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Petrologic Analysis of Surficial Sediments,
Gray's Reef National Marine Sanctuary,
Georgia Continental Shelf, U. S. A.

Approved for the Department:

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Adviser

_____
Date

Accepted:

_____
Dean of the Graduate School

_____
Date

Petrologic Analysis of Surficial Sediments, Gray's Reef National Marine Sanctuary, Georgia Continental Shelf, U. S. A.

By

Debia Hershelle Fine McCulloch
B.A., Emory University, 1979

Adviser: Pamela J. W. Gore, Ph.D.

An Abstract of
A Thesis submitted to the Faculty of the Graduate School
of Emory University in partial fulfillment
of the requirements for the degree of
Master of Science

Geology Department

1987

ABSTRACT

Gray's Reef National Marine Sanctuary is a 17 square nautical mile (59.76 square km) area of modern patch reefs or "live-bottoms". It is located approximately 18 nautical miles (33.75 km) east of Sapelo Island, Georgia, on the inner continental shelf.

The surficial sediment is a mixed carbonate-siliciclastic sand, composed primarily of quartz grains and shell fragments, including mollusks, bryozoans, echinoderm spines, corals and barnacles, with smaller amounts of phosphate, feldspar, and other silicate-mineral grains. The average mean-grain-size of the grab samples is 1.21ϕ, medium sand, and mean-grain-sizes range from 0.34ϕ to 2.08ϕ, coarse to fine sand. Sorting is moderately to poorly sorted, and most samples are coarsely skewed and mesokurtic to leptokurtic.

Based on data analysis, general areas of live-bottom growth and areas of barren sand and shell debris can be identified. However, the cluster analysis does not unequivocably define reef and non-reef facies.

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INTRODUCTION

Statement of Problem and Purpose of Study

The purposes of this study are (1) to analyze and describe sediments in Gray's Reef National Marine Sanctuary, a modern, mixed carbonate-siliciclastic environment that laterally changes from a carbonate-dominated area to a terrigenous-dominated area with distance from limestone, live-bottom outcrops, and (2) to determine whether or not distinct reef and non-reef facies are present in the study area. This research project is important because it will examine a modern sedimentary environment and may aid in hardground site location.

Setting and Location of Study Area

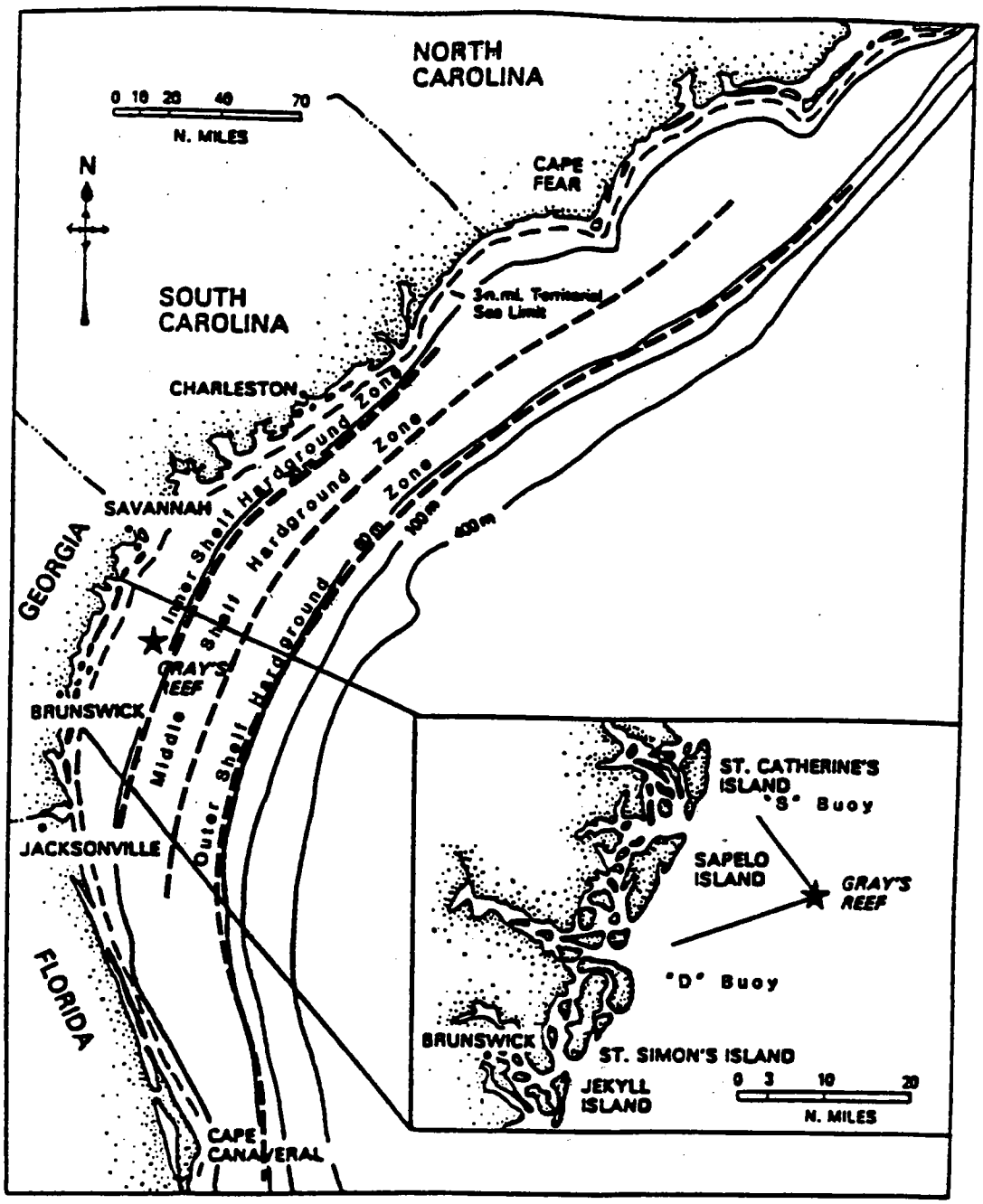
Gray's Reef National Marine Sanctuary is approximately 18 nautical miles (33.75 km) due east of Sapelo Island, Georgia, in the inner shelf hardground zone (Figure 1). Gray's Reef National Marine Sanctuary is approximately 17 square nautical miles (59.76 square km) in area and lies in water which is 48 to 72 ft (14.5 to 21.8 m) deep (Plate 1). Local bottom relief generally ranges from 0.5 to 3.96 ft (0.15 to 1.2 m) but relief can reach 19.8 ft (6 m) in Gray's Reef National Marine Sanctuary, a range of relief which is usually encountered in deeper water locations (Office of Coastal Zone Management, 1980).

Gray's Reef National Marine Sanctuary is an area containing "live-bottom reefs". Hunt (1974, p. 1) defined live-bottom reef as

Figure 1. Gray's Reef National Marine Sanctuary location map (from Henry, 1985).

"S" Buoy: Sapelo Whistle

"D" Buoy: Doboy Seabuoy


NORTH CAROLINA
0 10 20 40 70
N. MILES
N
CAPE FEAR
SOUTH CAROLINA
3 n.mi. Territorial Sea Limit
CHARLESTON
Inner Shell Hardground Zone
Middle Shell Hardground Zone
Outer Shell Hardground Zone
100m
400m
SAVANNAH
GEORGIA
GRAY'S REEF
BRUNSWICK
JACKSONVILLE
FLORIDA
CAPE CANAVERAL
ST. CATHERINE'S ISLAND
"S" Buoy
SAPELO ISLAND
GRAY'S REEF
"D" Buoy
BRUNSWICK
ST. SIMON'S ISLAND
JEKYLL ISLAND
0 3 10 20
N. MILES

p. 723). Since the last rise in sea level, the inner continental shelf has been covered with a layer of Holocene sediments of fluvial origin (Emery, 1965, p. 5). Holocene sediment is confined to this narrow, near shore, inner shelf which is generally shallower than 66 ft (20 m) (Emery, 1965, p. 5, 8). The middle and outer continental shelf are covered by a thin layer of relict sediments deposited approximately 7,000 years ago (Curray, 1965, p. 724) at the end of the last glacial epoch (Emery, 1965, p. 5) (Figure 2). The "... latest sea level transgression ... [began] ... approximately 18,000 years ago," (Office of Coastal Zone Management, 1980, p. 55). studies by Pilkey et al. (1981, p. 61) indicate that "... post-lower Pleistocene sediment ... averages less than 5 meters [16.5 ft]" thick and that the molluscan assemblages are of late Pleistocene or Holocene age. The lack of an older Pleistocene fauna indicates a reworking of the sediment cover with each marine transgression and extensive dissolution of most of the carbonate fraction with each marine regression (Pilkey et al., 1981, p. 61). Over the continental shelf, modern carbonate material is mixed with the relict sand fraction.

From studies of the COST GE-1 well, drilled offshore southeast of the south Georgia coast (Valentine, 1979, p. 5), and several other wells drilled into the coastal plain and continental shelf, the stratigraphy and structure of the Southeast Georgia Embayment beneath the continental shelf have been extrapolated (Figure 3). In general, the stratigraphic sequence contains Jurassic through Pleistocene

Figure 2. Types of surface sediments on the continental shelf (from Emery, 1965).

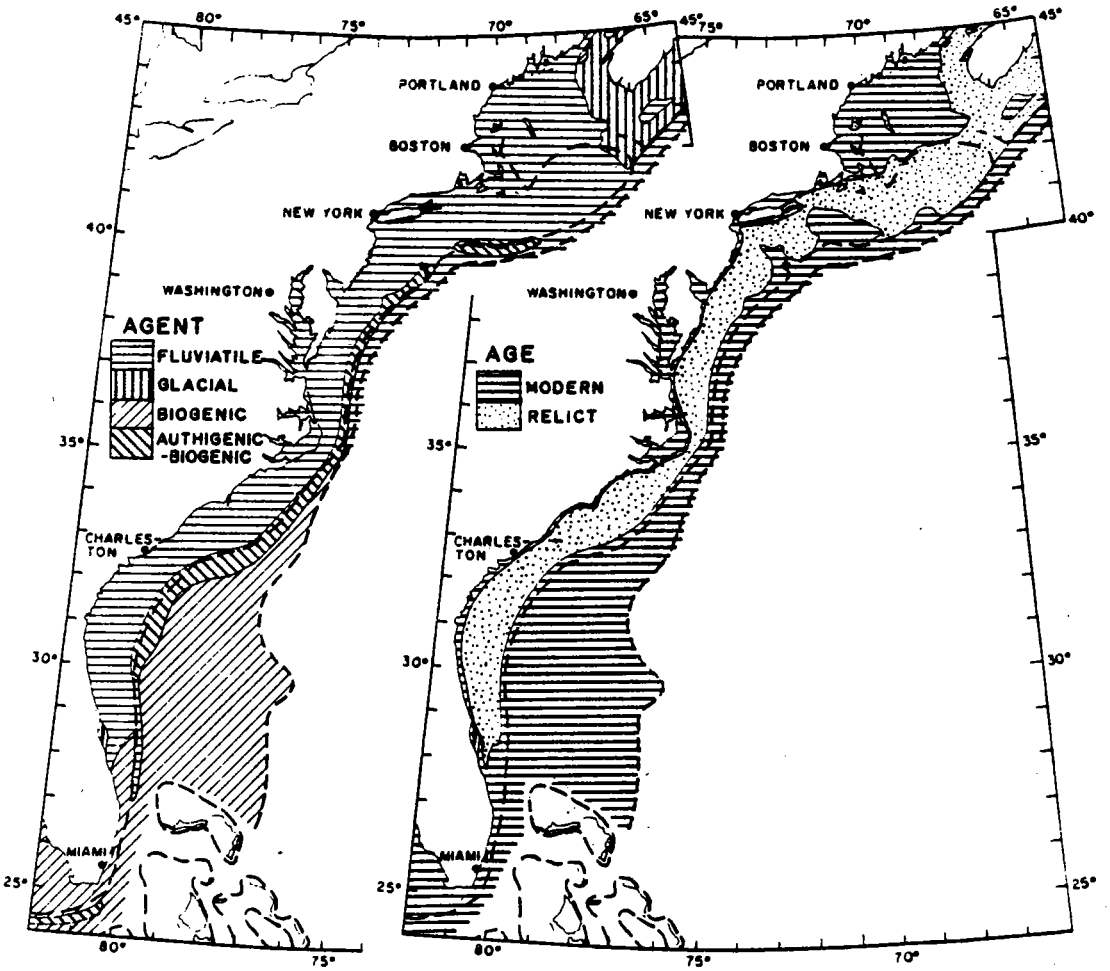
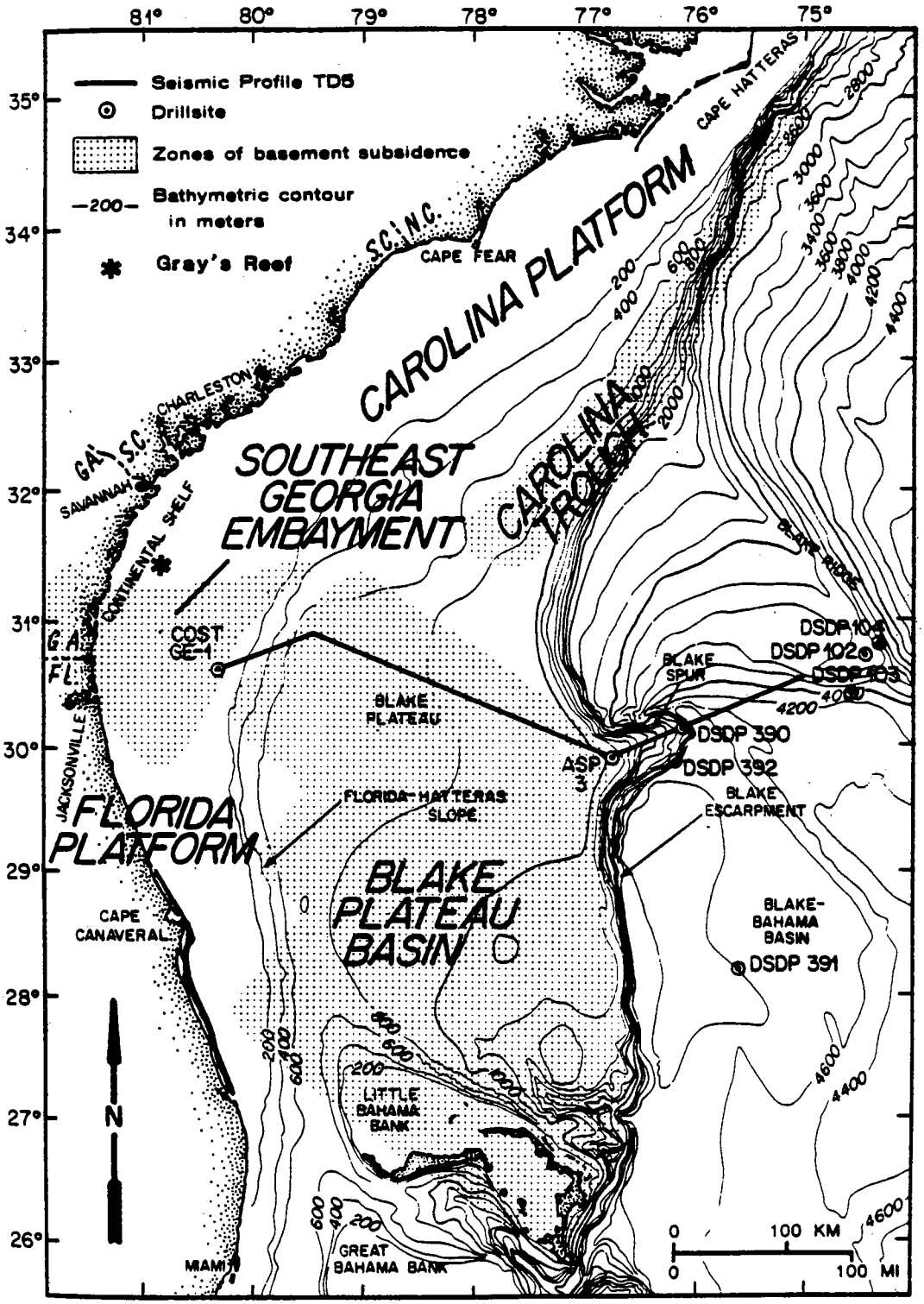

AGENT
FLUVIATILE
GLACIAL
BIOGENIC
AUTHIGENIC -BIOGENIC
AGE
MODERN
RELICT
PORTLAND
BOSTON
NEW YORK
WASHINGTON
CHARLESTON
MIAMI
45°
40°
35°
30°
25°
80°
75°
70°
65°

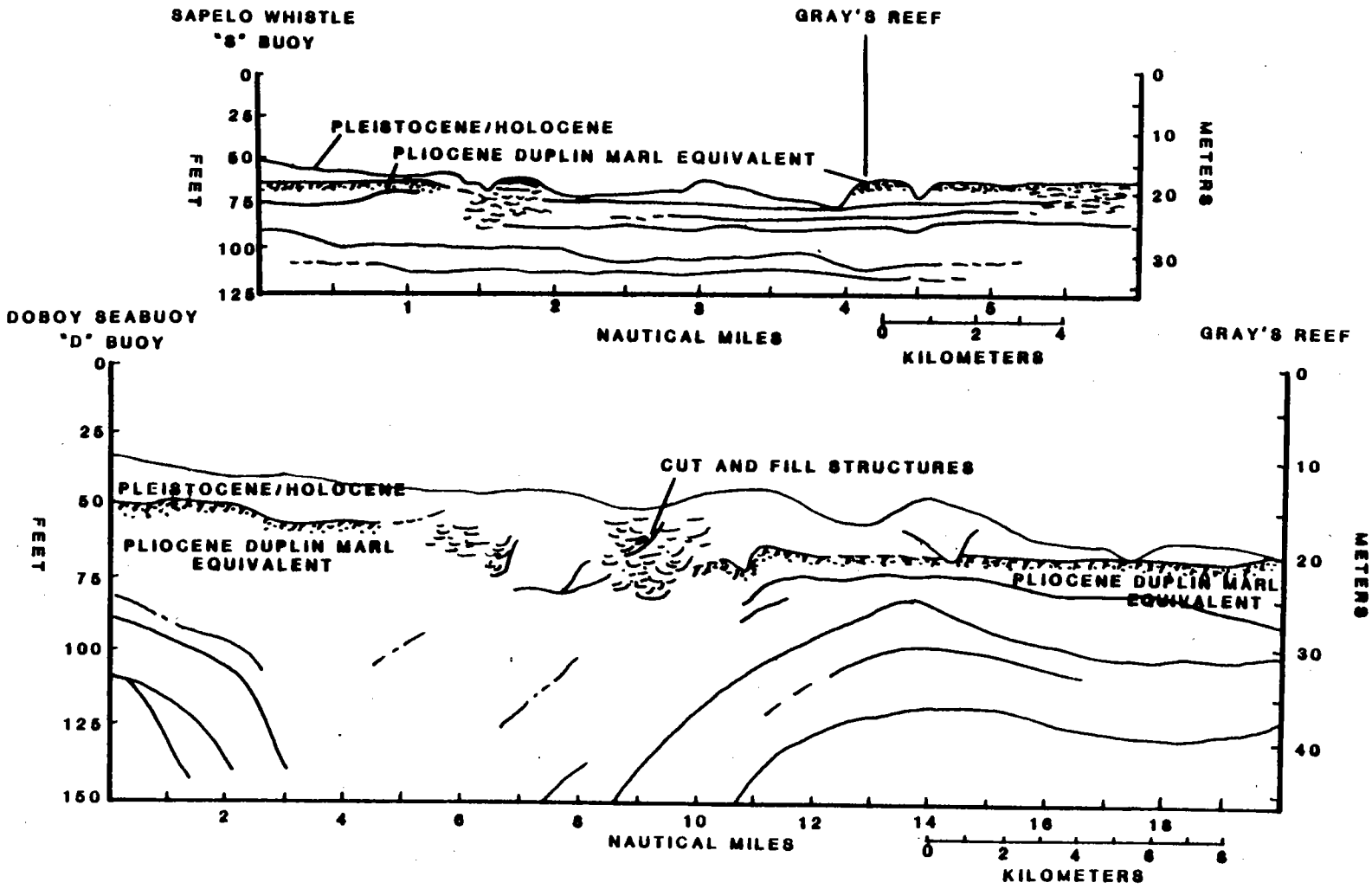
Figure 3. Map of the continental margin showing localites of wells, USGS seismic line TD-5, and bathymetric and structural features related to the Southeast Georgia Embayment (from Dillon et al., 1979).


81°
80°
79°
78°
77°
76°
75°
35°
34°
33°
32°
31°
30°
29°
28°
27°
26°
Seismic Profile TD5
Drillsite
Zones of basement subsidence
—200— Bathymetric contour in meters
Gray's Reef
CAROLINA PLATFORM
SOUTHEAST GEORGIA EMBAYMENT
CAROLINA TROUGH
FLORIDA PLATFORM
BLAKE PLATEAU BASIN
BLAKE PLATEAU
FLORIDA-HATTERAS SLOPE
BLAKE ESCARPMENT
BLAKE SPUR
BLAKE-BAHAMA BASIN
LITTLE BAHAMA BANK
GREAT BAHAMA BANK
CAPE HATTERAS
CAPE FEAR
CAPE CANAVERAL
CHARLESTON
SAVANNAH
JACKSONVILLE
MIAMI
S.C.
N.C.
GA.
FL.
CONTINENTAL SHELF
COST GE-1
DSDP 102
DSDP 390
DSDP 392
DSDP 391
ASP 3
N
0 100 KM
0 100 MI

sedimentary rocks. The COST GE-1 well penetrates Tertiary, Upper Cretaceous, Lower Cretaceous, and Paleozoic rocks (Scholle, 1979, p. 1). However, Hunt (1974, p. 46-50) pointed out that the stratigraphy of the Southeast Georgia Embayment is complex. The basement of the continental shelf is faulted and of pre-Cretaceous age, possibly Jurassic, and may be underlain by Paleozoic and Precambrian rocks at depth. Wells drilled into the exposed coastal plain near the coast in Glynn and Camden Counties, Georgia, bottom in unmetamorphosed Paleozoic sedimentary, volcanic, and plutonic rocks (Chowns and Williams, 1983, p. L9-L11). It is uncertain whether or not the Precambrian rocks exposed in the Piedmont extend in the subsurface to the continental margin. The pre-Cretaceous basement is overlain by a Lower Cretaceous non-marine to shallow-marine transgressive sequence; locally, older sedimentary rocks may be deposited in the fault basins of the basement. The Lower Cretaceous rocks are overlain by an Upper Cretaceous and Cenozoic sequence representing "... the distal portion of a thick carbonate-shelf wedge" (Valentine, 1979, p. 10-11).

The substrate at Gray's Reef is a "... moderately to strongly dolomitized, sandy biomicrite ..." (Hunt, 1974, p. 49) which is heavily encrusted by epibenthic organisms including barnacles, hard and soft coral, calcareous algae, and sponges (Hunt, 1974, p. 50). The reef rock is postulated to be the Pliocene Duplin Marl equivalent as indicated by rock samples, core samples, and seismic profiles between Doboy Sound and Gray's Reef (Hunt, 1974, p. 47; Vernon J. Henry,

Figure 4. Stratigraphic cross-sections from Gray's Reef area to the Georgia coast at Sapelo Island as interpreted from UNIBOOM profiles (from Hunt, 1974).


SAPELO WHISTLE
"S" BUOY
GRAY'S REEF
PLEISTOCENE/HOLOCENE
PLIOCENE DUPLIN MARL EQUIVALENT
FEET
METERS
NAUTICAL MILES
KILOMETERS
DOBOY SEABUOY
"D" BUOY
GRAY'S REEF
CUT AND FILL STRUCTURES
PLEISTOCENE/HOLOCENE
PLIOCENE DUPLIN MARL EQUIVALENT
PLIOCENE DUPLIN MARL EQUIVALENT
FEET
METERS
NAUTICAL MILES
KILOMETERS

Fursich analyzed many Jurassic hardgrounds in his study of their genesis, environments, and ecology; five of these hardgrounds are:

(1) Shell-cum-pebble bed, Upper Oxfordian, Cothill Quarry, Berkshire, England. It is a submarine hardground from a shallow, open, shelf environment. The lithology is an oosparite/sandy biomicrite (Fursich, 1979, p. 7).

(2) Oolithenbank, Hettangian, near Wutach region, Baden-Wurtemburg, Germany. It is a hiatus concretion from an offshore, shallow shelf. The lithology is an argillaceous micrite.

(3) Kuperfels, Hettangian, southwestern Baden-Wurtemburg, Germany. It is a hiatus concretion from an offshore, shallow shelf. The lithology is an argillaceous micrite.

(4) Amaltheenton, Upper Pliensbachian, fields northwest of Fechheim, Unterfranken, Germany. It is a hiatus concretion from an offshore, low-energy shelf. The lithology is a silty, argillaceous micrite.

(5) Ataxioceratenschichten, Kimmeridgian, quarry near Maierhof, SSE Vilshofen, Niederbayern, Germany. It is a hiatus concretion from an offshore, low-energy shelf. The lithology is a micrite (Fursich, 1979, p. 8).

The fauna of Jurassic hardgrounds are similar to that of Gray's Reef at the phylum level. Jurassic hardground fauna consist of foraminifera, sponges, bryozoa, brachiopods, bivalves, crinoids, and polychaetes. Additionally, stromatolite crusts, a solitary coral,

and an acrothoracic borer are associated with Jurassic hiatus concretions (Fursich, 1979, p. 30-32). Jurassic hardgrounds are characterized by large faunal diversity which depended on the environment, hardground morphology, and the hardground ecology (Fursich, 1979, p. 38-39).

Menzies et al. (1966, p. 393-431) described a submerged Pleistocene, lithothamnion algal "reef-like topographic structure" located off the North Carolina coast immediately below the continental shelf-slope break. The North Carolina reef and Gray's Reef are similar in that they both formed on a hard substrate and have similar living fauna; however, the substrate lithologies differ, the North Carolina reef is not on the continental shelf, and the North Carolina reef is in the deeper, warm water of the Florida Current.

Previous Work - Georgia Continental Shelf

Several studies of the continental shelf of the eastern United States which characterize its geographical and geological aspects have been done. Curray (1965, p. 723) described the general morphology of continental shelves. Continental shelves slope gently seaward to an increase in slope at approximately 130 m deep at the shelf break (Curray, 1965, p. 723). The morphology of continental shelves is not in equilibrium with present environmental conditions; the topography of the shelf and upper slope is relict, a product of erosion and alluvial deposition during sea level fluctuations of the Quaternary (Curray, 1965, p. 726). Curray (1965, p. 730) and Emery

(1965, p. 3) described the topography of the southern section of the continental shelf from Cape Hatteras, North Carolina to peninsular Florida. Most of the southeastern United States continental-shelf surface is covered with relict nearshore sands showing low topography suggestive of shoreline features (Curray, 1965, p. 730); a series of "beach-ridges" occur at elevations higher and lower than present sea level. Terraces on the coastal plain and continental shelf represent high interglacial and low glacial sea-level stands (Emery, 1965, p. 3). Dillon et al. (1979, p. 4-6) described the regional geologic and bathymetric features of the Florida-Hatteras shelf. The major features are the Blake Plateau, a wide surface separating the shelf from "abyssal depths"; the Florida-Hatteras Slope, a gently sloping surface between the shelf and Blake Plateau; and three main regions of basement subsidence: the Blake Plateau Basin, Carolina Trough, and Southeast Georgia Embayment (Dillon et al., 1979, p. 4). The Final Environmental Impact Statement on the Proposed Gray's Reef Marine Sanctuary (Office of Coastal Zone Management, 1980) found that the shelf width varies from "... 1.6 nmi (3 km) off the Florida Keys ... to 64.8 nmi (130 km) off Georgia," and shelf-to-slope-break depths are between "... 33 ft (10 m) off the Florida Keys ... and 396 to 528 ft (120 to 160 m) off Cape Hatteras" (Office of Coastal Zone Management, 1980, p. 48).

The geological history of the United States continental shelves was discussed by Curray (1965, p. 723-725). The United States Geological Survey's Geological Studies of the COST GE-1 Well

in in the 1960's (Hunt, 1974, p. 3). The Final Environmental Impact Statement on the Proposed Gray's Reef National Marine Sanctuary (Office of Coastal Zone Management, 1980) described the environmental setting, geological, physical and chemical oceanographic features, and living marine resources of the area. The Draft Final Report - Results of Gray's Reef National Marine Sanctuary Hydrographic and Geophysical Survey (Henry, 1985) described the results of a detailed investigation of the hydrology and geophysics of the area. These studies helped to define benthic habitats within the sanctuary. The geology of Gray's Reef has been studied by Hunt (1974). In his thesis, Hunt petrologically analyzed the Gray's Reef substrate and described its geological setting. In general, the substrate consists of a "... moderately to strongly dolomitized, sandy biomicrite ..." (Hunt, 1974, p. 49) heavily encrusted by epibenthic organisms.

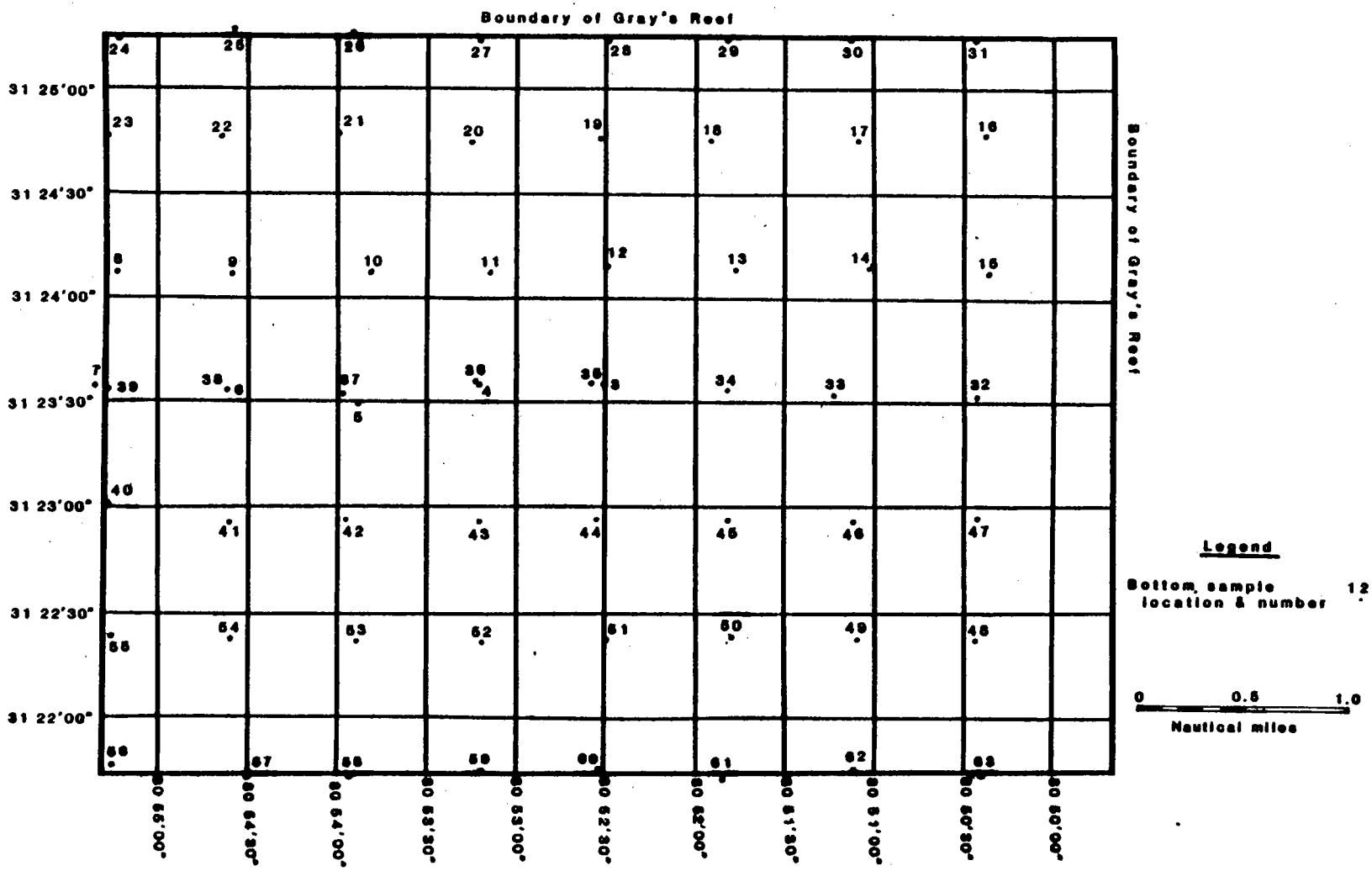
PROCEDURES FOR DATA ACQUISITION

Field Methods

Fifty-eight grab samples of unconsolidated bottom sediment were collected in 1983 during a hydrographic and sidescan sonar survey of the sanctuary by the National Oceanic and Atmospheric Administration research vessel "Whiting". Samples were obtained using a Shipek sediment grab-sampler (Henry, 1985, p. 8). The sampling plan was a rectangular grid, and samples were taken at approximately one nmi intervals. The latitude and longitude of each sample site were recorded at the time of collection and plotted on a map (Appendix I) (Figure 5).

The sediment-sample set was provided by Dr. Vernon J. Henry in the autumn of 1983 as part of a National Oceanic and Atmospheric Administration study of Gray's Reef National Marine Sanctuary; a sample numbering scheme had been assigned at the time of sample collection (Appendix I). Although some samples were not numbered consecutively when the sediment-sample set was received, the original numbering sequence was maintained for cross-referencing between this thesis and other reports using data from this sample set. The missing sample numbers are: .1, 2, 4, 6, and 8. Replicate samples were collected for most sites.

Figure 5. Sample location map.


Boundary of Gray's Reef
31 25'00"
31 24'30"
31 24'00"
31 23'30"
31 23'00"
31 22'30"
31 22'00"
80 55'00"
80 54'30"
80 54'00"
80 53'30"
80 53'00"
80 52'30"
80 52'00"
80 51'30"
80 51'00"
80 50'30"
80 50'00"
Boundary of Gray's Reef
Legend
Bottom sample location & number 12
0 0.5 1.0
Nautical miles

Laboratory Methods

Sediment samples were processed by taking a representative subsample, removing soluble salts, and drying in preparation for sieving. Samples were split using the method of Ingram (1971, p. 52), coning and quartering, to obtain an approximate sample weight of 50 g. Each subsample was placed in a beaker with 200 ml of distilled water, mixed well, and allowed to stand undisturbed overnight. The water was then removed by pipette from each subsample taking care to save all clays (Henry, 1984, personal communication). Once the soluble salts were removed, the split subsamples were dried in an oven at 40°C and allowed to reach equilibrium with the moisture in the room, requiring about one hour before sieving (Ingram, 1971, p. 59).

The subsamples were dry sieved using a Ro-tap into one-phi fractions over the interval from 4ϕ to -2ϕ (.063 mm to 4 mm) as follows. The dried subsample was weighed and poured into the stack of sieves. The sieves were placed on a Ro-tap, and the apparatus was turned on for ten minutes. The contents in each sieve were weighed on a triple-beam balance, and the weights were recorded to the nearest 0.01 g $\pm$ 0.005 g.

Carbonates were removed from each of the sieved subsamples by dissolution in HCl in order to determine the mass and size distributions of the carbonates in the sand samples prior to dissolution. Each size fraction was placed in a 250 ml beaker with 25 ml distilled water. Ten percent HCl was added to each of these beakers until effervescence stopped. The beakers were heated on a hot plate to

80-90°C, and HCl was added until effervescence stopped. The pH of each solution was checked with litmus paper to be sure dissolution of the carbonates was complete (pH ≤ 7).

Once all carbonate material was dissolved from the sieved subsamples, the liquid was carefully decanted, and the remaining sediment was washed. Washing was done by adding distilled water to the beakers, stirring, letting the sediment settle, and decanting the liquid. This procedure was repeated until no dissolved calcium ions were present in the solution. Calcium-ion presence was tested by

> "... making a small amount of the liquid in a test tube alkaline to litmus paper with ammonium oxalate. A white precipitate of calcium oxalate ... [formed] ... if much calcium ... [was] ... present"

(Ingram, 1971, p. 56).

After washing, the insoluble residues of the sample were dried in an oven at 40°C, and then allowed to equilibrate with the ambient room conditions. Each size fraction was weighed on a triple-beam balance, as before. The removal of carbonates allowed the determination of the mass and the size distributions of the insoluble residues and indirectly the mass of the carbonate fractions.

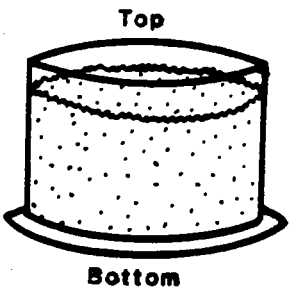
The determination of the size distribution of sediments by sieving is well documented by Muller (1967, p. 33-40), Ingram (1971), Folk (1980, p. 16-22, 31-36), and Briggs (1981, p. 60-78). Ginsburg (1956, p. 2411, 2423-2426) discussed methods for determining the size distribution of carbonate sediments. Tyler (1934, p. 3-11) and Pilkey (1964, p. 122) described procedures for analyzing the size distrib-

utions for the total sample, carbonate fraction, and insoluble residues in mixed carbonate-siliciclastic sediments.

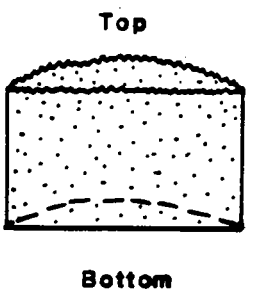
Thin sections of grains were prepared for constituent-particle identification. Thin sections were made from dry, unsieved samples, free of soluble salts, which had been split and imbedded in epoxy. Because the samples consisted of unconsolidated sands, it was necessary to imbed the sand in epoxy; Buehler's Epo-Kwick Resin and Hardener were found to be satisfactory. Using Buehler's plastic Sample-Kups with their Release Agent applied in a thin coat, a split sample was placed in the Sample-Kup to approximately three-fourths full. The epoxy was mixed according to directions and poured into the Sample-Kup. The epoxy-sand mixture was stirred thoroughly and allowed to cure at room temperature overnight. The epoxy-sand casts were removed from the Sample-Kups, and blanks were cut by sawing through the cylinder lengthwise (Figure 6).

Thin sections were prepared by grinding the blanks, cementing the blanks to petrographic slides, and reducing the thickness of the epoxy-sand blanks to 30 microns. Using 400 grit, the cut surface of each blank was ground on a lap until smooth and planar. Each chip was mounted to a petrographic slide using Hillquist Thin Section Epoxy, parts A and B. Most slides were cured on a hot plate at 80°C for 30 minutes. This procedure for curing was found to be unsatisfactory because, upon cooling, the Buehler epoxy contracted more than the glass slide, resulting in a slightly warped slide. Once this phenomenon was observed, remaining samples were cured overnight at

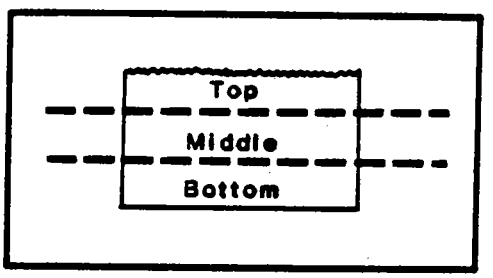
Figure 6. Schematic illustration of grain thin-section subdivisions for grain counting.



Sample-Kup with epoxy-sand cast



Sawed blank of epoxy-sand cast



Grain thin-section showing
top, middle, and bottom
subdivisions for grain counting

room temperature. The blanks were reduced to 30 microns in thickness by sawing and grinding on an Ingram thin-section saw and diamond lap.

Uncovered thin sections were stained for calcite, ferroan calcite, and ferroan dolomite following Dickson's method in Hutchison (1974, p. 25). The thin sections were etched with 1.5 percent HCl for 10 to 15 seconds. After etching, the thin sections were stained in an acid solution of Alizarin red S (ARS) and potassium ferricyanide (PF) for 30 to 45 seconds. The acid solution was made by dissolving 0.2 g ARS in 100 ml of 1.5 percent HCl and by dissolving 2.0 g PF in another 100 ml of 1.5 percent HCl. These two solutions were mixed in the ratio ARS solution to PF solution 3:2. After immersing the slides in this ARS+PF solution, the slides were rinsed with distilled water and further stained in an ARS solution, as prepared above, for 10 to 15 seconds. The slides were then rinsed and quickly dried on bibulous paper. Distilled water was used in preparing all solutions.

Upon staining with the ARS+PF solution, calcite is pink to red; ferroan calcite is pink, red, pale blue or dark blue; and ferroan dolomite is deep turquoise. Dolomite does not stain. Further staining with ARS solution results in calcite and ferroan calcite becoming darker red.

After drying, the stained thin sections were covered with Hillquist Thin Section Epoxy, parts C and D, and with glass cover slips and cured overnight at room temperature. The addition of the epoxy to the thin sections gave the thin section a purple cast to the

unaided eye; however, this coloration does not interfere with the results of staining when viewed under a petrographic microscope.

Grain counts were conducted following the line method proposed by Galehouse (1971, p.392-394).

> "The result of the line method is a 'number frequency' ... that simply shows how often particular species were encountered during the count. The number frequency is related to, but distinctly different from the ... [area or volume percent (modal analysis)] ... or the number percent. The number frequency is larger than the number percent for larger grains and smaller than the number percent for smaller grains. Because of ... [the built-in bias of number frequencies,] ... number frequencies cannot be treated statistically in the same manner as number or area percents ...."

Modifications were recommended by William B. Size (Emory University, personal communication, 1984) and incorporated into the grain-counting procedure to allow the testing of homogeneity for each thin section. Each thin section was considered to consist of three parts: top, middle, and bottom to correspond physically with the direction in which the epoxy and sand-casts were made (Figure 6). Within each part of the thin section, traverses were made using a Zeiss polarizing light microscope with a Swift automatic point-counter, and every grain which intersected the line of traverse was counted. Spacing of traverses was determined by the maximum grain size in each section (to avoid counting any grain more than once) and by the distance needed to cover maximum area of the section. Within any part of the thin section (top, middle or bottom), the spacing of traverses was kept constant; however, the spacing of traverses between parts of the thin section was variable. The spacing in each part of the thin

section was equal to the largest grain diameter in that section measured in a direction perpendicular to the direction of traverse.

The grain-count totals for each thin section are 100 grains in each part for a total of 300 grains per slide. The resulting grain counts yield a number frequency for each grain type in a slide (Galehouse, 1971, p. 388). The grain types identified and counted are: quartz, shell fragments, phosphate grains, microcline, plagioclase, orthoclase, hornblende, staurolite, opaque minerals, micas, calcite, rock fragments, glauconite, and unidentifiable siliciclastics.

For counting grains in thin section, Galehouse (1971), described several methods including the Fleet, ribbon or area, and line methods. Galehouse (1969, p. 812-81; 1971) discussed the interpretation and limitations of the results derived by these three methods.

PROCEDURES FOR DATA ANALYSIS

Grain-Size Analysis - Frequency Distribution Statistics

Grain-size data were obtained by sieving. Folk's (1980, p. 41-50) technique was used in analyzing the grain-size data. A FORTRAN library computer program, Folk57 (Thames, 1981) was used to compute statistics. The statistics used in this grain-size analysis are: graphic mean, inclusive graphic standard deviation, inclusive graphic skewness, and graphic kurtosis (Folk, 1980, p. 41-45).

Folk's (1980, p. 41) graphic mean, Mz, is a measure of average grain size and "... will be the standard measure of size used" (Table 1). The values are read directly from a cumulative weight-percent curve of grain size on probability paper, at cumulative percentiles 16%, 50%, and 84%. This method of determining the mean is based on three points and encompasses 68% of the distribution, or plus or minus one standard deviation. Folk (1980, p. 41) described his graphic mean as corresponding "... very closely to the mean as computed by the method of moments, yet easier to find". The graphic mean of Inman uses only two points (ϕ16 and ϕ84) and "... is not satisfactory in skewed curves" (Folk, 1980, p. 41).

Standard deviation is a measure of uniformity or sorting and can be used to test populations. Folk's (1980, p. 42) inclusive graphic standard deviation, σ1, "... is the best overall measure of sorting" (Table 1) and incorporates 90% of the grain-size distribution. Values for ϕ84, ϕ16, ϕ95, and ϕ5 are read directly from a cumulative frequency curve of the grain size, plotted on probability paper.

Table 1
Statistical Equations of Folk (1980).

Graphic mean (Mz)

$$Mz = (\phi 16+\phi 50+\phi 84)/3$$

Inclusive graphic standard deviation ($\sigma 1$)

$$\sigma 1 = (\phi 84-\phi 16)/4 + (\phi 95-\phi 5)/6.6$$

Inclusive graphic skewness (Sk1)

$$Sk1 = [(\phi 16+\phi 84-2\phi 50)/2(\phi 84-\phi 16)]+[(\phi 5+\phi 95-2\phi 50)/2(\phi 95-\phi 5)]$$

Graphic kurtosis (KG)

$$KG = (\phi 95-\phi 5)/2.44(\phi 75-\phi 25)$$

Normalized kurtosis (KG')

$$KG' = KG/(1+KG)$$

Inclusive graphic skewness and graphic kurtosis further describe the grain-size distributions. Skewness measures the amount and direction of asymmetry. Folk's (1980, p. 43) inclusive graphic skewness, Sk1, covers 90% of the distribution (Table 1). Positive Sk1 values have excess fine material; negative Sk1 values have excess coarse material; a zero Sk1 value indicates a symmetrical grain size distribution (Folk, 1980, p. 44).

"Kurtosis measures the ratio between average and extremes in grain size" (Henry, 1985, p. 32). For a grain-size frequency-distribution, kurtosis compares the sorting in the "tails" of the curve with the sorting in the central portion of the curve. Folk (1980, p. 44) suggested using graphic kurtosis, KG (Table 1). For normal curves KG=1.00; for leptokurtic curves KG>1.00; for platykurtic curves KG<1.00.

The computer program, Folk57, was used to compute grain-size data and the sedimentary statistics median (ϕ50), graphic mean, inclusive graphic standard deviation, inclusive graphic skewness, graphic kurtosis, and normalized kurtosis (KG/(1+KG)) for all samples (Appendix II). In addition to these statistics, output consists of a verbal classification of sorting, skewness, kurtosis, and the percentages of sand, silt, and clay. Folk57 outputs these values in table form (Appendix II). The program reads critical phi percentiles as slope values. Bar charts of weight percent versus phi are in Appendix III.

Cluster Analysis

Cluster analysis is a multivariate technique which is used to identify groups of similar data in large data sets. In the analysis, difference or similarity coefficients are used to produce a dendrogram, which represents hierarchical groupings of individuals or operational sedimentologic units (OSU's) such as samples or variables (Sneath and Sokal, 1973, p. 69). The dendrogram shows breaks between these groupings (Parks, 1964, p. 540).

For this study, cluster analysis was used as a tool in determining whether or not separate, distinct facies are present in the study area. Cluster analysis is preferred to factor analysis as a classification tool in this study because "... the research worker is at all times in close touch with... [the] ...original variables, and ... the clusters are more easily and simply interpreted" (Miller and Kahn, 1962, p. 295). Sneath and Sokal (1973) discussed different clustering methods and uses in detail. A Q-mode analysis was performed to cluster the samples into groupings; a SAS program was used to perform the cluster analysis (SAS, 1985, p. 259).

SAS (1985, p. 255-315) provided documentation and examples for its cluster-analysis computer-procedures. However, the documentation is not technically specific, and it does not provide the user with enough information to fully understand the manipulations of the raw data as the program forms clusters.

Sneath and Sokal (1973, p. 69, 114-285) gave a thorough explanation of cluster analysis. They included two-state (presence and

absence) and multi-state (quantitative and qualitative) characters in cluster analyses, similarity and distance coefficients, and clustering methods in their explanation. Massart and Kaufman (1983) interpreted chemical data with cluster analysis and included chemical examples. Parks (1964), Davis (1973), and Rao et al. (1986) discussed the application of cluster analysis to geologic problems.

To perform the cluster analysis, the SAS cluster procedure was used with the method, "average linkage", which is a sequential, agglomerative, hierarchic, nonoverlapping (SAHN) algorithm using squared Euclidean distances (SAS, 1985, p. 259). Sequential methods use iterative processes on a set of OSU's to join extant OSU's to clusters (Sneath and Sokal, 1973, p. 208). Agglomerative clustering groups OSU's into successively fewer and fewer clusters until one cluster is formed consisting of all OSU's (Sneath and Sokal, 1973, p. 202). Hierarchic methods group OSU's into successively higher ranking clusters (Sneath and Sokal, 1973, p. 206). Nonoverlapping algorithms are those in which an OSU in one cluster may not be a member of another cluster at the same rank (Sneath and Sokal, 1973, p. 207). This SAS program uses quantitative multi-state characters (see Appendix IV).

Of the SAHN clustering techniques available, the unweighted, pair-group method using arithmetic averages (UPGMA) was used. Unweighted clustering produces less distortion than does weighted clustering with respect to the original similarity or dissimilarity coefficient-matrix because unweighted clustering gives equal weight

C_K Kth cluster, subset of {1,2,...,n}

N_K number of observations in C_K

$\bar{X}$ sample mean vector

$\bar{X}_K$ mean vector for cluster C_K

/x/ Euclidean length of the vector x, that is, the square root of the sum of the elements of x

W_K $\sum_{i \in C_K} /x_i - \bar{X}_K/^2$

d(x,y) any distance or dissimilarity measure between observations or vectors $\bar{X}$ and $\bar{Y}$

D_{KL} any distance or dissimilarity measure between clusters C_K and C_L ."

The output includes:

1. Eigenvalues of the covariance matrix
2. Difference between successive eigenvalues
3. Proportion of variance explained by each eigenvalue
4. Cumulative proportion of variance explained
5. Root-mean-square for the standard deviation of the total sample
6. Root-mean-square distance between observations
7. Number of clusters
8. Names of the clusters joined
9. Frequency of new cluster
10. Normalized root-mean-square distance.

The SAS cluster procedure can produce a dendrogram to illustrate the clusters formed by "average linkage".

The SAS input data-set used in this cluster analysis is composed of 58 samples with 39 variables (Appendix IV); however, three samples have missing variable values due to the samples' being too small to collect all data on grain sizes and number frequencies. The SAS cluster procedure excludes samples with missing values from the analysis (SAS, 1985, p. 270).

DATA SUMMARIES

Most of the bottom samples from Gray's Reef National Marine Sanctuary are dominated by quartz, shell fragments, feldspar (orthoclase, microcline and plagioclase), and phosphate (Table 2) (Appendix V). Hornblende, staurolite, opaques, calcite or dolomite, micas, rock fragments, glauconite, and unidentified accessory minerals are also present (Table 2) (Appendix V). Quartz grains are the most abundant, averaging four times the amount of all other grains combined (174 to 270 counts per slide). Second in abundance are shell fragments. Coarse shell material consists primarily of mollusk shells and shell fragments, bryozoans, echinoderm spines, fragments of corals, barnacles, worm tubes, and sponges. The colors of the samples fall in the 10 Yellow Red, 2.5 Yellow and 5 Yellow hues; values are 5-7; chromas are 1-3 (Munsell, 1975).

The mean grain-diameter for the grab samples ranges from 0.34ϕ to 2.09ϕ with most samples falling in the medium and coarse sand sizes (Table 3). The abundance of silt and clay-size particles is very small and not adequate to make slides for x-ray diffraction analyses. The samples range from moderately to poorly sorted, with most samples being moderately sorted. Skewness ranges from strongly coarse-skewed to strongly fine-skewed with most samples being coarse-skewed to nearly symmetrical. Kurtosis ranges from platykurtic to very leptokurtic; most samples are mesokurtic.

Mean-grain-size of the carbonate fraction is predominantly coarse to medium sand (Table 4). The samples are almost entirely

Table 2
Summary of Number Frequency Data from Grain Counts of 56 Thin Sections with 300 Counts per Thin Section.

Grain Type	Range of counts	Mean number frequency
Quartz	174-270	246.5
Shell fragments	7-80	32.0
Phosphate	0-16	7.2
Orthoclase	0-12	4.7
Microcline	1-9	4.1
Plagioclase	0-3	0.5
Total feldspars	4-20	9.4
Hornblende	0-7	1.7
Opaques	0-5	0.8
Staurolite	0-2	0.6
Calcite or dolomite	0-3	0.2
Micas	0-2	0.1
Rock fragments	0-1	0.1
Accessory mineral	0-1	Trace
Glauconite	0-1	Trace

Table 3
Summary of Grain-Size Statistics for the
Grab Samples.

Grain size (Mz)

Coarse sand: 18 samples
Medium sand: 38 samples
Fine sand: 2 samples
Mz range: 0.34ϕ to 2.08ϕ

Sorting

Good: 0 samples
Moderately well sorted: 0 samples
Moderate: 35 samples
Poor: 23 samples
Very poor: 0 samples
Inclusive graphic standard deviation (σ1) range: 0.73 to 1.77

Skewness (Sk1)

Strongly coarse-skewed: 6 samples
Coarse-skewed: 35 samples
Nearly-symmetrical: 14 samples
Fine-skewed: 2 samples
Strongly fine-skewed: 1 sample
Sk1 range: -0.55 to 0.35

Kurtosis (KG)

Very platykurtic: 0 samples
Platykurtic: 3 samples
Mesokurtic: 32 samples
Leptokurtic: 20 samples
Very leptokurtic: 3 samples
KG range: 0.83 to 3.12

Table 4
Summary of Grain-Size Statistics for the
Carbonate Fraction of the Grab Samples.

Grain size (Mz)

Coarse sand: 40 samples
Medium sand: 15 samples
Fine sand: 0 samples
Mz range: 1.76ϕ to -0.36ϕ

Sorting

Good: 0 samples
Moderately well sorted: 0 samples
Moderate: 3 samples
Poor: 50 samples
Very poor: 2 samples
Inclusive graphic standard deviation (σ1) range: 0.78 to 2.11

Skewness (Sk1)

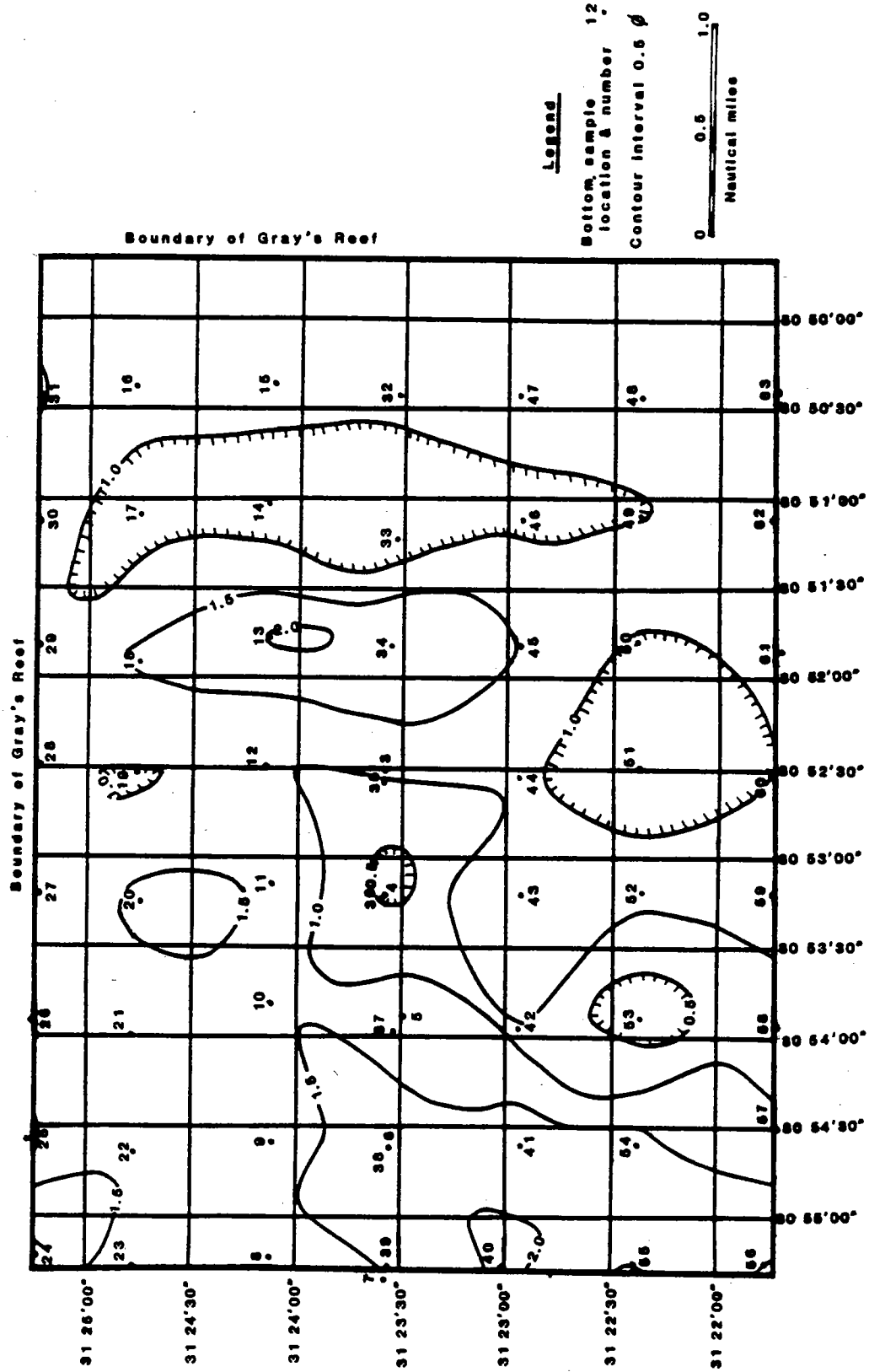
Strongly coarse-skewed: 17 samples
Coarse-skewed: 28 samples
Nearly-symmetrical: 10 samples
Fine-skewed: 0 samples
Strongly fine-skewed: 0 samples
Sk1 range: 0.00 to -0.61

Kurtosis (KG)

Very platykurtic: 4 samples
Platykurtic: 20 samples
Mesokurtic: 20 samples
Leptokurtic: 11 samples
Very leptokurtic: 0 samples
KG range: 0.50 to 1.42

poorly sorted and predominantly coarse-skewed to strongly coarse-skewed. Most samples are platykurtic to mesokurtic (Table 4).

