110	0.7110	1.0804	99.1658	0.7820	0.7824	1.1888	99.1000	0.0714	0.0002	
3.0000	2.8750	0.2930	0.2930	0.4452	99.6110	0.3240	0.3241	0.4926	99.5926	0.0311	0.0001	
3.2500	3.1250	0.1480	0.1480	0.2249	99.8359	0.1580	0.1581	0.2402	99.8328	0.0101	0.0000	
3.5000	3.3750	0.0690	0.0690	0.1048	99.9407	0.0710	0.0710	0.1079	99.9407	0.0020	0.0000	
3.7500	3.6250	0.0240	0.0240	0.0365	99.9772	0.0290	0.0290	0.0441	99.9848	0.0050	0.0000	
4.0000	3.8750	0.0150	0.0150	0.0228	100.0000	0.0100	0.0100	0.0152	100.0000	0.0050	0.0000	
SUMS:		65.8090	65.8090			65.7790	65.8090			3.0211	0.0076	
						0.0456	% loss	3.021/65.809 =		0.0001		

SAMPLE 13b

Sieve Size (phi)	Sieve Midpoint (phi)	Mass (grams)	Corrected Mass (grams)	Freq Weight %	Cumulative Weight %	Mass (grams)	Corrected Mass (grams)	Freq Weight %	Cumulative Weight %	Absolute Difference (grams)	Percent of Total Sample (%)	Statistics for Column to Left
-1.2500	-1.3750	0.1180	0.1181	0.1796	0.1796	0.1050	0.1190	0.1597	0.1597	0.0009	0.0000	Avg = 0.0008 %
-1.0000	-1.1250	0.1640	0.1641	0.2496	0.4293	0.1310	0.1410	0.1992	0.3589	0.0231	0.0002	Std = 0.0011 %
-0.7500	-0.8750	0.1700	0.1702	0.2588	0.6880	0.1510	0.1530	0.2296	0.5886	0.0172	0.0001	Max = 0.0047 %
-0.5000	-0.6250	0.5900	0.5905	0.8981	1.5861	0.5590	0.5310	0.8502	1.4387	0.0595	0.0004	
-0.2500	-0.3750	0.9320	0.9328	1.4187	3.0048	0.9700	0.9660	1.4752	2.9139	0.0332	0.0002	
0.0000	-0.1250	1.3970	1.3982	2.1265	5.1313	1.4050	1.3870	2.1368	5.0507	0.0112	0.0001	
0.2500	0.1250	2.2410	2.2430	3.4112	8.5425	2.2000	2.1640	3.3459	8.3966	0.0790	0.0006	
0.5000	0.3750	3.2270	3.2298	4.9121	13.4546	2.8600	2.8810	4.3496	12.7462	0.3488	0.0026	
0.7500	0.6250	4.3290	4.3328	6.5895	20.0441	4.3730	4.1240	6.6506	19.3968	0.2088	0.0015	
1.0000	0.8750	7.7970	7.8039	11.8685	31.9126	8.0150	7.9530	12.1896	31.5864	0.1491	0.0011	
1.2500	1.1250	9.3860	9.3943	14.2872	46.1999	8.9770	9.0520	13.6526	45.2390	0.3423	0.0025	
1.5000	1.3750	10.3400	10.3491	15.7394	61.9393	10.6870	10.4400	16.2533	61.4923	0.0909	0.0007	
1.7500	1.6250	9.2620	9.2702	14.0985	76.0378	9.6770	9.9050	14.7172	76.2095	0.6348	0.0047	
2.0000	1.8750	8.5430	8.5505	13.0040	89.0418	8.4240	8.6850	12.8116	89.0210	0.1345	0.0010	
2.2500	2.1250	4.3470	4.3508	6.6169	95.6587	4.0840	4.2330	6.2111	95.2322	0.1178	0.0009	
2.5000	2.3750	1.6880	1.6895	2.5694	98.2282	1.7350	1.7590	2.6387	97.8708	0.0695	0.0005	
2.7500	2.6250	0.6870	0.6876	1.0457	99.2739	0.8020	0.7570	1.2197	99.0905	0.0694	0.0005	
3.0000	2.8750	0.2930	0.2933	0.4460	99.7199	0.3370	0.3130	0.5125	99.6031	0.0197	0.0001	
3.2500	3.1250	0.1410	0.1411	0.2146	99.9345	0.1530	0.1340	0.2327	99.8357	0.0071	0.0001	
3.5000	3.3750	0.0060	0.0060	0.0091	99.9437	0.0700	0.0600	0.1065	99.9422	0.0540	0.0004	
3.7500	3.6250	0.0230	0.0230	0.0350	99.9787	0.0300	0.0150	0.0456	99.9878	0.0080	0.0001	
4.0000	3.8750	0.0140	0.0140	0.0213	100.0000	0.0080	0.0020	0.0122	100.0000	0.0120	0.0001	
SUMS:		65.6950	65.7530			65.7530				2.4910	0.0183	
		0.0883	% loss					2.491/65.753 =		0.0002		