Mean-grain-sizes of the insoluble-residue fraction fall in the medium to coarse sand range (Table 5). Samples are mainly moderately sorted, and skewness is coarse skewed to nearly symmetrical. Most samples are mesokurtic to leptokurtic (Table 5).


Legend
Bottom sample location & number
Contour interval 0.5 ϕ
0
0.5
1.0
Nautical miles
Boundary of Gray's Reef
Boundary of Gray's Reef
80 50'00"
80 50'30"
80 51'00"
80 51'30"
80 52'00"
80 52'30"
80 53'00"
80 53'30"
80 54'00"
80 54'30"
80 55'00"
31 26'00"
31 24'30"
31 24'00"
31 23'30"
31 23'00"
31 22'30"
31 22'00"

sand). From west to east these lobes of coarse sand trend to the northeast, north, and east, respectively. The majority of the finer sands lie in the western section of the study area, but two small lobes of fine sediment (less than 1.5ϕ, medium sand), occur in the central part of the study area. The two largest areas of sediment with mean grain-size greater than 1.5ϕ (medium to fine sand) tend to parallel the westernmost lobe of coarse sand and have a northeast trend (Figure 7).

Comparison of the mean-grain-size map for grab samples (Figure 7) with the reef-morphology map (Figure 10) and sonargram mosaic of Gray's Reef National Marine Sanctuary (Figure 11) illustrates that coarser samples were collected from areas of low- to moderate-relief live-bottom, and finer grained samples, consisting of sand and shell debris, were collected from areas which are barren of live-bottom fauna. These general patterns may be genetically related to the benthic organisms producing the bulk of coarse carbonate material. It is expected that the largest concentration of coarse debris produced by these organisms would remain near the site of deposition; however, bottom currents would distribute some shell debris over the ocean floor. The distribution of coarse material by bottom currents may account for the occurrence of coarse material away from centers of benthic growth. The occurrence of fine sand in areas of low- to moderate-relief live-bottoms also may be the result of bottom-current distribution, as well as of the patchy, discontinuous nature of live-bottoms (Figures 12, 13, 14, and 15).

Figure 10. Reef-morphology map.

Legend

L - indicates areas with low-relief live-bottom.

L-M - indicates areas with low- to moderate-relief live-bottom.

S-B - indicates areas of barren sand and shell debris.

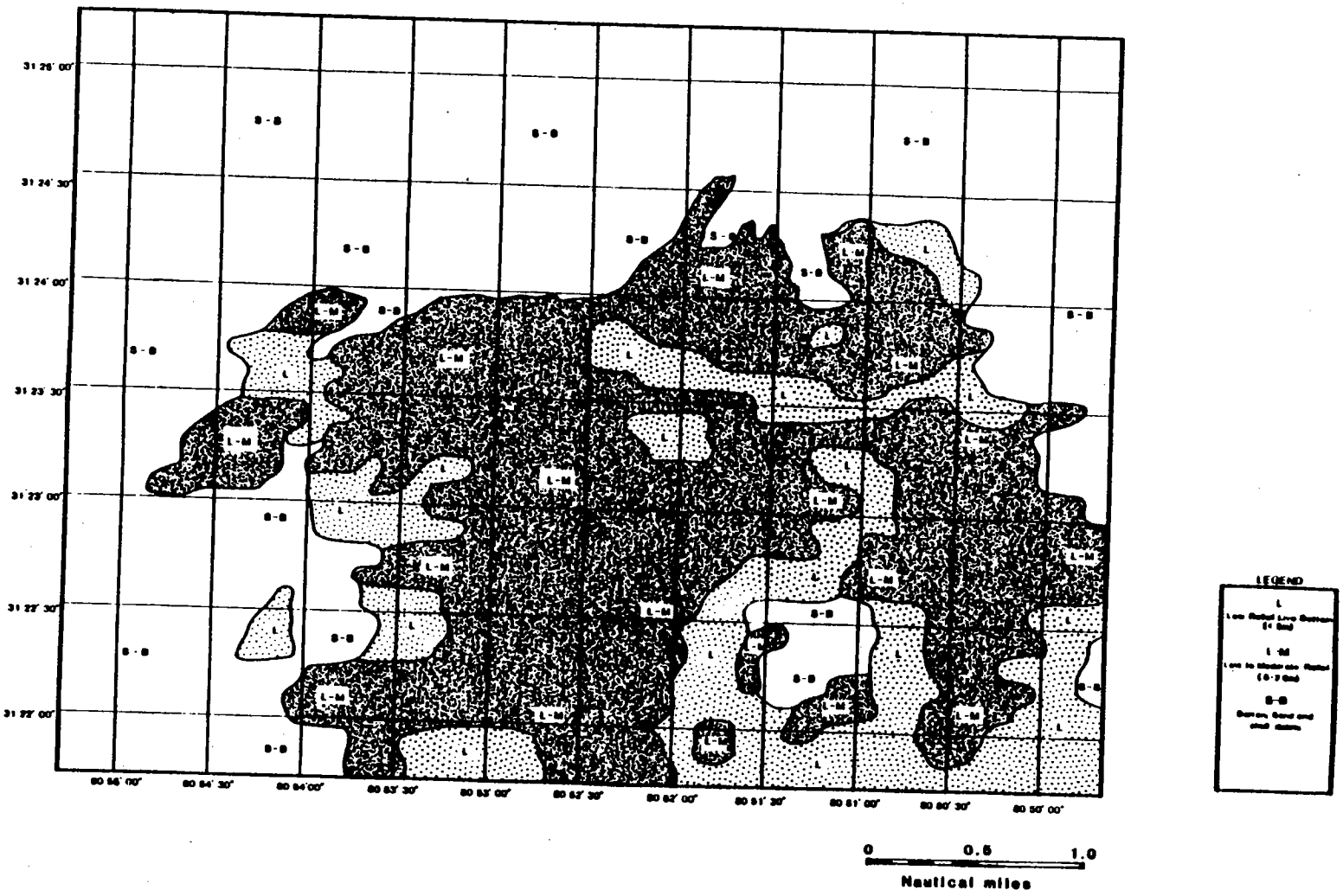

31 26' 00"
31 24' 30"
31 24' 00"
31 23' 30"
31 23' 00"
31 22' 30"
31 22' 00"
80 56' 00"
80 54' 30"
80 54' 00"
80 53' 30"
80 53' 00"
80 52' 30"
80 52' 00"
80 51' 30"
80 51' 00"
80 50' 30"
80 50' 00"
S - S
L
L - M
M
0
0.5
1.0
Nautical miles
LEGEND

Figure 11. Sonargram mosaic of Gray's Reef National Marine Sanctuary (from Henry, 1985).

Legend

Bounce-Dive stations
White circles - coarse sand and shell
Gray circles - sand
Dark circles - low- to high-density live-bottom

Towed-Diver transects (West, East, and West-East)
White tape - coarse sand and shell
Gray tape - sand
Striped tape - low-density live-bottom
Dark tape - moderate- to high-density live-bottom

Note: Density refers to a qualitative estimate of epibenthic biota present.


1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16/17
18
19
20
21
22
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24
25
26
27
28
29
30
31
32
33
LEG 1 EAST
LEG 3 WEST

Figure 12. High-density live-bottom developed on outcropping limestone (from Henry, 1985).

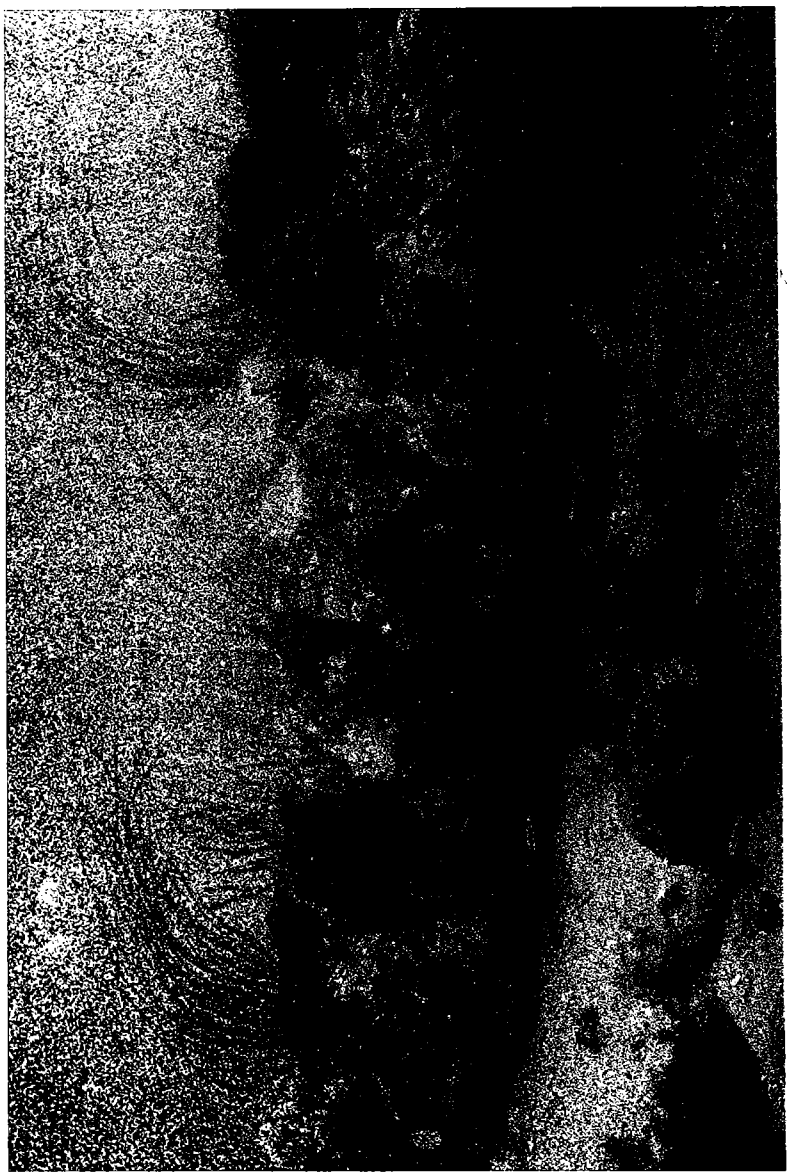
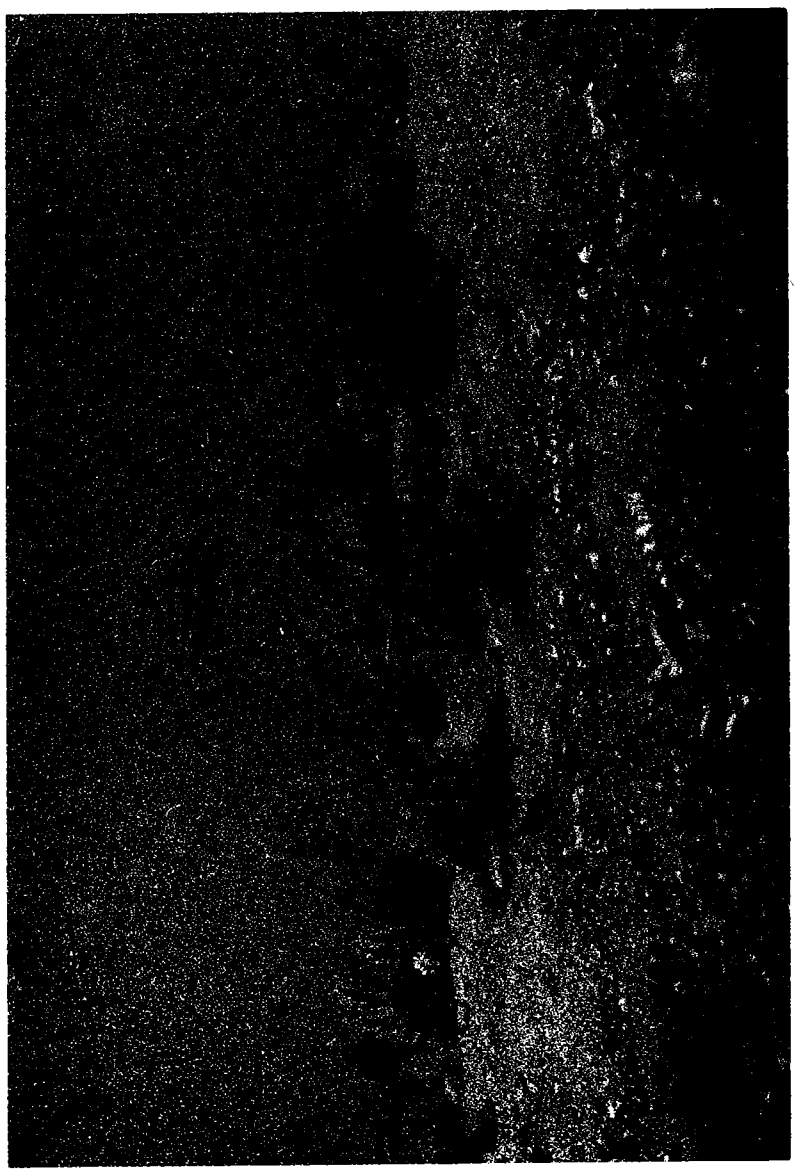


Figure 13. Moderate-density live-bottom developed on outcropping limestone (from Henry, 1985).

Figure 14. Low-density live-bottom developed on a hard substrate thinly covered by sand and reef debris (from Henry, 1985).



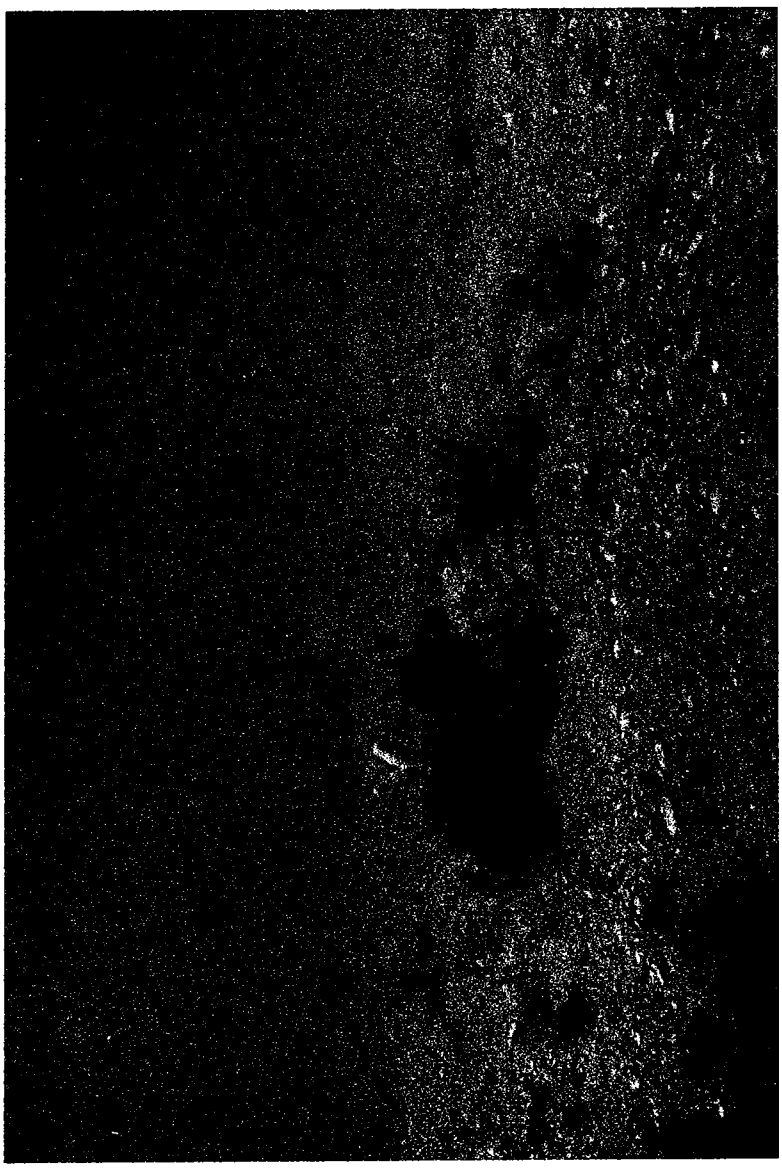
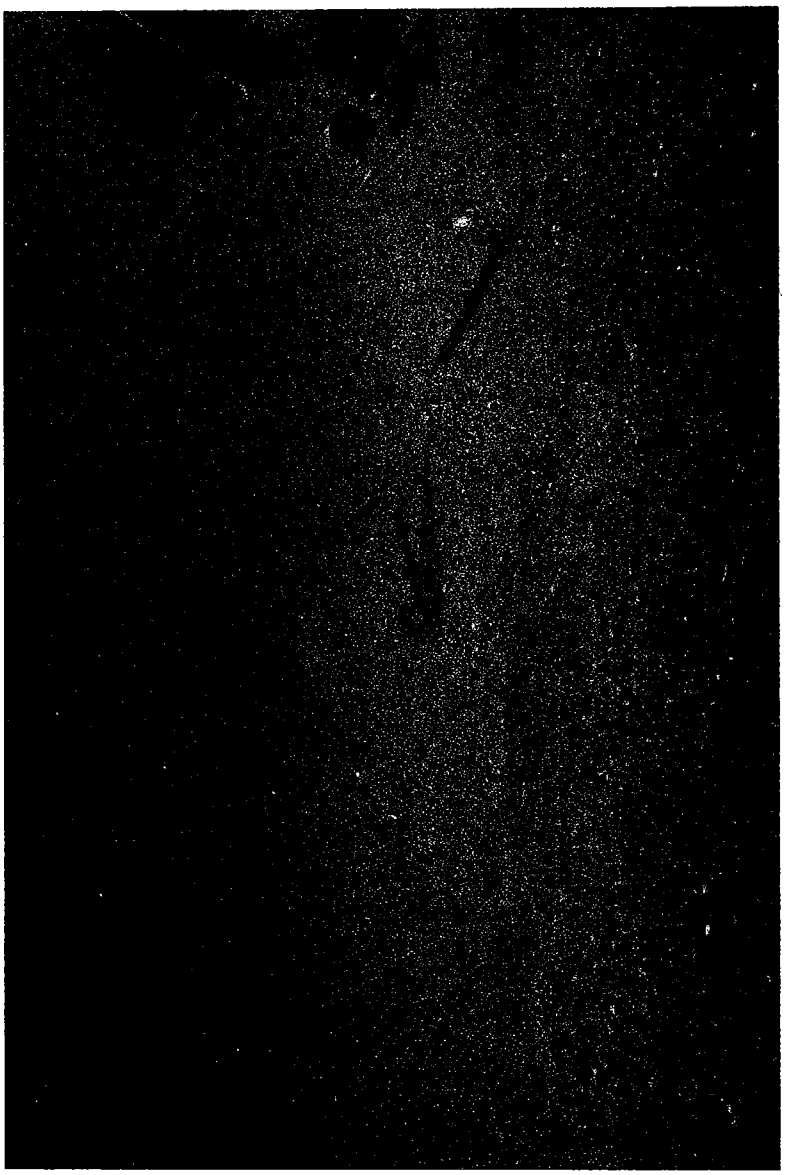
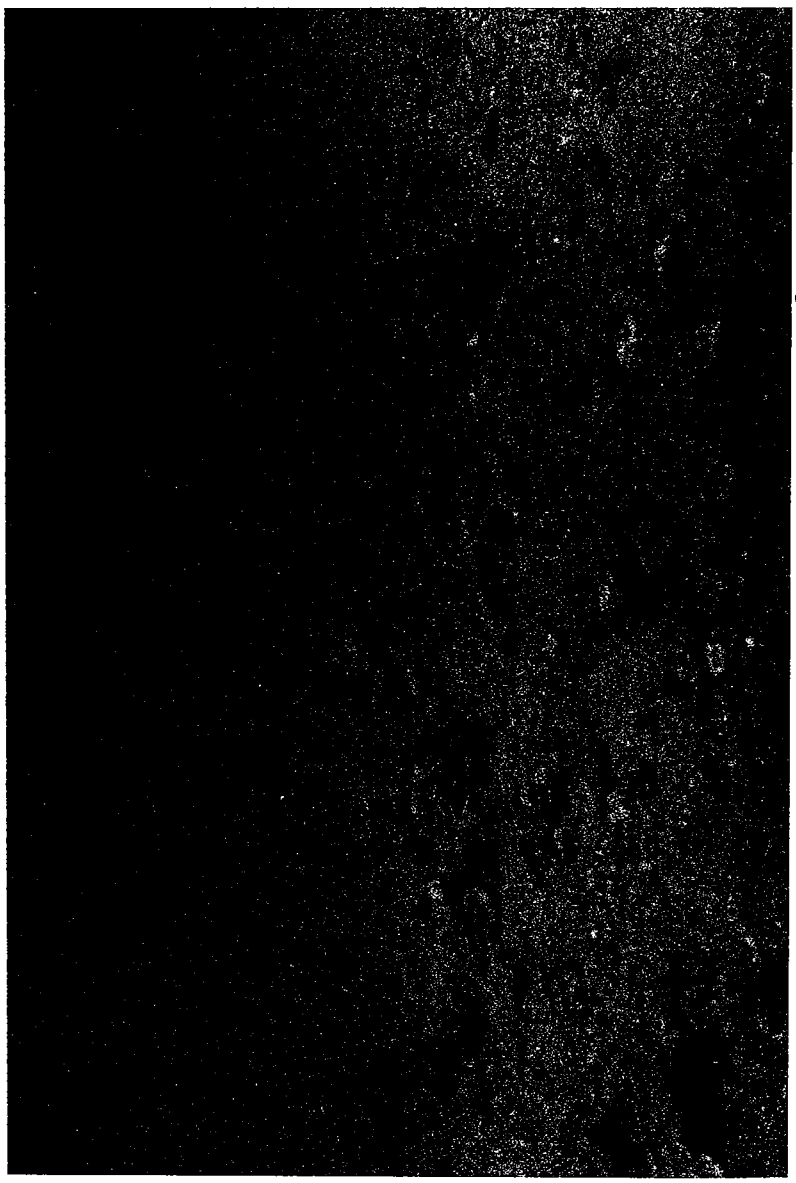


Figure 15. Barren area consisting of coarse sand, shells, and shell fragments (from Henry, 1985).





For the insoluble residues of the grab samples, mean-grain-size distribution is very similar to that of the grab samples. This similarity appears to be due, in large part, to the low amount of carbonate material present in the samples. The abundance of carbonate by weight in the samples ranges from 6.44% to 29.42% with a mean of 12.39%. The sizes of the insoluble-residue grains in the samples control the distribution of mean grain-size for the grab samples over the study area. Although the trends of insoluble-residue mean-grain-size (Figure 9) are essentially the same as those for the grab samples (Figure 7), the areas of coarser material are generally smaller than those of the grab samples, and the areas consisting of finer grained sand are larger for the insoluble residues. In some areas, the insoluble residue mean-grain-size map (Figure 9) shows a slight coarsening when compared with the same areas of the grab sample mean-grain-size map (Figure 7); coarsening may be due to a concentration of fine-grained carbonates in the grab samples.

The contour map for mean grain-size of the carbonate fraction of the grab samples (Figure 8) displays an overall coarsening in grain size and a vague similarity in trends when compared with the maps of mean grain-size for the grab sample (Figure 7) and insoluble residues (Figure 9). Although the carbonate content of the grab samples is only a mean of 12.39% by weight, the map of carbonate mean-grain-size (Figure 8) shows a close association of those areas on the carbonate mean-grain-size map having coarsest grain size with areas of high-density live-bottom and with areas of low- to moderate-relief live-

bottom on the reef-morphology map (Figure 10) and sonargram mosaic of Gray's Reef National Marine Sanctuary (Figure 11). The areas of finest carbonate material generally lie in the region of sand and shell debris. Additionally, those samples containing pieces of corals larger than sand size fall within the coarsest mean-grain-size contour-intervals (very coarse to coarse sand) and come from the areas of live-bottom growth.

The overall trends of the mean-grain-size maps correspond with patterns of epibenthic growth; regions of coarser mean-grain-size correspond with areas of low- to high-density live-bottoms, and the finer mean-grain-sizes occupy areas which are barren of epibenthic life and are characterized by sand and shell debris as determined from the sonargram mosaic of Gray's Reef National Marine Sanctuary (Figure 11). The contour map for mean grain-size of the carbonate fraction (Figure 8) clearly demonstrates that the coarse carbonate material lies in areas of live-bottom growth. The relationship of epibenthic growth and mean grain-size appears to be the result of accumulation of carbonate skeletal debris in close proximity to areas of abundant epibenthic growth.

Carbonate Abundance Maps

The contour maps of percent carbonate by weight and of percent shell fragments in each sample (Figures 16 and 17) show similar trends in the distribution of the amount of shell material. Both maps show a large area of high concentration of carbonate material in the southwest-central portion of the study area. The minimum concentrations of shell material lie in the southeastern and northwestern part of the study area on both maps. These distributions of carbonate concentration in the sediments are reflected in the contour maps for mean-grain-size of the carbonate fraction of the grab samples. Of the two carbonate-concentration maps, percent carbonate by weight (Figure 16) and percent shell fragments (Figure 17), the map showing percent carbonate by weight (Figure 16) corresponds more closely to the distribution map of the mean grain-size of the carbonate fraction (Figure 8). In the southwest-central and northeast-central regions of the study area, the largest concentrations of carbonate by weight occur (Figure 16); in the same areas of the contour map for mean grain-size of the carbonate fraction are the largest mean-grain-sizes. These areas of high carbonate concentration and large mean-grain-size correlate with areas of low- to moderate-relief live-bottom and with high-density live-bottom growth on the reef-morphology map and the sonargram mosaic of Gray's Reef National Marine Sanctuary (Figures 10 and 11). In addition to these correlations, areas of minimum carbonate concentration, low mean-grain-size in the carbonate fraction, barren sand and shell debris, and low-relief

Figure 16. Map showing percent carbonate by weight.

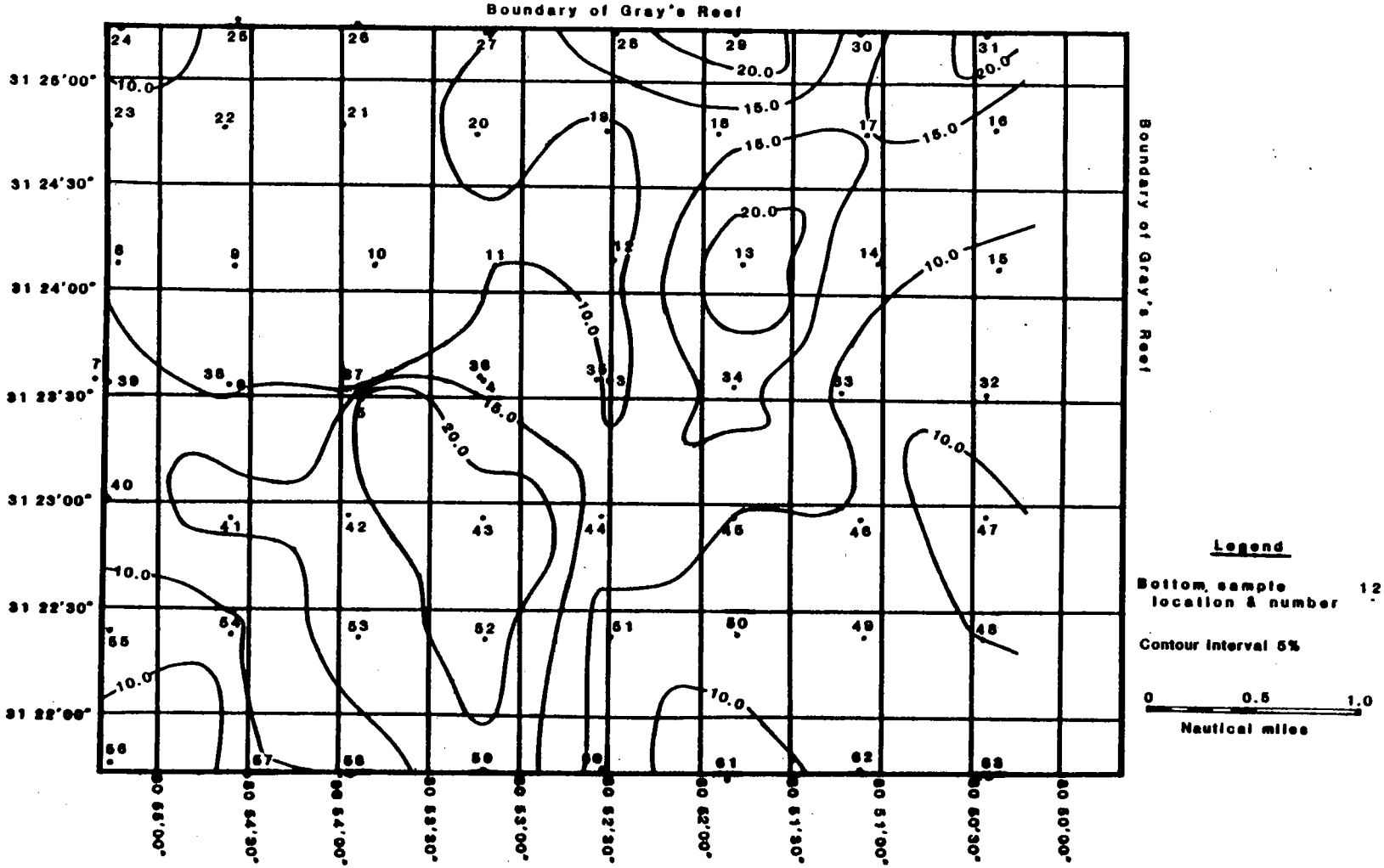
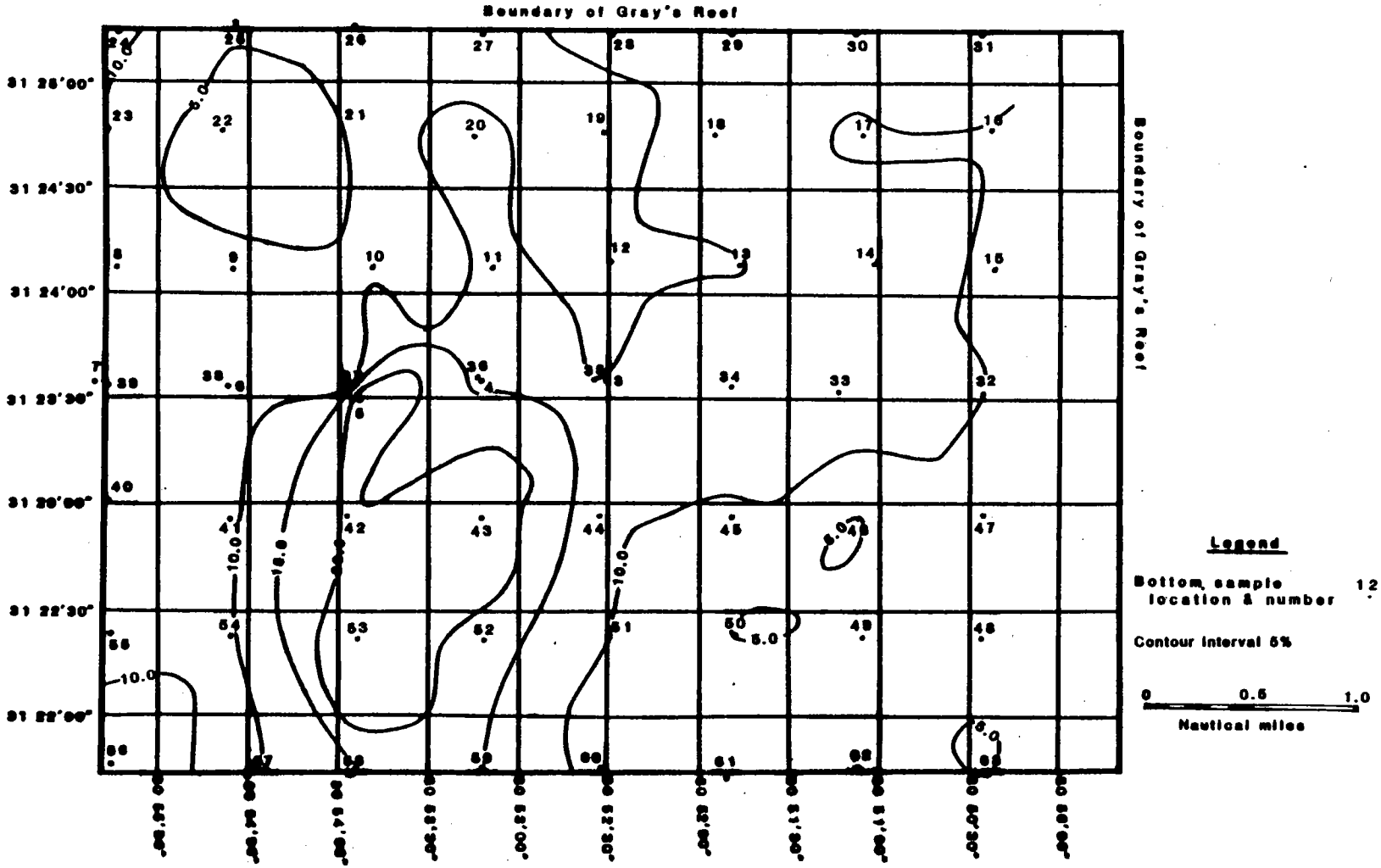

Boundary of Gray's Reef
31 25'00"
31 24'30"
31 24'00"
31 23'30"
31 23'00"
31 22'30"
31 22'00"
80 55'00"
80 54'30"
80 54'00"
80 53'30"
80 53'00"
80 52'30"
80 52'00"
80 51'30"
80 51'00"
80 50'30"
80 50'00"
Boundary of Gray's Reef
Legend
Bottom sample location & number
Contour interval 5%
0
0.5
1.0
Nautical miles

Figure 17. Map showing percent shell fragments calculated from grain counts.


Boundary of Gray's Reef
31 26'00"
31 24'30"
31 24'00"
31 23'30"
31 23'00"
31 22'30"
31 22'00"
Boundary of Gray's Reef
Legend
Bottom sample location & number
Contour interval 5%
0
0.5
1.0
Nautical miles

live-bottom correlate well with each other spatially over the study area.

Cluster Analysis

The results of the SAS cluster analysis performed on 55 samples using 39 variables produced a dendrogram illustrating two major clusters and a number of smaller smaller clusters (Figure 18). One primary break separates the samples into two groups, cluster two and cluster three; cluster one comprises the entire set of 55 samples. There are several other secondary breaks which form clusters four, ten, eleven, twenty, twenty-two, and twenty-three; these secondary clusters contain samples belonging to cluster two. These smaller separations do not appear to form groupings significant for classification purposes.

Cluster three is the smaller of clusters two and three. Cluster three is composed of samples 5, 24, 40, 34, 56, 13, 43, and 41, and cluster two is composed of the remaining samples in the cluster output.

The predominant difference between cluster two and cluster three is the smaller mean-grain-size of samples in cluster three. Especially pronounced are the differences in mean grain-size of the insoluble-residue fractions for which all samples in cluster three are smaller than those for cluster two. The mean grain-sizes for the grab samples are generally smaller for cluster three than for cluster

Figure 18. Dendrograms of SAS average linkage cluster analysis.

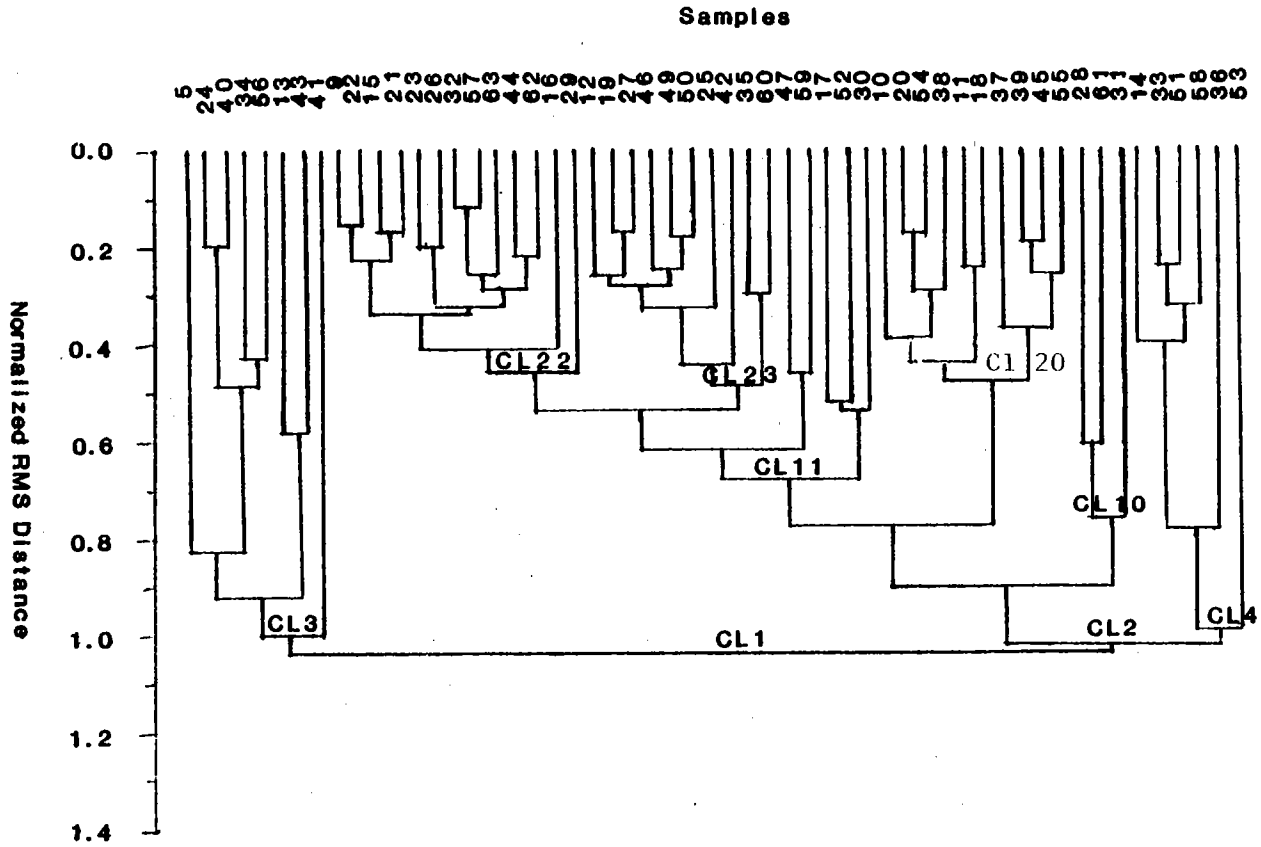
(a) Computer generated dendrogram from SAS cluster program "average linkage".

(b) Dendrogram drawn from Figure 18(a) showing primary and secondary clusters discussed in text.

Note: RMS Distance is the root-mean-square distance between clusters.

SAS
AVERAGE LINKAGE CLUSTER ANALYSIS
NAME OF OBSERVATION OR CLUSTER
AVERAGE DISTANCE BETWEEN CLUSTERS
1.4
1.2
1
0.8
0.6
0.4
0.2
0

18(a)


Samples
Normalized RMS Distance
0.0
0.2
0.4
0.6
0.8
1.0
1.2
1.4
CL22
CL23
CL20
CL11
CL10
CL3
CL1
CL2
CL4

18(b)

two. For the carbonate fractions, mean grain-size is coarser overall for cluster two than for cluster three.

When a sample-locality map, highlighting members of clusters two and three (Figure 19), is compared with the reef-morphology map (Figure 10) and with the sonargram mosaic of Gray's Reef National Marine Sanctuary (Figure 11), the results are inconclusive. Over the study area, 57% of the samples come from areas of barren sand and shell debris, 19% of the samples come from areas of low-relief live-bottom, and 24% of the samples come from areas of low- to moderate-relief live-bottom (Table 6). In cluster three, 50% of the samples come from areas of barren sand and shell debris, whereas 12.5% of the samples come from border areas between low- to low-to-moderate relief live-bottom, and 37.5% of the samples lay within areas of low- to moderate-relief live-bottom (Table 7). In cluster two, 58% of the samples come from areas of barren sand and shell debris, 20% come from areas of low-relief live-bottom, and 22% come from areas of low- to moderate-relief live-bottom (Table 7). The distribution by percentage of samples for clusters two and three in each of these geomorphologic areas is very similar (Table 7), although cluster two has a greater percent of samples from the combined barren sand and shell debris and low-relief live-bottom areas than does cluster three; cluster three has the greatest percent of samples from low- to moderate-relief live-bottom areas. The distribution of samples in clusters two and three also reflects the overall distribution of samples in the study area (Tables 6 and 7).

Figure 19. Distribution of cluster two and cluster three samples over the study area.

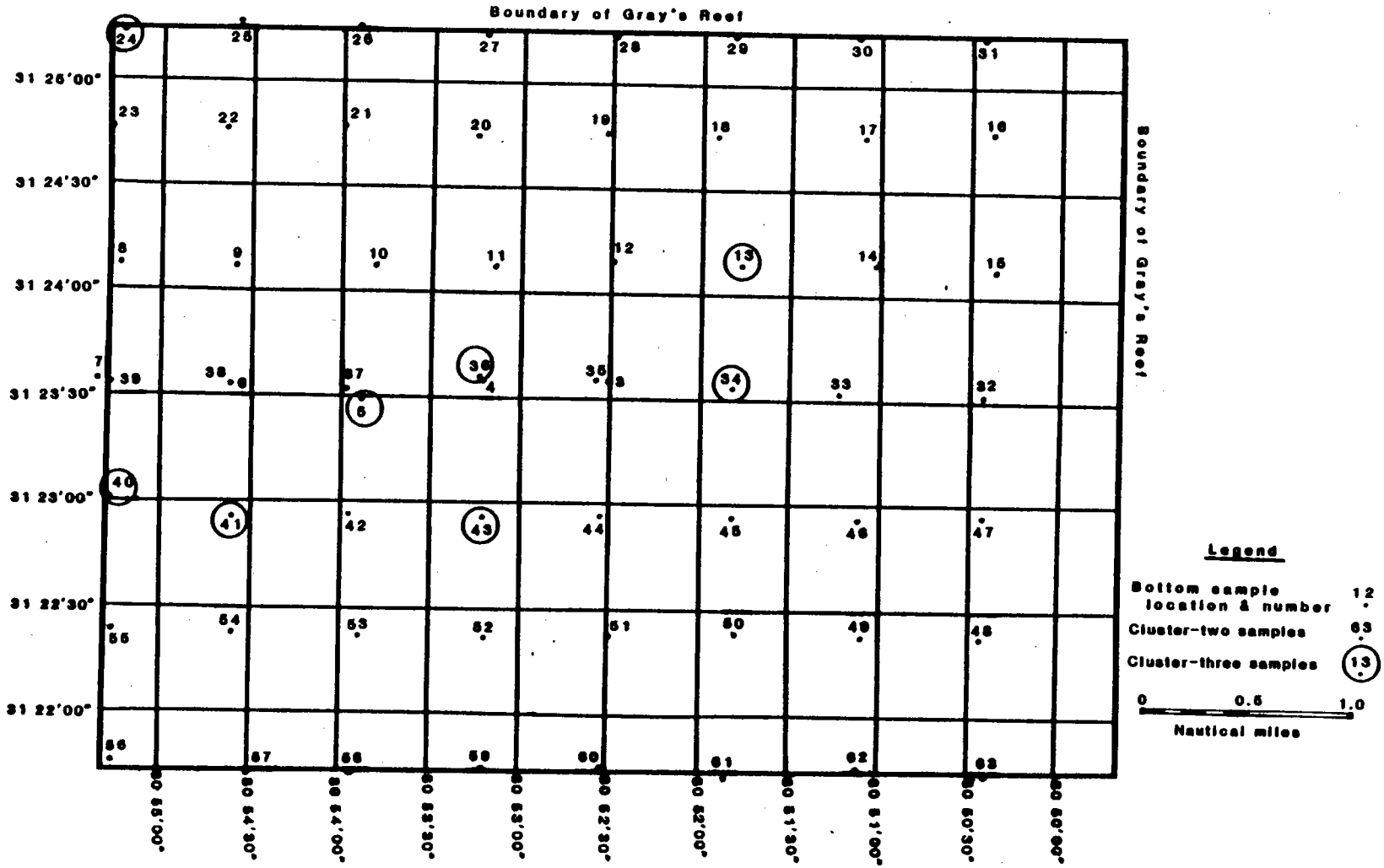

Boundary of Gray's Reef
31 26'00"
31 24'30"
31 24'00"
31 23'30"
31 23'00"
31 22'30"
31 22'00"
80 55'00"
80 54'30"
80 54'00"
80 53'30"
80 53'00"
80 52'30"
80 52'00"
80 51'30"
80 51'00"
80 50'30"
80 50'00"
Boundary of Gray's Reef
Legend
Bottom sample location & number
Cluster-two samples
Cluster-three samples
0
0.5
1.0
Nautical miles

Table 6
Percentage of Samples in Areas of Reef Morphology
for the Sample Set.

	Percentage of samples in reef-morphological areas			
Cluster	SB	L	L-M	Total
1	57	19	24	100

Table 7
Percentage of Samples in Areas of Reef Morphology
for Primary Clusters.

	Percentage of samples in reef-morphological areas			
Cluster	SB	L	L-M	Total
2	58	20	22	100
3	50	12.5	37.5	100

Table 8
Percentage of Samples in Areas of Reef Morphology
for Secondary Clusters.

	Percentage of samples in reef-morphological areas			
Cluster	SB	L	L-M	Total
4	33	17	50	100
10	67	33	0	100
20	80	10	10	100
22	69	23	8	100
23	50	30	20	100
11	57	25	18	100

When a sample-locality map, highlighting members of the secondary clusters, clusters four, ten, eleven, twenty, twenty-two, and twenty-three, (Figure 20), is compared with the reef-morphology map (Figure 10), the distribution of samples belonging to secondary clusters appears to be random with respect to membership to any of the reef-morphological areas. Table 8 summarizes the percent of samples in each of the reef-morphological areas for the secondary clusters.

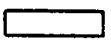
Within the set of secondary clusters, only clusters four and ten show complete separation from each other on the basis of variable values. Cluster four has smaller values for the mean- and median-grain sizes for the grab samples and insoluble residues and for the 2ϕ size fraction of the insoluble residues; cluster-four has larger values for the 0ϕ fraction of the insoluble residues than the other secondary clusters. Cluster ten has values larger than those of the other secondary clusters for the size fractions $\geq$5ϕ of the grab samples and the 3ϕ of the carbonates. The remaining secondary clusters do show separation from some but not all of the other secondary clusters on the basis of variable values. The separation of secondary cluster is summarized in Table 9.

Comparing the distribution of samples in clusters two, three, and the secondary clusters (Figures 19 and 20) with the reef-morphology map (Figure 10), it can be concluded that the clustering procedure does not define facies based on the presence or absence of reef live-bottom areas.

Figure 20. Distribution of secondary clusters over the study area.

Legend

Cluster 4 

Cluster 10 

Cluster 20 

Cluster 22 

Cluster 23 

Cluster 11 

(includes Clusters 22 & 23)

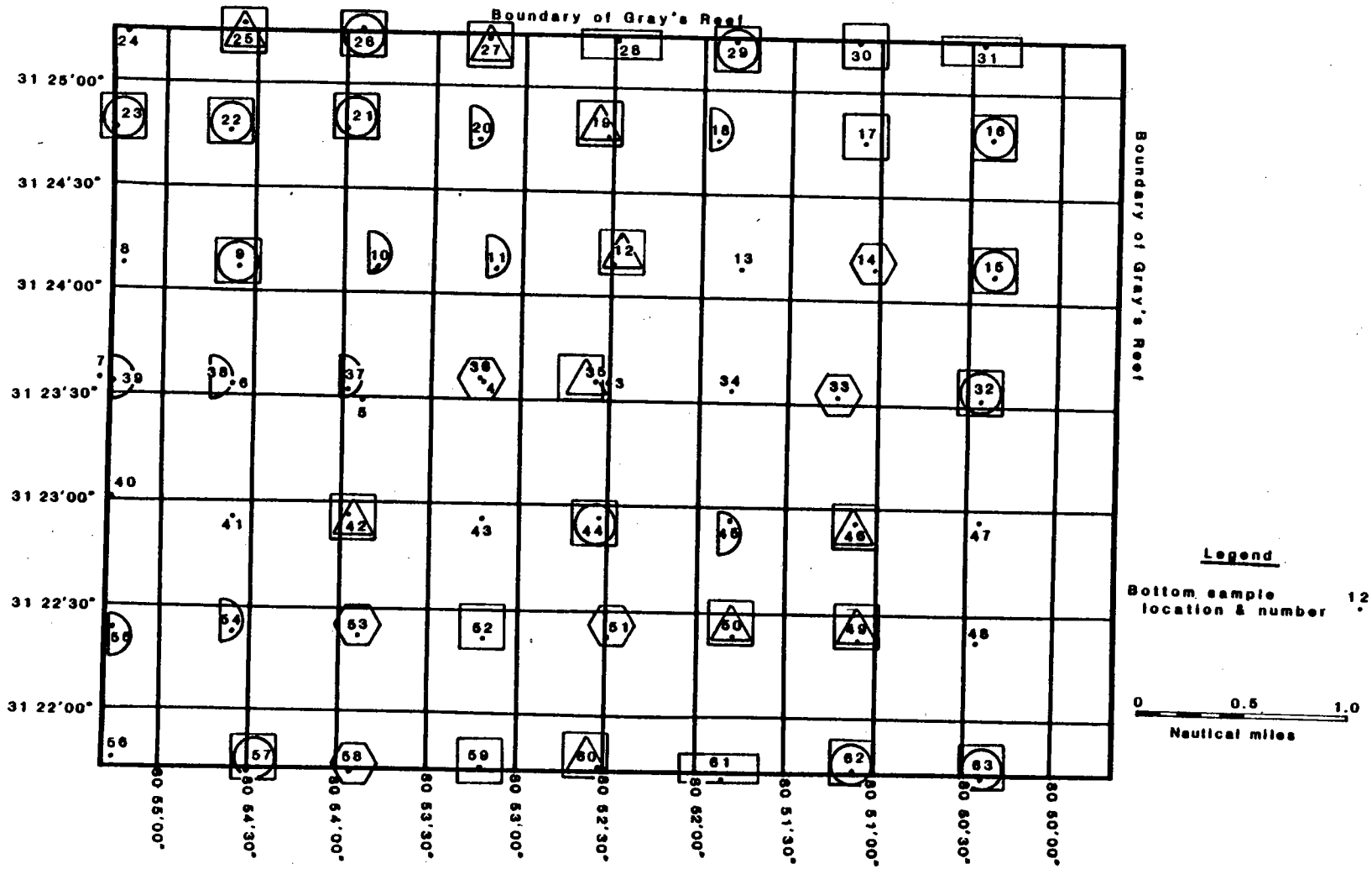

Boundary of Gray's Reef
31 25'00"
31 24'30"
31 24'00"
31 23'30"
31 23'00"
31 22'30"
31 22'00"
80 55'00"
80 54'30"
80 54'00"
80 53'30"
80 53'00"
80 52'30"
80 52'00"
80 51'30"
80 51'00"
80 50'30"
80 50'00"
Boundary of Gray's Reef
Legend
Bottom sample location & number
0
0.5
1.0
Nautical miles

Table 9
Summary of Variable Separation for
Clusters 4, 10, 20, 22, 23, and 11.

Cluster	Variable	Separation from clusters:
4	Mz, grab samples	10, 20, 22, 23, 11
	Median, grab samples	10, 20, 22, 23, 11
	0ϕ, insoluble residues	10, 20, 22, 23, 11
	2ϕ, insoluble residues	10, 20, 22, 23, 11
	median, insoluble residues	10, 20, 22, 23, 11
	Mz, insoluble residues	10, 20, 22, 23, 11
10	$\geq$5ϕ, grab samples	4, 20, 22, 23, 11
	3ϕ,carbonates	4, 20, 22, 23, 11
	median, carbonates	4, 22, 23, 11
	2ϕ,carbonates	20, 22, 23
20	0ϕ, grab samples	4, 10, 23
	1ϕ, grab samples	4, 11, 23
	KG, grab samples	4, 10, 23
	0ϕ, insoluble residues	4, 10, 23
	KG, insoluble residues	4, 10, 23
22	Mz, insoluble residues	4, 20, 23
23	KG, grab samples	10, 20, 22
	Mz, insoluble residues	4, 10, 20, 22
	KG, insoluble residues	10, 20, 22
	1ϕ, carbonates	10, 20, 22
11	Mz, insoluble residues	4, 20
	-2ϕ, carbonates	10, 20

Sampling Plan

The results of grain-size and mineralogic analyses indicate general, lateral trends of coarsening sediment and increasing carbonate content in the sands with proximity to large areas of live-bottom growth. However, smaller-scale photographs of Gray's Reef (Figures 12, 13, 14, and 15) show the patchy nature of this live-bottom. Within the large areas of low- to moderate-relief live-bottom (Figure 10), patches of epifaunal growth are surrounded by areas of sand devoid of benthic-organism accumulation. This patchiness is the result of the discontinuous nature of substrate outcrops upon which sessile benthos can attach; where the limestone substrate does not crop out or is buried too far below the surficial sands, benthic epifauna cannot grow.

When grab samples are taken, as in this study, within an overall area of live-bottom growth, it is possible to sample sand from barren areas between patches of live-bottom buildup. A nested sampling plan on a much smaller scale would better reveal the patchy nature of the Gray's Reef live-bottom and would allow comparison of variation in mean grain-size and carbonate abundance on the local level (noise) with variation over the entire study area.

CONCLUSIONS

Sediment samples from Gray's Reef National Marine Sanctuary are mixed carbonate-siliciclastic sands and contain quartz, shell fragments, feldspars (orthoclase, microcline and plagioclase), phosphate, hornblende, staurolite, opaques, calcite or dolomite, micas, rock fragments, glauconite, and unidentified accessory minerals. The shell material consists mostly of mollusk shells and shell fragments; other shells include bryozoans, echinoderm spines, fragments of corals, barnacles, worm tubes, and sponges. Mean grain-diameters of sediment samples fall in the fine to coarse sand sizes; mean size-range is from 2.08ϕ to 0.34ϕ. The abundance of silt and clay-size particles is very low.

Comparison of mean-grain-size distribution and carbonate abundance over Gray's Reef National Marine Sanctuary in the grab samples with maps of live-bottom growth show that coarser samples with larger carbonate abundance occur in areas of low- to moderate-relief live-bottom, and finer grained samples with lower carbonate content occur in areas which are barren of live-bottom fauna, consisting of sand and shell debris. These map patterns indicate a trend of increasing mean grain-size and carbonate abundance with proximity to areas of live-bottom growth.

Cluster analysis results in the formation of two primary clusters, formed on the basis of lowest mean-grain-size. The results of comparing the distribution of samples in the primary and secondary clusters (Figures 19 and 20) with the reef-morphology map (Figure 10)

do not show correlation to the presence of reef or non-reef areas. Therefore, live-bottom reefs cannot be detected by using this method of cluster analysis.

Whereas grain-size analyses and mineralogic analyses identify general areas of major live-bottom accumulation and areas of barren sand and shell debris, sediment sampling on a smaller scale, with more closely spaced samples, may increase the correlation between largest mean-grain-size and carbonate accumulation with areas of live-bottom growth and would better reflect the patchy nature of Gray's Reef live-bottoms.

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Appendix I

Location and Petrographic Description of Individual Sediment Samples

Sample 1. 31°21'48"N 80°55'15"W
Sample missing.

Sample 2. 31°21'43"N 80°54'23"W
Sample missing

Sample 3. 31°23'35"N 80°52'28"W
Medium sand, moderately sorted, near-symmetrical, mesokurtic. Mean diameter: 1.34ϕ. Slightly shelly. Coarse fraction: pelecypod fragments, quartz, feldspar, phosphate. Color: 5Y 6/2 light olive gray.

Sample 4. 31°23'36"N 80°53'13"W
See sample 36.

Sample 5. 31°23'20"N 80°53'54"W
Medium sand, poorly sorted, strongly coarse-skewed, platykurtic. Mean diameter: 1.51ϕ. Very shelly. Coarse fraction: pelecypods, echinoderms, bryozoa, quartz, feldspar, phosphate. Color: 5Y 6/3 pale olive.

Sample 6. 31°23'34"N 80°54'36"W
See sample 38.

Sample 7. 31°23'34"N 80°54'36"W
Medium sand, poorly sorted, strongly coarse-skewed, leptokurtic. Mean diameter: 1.16ϕ. Slightly shelly. Coarse fraction: Pelecypods, bryozoa, echinoderm spines, quartz, feldspar, phosphate. Color: 5Y 6/2 light olive gray.

Sample 8. 31°24'08"N 80°55'14"W
Sample missing.

Sample 9. 31°24'07"N 80°54'35"W
Medium sand, moderately sorted, coarse-skewed, leptokurtic. Mean diameter: 1.28ϕ. Shelly. Coarse fraction: pelecypods, bryozoa, echinoderm spines, quartz, feldspar, phosphate. Color: 5Y 5/1 gray.

Sample 10. 31°24'08"N 80°53'48"W
Medium sand, moderately sorted, near-symmetrical, leptokurtic. Mean diameter: 1.47ϕ. Shelly. Coarse

fraction: pelecypods, bryozoa, quartz, feldspar, phosphate. Color: 5Y 6/2 light olive gray.

Sample 11. 31°24'08"N 80°53'09"W
Medium sand, moderatly sorted, coarse-skewed, mesokurtic. Mean diameter: 1.43ϕ. Shelly. Coarse fraction: pelecypods, gastropods, worm tubes, bryozoa, quartz, feldspar, phosphate. color: 5Y 5/2 olive gray.

Sample 12. 31°24'09"N 80°52'29"W
Medium sand, moderately sorted, coarse-skewed, mesokurtic. Mean diameter: 1.02ϕ. Shelly. Coarse fraction: pelecypods, bryozoa, echinoderm spines, quartz, phosphate. Color: 5Y 6/1 gray.

Sample 13. 31°24'09"N 80°51'46"W
Medium sand, poorly sorted, strongly coarse-skewed, leptokurtic. Mean diameter: 1.41ϕ. Very shelly. Coarse fraction: coral, echinoderm fragments and spines, pelecypods, bryozoa, quartz, feldspar, phosphate, gastropod fragments, encrusting worm tubes. Color: 5Y 5/2 olive gray.

Sample 14. 31°24'10"N 80°51'02"W
Coarse sand, moderately sorted, near-symmetrical, mesokurtic. Mean diameter: 0.71ϕ. Shelly. Coarse fraction: pelecypods, bryozoa, echinoderm spines, quartz, feldspar, phosphate. Color: 2.5Y 6/2 light brownish gray.

Sample 15. 31°24'07"N 80°50'21"W
Medium sand, poorly sorted, coarse-skewed, leptokurtic. Mean diameter: 1.23ϕ. Slightly shelly. Coarse fraction: echinoderm fragments, bryozoa, quartz, feldspar, phosphate. Color: 2.5Y 6/2 light grayish brown.

Sample 16. 31°24'46"N 80°50'23"W
Medium sand, poorly sorted, coarse skewed, mesokurtic. Mean diameter: 1.20ϕ. Shelly. Coarse fraction: pelecypods, bryozoa, quartz, feldspar, phosphate. Color: 5Y 5/2 olive gray.

Sample 17. 31°24'45"N 80°51'05"W
Coarse sand, poorly sorted, near-symmetrical, mesokurtic. Mean diameter: 0.78ϕ. Shelly. Coarse fraction: pelecypods, bryozoa, encrusting worm tubes, quartz, feldspar, phosphate. Color: 2.5Y 5/2 grayish brown.

Sample 18. 31°24'46"N 80°51'55"W
Medium sand, moderately sorted, coarse-skewed, leptokurtic. Mean diameter: 1.61ϕ. Shelly. Coarse fraction: pelecypods, gastropods, bryozoa, quartz, feldspar, phosphate. Color: 5Y 5/1 gray.

Sample 19. 31°24'46"N 80°52'31"W
Medium sand, moderately sorted, coarse-skewed, mesokurtic. Mean diameter: 1.10ϕ. Slightly shelly. Coarse fraction: pelecypods, gastropods, bryozoa, echinoderm spines, egg cases, quartz, feldspar, phosphate. Color: 5Y 5/2 olive gray.

Sample 20. 31°24'45"N 80°53'15"W
Medium sand, moderately sorted, near-symmetrical, leptokurtic. Mean diameter: 1.61ϕ. Shelly. Coarse fraction: pelecypods, bryozoa, echinoderm spines, quartz, feldspar, phosphate. Color: 5Y 6/1 gray.

Sample 21. 31°24'47"N 80°53'58"W
Medium sand, poorly sorted, strongly fine-skewed, very leptokurtic. Mean diameter: 1.51ϕ. Shelly. Coarse fraction: bryozoa, pelecypods, quartz, feldspar, phosphate, encrusting worm tubes. Color: 5Y 6/2 light olive gray.

Sample 22. 31°24'46"N 80°54'38"W
Medium sand, moderately sorted, coarse-skewed, leptokurtic. Mean diameter: 1.55ϕ. Very shelly. Coarse fraction: pelecypods; gastropods, echinoderm spines, barnacles, bryozoa, egg cases, quartz, feldspar, phosphate. Color: 5Y 6/2 light olive gray.

Sample 23. 31°24'47"N 80°55'19"W
Coarse sand, poorly sorted, coarse-skewed, leptokurtic. Mean diameter: 0.97ϕ. Very shelly. Coarse fraction: pelecypods, gastropods, bryozoa, worm tubes, echinoderm spines, barnacles, quartz, feldspar, phosphate. Color: 2.5Y 6/2 light brownish gray.

Sample 24. 31°25'16"N 80°55'16"W
Fine sand, moderately sorted, coarse-skewed, mesokurtic. Mean diameter: 2.05ϕ. Slightly shelly. Coarse fraction: bryozoa, quartz, feldspar, large concentration of phosphate. Color: 10YR 5/1 gray.

Sample 25. 31°25'17"N 80°54'34"W
Coarse sand, poorly sorted, coarse-skewed, mesokurtic. Mean diameter: 0.82ϕ. Shelly. Coarse fraction:

pelecypods, bryozoa, echinoderm fragments and spines, gastropods, barnacles. Color: 5Y 6/2 light olive gray.

Sample 26. 31°25'16"N 80°53'54"W
Medium sand, poorly sorted, coarse-skewed, mesokurtic. Mean diameter: 1.19ϕ. Shelly. Coarse fraction: pelecypods, encrusting worm tubes, bryozoa, quartz, feldspar, phosphate. Color: 5Y 5/1 gray.

Sample 27. 31°25'13"N 80°53'13"W
Coarse sand, moderately sorted, coarse-skewed, mesokurtic. Mean diameter: 0.98ϕ. Slightly shelly. Coarse fraction: pelecypods, bryozoa, encrusting worm tubes, quartz, feldspar, phosphate. Color: 5Y 6/2 olive gray.

Sample 28. 31°25'14"N 80ϕ52'29"W
Medium sand, moderately sorted, coarse-skewed, mesokurtic. Mean diameter: 1.02ϕ. Shelly. Coarse fraction: pelecypods, bryozoa, worm tubes, quartz, feldspar, phosphate. Color: 2.5Y 5/2 grayish brown.

Sample 29. 31°25'14"N 80°51'49"W
Medium sand, poorly sorted, coarse-skewed, mesokurtic. Mean diameter: 1.14ϕ. Shelly. Coarse fraction: pelecypods, encrusting worm tubes, echinoderm spines, quartz, feldspar, phosphate. Color: 5Y 5/2 olive gray.

Sample 30. 31°25'14"N 80°51'07"W
Medium sand, poorly sorted, near-symmetrical, mesokurtic. Mean diameter: 1.07ϕ. Very shelly. Coarse fraction: pelecypods, bryozoa, echinoderm spines, gastropods, worm tubes, quartz, feldspar, phosphate. Color: 5Y 5/1 gray.

Sample 31. 31°25'14"N 80°50'25"W
Medium sand, poorly sorted, coarse-skewed, mesokurtic. Mean diameter: 1.55ϕ. Very shelly. Coarse fraction: pelecypods, gastropods, echinoderm spines, bryozoa, quartz, feldspar, phosphate. Color: 5Y 6/1 gray.

Sample 32. 31°23'32"N 80°50'25"W
Medium sand, moderately sorted, coarse-skewed, leptokurtic. Mean diameter: 1.14ϕ. Shelly. Coarse fraction: pelecypods, bryozoa, worm tubes, quartz, feldspar, phosphate. Color: 5Y 6/2 olive gray.

Sample 33. 31°23'32"N 80°51'14"W
Coarse sand, moderately sorted, near-symmetrical, mesokurtic. Mean diameter: 0.65ϕ. Very shelly. Coarse

fraction: pelecypods, gastropods, bryozoa, worm tubes, echinoderm spines, quartz, feldspar, phosphate. Color: 2.5Y 6/2 light brownish gray.

Sample 34. 31°23'33"N 80°51'49"W
Medium sand, poorly sorted, strongly coarse-skewed, leptokurtic. Mean diameter: 1.89ϕ. Shelly. Coarse fraction: gastropod and other mollusk fragments, quartz, feldspar, phosphate. Color: 2.5Y 6/2 light brownish gray.

Sample 35. 31°23'35"N 80°52'34"W
Coarse sand, moderately sorted, near-symmetrical, mesokurtic. Mean diameter: 0.95ϕ. Shelly. Coarse fraction: pelecypods, echinoderm spines, gastropods, quartz, feldspar, phosphate. Color: 5Y 5/2 olive gray.

Sample 36. 31°23'36"N 80°53'14"W
Coarse sand, poorly sorted, fine-skewed, mesokurtic. Mean diameter: 0.48ϕ. Very shelly. Coarse fraction: coral, pelecypods, rock fragment, bryozoa, worm tubes, gastropods, quartz, feldspar, phosphate. Color: 2.5Y 6/2 light brownish gray.

Sample 37. 31°23'33"N 80°53'58"W
Medium sand, moderately sorted, near-symmetrical, leptokurtic. Mean diameter: 1.47ϕ. Shelly. Coarse fraction: pelecypods, bryozoa, quartz, feldspar, phosphate. Color: 5Y 5/2 olive gray.

Sample 38. 31°23'26"N 80°53'14"W
Medium sand, moderately sorted, near-symmetrical, mesokurtic. Mean diameter: 1.69ϕ. Slightly shelly. Coarse fraction: pelecypods, bryozoa, quartz, feldspar, phosphate. Color: 5Y 5/2 olive gray.

Sample 39. 31°23'34"N 80°55'18"W
Medium sand, moderately sorted, coarse-skewed, leptokurtic. Mean diameter: 1.46ϕ. Shelly. Coarse fraction: pelecypods, echinoderm fragments and spines, gastropods, bryozoa, quartz, feldspar, phosphate. Color: 5Y 5/1 gray.

Sample 40. 31°23'01"N 80°55'18"W
Fine sand, moderately sorted, coarse-skewed, mesokurtic. Mean diameter: 2.08ϕ. Shelly. Coarse fraction: pelecypods, echinoderm spines, bryozoa, quartz, feldspar, phosphate. Color: 5Y 6/2 light olive gray.

Sample 41. 31°22'56"N 80°55'18"W
Medium sand, poorly sorted, coarse-skewed, leptokurtic. Mean diameter: 1.80ϕ. Slightly shelly. Coarse fraction: pelecypods, bryozoa, worm tubes, quartz, feldspar, phosphate. Color: 5Y 6/1 gray.

Sample 42. 31°22'57"N 80°53'56"W
Coarse sand, poorly sorted, coarse-skewed, mesokurtic. Mean diameter: 0.80ϕ. Very shelly. Coarse fraction: coral, bryozoa, pelecypods, bone fragment, echinoderm spines, quartz, feldspar, phosphate. Color: 5Y 6/2 olive gray.

Sample 43. 31°22'57"N 80°53'56"W
Medium sand, poorly sorted, strongly coarse-skewed, very leptokurtic. Mean diameter: 1.01ϕ. Shelly. Coarse fraction: pelecypods, bryozoa, worm tubes, gastropods, quartz, feldspar, phosphate, rock fragment. Color: 5Y 6/2 light olive gray.

Sample 44. 31°22'57"N 80°52'33"W
Medium sand, moderately sorted, coarse-skewed, leptokurtic. Mean diameter: 1.10ϕ. Shelly. Coarse fraction: pelecypods, bryozoa, coral, quartz, feldspar, phosphate. Color: 2.5Y 6/2 light brownish gray.

Sample 45. 31°22'57"N 80°51'49"W
Medium sand, poorly sorted, coarse-skewed, very leptokurtic. Mean diameter: 1.39ϕ. Very shelly. Coarse fraction: pelecypods, bryozoa, gastropod fragments, worm tubes, echinoderm spines, quartz, feldspar, phosphate. Color: 2.5Y 6/2 light brownish gray.

Sample 46. 31°22'57"N 80ϕ51'07"W
Coarse sand, poorly sorted, coarse-skewed, mesokurtic. Mean diameter: 0.87ϕ. Shelly. Coarse fraction: pelecypods, bryozoa, echinoderm spines, quartz, feldspar, phosphate. Color: 2.5Y 6/2 light brownish gray.

Sample 47. 31°22'57"N 80°50'25"W
Medium sand, moderately sorted, coarse-skewed, leptokurtic. Mean diameter: 1.22ϕ. Shelly. Coarse fraction: pelecypods, bryozoa, quartz, feldspar, phosphate. Color: 2.5Y 7/2 light gray.

Sample 48. 31°22'22"N 80°50'57"W
Coarse sand, poorly sorted, coarse-skewed, leptokurtic. Mean diameter: 0.84ϕ. Coarse fraction: sponges, shell fragments. Color: 5Y 6/3 pale olive.

Sample 49. 31°22'22"N 80°51'06"W
Coarse sand, moderately sorted, coarse-skewed, mesokurtic. Mean diameter: 0.97ϕ. Shelly. Coarse fraction: pelecypod valves, bryozoa, echinoderm spines, barnacle, quartz, feldspar, phosphate. Color: 5Y 6/2 light olive gray.

Sample 50. 31°22'23"N 80°51'48"W
Medium sand, poorly sorted, strongly coarse-skewed, platykurtic. Mean diameter: 1.52ϕ. Shelly. Coarse fraction: pelecypods, bryozoa, quartz, feldspar, phosphate. Color: 5Y 6/1 gray.

Sample 51. 31°22'20"N 80°52'30"W
Coarse sand, moderately sorted, near-symmetrical, mesokurtic. Mean diameter: 0.66ϕ. Shelly. Coarse fraction: coral, pelecypods, crustacean fragment, bryozoa, echinoderm spines, quartz, feldspar, phosphate. Color: 10Y 5/3 brown.

Sample 52. 31°22'22"N 80°53'12"W
Coarse sand, poorly sorted, coarse-skewed, leptokurtic. Mean diameter: 1.00ϕ. Shelly. Coarse fraction: coral, pelecypod valves, quartz, feldspar, phosphate. Color: 10YR 6/4 light yellowish brown.

Sample 53. 31°22'23"N 80°53'54"W
Coarse sand, moderately sorted, fine-skewed, platykurtic. Mean diameter: 0.34ϕ. Shelly. Coarse fraction: pelecypods, bryozoa, gastropods, echinoderm spines, worm tubes, quartz, feldspar, phosphate. Color: 5Y 6/2 light olive gray.

Sample 54. 31°22'22"N 80°54'36"W
Medium sand, moderately sorted, near-symmetrical, mesokurtic. Mean diameter: 1.64ϕ. Shelly. Coarse fraction: pelecypods, gastropods, bryozoa, echinoderm spines, quartz, feldspar, phosphate. Color: 5Y 6/1 gray.

Sample 55. 31°22'24"N 80°22'17"W
Medium sand, moderately sorted, near-symmetrical, leptokurtic. Mean diameter: 1.47ϕ. Shelly. Coarse fraction: pelecypods, bryozoa, echinoderm spines, quartz, feldspar, phosphate. Color: 5Y 6/1 gray.

Sample 56. 31°21'47"N 80°55'16"W
Medium sand, moderately sorted, coarse-skewed, mesokurtic. Mean diameter: 1.95ϕ. Shelly. Coarse fraction: pelecypods, gastropods, bryozoa, echinoderm

spines, quartz, feldspar, phosphate. Color: 5Y 6/2 light olive gray.

Sample 57. 31°21'44"N 80°54'30"W
Medium sand, moderately sorted, coarse-skewed, leptokurtic. Mean diameter: 1.10ϕ. Shelly. Coarse fraction: pelecypods, echinoderm spines, worm tubes, quartz, feldspar, phosphate. Color: 5Y 5/1 gray.

Sample 58. 31°21'44"N 80°53'55"W
Coarse sand, moderately sorted, near-symmetrical, mesokurtic. Mean diameter: 0.69ϕ. Shelly. Coarse fraction: pelecypods, bryozoa, echinoderm fragments and spines, worm tubes. Color: 10YR 5/3 brown.

Sample 59. 31°21'45"N 80°53'12"W
Coarse sand, moderately sorted, coarse-skewed, mesokurtic. Mean diameter: 0.98ϕ. Very shelly. Coarse fraction: coral, pelecypods, gastropods, quartz, feldspar, phosphate. Color: 10YR 5/3 brown.

Sample 60. 31°21'45"N 80°52'31"W
Coarse sand, moderately sorted, coarse-skewed, mesokurtic. Mean diameter: 0.98ϕ. Shelly. Coarse fraction: coral, encrusting worm tubes, large mollusk fragments, pelecypods, worm tubes, quartz, feldspar, phosphate. Color: 2.5Y 6/2 light brownish gray.

Sample 61. 31°21'42"N 80°51'50"W
Medium sand, moderately sorted, coarse-skewed, mesokurtic. Mean diameter: 1.15ϕ. Shelly. Coarse fraction: pelecypods, bryozoa, quartz, feldspar, phosphate. Color: 5Y 6/1 gray.

Sample 62. 31°21'41"N 80°51'50"W
Medium sand, moderately sorted, coarse-skewed, mesokurtic. Mean diameter: 1.07ϕ. Shelly. Coarse fraction: pelecypods, bryozoa, echinoderm spines, gastropods, quartz, feldspar, phosphate. Color: 5Y 6/2 light olive gray.

Sample 63. 31°21'44"N 80°50'24"W
Medium sand, moderately sorted, coarse-skewed, mesokurtic. Mean diameter: 1.17ϕ. Slightly shelly. Coarse fraction: pelecypods, bryozoa, echinoderm spines, quartz, feldspar, phosphate. Color: 5Y 5/2 olive gray.

Appendix II

Output from Folk57 Program -

Characterization of Grain-Size Frequency-Distributions

Grain Size Data for Grab Samples

Samples 1, 2, 4, 6, and 8 are missing; they are not included in the samp le set.

SAMPLE NUMBER 3

PHI SIZE	WEIGHT	WEIGHT %	C.WEIGHT %
-2.0000	0.0300	0.0515	0.0515
-1.0000	0.1300	0.2234	0.2749
0.0000	2.1900	3.7629	4.0378
1.0000	14.9000	25.6014	29.6392
2.0000	29.9200	51.4089	81.0481
3.0000	10.3800	17.8351	98.8832
4.0000	0.5800	0.9966	99.8797
5.0000	0.0200	0.0344	99.9141

MEDIAN 1.3961
GRAPHIC MEAN 1.3429
INCLUSIVE GRAPHIC STANDARD DEVIATION 0.8404
INCLUSIVE GRAPHIC SKEWNESS -0.0419
GRAPHIC KURTOSIS 1.0576
NORMALIZED KURTOSIS 0.5140
SAMPLE WEIGHT 58.2000

VERBAL CLASSIFICATION

MODERATELY SORTED
NEARLY SYMMETRICAL
MESOKURTIC

CRITICAL PERCENTILES

PHI5=	0.0376	PHI75=	1.8824
PHI16=	0.4672	PHI84=	2.1655
PHI25=	0.8188	PHI95=	2.7823
PHI50=	1.3961		

PERCENTAGES

SAND 99.8797 %
SILT 0.0344 %
CLAY 0.0000 %

SAMPLE NUMBER 5

PHI SIZE	WEIGHT	WEIGHT %	C.WEIGHT %
-2.0000	0.3400	0.7372	0.7372
-1.0000	1.3400	2.9055	3.6427
0.0000	4.4700	9.6921	13.3348
1.0000	8.0700	17.4978	30.8326
2.0000	12.2300	26.5178	57.3504
3.0000	18.6500	40.4380	97.7884
4.0000	0.9500	2.0598	99.8482
5.0000	0.0300	0.0650	99.9133

MEDIAN 1.7228
GRAPHIC MEAN 1.5114
INCLUSIVE GRAPHIC STANDARD DEVIATION 1.2011
INCLUSIVE GRAPHIC SKEWNESS -0.3078
GRAPHIC KURTOSIS 0.8779
NORMALIZED KURTOSIS 0.4675
SAMPLE WEIGHT 46.1200

VERBAL CLASSIFICATION

POORLY SORTED
STRONGLY COARSE SKEWED
PLATYKURTIC

CRITICAL PERCENTILES

PHI5=	-0.8600	PHI75=	2.4365
PHI16=	0.1523	PHI84=	2.6590
PHI25=	0.6667	PHI95=	2.9310
PHI50=	1.7228		

PERCENTAGES

SAND 99.8482 %
SILT 0.0650 %
CLAY 0.0000 %

SAMPLE NUMBER 7

PHI SIZE	WEIGHT	WEIGHT %	C.WEIGHT %
-2.0000	0.0000	0.0000	0.0000
-1.0000	1.0900	6.7576	6.7576
0.0000	1.0000	6.1996	12.9572
1.0000	2.8900	17.9169	30.8742
2.0000	8.8800	55.0527	85.9268
3.0000	2.1300	13.2052	99.1321
4.0000	0.0200	0.1240	99.2561
5.0000	0.0050	0.0310	99.2870

MEDIAN 1.3474
GRAPHIC MEAN 1.1607
INCLUSIVE GRAPHIC STANDARD DEVIATION 1.0469
INCLUSIVE GRAPHIC SKEWNESS -0.3166
GRAPHIC KURTOSIS 1.4324
NORMALIZED KURTOSIS 0.5889
SAMPLE WEIGHT 16.1300

VERBAL CLASSIFICATION

POORLY SORTED
STRONGLY COARSE SKEWED
LEPTOKURTIC

CRITICAL PERCENTILES

PHI5= -1.2601 PHI75= 1.8015
PHI16= 0.1698 PHI84= 1.9650
PHI25= 0.6721 PHI95= 2.6871
PHI50= 1.3474

PERCENTAGES

SAND 99.2561 %
SILT 0.0310 %
CLAY 0.0000 %

SAMPLE NUMBER 9

PHI SIZE	WEIGHT	WEIGHT %	C.WEIGHT %
-3.0000	0.0000	0.0000	0.0000
-2.0000	0.6800	1.0345	1.0345
-1.0000	0.6500	0.9889	2.0234
0.0000	3.0100	4.5793	6.6028
1.0000	16.2000	24.6463	31.2491
2.0000	33.4800	50.9356	82.1847
3.0000	11.4200	17.3741	99.5588
4.0000	0.2900	0.4412	100.0000
5.0000	0.0000	0.0000	100.0000

MEDIAN 1.3681
GRAPHIC MEAN 1.2846
INCLUSIVE GRAPHIC STANDARD DEVIATION 0.8986
INCLUSIVE GRAPHIC SKEWNESS -0.1291
GRAPHIC KURTOSIS 1.1375
NORMALIZED KURTOSIS 0.5322
SAMPLE WEIGHT 65.7300

VERBAL CLASSIFICATION

MODERATELY SORTED
COARSE SKEWED
LEPTOKURTIC

CRITICAL PERCENTILES

PHI5= -0.3500 PHI75= 1.8589
PHI16= 0.3813 PHI84= 2.1045
PHI25= 0.7465 PHI95= 2.7376
PHI50= 1.3681

PERCENTAGES

SAND100.0000 %
SILT 0.0000 %
CLAY 0.0000 %

SAMPLE NUMBER 10

PHI SIZE	WEIGHT	WEIGHT %	C.WEIGHT %
-2.0000	0.0000	0.0000	0.0000
-1.0000	0.1600	0.3124	0.3124
0.0000	1.8700	3.6516	3.9641
1.0000	9.0200	17.6137	21.5778
2.0000	30.0900	58.7581	80.3359
3.0000	9.7400	19.0197	99.3556
4.0000	0.2500	0.4882	99.8438
5.0000	0.0050	0.0098	99.8536

MEDIAN 1.4837
GRAPHIC MEAN 1.4532
INCLUSIVE GRAPHIC STANDARD DEVIATION 0.7883
INCLUSIVE GRAPHIC SKEWNESS -0.0557
GRAPHIC KURTOSIS 1.3063
NORMALIZED KURTOSIS 0.5664
SAMPLE WEIGHT 51.2100

VERBAL CLASSIFICATION

MODERATELY SORTED
NEARLY SYMMETRICAL
LEPTOKURTIC

CRITICAL PERCENTILES

PHI5=	0.0588	PHI75=	1.9092
PHI16=	0.6833	PHI84=	2.1926
PHI25=	1.0582	PHI95=	2.7710
PHI50=	1.4837		

PERCENTAGES

SAND 99.8438 %
SILT 0.0098 %
CLAY 0.0000 %

SAMPLE NUMBER 11

PHI SIZE	WEIGHT	WEIGHT %	C.WEIGHT %
-2.0000	0.0400	0.0572	0.0572
-1.0000	0.2500	0.3573	0.4145
0.0000	3.0800	4.4019	4.8163
1.0000	12.6400	18.0649	22.8812
2.0000	39.6800	56.7100	79.5913
3.0000	13.4900	19.2797	98.8709
4.0000	0.5500	0.7861	99.6570
5.0000	0.0200	0.0286	99.6856

MEDIAN 1.4782
GRAPHIC MEAN 1.4420
INCLUSIVE GRAPHIC STANDARD DEVIATION 0.8250
INCLUSIVE GRAPHIC SKEWNESS -0.0601
GRAPHIC KURTOSIS 1.2965
NORMALIZED KURTOSIS 0.5645
SAMPLE WEIGHT 69.9700

VERBAL CLASSIFICATION

MODERATELY SORTED
NEARLY SYMMETRICAL
LEPTOKURTIC

CRITICAL PERCENTILES

PHI5=	0.0102	PHI75=	1.9190
PHI16=	0.6191	PHI84=	2.2287
PHI25=	1.0374	PHI95=	2.7992
PHI50=	1.4782		

PERCENTAGES

SAND 99.6570 %
SILT 0.0286 %
CLAY 0.0000 %

SAMPLE NUMBER 18

PHI SIZE	WEIGHT	WEIGHT %	C.WEIGHT %
-2.0000	0.0000	0.0000	0.0000
-1.0000	0.2600	0.4120	0.4120
0.0000	2.5100	3.9772	4.3892
1.0000	8.6800	13.7538	18.1429
2.0000	34.9900	55.4429	73.5858
3.0000	15.5000	24.5603	98.1461
4.0000	0.6600	1.0458	99.1919
5.0000	0.0100	0.0158	99.2077

MEDIAN 1.5746
GRAPHIC MEAN 1.6143
INCLUSIVE GRAPHIC STANDARD DEVIATION 0.8234
INCLUSIVE GRAPHIC SKEWNESS -0.0035
GRAPHIC KURTOSIS 1.2408
NORMALIZED KURTOSIS 0.5537
SAMPLE WEIGHT 63.1100

VERBAL CLASSIFICATION

MODERATELY SORTED
NEARLY SYMMETRICAL
LEPTOKURTIC

CRITICAL PERCENTILES

PHI5=	0.0444	PHI75=	2.0576
PHI16=	0.8442	PHI84=	2.4240
PHI25=	1.1237	PHI95=	2.8719
PHI50=	1.5746		

PERCENTAGES

SAND 99.1919 %
SILT 0.0158 %
CLAY 0.0000 %

SAMPLE NUMBER 19

PHI SIZE	WEIGHT	WEIGHT %	C.WEIGHT %
-2.0000	0.1800	0.3300	0.3300
-1.0000	0.7400	1.3568	1.6868
0.0000	7.0400	12.9080	14.5948
1.0000	18.2100	33.3883	47.9831
2.0000	23.9000	43.8210	91.8042
3.0000	4.2900	7.8658	99.6700
4.0000	0.1800	0.3300	100.0000
5.0000	0.0400	0.0733	100.0733

MEDIAN 1.0460
GRAPHIC MEAN 0.9700
INCLUSIVE GRAPHIC STANDARD DEVIATION 0.9222
INCLUSIVE GRAPHIC SKEWNESS -0.1322
GRAPHIC KURTOSIS 0.9892
NORMALIZED KURTOSIS 0.4973
SAMPLE WEIGHT 54.5400

VERBAL CLASSIFICATION

MODERATELY SORTED
COARSE SKEWED
MESOKURTIC

CRITICAL PERCENTILES

PHI5=	-0.7433	PHI75=	1.6165
PHI16=	0.0421	PHI84=	1.8219
PHI25=	0.3116	PHI95=	2.4063
PHI50=	1.0460		

PERCENTAGES

SAND100.0000 %
SILT 0.0733 %
CLAY 0.0000 %

SAMPLE NUMBER 20

PHI SIZE	WEIGHT	WEIGHT %	C.WEIGHT %
-2.0000	0.0000	0.0000	0.0000
-1.0000	0.4100	0.8349	0.8349
0.0000	2.2200	4.5205	5.3553
1.0000	7.2500	14.7628	20.1181
2.0000	24.2900	49.4604	69.5785
3.0000	14.3000	29.1183	98.6968
4.0000	0.6400	1.3032	100.0000

MEDIAN 1.6042
GRAPHIC MEAN 1.6068
INCLUSIVE GRAPHIC STANDARD DEVIATION 0.8908
INCLUSIVE GRAPHIC SKEWNESS -0.0679
GRAPHIC KURTOSIS 1.1124
NORMALIZED KURTOSIS 0.5266
SAMPLE WEIGHT 49.1100

VERBAL CLASSIFICATION

MODERATELY SORTED
NEARLY SYMMETRICAL
LEPTOKURTIC

CRITICAL PERCENTILES

PHI5= -0.0786 PHI75= 2.1862
PHI16= 0.7210 PHI84= 2.4953
PHI25= 1.0987 PHI95= 2.8730
PHI50= 1.6042

PERCENTAGES

SAND100.0000 %
SILT 0.0000 %
CLAY 0.0000 %

SAMPLE NUMBER 21

PHI SIZE	WEIGHT	WEIGHT %	C.WEIGHT %
-2.0000	0.0000	0.0000	0.0000
-1.0000	0.3100	0.6261	0.6261
0.0000	1.8800	3.7972	4.4233
1.0000	11.1900	22.6015	27.0248
2.0000	23.7700	48.0105	75.0353
3.0000	8.3100	16.7845	91.8198
4.0000	0.1200	0.2424	92.0622
5.0000	0.0050	0.0101	92.0723

MEDIAN 1.4785
GRAPHIC MEAN 1.5083
INCLUSIVE GRAPHIC STANDARD DEVIATION 1.7628
INCLUSIVE GRAPHIC SKEWNESS 0.3470
GRAPHIC KURTOSIS 3.1234
NORMALIZED KURTOSIS 0.7575
SAMPLE WEIGHT 49.5100

VERBAL CLASSIFICATION

POORLY SORTED
STRONGLY FINE-SKEWED
EXTREMELY LEPTOKURTIC

CRITICAL PERCENTILES

PHI5= 0.0255 PHI75= 1.9993
PHI16= 0.5122 PHI84= 2.5341
PHI25= 0.9104 PHI95= 8.3237
PHI50= 1.4785

PERCENTAGES

SAND 92.0622 %
SILT 0.0101 %
CLAY 0.0000 %

SAMPLE NUMBER 22

PHI SIZE	WEIGHT	WEIGHT %	C.WEIGHT %
-2.0000	0.5700	1.2669	1.2669
-1.0000	0.4100	0.9113	2.1783
0.0000	2.4600	5.4679	7.6461
1.0000	9.9700	22.1605	29.8066
2.0000	22.6300	50.3001	80.1067
3.0000	8.5200	18.9375	99.0442
4.0000	0.3300	0.7335	99.7777
5.0000	0.0050	0.0111	99.7888

MEDIAN 1.4015
GRAPHIC MEAN 1.3280
INCLUSIVE GRAPHIC STANDARD DEVIATION 0.9527
INCLUSIVE GRAPHIC SKEWNESS -0.1368
GRAPHIC KURTOSIS 1.2017
NORMALIZED KURTOSIS 0.5458
SAMPLE WEIGHT 44.9900

VERBAL CLASSIFICATION

MODERATELY SORTED
COARSE SKEWED
LEPTOKURTIC

CRITICAL PERCENTILES

PHI5=	-0.4839	PHI75=	1.8985
PHI16=	0.3770	PHI84=	2.2056
PHI25=	0.7831	PHI95=	2.7864
PHI50=	1.4015		

PERCENTAGES

SAND 99.7777 %
SILT 0.0111 %
CLAY 0.0000 %

SAMPLE NUMBER 23

PHI SIZE	WEIGHT	WEIGHT %	C.WEIGHT %
-2.0000	1.4700	3.6741	3.6741
-1.0000	1.1700	2.9243	6.5984
0.0000	4.9500	12.3719	18.9703
1.0000	9.1300	22.8193	41.7896
2.0000	17.4600	43.6391	85.4286
3.0000	5.5200	13.7966	99.2252
4.0000	0.3100	0.7748	100.0000
5.0000	0.0200	0.0500	100.0500

MEDIAN 1.1881
GRAPHIC MEAN 0.9718
INCLUSIVE GRAPHIC STANDARD DEVIATION 1.1943
INCLUSIVE GRAPHIC SKEWNESS -0.2920
GRAPHIC KURTOSIS 1.1610
NORMALIZED KURTOSIS 0.5373
SAMPLE WEIGHT 40.0100

VERBAL CLASSIFICATION

POORLY SORTED
COARSE SKEWED
LEPTOKURTIC

CRITICAL PERCENTILES

PHI5=	-1.5466	PHI75=	1.7610
PHI16=	-0.2401	PHI84=	1.9673
PHI25=	0.2642	PHI95=	2.6937
PHI50=	1.1881		

PERCENTAGES

SAND100.0000 %
SILT 0.0500 %
CLAY 0.0000 %

SAMPLE NUMBER 24

PHI SIZE	WEIGHT	WEIGHT %	C.WEIGHT %
-2.0000	0.0500	0.1194	0.1194
-1.0000	0.2000	0.4774	0.5968
0.0000	0.7200	1.7188	2.3156
1.0000	2.4100	5.7532	8.0688
2.0000	14.2300	33.9699	42.0387
3.0000	23.0300	54.9773	97.0160
4.0000	1.2500	2.9840	100.0000
5.0000	0.0000	0.0000	100.0000

MEDIAN 2.1448
GRAPHIC MEAN 2.0472
INCLUSIVE GRAPHIC STANDARD DEVIATION 0.7607
INCLUSIVE GRAPHIC SKEWNESS -0.2679
GRAPHIC KURTOSIS 0.9293
NORMALIZED KURTOSIS 0.4817
SAMPLE WEIGHT 41.8900

VERBAL CLASSIFICATION

MODERATELY SORTED
COARSE SKEWED
MESOKURTIC

CRITICAL PERCENTILES

PHI5=	0.4666	PHI75=	2.5995
PHI16=	1.2335	PHI84=	2.7632
PHI25=	1.4984	PHI95=	2.9633
PHI50=	2.1448		

PERCENTAGES

SAND100.0000 %
SILT 0.0000 %
CLAY 0.0000 %

SAMPLE NUMBER 25

PHI SIZE	WEIGHT	WEIGHT %	C.WEIGHT %
-2.0000	0.5600	1.2644	1.2644
-1.0000	1.4800	3.3416	4.6060
0.0000	7.3100	16.5049	21.1109
1.0000	13.2500	29.9165	51.0273
2.0000	18.1500	40.9799	92.0072
3.0000	3.3800	7.6315	99.6387
4.0000	0.1100	0.2484	99.8871
5.0000	0.0100	0.0226	99.9097

MEDIAN 0.9657
GRAPHIC MEAN 0.8202
INCLUSIVE GRAPHIC STANDARD DEVIATION 1.0389
INCLUSIVE GRAPHIC SKEWNESS -0.1797
GRAPHIC KURTOSIS 0.9488
NORMALIZED KURTOSIS 0.4869
SAMPLE WEIGHT 44.2900

VERBAL CLASSIFICATION

POORLY SORTED
COARSE SKEWED
MESOKURTIC

CRITICAL PERCENTILES

PHI5=	-0.9761	PHI75=	1.5850
PHI16=	-0.3097	PHI84=	1.8046
PHI25=	0.1300	PHI95=	2.3922
PHI50=	0.9657		

PERCENTAGES

SAND 99.8871 %
SILT 0.0226 %
CLAY 0.0000 %

SAMPLE NUMBER 26

PHI SIZE	WEIGHT	WEIGHT %	C.WEIGHT %
-2.0000	0.2600	0.5832	0.5832
-1.0000	1.1000	2.4675	3.0507
0.0000	4.4200	9.9148	12.9655
1.0000	10.8200	24.2710	37.2364
2.0000	19.5700	43.8986	81.1350
3.0000	7.9800	17.9004	99.0354
4.0000	0.2500	0.5608	99.5962
5.0000	0.0100	0.0224	99.6187

MEDIAN 1.2908
GRAPHIC MEAN 1.1919
INCLUSIVE GRAPHIC STANDARD DEVIATION 1.0509
INCLUSIVE GRAPHIC SKEWNESS -0.1581
GRAPHIC KURTOSIS 1.0747
NORMALIZED KURTOSIS 0.5180
SAMPLE WEIGHT 44.5800

VERBAL CLASSIFICATION

POORLY SORTED
COARSE SKEWED
MESOKURTIC

CRITICAL PERCENTILES

PHI5=	-0.8034	PHI75=	1.8602
PHI16=	0.1250	PHI84=	2.1601
PHI25=	0.4958	PHI95=	2.7746
PHI50=	1.2908		

PERCENTAGES

SAND 99.5962 %
SILT 0.0224 %
CLAY 0.0000 %

SAMPLE NUMBER 27

PHI SIZE	WEIGHT	WEIGHT %	C.WEIGHT %
-2.0000	0.2700	0.5026	0.5026
-1.0000	1.0900	2.0290	2.5316
0.0000	6.1000	11.3552	13.8868
1.0000	16.9100	31.4780	45.3649
2.0000	25.1400	46.7982	92.1631
3.0000	3.7400	6.9620	99.1251
4.0000	0.3400	0.6329	99.7580
5.0000	0.0300	0.0558	99.8139

MEDIAN 1.0990
GRAPHIC MEAN 0.9972
INCLUSIVE GRAPHIC STANDARD DEVIATION 0.9230
INCLUSIVE GRAPHIC SKEWNESS -0.1767
GRAPHIC KURTOSIS 1.0213
NORMALIZED KURTOSIS 0.5053
SAMPLE WEIGHT 53.7200

VERBAL CLASSIFICATION

MODERATELY SORTED
COARSE SKEWED
MESOKURTIC

CRITICAL PERCENTILES

PHI5=	-0.7826	PHI75=	1.6333
PHI16=	0.0671	PHI84=	1.8256
PHI25=	0.3530	PHI95=	2.4075
PHI50=	1.0990		

PERCENTAGES

SAND 99.7580 %
SILT 0.0558 %
CLAY 0.0000 %

SAMPLE NUMBER 28

PHI SIZE	WEIGHT	WEIGHT %	C.WEIGHT %
-2.0000	0.3100	0.5571	0.5571
-1.0000	0.9800	1.7610	2.3181
0.0000	6.9300	12.4528	14.7709
1.0000	17.4100	31.2848	46.0557
2.0000	23.1800	41.6532	87.7089
3.0000	6.4000	11.5004	99.2093
4.0000	0.4700	0.8446	100.0539
5.0000	0.0300	0.0539	100.1078

MEDIAN 1.0947
GRAPHIC MEAN 1.0150
INCLUSIVE GRAPHIC STANDARD DEVIATION 0.9859
INCLUSIVE GRAPHIC SKEWNESS -0.1136
GRAPHIC KURTOSIS 1.0242
NORMALIZED KURTOSIS 0.5060
SAMPLE WEIGHT 55.6500

VERBAL CLASSIFICATION

MODERATELY SORTED
COARSE SKEWED
MESOKURTIC

CRITICAL PERCENTILES

PHI5= -0.7846 PHI75= 1.6949
PHI16= 0.0393 PHI84= 1.9110
PHI25= 0.3270 PHI95= 2.6340
PHI50= 1.0947

PERCENTAGES

SAND100.0539 %
SILT 0.0539 %
CLAY 0.0000 %

SAMPLE NUMBER 29

PHI SIZE	WEIGHT	WEIGHT %	C.WEIGHT %
-2.0000	0.2700	0.4903	0.4903
-1.0000	1.1000	1.9975	2.4877
0.0000	5.2500	9.5333	12.0211
1.0000	13.9000	25.2406	37.2617
2.0000	25.7500	46.7587	84.0203
3.0000	7.3000	13.2559	97.2762
4.0000	0.6500	1.1803	98.4565
5.0000	0.0200	0.0363	98.4928

MEDIAN 1.2724
GRAPHIC MEAN 1.1432
INCLUSIVE GRAPHIC STANDARD DEVIATION 1.0006
INCLUSIVE GRAPHIC SKEWNESS -0.1688
GRAPHIC KURTOSIS 1.1300
NORMALIZED KURTOSIS 0.5305
SAMPLE WEIGHT 55.0700

VERBAL CLASSIFICATION

POORLY SORTED
COARSE SKEWED
LEPTOKURTIC

CRITICAL PERCENTILES

PHI5= -0.7365 PHI75= 1.8071
PHI16= 0.1576 PHI84= 1.9996
PHI25= 0.5142 PHI95= 2.8283
PHI50= 1.2724

PERCENTAGES

SAND 98.4565 %
SILT 0.0363 %
CLAY 0.0000 %

SAMPLE NUMBER 30

PHI SIZE	WEIGHT	WEIGHT %	C.WEIGHT %
-3.0000	0.0000	0.0000	0.0000
-2.0000	0.0300	0.1039	0.1039
-1.0000	0.0400	0.1386	0.2425
0.0000	0.9400	3.2560	3.4984
1.0000	7.5100	26.0132	29.5116
2.0000	14.9600	51.8185	81.3301
3.0000	5.1400	17.8039	99.1340
4.0000	0.2500	0.8660	100.0000
5.0000	0.0000	0.0000	100.0000

MEDIAN 1.3954
GRAPHIC MEAN 1.3420
INCLUSIVE GRAPHIC STANDARD DEVIATION 0.8280
INCLUSIVE GRAPHIC SKEWNESS -0.0416
GRAPHIC KURTOSIS 1.0565
NORMALIZED KURTOSIS 0.5137
SAMPLE WEIGHT 28.8700

VERBAL CLASSIFICATION

MODERATELY SORTED
NEARLY SYMMETRICAL
MESOKURTIC

CRITICAL PERCENTILES

PHI5= 0.0577 PHI75= 1.8778
PHI16= 0.4806 PHI84= 2.1500
PHI25= 0.8266 PHI95= 2.7678
PHI50= 1.3954

PERCENTAGES

SAND100.0000 %
SILT 0.0000 %
CLAY 0.0000 %

SAMPLE NUMBER 31

PHI SIZE	WEIGHT	WEIGHT %	C.WEIGHT %
-2.0000	0.2000	0.3811	0.3811
-1.0000	1.1100	2.1151	2.4962
0.0000	3.8700	7.3742	9.8704
1.0000	8.9300	17.0160	26.8864
2.0000	19.0300	36.2614	63.1479
3.0000	16.8800	32.1646	95.3125
4.0000	1.9100	3.6395	98.9520
5.0000	0.0500	0.0953	99.0473

MEDIAN 1.6374
GRAPHIC MEAN 1.5486
INCLUSIVE GRAPHIC STANDARD DEVIATION 1.1252
INCLUSIVE GRAPHIC SKEWNESS -0.1876
GRAPHIC KURTOSIS 1.0114
NORMALIZED KURTOSIS 0.5028
SAMPLE WEIGHT 52.4800

VERBAL CLASSIFICATION

POORLY SORTED
COARSE SKEWED
MESOKURTIC

CRITICAL PERCENTILES

PHI5= -0.6605 PHI75= 2.3685
PHI16= 0.3602 PHI84= 2.6483
PHI25= 0.8891 PHI95= 2.9903
PHI50= 1.6374

PERCENTAGES

SAND 98.9520 %
SILT 0.0953 %
CLAY 0.0000 %

SAMPLE NUMBER 32

PHI SIZE	WEIGHT	WEIGHT %	C.WEIGHT %
-2.0000	0.2500	0.4422	0.4422
-1.0000	0.8000	1.4149	1.8571
0.0000	4.1100	7.2692	9.1263
1.0000	15.4400	27.3081	36.4344
2.0000	29.5700	52.2993	88.7336
3.0000	6.0600	10.7181	99.4517
4.0000	0.3100	0.5483	100.0000
5.0000	0.0000	0.0000	100.0000

MEDIAN 1.2594
GRAPHIC MEAN 1.1402
INCLUSIVE GRAPHIC STANDARD DEVIATION 0.8921
INCLUSIVE GRAPHIC SKEWNESS -0.1874
GRAPHIC KURTOSIS 1.1175
NORMALIZED KURTOSIS 0.5277
SAMPLE WEIGHT 56.5400

VERBAL CLASSIFICATION

MODERATELY SORTED
COARSE SKEWED
LEPTOKURTIC

CRITICAL PERCENTILES

PHI5=	-0.5676	PHI75=	1.7374
PHI16=	0.2517	PHI84=	1.9095
PHI25=	0.5813	PHI95=	2.5847
PHI50=	1.2594		

PERCENTAGES

SAND100.0000 %
SILT 0.0000 %
CLAY 0.0000 %

SAMPLE NUMBER 33

PHI SIZE	WEIGHT	WEIGHT %	C.WEIGHT %
-2.0000	0.3600	0.7961	C.7961
-1.0000	0.6400	1.4153	2.2114
0.0000	8.7700	19.3941	21.6055
1.0000	20.0100	44.2503	65.8558
2.0000	13.6500	30.1858	96.0416
3.0000	1.6700	3.6931	99.7346
4.0000	0.0700	0.1548	99.8894
5.0000	0.0100	0.0221	99.9116

MEDIAN 0.6417
GRAPHIC MEAN 0.6512
INCLUSIVE GRAPHIC STANDARD DEVIATION 0.9001
INCLUSIVE GRAPHIC SKEWNESS -0.0233
GRAPHIC KURTOSIS 0.9431
NORMALIZED KURTOSIS 0.4854
SAMPLE WEIGHT 45.2200

VERBAL CLASSIFICATION

MODERATELY SORTED
NEARLY SYMMETRICAL
MESOKURTIC

CRITICAL PERCENTILES

PHI5=	-0.8562	PHI75=	1.3029
PHI16=	-0.2890	PHI84=	1.6011
PHI25=	0.0767	PHI95=	1.9655
PHI50=	0.6417		

PERCENTAGES

SAND 99.8894 %
SILT 0.0221 %
CLAY 0.0000 %

SAMPLE NUMBER 34

PHI SIZE	WEIGHT	WEIGHT %	C.WEIGHT %
-2.0000	0.3200	1.0003	1.0003
-1.0000	1.1300	3.5324	4.5327
0.0000	1.5100	4.7202	9.2529
1.0000	2.3100	7.2210	16.4739
2.0000	10.4700	32.7290	49.2029
3.0000	15.3000	47.8274	97.0303
4.0000	0.9800	3.0635	100.0938
5.0000	0.0300	0.0938	100.1876

MEDIAN 2.0167
GRAPHIC MEAN 1.8929
INCLUSIVE GRAPHIC STANDARD DEVIATION 1.0329
INCLUSIVE GRAPHIC SKEWNESS -0.3597
GRAPHIC KURTOSIS 1.2365
NORMALIZED KURTOSIS 0.5529
SAMPLE WEIGHT 31.9900

VERBAL CLASSIFICATION

POORLY SORTED
STRONGLY COARSE SKEWED
LEPTOKURTIC

CRITICAL PERCENTILES

PHI5= -0.9010 PHI75= 2.5394
PHI16= 0.9344 PHI84= 2.7276
PHI25= 1.2605 PHI95= 2.9575
PHI50= 2.0167

PERCENTAGES

SAND100.0938 %
SILT 0.0938 %
CLAY 0.0000 %

SAMPLE NUMBER 35

PHI SIZE	WEIGHT	WEIGHT %	C.WEIGHT %
-2.0000	0.0000	0.0000	0.0000
-1.0000	0.4000	0.9145	0.9145
0.0000	4.7000	10.7453	11.6598
1.0000	18.2100	41.6324	53.2922
2.0000	16.3600	37.4028	90.6950
3.0000	3.6400	8.3219	99.0169
4.0000	0.2500	0.5716	99.5885
5.0000	0.0300	0.0686	99.6571

MEDIAN 0.9209
GRAPHIC MEAN 0.9487
INCLUSIVE GRAPHIC STANDARD DEVIATION 0.9045
INCLUSIVE GRAPHIC SKEWNESS 0.0332
GRAPHIC KURTOSIS 1.0204
NORMALIZED KURTOSIS 0.5051
SAMPLE WEIGHT 43.7400

VERBAL CLASSIFICATION

MODERATELY SORTED
NEARLY SYMMETRICAL
MESOKURTIC

CRITICAL PERCENTILES

PHI5= -0.6198 PHI75= 1.5804
PHI16= 0.1043 PHI84= 1.8210
PHI25= 0.3204 PHI95= 2.5173
PHI50= 0.9209

PERCENTAGES

SAND 99.5885 %
SILT 0.0686 %
CLAY 0.0000 %

SAMPLE NUMBER 36

PHI SIZE	WEIGHT	WEIGHT %	C.WEIGHT %
-2.0000	0.8300	2.7965	2.7965
-1.0000	0.6300	2.1226	4.9191
0.0000	9.4400	31.8059	36.7251
1.0000	10.6000	35.7143	72.4394
2.0000	4.7400	15.9704	88.4097
3.0000	3.0500	10.2763	98.6860
4.0000	0.3900	1.3140	100.0000
5.0000	0.0000	0.0000	100.0000

MEDIAN 0.3717
GRAPHIC MEAN 0.4813
INCLUSIVE GRAPHIC STANDARD DEVIATION 1.1452
INCLUSIVE GRAPHIC SKEWNESS 0.1930
GRAPHIC KURTOSIS 0.9754
NORMALIZED KURTOSIS 0.4938
SAMPLE WEIGHT 29.6800

VERBAL CLASSIFICATION

POORLY SORTED
FINE-SKEWED
MESOKURTIC

CRITICAL PERCENTILES

PHI5= -0.9975 PHI75= 1.1603
PHI16= -0.6516 PHI84= 1.7239
PHI25= -0.3686 PHI95= 2.6413
PHI50= 0.3717

PERCENTAGES

SAND100.0000 %
SILT 0.0000 %
CLAY 0.0000 %

SAMPLE NUMBER 37

PHI SIZE	WEIGHT	WEIGHT %	C.WEIGHT %
-2.0000	0.2700	0.4950	0.4950
-1.0000	0.4400	0.8066	1.3016
0.0000	2.0800	3.8130	5.1146
1.0000	8.2300	15.0871	20.2016
2.0000	32.9100	60.3300	80.5316
3.0000	10.2900	18.8634	99.3951
4.0000	0.1700	0.3116	99.7067
5.0000	0.0100	0.0183	99.7250

MEDIAN 1.4939
GRAPHIC MEAN 1.4664
INCLUSIVE GRAPHIC STANDARD DEVIATION 0.7894
INCLUSIVE GRAPHIC SKEWNESS -0.0730
GRAPHIC KURTOSIS 1.3832
NORMALIZED KURTOSIS 0.5804
SAMPLE WEIGHT 54.5500

VERBAL CLASSIFICATION

MODERATELY SORTED
NEARLY SYMMETRICAL
LEPTOKURTIC

CRITICAL PERCENTILES

PHI5= -0.0300 PHI75= 1.9083
PHI16= 0.7215 PHI84= 2.1839
PHI25= 1.0795 PHI95= 2.7670
PHI50= 1.4939

PERCENTAGES

SAND 99.7067 %
SILT 0.0183 %
CLAY 0.0000 %

SAMPLE NUMBER 38

PHI SIZE	WEIGHT	WEIGHT %	C.WEIGHT %
-2.0000	0.1200	0.1998	0.1998
-1.0000	0.4200	0.6994	0.8993
0.0000	1.7900	2.9808	3.8801
1.0000	7.0300	11.7069	15.5870
2.0000	32.3400	53.8551	69.4421
3.0000	20.8200	34.6711	104.1132
4.0000	0.4100	0.6828	104.7960
5.0000	0.0100	0.0167	104.8127

MEDIAN 1.6390
GRAPHIC MEAN 1.6888
INCLUSIVE GRAPHIC STANDARD DEVIATION 0.7533
INCLUSIVE GRAPHIC SKEWNESS -0.0313
GRAPHIC KURTOSIS 1.0985
NORMALIZED KURTOSIS 0.5235
SAMPLE WEIGHT 60.0500

VERBAL CLASSIFICATION

MODERATELY SORTED
NEARLY SYMMETRICAL
MESOKURTIC

CRITICAL PERCENTILES

PHI5= 0.0957 PHI75= 2.1603
PHI16= 1.0077 PHI84= 2.4199
PHI25= 1.1748 PHI95= 2.7372
PHI50= 1.6390

PERCENTAGES

SAND104 7960 %
SILT 0.0167 %
CLAY 0.0000 %

SAMPLE NUMBER 39

PHI SIZE	WEIGHT	WEIGHT %	C.WEIGHT %
-2.0000	0.2000	0.4457	0.4457
-1.0000	0.6000	1.3372	1.7829
0.0000	2.3600	5.2596	7.0426
1.0000	6.9400	15.4669	22.5095
2.0000	24.6400	54.9142	77.4237
3.0000	9.7200	21.6626	99.0863
4.0000	0.0300	0.0669	99.1531
5.0000	0.0100	0.0223	99.1754

MEDIAN 1.5006
GRAPHIC MEAN 1.4611
INCLUSIVE GRAPHIC STANDARD DEVIATION 0.9159
INCLUSIVE GRAPHIC SKEWNESS -0.1247
GRAPHIC KURTOSIS 1.4402
NORMALIZED KURTOSIS 0.5902
SAMPLE WEIGHT 44.8700

VERBAL CLASSIFICATION

MODERATELY SORTED
COARSE SKEWED
LEPTOKURTIC

CRITICAL PERCENTILES

PHI5= -0.3883 PHI75= 1.9559
PHI16= 0.5791 PHI84= 2.3036
PHI25= 1.0454 PHI95= 2.8114
PHI50= 1.5006

PERCENTAGES

SAND 99.1531 %
SILT 0.0223 %
CLAY 0.0000 %

SAMPLE NUMBER 40

PHI SIZE	WEIGHT	WEIGHT %	C.WEIGHT %
-2.0000	0.0000	0.0000	0.0000
-1.0000	0.3600	0.8830	0.8830
0.0000	0.7300	1.7905	2.6735
1.0000	1.6300	3.9980	6.6716
2.0000	13.5200	33.1616	39.8332
3.0000	23.4700	57.5668	97.4000
4.0000	1.0600	2.6000	100.0000
5.0000	0.0000	0.0000	100.0000

MEDIAN 2.1766
GRAPHIC MEAN 2.0750
INCLUSIVE GRAPHIC STANDARD DEVIATION 0.7315
INCLUSIVE GRAPHIC SKEWNESS -0.2736
GRAPHIC KURTOSIS 0.9204
NORMALIZED KURTOSIS 0.4793
SAMPLE WEIGHT 40.7700

VERBAL CLASSIFICATION

MODERATELY SORTED
COARSE SKEWED
MESOKURTIC

CRITICAL PERCENTILES

PHI5=	0.5819	PHI75=	2.6109
PHI16=	1.2813	PHI84=	2.7672
PHI25=	1.5527	PHI95=	2.9583
PHI50=	2.1766		

PERCENTAGES

SAND100.0000 %
SILT 0.0000 %
CLAY 0.0000 %

SAMPLE NUMBER 41

PHI SIZE	WEIGHT	WEIGHT %	C.WEIGHT %
-2.0000	1.5900	3.8129	3.8129
-1.0000	0.4100	0.9832	4.7962
0.0000	0.9900	2.3741	7.1703
1.0000	3.9000	9.3525	16.5228
2.0000	17.2600	41.3909	57.9137
3.0000	16.7800	40.2398	98.1535
4.0000	0.7300	1.7506	99.9041
5.0000	0.0100	0.0240	99.9281

MEDIAN 1.8088
GRAPHIC MEAN 1.8004
INCLUSIVE GRAPHIC STANDARD DEVIATION 1.0072
INCLUSIVE GRAPHIC SKEWNESS -0.2173
GRAPHIC KURTOSIS 1.2888
NORMALIZED KURTOSIS 0.5631
SAMPLE WEIGHT 41.7000

VERBAL CLASSIFICATION

POORLY SORTED
COARSE SKEWED
LEPTOKURTIC

CRITICAL PERCENTILES

PHI5=	-0.9141	PHI75=	2.4246
PHI16=	0.9441	PHI84=	2.6483
PHI25=	1.2048	PHI95=	2.9216
PHI50=	1.8088		

PERCENTAGES

SAND 99.9041 %
SILT 0.0240 %
CLAY 0.0000 %

SAMPLE NUMBER 42

PHI SIZE	WEIGHT	WEIGHT %	C.WEIGHT %
-3.0000	0.0000	0.0000	0.0000
-2.0000	0.4400	0.7232	0.7232
-1.0000	2.4600	4.0434	4.7666
0.0000	9.9300	16.3215	21.0881
1.0000	18.5600	30.5062	51.5943
2.0000	25.4000	41.7488	93.3432
3.0000	3.8100	6.2623	99.6055
4.0000	0.2400	0.3945	100.0000
5.0000	0.0000	0.0000	100.0000

MEDIAN 0.9477
GRAPHIC MEAN 0.8041
INCLUSIVE GRAPHIC STANDARD DEVIATION 1.0145
INCLUSIVE GRAPHIC SKEWNESS -0.1981
GRAPHIC KURTOSIS 0.9300
NORMALIZED KURTOSIS 0.4819
SAMPLE WEIGHT 60.8400