SAMPLE 13c

Sieve Size (phi)	Sieve Midpoint (phi)	ROTAP				MEINZER				Absolute Difference (grams)	Percent of Total Sample (%)	Statistics for Column to Left
		Mass (grams)	Corrected Mass (grams)	Freq Weight (%)	Cumulative Weight (%)	Mass (grams)	Corrected Mass (grams)	Freq Weight (%)	Cumulative Weight (%)			
-1.2500	-1.3750	0.1050	0.1051	0.1600	0.1600	0.1060	0.1061	0.1616	0.1616	0.0010	0.0000	Avg = 0.0010 % Std = 0.0014 % Max = 0.0054 %
-1.0000	-1.1250	0.1660	0.1662	0.2529	0.4129	0.1590	0.1591	0.2425	0.4041	0.0070	0.0001	
-0.7500	-0.8750	0.1850	0.1852	0.2819	0.6948	0.1530	0.1531	0.2333	0.6374	0.0321	0.0004	
-0.5000	-0.6250	0.5700	0.5706	0.8685	1.5633	0.5210	0.5215	0.7945	1.4320	0.0491	0.0005	
-0.2500	-0.3750	0.9280	0.9289	1.4139	2.9772	0.9570	0.9578	1.4594	2.8914	0.0289	0.0003	
0.0000	-0.1250	1.4380	1.4394	2.1910	5.1682	1.3600	1.3612	2.0740	4.9654	0.0782	0.0009	
0.2500	0.1250	2.2740	2.2763	3.4648	8.6330	2.2360	2.2380	3.4099	8.3753	0.0383	0.0004	
0.5000	0.3750	3.1510	3.1542	4.8010	13.4340	2.9470	2.9496	4.4942	12.8694	0.2046	0.0023	
0.7500	0.6250	4.2790	4.2833	6.5197	19.9537	4.2490	4.2528	6.4797	19.3491	0.0305	0.0003	
1.0000	0.8750	7.7020	7.7097	11.7351	31.6888	7.7020	7.7088	11.7455	31.0946	0.0009	0.0000	
1.2500	1.1250	9.0960	9.1051	13.8591	45.5479	8.9200	8.9279	13.6030	44.6976	0.1772	0.0020	
1.5000	1.3750	10.3210	10.3314	15.7256	61.2735	10.5510	10.5603	16.0902	60.7878	0.2290	0.0025	
1.7500	1.6250	9.3330	9.3424	14.2202	75.4937	9.8170	9.8257	14.9709	75.7587	0.4833	0.0054	
2.0000	1.8750	8.6260	8.6347	13.1430	88.6366	8.7170	8.7247	13.2934	89.0521	0.0900	0.0010	
2.2500	2.1250	4.4100	4.4144	6.7193	95.3559	4.0570	4.0606	6.1869	95.2390	0.3538	0.0039	
2.5000	2.3750	1.7300	1.7317	2.6359	97.9918	1.7190	1.7205	2.6215	97.8604	0.0112	0.0001	
2.7500	2.6250	0.7770	0.7778	1.1839	99.1757	0.8220	0.8227	1.2535	99.1140	0.0449	0.0005	
3.0000	2.8750	0.3090	0.3093	0.4708	99.6465	0.3370	0.3373	0.5139	99.6279	0.0280	0.0003	
3.2500	3.1250	0.1450	0.1451	0.2209	99.8674	0.1570	0.1571	0.2394	99.8673	0.0120	0.0001	
3.5000	3.3750	0.0580	0.0581	0.0884	99.9558	0.0620	0.0621	0.0945	99.9619	0.0040	0.0000	
3.7500	3.6250	0.0140	0.0140	0.0213	99.9771	0.0240	0.0240	0.0366	99.9985	0.0100	0.0001	
4.0000	3.8750	0.0150	0.0150	0.0229	100.0000	0.0010	0.0010	0.0015	100.0000	0.0140	0.0002	
SUMS:		65.6320				65.5740	65.6320			1.9282	0.0214	
						0.0884	% loss	1.9282/65.632 =		0.0002		