VERBAL CLASSIFICATION

POORLY SORTED
COARSE SKEWED
MESOKURTIC

CRITICAL PERCENTILES

PHI5= -0.9857 PHI75= 1.5606
PHI16= -0.3117 PHI84= 1.7762
PHI25= 0.1282 PHI95= 2.2646
PHI50= 0.9477

PERCENTAGES

SAND100.0000 %
SILT 0.0000 %
CLAY 0.0000 %

SAMPLE NUMBER 43

PHI SIZE	WEIGHT	WEIGHT %	C.WEIGHT %
-3.0000	0.0000	0.0000	0.0000
-2.0000	2.2000	13.9241	13.9241
-1.0000	0.3800	2.4051	16.3291
0.0000	0.3500	2.2152	18.5443
1.0000	1.2400	7.8481	26.3924
2.0000	6.1500	38.9240	65.3165
3.0000	5.1900	32.8481	98.1646
4.0000	0.2900	1.8354	100.0000
5.0000	0.0000	0.0000	100.0000

MEDIAN 1.6065
GRAPHIC MEAN 1.0128
INCLUSIVE GRAPHIC STANDARD DEVIATION 1.7665
INCLUSIVE GRAPHIC SKEWNESS -0.5064
GRAPHIC KURTOSIS 1.5435
NORMALIZED KURTOSIS 0.6068
SAMPLE WEIGHT 15.8000

VERBAL CLASSIFICATION

POORLY SORTED
STRONGLY COARSE SKEWED
VERY LEPTOKURTIC

CRITICAL PERCENTILES

PHI5= -2.6409 PHI75= 2.2948
PHI16= -1.1368 PHI84= 2.5688
PHI25= 0.8226 PHI95= 2.9037
PHI50= 1.6065

PERCENTAGES

SAND100.0000 %
SILT 0.0000 %
CLAY 0.0000 %

SAMPLE NUMBER 44

PHI SIZE	WEIGHT	WEIGHT %	C.WEIGHT %
-3.0000	0.0000	0.0000	0.0000
-2.0000	0.6600	1.7544	1.7544
-1.0000	0.7600	2.0202	3.7746
0.0000	3.0900	8.2137	11.9883
1.0000	10.4200	27.6980	39.6863
2.0000	17.6500	46.9165	86.6029
3.0000	4.8200	12.8123	99.4152
4.0000	0.2200	0.5848	100.0000
5.0000	0.0000	0.0000	100.0000

MEDIAN 1.2198
GRAPHIC MEAN 1.1031
INCLUSIVE GRAPHIC STANDARD DEVIATION 0.9812
INCLUSIVE GRAPHIC SKEWNESS -0.1879
GRAPHIC KURTOSIS 1.1201
NORMALIZED KURTOSIS 0.5283
SAMPLE WEIGHT 37.6200

VERBAL CLASSIFICATION

MODERATELY SORTED
COARSE SKEWED
LEPTOKURTIC

CRITICAL PERCENTILES

PHI5=	-0.8508	PHI75=	1.7527
PHI16=	0.1448	PHI84=	1.9445
PHI25=	0.4698	PHI95=	2.6554
PHI50=	1.2198		

PERCENTAGES

SAND100.0000 %
SILT 0.0000 %
CLAY 0.0000 %

SAMPLE NUMBER 45

PHI SIZE	WEIGHT	WEIGHT %	C.WEIGHT %
-3.0000	0.0000	0.0000	0.0000
-2.0000	0.1500	0.2137	0.2137
-1.0000	1.9800	2.8205	3.0342
0.0000	5.0200	7.1510	10.1852
1.0000	10.4000	14.8148	25.0000
2.0000	36.9900	52.6923	77.6923
3.0000	14.9200	21.2536	98.9459
4.0000	0.7400	1.0541	100.0000
5.0000	0.0000	0.0000	100.0000

MEDIAN 1.4745
GRAPHIC MEAN 1.3879
INCLUSIVE GRAPHIC STANDARD DEVIATION 1.0123
INCLUSIVE GRAPHIC SKEWNESS -0.1896
GRAPHIC KURTOSIS 1.5287
NORMALIZED KURTOSIS 0.6045
SAMPLE WEIGHT 70.2000

VERBAL CLASSIFICATION

POORLY SORTED
COARSE SKEWED
VERY LEPTOKURTIC

CRITICAL PERCENTILES

PHI5=	-0.7251	PHI75=	1.9489
PHI16=	0.3925	PHI84=	2.2968
PHI25=	1.0000	PHI95=	2.8143
PHI50=	1.4745		

PERCENTAGES

SAND100.0000 %
SILT 0.0000 %
CLAY 0.0000 %

SAMPLE NUMBER 46

PHI SIZE	WEIGHT	WEIGHT %	C.WEIGHT %
-2.0000	0.1400	0.3424	0.3424
-1.0000	1.2100	2.9592	3.3015
0.0000	6.8500	16.7523	20.0538
1.0000	11.7100	28.6378	48.6916
2.0000	17.3000	42.3086	91.0002
3.0000	3.5300	8.6329	99.6332
4.0000	0.1700	0.4157	100.0489
5.0000	0.0300	0.0734	100.1223

MEDIAN 1.0309
GRAPHIC MEAN 0.8745
INCLUSIVE GRAPHIC STANDARD DEVIATION 1.0285
INCLUSIVE GRAPHIC SKEWNESS -0.1869
GRAPHIC KURTOSIS 0.9508
NORMALIZED KURTOSIS 0.4874
SAMPLE WEIGHT 40.8900

VERBAL CLASSIFICATION

POORLY SORTED
COARSE SKEWED
MESOKURTIC

CRITICAL PERCENTILES

PHI5=	-0.8986	PHI75=	1.6218
PHI16=	-0.2420	PHI84=	1.8345
PHI25=	0.1727	PHI95=	2.4633
PHI50=	1.0309		

PERCENTAGES

SAND100.0489 %
SILT 0.0734 %
CLAY 0.0000 %

SAMPLE NUMBER 47

PHI SIZE	WEIGHT	WEIGHT %	C.WEIGHT %
-3.0000	0.0000	0.0000	0.0000
-2.0000	1.0300	2.5932	2.5932
-1.0000	0.3800	0.9567	3.5498
0.0000	1.7600	4.4310	7.9809
1.0000	8.5800	21.6012	29.5821
2.0000	23.1000	58.1571	87.7392
3.0000	4.7900	12.0594	99.7986
4.0000	0.0800	0.2014	100.0000
5.0000	0.0000	0.0000	100.0000

MEDIAN 1.3511
GRAPHIC MEAN 1.2193
INCLUSIVE GRAPHIC STANDARD DEVIATION 0.8873
INCLUSIVE GRAPHIC SKEWNESS -0.2443
GRAPHIC KURTOSIS 1.3515
NORMALIZED KURTOSIS 0.5747
SAMPLE WEIGHT 39.7200

VERBAL CLASSIFICATION

MODERATELY SORTED
COARSE SKEWED
LEPTOKURTIC

CRITICAL PERCENTILES

PHI5=	-0.6727	PHI75=	1.7810
PHI16=	0.3712	PHI84=	1.9357
PHI25=	0.7879	PHI95=	2.6021
PHI50=	1.3511		

PERCENTAGES

SAND100.0000 %
SILT 0.0000 %
CLAY 0.0000 %

SAMPLE NUMBER 48

PHI SIZE	WEIGHT	WEIGHT %	C.WEIGHT %
-2.0000	0.0000	0.0000	0.0000
-1.0000	0.2000	9.5923	9.5923
0.0000	0.2050	9.8321	19.4245
1.0000	0.6750	32.3741	51.7986
2.0000	0.7250	34.7722	86.5707
3.0000	0.2500	11.9904	98.5612
4.0000	0.0100	0.4796	99.0408
5.0000	0.0000	0.0000	99.0408

MEDIAN 0.9444
GRAPHIC MEAN 0.8407
INCLUSIVE GRAPHIC STANDARD DEVIATION 1.2022
INCLUSIVE GRAPHIC SKEWNESS -0.1479
GRAPHIC KURTOSIS 1.1464
NORMALIZED KURTOSIS 0.5341
SAMPLE WEIGHT 2.0850

VERBAL CLASSIFICATION

POORLY SORTED
COARSE SKEWED
LEPTOKURTIC

CRITICAL PERCENTILES

PHI5=	-1.4787	PHI75=	1.6672
PHI16=	-0.3483	PHI84=	1.9261
PHI25=	0.1722	PHI95=	2.7030
PHI50=	0.9444		

PERCENTAGES

SAND 99.0408 %
SILT 0.0000 %
CLAY 0.0000 %

SAMPLE NUMBER 49

PHI SIZE	WEIGHT	WEIGHT %	C.WEIGHT %
-3.0000	0.0000	0.0000	0.0000
-2.0000	0.5300	0.7969	0.7969
-1.0000	0.8500	1.2780	2.0749
0.0000	9.2300	13.8776	15.9525
1.0000	21.1200	31.7546	47.7071
2.0000	27.9300	41.9937	89.7008
3.0000	6.5300	9.8181	99.5189
4.0000	0.3200	0.4811	100.0000
5.0000	0.0000	0.0000	100.0000

MEDIAN 1.0546
GRAPHIC MEAN 0.9734
INCLUSIVE GRAPHIC STANDARD DEVIATION 0.9701
INCLUSIVE GRAPHIC SKEWNESS -0.1192
GRAPHIC KURTOSIS 0.9995
NORMALIZED KURTOSIS 0.4999
SAMPLE WEIGHT 66.5100

VERBAL CLASSIFICATION

MODERATELY SORTED
COARSE SKEWED
MESOKURTIC

CRITICAL PERCENTILES

PHI5=	-0.7892	PHI75=	1.6499
PHI16=	0.0015	PHI84=	1.8642
PHI25=	0.2849	PHI95=	2.5397
PHI50=	1.0546		

PERCENTAGES

SAND100.0000 %
SILT 0.0000 %
CLAY 0.0000 %

SAMPLE NUMBER 50

PHI SIZE	WEIGHT	WEIGHT %	C.WEIGHT %
-3.0000	0.0000	0.0000	0.0000
-2.0000	0.3400	0.7414	0.7414
-1.0000	1.2600	2.7475	3.4889
0.0000	4.3800	9.5508	13.0397
1.0000	8.1100	17.6843	30.7239
2.0000	12.0400	26.2538	56.9778
3.0000	18.8700	41.1470	98.1247
4.0000	0.8600	1.8753	100.0000
5.0000	0.0000	0.0000	100.0000

MEDIAN 1.7342
GRAPHIC MEAN 1.5194
INCLUSIVE GRAPHIC STANDARD DEVIATION 1.1929
INCLUSIVE GRAPHIC SKEWNESS -0.3135
GRAPHIC KURTOSIS 0.8761
NORMALIZED KURTOSIS 0.4670
SAMPLE WEIGHT 45.8600

VERBAL CLASSIFICATION

POORLY SORTED
STRONGLY COARSE SKEWED
PLATYKURTIC

CRITICAL PERCENTILES

PHI5= -0.8418 PHI75= 2.4380
PHI16= 0.1674 PHI84= 2.6567
PHI25= 0.6763 PHI95= 2.9241
PHI50= 1.7342

PERCENTAGES

SAND100.0000 %
SILT 0.0000 %
CLAY 0.0000 %

SAMPLE NUMBER 51

PHI SIZE	WEIGHT	WEIGHT %	C.WEIGHT %
-2.0000	0.0500	0.1033	0.1033
-1.0000	1.0500	2.1685	2.2718
0.0000	8.6800	17.9265	20.1983
1.0000	23.2000	47.9141	68.1124
2.0000	13.0100	26.8691	94.9814
3.0000	2.2200	4.5849	99.5663
4.0000	0.1600	0.3304	99.8968
5.0000	0.0100	0.0207	99.9174

MEDIAN 0.6220
GRAPHIC MEAN 0.6597
INCLUSIVE GRAPHIC STANDARD DEVIATION 0.8885
INCLUSIVE GRAPHIC SKEWNESS 0.0156
GRAPHIC KURTOSIS 1.0110
NORMALIZED KURTOSIS 0.5027
SAMPLE WEIGHT 48.4200

VERBAL CLASSIFICATION

MODERATELY SORTED
NEARLY SYMMETRICAL
MESOKURTIC

CRITICAL PERCENTILES

PHI5= -0.8478 PHI75= 1.2563
PHI16= -0.2342 PHI84= 1.5913
PHI25= 0.1002 PHI95= 2.0041
PHI50= 0.6220

PERCENTAGES

SAND 99.8968 %
SILT 0.0207 %
CLAY 0.0000 %

SAMPLE NUMBER 52

PHI SIZE	WEIGHT	WEIGHT %	C.WEIGHT %
-3.0000	0.0000	0.0000	0.0000
-2.0000	2.9900	6.0404	6.0404
-1.0000	0.9200	1.8586	7.8990
0.0000	6.7400	13.6162	21.5152
1.0000	11.2400	22.7071	44.2222
2.0000	17.1500	34.6465	78.8687
3.0000	10.1100	20.4242	99.2929
4.0000	0.3500	0.7071	100 0000
5.0000	0.0000	0.0000	100.0000

MEDIAN 1.1668
GRAPHIC MEAN 1.0043
INCLUSIVE GRAPHIC STANDARD DEVIATION 1.4159
INCLUSIVE GRAPHIC SKEWNESS -0.2646
GRAPHIC KURTOSIS 1.1722
NORMALIZED KURTOSIS 0.5396
SAMPLE WEIGHT 49.5000

VERBAL CLASSIFICATION

POORLY SORTED
COARSE SKEWED
LEPTOKURTIC

CRITICAL PERCENTILES

PHI5=	-2.1722	PHI75=	1.8883
PHI16=	-0.4050	PHI84=	2.2512
PHI25=	0.1535	PHI95=	2.7898
PHI50=	1.1668		

PERCENTAGES

SAND100.0000 %
SILT 0.0000 %
CLAY 0.0000 %

SAMPLE NUMBER 53

PHI SIZE	WEIGHT	WEIGHT %	C.WEIGHT %
-2.0000	0.0200	0.0331	0.0331
-1.0000	0.4900	0.8111	0.8442
0.0000	25.1800	41.6818	42.5261
1.0000	19.8400	32.8422	75.3683
2.0000	12.1600	20.1291	95.4974
3.0000	2.4800	4.1053	99.6027
4.0000	0.1600	0.2649	99.8676
5.0000	0.0300	0.0497	99.9172

MEDIAN 0.2276
GRAPHIC MEAN 0.3400
INCLUSIVE GRAPHIC STANDARD DEVIATION 0.9520
INCLUSIVE GRAPHIC SKEWNESS 0.1894
GRAPHIC KURTOSIS 0.8363
NORMALIZED KURTOSIS 0.4554
SAMPLE WEIGHT 60.4100

VERBAL CLASSIFICATION

MODERATELY SORTED
FINE-SKEWED
PLATYKURTIC

CRITICAL PERCENTILES

PHI5=	-0.9003	PHI75=	0.9888
PHI16=	-0.6364	PHI84=	1.4288
PHI25=	-0.4205	PHI95=	1.9753
PHI50=	0.2276		

PERCENTAGES

SAND 99.8676 %
SILT 0.0497 %
CLAY 0.0000 %

SAMPLE NUMBER 54

PHI SIZE	WEIGHT	WEIGHT %	C.WEIGHT %
-2.0000	0.0900	0.2277	0.2277
-1.0000	0.2800	0.7083	0.9360
0.0000	1.2800	3.2380	4.1740
1.0000	5.6000	14.1665	18.3405
2.0000	20.5000	51.8593	70.1999
3.0000	11.2700	28.5100	98.7098
4.0000	0.3900	0.9866	99.6964
5.0000	0.0100	0.0253	99.7217

MEDIAN 1.6105
GRAPHIC MEAN 1.6431
INCLUSIVE GRAPHIC STANDARD DEVIATION 0.8383
INCLUSIVE GRAPHIC SKEWNESS -0.0224
GRAPHIC KURTOSIS 1.1080
NORMALIZED KURTOSIS 0.5256
SAMPLE WEIGHT 39.5300

VERBAL CLASSIFICATION

MODERATELY SORTED
NEARLY SYMMETRICAL
MESOKURTIC

CRITICAL PERCENTILES

PHI5= 0.0583 PHI75= 2.1684
PHI16= 0.8348 PHI84= 2.4840
PHI25= 1.1284 PHI95= 2.8699
PHI50= 1.6105

PERCENTAGES

SAND 99.6964 %
SILT 0.0253 %
CLAY 0.0000 %

SAMPLE NUMBER 55

PHI SIZE	WEIGHT	WEIGHT %	C.WEIGHT %
-3.0000	0.0000	0.0000	0.0000
-2.0000	0.3100	0.4800	0.4800
-1.0000	0.5400	0.8360	1.3160
0.0000	2.6700	4.1338	5.4498
1.0000	12.3300	19.0896	24.5394
2.0000	32.9800	51.0605	75.5999
3.0000	15.4500	23.9201	99.5201
4.0000	0.3100	0.4800	100.0000
5.0000	0.0000	0.0000	100.0000

MEDIAN 1.4986
GRAPHIC MEAN 1.4675
INCLUSIVE GRAPHIC STANDARD DEVIATION 0.8920
INCLUSIVE GRAPHIC SKEWNESS -0.0765
GRAPHIC KURTOSIS 1.2220
NORMALIZED KURTOSIS 0.5500
SAMPLE WEIGHT 64.5900

VERBAL CLASSIFICATION

MODERATELY SORTED
NEARLY SYMMETRICAL
LEPTOKURTIC

CRITICAL PERCENTILES

PHI5= -0.1088 PHI75= 1.9883
PHI16= 0.5527 PHI84= 2.3512
PHI25= 1.0090 PHI95= 2.8110
PHI50= 1.4986

PERCENTAGES

SAND100.0000 %
SILT 0.0000 %
CLAY 0.0000 %

SAMPLE NUMBER 56

PHI SIZE	WEIGHT	WEIGHT %	C.WEIGHT %
-2.0000	0.0000	0.0000	0.0000
-1.0000	0.4600	0.9912	0.9912
0.0000	0.8700	1.8746	2.8658
1.0000	1.9800	4.2663	7.1321
2.0000	20.5500	44.2792	51.4113
3.0000	21.8600	47.1019	98.5133
4.0000	0.6900	1.4867	100.0000
5.0000	0.0000	0.0000	100.0000

MEDIAN 1.9681
GRAPHIC MEAN 1.9534
INCLUSIVE GRAPHIC STANDARD DEVIATION 0.7403
INCLUSIVE GRAPHIC SKEWNESS -0.1201
GRAPHIC KURTOSIS 0.9058
NORMALIZED KURTOSIS 0.4753
SAMPLE WEIGHT 46.4100

VERBAL CLASSIFICATION

MODERATELY SORTED
COARSE SKEWED
MESOKURTIC

CRITICAL PERCENTILES

PHI5=	0.5003	PHI75=	2.5008
PHI16=	1.2003	PHI84=	2.6919
PHI25=	1.4035	PHI95=	2.9254
PHI50=	1.9681		

PERCENTAGES

SAND100.0000 %
SILT 0.0000 %
CLAY 0.0000 %

SAMPLE NUMBER 57

PHI SIZE	WEIGHT	WEIGHT %	C.WEIGHT %
-2.0000	1.6100	2.5382	2.5382
-1.0000	1.0100	1.5923	4.1305
0.0000	4.7400	7.4728	11.6033
1.0000	17.2900	27.2584	38.8617
2.0000	31.6600	49.9133	88.7750
3.0000	6.9300	10.9254	99.7005
4.0000	0.1600	0.2522	99.9527
5.0000	0.0200	0.0315	99.9842

MEDIAN 1.2232
GRAPHIC MEAN 1.0963
INCLUSIVE GRAPHIC STANDARD DEVIATION 0.9590
INCLUSIVE GRAPHIC SKEWNESS -0.2193
GRAPHIC KURTOSIS 1.1483
NORMALIZED KURTOSIS 0.5345
SAMPLE WEIGHT 63.4300

VERBAL CLASSIFICATION

MODERATELY SORTED
COARSE SKEWED
LEPTOKURTIC

CRITICAL PERCENTILES

PHI5=	-0.8836	PHI75=	1.7240
PHI16=	0.1613	PHI84=	1.9043
PHI25=	0.4915	PHI95=	2.5698
PHI50=	1.2232		

PERCENTAGES

SAND 99.9527 %
SILT 0.0315 %
CLAY 0.0000 %

SAMPLE NUMBER 58

PHI SIZE	WEIGHT	WEIGHT %	C.WEIGHT %
-2.0000	0.0700	0.1295	0.1295
-1.0000	0.3000	0.5551	0.6847
0.0000	10.0300	18.5603	19.2450
1.0000	25.5500	47.2798	66.5248
2.0000	15.6500	28.9600	95.4848
3.0000	2.2600	4.1821	99.6669
4.0000	0.1700	0.3146	99.9815
5.0000	0.0200	0.0370	100.0185

MEDIAN 0.6505
GRAPHIC MEAN 0.6930
INCLUSIVE GRAPHIC STANDARD DEVIATION 0.8613
INCLUSIVE GRAPHIC SKEWNESS 0.0204
GRAPHIC KURTOSIS 0.9628
NORMALIZED KURTOSIS 0.4905
SAMPLE WEIGHT 54.0400

VERBAL CLASSIFICATION

MODERATELY SORTED
NEARLY SYMMETRICAL
MESOKURTIC

CRITICAL PERCENTILES

PHI5=	-0.7675	PHI75=	1.2927
PHI16=	-0.1748	PHI84=	1.6034
PHI25=	0.1217	PHI95=	1.9833
PHI50=	0.6505		

PERCENTAGES

SAND 99.9815 %
SILT 0.0370 %
CLAY 0.0000 %

SAMPLE NUMBER 59

PHI SIZE	WEIGHT	WEIGHT %	C.WEIGHT %
-2.0000	0.0900	0.2844	0.2844
-1.0000	0.5500	1.7378	2.0221
0.0000	1.7800	5.6240	7.6461
1.0000	6.4000	20.2212	27.8673
2.0000	18.6200	58.8310	86.6983
3.0000	4.1800	13.2070	99.9052
4.0000	0.0600	0.1896	100.0948
5.0000	0.0300	0.0948	100.1896

MEDIAN 1.3762
GRAPHIC MEAN 1.2478
INCLUSIVE GRAPHIC STANDARD DEVIATION 0.8548
INCLUSIVE GRAPHIC SKEWNESS -0.2209
GRAPHIC KURTOSIS 1.3470
NORMALIZED KURTOSIS 0.5739
SAMPLE WEIGHT 31.6500

VERBAL CLASSIFICATION

MODERATELY SORTED
COARSE SKEWED
LEPTOKURTIC

CRITICAL PERCENTILES

PHI5=	-0.4705	PHI75=	1.8012
PHI16=	0.4131	PHI84=	1.9541
PHI25=	0.8582	PHI95=	2.6286
PHI50=	1.3762		

PERCENTAGES

SAND100.0948 %
SILT 0.0948 %
CLAY 0.0000 %

SAMPLE NUMBER 60

PHI SIZE	WEIGHT	WEIGHT %	C.WEIGHT %
-3.0000	0.0000	0.0000	0.0000
-2.0000	0.9900	1.6566	1.6566
-1.0000	0.7200	1.2048	2.8614
0.0000	4.7100	7.8815	10.7430
1.0000	22.7800	38.1191	48.8621
2.0000	27.1100	45.3648	94.2269
3.0000	3.3500	5.6058	99.8327
4.0000	0.1000	0.1673	100.0000
5.0000	0.0000	0.0000	100.0000

MEDIAN 1.0251
GRAPHIC MEAN 0.9792
INCLUSIVE GRAPHIC STANDARD DEVIATION 0.8435
INCLUSIVE GRAPHIC SKEWNESS -0.1539
GRAPHIC KURTOSIS 0.9773
NORMALIZED KURTOSIS 0.4943
SAMPLE WEIGHT 59.7600

VERBAL CLASSIFICATION

MODERATELY SORTED
COARSE SKEWED
MESOKURTIC

CRITICAL PERCENTILES

PHI5= -0.7287 PHI75= 1.5762
PHI16= 0.1379 PHI84= 1.7746
PHI25= 0.3740 PHI95= 2.1379
PHI50= 1.0251

PERCENTAGES

SAND100.0000 %
SILT 0.0000 %
CLAY 0.0000 %

SAMPLE NUMBER 61

PHI SIZE	WEIGHT	WEIGHT %	C.WEIGHT %
-2.0000	0.0000	0.0000	0.0000
-1.0000	0.5800	0.9055	0.9055
0.0000	4.7700	7.4473	8.3528
1.0000	17.0600	26.6354	34.9883
2.0000	35.5400	55.4879	90.4762
3.0000	5.9300	9.2584	99.7346
4.0000	0.1700	0.2654	100.0000
5.0000	0.0000	0.0000	100.0000

MEDIAN 1.2705
GRAPHIC MEAN 1.1470
INCLUSIVE GRAPHIC STANDARD DEVIATION 0.8443
INCLUSIVE GRAPHIC SKEWNESS -0.2016
GRAPHIC KURTOSIS 1.0989
NORMALIZED KURTOSIS 0.5235
SAMPLE WEIGHT 64.0500

VERBAL CLASSIFICATION

MODERATELY SORTED
COARSE SKEWED
MESOKURTIC

CRITICAL PERCENTILES

PHI5= -0.4502 PHI75= 1.7211
PHI16= 0.2871 PHI84= 1.8833
PHI25= 0.6250 PHI95= 2.4886
PHI50= 1.2705

PERCENTAGES

SAND100.0000 %
SILT 0.0000 %
CLAY 0.0000 %

SAMPLE NUMBER 62

PHI SIZE	WEIGHT	WEIGHT %	C.WEIGHT %
-2.0000	0.0400	0.0657	0.0657
-1.0000	0.6700	1.1005	1.1662
0.0000	5.7900	9.5105	10.6767
1.0000	19.8400	32.5887	43.2654
2.0000	27.8900	45.8114	89.0769
3.0000	6.3200	10.3811	99.4580
4.0000	0.2900	0.4763	99.9343
5.0000	0.0200	0.0329	99.9672

MEDIAN 1.1470
GRAPHIC MEAN 1.0665
INCLUSIVE GRAPHIC STANDARD DEVIATION 0.9114
INCLUSIVE GRAPHIC SKEWNESS -0.1205
GRAPHIC KURTOSIS 1.0359
NORMALIZED KURTOSIS 0.5088
SAMPLE WEIGHT 60.8800

VERBAL CLASSIFICATION

MODERATELY SORTED
COARSE SKEWED
MESOKURTIC

CRITICAL PERCENTILES

PHI5=	-0.5969	PHI75=	1.6927
PHI16=	0.1633	PHI84=	1.8892
PHI25=	0.4395	PHI95=	2.5706
PHI50=	1.1470		

PERCENTAGES

SAND 99.9343 %
SILT 0.0329 %
CLAY 0.0000 %

SAMPLE NUMBER 63

PHI SIZE	WEIGHT	WEIGHT %	C.WEIGHT %
-2.0000	0.3100	0.4367	0.4367
-1.0000	1.0600	1.4932	1.9298
0.0000	4.9000	6.9024	8.8322
1.0000	19.4700	27.4264	36.2586
2.0000	34.6800	48.8520	85.1106
3.0000	10.1200	14.2555	99.3661
4.0000	0.3300	0.4649	99.8310
5.0000	0.0200	0.0282	99.8591

MEDIAN 1.2813
GRAPHIC MEAN 1.1733
INCLUSIVE GRAPHIC STANDARD DEVIATION 0.9212
INCLUSIVE GRAPHIC SKEWNESS -0.1597
GRAPHIC KURTOSIS 1.1063
NORMALIZED KURTOSIS 0.5252
SAMPLE WEIGHT 70.9900

VERBAL CLASSIFICATION

MODERATELY SORTED
COARSE SKEWED
MESOKURTIC

CRITICAL PERCENTILES

PHI5=	-0.5552	PHI75=	1.7930
PHI16=	0.2613	PHI84=	1.9773
PHI25=	0.5895	PHI95=	2.6937
PHI50=	1.2813		

PERCENTAGES

SAND 99.8310 %
SILT 0.0282 %
CLAY 0.0000 %

Grain Size Data for Carbonate Fraction following HCl Dissolution of Sieved Grab Samples

Samples 1, 2, 4, 6, and 8 are missing; they are not included in the sample set.

Samples 7 and 48 were too small for dissolution.

SAMPLE NUMBER 3

PHI SIZE	WEIGHT	WEIGHT %	C.WEIGHT %
-2.0000	0.0300	1.1765	1.1765
-1.0000	0.0200	0.7843	1.9608
0.0000	0.0900	3.5294	5.4902
1.0000	0.6800	26.6667	32.1569
2.0000	0.9800	38.4314	70.5882
3.0000	0.7000	27.4510	98.0392
4.0000	0.0500	1.9608	100.0000

MEDIAN 1.4643
GRAPHIC MEAN 1.4490
INCLUSIVE GRAPHIC STANDARD DEVIATION 0.9824
INCLUSIVE GRAPHIC SKEWNESS -0.0404
GRAPHIC KURTOSIS 0.8684
NORMALIZED KURTOSIS 0.4648
SAMPLE WEIGHT 2.5500

VERBAL CLASSIFICATION

MODERATELY SORTED
NEARLY SYMMETRICAL
PLATYKURTIC

CRITICAL PERCENTILES

PHI5=	-0.1389	PHI75=	2.1607
PHI16=	0.3941	PHI84=	2.4886
PHI25=	0.7316	PHI95=	2.8893
PHI50=	1.4643		

PERCENTAGES

SAND100.0000 %
SILT 0.0000 %
CLAY 0.0000 %

SAMPLE NUMBER 5

PHI SIZE	WEIGHT	WEIGHT %	C.WEIGHT %
-2.0000	0.3400	2.8381	2.8381
-1.0000	0.8700	7.2621	10.1002
0.0000	1.7900	14.9416	25.0417
1.0000	3.0000	25.0417	50.0835
2.0000	3.7300	31.1352	81.2187
3.0000	2.0900	17.4457	98.6644
4.0000	0.1600	1.3356	100.0000

MEDIAN 0.9967
GRAPHIC MEAN 0.8503
INCLUSIVE GRAPHIC STANDARD DEVIATION 1.3718
INCLUSIVE GRAPHIC SKEWNESS -0.1802
GRAPHIC KURTOSIS 1.0211
NORMALIZED KURTOSIS 0.5052
SAMPLE WEIGHT 11.9800

VERBAL CLASSIFICATION

POORLY SORTED
COARSE SKEWED
MESOKURTIC

CRITICAL PERCENTILES

PHI5=	-1.7023	PHI75=	1.8003
PHI16=	-0.6051	PHI84=	2.1594
PHI25=	-0.0028	PHI95=	2.7900
PHI50=	0.9967		

PERCENTAGES

SAND100.0000 %
SILT 0.0000 %
CLAY 0.0000 %

SAMPLE NUMBER 9

PHI SIZE	WEIGHT	WEIGHT %	C.WEIGHT %
-3.0000	0.0000	0.0000	0.0000
-2.0000	0.6800	12.6866	12.6866
-1.0000	0.5300	9.8881	22.5746
0.0000	0.7000	13.0597	35.6343
1.0000	0.6900	12.8731	48.5075
2.0000	1.2300	22.9478	71.4552
3.0000	1.4500	27.0522	98.5075
4.0000	0.0800	1.4925	100.0000

MEDIAN 1.0650
GRAPHIC MEAN 0.6213
INCLUSIVE GRAPHIC STANDARD DEVIATION 1.8619
INCLUSIVE GRAPHIC SKEWNESS -0.3316
GRAPHIC KURTOSIS 0.7620
NORMALIZED KURTOSIS 0.4325
SAMPLE WEIGHT 5.3600

VERBAL CLASSIFICATION

POORLY SORTED
STRONGLY COARSE SKEWED
PLATYKURTIC

CRITICAL PERCENTILES

PHI5=	-2.6059	PHI75=	2.1310
PHI16=	-1.6649	PHI84=	2.4637
PHI25=	-0.8143	PHI95=	2.8703
PHI50=	1.0650		

PERCENTAGES

SAND100.0000 %
SILT 0.0000 %
CLAY 0.0000 %

SAMPLE NUMBER 10

PHI SIZE	WEIGHT	WEIGHT %	C.WEIGHT %
-2.0000	0.0000	0.0000	0.0000
-1.0000	0.1200	3.3613	3.3613
0.0000	0.3800	10.6443	14.0056
1.0000	0.4300	12.0448	26.0504
2.0000	1.2200	34.1737	60.2241
3.0000	1.3600	38.0952	98.3193
4.0000	0.0600	1.6807	100.0000

MEDIAN 1.7008
GRAPHIC MEAN 1.4968
INCLUSIVE GRAPHIC STANDARD DEVIATION 1.1842
INCLUSIVE GRAPHIC SKEWNESS -0.3020
GRAPHIC KURTOSIS 1.0444
NORMALIZED KURTOSIS 0.5109
SAMPLE WEIGHT 3.5700

VERBAL CLASSIFICATION

POORLY SORTED
STRONGLY COARSE SKEWED
MESOKURTIC

CRITICAL PERCENTILES

PHI5=	-0.8461	PHI75=	2.3879
PHI16=	0.1656	PHI84=	2.6241
PHI25=	0.9128	PHI95=	2.9129
PHI50=	1.7008		

PERCENTAGES

SAND100.0000 %
SILT 0.0000 %
CLAY 0.0000 %

SAMPLE NUMBER 11

PHI SIZE	WEIGHT	WEIGHT %	C.WEIGHT %
-2.0000	0.0400	0.5722	0.5722
-1.0000	0.2100	3.0043	3.5765
0.0000	0.7500	10.7296	14.3062
1.0000	1.2200	17.4535	31.7597
2.0000	3.0000	42.9185	74.6781
3.0000	1.6700	23.8913	98.5694
4.0000	0.1000	1.4306	100.0000

MEDIAN 1.4250
GRAPHIC MEAN 1.3041
INCLUSIVE GRAPHIC STANDARD DEVIATION 1.1366
INCLUSIVE GRAPHIC SKEWNESS -0.1957
GRAPHIC KURTOSIS 1.0878
NORMALIZED KURTOSIS 0.5210
SAMPLE WEIGHT 6.9900

VERBAL CLASSIFICATION

POORLY SORTED
COARSE SKEWED
MESOKURTIC

CRITICAL PERCENTILES

PHI5=	-0.8673	PHI75=	2.0135
PHI16=	0.0970	PHI84=	2.3902
PHI25=	0.6127	PHI95=	2.8506
PHI50=	1.4250		

PERCENTAGES

SAND100.0000 %
SILT 0.0000 %
CLAY 0.0000 %

SAMPLE NUMBER 12

PHI SIZE	WEIGHT	WEIGHT %	C.WEIGHT %
-3.0000	0.0000	0.0000	0.0000
-2.0000	0.3200	8.1013	8.1013
-1.0000	0.1700	4.3038	12.4051
0.0000	0.4800	12.1519	24.5570
1.0000	1.0200	25.8228	50.3797
2.0000	1.3800	34.9367	85.3165
3.0000	0.5400	13.6709	98.9874
4.0000	0.0400	1.0127	100.0000

MEDIAN 0.9853
GRAPHIC MEAN 0.7478
INCLUSIVE GRAPHIC STANDARD DEVIATION 1.4380
INCLUSIVE GRAPHIC SKEWNESS -0.2952
GRAPHIC KURTOSIS 1.2364
NORMALIZED KURTOSIS 0.5529
SAMPLE WEIGHT 3.9500

VERBAL CLASSIFICATION

POORLY SORTED
COARSE SKEWED
LEPTOKURTIC

CRITICAL PERCENTILES

PHI5=	-2.3828	PHI75=	1.7047
PHI16=	-0.7042	PHI84=	1.9623
PHI25=	0.0172	PHI95=	2.7083
PHI50=	0.9853		

PERCENTAGES

SAND100.0000 %
SILT 0.0000 %
CLAY 0.0000 %

SAMPLE NUMBER 13

PHI SIZE	WEIGHT	WEIGHT %	C.WEIGHT %
-3.0000	0.0000	0.0000	0.0000
-2.0000	4.2100	34.2834	34.2834
-1.0000	0.5800	4.7231	39.0065
0.0000	0.9500	7.7362	46.7427
1.0000	0.9700	7.8990	54.6417
2.0000	2.4700	20.1140	74.7557
3.0000	2.7000	21.9870	96.7427
4.0000	0.4000	3.2573	100.0000

MEDIAN 0.4124
GRAPHIC MEAN 0.0998
INCLUSIVE GRAPHIC STANDARD DEVIATION 2.1134
INCLUSIVE GRAPHIC SKEWNESS -0.1603
GRAPHIC KURTOSIS 0.5527
NORMALIZED KURTOSIS 0.3560
SAMPLE WEIGHT 12.2800

VERBAL CLASSIFICATION

VERY POORLY SORTED
COARSE SKEWED
VERY PLATYKURTIC

CRITICAL PERCENTILES

PHI5= -2.8542 PHI75= 2.0111
PHI16= -2.5333 PHI84= 2.4204
PHI25= -2.2708 PHI95= 2.9207
PHI50= 0.4124

PERCENTAGES

SAND100.0000 %
SILT 0.0000 %
CLAY 0.0000 %

SAMPLE NUMBER 14

PHI SIZE	WEIGHT	WEIGHT %	C.WEIGHT %
-3.0000	0.0000	0.0000	0.0000
-2.0000	0.2800	8.3582	8.3582
-1.0000	0.3200	9.5522	17.9104
0.0000	0.8300	24.7761	42.6866
1.0000	1.1800	35.2239	77.9104
2.0000	0.6300	18.8060	96.7164
3.0000	0.0900	2.6866	99.4030
4.0000	0.0200	0.5970	100.0000

MEDIAN 0.2076
GRAPHIC MEAN 0.1105
INCLUSIVE GRAPHIC STANDARD DEVIATION 1.2841
INCLUSIVE GRAPHIC SKEWNESS -0.1631
GRAPHIC KURTOSIS 1.0830
NORMALIZED KURTOSIS 0.5199
SAMPLE WEIGHT 3.3500

VERBAL CLASSIFICATION

POORLY SORTED
COARSE SKEWED
MESOKURTIC

CRITICAL PERCENTILES

PHI5= -2.4018 PHI75= 0.9174
PHI16= -1.2000 PHI84= 1.3238
PHI25= -0.7139 PHI95= 1.9087
PHI50= 0.2076

PERCENTAGES

SAND100.0000 %
SILT 0.0000 %
CLAY 0.0000 %

SAMPLE NUMBER 15

PHI SIZE	WEIGHT	WEIGHT %	C.WEIGHT %
-3.0000	0.0000	0.0000	0.0000
-2.0000	0.4800	7.5949	7.5949
-1.0000	0.3400	5.3797	12.9747
0.0000	0.7900	12.5000	25.4747
1.0000	1.1600	18.3544	43.8291
2.0000	1.7900	28.3228	72.1519
3.0000	1.6600	26.2658	98.4177
4.0000	0.1000	1.5823	100.0000

MEDIAN 1.2179
GRAPHIC MEAN 0.9703
INCLUSIVE GRAPHIC STANDARD DEVIATION 1.5919
INCLUSIVE GRAPHIC SKEWNESS -0.2987
GRAPHIC KURTOSIS 0.9951
NORMALIZED KURTOSIS 0.4988
SAMPLE WEIGHT 6.3200

VERBAL CLASSIFICATION

POORLY SORTED
COARSE SKEWED
MESOKURTIC

CRITICAL PERCENTILES

PHI5=	-2.3417	PHI75=	2.1084
PHI16=	-0.7580	PHI84=	2.4511
PHI25=	-0.0380	PHI95=	2.8699
PHI50=	1.2179		

PERCENTAGES

SAND100.0000 %
SILT 0.0000 %
CLAY 0.0000 %

SAMPLE NUMBER 16

PHI SIZE	WEIGHT	WEIGHT %	C.WEIGHT %
-3.0000	0.0000	0.0000	C.0000
-2.0000	1.0400	22.1748	22.1748
-1.0000	0.2700	5.7569	27.9318
0.0000	0.3700	7.8891	35.8209
1.0000	0.7700	16.4179	52.2388
2.0000	0.9600	20.4691	72.7079
3.0000	1.1800	25.1599	97.8678
4.0000	0.1000	2.1322	100.0000

MEDIAN 0.8636
GRAPHIC MEAN 0.3447
INCLUSIVE GRAPHIC STANDARD DEVIATION 2.0395
INCLUSIVE GRAPHIC SKEWNESS -0.3074
GRAPHIC KURTOSIS 0.6443
NORMALIZED KURTOSIS 0.3919
SAMPLE WEIGHT 4.6900

VERBAL CLASSIFICATION

VERY POORLY SORTED
STRONGLY COARSE SKEWED
VERY PLATYKURTIC

CRITICAL PERCENTILES

PHI5=	-2.7745	PHI75=	2.0911
PHI16=	-2.2785	PHI84=	2.4488
PHI25=	-1.5093	PHI95=	2.8860
PHI50=	0.8636		

PERCENTAGES

SAND100.0000 %
SILT 0.0000 %
CLAY 0.0000 %

SAMPLE NUMBER 17

PHI SIZE	WEIGHT	WEIGHT %	C.WEIGHT %
-3.0000	0.0000	0.0000	0.0000
-2.0000	3.1500	26.5599	26.5599
-1.0000	0.9700	8.1788	34.7386
0.0000	2.5200	21.2479	55.9865
1.0000	2.2700	19.1400	75.1265
2.0000	1.7500	14.7555	89.8819
3.0000	1.0600	8.9376	98.8195
4.0000	0.1400	1.1804	100.0000

MEDIAN -0.2817
GRAPHIC MEAN -0.3593
INCLUSIVE GRAPHIC STANDARD DEVIATION 1.8156
INCLUSIVE GRAPHIC SKEWNESS 0.0010
GRAPHIC KURTOSIS 0.7230
NORMALIZED KURTOSIS 0.4196
SAMPLE WEIGHT 11.8600

VERBAL CLASSIFICATION

POORLY SORTED
NEARLY SYMMETRICAL
PLATYKURTIC

CRITICAL PERCENTILES

PHI5= -2.8117 PHI75= 0.9934
PHI16= -2.3976 PHI84= 1.6014
PHI25= -2.0587 PHI95= 2.5726
PHI50= -0.2817

PERCENTAGES

SAND100.0000 %
SILT 0.0000 %
CLAY 0.0000 %

SAMPLE NUMBER 18

PHI SIZE	WEIGHT	WEIGHT %	C.WEIGHT %
-2.0000	0.0000	0.0000	0.0000
-1.0000	0.2300	2.8536	2.8536
0.0000	0.7800	9.6774	12.5310
1.0000	1.4900	18.4864	31.0174
2.0000	3.6000	44.6650	75.6824
3.0000	1.7900	22.2084	97.8908
4.0000	0.1700	2.1092	100.0000

MEDIAN 1.4250
GRAPHIC MEAN 1.3291
INCLUSIVE GRAPHIC STANDARD DEVIATION 1.0995
INCLUSIVE GRAPHIC SKEWNESS -0.1697
GRAPHIC KURTOSIS 1.1411
NORMALIZED KURTOSIS 0.5330
SAMPLE WEIGHT 8.0600

VERBAL CLASSIFICATION

POORLY SORTED
COARSE SKEWED
LEPTOKURTIC

CRITICAL PERCENTILES

PHI5= -0.7782 PHI75= 1.9847
PHI16= 0.1877 PHI84= 2.3745
PHI25= 0.6745 PHI95= 2.8698
PHI50= 1.4250

PERCENTAGES

SAND100.0000 %
SILT 0.0000 %
CLAY 0.0000 %

SAMPLE NUMBER 19

PHI SIZE	WEIGHT	WEIGHT %	C.WEIGHT %
-2.0000	0.1800	3.5225	3.5225
-1.0000	0.3000	5.8708	9.3933
0.0000	1.0400	20.3522	29.7456
1.0000	1.4300	27.9843	57.7299
2.0000	1.5300	29.9413	87.6712
3.0000	0.5900	11.5460	99 2172
4.0000	0.0400	0.7828	100.0000

MEDIAN 0.7238
GRAPHIC MEAN 0.6419
INCLUSIVE GRAPHIC STANDARD DEVIATION 1.3023
INCLUSIVE GRAPHIC SKEWNESS -0.1121
GRAPHIC KURTOSIS 0.9925
NORMALIZED KURTOSIS 0.4981
SAMPLE WEIGHT 5.1100

VERBAL CLASSIFICATION

POORLY SORTED
COARSE SKEWED
MESOKURTIC

CRITICAL PERCENTILES

PHI5=	-1.7483	PHI75=	1.5768
PHI16=	-0.6754	PHI84=	1.8774
PHI25=	-0.2332	PHI95=	2.6347
PHI50=	0.7238		

PERCENTAGES

SAND100.0000 %
SILT 0.0000 %
CLAY 0.0000 %

SAMPLE NUMBER 20

PHI SIZE	WEIGHT	WEIGHT %	C.WEIGHT %
-2.0000	0.0000	0.0000	0.0000
-1.0000	0.2400	4.4199	4.4199
0.0000	0.5600	10.3131	14.7330
1.0000	0.7700	14.1805	28.9134
2.0000	2.0200	37.2007	66.1142
3.0000	1.7100	31.4917	97.6059
4.0000	0.1300	2.3941	100.0000

MEDIAN 1.5668
GRAPHIC MEAN 1.4080
INCLUSIVE GRAPHIC STANDARD DEVIATION 1.2047
INCLUSIVE GRAPHIC SKEWNESS -0.2463
GRAPHIC KURTOSIS 1.0156
NORMALIZED KURTOSIS 0.5039
SAMPLE WEIGHT 5.4300

VERBAL CLASSIFICATION

POORLY SORTED
COARSE SKEWED
MESOKURTIC

CRITICAL PERCENTILES

PHI5=	-0.9437	PHI75=	2.2822
PHI16=	0.0894	PHI84=	2.5680
PHI25=	0.7240	PHI95=	2.9173
PHI50=	1.5668		

PERCENTAGES

SAND100.0000 %
SILT 0.0000 %
CLAY 0.0000 %

SAMPLE NUMBER 21

PHI SIZE	WEIGHT	WEIGHT %	C.WEIGHT %
-2.0000	0.1900	4.2986	4.2986
-1.0000	0.3200	7.2398	11.5385
0.0000	0.6200	14.0271	25.5656
1.0000	0.7600	17.1946	42.7602
2.0000	1.3700	30.9955	73.7557
3.0000	1.1100	25.1131	98.8688
4.0000	0.0500	1.1312	100.0000

MEDIAN 1.2336
GRAPHIC MEAN 0.9865
INCLUSIVE GRAPHIC STANDARD DEVIATION 1.4920
INCLUSIVE GRAPHIC SKEWNESS -0.2804
GRAPHIC KURTOSIS 0.9313
NORMALIZED KURTOSIS 0.4822
SAMPLE WEIGHT 4.4200

VERBAL CLASSIFICATION

POORLY SORTED
COARSE SKEWED
MESOKURTIC

CRITICAL PERCENTILES

PHI5=	-1.9031	PHI75=	2.0495
PHI16=	-0.6819	PHI84=	2.4079
PHI25=	-0.0403	PHI95=	2.8459
PHI50=	1.2336		

PERCENTAGES

SAND100.0000 %
SILT 0.0000 %
CLAY 0.0000 %

SAMPLE NUMBER 22

PHI SIZE	WEIGHT	WEIGHT %	C.WEIGHT %
-3.0000	0.0000	0.0000	0.0000
-2.0000	0.7200	9.3023	9.3023
-1.0000	0.6000	7.7519	17.0543
0.0000	0.9100	11.7571	28.8114
1.0000	1.0400	13.4367	42.2481
2.0000	2.0300	26.2274	68.4754
3.0000	2.3000	29.7158	98.1912
4.0000	0.1400	1.8088	100.0000

MEDIAN 1.2956
GRAPHIC MEAN 0.8940
INCLUSIVE GRAPHIC STANDARD DEVIATION 1.7260
INCLUSIVE GRAPHIC SKEWNESS -0.3664
GRAPHIC KURTOSIS 0.8628
NORMALIZED KURTOSIS 0.4632
SAMPLE WEIGHT 7.7400

VERBAL CLASSIFICATION

POORLY SORTED
STRONGLY COARSE SKEWED
PLATYKURTIC

CRITICAL PERCENTILES

PHI5=	-2.4625	PHI75=	2.2196
PHI16=	-1.1360	PHI84=	2.5224
PHI25=	-0.3242	PHI95=	2.8926
PHI50=	1.2956		

PERCENTAGES

SAND100.0000 %
SILT 0.0000 %
CLAY 0.0000 %

SAMPLE NUMBER 23

PHI SIZE	WEIGHT	WEIGHT %	C.WEIGHT %
-2.0000	0.2000	2.6631	2.6631
-1.0000	1.2000	15.9787	18.6418
0.0000	1.4200	18.9081	37.5499
1.0000	1.4600	19.4407	56.9907
2.0000	1.5700	20.9055	77.8961
3.0000	1.5000	19.9734	97.8695
4.0000	0.1600	2.1305	100.0000

MEDIAN 0.6404
GRAPHIC MEAN 0.5936
INCLUSIVE GRAPHIC STANDARD DEVIATION 1.5814
INCLUSIVE GRAPHIC SKEWNESS -0.0498
GRAPHIC KURTOSIS 0.7644
NORMALIZED KURTOSIS 0.4332
SAMPLE WEIGHT 7.5100

VERBAL CLASSIFICATION

POORLY SORTED
NEARLY SYMMETRICAL
PLATYKURTIC

CRITICAL PERCENTILES

PHI5=	-1.8537	PHI75=	1.8615
PHI16=	-1.1653	PHI84=	2.3056
PHI25=	-0.6637	PHI95=	2.8563
PHI50=	0.6404		

PERCENTAGES

SAND100.0000 %
SILT 0.0000 %
CLAY 0.0000 %

SAMPLE NUMBER 24

PHI SIZE	WEIGHT	WEIGHT %	C.WEIGHT %
-2.0000	0.0500	1.0309	1.0309
-1.0000	0.2000	4.1237	5.1546
0.0000	0.3700	7.6289	12.7835
1.0000	0.4200	8.6598	21.4433
2.0000	1.0500	21.6495	43.0928
3.0000	2.5000	51.5464	94.6392
4.0000	0.2600	5.3608	100.0000

MEDIAN 2.1340
GRAPHIC MEAN 1.7663
INCLUSIVE GRAPHIC STANDARD DEVIATION 1.2275
INCLUSIVE GRAPHIC SKEWNESS -0.5003
GRAPHIC KURTOSIS 1.1564
NORMALIZED KURTOSIS 0.5363
SAMPLE WEIGHT 4.8500

VERBAL CLASSIFICATION

POORLY SORTED
STRONGLY COARSE SKEWED
LEPTOKURTIC

CRITICAL PERCENTILES

PHI5=	-1.0375	PHI75=	2.6190
PHI16=	0.3714	PHI84=	2.7936
PHI25=	1.1643	PHI95=	3.0673
PHI50=	2.1340		

PERCENTAGES

SAND100.0000 %
SILT 0.0000 %
CLAY 0.0000 %

SAMPLE NUMBER 25

PHI SIZE	WEIGHT	WEIGHT %	C.WEIGHT %
-3.0000	0.0000	0.0000	0.0000
-2.0000	0.4700	6.5460	6.5460
-1.0000	0.8500	11.8384	18.3844
0.0000	1.6900	23.5376	41.9220
1.0000	1.7600	24.5125	66.4345
2.0000	1.4800	20.6128	87.0474
3.0000	0.8400	11.6992	98.7465
4.0000	0.0900	1.2535	100.0000

MEDIAN 0.3295
GRAPHIC MEAN 0.3268
INCLUSIVE GRAPHIC STANDARD DEVIATION 1.5082
INCLUSIVE GRAPHIC SKEWNESS -0.0233
GRAPHIC KURTOSIS 0.9439
NORMALIZED KURTOSIS 0.4856
SAMPLE WEIGHT 7.1800

VERBAL CLASSIFICATION

POORLY SORTED
NEARLY SYMMETRICAL
MESOKURTIC

CRITICAL PERCENTILES

PHI5= -2.2362 PHI75= 1.4155
PHI16= -1.2014 PHI84= 1.8522
PHI25= -0.7189 PHI95= 2.6798
PHI50= 0.3295

PERCENTAGES

SAND100.0000 %
SILT 0.0000 %
CLAY 0.0000 %

SAMPLE NUMBER 26

PHI SIZE	WEIGHT	WEIGHT %	C.WEIGHT %
-3.0000	0.0000	0.0000	0.0000
-2.0000	0.5200	7.6358	7.6358
-1.0000	0.8800	12.9222	20.5580
0.0000	1.1900	17.4743	38.0323
1.0000	1.1700	17.1806	55.2129
2.0000	1.7600	25.8443	81.0573
3.0000	1.2200	17.9148	98.9721
4.0000	0.0700	1.0279	100.0000

MEDIAN 0.6966
GRAPHIC MEAN 0.5027
INCLUSIVE GRAPHIC STANDARD DEVIATION 1.6555
INCLUSIVE GRAPHIC SKEWNESS -0.1764
GRAPHIC KURTOSIS 0.8361
NORMALIZED KURTOSIS 0.4554
SAMPLE WEIGHT 6.8100

VERBAL CLASSIFICATION

POORLY SORTED
COARSE SKEWED
PLATYKURTIC

CRITICAL PERCENTILES

PHI5= -2.3452 PHI75= 1.7656
PHI16= -1.3527 PHI84= 2.1643
PHI25= -0.7458 PHI95= 2.7783
PHI50= 0.6966

PERCENTAGES

SAND100.0000 %
SILT 0.0000 %
CLAY 0.0000 %

SAMPLE NUMBER 27

PHI SIZE	WEIGHT	WEIGHT %	C.WEIGHT %
-3.0000	0.0000	0.0000	0.0000
-2.0000	0.3500	5.0215	5.0215
-1.0000	0.4800	6.8867	11.9082
0.0000	1.4800	21.2339	33.1420
1.0000	1.9700	28.2640	61.4060
2.0000	1.8500	26.5423	87.9483
3.0000	0.7400	10.6169	98.5653
4.0000	0.1000	1.4347	100.0000

MEDIAN 0.5964
GRAPHIC MEAN 0.5468
INCLUSIVE GRAPHIC STANDARD DEVIATION 1.3720
INCLUSIVE GRAPHIC SKEWNESS -0.0851
GRAPHIC KURTOSIS 1.0093
NORMALIZED KURTOSIS 0.5023
SAMPLE WEIGHT 6.9700

VERBAL CLASSIFICATION

POORLY SORTED
NEARLY SYMMETRICAL
MESOKURTIC

CRITICAL PERCENTILES

PHI5=	-2.0043	PHI75=	1.5122
PHI16=	-0.8073	PHI84=	1.8512
PHI25=	-0.3834	PHI95=	2.6642
PHI50=	0.5964		

PERCENTAGES

SAND100.0000 %
SILT 0.0000 %
CLAY 0.0000 %

SAMPLE NUMBER 28

PHI SIZE	WEIGHT	WEIGHT %	C.WEIGHT %
-2.0000	0.1700	0.8521	0.8521
-1.0000	1.1000	5.5138	6.3659
0.0000	3.0200	15.1378	21.5038
1.0000	3.7400	18.7469	40.2506
2.0000	3.3400	16.7419	56.9925
3.0000	8.3800	42.0050	98.9975
4.0000	0.2000	1.0025	100.0000

MEDIAN 1.5823
GRAPHIC MEAN 1.2872
INCLUSIVE GRAPHIC STANDARD DEVIATION 1.3808
INCLUSIVE GRAPHIC SKEWNESS -0.3287
GRAPHIC KURTOSIS 0.7590
NORMALIZED KURTOSIS 0.4315
SAMPLE WEIGHT 19.9500

VERBAL CLASSIFICATION

POORLY SORTED
STRONGLY COARSE SKEWED
PLATYKURTIC

CRITICAL PERCENTILES

PHI5=	-1.2477	PHI75=	2.4287
PHI16=	-0.3636	PHI84=	2.6430
PHI25=	0.1865	PHI95=	2.9048
PHI50=	1.5823		

PERCENTAGES

SAND100.0000 %
SILT 0.0000 %
CLAY 0.0000 %

SAMPLE NUMBER 29

PHI SIZE	WEIGHT	WEIGHT %	C.WEIGHT %
-2.0000	0.8100	4.5506	4.5506
-1.0000	0.8200	4.6067	9.1573
0.0000	1.1900	6.6854	15.8427
1.0000	2.0400	11.4607	27.3034
2.0000	6.8600	38.5393	65.8427
3.0000	5.9600	33.4831	99.3258
4.0000	0.1200	0.6742	100.0000

MEDIAN 1.5889
GRAPHIC MEAN 1.3816
INCLUSIVE GRAPHIC STANDARD DEVIATION 1.3554
INCLUSIVE GRAPHIC SKEWNESS -0.3544
GRAPHIC KURTOSIS 1.3267
NORMALIZED KURTOSIS 0.5702
SAMPLE WEIGHT 17.8000

VERBAL CLASSIFICATION

POORLY SORTED
STRONGLY COARSE SKEWED
LEPTOKURTIC

CRITICAL PERCENTILES

PHI5=	-1.9024	PHI75=	2.2735
PHI16=	0.0137	PHI84=	2.5423
PHI25=	0.7990	PHI95=	2.8708
PHI50=	1.5889		

PERCENTAGES

SAND100.0000 %
SILT 0.0000 %
CLAY 0.0000 %

SAMPLE NUMBER 30

PHI SIZE	WEIGHT	WEIGHT %	C.WEIGHT %
-3.0000	0.0000	0.0000	0.0000
-2.0000	1.1900	8.2182	8.2182
-1.0000	1.8200	12.5691	20.7873
0.0000	2.6900	18.5773	39.3646
1.0000	2.2200	15.3315	54.6961
2.0000	2.4600	16.9889	71.6851
3.0000	3.3000	22.7901	94.4751
4.0000	0.8000	5.5249	100.0000

MEDIAN 0.6937
GRAPHIC MEAN 0.6177
INCLUSIVE GRAPHIC STANDARD DEVIATION 1.8116
INCLUSIVE GRAPHIC SKEWNESS -0.0914
GRAPHIC KURTOSIS 0.7704
NORMALIZED KURTOSIS 0.4352
SAMPLE WEIGHT 14.4800

VERBAL CLASSIFICATION

POORLY SORTED
NEARLY SYMMETRICAL
PLATYKURTIC

CRITICAL PERCENTILES

PHI5=	-2.3916	PHI75=	2.1455
PHI16=	-1.3809	PHI84=	2.5404
PHI25=	-0.7732	PHI95=	3.0950
PHI50=	0.6937		

PERCENTAGES

SAND100.0000 %
SILT 0.0000 %
CLAY 0.0000 %

SAMPLE NUMBER 31

PHI SIZE	WEIGHT	WEIGHT %	C.WEIGHT %
-2.0000	0.3400	2.4478	2.4478
-1.0000	0.8800	6.3355	8.7833
0.0000	1.4800	10.6551	19.4384
1.0000	1.5400	11.0871	30.5256
2.0000	1.7500	12.5990	43.1245
3.0000	7.4500	53.6357	96.7603
4.0000	0.4500	3.2397	100.0000

MEDIAN 2.1282
GRAPHIC MEAN 1.5225
INCLUSIVE GRAPHIC STANDARD DEVIATION 1.4628
INCLUSIVE GRAPHIC SKEWNESS -0.6107
GRAPHIC KURTOSIS 0.8939
NORMALIZED KURTOSIS 0.4720
SAMPLE WEIGHT 13.8900

VERBAL CLASSIFICATION

POORLY SORTED
STRONGLY COARSE SKEWED
PLATYKURTIC

CRITICAL PERCENTILES

PHI5=	-1.5972	PHI75=	2.5943
PHI16=	-0.3227	PHI84=	2.7621
PHI25=	0.5016	PHI95=	2.9672
PHI50=	2.1282		

PERCENTAGES

SAND100.0000 %
SILT 0.0000 %
CLAY 0.0000 %

SAMPLE NUMBER 32

PHI SIZE	WEIGHT	WEIGHT %	C.WEIGHT %
-3.0000	0.0000	0.0000	0.0000
-2.0000	0.2500	5.3533	5.3533
-1.0000	0.4400	9.4218	14.7752
0.0000	0.7800	16.7024	31.4775
1.0000	0.8700	18.6295	50.1071
2.0000	1.2600	26.9807	77.0878
3.0000	0.9900	21.1991	98.2869
4.0000	0.0800	1.7131	100.0000

MEDIAN 0.9943
GRAPHIC MEAN 0.7979
INCLUSIVE GRAPHIC STANDARD DEVIATION 1.5573
INCLUSIVE GRAPHIC SKEWNESS -0.2137
GRAPHIC KURTOSIS 0.8711
NORMALIZED KURTOSIS 0.4656
SAMPLE WEIGHT 4.6700

VERBAL CLASSIFICATION

POORLY SORTED
COARSE SKEWED
PLATYKURTIC

CRITICAL PERCENTILES

PHI5=	-2.0660	PHI75=	1.9226
PHI16=	-0.9267	PHI84=	2.3261
PHI25=	-0.3878	PHI95=	2.8449
PHI50=	0.9943		

PERCENTAGES

SAND100.0000 %
SILT 0.0000 %
CLAY 0.0000 %

SAMPLE NUMBER 33

PHI SIZE	WEIGHT	WEIGHT %	C.WEIGHT %
-3.0000	0.0000	0.0000	0.0000
-2.0000	0.6700	9.1156	9.1156
-1.0000	0.1800	2.4490	11.5646
0.0000	1.3800	18.7755	30.3401
1.0000	3.1300	42.5850	72.9252
2.0000	1.5200	20.6803	93.6055
3.0000	0.4300	5.8503	99.4558
4.0000	0.0400	0.5442	100.0000

MEDIAN 0.4617
GRAPHIC MEAN 0.4111
INCLUSIVE GRAPHIC STANDARD DEVIATION 1.2854
INCLUSIVE GRAPHIC SKEWNESS -0.1541
GRAPHIC KURTOSIS 1.3880
NORMALIZED KURTOSIS 0.5812
SAMPLE WEIGHT 7.3500

VERBAL CLASSIFICATION

POORLY SORTED
COARSE SKEWED
LEPTOKURTIC

CRITICAL PERCENTILES

PHI5=	-2.4515	PHI75=	1.1003
PHI16=	-0.7638	PHI84=	1.5355
PHI25=	-0.2844	PHI95=	2.2384
PHI50=	0.4617		

PERCENTAGES

SAND100.0000 %
SILT 0.0000 %
CLAY 0.0000 %

SAMPLE NUMBER 34

PHI SIZE	WEIGHT	WEIGHT %	C.WEIGHT %
-3.0000	0.0000	0.0000	0.0000
-2.0000	0.8400	9.9408	9.9408
-1.0000	0.8600	10.1775	20.1183
0.0000	0.5600	6.6272	26.7456
1.0000	0.8000	9.4675	36.2130
2.0000	2.5000	29.5858	65.7988
3.0000	2.6600	31.4793	97.2781
4.0000	0.2300	2.7219	100.0000

MEDIAN 1.4660
GRAPHIC MEAN 0.8798
INCLUSIVE GRAPHIC STANDARD DEVIATION 1.8176
INCLUSIVE GRAPHIC SKEWNESS -0.4513
GRAPHIC KURTOSIS 0.8699
NORMALIZED KURTOSIS 0.4652
SAMPLE WEIGHT 8.4500

VERBAL CLASSIFICATION

POORLY SORTED
STRONGLY COARSE SKEWED
PLATYKURTIC

CRITICAL PERCENTILES

PHI5=	-2.4970	PHI75=	2.2923
PHI16=	-1.4047	PHI84=	2.5782
PHI25=	-0.2634	PHI95=	2.9276
PHI50=	1.4660		

PERCENTAGES

SAND100.0000 %
SILT 0.0000 %
CLAY 0.0000 %

SAMPLE NUMBER 35

PHI SIZE	WEIGHT	WEIGHT %	C.WEIGHT %
-3.0000	0.0000	0.0000	0.0000
-2.0000	1.2600	19.1781	19.1781
-1.0000	0.3500	5.3272	24.5053
0.0000	0.7500	11.4155	35.9208
1.0000	1.8000	27.3973	63.3181
2.0000	1.5800	24.0487	87.3668
3.0000	0.7200	10.9589	98.3257
4.0000	0.1100	1.6743	100.0000

MEDIAN 0.5139
GRAPHIC MEAN 0.0694
INCLUSIVE GRAPHIC STANDARD DEVIATION 1.8300
INCLUSIVE GRAPHIC SKEWNESS -0.2641
GRAPHIC KURTOSIS 0.9121
NORMALIZED KURTOSIS 0.4770
SAMPLE WEIGHT 6.5700

VERBAL CLASSIFICATION

POORLY SORTED
COARSE SKEWED
MESOKURTIC

CRITICAL PERCENTILES

PHI5=	-2.7393	PHI75=	1.4858
PHI16=	-2.1657	PHI84=	1.8600
PHI25=	-0.9567	PHI95=	2.6965
PHI50=	0.5139		

PERCENTAGES

SAND100.0000 %
SILT 0.0000 %
CLAY 0.0000 %

SAMPLE NUMBER 36

PHI SIZE	WEIGHT	WEIGHT %	C.WEIGHT %
-3.0000	0.0000	0.0000	0.0000
-2.0000	0.8000	22.8571	22.8571
-1.0000	0.1900	5.4286	28.2857
0.0000	0.5900	16.8571	45.1429
1.0000	0.8900	25.4286	70.5714
2.0000	0.5400	15.4286	86.0000
3.0000	0.4100	11.7143	97.7143
4.0000	0.0800	2.2857	100.0000

MEDIAN 0.1910
GRAPHIC MEAN -0.0795
INCLUSIVE GRAPHIC STANDARD DEVIATION 1.8834
INCLUSIVE GRAPHIC SKEWNESS -0.1329
GRAPHIC KURTOSIS 0.7864
NORMALIZED KURTOSIS 0.4402
SAMPLE WEIGHT 3.5000

VERBAL CLASSIFICATION

POORLY SORTED
COARSE SKEWED
PLATYKURTIC

CRITICAL PERCENTILES

PHI5=	-2.7813	PHI75=	1.2870
PHI16=	-2.3000	PHI84=	1.8704
PHI25=	-1.6053	PHI95=	2.7683
PHI50=	0.1910		

PERCENTAGES

SAND100.0000 %
SILT 0.0000 %
CLAY 0.0000 %

SAMPLE NUMBER 37

PHI SIZE	WEIGHT	WEIGHT %	C.WEIGHT %
-3.0000	0.0000	0.0000	0.0000
-2.0000	0.1300	2.2184	2.2184
-1.0000	0.5900	10.0683	12.2867
0.0000	1.1800	20.1365	32.4232
1.0000	1.1700	19.9659	52.3891
2.0000	1.7100	29.1809	81.5700
3.0000	1.0200	17.4061	98.9761
4.0000	0.0600	1.0239	100.0000

MEDIAN 0.8803
GRAPHIC MEAN 0.7348
INCLUSIVE GRAPHIC STANDARD DEVIATION 1.4199
INCLUSIVE GRAPHIC SKEWNESS -0.1532
GRAPHIC KURTOSIS 0.8595
NORMALIZED KURTOSIS 0.4622
SAMPLE WEIGHT 5.8600

VERBAL CLASSIFICATION

POORLY SORTED
COARSE SKEWED
PLATYKURTIC

CRITICAL PERCENTILES

PHI5=	-1.7237	PHI75=	1.7749
PHI16=	-0.8156	PHI84=	2.1396
PHI25=	-0.3686	PHI95=	2.7716
PHI50=	0.8803		

PERCENTAGES

SAND100.0000 %
SILT 0.0000 %
CLAY 0.0000 %

SAMPLE NUMBER 38

PHI SIZE	WEIGHT	WEIGHT %	C.WEIGHT %
-3.0000	0.0000	0.0000	0.0000
-2.0000	0.0000	0.0000	0.0000
-1.0000	0.2900	6.9048	6.9048
0.0000	0.3800	9.0476	15.9524
1.0000	0.4600	10.9524	26.9048
2.0000	1.2000	28.5714	55.4762
3.0000	1.7800	42.3810	97.8571
4.0000	0.0900	2.1429	100.0000

MEDIAN 1.8083
GRAPHIC MEAN 1.4952
INCLUSIVE GRAPHIC STANDARD DEVIATION 1.3048
INCLUSIVE GRAPHIC SKEWNESS -0.4088
GRAPHIC KURTOSIS 1.0552
NORMALIZED KURTOSIS 0.5134
SAMPLE WEIGHT 4.2000

VERBAL CLASSIFICATION

POORLY SORTED
STRONGLY COARSE SKEWED
MESOKURTIC

CRITICAL PERCENTILES

PHI5=	-1.2759	PHI75=	2.4607
PHI16=	0.0043	PHI84=	2.6730
PHI25=	0.8261	PHI95=	2.9326
PHI50=	1.8083		

PERCENTAGES

SAND100.0000 %
SILT 0.0000 %
CLAY 0.0000 %

SAMPLE NUMBER 39

PHI SIZE	WEIGHT	WEIGHT %	C.WEIGHT %
-3.0000	0.0000	0.0000	0.0000
-2.0000	0.2500	4.1946	4.1946
-1.0000	0.9200	15.4362	19.6309
0.0000	0.9800	16.4430	36.0738
1.0000	0.9200	15.4362	51.5101
2.0000	1.4000	23.4899	75.0000
3.0000	1.4200	23.8255	98.8255
4.0000	0.0700	1.1745	100.0000

MEDIAN 0.9022
GRAPHIC MEAN 0.6816
INCLUSIVE GRAPHIC STANDARD DEVIATION 1.6286
INCLUSIVE GRAPHIC SKEWNESS -0.1869
GRAPHIC KURTOSIS 0.7339
NORMALIZED KURTOSIS 0.4233
SAMPLE WEIGHT 5.9600

VERBAL CLASSIFICATION

POORLY SORTED
COARSE SKEWED
PLATYKURTIC

CRITICAL PERCENTILES

PHI5=	-1.9478	PHI75=	2.0000
PHI16=	-1.2352	PHI84=	2.3777
PHI25=	-0.6735	PHI95=	2.8394
PHI50=	0.9022		

PERCENTAGES

SAND100.0000 %
SILT 0.0000 %
CLAY 0.0000 %

SAMPLE NUMBER 40

PHI SIZE	WEIGHT	WEIGHT %	C.WEIGHT %
-2.0000	0.0000	0.0000	0.0000
-1.0000	0.3300	6.9038	6.9038
0.0000	0.4700	9.8326	16.7364
1.0000	0.4600	9.6234	26.3598
2.0000	1.1600	24.2678	50.6276
3.0000	2.1500	44.9791	95.6067
4.0000	0.2100	4.3933	100.0000

MEDIAN 1.9741
GRAPHIC MEAN 1.5471
INCLUSIVE GRAPHIC STANDARD DEVIATION 1.3500
INCLUSIVE GRAPHIC SKEWNESS -0.4899
GRAPHIC KURTOSIS 1.0378
NORMALIZED KURTOSIS 0.5093
SAMPLE WEIGHT 4.7800

VERBAL CLASSIFICATION

POORLY SORTED
STRONGLY COARSE SKEWED
MESOKURTIC

CRITICAL PERCENTILES

PHI5=	-1.2758	PHI75=	2.5419
PHI16=	-0.0749	PHI84=	2.7420
PHI25=	0.8587	PHI95=	2.9865
PHI50=	1.9741		

PERCENTAGES

SAND100.0000 %
SILT 0.0000 %
CLAY 0.0000 %

SAMPLE NUMBER 41

PHI SIZE	WEIGHT	WEIGHT %	C.WEIGHT %
-3.0000	0.0000	0.0000	0.0000
-2.0000	0.8100	6.4800	6.4800
-1.0000	0.4900	3.9200	10.4000
0.0000	1.0000	8.0000	18.4000
1.0000	5.9600	47.6800	66.0800
2.0000	1.5700	12.5600	78.6400
3.0000	2.4200	19.3600	98.0000
4.0000	0.2500	2.0000	100.0000

MEDIAN 0.6628
GRAPHIC MEAN 0.8799
INCLUSIVE GRAPHIC STANDARD DEVIATION 1.4129
INCLUSIVE GRAPHIC SKEWNESS 0.0565
GRAPHIC KURTOSIS 1.3229
NORMALIZED KURTOSIS 0.5695
SAMPLE WEIGHT 12.5000

VERBAL CLASSIFICATION

POORLY SORTED
NEARLY SYMMETRICAL
LEPTOKURTIC

CRITICAL PERCENTILES

PHI5=	-2.2284	PHI75=	1.7102
PHI16=	-0.3000	PHI84=	2.2769
PHI25=	0.1384	PHI95=	2.8450
PHI50=	0.6628		

PERCENTAGES

SAND100.0000 %
SILT 0.0000 %
CLAY 0.0000 %

SAMPLE NUMBER 42

PHI SIZE	WEIGHT	WEIGHT %	C.WEIGHT %
-3.0000	0.0000	0.0000	0.0000
-2.0000	0.4400	3.9497	3.9497
-1.0000	1.3600	12.2083	16.1580
0.0000	2.8200	25.3142	41.4722
1.0000	3.6200	32.4955	73.9677
2.0000	2.2800	20.4668	94.4345
3.0000	0.5800	5.2065	99.6409
4.0000	0.0400	0.3591	100.0000

MEDIAN 0.2624
GRAPHIC MEAN 0.2466
INCLUSIVE GRAPHIC STANDARD DEVIATION 1.2353
INCLUSIVE GRAPHIC SKEWNESS -0.0506
GRAPHIC KURTOSIS 0.9691
NORMALIZED KURTOSIS 0.4922
SAMPLE WEIGHT 11.1400

VERBAL CLASSIFICATION

POORLY SORTED
NEARLY SYMMETRICAL
MESOKURTIC

CRITICAL PERCENTILES

PHI5=	-1.9140	PHI75=	1.0504
PHI16=	-1.0129	PHI84=	1.4902
PHI25=	-0.6507	PHI95=	2.1086
PHI50=	0.2624		

PERCENTAGES

SAND100.0000 %
SILT 0.0000 %
CLAY 0.0000 %

SAMPLE NUMBER 43

PHI SIZE	WEIGHT	WEIGHT %	C.WEIGHT %
-3.0000	0.0000	0.0000	0.0000
-2.0000	1.8000	38.6266	38.6266
-1.0000	0.1400	3.0043	41.6309
0.0000	0.2300	4.9356	46.5665
1.0000	0.4900	10.5150	57.0815
2.0000	1.1200	24.0343	81.1159
3.0000	0.8200	17.5966	98.7124
4.0000	0.0600	1.2876	100.0000

MEDIAN 0.3265
GRAPHIC MEAN -0.0318
INCLUSIVE GRAPHIC STANDARD DEVIATION 2.0449
INCLUSIVE GRAPHIC SKEWNESS -0.1781
GRAPHIC KURTOSIS 0.5660
NORMALIZED KURTOSIS 0.3614
SAMPLE WEIGHT 4.6600

VERBAL CLASSIFICATION

VERY POORLY SORTED
COARSE SKEWED
VERY PLATYKURTIC

CRITICAL PERCENTILES

PHI5=	-2.8706	PHI75=	1.7455
PHI16=	-2.5858	PHI84=	2.1639
PHI25=	-2.3528	PHI95=	2.7890
PHI50=	0.3265		

PERCENTAGES

SAND100.0000 %
SILT 0.0000 %
CLAY 0.0000 %

SAMPLE NUMBER 44

PHI SIZE	WEIGHT	WEIGHT %	C.WEIGHT %
-3.0000	0.0000	0.0000	0.0000
-2.0000	0.6600	14.1328	14.1328
-1.0000	0.3300	7.0664	21.1991
0.0000	0.5300	11.3490	32.5482
1.0000	1.0600	22.6981	55.2463
2.0000	1.3800	29.5503	84.7966
3.0000	0.6700	14.3469	99.1435
4.0000	0.0400	0.8565	100.0000

MEDIAN 0.7689
GRAPHIC MEAN 0.3354
INCLUSIVE GRAPHIC STANDARD DEVIATION 1.7389
INCLUSIVE GRAPHIC SKEWNESS -0.3128
GRAPHIC KURTOSIS 0.9409
NORMALIZED KURTOSIS 0.4848
SAMPLE WEIGHT 4.6700

VERBAL CLASSIFICATION

POORLY SORTED
STRONGLY COARSE SKEWED
MESOKURTIC

CRITICAL PERCENTILES

PHI5=	-2.6462	PHI75=	1.6685
PHI16=	-1.7358	PHI84=	1.9730
PHI25=	-0.6651	PHI95=	2.7112
PHI50=	0.7689		

PERCENTAGES

SAND100.0000 %
SILT 0.0000 %
CLAY 0.0000 %

SAMPLE NUMBER 50

PHI SIZE	WEIGHT	WEIGHT %	C.WEIGHT %
-3.0000	0.0000	0.0000	0.0000
-2.0000	0.1800	3.0508	3.0508
-1.0000	0.4400	7.4576	10.5085
0.0000	0.9600	16.2712	26.7797
1.0000	1.4200	24.0678	50.8475
2.0000	1.6300	27.6271	78.4746
3.0000	1.1900	20.1695	98.6441
4.0000	0.0800	1.3559	100.0000

MEDIAN 0.9648
GRAPHIC MEAN 0.8587
INCLUSIVE GRAPHIC STANDARD DEVIATION 1.4247
INCLUSIVE GRAPHIC SKEWNESS -0.1473
GRAPHIC KURTOSIS 0.9417
NORMALIZED KURTOSIS 0.4850
SAMPLE WEIGHT 5.9000

VERBAL CLASSIFICATION

POORLY SORTED
COARSE SKEWED
MESOKURTIC

CRITICAL PERCENTILES

PHI5=	-1.7386	PHI75=	1.8742
PHI16=	-0.6625	PHI84=	2.2739
PHI25=	-0.1094	PHI95=	2.8193
PHI50=	0.9648		

PERCENTAGES

SAND100.0000 %
SILT 0.0000 %
CLAY 0.0000 %

SAMPLE NUMBER 51

PHI SIZE	WEIGHT	WEIGHT %	C.WEIGHT %
-3.0000	0.0000	0.0000	0.0000
-2.0000	0.6000	9.3604	9.3604
-1.0000	0.3000	4.6802	14 0406
0.0000	0.7300	11.3885	25.4290
1.0000	2.5300	39.4696	64.8986
2.0000	1.6300	25.4290	90.3276
3.0000	0.5700	8.8924	99.2200
4.0000	0.0500	0.7800	100.0000

MEDIAN 0.6225
GRAPHIC MEAN 0.5153
INCLUSIVE GRAPHIC STANDARD DEVIATION 1.4010
INCLUSIVE GRAPHIC SKEWNESS -0.1811
GRAPHIC KURTOSIS 1.4256
NORMALIZED KURTOSIS 0.5877
SAMPLE WEIGHT 6.4100

VERBAL CLASSIFICATION

POORLY SORTED
COARSE SKEWED
LEPTOKURTIC

CRITICAL PERCENTILES

PHI5=	-2.4658	PHI75=	1.3972
PHI16=	-0.8279	PHI84=	1.7512
PHI25=	-0.0377	PHI95=	2.5254
PHI50=	0.6225		

PERCENTAGES

SAND100.0000 %
SILT 0.0000 %
CLAY 0.0000 %

SAMPLE NUMBER 62

PHI SIZE	WEIGHT	WEIGHT %	C.WEIGHT %
-3.0000	0.0000	0.0000	0.0000
-2.0000	0.6900	11.9584	11.9584
-1.0000	0.2600	4.5061	16.4645
0.0000	0.9000	15.5979	32.0624
1.0000	1.1600	20.1040	52.1664
2.0000	1.5500	26.8631	79.0295
3.0000	1.1600	20.1040	99.1335
4.0000	0.0500	0.8666	100.0000

MEDIAN 0.8922
GRAPHIC MEAN 0.6788
INCLUSIVE GRAPHIC STANDARD DEVIATION 1.6522
INCLUSIVE GRAPHIC SKEWNESS -0.2418
GRAPHIC KURTOSIS 0.9568
NORMALIZED KURTOSIS 0.4890
SAMPLE WEIGHT 5.7700

VERBAL CLASSIFICATION

POORLY SORTED
COARSE SKEWED
MESOKURTIC

CRITICAL PERCENTILES

PHI5=	-2.5819	PHI75=	1.8500
PHI16=	-1.1031	PHI84=	2.2472
PHI25=	-0.4528	PHI95=	2.7944
PHI50=	0.8922		

PERCENTAGES

SAND100.0000 %
SILT 0.0000 %
CLAY 0.0000 %

SAMPLE NUMBER 63

PHI SIZE	WEIGHT	WEIGHT %	C.WEIGHT %
-3.0000	0.0000	0.0000	0.0000
-2.0000	0.7900	15.5206	15.5206
-1.0000	0.5500	10.8055	26.3261
0.0000	0.5300	10.4126	36.7387
1.0000	0.7000	13.7525	50.4912
2.0000	1.1800	23.1827	73.6739
3.0000	1.2700	24.9509	98.6248
4.0000	0.0700	1.3752	100.0000

MEDIAN 0.9643
GRAPHIC MEAN 0.4742
INCLUSIVE GRAPHIC STANDARD DEVIATION 1.9306
INCLUSIVE GRAPHIC SKEWNESS -0.3266
GRAPHIC KURTOSIS 0.7140
NORMALIZED KURTOSIS 0.4166
SAMPLE WEIGHT 5.0900

VERBAL CLASSIFICATION

POORLY SORTED
STRONGLY COARSE SKEWED
PLATYKURTIC

CRITICAL PERCENTILES

PHI5=	-2.6778	PHI75=	2.0531
PHI16=	-1.9556	PHI84=	2.4139
PHI25=	-1.1227	PHI95=	2.8547
PHI50=	0.9643		

PERCENTAGES

SAND100.0000 %
SILT 0.0000 %
CLAY 0.0000 %

Grain Size Data for Insoluble-Residue Fraction

following HCl Dissolution of Grab Samples

Samples 1, 2, 4, 6, and 8 are missing; they are not included in the sample set.

Samples 7 and 48 were too small for dissolution.

SAMPLE NUMBER 3

PHI SIZE	WEIGHT	WEIGHT %	C.WEIGHT %
-1.0000	0.0200	0.0760	0.0760
0.0000	0.8500	3.2295	3.3055
1.0000	6.8300	25.9498	29.2553
2.0000	13.9800	53.1155	82.3708
3.0000	4.4400	16.8693	99.2401
4.0000	0.2000	0.7599	100.0000
5.0000	0.0000	0.0000	100.0000

MEDIAN 1.3906
GRAPHIC MEAN 1.3254
INCLUSIVE GRAPHIC STANDARD DEVIATION 0.8084
INCLUSIVE GRAPHIC SKEWNESS -0.0546
GRAPHIC KURTOSIS 1.0727
NORMALIZED KURTOSIS 0.5175
SAMPLE WEIGHT 26.3200

VERBAL CLASSIFICATION

MODERATELY SORTED
NEARLY SYMMETRICAL
MESOKURTIC

CRITICAL PERCENTILES

PHI5=	0.0653	PHI75=	1.8612
PHI16=	0.4892	PHI84=	2.0966
PHI25=	0.8360	PHI95=	2.7486
PHI50=	1.3906		

PERCENTAGES

SAND100.0000 %
SILT 0.0000 %
CLAY 0.0000 %

SAMPLE NUMBER 5

PHI SIZE	WEIGHT	WEIGHT %	C.WEIGHT %
-2.0000	0.0000	0.0000	0.0000
-1.0000	0.3900	1.1511	1.1511
0.0000	2.5900	7.6446	8.7957
1.0000	5.1100	15.0826	23.8784
2.0000	8.3100	24.5277	48.4061
3.0000	16.7800	49.5277	97.9339
4.0000	0.7000	2.0661	100.0000
5.0000	0.0000	0.0000	100.0000

MEDIAN 2.0322
GRAPHIC MEAN 1.7428
INCLUSIVE GRAPHIC STANDARD DEVIATION 1.0811
INCLUSIVE GRAPHIC SKEWNESS -0.4293
GRAPHIC KURTOSIS 0.9447
NORMALIZED KURTOSIS 0.4858
SAMPLE WEIGHT 33.8800

VERBAL CLASSIFICATION

POORLY SORTED
STRONGLY COARSE SKEWED
MESOKURTIC

CRITICAL PERCENTILES

PHI5=	-0.4965	PHI75=	2.5369
PHI16=	0.4777	PHI84=	2.7187
PHI25=	1.0457	PHI95=	2.9408
PHI50=	2.0322		

PERCENTAGES

SAND100.0000 %
SILT 0.0000 %
CLAY 0.0000 %

SAMPLE NUMBER 9

PHI SIZE	WEIGHT	WEIGHT %	C.WEIGHT %
-2.0000	0.0000	0.0000	0.0000
-1.0000	0.1200	0.1988	0.1988
0.0000	2.3100	3.8264	4.0252
1.0000	15.5100	25.6916	29.7167
2.0000	32.2500	53.4206	83.1373
3.0000	9.9700	16.5148	99.6521
4.0000	0.2100	0.3479	100.0000
5.0000	0.0000	0.0000	100.0000

MEDIAN 1.3797
GRAPHIC MEAN 1.2993
INCLUSIVE GRAPHIC STANDARD DEVIATION 0.8026
INCLUSIVE GRAPHIC SKEWNESS -0.0766
GRAPHIC KURTOSIS 1.0652
NORMALIZED KURTOSIS 0.5158
SAMPLE WEIGHT 60.3700

VERBAL CLASSIFICATION

MODERATELY SORTED
NEARLY SYMMETRICAL
MESOKURTIC

CRITICAL PERCENTILES

PHI5= 0.0379 PHI75= 1.8477
PHI16= 0.4661 PHI84= 2.0522
PHI25= 0.8164 PHI95= 2.7183
PHI50= 1.3797

PERCENTAGES

SAND100.0000 %
SILT 0.0000 %
CLAY 0.0000 %

SAMPLE NUMBER 10

PHI SIZE	WEIGHT	WEIGHT %	C.WEIGHT %
-1.0000	0.0400	0.0841	0.0841
0.0000	1.4900	3.1329	3.2170
1.0000	8.5900	18.0614	21.2784
2.0000	28.8700	60.7023	81.9807
3.0000	8.3800	17.6198	99.6005
4.0000	0.1900	0.3995	100.0000
5.0000	0.0000	0.0000	100.0000

MEDIAN 1.4732
GRAPHIC MEAN 1.4318
INCLUSIVE GRAPHIC STANDARD DEVIATION 0.7517
INCLUSIVE GRAPHIC SKEWNESS -0.0646
GRAPHIC KURTOSIS 1.3136
NORMALIZED KURTOSIS 0.5678
SAMPLE WEIGHT 47.5600

VERBAL CLASSIFICATION

MODERATELY SORTED
NEARLY SYMMETRICAL
LEPTOKURTIC

CRITICAL PERCENTILES

PHI5= 0.0987 PHI75= 1.8850
PHI16= 0.7078 PHI84= 2.1146
PHI25= 1.0613 PHI95= 2.7389
PHI50= 1.4732

PERCENTAGES

SAND100.0000 %
SILT 0.0000 %
CLAY 0.0000 %

SAMPLE NUMBER 11

PHI SIZE	WEIGHT	WEIGHT %	C.WEIGHT %
-1.0000	0.0400	0.0638	0.0638
0.0000	2.3300	3.7137	3.7775
1.0000	11.4200	18.2021	21.9796
2.0000	36.6800	58.4635	80.4431
3.0000	11.8200	18.8397	99.2828
4.0000	0.4500	0.7172	100.0000
5.0000	0.0000	0.0000	100.0000

MEDIAN 1.4793
GRAPHIC MEAN 1.4465
INCLUSIVE GRAPHIC STANDARD DEVIATION 0.7893
INCLUSIVE GRAPHIC SKEWNESS -0.0543
GRAPHIC KURTOSIS 1.2965
NORMALIZED KURTOSIS 0.5646
SAMPLE WEIGHT 62.7400

VERBAL CLASSIFICATION

MODERATELY SORTED
NEARLY SYMMETRICAL
LEPTOKURTIC

CRITICAL PERCENTILES

PHI5=	0.0672	PHI75=	1.9069
PHI16=	0.6715	PHI84=	2.1888
PHI25=	1.0517	PHI95=	2.7727
PHI50=	1.4793		

PERCENTAGES

SAND100.0000 %
SILT 0.0000 %
CLAY 0.0000 %

SAMPLE NUMBER 12

PHI SIZE	WEIGHT	WEIGHT %	C.WEIGHT %
-2.0000	0.0000	0.0000	0.0000
-1.0000	0.5200	1.3720	1.3720
0.0000	3.6000	9.4987	10.8707
1.0000	13.2200	34.8813	45.7520
2.0000	17.1500	45.2507	91.0026
3.0000	3.2400	8.5488	99.5515
4.0000	0.1700	0.4485	100.0000
5.0000	0.0000	0.0000	100.0000

MEDIAN 1.0939
GRAPHIC MEAN 1.0287
INCLUSIVE GRAPHIC STANDARD DEVIATION 0.8921
INCLUSIVE GRAPHIC SKEWNESS -0.1124
GRAPHIC KURTOSIS 1.0188
NORMALIZED KURTOSIS 0.5047
SAMPLE WEIGHT 37.9000

VERBAL CLASSIFICATION

MODERATELY SORTED
COARSE SKEWED
MESOKURTIC

CRITICAL PERCENTILES

PHI5=	-0.6181	PHI75=	1.6464
PHI16=	0.1470	PHI84=	1.8452
PHI25=	0.4051	PHI95=	2.4676
PHI50=	1.0939		

PERCENTAGES

SAND100.0000 %
SILT 0.0000 %
CLAY 0.0000 %

SAMPLE NUMBER 13

PHI SIZE	WEIGHT	WEIGHT %	C.WEIGHT %
-2.0000	0.1300	0.3412	0.3412
-1.0000	0.1200	0.3150	0.6562
0.0000	0.6400	1.6798	2.3360
1.0000	1.8200	4.7769	7.1129
2.0000	12.7500	33.4646	40.5774
3.0000	20.7300	54.4095	94.9869
4.0000	1.9100	5.0131	100.0000
5.0000	0.0000	0.0000	100.0000

MEDIAN 2.1732
GRAPHIC MEAN 2.0789
INCLUSIVE GRAPHIC STANDARD DEVIATION 0.7536
INCLUSIVE GRAPHIC SKEWNESS -0.2530
GRAPHIC KURTOSIS 0.9125
NORMALIZED KURTOSIS 0.4771
SAMPLE WEIGHT 38.1000

VERBAL CLASSIFICATION

MODERATELY SORTED
COARSE SKEWED
MESOKURTIC

CRITICAL PERCENTILES

PHI5= 0.5577 PHI75= 2.6327
PHI16= 1.2656 PHI84= 2.7981
PHI25= 1.5345 PHI95= 3.0026
PHI50= 2.1732

PERCENTAGES

SAND100.0000 %
SILT 0.0000 %
CLAY 0.0000 %

SAMPLE NUMBER 14

PHI SIZE	WEIGHT	WEIGHT %	C.WEIGHT %
-2.0000	0.0100	0.0390	0.0390
-1.0000	0.7000	2.7322	2.7713
0.0000	4.5200	17.6425	20.4137
1.0000	10.7200	41.8423	62.2561
2.0000	9.0900	35.4801	97.7362
3.0000	0.5700	2.2248	99.9610
4.0000	0.0100	0.0390	100.0000
5.0000	0.0000	0.0000	100.0000

MEDIAN 0.7071
GRAPHIC MEAN 0.6899
INCLUSIVE GRAPHIC STANDARD DEVIATION 0.8895
INCLUSIVE GRAPHIC SKEWNESS -0.0791
GRAPHIC KURTOSIS 0.9172
NORMALIZED KURTOSIS 0.4784
SAMPLE WEIGHT 25.6200

VERBAL CLASSIFICATION

MODERATELY SORTED
NEARLY SYMMETRICAL
MESOKURTIC

CRITICAL PERCENTILES

PHI5= -0.8737 PHI75= 1.3592
PHI16= -0.2502 PHI84= 1.6128
PHI25= 0.1096 PHI95= 1.9229
PHI50= 0.7071

PERCENTAGES

SAND100.0000 %
SILT 0.0000 %
CLAY 0.0000 %

SAMPLE NUMBER 15

PHI SIZE	WEIGHT	WEIGHT %	C.WEIGHT %
-2.0000	0.0000	0.0000	0.0000
-1.0000	0.4600	0.7764	0.7764
0.0000	3.0600	5.1646	5.9409
1.0000	14.7900	24.9620	30.9030
2.0000	31.2300	52.7089	83.6118
3.0000	9.2500	15.6118	99.2236
4.0000	0.4600	0.7764	100.0000
5.0000	0.0000	0.0000	100.0000

MEDIAN 1.3623
GRAPHIC MEAN 1.2634
INCLUSIVE GRAPHIC STANDARD DEVIATION 0.8466
INCLUSIVE GRAPHIC SKEWNESS -0.1219
GRAPHIC KURTOSIS 1.1120
NORMALIZED KURTOSIS 0.5265
SAMPLE WEIGHT 59.2500

VERBAL CLASSIFICATION

MODERATELY SORTED
COARSE SKEWED
LEPTOKURTIC

CRITICAL PERCENTILES

PHI5= -0.1822 PHI75= 1.8366
PHI16= 0.4030 PHI84= 2.0249
PHI25= 0.7635 PHI95= 2.7295
PHI50= 1.3623

PERCENTAGES

SAND100.0000 %
SILT 0.0000 %
CLAY 0.0000 %

SAMPLE NUMBER 16

PHI SIZE	WEIGHT	WEIGHT %	C.WEIGHT %
-2.0000	0.0000	0.0000	0.0000
-1.0000	0.3900	1.0185	1.0185
0.0000	3.2500	8.4879	9.5064
1.0000	10.1100	26.4038	35.9102
2.0000	17.4900	45.6777	81.5879
3.0000	6.6700	17.4197	99.0076
4.0000	0.3800	0.9924	100.0000
5.0000	0.0000	0.0000	100.0000

MEDIAN 1.3085
GRAPHIC MEAN 1.2310
INCLUSIVE GRAPHIC STANDARD DEVIATION 0.9733
INCLUSIVE GRAPHIC SKEWNESS -0.1187
GRAPHIC KURTOSIS 1.0661
NORMALIZED KURTOSIS 0.5160
SAMPLE WEIGHT 38.2900

VERBAL CLASSIFICATION

MODERATELY SORTED
COARSE SKEWED
MESOKURTIC

CRITICAL PERCENTILES

PHI5= -0.5309 PHI75= 1.8558
PHI16= 0.2459 PHI84= 2.1385
PHI25= 0.5868 PHI95= 2.7699
PHI50= 1.3085

PERCENTAGES

SAND100.0000 %
SILT 0.0000 %
CLAY 0.0000 %

SAMPLE NUMBER 17

PHI SIZE	WEIGHT	WEIGHT %	C.WEIGHT %
-2.0000	0.2100	0.3067	0.3067
-1.0000	2.3100	3.3742	3.6810
0.0000	12.1100	17.6892	21.3701
1.0000	21.4500	31.3322	52.7023
2.0000	25.9800	37.9492	90.6515
3.0000	5.9500	8.6912	99.3427
4.0000	0.4500	0.6573	100.0000
5.0000	0.0000	0.0000	100.0000

MEDIAN 0.9138
GRAPHIC MEAN 0.8116
INCLUSIVE GRAPHIC STANDARD DEVIATION 1.0511
INCLUSIVE GRAPHIC SKEWNESS -0.1088
GRAPHIC KURTOSIS 0.9540
NORMALIZED KURTOSIS 0.4882
SAMPLE WEIGHT 68.4600

VERBAL CLASSIFICATION

POORLY SORTED
COARSE SKEWED
MESOKURTIC

CRITICAL PERCENTILES

PHI5=	-0.9254	PHI75=	1.5876
PHI16=	-0.3036	PHI84=	1.8247
PHI25=	0.1159	PHI95=	2.5003
PHI50=	0.9138		

PERCENTAGES

SAND100.0000 %
SILT 0.0000 %
CLAY 0.0000 %

SAMPLE NUMBER 18

PHI SIZE	WEIGHT	WEIGHT %	C.WEIGHT %
-1.0000	0.0300	0.0550	0.0550
0.0000	1.7300	3.1720	3.2270
1.0000	7.1900	13.1830	16.4100
2.0000	31.3900	57.5541	73.9641
3.0000	13.7100	25.1375	99.1016
4.0000	0.4900	0.8984	100.0000
5.0000	0.0000	0.0000	100.0000

MEDIAN 1.5836
GRAPHIC MEAN 1.6506
INCLUSIVE GRAPHIC STANDARD DEVIATION 0.7670
INCLUSIVE GRAPHIC SKEWNESS 0.0340
GRAPHIC KURTOSIS 1.2417
NORMALIZED KURTOSIS 0.5539
SAMPLE WEIGHT 54.5400

VERBAL CLASSIFICATION

MODERATELY SORTED
NEARLY SYMMETRICAL
LEPTOKURTIC

CRITICAL PERCENTILES

PHI5=	0.1345	PHI75=	2.0412
PHI16=	0.9689	PHI84=	2.3992
PHI25=	1.1493	PHI95=	2.8368
PHI50=	1.5836		

PERCENTAGES

SAND100.0000 %
SILT 0.0000 %
CLAY 0.0000 %

SAMPLE NUMBER 19

PHI SIZE	WEIGHT	WEIGHT %	C.WEIGHT %
-2.0000	0.0000	0.0000	0.0000
-1.0000	0.4400	0.8901	0.8901
0.0000	6.0000	12.1384	13.0285
1.0000	16.7800	33.9470	46.9755
2.0000	22.3700	45.2559	92.2314
3.0000	3.7000	7.4853	99.7168
4.0000	0.1400	0.2832	100.0000
5.0000	0.0000	0.0000	100.0000

MEDIAN 1.0668
GRAPHIC MEAN 0.9908
INCLUSIVE GRAPHIC STANDARD DEVIATION 0.8919
INCLUSIVE GRAPHIC SKEWNESS -0.1360
GRAPHIC KURTOSIS 0.9808
NORMALIZED KURTOSIS 0.4952
SAMPLE WEIGHT 49.4300

VERBAL CLASSIFICATION

MODERATELY SORTED
COARSE SKEWED
MESOKURTIC

CRITICAL PERCENTILES

PHI5=	-0.6614	PHI75=	1.6192
PHI16=	0.0875	PHI84=	1.8181
PHI25=	0.3527	PHI95=	2.3699
PHI50=	1.0668		

PERCENTAGES

SAND100.0000 %
SILT 0.0000 %
CLAY 0.0000 %

SAMPLE NUMBER 20

PHI SIZE	WEIGHT	WEIGHT %	C.WEIGHT %
-2.0000	0.0000	0.0000	0.0000
-1.0000	0.1700	0.3892	0.3892
0.0000	1.6600	3.8004	4.1896
1.0000	6.4800	14.8352	19.0247
2.0000	22.2700	50.9844	70.0092
3.0000	12.5900	28.8233	98.8324
4.0000	0.5100	1.1676	100.0000
5.0000	0.0000	0.0000	100.0000

MEDIAN 1.6075
GRAPHIC MEAN 1.6297
INCLUSIVE GRAPHIC STANDARD DEVIATION 0.8484
INCLUSIVE GRAPHIC SKEWNESS -0.0325
GRAPHIC KURTOSIS 1.0915
NORMALIZED KURTOSIS 0.5219
SAMPLE WEIGHT 43.6800

VERBAL CLASSIFICATION

MODERATELY SORTED
NEARLY SYMMETRICAL
MESOKURTIC

CRITICAL PERCENTILES

PHI5=	0.0546	PHI75=	2.1732
PHI16=	0.7961	PHI84=	2.4854
PHI25=	1.1172	PHI95=	2.8670
PHI50=	1.6075		

PERCENTAGES

SAND100.0000 %
SILT 0.0000 %
CLAY 0.0000 %

SAMPLE NUMBER 21

PHI SIZE	WEIGHT	WEIGHT %	C.WEIGHT %
-2.0000	0.0000	0.0000	0.0000
-1.0000	0.1100	0.1713	0.1713
0.0000	2.9500	4.5929	4.7641
1.0000	17.3400	26.9967	31.7609
2.0000	35.5300	55.3168	87.0777
3.0000	8.1300	12.6576	99.7353
4.0000	0.1700	0.2647	100.0000
5.0000	0.0000	0.0000	100.0000

MEDIAN 1.3297
GRAPHIC MEAN 1.2301
INCLUSIVE GRAPHIC STANDARD DEVIATION 0.7786
INCLUSIVE GRAPHIC SKEWNESS -0.1025
GRAPHIC KURTOSIS 1.0392
NORMALIZED KURTOSIS 0.5096
SAMPLE WEIGHT 64.2300

VERBAL CLASSIFICATION

MODERATELY SORTED
COARSE SKEWED
MESOKURTIC

CRITICAL PERCENTILES

PHI5=	0.0087	PHI75=	1.7817
PHI16=	0.4162	PHI84=	1.9444
PHI25=	0.7496	PHI95=	2.6259
PHI50=	1.3297		

PERCENTAGES

SAND100.0000 %
SILT 0.0000 %
CLAY 0.0000 %

SAMPLE NUMBER 22

PHI SIZE	WEIGHT	WEIGHT %	C.WEIGHT %
-2.0000	0.0300	0.0359	0.0359
-1.0000	0.2300	0.2753	0.3112
0.0000	3.4800	4.1657	4.4769
1.0000	18.8100	22.5162	26.9931
2.0000	44.6300	53.4235	80.4166
3.0000	15.7200	18.8173	99.2339
4.0000	0.6400	0.7661	100.0000
5.0000	0.0000	0.0000	100.0000

MEDIAN 1.4307
GRAPHIC MEAN 1.3776
INCLUSIVE GRAPHIC STANDARD DEVIATION 0.8366
INCLUSIVE GRAPHIC SKEWNESS -0.0588
GRAPHIC KURTOSIS 1.1425
NORMALIZED KURTOSIS 0.5333
SAMPLE WEIGHT 83.5400

VERBAL CLASSIFICATION

MODERATELY SORTED
NEARLY SYMMETRICAL
LEPTOKURTIC

CRITICAL PERCENTILES

PHI5=	0.0232	PHI75=	1.8986
PHI16=	0.5118	PHI84=	2.1904
PHI25=	0.9115	PHI95=	2.7750
PHI50=	1.4307		

PERCENTAGES

SAND100.0000 %
SILT 0.0000 %
CLAY 0.0000 %

SAMPLE NUMBER 23

PHI SIZE	WEIGHT	WEIGHT %	C.WEIGHT %
-2.0000	0.0000	0.0000	0.0000
-1.0000	0.9900	1.1888	1.1888
0.0000	7.3300	8.8016	9.9904
1.0000	19.4800	23.3910	33.3814
2.0000	43.6200	52.3775	85.7589
3.0000	11.1900	13.4366	99.1955
4.0000	0.6700	0.8045	100.0000
5.0000	0.0000	0.0000	100.0000

MEDIAN 1.3173
GRAPHIC MEAN 1.1802
INCLUSIVE GRAPHIC STANDARD DEVIATION 0.9205
INCLUSIVE GRAPHIC SKEWNESS -0.1992
GRAPHIC KURTOSIS 1.1570
NORMALIZED KURTOSIS 0.5364
SAMPLE WEIGHT 83.2800

VERBAL CLASSIFICATION

MODERATELY SORTED
COARSE SKEWED
LEPTOKURTIC

CRITICAL PERCENTILES

PHI5= -0.5670 PHI75= 1.7946
PHI16= 0.2569 PHI84= 1.9664
PHI25= 0.6417 PHI95= 2.6878
PHI50= 1.3173

PERCENTAGES

SAND100.0000 %
SILT 0.0000 %
CLAY 0.0000 %

SAMPLE NUMBER 24

PHI SIZE	WEIGHT	WEIGHT %	C.WEIGHT %
-2.0000	0.0000	0.0000	0.0000
-1.0000	0.0000	0.0000	0.0000
0.0000	0.3500	0.9447	0.9447
1.0000	1.9900	5.3711	6.3158
2.0000	13.1800	35.5735	41.8893
3.0000	20.5300	55.4116	97.3009
4.0000	1.0000	2.6991	100.0000
5.0000	0.0000	0.0000	100.0000

MEDIAN 2.1464
GRAPHIC MEAN 2.0595
INCLUSIVE GRAPHIC STANDARD DEVIATION 0.7058
INCLUSIVE GRAPHIC SKEWNESS -0.2190
GRAPHIC KURTOSIS 0.8422
NORMALIZED KURTOSIS 0.4572
SAMPLE WEIGHT 37.0500

VERBAL CLASSIFICATION

MODERATELY WELL SORTED
COARSE SKEWED
PLATYKURTIC

CRITICAL PERCENTILES

PHI5= 0.7550 PHI75= 2.5975
PHI16= 1.2722 PHI84= 2.7600
PHI25= 1.5252 PHI95= 2.9585
PHI50= 2.1464

PERCENTAGES

SAND100.0000 %
SILT 0.0000 %
CLAY 0.0000 %

SAMPLE NUMBER 25

PHI SIZE	WEIGHT	WEIGHT %	C.WEIGHT %
-2.0000	0.3100	0.4468	0.4468
-1.0000	1.2600	1.8161	2.2629
0.0000	10.3500	14.9178	17.1807
1.0000	18.8300	27.1404	44.3211
2.0000	31.9700	46.0796	90.4007
3.0000	6.4000	9.2246	99.6253
4.0000	0.2600	0.3747	100.0000
5.0000	0.0000	0.0000	100.0000

MEDIAN 1.1232
GRAPHIC MEAN 0.9684
INCLUSIVE GRAPHIC STANDARD DEVIATION 0.9874
INCLUSIVE GRAPHIC SKEWNESS -0.2048
GRAPHIC KURTOSIS 0.9862
NORMALIZED KURTOSIS 0.4965
SAMPLE WEIGHT 69.3800

VERBAL CLASSIFICATION

MODERATELY SORTED
COARSE SKEWED
MESOKURTIC

CRITICAL PERCENTILES

PHI5= -0.8165 PHI75= 1.6658
PHI16= -0.0791 PHI84= 1.8611
PHI25= 0.2881 PHI95= 2.4986
PHI50= 1.1232

PERCENTAGES

SAND100.0000 %
SILT 0.0000 %
CLAY 0.0000 %

SAMPLE NUMBER 26

PHI SIZE	WEIGHT	WEIGHT %	C.WEIGHT %
-2.0000	0.0000	0.0000	0.0000
-1.0000	0.5600	0.7608	0.7608
0.0000	5.7100	7.7571	8.5179
1.0000	18.6100	25.2819	33.7998
2.0000	37.5500	51.0121	84.8118
3.0000	10.9200	14.8349	99.6468
4.0000	0.2600	0.3532	100.0000
5.0000	0.0000	0.0000	100.0000

MEDIAN 1.3176
GRAPHIC MEAN 1.1992
INCLUSIVE GRAPHIC STANDARD DEVIATION 0.8978
INCLUSIVE GRAPHIC SKEWNESS -0.1692
GRAPHIC KURTOSIS 1.1136
NORMALIZED KURTOSIS 0.5269
SAMPLE WEIGHT 73.6100

VERBAL CLASSIFICATION

MODERATELY SORTED
COARSE SKEWED
LEPTOKURTIC

CRITICAL PERCENTILES

PHI5= -0.4535 PHI75= 1.8077
PHI16= 0.2959 PHI84= 1.9841
PHI25= 0.6519 PHI95= 2.6868
PHI50= 1.3176

PERCENTAGES

SAND100.0000 %
SILT 0.0000 %
CLAY 0.0000 %

SAMPLE NUMBER 27

PHI SIZE	WEIGHT	WEIGHT %	C.WEIGHT %
-2.0000	0.0100	0.0157	0.0157
-1.0000	0.5400	0.8479	0.8636
0.0000	6.3300	9.9388	10.8023
1.0000	20.7300	32.5483	43.3506
2.0000	31.3800	49.2699	92.6205
3.0000	4.4300	6.9556	99.5761
4.0000	0.2700	0.4239	100.0000
5.0000	0.0000	0.0000	100.0000

MEDIAN 1.1350
GRAPHIC MEAN 1.0399
INCLUSIVE GRAPHIC STANDARD DEVIATION 0.8597
INCLUSIVE GRAPHIC SKEWNESS -0.1731
GRAPHIC KURTOSIS 0.9942
NORMALIZED KURTOSIS 0.4985
SAMPLE WEIGHT 63.6900

VERBAL CLASSIFICATION

MODERATELY SORTED
COARSE SKEWED
MESOKURTIC

CRITICAL PERCENTILES

PHI5=	-0.5838	PHI75=	1.6424
PHI16=	0.1597	PHI84=	1.8250
PHI25=	0.4362	PHI95=	2.3421
PHI50=	1.1350		

PERCENTAGES

SAND100.0000 %
SILT 0.0000 %
CLAY 0.0000 %

SAMPLE NUMBER 28

PHI SIZE	WEIGHT	WEIGHT %	C.WEIGHT %
-2.0000	0.0000	0.0000	0.0000
-1.0000	1.0300	1.1050	1.1050
0.0000	10.6700	11.4473	12.5523
1.0000	30.8500	33.0973	45.6496
2.0000	39.7800	42.6778	88.3274
3.0000	10.3700	11.1254	99.4528
4.0000	0.5100	0.5472	100.0000
5.0000	0.0000	0.0000	100.0000

MEDIAN 1.1019
GRAPHIC MEAN 1.0349
INCLUSIVE GRAPHIC STANDARD DEVIATION 0.9425
INCLUSIVE GRAPHIC SKEWNESS -0.0965
GRAPHIC KURTOSIS 1.0185
NORMALIZED KURTOSIS 0.5046
SAMPLE WEIGHT 93.2100

VERBAL CLASSIFICATION

MODERATELY SORTED
NEARLY SYMMETRICAL
MESOKURTIC

CRITICAL PERCENTILES

PHI5=	-0.6597	PHI75=	1.6877
PHI16=	0.1042	PHI84=	1.8986
PHI25=	0.3761	PHI95=	2.5998
PHI50=	1.1019		

PERCENTAGES

SAND100.0000 %
SILT 0.0000 %
CLAY 0.0000 %

SAMPLE NUMBER 29

PHI SIZE	WEIGHT	WEIGHT %	C.WEIGHT %
-2.0000	0.1200	0.1787	0.1787
-1.0000	1.2400	1.8461	2.0247
0.0000	6.6300	9.8705	11.8952
1.0000	17.7600	26.4404	38.3356
2.0000	32.2400	47.9976	86.3332
3.0000	8.7200	12.9820	99.3152
4.0000	0.4600	0.6848	100.0000
5.0000	0.0000	0.0000	100.0000

MEDIAN 1.2430
GRAPHIC MEAN 1.1166
INCLUSIVE GRAPHIC STANDARD DEVIATION 0.9591
INCLUSIVE GRAPHIC SKEWNESS -0.1824
GRAPHIC KURTOSIS 1.0878
NORMALIZED KURTOSIS 0.5210
SAMPLE WEIGHT 67.1700

VERBAL CLASSIFICATION

MODERATELY SORTED
COARSE SKEWED
MESOKURTIC

CRITICAL PERCENTILES

PHI5=	-0.6986	PHI75=	1.7639
PHI16=	0.1552	PHI84=	1.9514
PHI25=	0.4956	PHI95=	2.6676
PHI50=	1.2430		

PERCENTAGES

SAND100.0000 %
SILT 0.0000 %
CLAY 0.0000 %

SAMPLE NUMBER 30

PHI SIZE	WEIGHT	WEIGHT %	C.WEIGHT %
-2.0000	0.1100	0.1199	0.1199
-1.0000	2.4000	2.6155	2.7354
0.0000	11.3600	12.3801	15.1155
1.0000	22.9900	25.0545	40.1700
2.0000	33.4200	36.4211	76.5911
3.0000	18.1600	19.7908	96.3819
4.0000	3.3200	3.6181	100.0000
5.0000	0.0000	0.0000	100.0000

MEDIAN 1.2699
GRAPHIC MEAN 1.2265
INCLUSIVE GRAPHIC STANDARD DEVIATION 1.1525
INCLUSIVE GRAPHIC SKEWNESS -0.0848
GRAPHIC KURTOSIS 0.9833
NORMALIZED KURTOSIS 0.4958
SAMPLE WEIGHT 91.7600

VERBAL CLASSIFICATION

POORLY SORTED
NEARLY SYMMETRICAL
MESOKURTIC

CRITICAL PERCENTILES

PHI5=	-0.8171	PHI75=	1.9563
PHI16=	0.0353	PHI84=	2.3744
PHI25=	0.3945	PHI95=	2.9302
PHI50=	1.2699		

PERCENTAGES

SAND100.0000 %
SILT 0.0000 %
CLAY 0.0000 %

SAMPLE NUMBER 31

PHI SIZE	WEIGHT	WEIGHT %	C.WEIGHT %
-2.0000	0.0000	0.0000	0.0000
-1.0000	0.4000	0.8222	0.8222
0.0000	2.7500	5.6526	6.4748
1.0000	8.4500	17.3690	23.8438
2.0000	21.3800	43.9466	67.7903
3.0000	13.9500	28.6742	96.4645
4.0000	1.7200	3.5355	100.0000
5.0000	0.0000	0.0000	100.0000

MEDIAN 1.5952
GRAPHIC MEAN 1.5696
INCLUSIVE GRAPHIC STANDARD DEVIATION 0.9906
INCLUSIVE GRAPHIC SKEWNESS -0.0973
GRAPHIC KURTOSIS 1.0738
NORMALIZED KURTOSIS 0.5178
SAMPLE WEIGHT 48.6500

VERBAL CLASSIFICATION

MODERATELY SORTED
NEARLY SYMMETRICAL
MESOKURTIC

CRITICAL PERCENTILES

PHI5= -0.2609 PHI75= 2.2514
PHI16= 0.5484 PHI84= 2.5653
PHI25= 1.0263 PHI95= 2.9489
PHI50= 1.5952

PERCENTAGES

SAND100.0000 %
SILT 0.0000 %
CLAY 0.0000 %

SAMPLE NUMBER 32

PHI SIZE	WEIGHT	WEIGHT %	C.WEIGHT %
-2.0000	0.0000	0.0000	0.0000
-1.0000	0.3600	0.6940	0.6940
0.0000	3.3300	6.4199	7.1139
1.0000	14.5700	28.0895	35.2034
2.0000	28.3100	54.5788	89.7822
3.0000	5.0700	9.7744	99.5566
4.0000	0.2300	0.4434	100.0000
5.0000	0.0000	0.0000	100.0000

MEDIAN 1.2711
GRAPHIC MEAN 1.1605
INCLUSIVE GRAPHIC STANDARD DEVIATION 0.8282
INCLUSIVE GRAPHIC SKEWNESS -0.1641
GRAPHIC KURTOSIS 1.0741
NORMALIZED KURTOSIS 0.5179
SAMPLE WEIGHT 51.8700