SAMPLE 13d

Sieve Size (phi)	Sieve Midpoint (phi)	ROTAP				MEINZER				Absolute Difference (grams)	Percent of Total Sample (%)	Statistics for Column to Left
		Mass (grams)	Corrected Mass (grams)	Freq Weight %	Cumulative Weight %	Mass (grams)	Corrected Mass (grams)	Freq Weight %	Cumulative Weight %			
-1.2500	-1.3750	0.1010	0.1011	0.1537	0.1537	0.1190	0.1190	0.1809	0.1809	0.0179	0.0001	Avg = 0.0005 % Std = 0.0006 % Max = 0.0022 %
-1.0000	-1.1250	0.1760	0.1762	0.2679	0.4216	0.1410	0.1410	0.2144	0.3953	0.0352	0.0002	
-0.7500	-0.8750	0.1720	0.1722	0.2618	0.6833	0.1530	0.1530	0.2326	0.6279	0.0192	0.0001	
-0.5000	-0.6250	0.5920	0.5926	0.9010	1.5843	0.5310	0.5310	0.8073	1.4352	0.0616	0.0003	
-0.2500	-0.3750	0.8900	0.8909	1.3545	2.9388	0.9660	0.9660	1.4687	2.9039	0.0751	0.0004	
0.0000	-0.1250	1.3720	1.3734	2.0880	5.0268	1.3870	1.3870	2.1087	5.0126	0.0136	0.0001	
0.2500	0.1250	2.2460	2.2483	3.4182	8.4449	2.1640	2.1640	3.2901	8.3027	0.0843	0.0004	
0.5000	0.3750	3.1430	3.1462	4.7833	13.2282	2.8810	2.8810	4.3802	12.6828	0.2652	0.0013	
0.7500	0.6250	4.3420	4.3464	6.6080	19.8362	4.1240	4.1240	6.2700	18.9528	0.2224	0.0011	
1.0000	0.8750	7.7350	7.7428	11.7718	31.6080	7.9530	7.9530	12.0914	31.0442	0.2102	0.0010	
1.2500	1.1250	9.1290	9.1382	13.8933	45.5013	9.0520	9.0520	13.7623	44.8065	0.0862	0.0004	
1.5000	1.3750	10.1810	10.1912	15.4943	60.9956	10.4400	10.4400	15.8725	60.6790	0.2488	0.0012	
1.7500	1.6250	9.4330	9.4425	14.3559	75.3516	9.9050	9.9050	15.0591	75.7381	0.4625	0.0022	
2.0000	1.8750	8.7390	8.7478	13.2998	88.6513	8.6850	8.6850	13.2043	88.9424	0.0628	0.0003	
2.2500	2.1250	4.4830	4.4875	6.8226	95.4739	4.2330	4.2330	6.4357	95.3781	0.2545	0.0012	
2.5000	2.3750	1.7220	1.7237	2.6207	98.0946	1.7590	1.7590	2.6743	98.0524	0.0353	0.0002	
2.7500	2.6250	0.7300	0.7307	1.1110	99.2056	0.7570	0.7570	1.1509	99.2033	0.0263	0.0001	
3.0000	2.8750	0.3010	0.3013	0.4581	99.6637	0.3130	0.3130	0.4759	99.6792	0.0117	0.0001	
3.2500	3.1250	0.1370	0.1371	0.2085	99.8722	0.1340	0.1340	0.2037	99.8829	0.0031	0.0000	
3.5000	3.3750	0.0600	0.0601	0.0913	99.9635	0.0600	0.0600	0.0912	99.9742	0.0001	0.0000	
3.7500	3.6250	0.0150	0.0150	0.0228	99.9863	0.0150	0.0150	0.0228	99.9970	0.0000	0.0000	
4.0000	3.8750	0.0090	0.0090	0.0137	100.0000	0.0020	0.0020	0.0030	100.0000	0.0070	0.0000	
SUMS:		65.7080	65.7740			65.7740				2.2028	0.0107	
		0.1004	% loss						2.203/65.774 =	0.0001		