VERBAL CLASSIFICATION

MODERATELY SORTED
COARSE SKEWED
MESOKURTIC

CRITICAL PERCENTILES

PHI5= -0.3293 PHI75= 1.7292
PHI16= 0.3163 PHI84= 1.8941
PHI25= 0.6368 PHI95= 2.5338
PHI50= 1.2711

PERCENTAGES

SAND100.0000 %
SILT 0.0000 %
CLAY 0.0000 %

SAMPLE NUMBER 33

PHI SIZE	WEIGHT	WEIGHT %	C.WEIGHT %
-2.0000	0.0200	0.0281	0.0281
-1.0000	0.5700	0.8012	0.8294
0.0000	12.3600	17.3742	18.2035
1.0000	32.1900	45.2488	63.4523
2.0000	23.2100	32.6258	96.0782
3.0000	2.7100	3.8094	99.8875
4.0000	0.0800	0.1125	100.0000
5.0000	0.0000	0.0000	100.0000

MEDIAN 0.7027
GRAPHIC MEAN 0.7352
INCLUSIVE GRAPHIC STANDARD DEVIATION 0.8523
INCLUSIVE GRAPHIC SKEWNESS -0.0086
GRAPHIC KURTOSIS 0.9284
NORMALIZED KURTOSIS 0.4814
SAMPLE WEIGHT 71.1400

VERBAL CLASSIFICATION

MODERATELY SORTED
NEARLY SYMMETRICAL
MESOKURTIC

CRITICAL PERCENTILES

PHI5=	-0.7600	PHI75=	1.3539
PHI16=	-0.1268	PHI84=	1.6298
PHI25=	0.1502	PHI95=	1.9670
PHI50=	0.7027		

PERCENTAGES

SAND100.0000 %
SILT 0.0000 %
CLAY 0.0000 %

SAMPLE NUMBER 34

PHI SIZE	WEIGHT	WEIGHT %	C.WEIGHT %
-2.0000	0.0500	0.1195	0.1195
-1.0000	1.5100	3.6090	3.7285
0.0000	2.1800	5.2103	8.9388
1.0000	3.1900	7.6243	16.5631
2.0000	13.6900	32.7199	49.2830
3.0000	20.2000	48.2792	97.5621
4.0000	1.0200	2.4379	100.0000
5.0000	0.0000	0.0000	100.0000

MEDIAN 2.0149
GRAPHIC MEAN 1.8867
INCLUSIVE GRAPHIC STANDARD DEVIATION 1.0093
INCLUSIVE GRAPHIC SKEWNESS -0.3555
GRAPHIC KURTOSIS 1.1904
NORMALIZED KURTOSIS 0.5435
SAMPLE WEIGHT 41.8400

VERBAL CLASSIFICATION

POORLY SORTED
STRONGLY COARSE SKEWED
LEPTOKURTIC

CRITICAL PERCENTILES

PHI5=	-0.7560	PHI75=	2.5327
PHI16=	0.9261	PHI84=	2.7191
PHI25=	1.2579	PHI95=	2.9469
PHI50=	2.0149		

PERCENTAGES

SAND100.0000 %
SILT 0.0000 %
CLAY 0.0000 %

SAMPLE NUMBER 35

PHI SIZE	WEIGHT	WEIGHT %	C.WEIGHT %
-2.0000	0.0100	0.0183	0.0183
-1.0000	0.6900	1.2661	1.2844
0.0000	5.6400	10.3486	11.6330
1.0000	23.4300	42.9908	54.6239
2.0000	20.0400	36.7706	91.3945
3.0000	4.3800	8.0367	99.4312
4.0000	0.3100	0.5688	100.0000
5.0000	0.0000	0.0000	100.0000

MEDIAN 0.8924
GRAPHIC MEAN 0.9310
INCLUSIVE GRAPHIC STANDARD DEVIATION 0.8925
INCLUSIVE GRAPHIC SKEWNESS 0.0377
GRAPHIC KURTOSIS 1.0185
NORMALIZED KURTOSIS 0.5046
SAMPLE WEIGHT 54.5000

VERBAL CLASSIFICATION

MODERATELY SORTED
NEARLY SYMMETRICAL
MESOKURTIC

CRITICAL PERCENTILES

PHI5= -0.6410 PHI75= 1.5541
PHI16= 0.1016 PHI84= 1.7989
PHI25= 0.3109 PHI95= 2.4486
PHI50= 0.8924

PERCENTAGES

SAND100.0000 %
SILT 0.0000 %
CLAY 0.0000 %

SAMPLE NUMBER 36

PHI SIZE	WEIGHT	WEIGHT %	C.WEIGHT %
-2.0000	0.0300	0.1146	0.1146
-1.0000	0.4400	1.6807	1.7953
0.0000	8.8500	33.8044	35.5997
1.0000	9.7100	37.0894	72.6891
2.0000	4.2000	16.0428	88.7319
3.0000	2.6400	10.0840	98.8159
4.0000	0.3100	1.1841	100.0000
5.0000	0.0000	0.0000	100.0000

MEDIAN 0.3883
GRAPHIC MEAN 0.5045
INCLUSIVE GRAPHIC STANDARD DEVIATION 1.1056
INCLUSIVE GRAPHIC SKEWNESS 0.2096
GRAPHIC KURTOSIS 0.9916
NORMALIZED KURTOSIS 0.4979
SAMPLE WEIGHT 26.1800

VERBAL CLASSIFICATION

POORLY SORTED
FINE-SKEWED
MESOKURTIC

CRITICAL PERCENTILES

PHI5= -0.9052 PHI75= 1.1440
PHI16= -0.5798 PHI84= 1.7050
PHI25= -0.3136 PHI95= 2.6216
PHI50= 0.3883

PERCENTAGES

SAND100.0000 %
SILT 0.0000 %
CLAY 0.0000 %

SAMPLE NUMBER 37

PHI SIZE	WEIGHT	WEIGHT %	C.WEIGHT %
-1.0000	0.0400	0.0729	0.0729
0.0000	1.8800	3.4263	3.4992
1.0000	10.6300	19.3731	22.8722
2.0000	34.0400	62.0375	84.9098
3.0000	8.1700	14.8897	99.7995
4.0000	0.1100	0.2005	100.0000
5.0000	0.0000	0.0000	100.0000

MEDIAN 1.4373
GRAPHIC MEAN 1.3560
INCLUSIVE GRAPHIC STANDARD DEVIATION 0.7290
INCLUSIVE GRAPHIC SKEWNESS -0.1140
GRAPHIC KURTOSIS 1.3222
NORMALIZED KURTOSIS 0.5694
SAMPLE WEIGHT 54.8700

VERBAL CLASSIFICATION

MODERATELY SORTED
COARSE SKEWED
LEPTOKURTIC

CRITICAL PERCENTILES

PHI5=	0.0775	PHI75=	1.8403
PHI16=	0.6453	PHI84=	1.9853
PHI25=	1.0343	PHI95=	2.6777
PHI50=	1.4373		

PERCENTAGES

SAND100.0000 %
SILT 0.0000 %
CLAY 0.0000 %

SAMPLE NUMBER 38

PHI SIZE	WEIGHT	WEIGHT %	C.WEIGHT %
-1.0000	0.0300	0.0689	0.0689
0.0000	0.7500	1.7229	1.7919
1.0000	4.7900	11.0039	12.7958
2.0000	24.7100	56.7654	69.5612
3.0000	12.9600	29.7726	99.3338
4.0000	0.2900	0.6662	100.0000
5.0000	0.0000	0.0000	100.0000

MEDIAN 1.6554
GRAPHIC MEAN 1.7323
INCLUSIVE GRAPHIC STANDARD DEVIATION 0.7454
INCLUSIVE GRAPHIC SKEWNESS 0.0486
GRAPHIC KURTOSIS 1.0854
NORMALIZED KURTOSIS 0.5205
SAMPLE WEIGHT 43.5300

VERBAL CLASSIFICATION

MODERATELY SORTED
NEARLY SYMMETRICAL
MESOKURTIC

CRITICAL PERCENTILES

PHI5=	0.2915	PHI75=	2.1827
PHI16=	1.0564	PHI84=	2.4850
PHI25=	1.2150	PHI95=	2.8544
PHI50=	1.6554		

PERCENTAGES

SAND100.0000 %
SILT 0.0000 %
CLAY 0.0000 %

SAMPLE NUMBER 39

PHI SIZE	WEIGHT	WEIGHT %	C.WEIGHT %
-2.0000	0.0000	0.0000	0.0000
-1.0000	0.1200	0.2564	0.2564
0.0000	1.4800	3.1617	3.4181
1.0000	7.0900	15.1463	18.5644
2.0000	28.1700	60.1794	78.7439
3.0000	9.6800	20.6793	99.4232
4.0000	0.2700	0.5768	100.0000
5.0000	0.0000	0.0000	100.0000

MEDIAN 1.5224
GRAPHIC MEAN 1.5357
INCLUSIVE GRAPHIC STANDARD DEVIATION 0.7622
INCLUSIVE GRAPHIC SKEWNESS -0.0146
GRAPHIC KURTOSIS 1.3228
NORMALIZED KURTOSIS 0.5695
SAMPLE WEIGHT 46.8100

VERBAL CLASSIFICATION

MODERATELY SORTED
NEARLY SYMMETRICAL
LEPTOKURTIC

CRITICAL PERCENTILES

PHI5= 0.1044 PHI75= 1.9378
PHI16= 0.8307 PHI84= 2.2542
PHI25= 1.1069 PHI95= 2.7861
PHI50= 1.5224

PERCENTAGES

SAND100.0000 %
SILT 0.0000 %
CLAY 0.0000 %

SAMPLE NUMBER 40

PHI SIZE	WEIGHT	WEIGHT %	C.WEIGHT %
-1.0000	0.0300	0.0834	0.0834
0.0000	0.2600	0.7224	0.8058
1.0000	1.1700	3.2509	4.0567
2.0000	12.3600	34.3429	38.3996
3.0000	21.3200	59.2387	97.6382
4.0000	0.8500	2.3618	100.0000
5.0000	0.0000	0.0000	100.0000

MEDIAN 2.1958
GRAPHIC MEAN 2.1045
INCLUSIVE GRAPHIC STANDARD DEVIATION 0.6476
INCLUSIVE GRAPHIC SKEWNESS -0.2024
GRAPHIC KURTOSIS 0.7839
NORMALIZED KURTOSIS 0.4394
SAMPLE WEIGHT 35.9900

VERBAL CLASSIFICATION

MODERATELY WELL SORTED
COARSE SKEWED
PLATYKURTIC

CRITICAL PERCENTILES

PHI5= 1.0275 PHI75= 2.6178
PHI16= 1.3478 PHI84= 2.7698
PHI25= 1.6098 PHI95= 2.9555
PHI50= 2.1958

PERCENTAGES

SAND100.0000 %
SILT 0.0000 %
CLAY 0.0000 %

SAMPLE NUMBER 41

PHI SIZE	WEIGHT	WEIGHT %	C.WEIGHT %
-2.0000	0.4100	0.6491	0.6491
-1.0000	0.1200	0.1900	0.8391
0.0000	6.6300	10.4971	11.3363
1.0000	1.1900	1.8841	13.2204
2.0000	29.8400	47.2451	60.4655
3.0000	24.0900	38.1412	98.6067
4.0000	0.8800	1.3933	100.0000
5.0000	0.0000	0.0000	100.0000

MEDIAN 1.7785
GRAPHIC MEAN 1.8181
INCLUSIVE GRAPHIC STANDARD DEVIATION 0.9212
INCLUSIVE GRAPHIC SKEWNESS -0.1407
GRAPHIC KURTOSIS 1.2707
NORMALIZED KURTOSIS 0.5596
SAMPLE WEIGHT 63.1600

VERBAL CLASSIFICATION

MODERATELY SORTED
COARSE SKEWED
LEPTOKURTIC

CRITICAL PERCENTILES

PHI5=	-0.6036	PHI75=	2.3811
PHI16=	1.0588	PHI84=	2.6170
PHI25=	1.2493	PHI95=	2.9054
PHI50=	1.7785		

PERCENTAGES

SAND100.0000 %
SILT 0.0000 %
CLAY 0.0000 %

SAMPLE NUMBER 42

PHI SIZE	WEIGHT	WEIGHT %	C.WEIGHT %
-2.0000	0.0000	0.0000	0.0000
-1.0000	1.1000	2.2133	2.2133
0.0000	7.1100	14.3058	16.5191
1.0000	14.9400	30.0604	46.5795
2.0000	23.1200	46.5191	93.0986
3.0000	3.2300	6.4990	99.5976
4.0000	0.2000	0.4024	100.0000
5.0000	0.0000	0.0000	100.0000

MEDIAN 1.0735
GRAPHIC MEAN 0.9472
INCLUSIVE GRAPHIC STANDARD DEVIATION 0.9295
INCLUSIVE GRAPHIC SKEWNESS -0.2094
GRAPHIC KURTOSIS 0.9554
NORMALIZED KURTOSIS 0.4886
SAMPLE WEIGHT 49.7000

VERBAL CLASSIFICATION

MODERATELY SORTED
COARSE SKEWED
MESOKURTIC

CRITICAL PERCENTILES

PHI5=	-0.8052	PHI75=	1.6109
PHI16=	-0.0363	PHI84=	1.8044
PHI25=	0.2821	PHI95=	2.2926
PHI50=	1.0735		

PERCENTAGES

SAND100.0000 %
SILT 0.0000 %
CLAY 0.0000 %

SAMPLE NUMBER 43

PHI SIZE	WEIGHT	WEIGHT %	C.WEIGHT %
-2.0000	0.4000	3.5907	3.5907
-1.0000	0.2400	2.1544	5.7451
0.0000	0.1200	1.0772	6.8223
1.0000	0.7500	6.7325	13.5548
2.0000	5.0300	45.1526	58.7074
3.0000	4.3700	39.2280	97.9354
4.0000	0.2300	2.0646	100.0000
5.0000	0.0000	0.0000	100.0000

MEDIAN 1.8072
GRAPHIC MEAN 1.8354
INCLUSIVE GRAPHIC STANDARD DEVIATION 1.0448
INCLUSIVE GRAPHIC SKEWNESS -0.2116
GRAPHIC KURTOSIS 1.5066
NORMALIZED KURTOSIS 0.6010
SAMPLE WEIGHT 11.1400

VERBAL CLASSIFICATION

POORLY SORTED
COARSE SKEWED
VERY LEPTOKURTIC

CRITICAL PERCENTILES

PHI5=	-1.3458	PHI75=	2.4153
PHI16=	1.0542	PHI84=	2.6448
PHI25=	1.2535	PHI95=	2.9252
PHI50=	1.8072		

PERCENTAGES

SAND100.0000 %
SILT 0.0000 %
CLAY 0.0000 %

SAMPLE NUMBER 44

PHI SIZE	WEIGHT	WEIGHT %	C.WEIGHT %
-2.0000	0.0000	0.0000	0.0000
-1.0000	0.4300	1.3050	1.3050
0.0000	2.5600	7.7693	9.0744
1.0000	9.3600	28.4067	37.4810
2.0000	16.2700	49.3778	-86.8589
3.0000	4.1500	12.5948	99.4537
4.0000	0.1800	0.5463	100.0000
5.0000	0.0000	0.0000	100.0000

MEDIAN 1.2535
GRAPHIC MEAN 1.1465
INCLUSIVE GRAPHIC STANDARD DEVIATION 0.9050
INCLUSIVE GRAPHIC SKEWNESS -0.1553
GRAPHIC KURTOSIS 1.0836
NORMALIZED KURTOSIS 0.5201
SAMPLE WEIGHT 32.9500

VERBAL CLASSIFICATION

MODERATELY SORTED
COARSE SKEWED
MESOKURTIC

CRITICAL PERCENTILES

PHI5=	-0.5244	PHI75=	1.7598
PHI16=	0.2438	PHI84=	1.9421
PHI25=	0.5606	PHI95=	2.6464
PHI50=	1.2535		

PERCENTAGES

SAND100.0000 %
SILT 0.0000 %
CLAY 0.0000 %

SAMPLE NUMBER 45

PHI SIZE	WEIGHT	WEIGHT %	C.WEIGHT %
-2.0000	0.0000	0.0000	0.0000
-1.0000	1.0600	1.6799	1.6799
0.0000	3.9600	6.2758	7.9556
1.0000	9.4400	14.9604	22.9160
2.0000	35.2700	55.8954	78.8114
3.0000	12.8000	20.2853	99.0967
4.0000	0.5700	0.9033	100.0000
5.0000	0.0000	0.0000	100.0000

MEDIAN 1.4845
GRAPHIC MEAN 1.4260
INCLUSIVE GRAPHIC STANDARD DEVIATION 0.9248
INCLUSIVE GRAPHIC SKEWNESS -0.1493
GRAPHIC KURTOSIS 1.4977
NORMALIZED KURTOSIS 0.5996
SAMPLE WEIGHT 63.1000

VERBAL CLASSIFICATION

MODERATELY SORTED
COARSE SKEWED
LEPTOKURTIC

CRITICAL PERCENTILES

PHI5= -0.4710 PHI75= 1.9318
PHI16= 0.5377 PHI84= 2.2558
PHI25= 1.0373 PHI95= 2.7980
PHI50= 1.4845

PERCENTAGES

SAND100.0000 %
SILT 0.0000 %
CLAY 0.0000 %

SAMPLE NUMBER 46

PHI SIZE	WEIGHT	WEIGHT %	C.WEIGHT %
-2.0000	0.0000	0.0000	0.0000
-1.0000	1.2300	2.2142	2.2142
0.0000	9.7300	17.5158	19.7300
1.0000	16.2100	29.1809	48.9109
2.0000	24.2800	43.7084	92.6193
3.0000	3.9200	7.0567	99.6760
4.0000	0.1800	0.3240	100.0000
5.0000	0.0000	0.0000	100.0000

MEDIAN 1.0249
GRAPHIC MEAN 0.8716
INCLUSIVE GRAPHIC STANDARD DEVIATION 0.9855
INCLUSIVE GRAPHIC SKEWNESS -0.2012
GRAPHIC KURTOSIS 0.9197
NORMALIZED KURTOSIS 0.4791
SAMPLE WEIGHT 55.5500

VERBAL CLASSIFICATION

MODERATELY SORTED
COARSE SKEWED
MESOKURTIC

CRITICAL PERCENTILES

PHI5= -0.8410 PHI75= 1.5969
PHI16= -0.2129 PHI84= 1.8028
PHI25= 0.1806 PHI95= 2.3374
PHI50= 1.0249

PERCENTAGES

SAND100.0000 %
SILT 0.0000 %
CLAY 0.0000 %

SAMPLE NUMBER 47

PHI SIZE	WEIGHT	WEIGHT %	C.WEIGHT %
-2.0000	0.0100	0.0281	0.0281
-1.0000	0.1500	0.4219	0.4501
0.0000	1.2700	3.5724	4.0225
1.0000	7.8900	22.1941	26.2166
2.0000	21.9700	61.8003	88.0169
3.0000	4.1900	11.7862	99.8031
4.0000	0.0700	0.1969	100.0000
5.0000	0.0000	0.0000	100.0000

MEDIAN 1.3848
GRAPHIC MEAN 1.2865
INCLUSIVE GRAPHIC STANDARD DEVIATION 0.7350
INCLUSIVE GRAPHIC SKEWNESS -0.1318
GRAPHIC KURTOSIS 1.2372
NORMALIZED KURTOSIS 0.5530
SAMPLE WEIGHT 35.5500

VERBAL CLASSIFICATION

MODERATELY SORTED
COARSE SKEWED
LEPTOKURTIC

CRITICAL PERCENTILES

PHI5=	0.0440	PHI75=	1.7894
PHI16=	0.5397	PHI84=	1.9350
PHI25=	0.9452	PHI95=	2.5925
PHI50=	1.3848		

PERCENTAGES

SAND100.0000 %
SILT 0.0000 %
CLAY 0.0000 %

SAMPLE NUMBER 49

PHI SIZE	WEIGHT	WEIGHT %	C.WEIGHT %
-2.0000	0.0300	0.0490	0.0490
-1.0000	0.5500	0.8985	0.9476
0.0000	8.5900	14.0337	14.9812
1.0000	19.7500	32.2660	47.2472
2.0000	26.5700	43.4079	90.6551
3.0000	5.4500	8.9038	99.5589
4.0000	0.2700	0.4411	100.0000
5.0000	0.0000	0.0000	100.0000

MEDIAN 1.0634
GRAPHIC MEAN 0.9806
INCLUSIVE GRAPHIC STANDARD DEVIATION 0.9385
INCLUSIVE GRAPHIC SKEWNESS -0.1232
GRAPHIC KURTOSIS 0.9867
NORMALIZED KURTOSIS 0.4966
SAMPLE WEIGHT 61.2100

VERBAL CLASSIFICATION

MODERATELY SORTED
COARSE SKEWED
MESOKURTIC

CRITICAL PERCENTILES

PHI5=	-0.7112	PHI75=	1.6393
PHI16=	0.0316	PHI84=	1.8467
PHI25=	0.3105	PHI95=	2.4880
PHI50=	1.0634		

PERCENTAGES

SAND100.0000 %
SILT 0.0000 %
CLAY 0.0000 %

SAMPLE NUMBER 50

PHI SIZE	WEIGHT	WEIGHT %	C.WEIGHT %
-2.0000	0.0000	0.0000	0.0000
-1.0000	1.3700	1.9065	1.9065
0.0000	10.0300	13.9577	15.8642
1.0000	21.8800	30.4481	46.3123
2.0000	32.9800	45.8948	92.2071
3.0000	5.3200	7.4033	99.6104
4.0000	0.2800	0.3896	100.0000
5.0000	0.0000	0.0000	100.0000

MEDIAN 1.0804
GRAPHIC MEAN 0.9687
INCLUSIVE GRAPHIC STANDARD DEVIATION 0.9323
INCLUSIVE GRAPHIC SKEWNESS -0.1812
GRAPHIC KURTOSIS 0.9760
NORMALIZED KURTOSIS 0.4939
SAMPLE WEIGHT 71.8600

VERBAL CLASSIFICATION

MODERATELY SORTED
COARSE SKEWED
MESOKURTIC

CRITICAL PERCENTILES

PHI5=	-0.7784	PHI75=	1.6251
PHI16=	0.0045	PHI84=	1.8212
PHI25=	0.3000	PHI95=	2.3773
PHI50=	1.0804		

PERCENTAGES

SAND100.0000 %
SILT 0.0000 %
CLAY 0.0000 %

SAMPLE NUMBER 51

PHI SIZE	WEIGHT	WEIGHT %	C.WEIGHT %
-2.0000	0.0000	0.0000	0.0000
-1.0000	1.3100	1.9008	1.9008
0.0000	11.1000	16.1056	18.0064
1.0000	33.6200	48.7812	66.7876
2.0000	19.9200	28.9031	95.6907
3.0000	2.7600	4.0046	99.6953
4.0000	0.2100	0.3047	100.0000
5.0000	0.0000	0.0000	100.0000

MEDIAN 0.6559
GRAPHIC MEAN 0.7089
INCLUSIVE GRAPHIC STANDARD DEVIATION 0.8518
INCLUSIVE GRAPHIC SKEWNESS 0.0206
GRAPHIC KURTOSIS 1.0001
NORMALIZED KURTOSIS 0.5000
SAMPLE WEIGHT 68.9200

VERBAL CLASSIFICATION

MODERATELY SORTED
NEARLY SYMMETRICAL
MESOKURTIC

CRITICAL PERCENTILES

PHI5=	-0.8076	PHI75=	1.2841
PHI16=	-0.1246	PHI84=	1.5955
PHI25=	0.1434	PHI95=	1.9761
PHI50=	0.6559		

PERCENTAGES

SAND100.0000 %
SILT 0.0000 %
CLAY 0.0000 %

SAMPLE NUMBER 52

PHI SIZE	WEIGHT	WEIGHT %	C.WEIGHT %
-2.0000	0.0800	0.2090	0.2090
-1.0000	0.3800	0.9929	1.2020
0.0000	5.8200	15.2077	16.4097
1.0000	8.4600	22.1061	38.5158
2.0000	14.5000	37.8887	76.4045
3.0000	8.8000	22.9945	99.3990
4.0000	0.2300	0.6010	100.0000
5.0000	0.0000	0.0000	100.0000

MEDIAN 1.3031
GRAPHIC MEAN 1.2022
INCLUSIVE GRAPHIC STANDARD DEVIATION 1.1285
INCLUSIVE GRAPHIC SKEWNESS -0.1412
GRAPHIC KURTOSIS 0.9265
NORMALIZED KURTOSIS 0.4809
SAMPLE WEIGHT 38.2700

VERBAL CLASSIFICATION

POORLY SORTED
COARSE SKEWED
MESOKURTIC

CRITICAL PERCENTILES

PHI5=	-0.7503	PHI75=	1.9629
PHI16=	-0.0269	PHI84=	2.3303
PHI25=	0.3886	PHI95=	2.8087
PHI50=	1.3031		

PERCENTAGES

SAND100.0000 %
SILT 0.0000 %
CLAY 0.0000 %

SAMPLE NUMBER 53

PHI SIZE	WEIGHT	WEIGHT %	C.WEIGHT %
-2.0000	0.0000	0.0000	0.0000
-1.0000	0.5000	0.6843	0.6843
0.0000	35.9600	49.2131	49.8974
1.0000	21.7900	29.8207	79.7181
2.0000	12.7800	17.4901	97.2082
3.0000	1.9500	2.6687	99.8768
4.0000	0.0900	0.1232	100.0000
5.0000	0.0000	0.0000	100.0000

MEDIAN 0.0034
GRAPHIC MEAN 0.1865
INCLUSIVE GRAPHIC STANDARD DEVIATION 0.9055
INCLUSIVE GRAPHIC SKEWNESS 0.3133
GRAPHIC KURTOSIS 0.8472
NORMALIZED KURTOSIS 0.4587
SAMPLE WEIGHT 73.0700

VERBAL CLASSIFICATION

MODERATELY SORTED
STRONGLY FINE-SKEWED
PLATYKURTIC

CRITICAL PERCENTILES

PHI5=	-0.9123	PHI75=	0.8418
PHI16=	-0.6888	PHI84=	1.2448
PHI25=	-0.5059	PHI95=	1.8737
PHI50=	0.0034		

PERCENTAGES

SAND100.0000 %
SILT 0.0000 %
CLAY 0.0000 %

SAMPLE NUMBER 54

PHI SIZE	WEIGHT	WEIGHT %	C.WEIGHT %
-1.0000	0.0700	0.1299	0.1299
0.0000	1.1700	2.1707	2.3006
1.0000	6.7700	12.5603	14.8609
2.0000	30.8900	57.3098	72.1707
3.0000	14.5700	27.0315	99.2022
4.0000	0.4300	0.7978	100.0000
5.0000	0.0000	0.0000	100 0000

MEDIAN 1.6131
GRAPHIC MEAN 1.6902
INCLUSIVE GRAPHIC STANDARD DEVIATION 0.7529
INCLUSIVE GRAPHIC SKEWNESS 0.0498
GRAPHIC KURTOSIS 1.1616
NORMALIZED KURTOSIS 0.5374
SAMPLE WEIGHT 53.9000

VERBAL CLASSIFICATION

MODERATELY SORTED
NEARLY SYMMETRICAL
LEPTOKURTIC

CRITICAL PERCENTILES

PHI5= 0.2149 PHI75= 2.1047
PHI16= 1.0199 PHI84= 2.4376
PHI25= 1.1769 PHI95= 2.8445
PHI50= 1.6131

PERCENTAGES

SAND100.0000 %
SILT 0.0000 %
CLAY 0.0000 %

SAMPLE NUMBER 55

PHI SIZE	WEIGHT	WEIGHT %	C.WEIGHT %
-2.0000	0.0200	0.0339	0.0339
-1.0000	0.1300	0.2202	0.2540
0.0000	1.9200	3.2515	3.5055
1.0000	11.4300	19.3565	22.8620
2.0000	31.5600	53.4462	76.3082
3.0000	13.7500	23.2854	99.5936
4.0000	0.2400	0.4064	100.0000
5.0000	0.0000	0.0000	100.0000

MEDIAN 1.5078
GRAPHIC MEAN 1.4945
INCLUSIVE GRAPHIC STANDARD DEVIATION 0.8342
INCLUSIVE GRAPHIC SKEWNESS -0.0367
GRAPHIC KURTOSIS 1.1940
NORMALIZED KURTOSIS 0.5442
SAMPLE WEIGHT 59.0500

VERBAL CLASSIFICATION

MODERATELY SORTED
NEARLY SYMMETRICAL
LEPTOKURTIC

CRITICAL PERCENTILES

PHI5= 0.0772 PHI75= 1.9755
PHI16= 0.6455 PHI84= 2.3303
PHI25= 1.0400 PHI95= 2.8027
PHI50= 1.5078

PERCENTAGES

SAND100.0000 %
SILT 0.0000 %
CLAY 0.0000 %

SAMPLE NUMBER 56

PHI SIZE	WEIGHT	WEIGHT %	C.WEIGHT %
-1.0000	0.0200	0.0490	0.0490
0.0000	0.1000	0.2450	0.2940
1.0000	1.4000	3.4297	3.7237
2.0000	18.8200	46.1049	49.8285
3.0000	19.9300	48.8241	98.6526
4.0000	0.5500	1.3474	100.0000
5.0000	0.0000	0.0000	100.0000

MEDIAN 2.0035
GRAPHIC MEAN 1.9899
INCLUSIVE GRAPHIC STANDARD DEVIATION 0.6459
INCLUSIVE GRAPHIC SKEWNESS -0.0285
GRAPHIC KURTOSIS 0.7378
NORMALIZED KURTOSIS 0.4245
SAMPLE WEIGHT 40.8200

VERBAL CLASSIFICATION

MODERATELY WELL SORTED
NEARLY SYMMETRICAL
PLATYKURTIC

CRITICAL PERCENTILES

PHI5= 1.0277 PHI75= 2.5156
PHI16= 1.2663 PHI84= 2.6999
PHI25= 1.4615 PHI95= 2.9252
PHI50= 2.0035

PERCENTAGES

SAND100.0000 %
SILT 0.0000 %
CLAY 0.0000 %

SAMPLE NUMBER 57

PHI SIZE	WEIGHT	WEIGHT %	C.WEIGHT %
-2.0000	0.0200	0.0346	0.0346
-1.0000	0.5300	0.9170	0.9516
0.0000	3.6100	6.2457	7.1972
1.0000	16.1300	27.9066	35.1038
2.0000	30.7700	53.2353	88.3391
3.0000	6.6100	11.4360	99.7751
4.0000	0.1300	0.2249	100.0000
5.0000	0.0000	0.0000	100.0000

MEDIAN 1.2798
GRAPHIC MEAN 1.1712
INCLUSIVE GRAPHIC STANDARD DEVIATION 0.8453
INCLUSIVE GRAPHIC SKEWNESS -0.1576
GRAPHIC KURTOSIS 1.0819
NORMALIZED KURTOSIS 0.5197
SAMPLE WEIGHT 57.8000

VERBAL CLASSIFICATION

MODERATELY SORTED
COARSE SKEWED
MESOKURTIC

CRITICAL PERCENTILES

PHI5= -0.3518 PHI75= 1.7494
PHI16= 0.3154 PHI84= 1.9185
PHI25= 0.6379 PHI95= 2.5825
PHI50= 1.2798

PERCENTAGES

SAND100.0000 %
SILT 0.0000 %
CLAY 0.0000 %

SAMPLE NUMBER 58

PHI SIZE	WEIGHT	WEIGHT %	C.WEIGHT %
-2.0000	0.0000	0.0000	0.0000
-1.0000	0.6400	0.7685	0.7685
0.0000	13.8700	16.6547	17.4231
1.0000	39.4200	47.3343	64.7574
2.0000	25.5500	30.6796	95.4371
3.0000	3.5800	4.2988	99.7358
4.0000	0.2200	0.2642	100.0000
5.0000	0.0000	0.0000	100.0000

MEDIAN 0.6882
GRAPHIC MEAN 0.7433
INCLUSIVE GRAPHIC STANDARD DEVIATION 0.8421
INCLUSIVE GRAPHIC SKEWNESS 0.0232
GRAPHIC KURTOSIS 0.9538
NORMALIZED KURTOSIS 0.4882
SAMPLE WEIGHT 83.2800

VERBAL CLASSIFICATION

MODERATELY SORTED
NEARLY SYMMETRICAL
MESOKURTIC

CRITICAL PERCENTILES

PHI5= -0.7459 PHI75= 1.3339
PHI16= -0.0855 PHI84= 1.6272
PHI25= 0.1601 PHI95= 1.9858
PHI50= 0.6882

PERCENTAGES

SAND100.0000 %
SILT 0.0000 %
CLAY 0.0000 %

SAMPLE NUMBER 59

PHI SIZE	WEIGHT	WEIGHT %	C.WEIGHT %
-2.0000	0.4900	0.6693	0.6693
-1.0000	0.8900	1.2157	1.8850
0.0000	4.0800	5.5730	7.4580
1.0000	14.4800	19.7787	27.2367
2.0000	43.4200	59.3088	86.5456
3.0000	9.7000	13.2496	99.7951
4.0000	0.1500	0.2049	100.0000
5.0000	0.0000	0.0000	100.0000

MEDIAN 1.3838
GRAPHIC MEAN 1.2576
INCLUSIVE GRAPHIC STANDARD DEVIATION 0.8478
INCLUSIVE GRAPHIC SKEWNESS -0.2168
GRAPHIC KURTOSIS 1.3740
NORMALIZED KURTOSIS 0.5788
SAMPLE WEIGHT 73.2100

VERBAL CLASSIFICATION

MODERATELY SORTED
COARSE SKEWED
LEPTOKURTIC

CRITICAL PERCENTILES

PHI5= -0.4411 PHI75= 1.8053
PHI16= 0.4319 PHI84= 1.9571
PHI25= 0.8869 PHI95= 2.6381
PHI50= 1.3838

PERCENTAGES

SAND100.0000 %
SILT 0.0000 %
CLAY 0.0000 %

SAMPLE NUMBER 60

PHI SIZE	WEIGHT	WEIGHT %	C.WEIGHT %
-2.0000	0.0600	0.1095	0.1095
-1.0000	0.4200	0.7666	0.8761
0.0000	4.3500	7.9394	8.8155
1.0000	21.4000	39.0582	47.8737
2.0000	25.7300	46.9611	94.8348
3.0000	2.7600	5.0374	99.8722
4.0000	0.0700	0.1278	100.0000
5.0000	0.0000	0.0000	100.0000

MEDIAN 1.0453
GRAPHIC MEAN 0.9995
INCLUSIVE GRAPHIC STANDARD DEVIATION 0.7771
INCLUSIVE GRAPHIC SKEWNESS -0.1504
GRAPHIC KURTOSIS 0.8855
NORMALIZED KURTOSIS 0.4696
SAMPLE WEIGHT 54.7900

VERBAL CLASSIFICATION

MODERATELY SORTED
COARSE SKEWED
PLATYKURTIC

CRITICAL PERCENTILES

PHI5=	-0.4806	PHI75=	1.5776
PHI16=	0.1839	PHI84=	1.7693
PHI25=	0.4144	PHI95=	2.0328
PHI50=	1.0453		

PERCENTAGES

SAND100.0000 %
SILT 0.0000 %
CLAY 0.0000 %

SAMPLE NUMBER 61

PHI SIZE	WEIGHT	WEIGHT %	C.WEIGHT %
-2.0000	0.0000	0.0000	0.0000
-1.0000	0.3900	0.6502	0.6502
0.0000	4.3300	7.2191	7.8693
1.0000	16.1000	26.8423	34.7116
2.0000	34.1700	56.9690	91.6806
3.0000	4.8700	8.1194	99.7999
4.0000	0.1200	0.2001	100.0000
5.0000	0.0000	0.0000	100.0000

MEDIAN 1.2684
GRAPHIC MEAN 1.1455
INCLUSIVE GRAPHIC STANDARD DEVIATION 0.8158
INCLUSIVE GRAPHIC SKEWNESS -0.2116
GRAPHIC KURTOSIS 1.0759
NORMALIZED KURTOSIS 0.5183
SAMPLE WEIGHT 59.9800

VERBAL CLASSIFICATION

MODERATELY SORTED
COARSE SKEWED
MESOKURTIC

CRITICAL PERCENTILES

PHI5=	-0.3975	PHI75=	1.7072
PHI16=	0.3029	PHI84=	1.8652
PHI25=	0.6382	PHI95=	2.4088
PHI50=	1.2684		

PERCENTAGES

SAND100.0000 %
SILT 0.0000 %
CLAY 0.0000 %

SAMPLE NUMBER 62

PHI SIZE	WEIGHT	WEIGHT %	C.WEIGHT %
-2.0000	0.0000	0.0000	0.0000
-1.0000	0.4000	0.6270	0.6270
0.0000	4.9600	7.7743	8.4013
1.0000	21.1500	33.1505	41.5517
2.0000	30.6600	48.0564	89.6081
3.0000	6.3800	10.0000	99.6081
4.0000	0.2500	0.3918	100.0000
5.0000	0.0000	0.0000	100.0000

MEDIAN 1.1758
GRAPHIC MEAN 1.0961
INCLUSIVE GRAPHIC STANDARD DEVIATION 0.8645
INCLUSIVE GRAPHIC SKEWNESS -0.1142
GRAPHIC KURTOSIS 1.0206
NORMALIZED KURTOSIS 0.5051
SAMPLE WEIGHT 63.8000

VERBAL CLASSIFICATION

MODERATELY SORTED
COARSE SKEWED
MESOKURTIC

CRITICAL PERCENTILES

PHI5= -0.4375 PHI75= 1.6960
PHI16= 0.2292 PHI84= 1.8833
PHI25= 0.5007 PHI95= 2.5392
PHI50= 1.1758

PERCENTAGES

SAND100.0000 %
SILT 0.0000 %
CLAY 0.0000 %

SAMPLE NUMBER 63

PHI SIZE	WEIGHT	WEIGHT %	C.WEIGHT %
-2.0000	0.0100	0.0206	0.0206
-1.0000	0.3400	0.7013	0.7219
0.0000	3.4600	7.1370	7.8589
1.0000	14.4500	29.8061	37.6650
2.0000	24.8500	51.2582	88.9233
3.0000	5.2200	10.7673	99.6906
4.0000	0.1500	0.3094	100.0000
5.0000	0.0000	0.0000	100.0000

MEDIAN 1.2406
GRAPHIC MEAN 1.1392
INCLUSIVE GRAPHIC STANDARD DEVIATION 0.8569
INCLUSIVE GRAPHIC SKEWNESS -0.1468
GRAPHIC KURTOSIS 1.0536
NORMALIZED KURTOSIS 0.5131
SAMPLE WEIGHT 48.4800

VERBAL CLASSIFICATION

MODERATELY SORTED
COARSE SKEWED
MESOKURTIC

CRITICAL PERCENTILES

PHI5= -0.4006 PHI75= 1.7284
PHI16= 0.2731 PHI84= 1.9040
PHI25= 0.5751 PHI95= 2.5644
PHI50= 1.2406

PERCENTAGES

SAND100.0000 %
SILT 0.0000 %
CLAY 0.0000 %

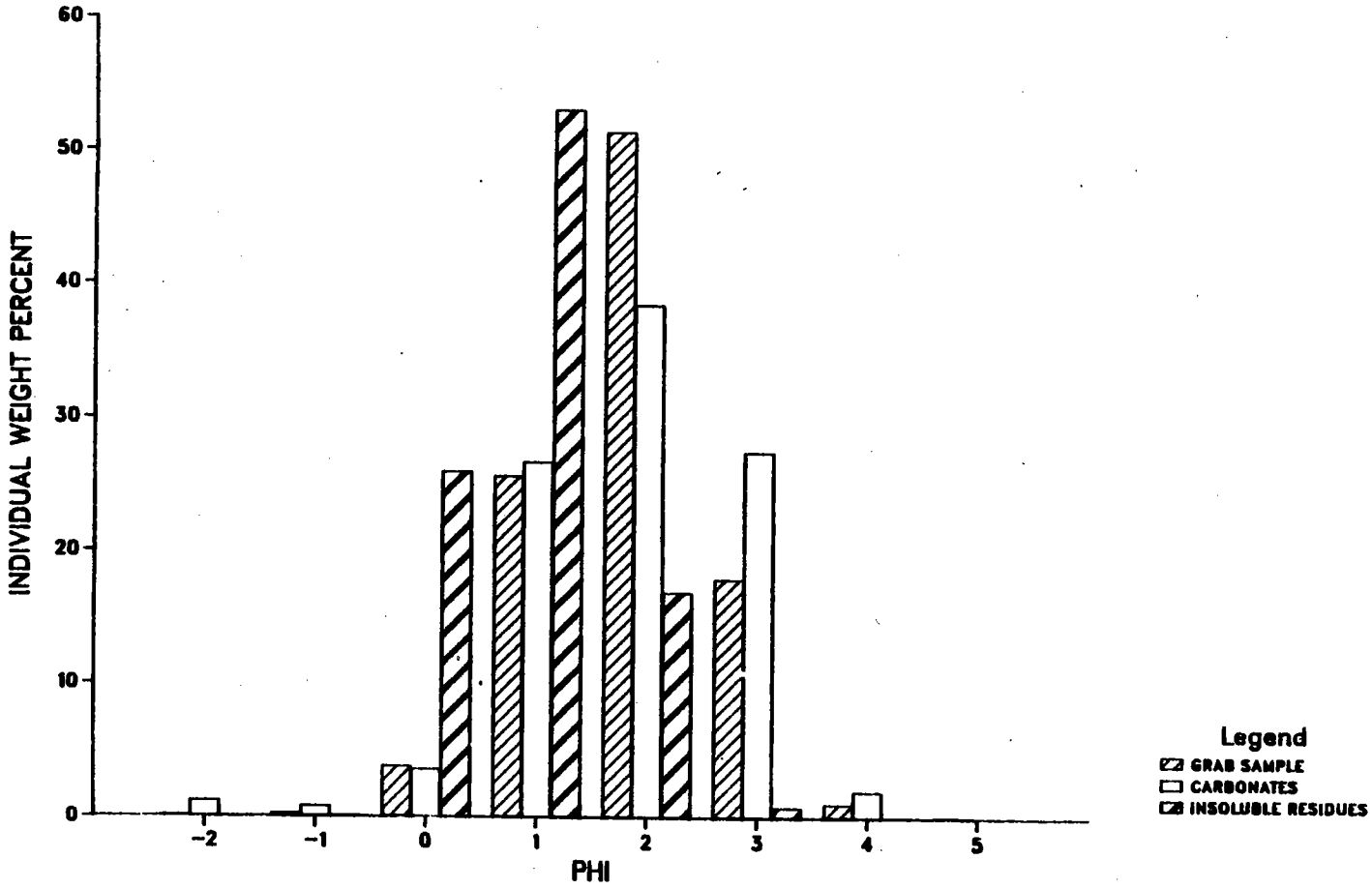
Appendix III

Histograms of Weight Percent Versus Phi

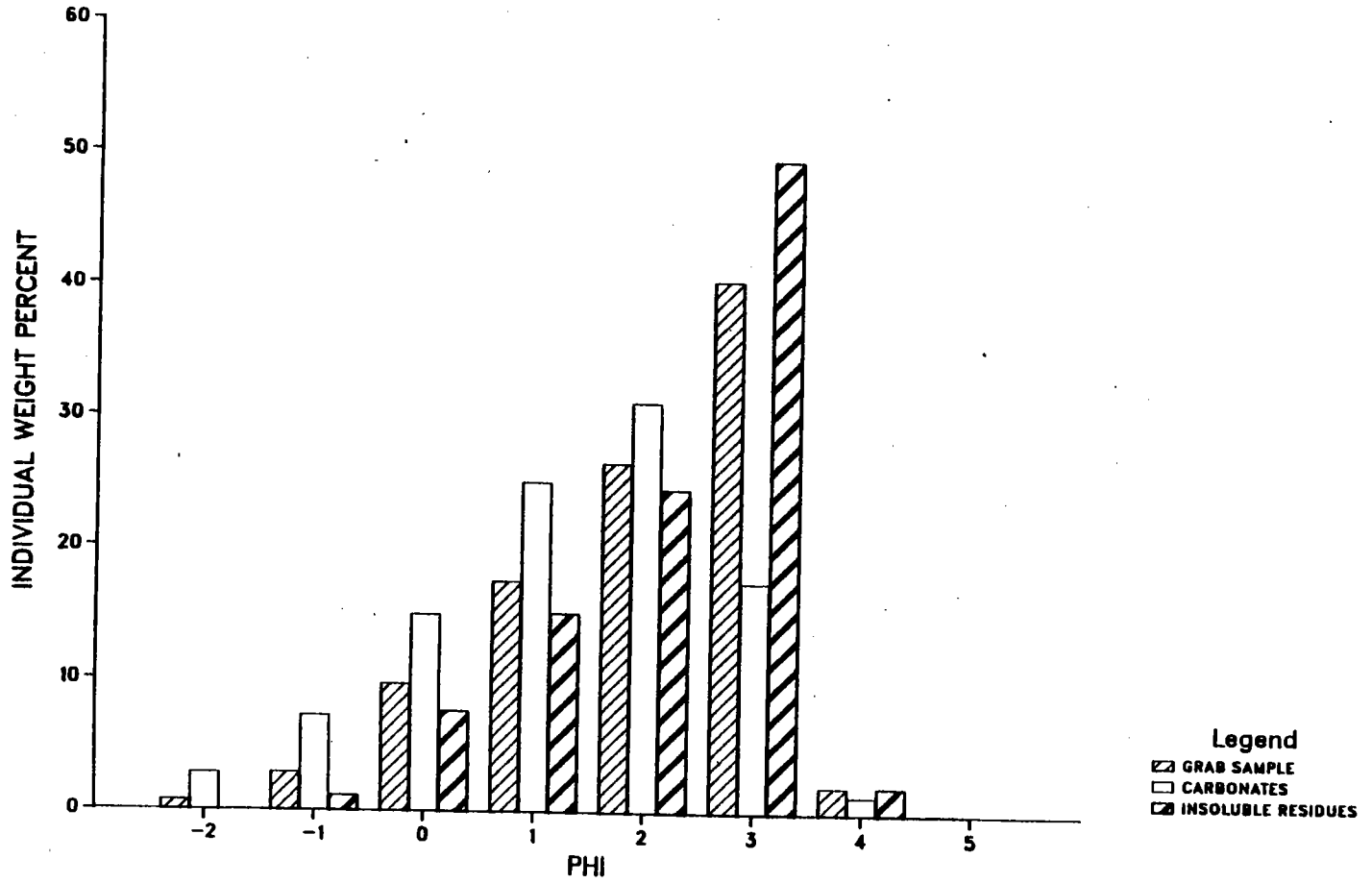
Samples 1, 2, 4, 6, and 8 are missing; they are not included in the sample set.

Samples 7 and 48 show histograms only for the grab samples; these samples were too small for dissolution.