SAMPLE 13e

Sieve Size (phi)	Sieve Midpoint (phi)	ROTAP				MEINZER				Absolute Difference (grams)	Percent of Total Sample (%)	Statistics for Column to Left
		Mass (grams)	Corrected Mass (grams)	Freq Weight %	Cumulative Weight %	Mass (grams)	Corrected Mass (grams)	Freq Weight %	Cumulative Weight %			
-1.2500	-1.3750	0.1010	0.1011	0.1537	0.1537	0.1020	0.1190	0.1550	0.1550	0.0179	0.0001	Avg = 0.0005 % Std = 0.0006 % Max = 0.0022 %
-1.0000	-1.1250	0.1760	0.1762	0.2679	0.4216	0.1200	0.1410	0.1824	0.3374	0.0352	0.0002	
-0.7500	-0.8750	0.1720	0.1722	0.2618	0.6833	0.2010	0.1530	0.3055	0.6429	0.0192	0.0001	
-0.5000	-0.6250	0.5920	0.5928	0.9010	1.5843	0.4980	0.5310	0.7569	1.3998	0.0618	0.0003	
-0.2500	-0.3750	0.8900	0.8912	1.3545	2.9388	0.9650	0.9660	1.4666	2.8664	0.0748	0.0004	
0.0000	-0.1250	1.3720	1.3739	2.0880	5.0268	1.3870	1.3870	2.1080	4.9744	0.0131	0.0001	
0.2500	0.1250	2.2460	2.2490	3.4182	8.4449	2.2410	2.1640	3.4059	8.3803	0.0850	0.0004	
0.5000	0.3750	3.1430	3.1473	4.7833	13.2282	2.9600	2.8810	4.4987	12.8790	0.2663	0.0013	
0.7500	0.6250	4.3420	4.3479	6.6080	19.8362	3.7470	4.1240	5.6948	18.5738	0.2239	0.0011	
1.0000	0.8750	7.7350	7.7455	11.7718	31.6080	8.3230	7.9530	12.6495	31.2233	0.2075	0.0010	
1.2500	1.1250	9.1290	9.1414	13.8933	45.5013	8.9980	9.0520	13.6754	44.8987	0.0894	0.0004	
1.5000	1.3750	10.1810	10.1948	15.4943	60.9956	10.3290	10.4400	15.6983	60.5970	0.2452	0.0012	
1.7500	1.6250	9.4330	9.4458	14.3559	75.3516	9.7910	9.9050	14.8806	75.4776	0.4592	0.0022	
2.0000	1.8750	8.7390	8.7508	13.2998	88.6513	8.6960	8.6850	13.2164	88.6940	0.0658	0.0003	
2.2500	2.1250	4.4830	4.4891	6.8226	95.4739	4.2570	4.2330	6.4699	95.1639	0.2561	0.0012	
2.5000	2.3750	1.7220	1.7243	2.6207	98.0946	1.7340	1.7590	2.6354	97.7993	0.0347	0.0002	
2.7500	2.6250	0.7300	0.7310	1.1110	99.2056	0.8310	0.7570	1.2630	99.0623	0.0260	0.0001	
3.0000	2.8750	0.3010	0.3014	0.4581	99.6637	0.3550	0.3130	0.5395	99.6018	0.0116	0.0001	
3.2500	3.1250	0.1370	0.1372	0.2085	99.8722	0.1500	0.1340	0.2280	99.8298	0.0032	0.0000	
3.5000	3.3750	0.0600	0.0601	0.0913	99.9635	0.0730	0.0600	0.1109	99.9407	0.0001	0.0000	
3.7500	3.6250	0.0150	0.0150	0.0228	99.9863	0.0290	0.0150	0.0441	99.9848	0.0000	0.0000	
4.0000	3.8750	0.0090	0.0090	0.0137	100.0000	0.0100	0.0020	0.0152	100.0000	0.0070	0.0000	
SUMS:		65.7080	65.7970			65.7970				2.2031	0.0107	
		0.1354	% loss					2.203/65.797 =		0.0001		

APPENDIX III

PHI SCALE AND MOMENT MEASURES IN GRANULOMETRY

PHI SCALE AND MOMENT MEASURES IN GRANULOMETRY

by

James H. Balsillie

From time to time it is customary to record the history of endeavors that have endured long enough to achieve significant objectives. Achievements of particular significance include those where standards of scientific approach have been defined. It becomes of even more import to record the history of such endeavors when practitioners wish to make changes to standards with no historical appreciation of the wisdom of the founding fathers of the standards. Such, in part, is the purpose of this work.

At the middle of the last century, Truesdell and Varnes (1950) identified that there were some 20 different grain-size measurement scales in use. In 1963 the Society of Economic Paleontologists and Mineralogists (S.E.P.M.) convened a committee, called the **Inter-Society Grain Size Study Committee** (ISGSSC), to alleviate confusion by establishing standardization for grain-size measurement (*i.e.*, a measure of particle diameter) and classification. It was comprised of accomplished professional geologists, soils scientists, and engineers. Concluding published reports about the findings of the committee were forthcoming from Rogers (1965), Folk (1966), and Tanner (1969). It was concluded that a method devised by one William C. Krumbein would become America's standard grain-size measurement method. Krumbein (1934) redefined grain-size using what was termed the phi grain-size or phi scale. Phi ϕ units were numerically defined as:

$$\phi = -\log_2 \frac{d(\text{mm})}{1.0\text{mm}} \quad (1)$$

where $d(\text{mm})$ is the particle size in millimeters and the dimensionless aspect of the equation (*i.e.*, $d(\text{mm})/1.0\text{ mm}$) was redefined by McManus (1963) and amplified by Krumbein (1964). In essence, the phi scale linearizes the grain-size scale as illustrated in Figure III-1. Conversely, it may be stated:

$$d(\text{mm}) = (1.0\text{ mm}) 2^{-\phi} \quad (2)$$

The phi grain-size measurement scale has 11 specific advantages. Tanner (1969) listed them as follows:

- (1) *Evenly-spaced division points, facilitating plotting.*
- (2) *Geometric basis, allowing equally close inspection of all parts of the size spectrum.*
- (3) *Simplicity of subdivision of classes to any precision desired, with no awkward numbers.*
- (4) *Wide range of sizes, extending automatically to any extreme.*
- (5) *Widespread acceptance.*
- (6) *Coincidence of major dividing points with natural class boundaries.*
- (7) *Ease of use in probability analysis.*
- (8) *Ease of use in computing statistical parameters.*
- (9) *Amenability to more advanced analytical methods.*
- (10) *Close approximation to most other scales, allowing easy adoption.*
- (11) *Phi-size screens are available commercially.*

Tanner (1969) emphasized that of the 20 grain-size measurement scales in use at the time, ... *no other scale is even close to matching this list; most other scales do not have more than three or*

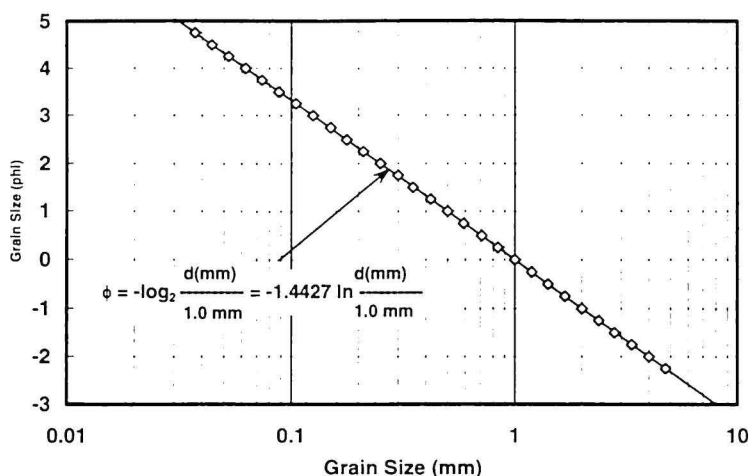


Figure III-1. Phi versus millimeters illustrating that the phi-scale linearizes the grain-size scale.

four of these advantages.

It is of critical historical importance to note that Krumbein's methodology was based on Wentworth's (1922) particle size nomenclature listed in Table 1, for which millimeter-phi equivalents have been specified.

Sediment grain-size data are used in many geologic and engineering applications. The grain-size distribution of a sediment sample provides information on the relative energy level present in the environment under which the sediment was transported and deposited. It also contributes practical information of engineering importance. For instance, in beach restoration projects, the mean grain size and standard deviation using composite statistics (see Balsillie and Tanner 1999) of the grain-size distribution are used in calculations to determine the suitability of local sand deposits as borrow material for nourishment, as well as in predicting the maintenance renourishment needs of a project (e.g., Krumbein 1957; James 1975; Hobson 1977; U. S. Army 1984).