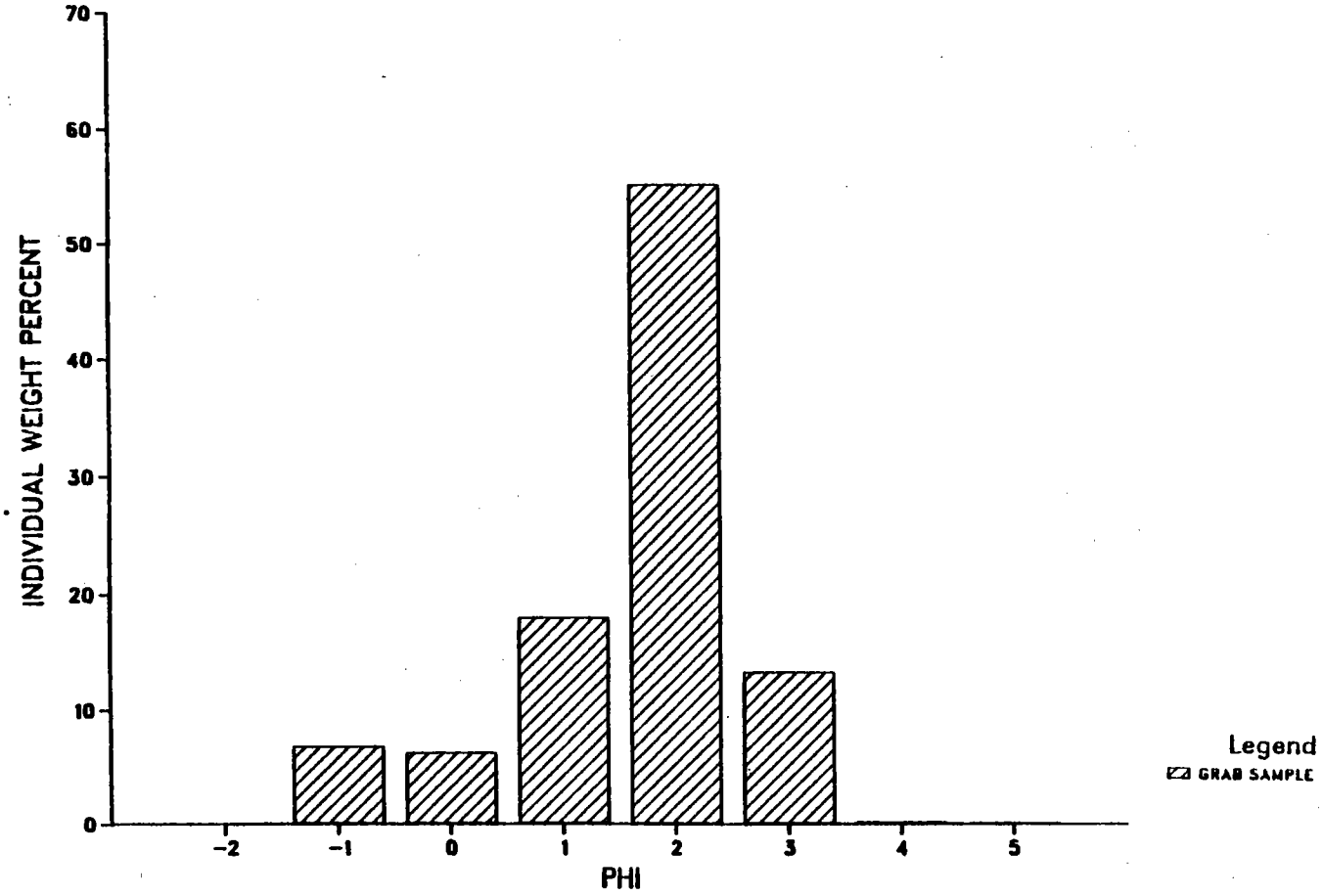
GRAIN SIZE DISTRIBUTION, SAMPLE 3



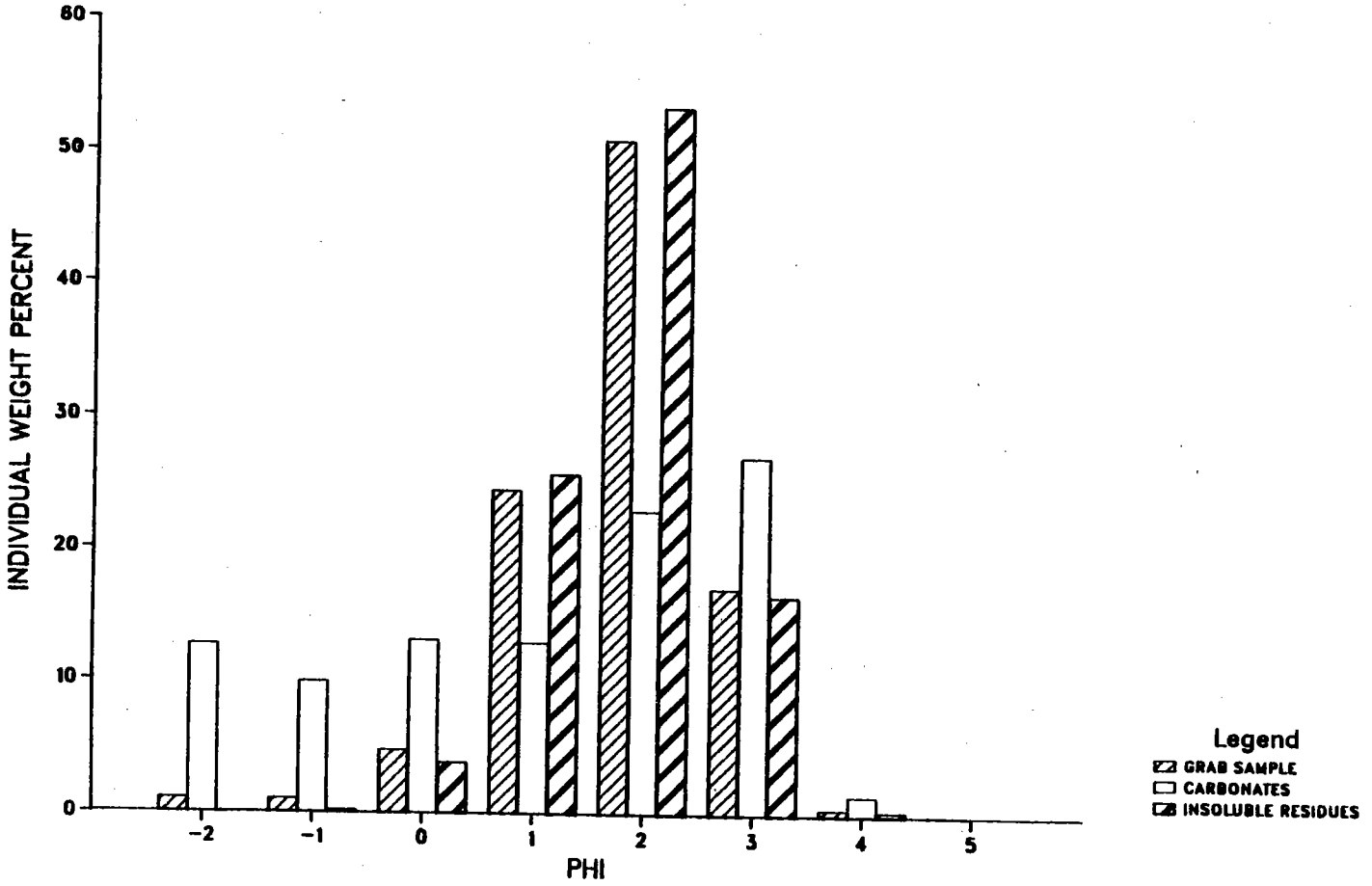
GRAIN SIZE DISTRIBUTION, SAMPLE 5



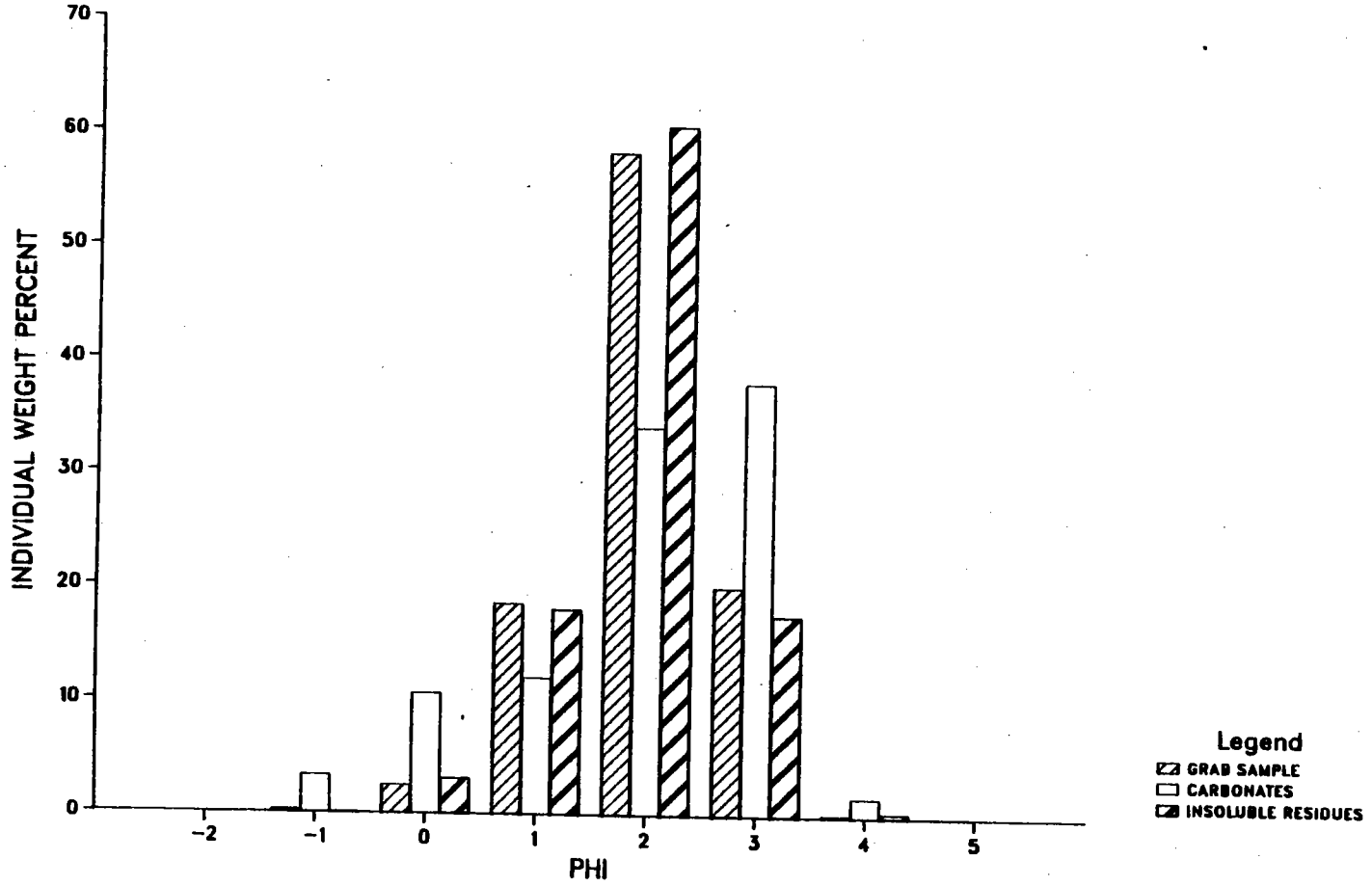
GRAIN SIZE DISTRIBUTION, SAMPLE 7



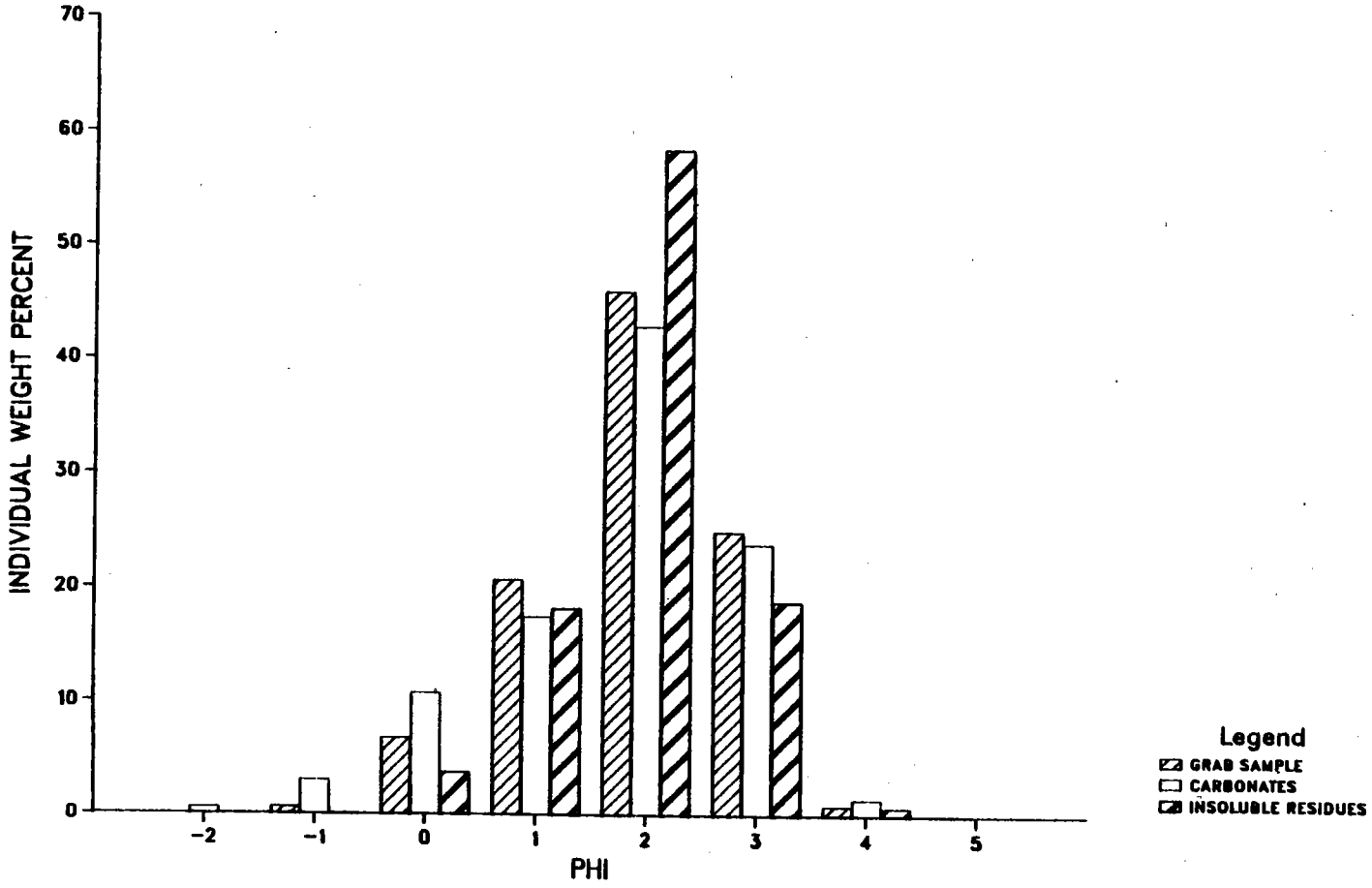
GRAIN SIZE DISTRIBUTION, SAMPLE 9



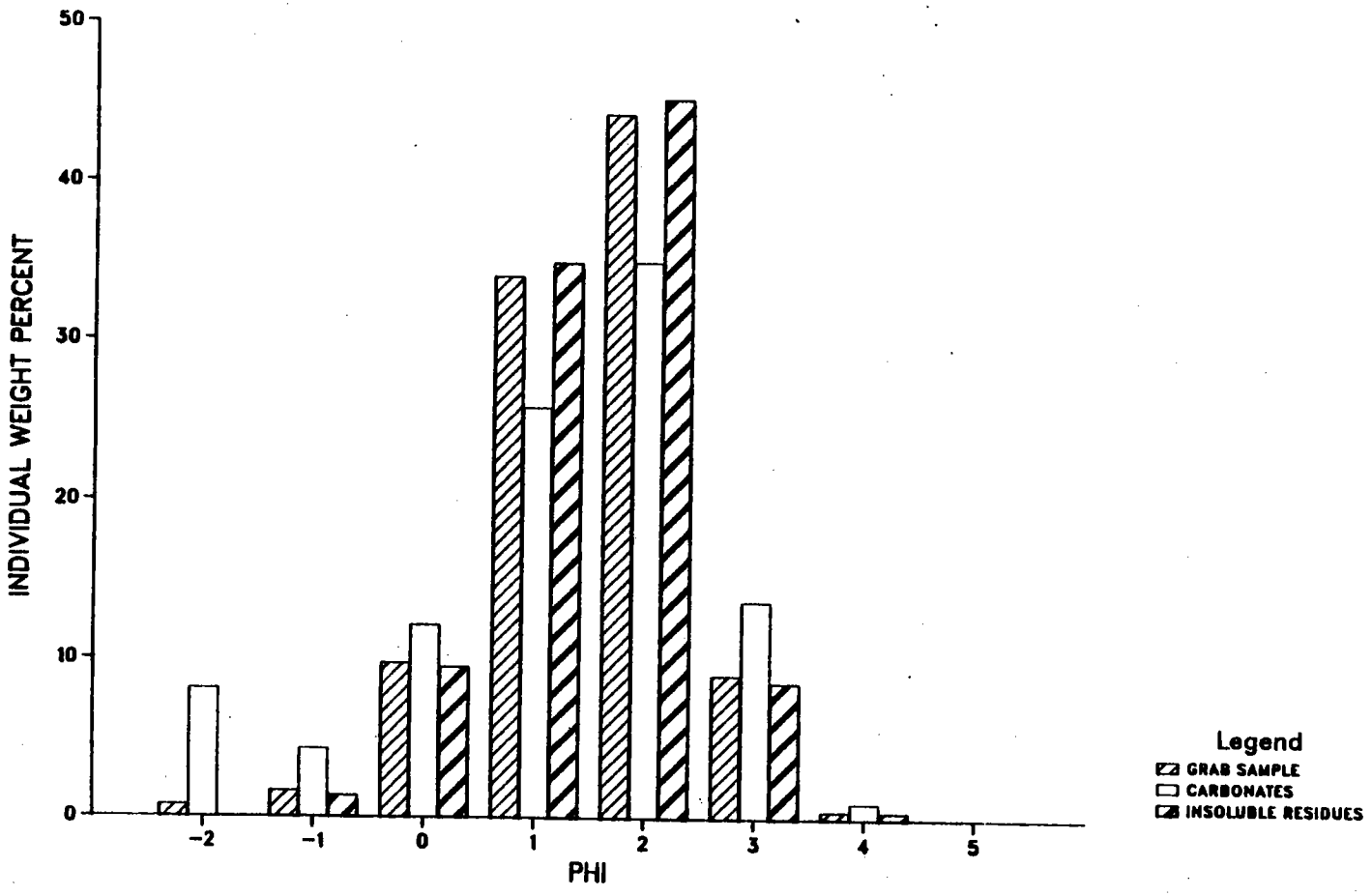
GRAIN SIZE DISTRIBUTION, SAMPLE 10



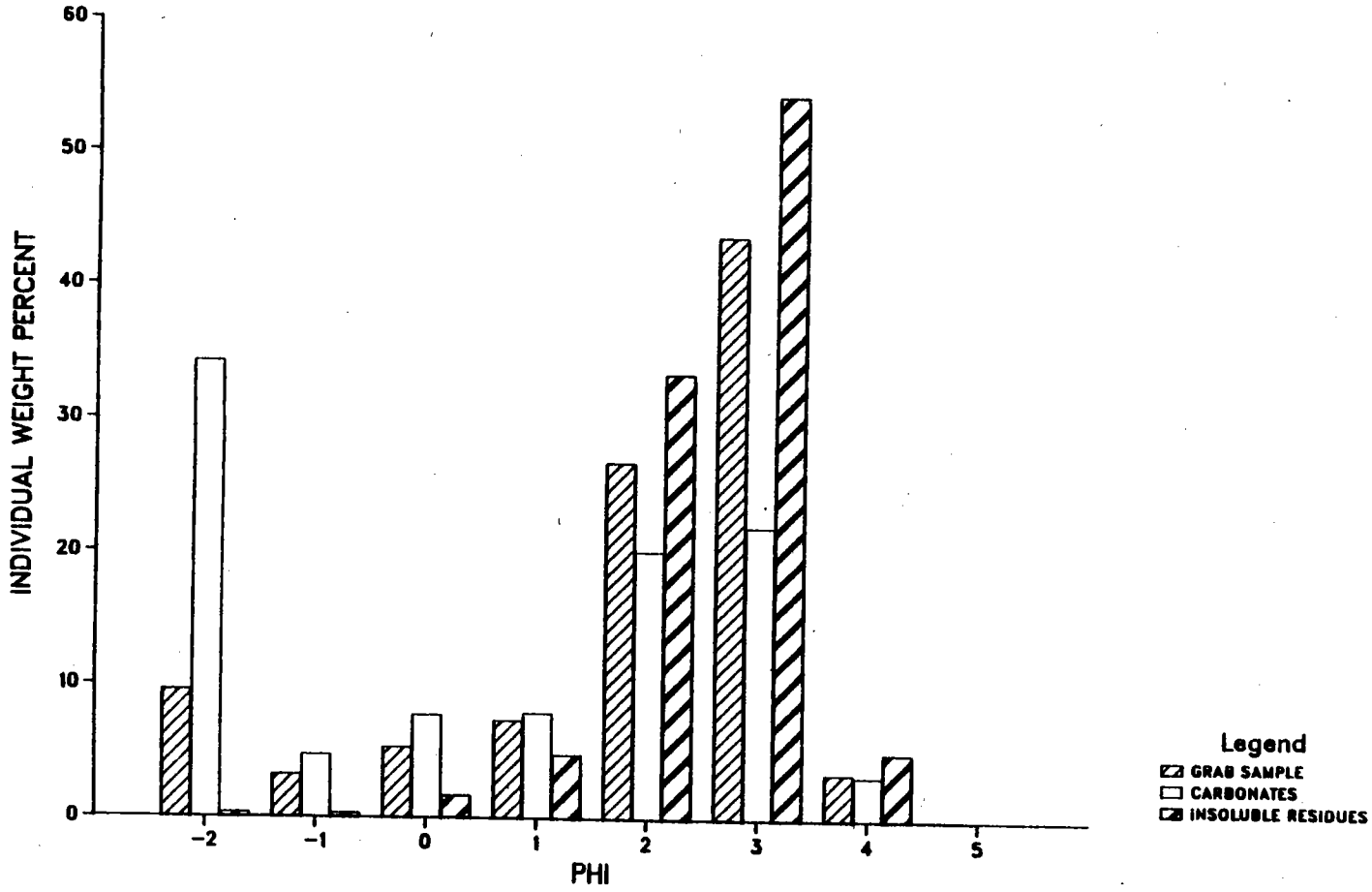
GRAIN SIZE DISTRIBUTION, SAMPLE 11



GRAIN SIZE DISTRIBUTION, SAMPLE 12



GRAIN SIZE DISTRIBUTION, SAMPLE 13



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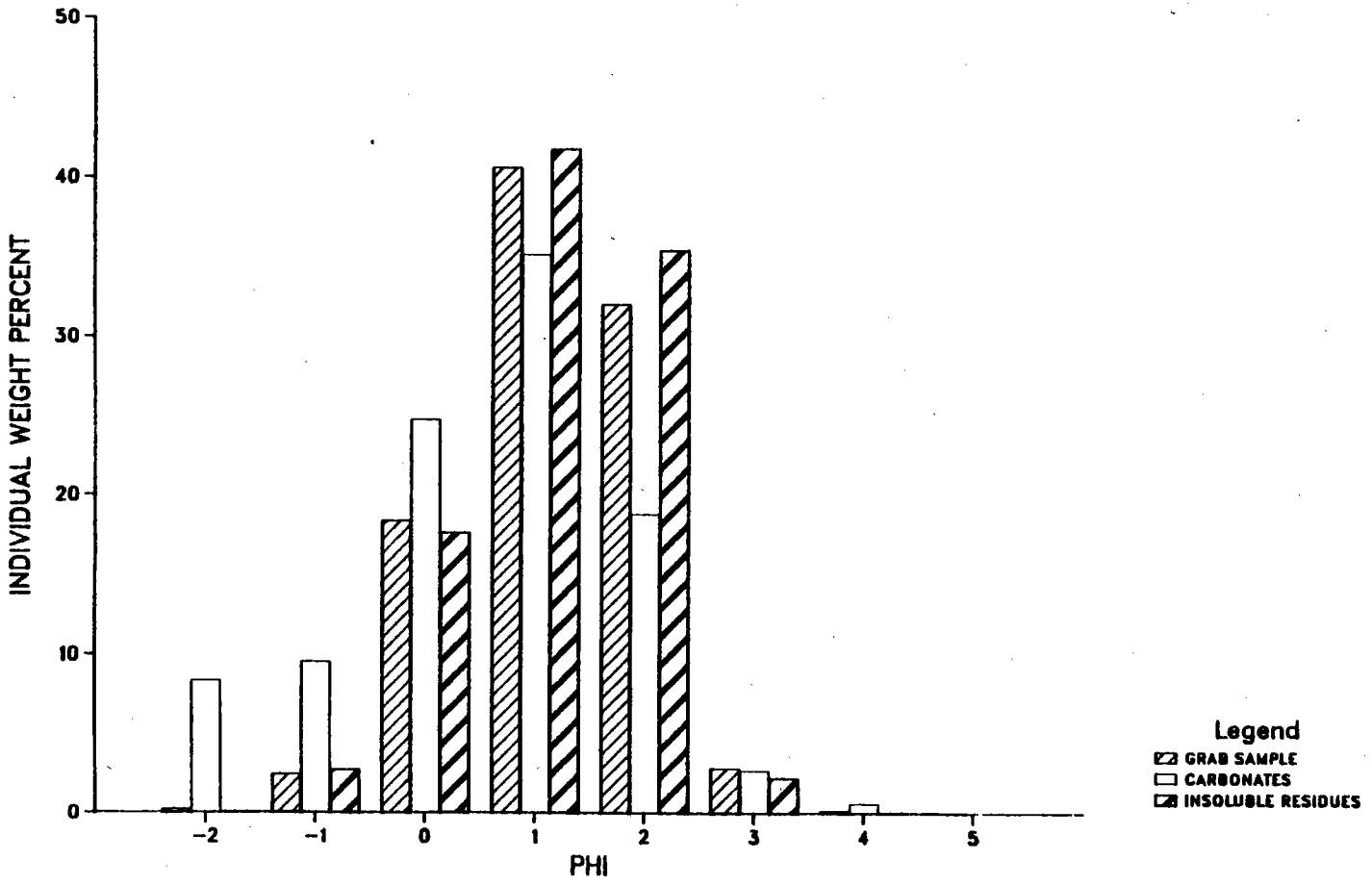
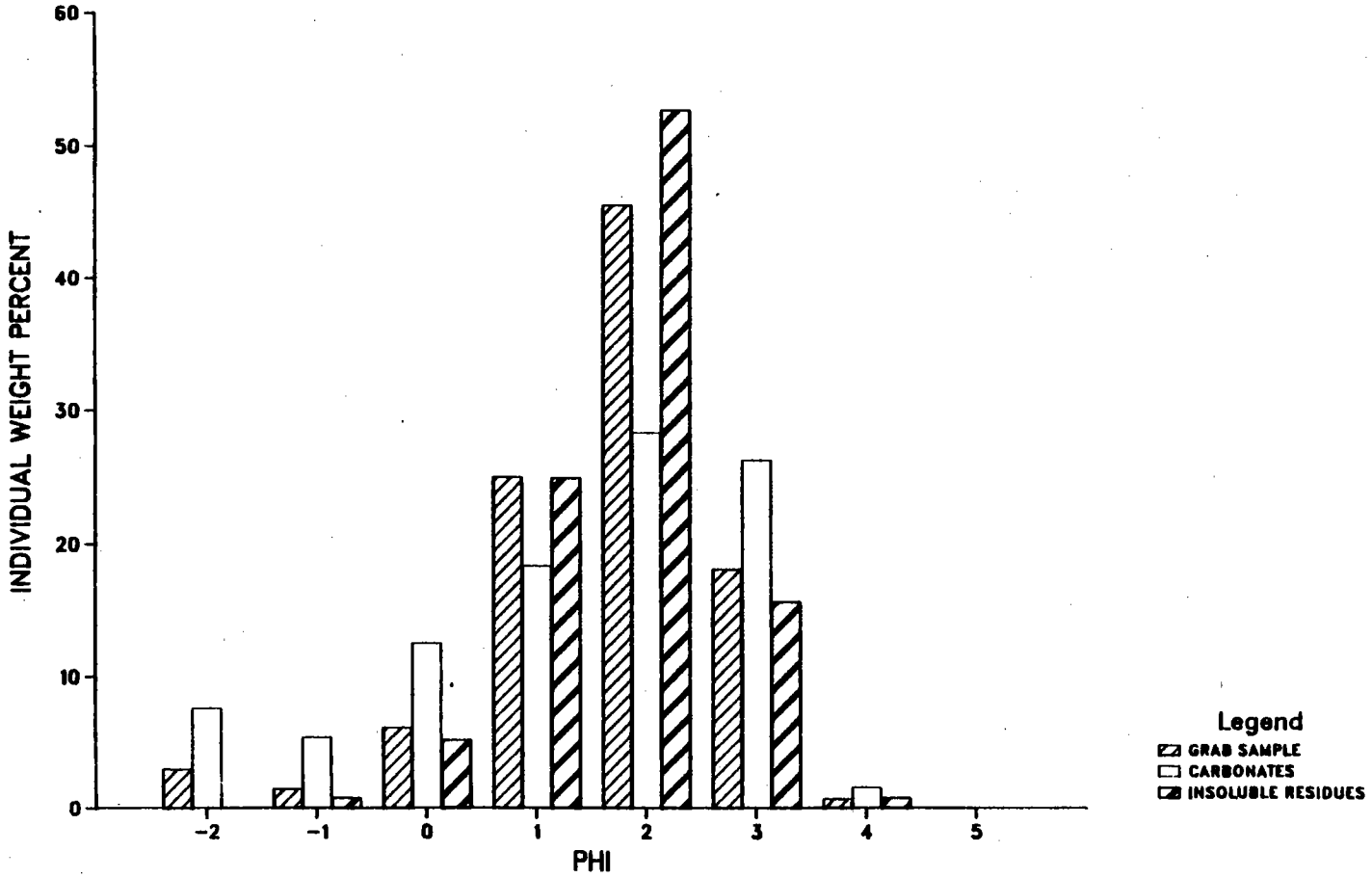


GRAIN SIZE DISTRIBUTION, SAMPLE 15



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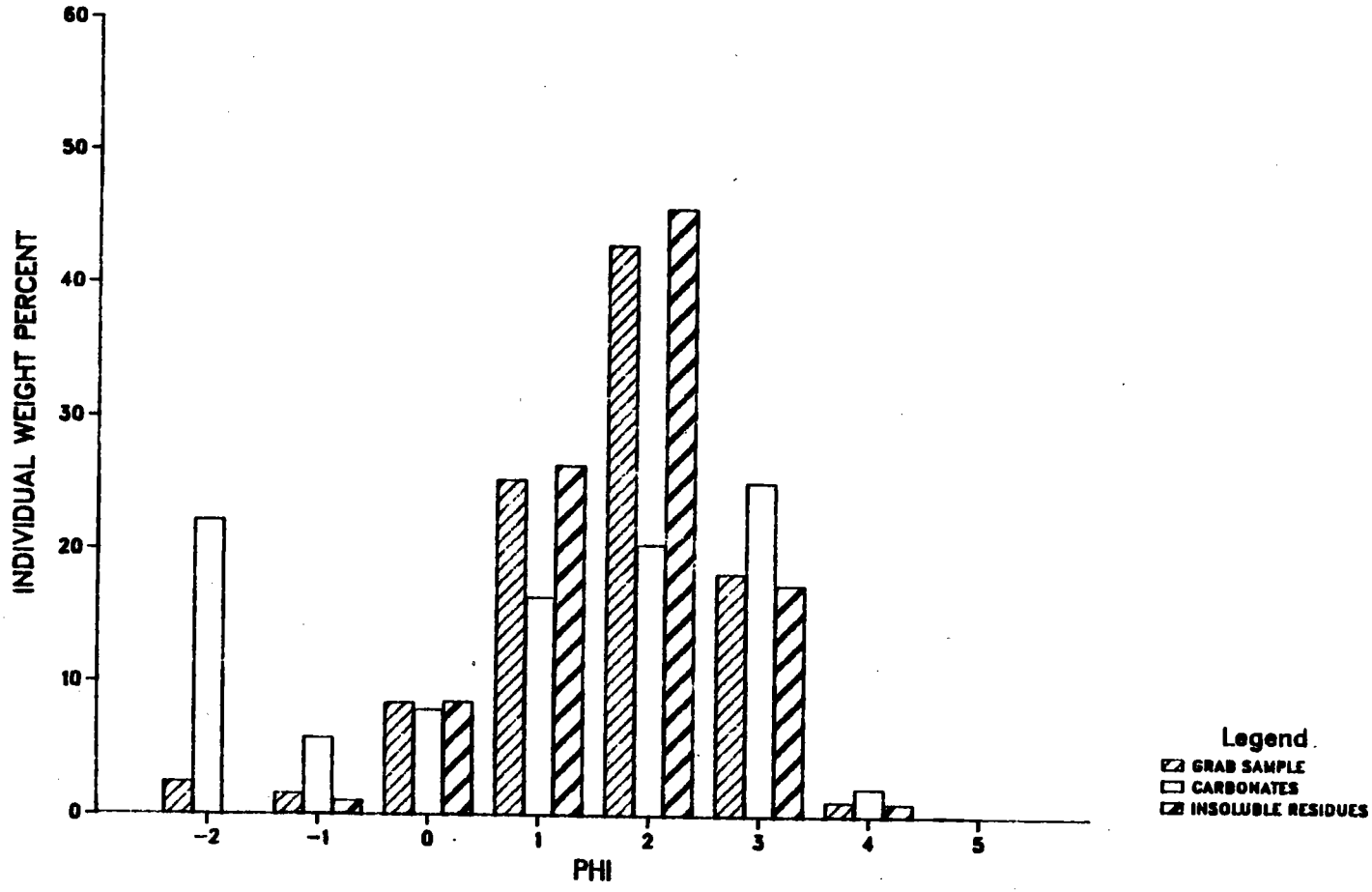

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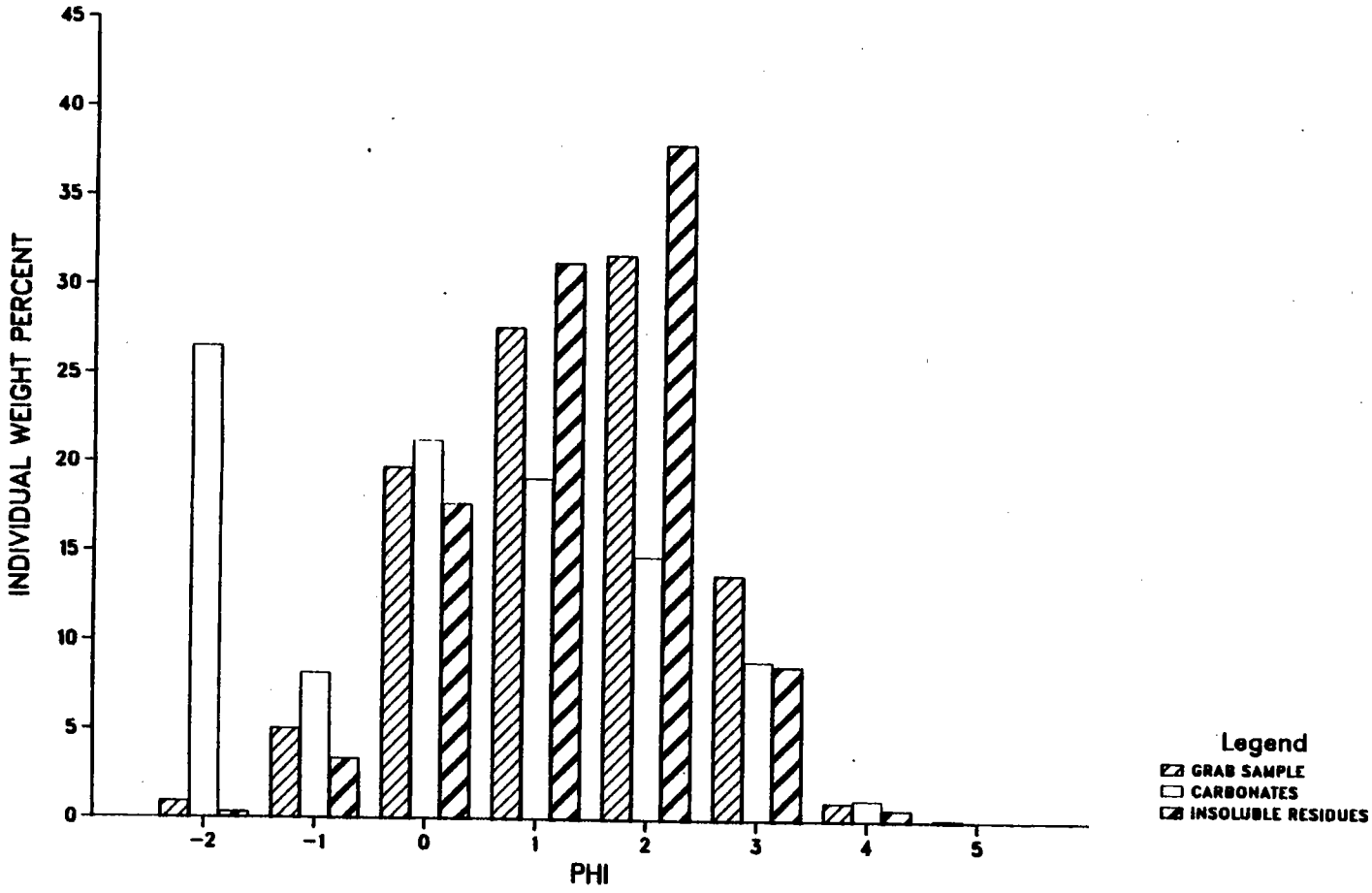

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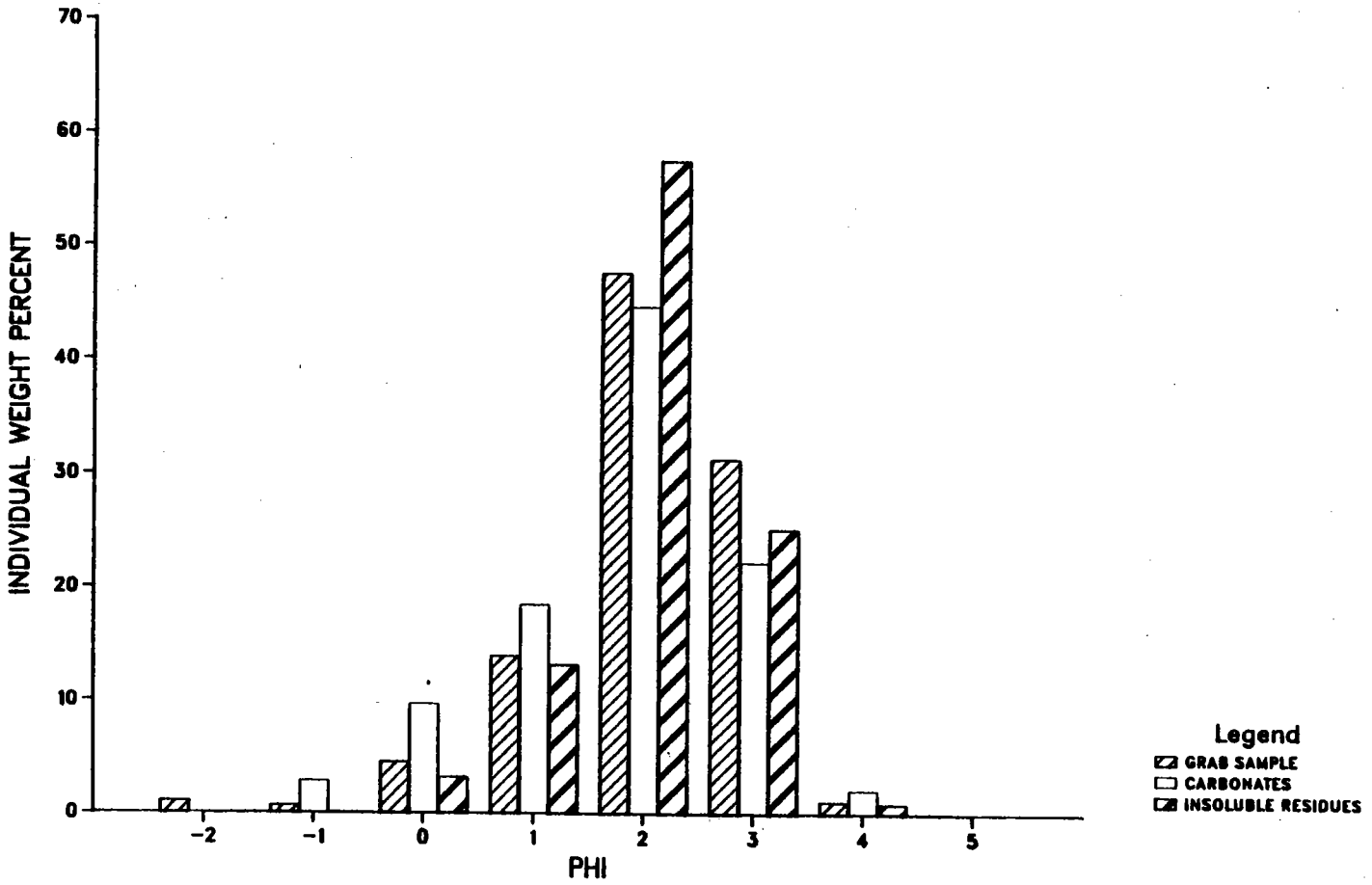

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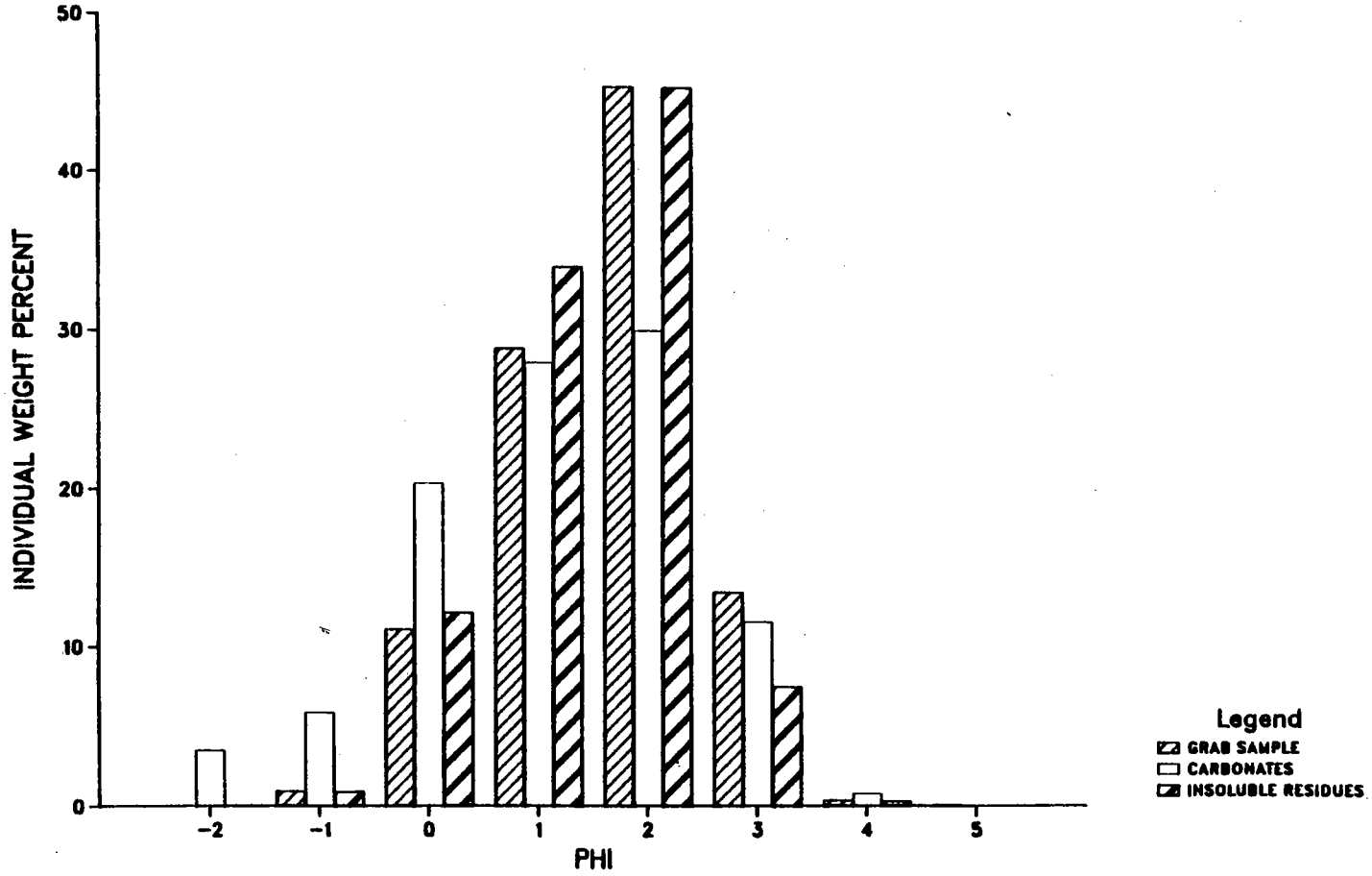

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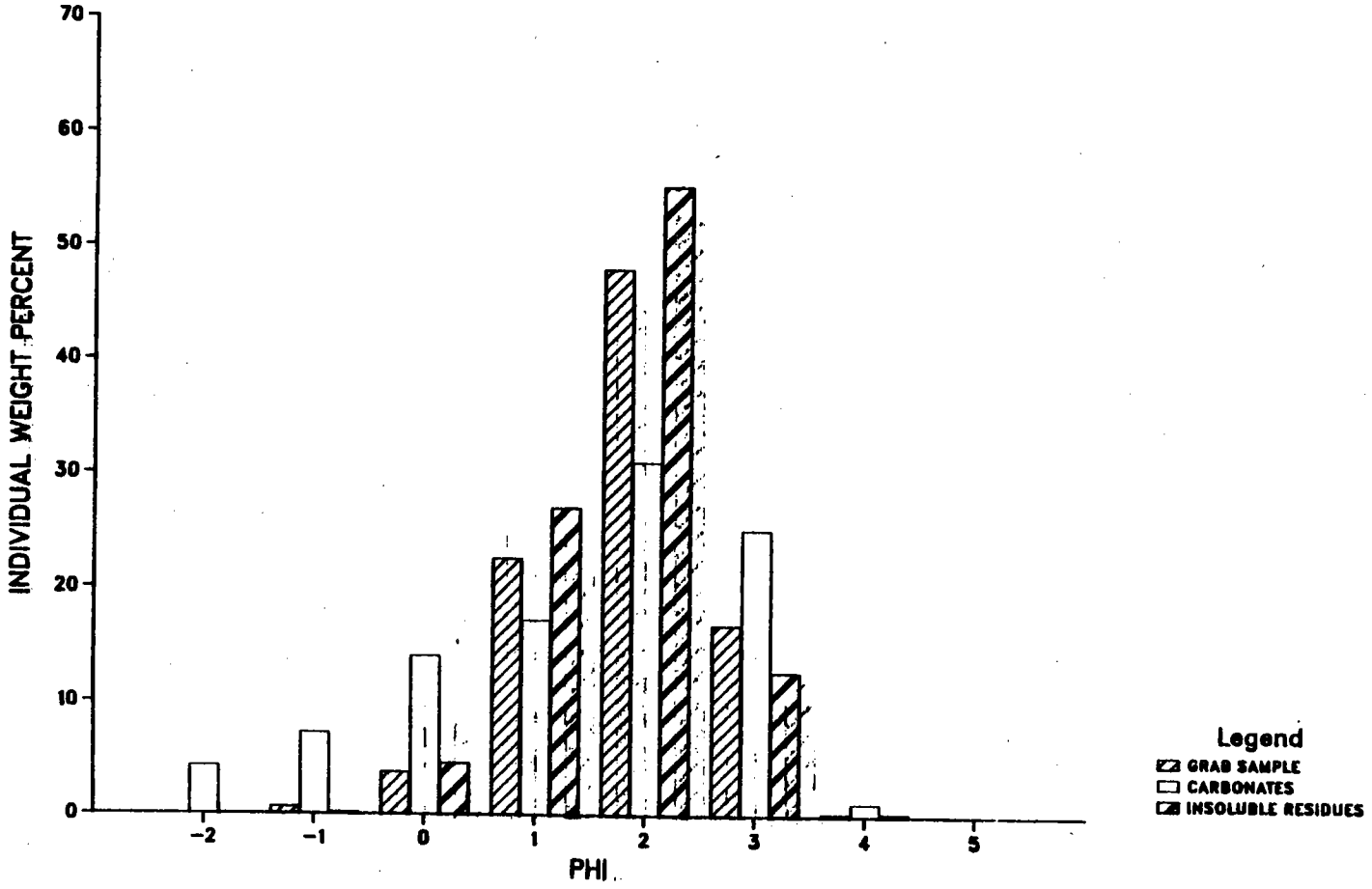

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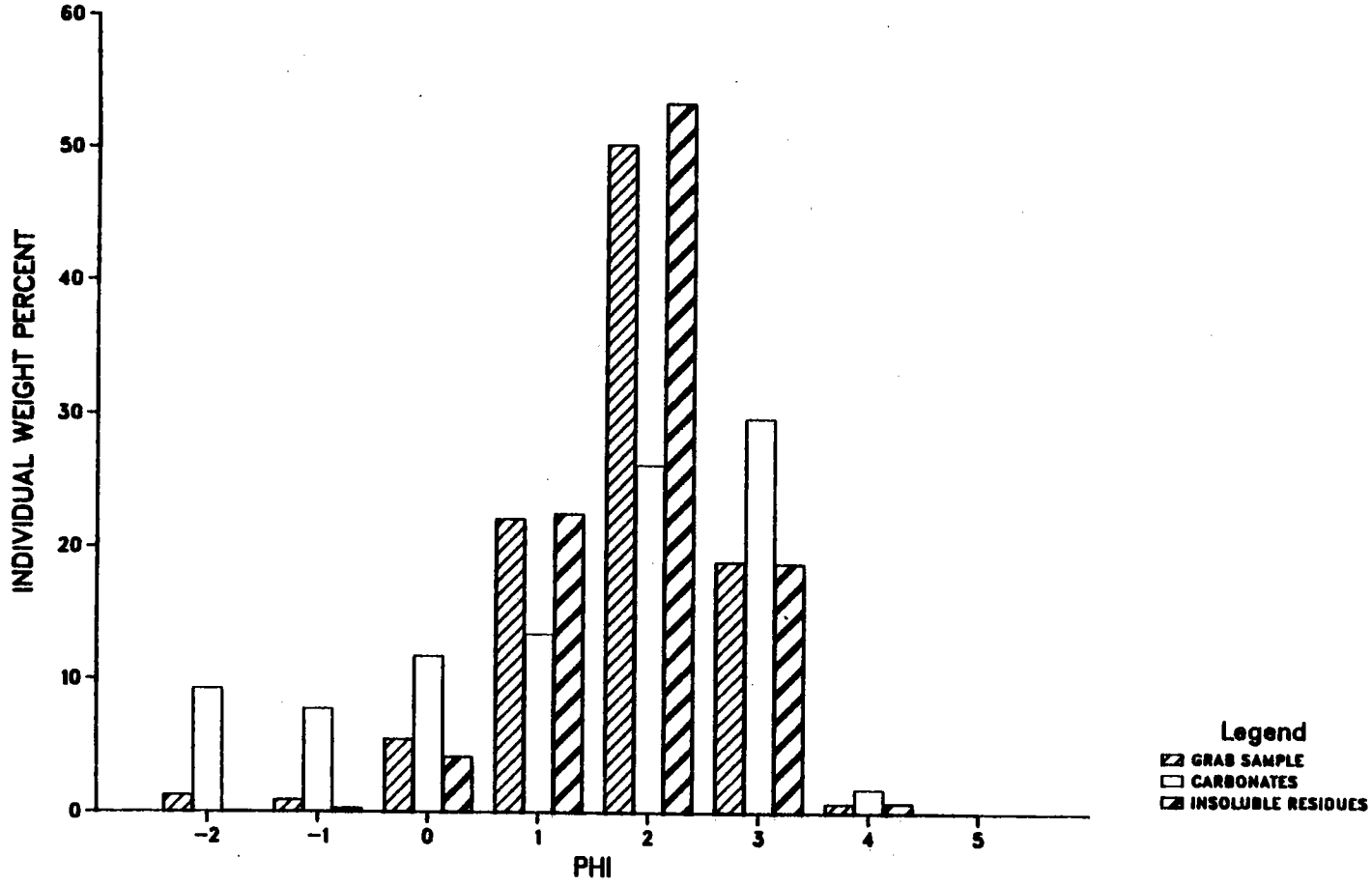

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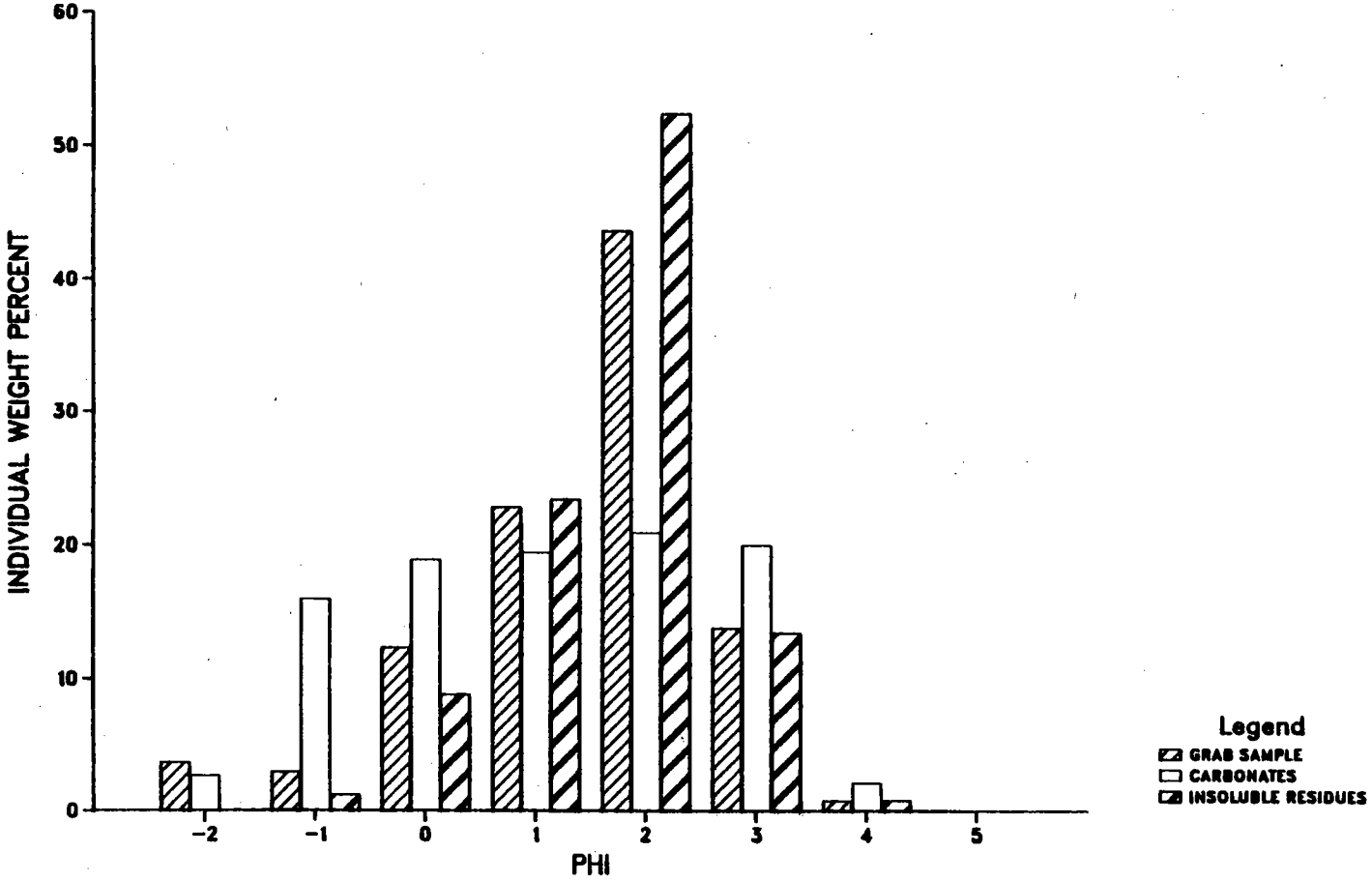

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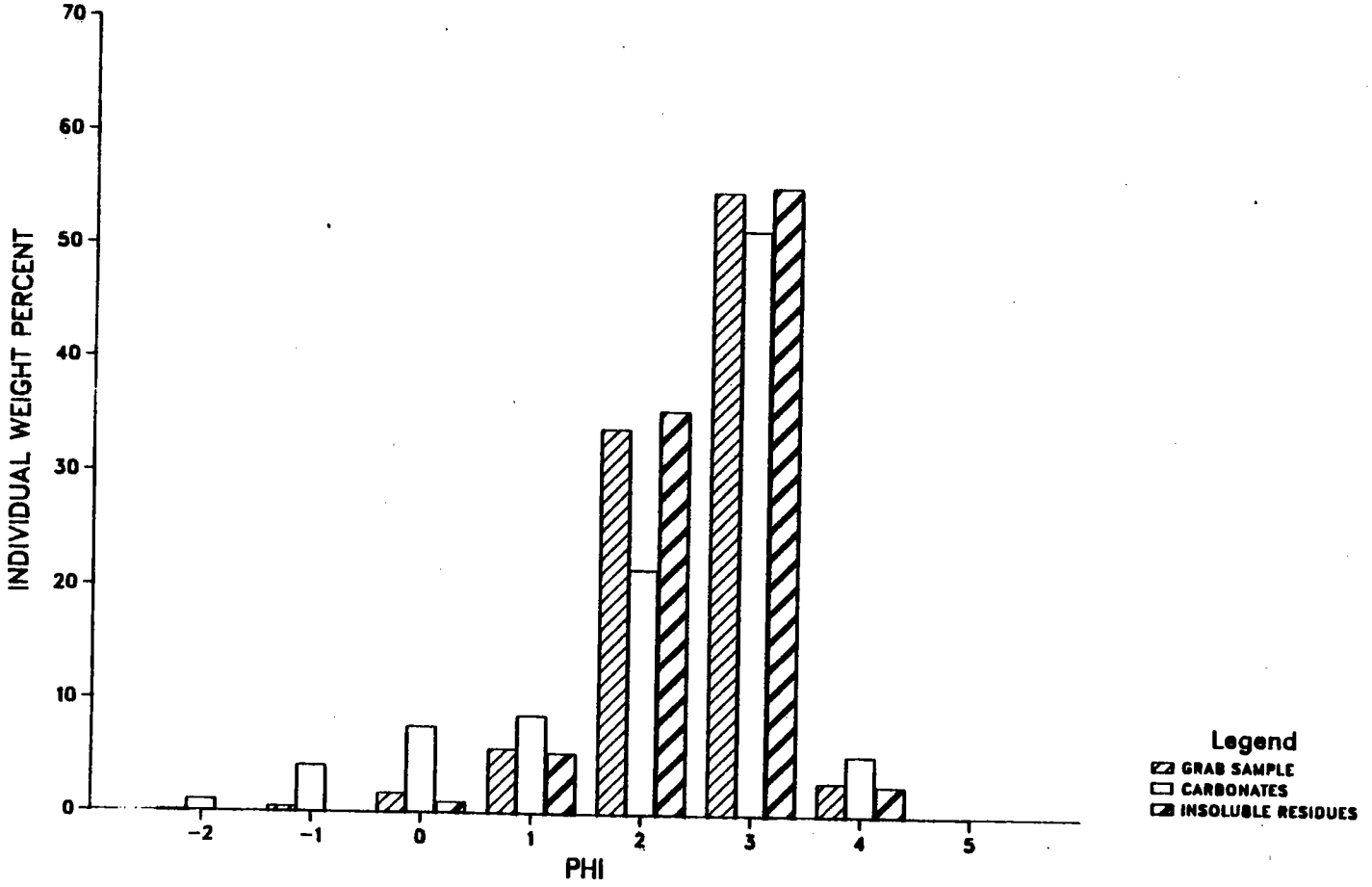
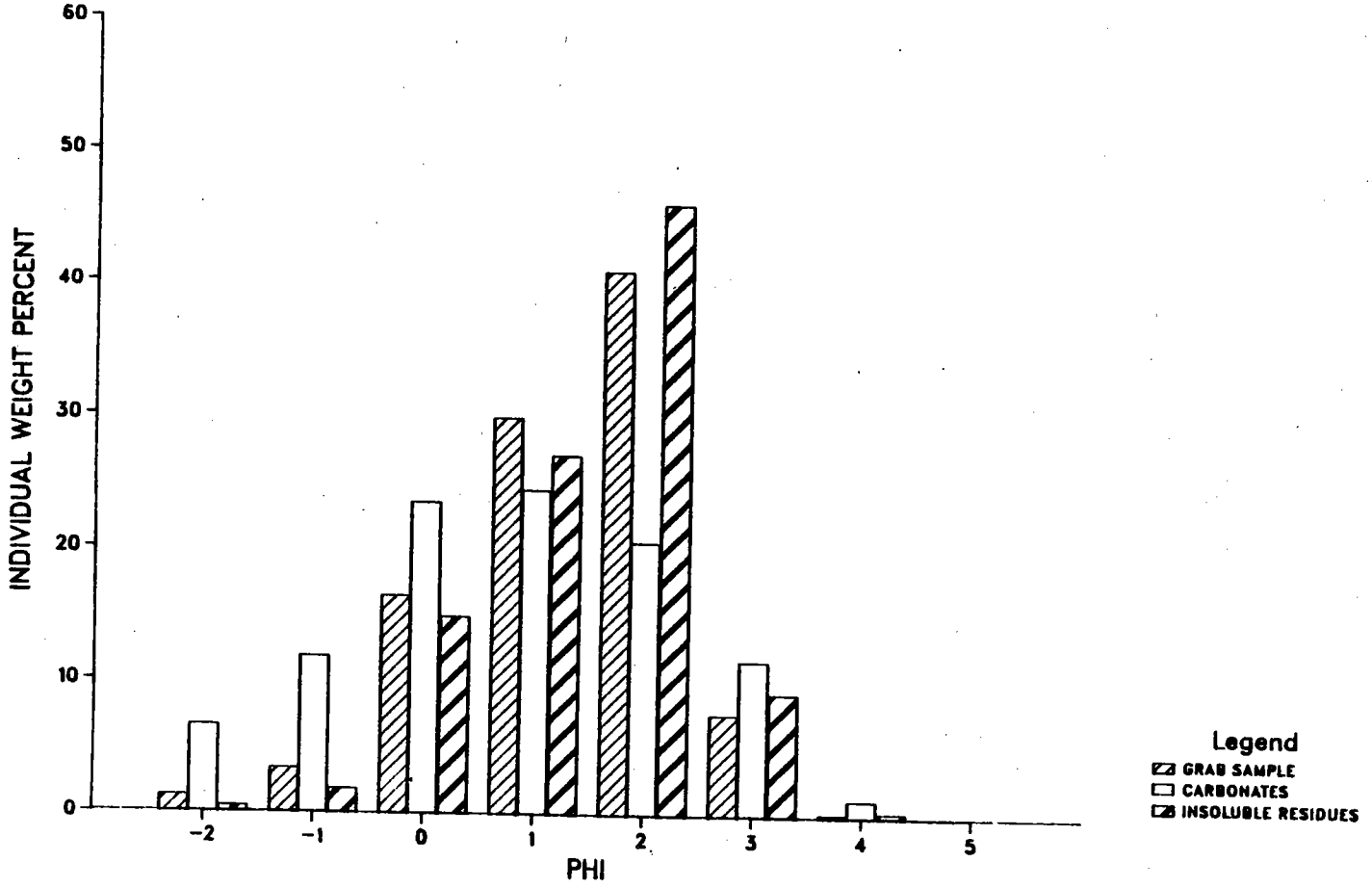
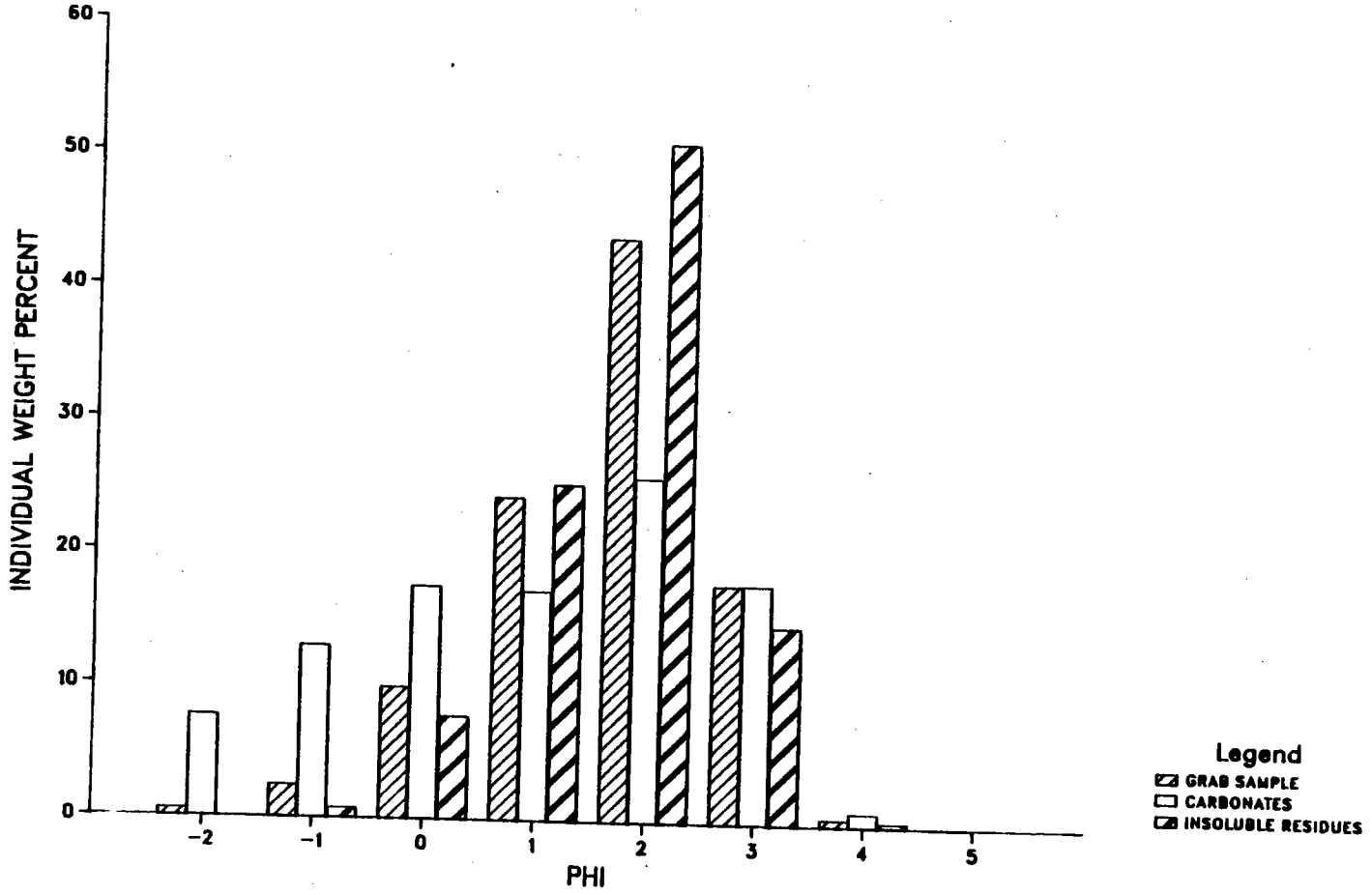