Standard methods of quantifying sediment textural data employ statistical measures (mean, standard deviation,

skewness, kurtosis), grain-size distribution diagrams, and frequency and cumulative frequency probability plots. Probability considerations are based on the underlying concept that sediments conform to the "Normal" or Gaussian density distribution function. The Gaussian distribution plays a central role in all of statistics. It is, perhaps, the most ubiquitous distribution utilized in all the sciences. Results from statistical application

of the Gaussian distribution are best plotted using arithmetic probability paper (APP). The usefulness of APP is, among informed practitioners, of unequalled practical importance when compared to other plotting options. The graph paper has one arithmetic axis that represents quantifiable data (e.g., sediment grain size) plotted against the cumulative percent occurrence (or cumulative probability), which is a nonlinear axis. Typically, the arithmetic axis is the horizontal axis representing grain size. The nonlinear (Gaussian) axis is the vertical axis and represents the cumulative percent weight from the sieve fractions. The cumulative probability distribution of the paper has commonly been termed the "normal" distribution. It should not be so designated, however, because "normal" is applied in too many applications. Johann Carl Friedrich Gauss (1777-1855) was its originator, and it should properly be referred to as the Gaussian distribution or Gaussian probability density distribution (GPDD). APP, constructed so that the ogive (S-shaped curve on arithmetic paper) plots as a straight line, was developed in 1913 by Hazen (1914), and is acknowledged as a milestone in statistical graphic applications (<http://www.math.yorku.ca/SCS/Gallery/milestone/sec7.html>). There

Table 1. Size conversions and particle size nomenclature.

Wentworth (1922) Classification		Milli- meters	Phi Units	Sieve #	Unified Soils Classification	
	Boulder					
-----	-----	256.00	-8.00			
		152.22	-7.25			
Cobble		128.00	-7.00			Cobble
		76.11	-6.25		-----	-----
-----		64.00	-6.00			
		45.25	-5.50			
		32.00	-5.00		Coarse Gravel	
		22.63	-4.50			
		19.027	-4.25		-----	Gravel
Pebble	Gravel	16.000	-4.00			
		11.314	-3.50			
		8.000	-3.00		Fine Gravel	
		5.657	-2.50			
		4.757	-2.25	4	-----	-----
-----		4.000	-2.00	5		
		3.364	-1.75	6	Coarse Sand	
Granule		2.828	-1.50	7		
		2.378	-1.25	8		
-----	-----	2.000	-1.00	10	-----	
Very		1.682	-0.75	12		
Coarse		1.414	-0.50	14		
Sand		1.189	-0.25	16		
-----		1.000	0.00	18	Medium Sand	
Coarse		0.841	0.25	20		
Sand		0.707	0.50	25		Sand
Sand		0.595	0.75	30		
-----		0.500	1.00	35		
Medium		0.420	1.25	40	-----	
	Sand	0.354	1.50	45		
Sand		0.297	1.75	50		
-----		0.250	2.00	60		
Fine		0.210	2.25	70	Fine Sand	
		0.177	2.50	80		
Sand		0.149	2.75	100		
-----		0.125	3.00	120		
Very		0.1051	3.25	140		
Fine		0.0884	3.50	170		
Sand		0.0743	3.75	200	-----	-----
-----	-----	0.0625	4.00	230		
		0.0186	5.75			
	Silt	0.0156	6.00			Silt
		0.0046	7.75	325		
-----	-----	0.0039	8.00	400	-----	-----
		0.00116	9.75			
	Clay	0.00098	10.00			
		0.00082	10.25			Clay
-----	-----	0.00024	12.00			
	Colloid					

are three fundamental properties of the GPPD that when plotted on APP require understanding.

First, if the quantified data, in general, conform to the Gaussian Distribution, any one sample shall, if it is precisely Gaussian, plot as a straight line on APP. Second, are the natural data of any one sample precisely equivalent to the GPDD? Most are not, nor would we wish them so, for it is the deviation from the Gaussian that tells us something about the sample. This is especially true for sediment grain size distributions. Third, natural data plotted on APP may, in many applications, be made up of several straight-line segments. These segments are often attributable to some identifiable natural cause or process. For instance, Tanner (1991) found, based on the analysis of over 11,000 sediment samples from all types of environments, that the geometry of straight-line segments for sediment distributions can definitively identify whether the latest transpositional history of the sediment sample was due to eolian, littoral, fluvial, settling processes, *etc.*, or even combinations of processes (Balsillie, 1995). Balsillie (1999b) found that they may be related to storm and hurricane induced erosion.

Statistically, the Gaussian distribution is defined in terms of **moments**. The term moment was introduced into statistics by analogy. In mechanics, the moment of a force about a point of rotation, *e.g.*, about a fulcrum, is determined by multiplying the magnitude of the force times the distance to the point of rotation (see Friedman and Sanders, 1978 [p. 78-79] for a more detailed description).

Moments and moment measures are not identical quantities. In the **method of moments**, **moment** in the statistical context refers to the sum of deviations from the mean relative to the sample size (Fogiel, 1985). The **mean**, μ , for grouped or classified data is calculated by:

$$\mu = MM_1 = \frac{1}{n} \sum_{i=1}^k f_i x_i \quad (3)$$

in which x_i is the class midpoint, and f_i is the frequency of the class. The mean is a measure of the central tendency of the distribution (Figure III-2).

The **first moment**, m_1 , always has a value of zero (Fogiel, 1985), and is the point of rotation (*e.g.*, a fulcrum) referred to above. In granulometry as in most data sets, the "fulcrum" will seldom have a value of zero and, instead, the mean is substituted and specified as the **first moment measure**, MM_1 . All higher **moments** and **moment measures** apply equally well about the **first moment** or **first moment measure**. Outcomes for granulometric work are normally expressed in millimeters or dimensionless phi (ϕ) units. Progressively larger moments are determined according to:

$$m_p = \frac{1}{n-1} \sum_{i=1}^k f_i (x_i - \mu)^p \quad (4)$$

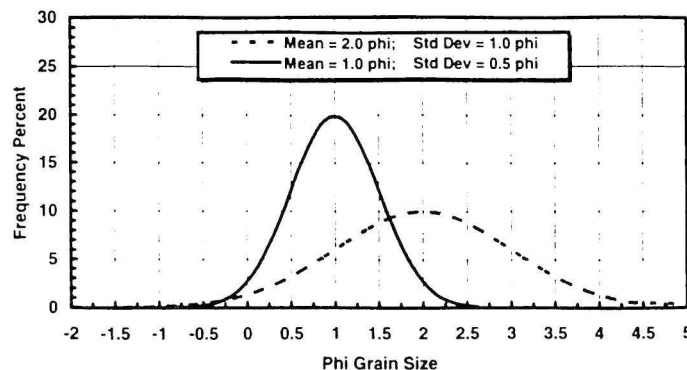


Figure III-2. Illustration of different means and standard deviations (sorting coefficients) for two Gaussian distributions. The dashed distribution is more poorly sorted than the other distribution.

in which p is an integer, and m_p is the p^{th} moment about the mean.

The second moment, m_2 , is the variance, σ^2 , and the **standard deviation** (or **sorting coefficient**), σ , or **second moment measure**, MM_2 , becomes:

$$\sigma = MM_2 = (m_2)^{1/2} \quad (5)$$

which has units of millimeters or phi-units. The standard deviation is a measure of the degree of spread of the distribution about the mean. The larger the standard deviation, the larger the spread (Figure III-2). For the cumulative probability distribution on arithmetic probability probability paper, the slope of the Gaussian distribution is the standard deviation.

A misuse of the phi or ϕ often occurs in the notation used for the standard deviation. From inspection of Table 1, it will be noted that all of the smaller descriptive units (e.g., very fine sand) are one-phi-unit in length for the Wentworth scale. It is no mistake that Krumbein (1936) selected the Wentworth scale. Each one-unit length is, in fact, referred to as a "Wentworth grade" (Krumbein, 1936, p. 43; McManus, 1963, p. 671). McManus (1963) further elaborated that the standard deviation (σ_ϕ) is the number of Wentworth grades or one-phi-units. Hence, for σ_ϕ equal to 0.5, it is one-half a Wentworth grade or half a one-phi-unit. Hence, McManus (1963) specified that the standard deviation be expressed precisely as "phi-units", with which Krumbein (1964) agreed. Moreover, one cannot transform a phi-unit standard deviation to a millimeter equivalent using equation (2). It will give nonsensical results.

Higher **moment measures** are determined according to:

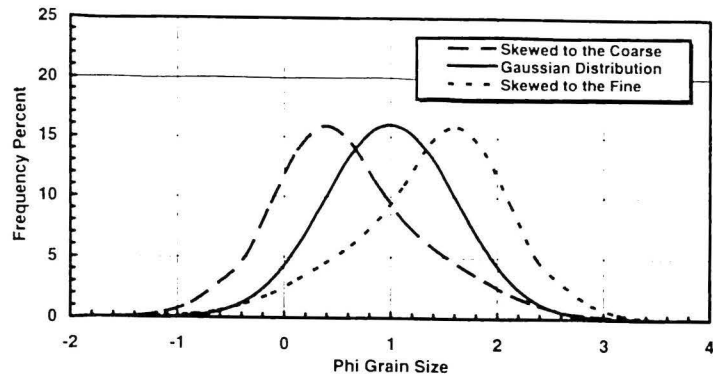


Figure III-3. Illustration of the effect of skewness.

$$MM_p = \frac{m_p}{\sqrt{m_2^p}} = \frac{m_p}{m_2^{p/2}} \quad (6)$$

which all have truly dimensionless units.

The **third moment measure**, MM_3 ($p = 3$) is the **skewness**, Sk , where:

$$Sk = MM_3 = \frac{m_p}{m_2^{1.5}} \quad (7)$$

The skewness is a measure of the asymmetry of the distribution, wherein it may be skewed to the right or to the left of the mean, or skewed to the fine or coarse end of the distribution (Figure III-3). and the **fourth moment measure**, MM_4 ($p = 4$) is the **kurtosis**, K , or:

$$K = MM_4 = \frac{m_p}{m_2^2} \quad (8)$$

The kurtosis is a measure of the peakedness of the frequency curve, termed platykurtic is flat and leptokurtic if peaked (Figure III-4).

In this work we shall utilize only the first four moment measures assessed using grain-size data expressed in phi (ϕ) units; measures higher than the second moment measure are truly dimensionless. There are higher moment measures that can be calculated provided that there are sufficient data to do so (Tanner, 1991; Balsillie, 1995; Balsillie and Tanner,

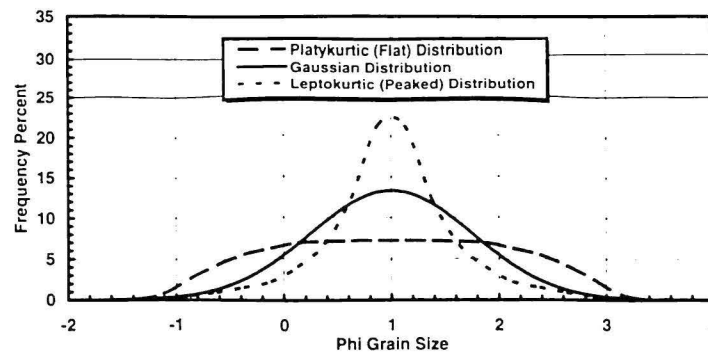


Figure III-4. Illustration of the effects of kurtosis.

1999). Moment measures higher than order four have not been assigned names. Also, in this work moment measures are evaluated for grouped (or classified) data since particle sizes are collected for 1/4-phi sieve intervals. Ungrouped (or unclassified) data would require that one know the size of each and every grain. Statistical ramifications of grouped and ungrouped data in granulometric pursuits are discussed in detail by Swan and others (1978, 1979).

Finally, a case can be identified wherein recent deviation from the adopted standards is being prompted. In recent years, there has been a certain section of practitioners who are promoting the use of the Unified Soils Classification scale. For this reason it has been included in Table 1 so that it can be compared to the Wentworth Classification scale. Preceding developments of this work has identified that the phi scale or phi methodology of Krumbein (1936, 1964) is successful only because descriptive class boundaries of the Wentworth scale occur at one-phi intervals. The Unified Soils Classification scale, however, does not. For example, coarse sand occupies an interval of 1 ¼ phi units, medium sand an interval of 2 ¼ phi units, fine sand an interval of 2 ½ phi units, etc. The lesson here is that before one proposes to make alterations to an achievement of historically significant proportions, he or she needs to investigate the details of its origins and the ramifications of any

alterations. In other words, they need to be abundantly knowledgeable about its history.

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