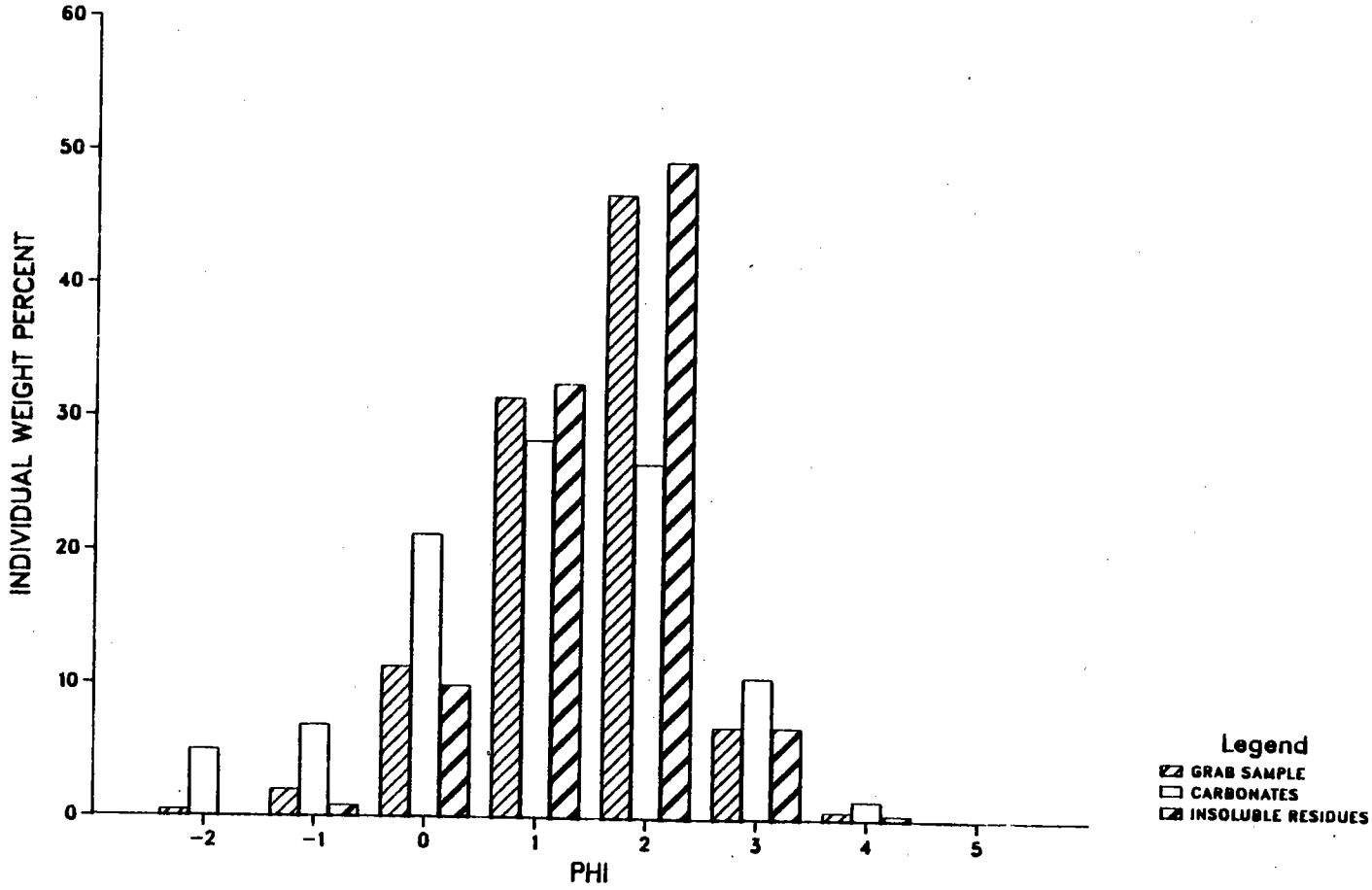
GRAIN SIZE DISTRIBUTION, SAMPLE 25



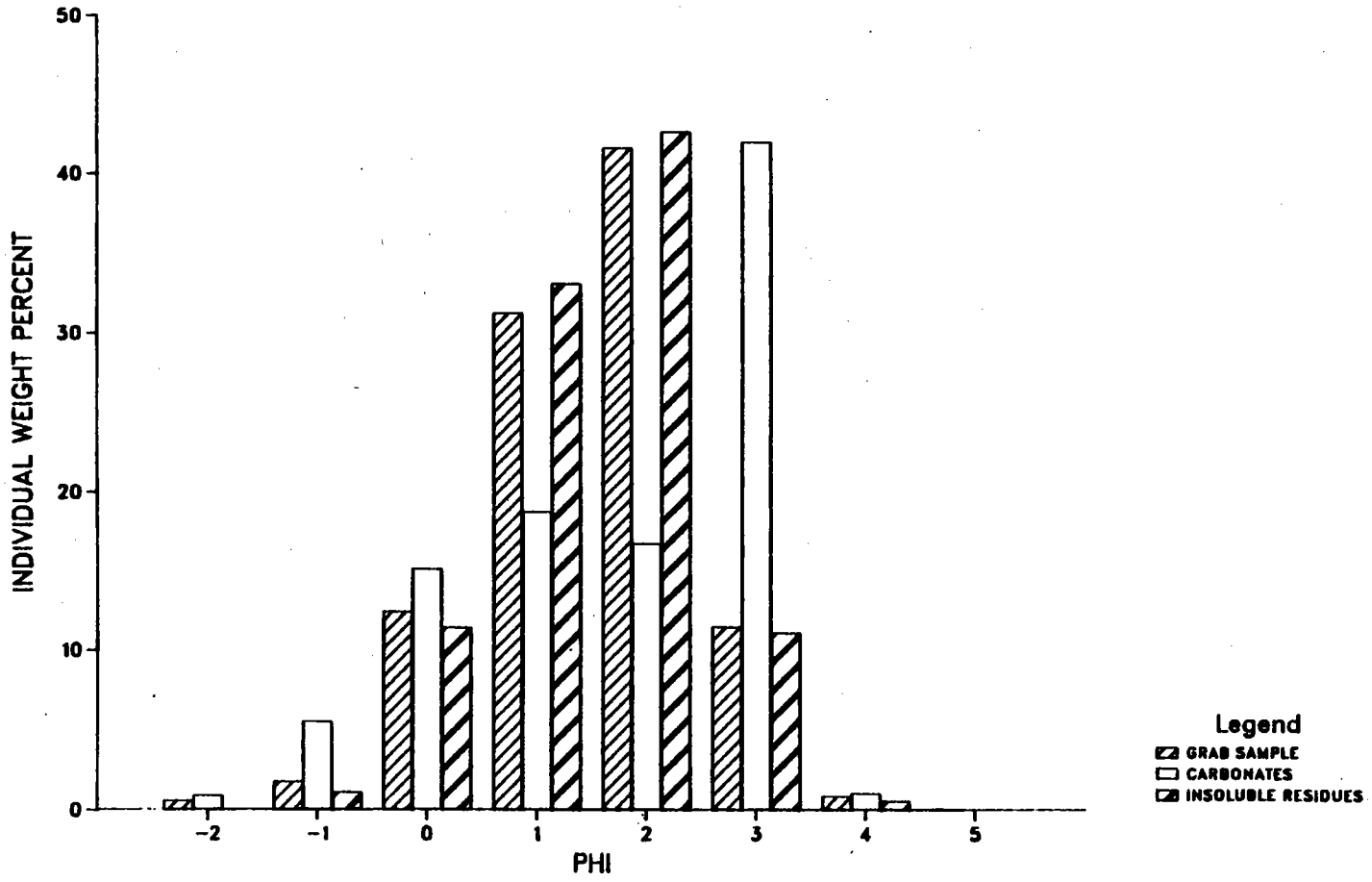
GRAIN SIZE DISTRIBUTION, SAMPLE 26



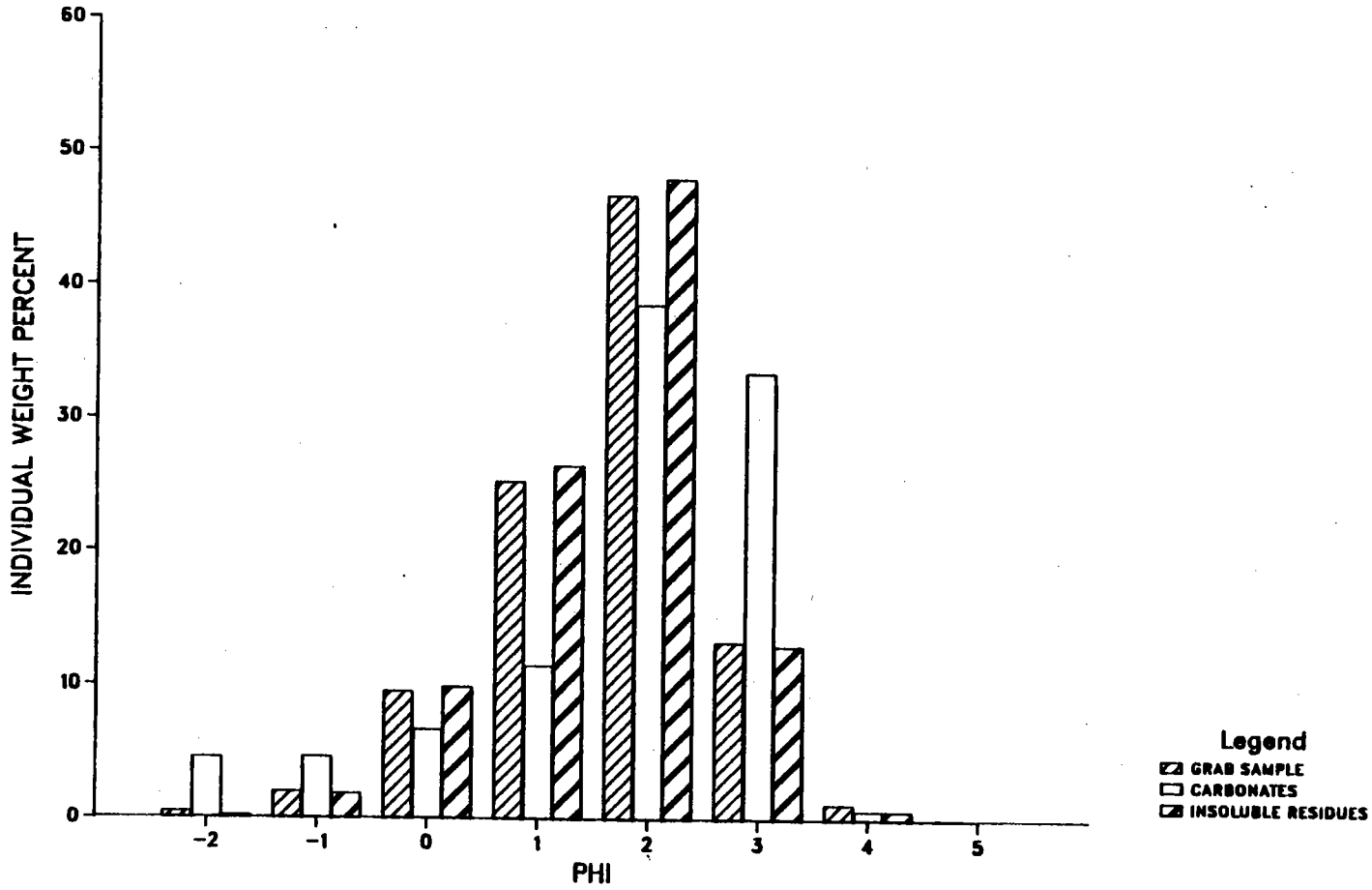
GRAIN SIZE DISTRIBUTION, SAMPLE 27



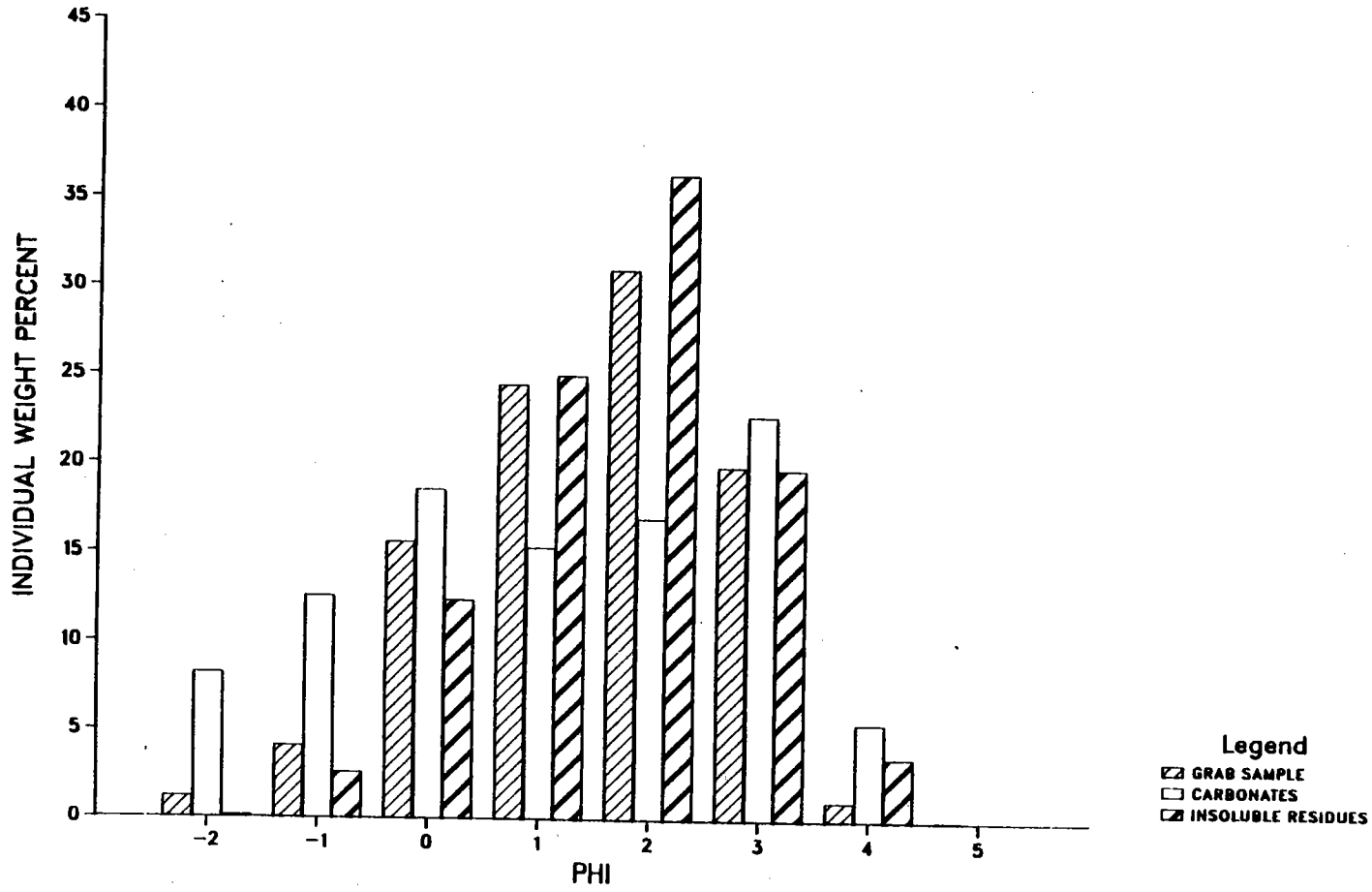
GRAIN SIZE DISTRIBUTION, SAMPLE 28



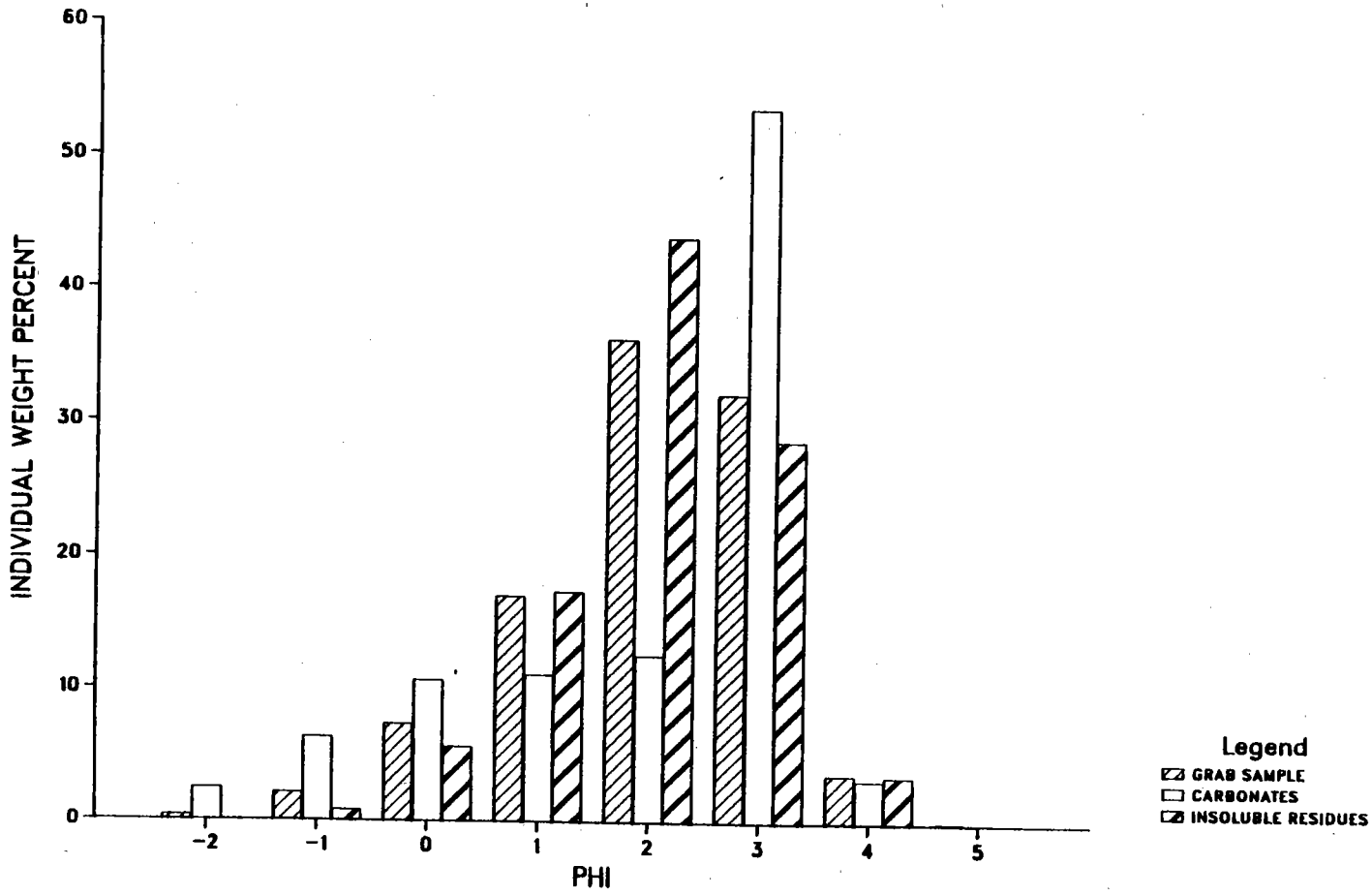
GRAIN SIZE DISTRIBUTION, SAMPLE 29



GRAIN SIZE DISTRIBUTION, SAMPLE 30



GRAIN SIZE DISTRIBUTION, SAMPLE 31



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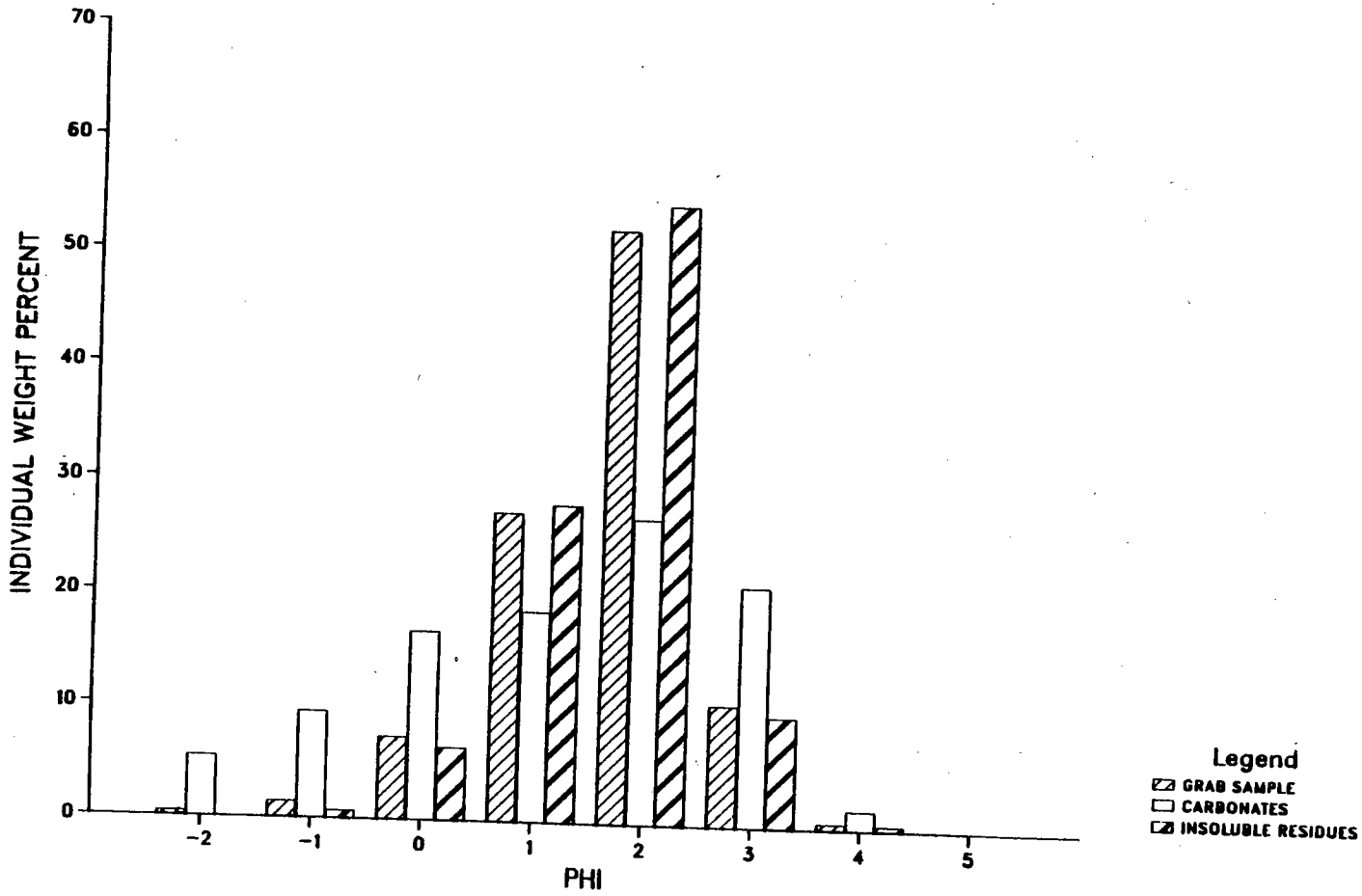
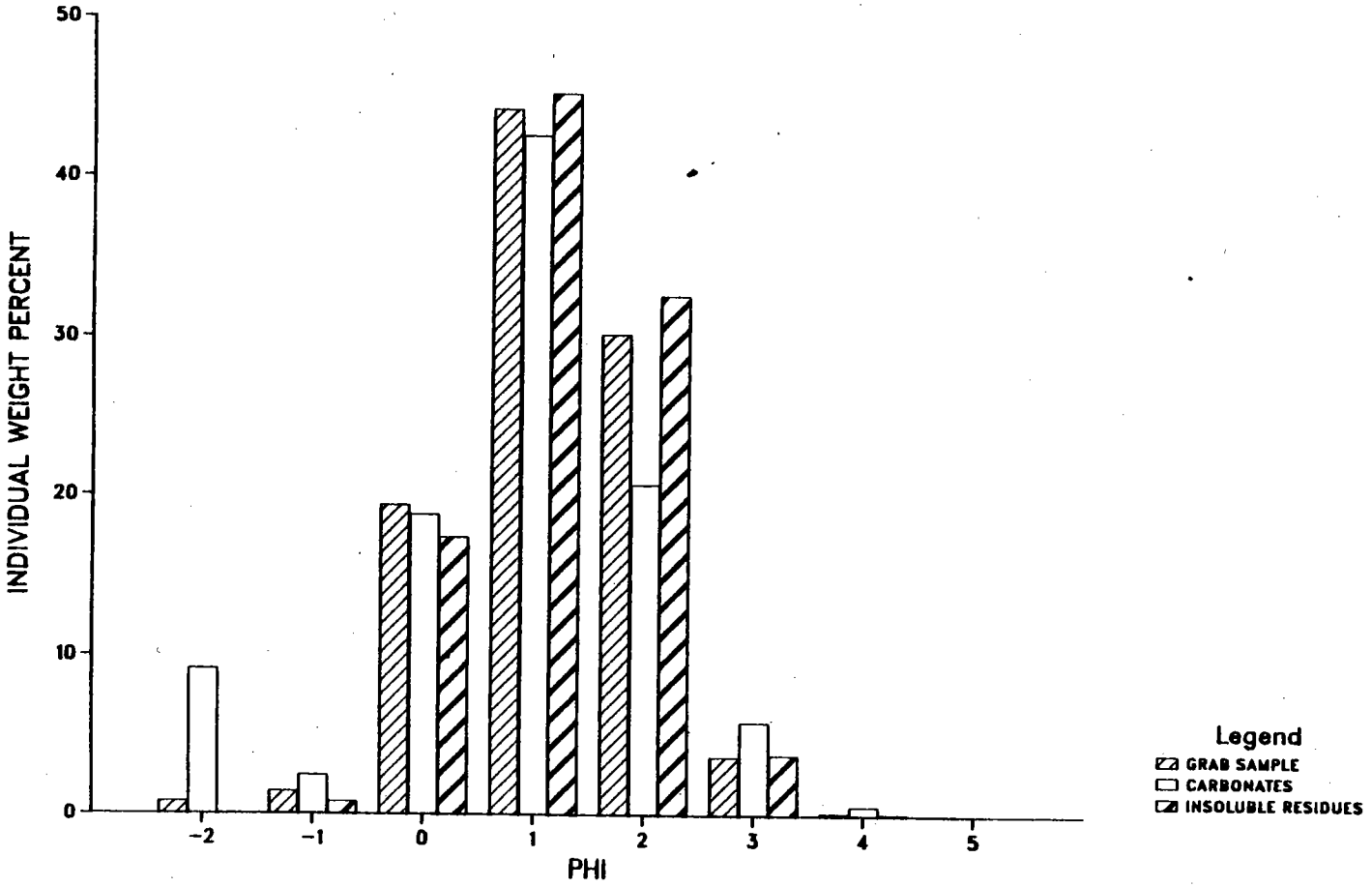
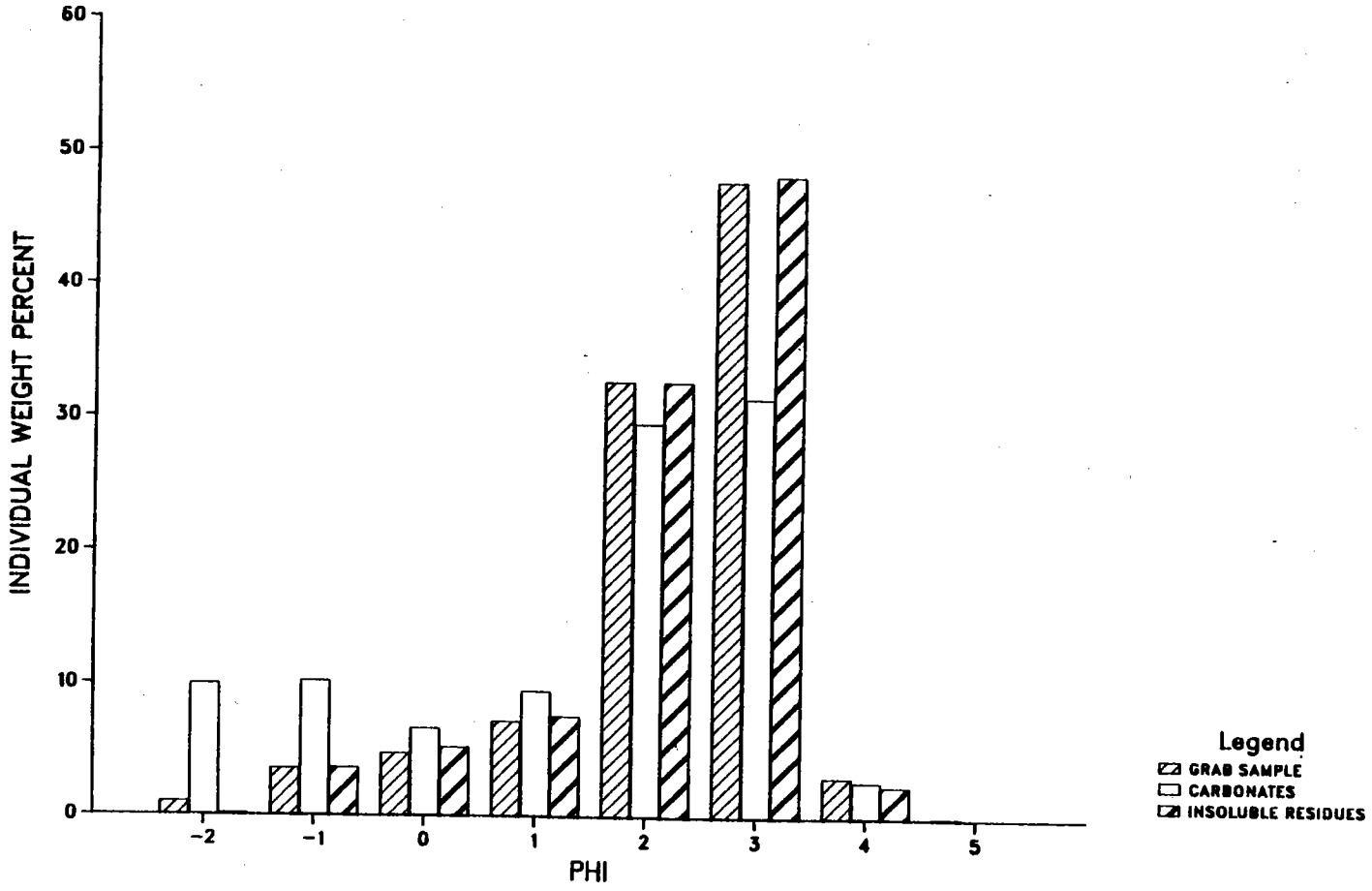


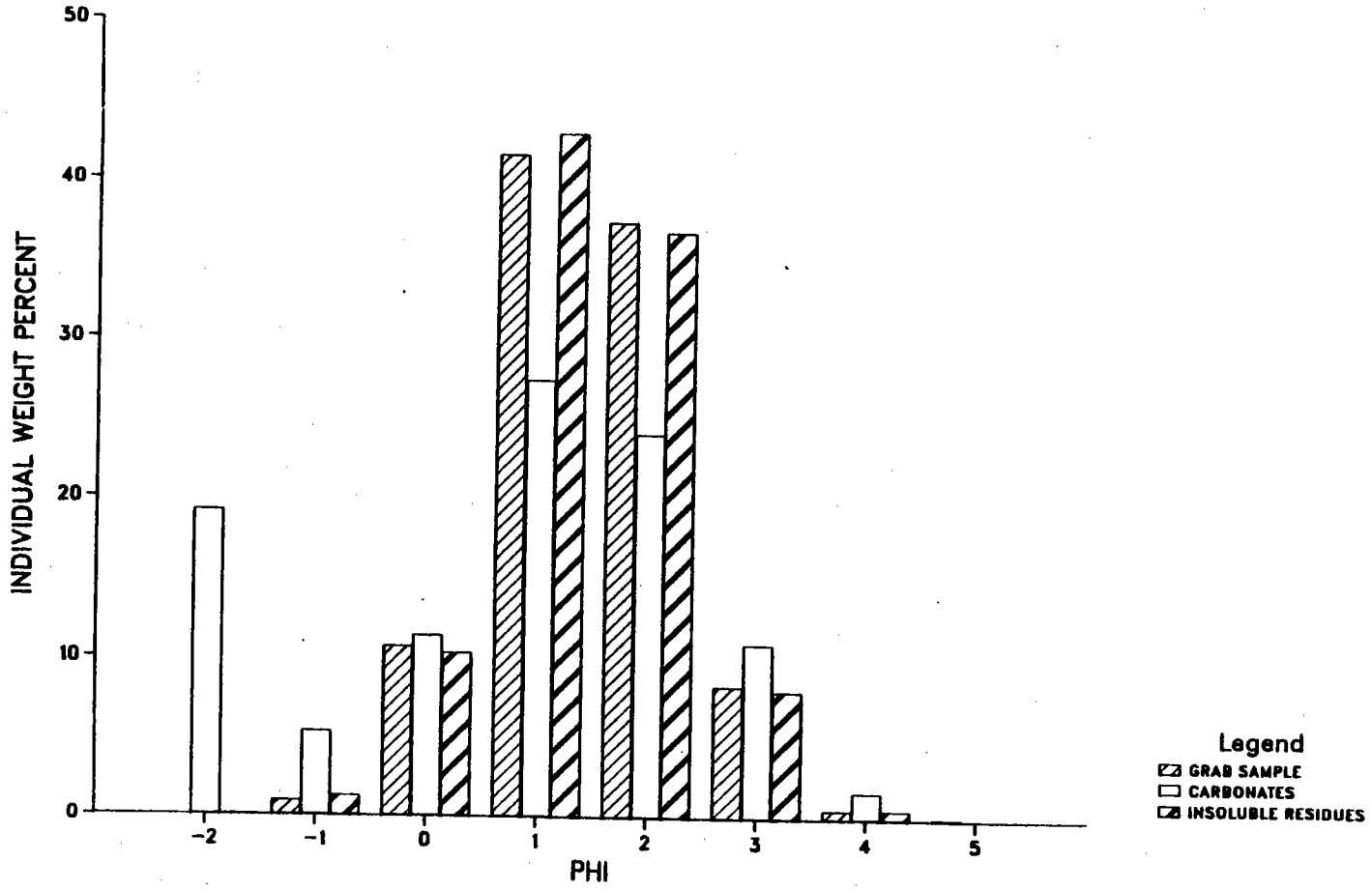
GRAIN SIZE DISTRIBUTION, SAMPLE 33



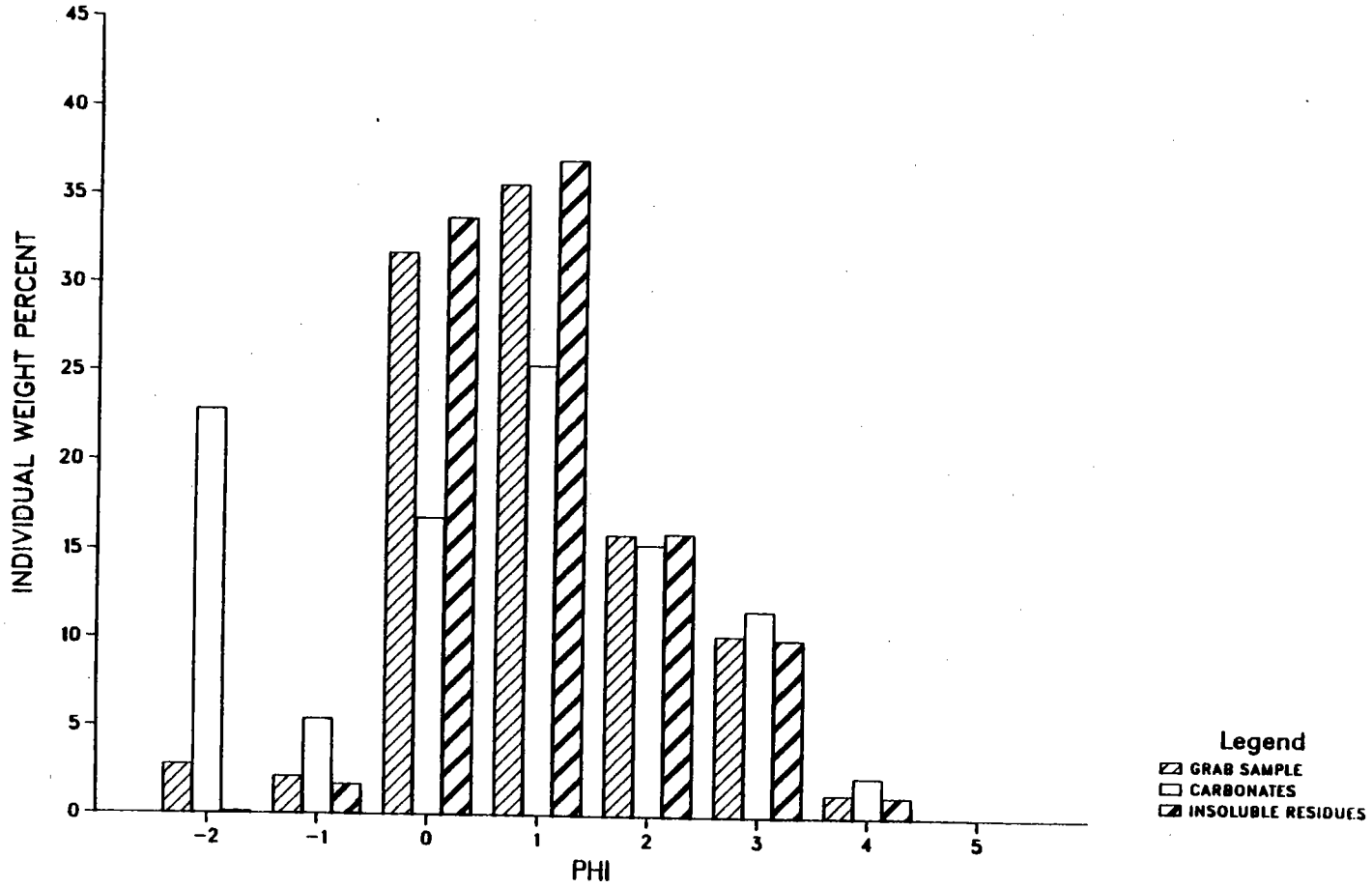
GRAIN SIZE DISTRIBUTION, SAMPLE 34



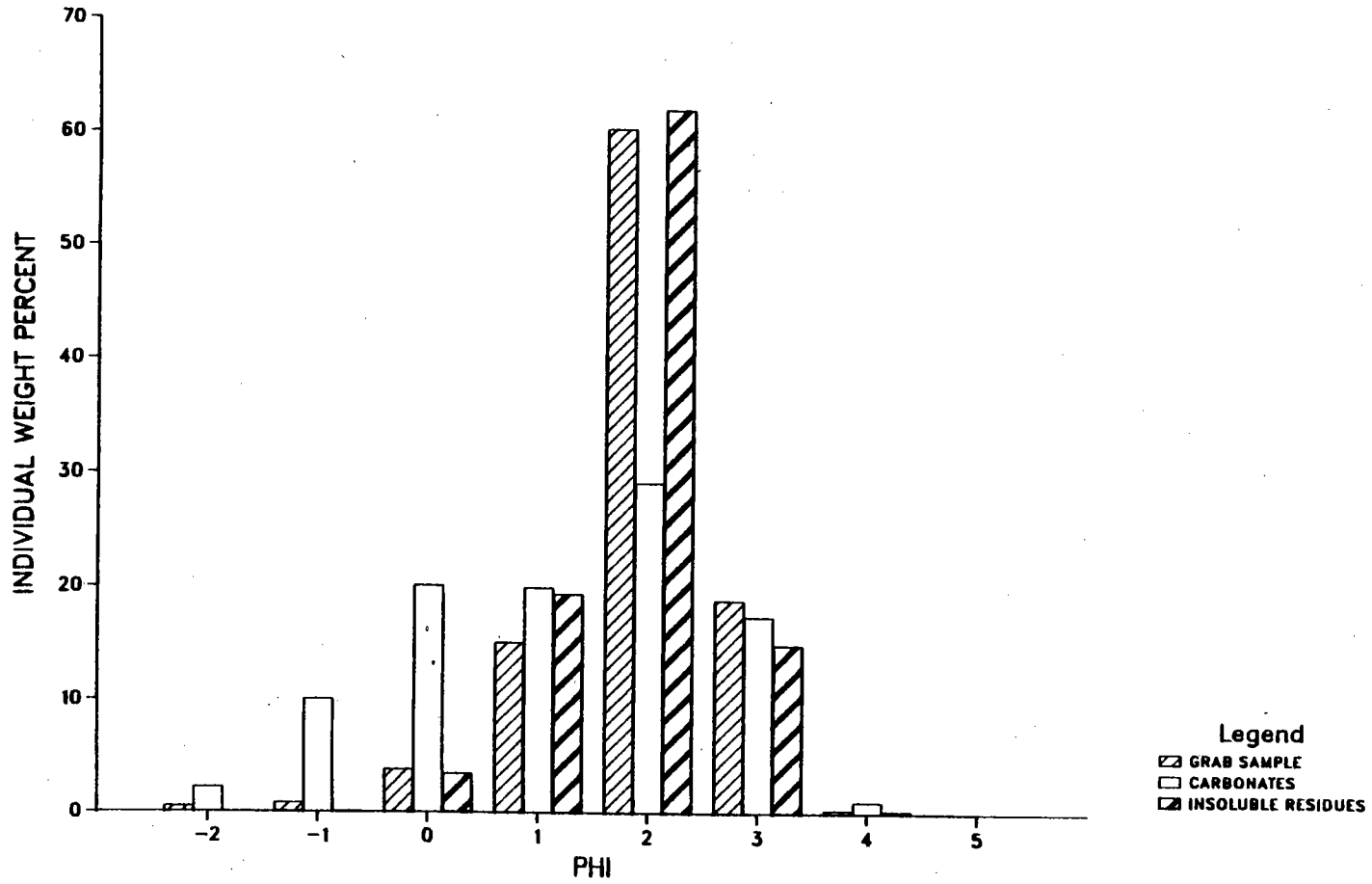
GRAIN SIZE DISTRIBUTION, SAMPLE 35



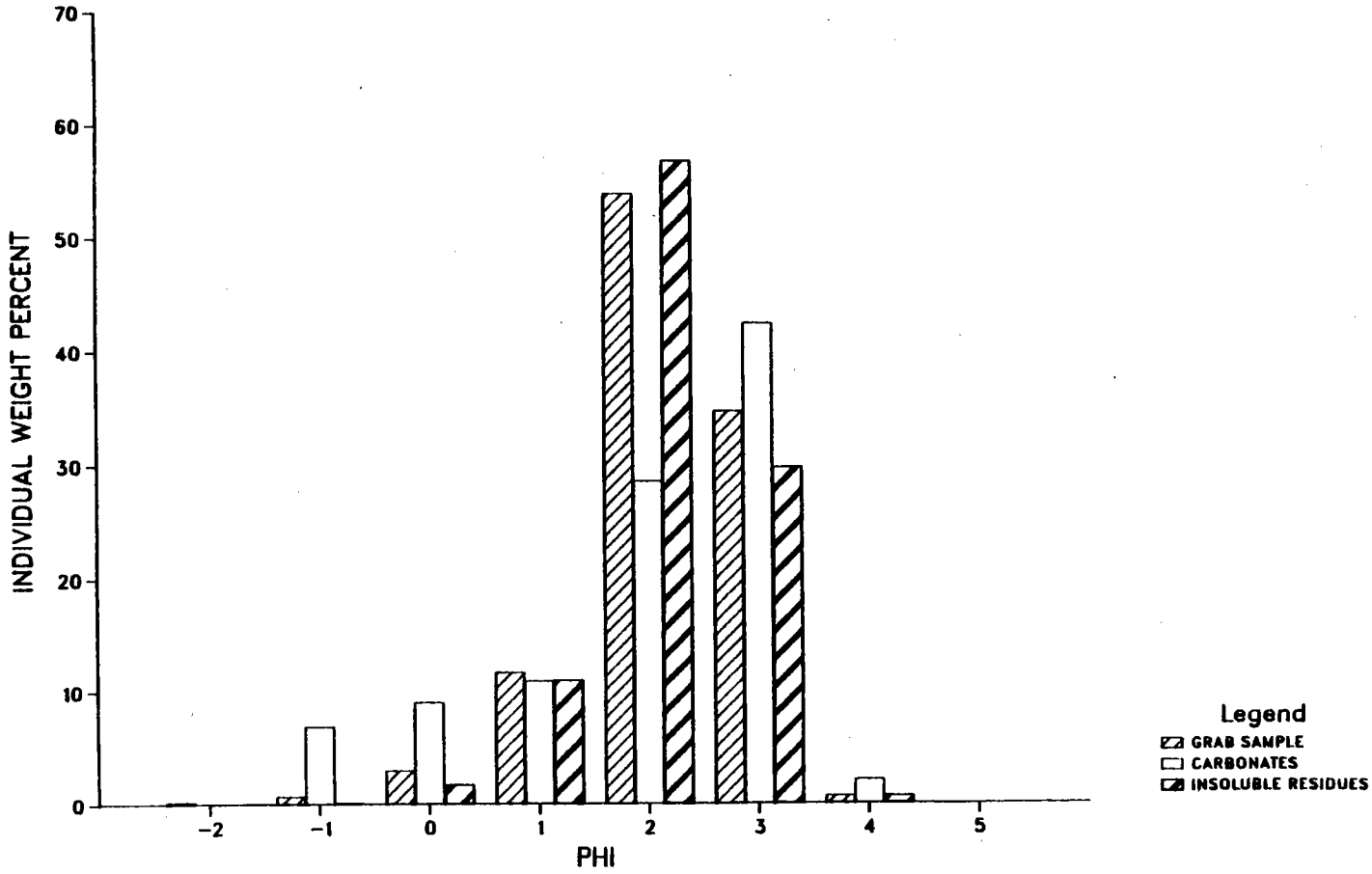
GRAIN SIZE DISTRIBUTION, SAMPLE 36



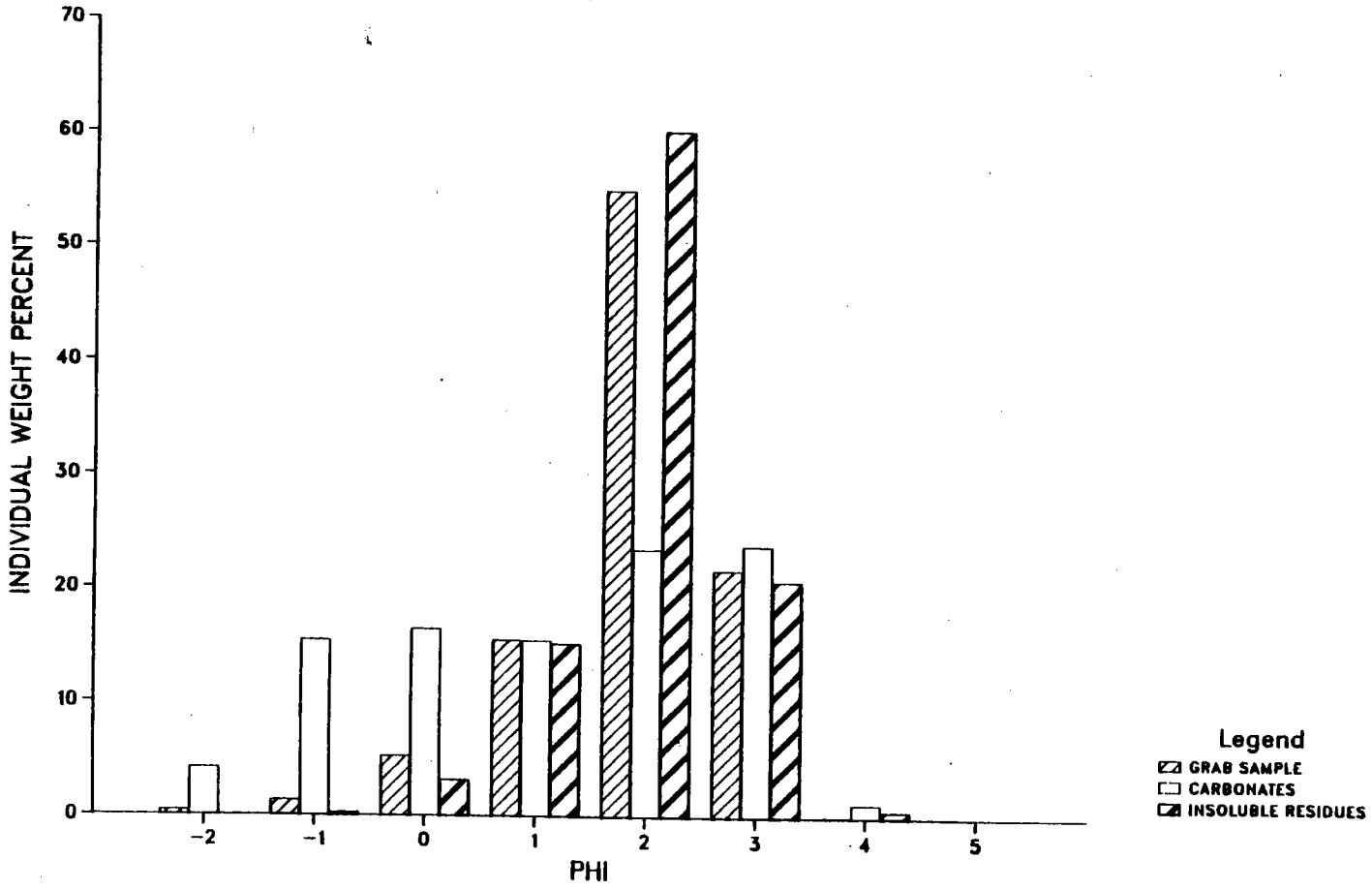
GRAIN SIZE DISTRIBUTION, SAMPLE 37



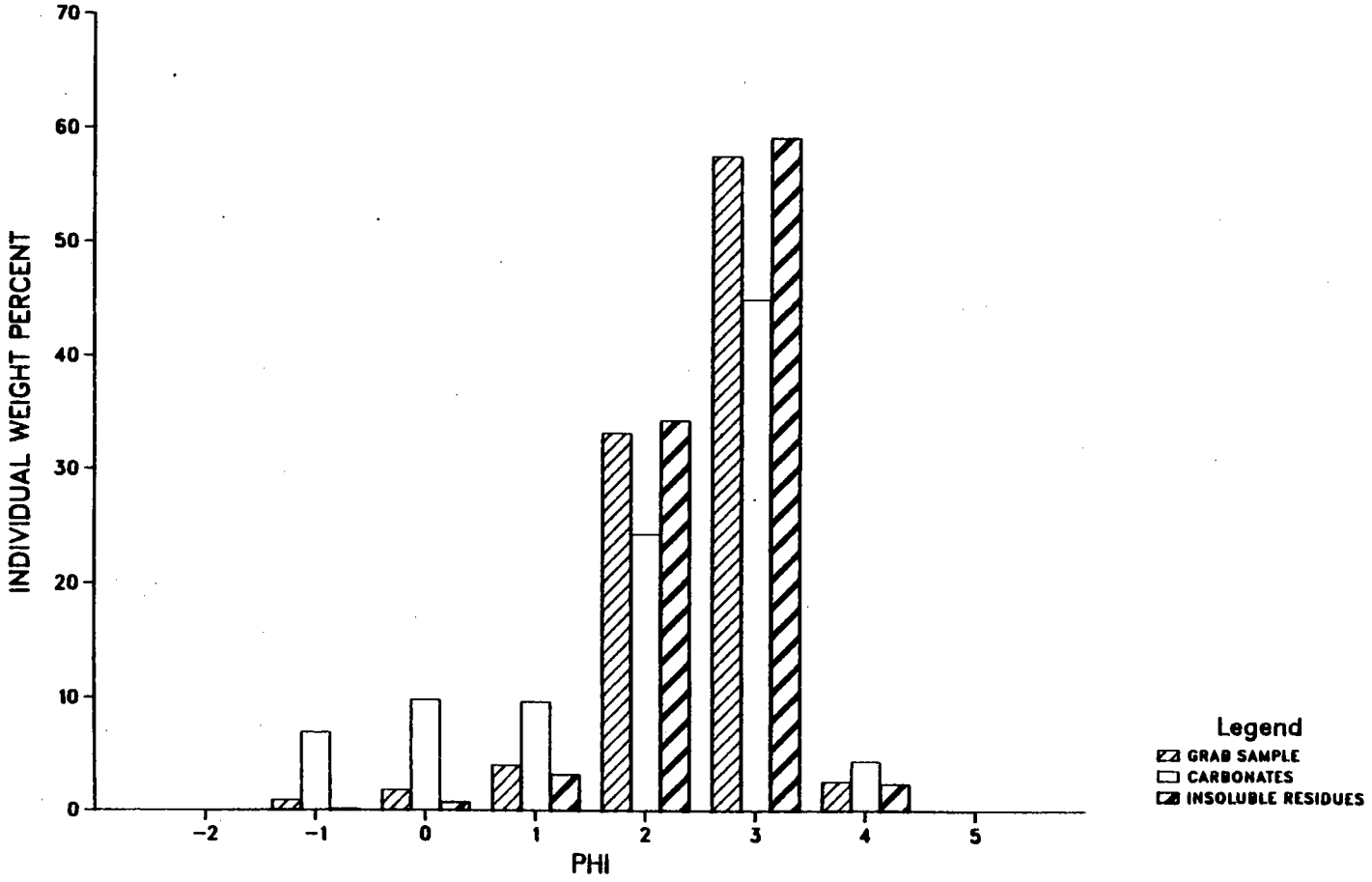
GRAIN SIZE DISTRIBUTION, SAMPLE 38



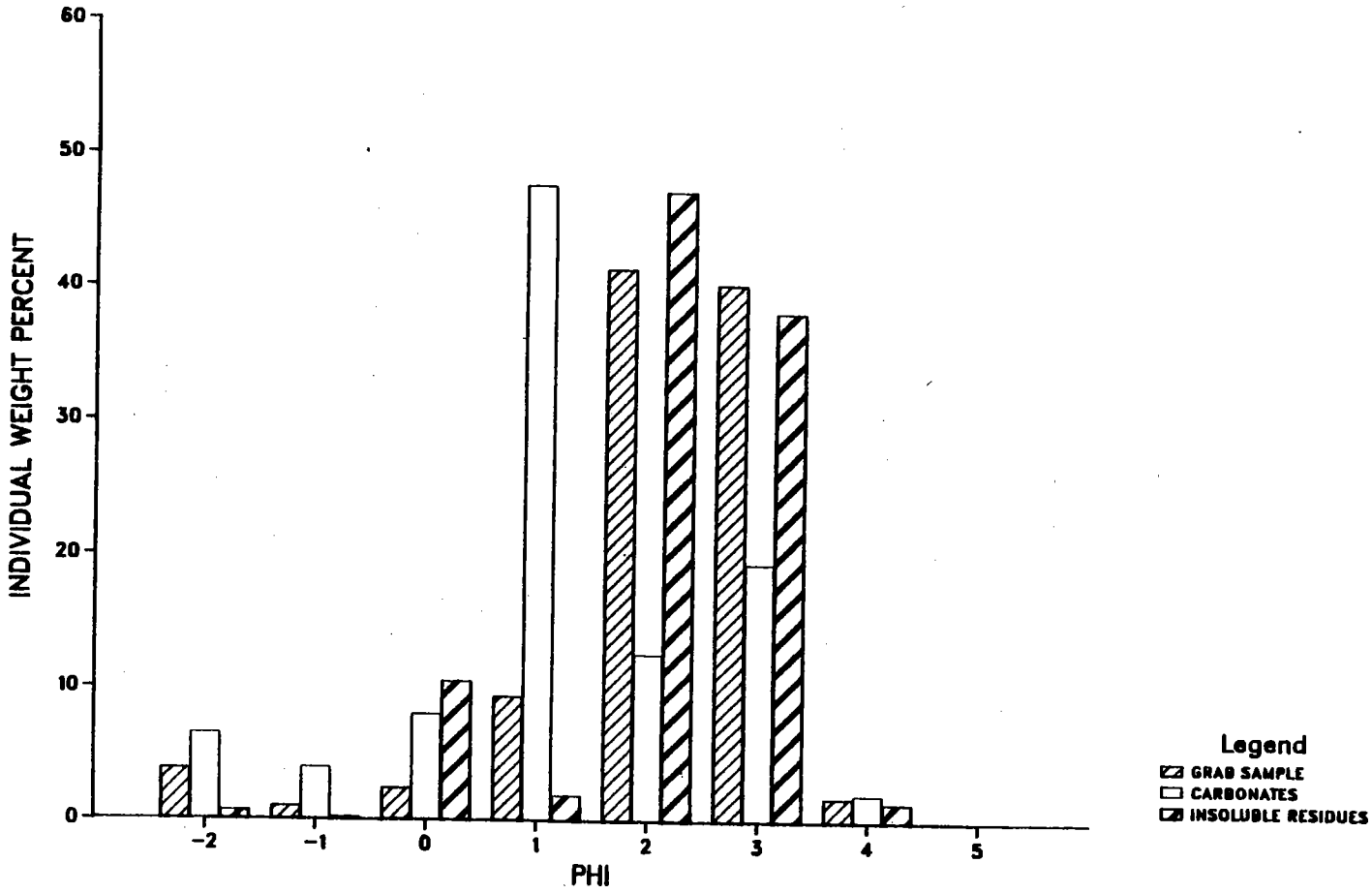
GRAIN SIZE DISTRIBUTION, SAMPLE 39



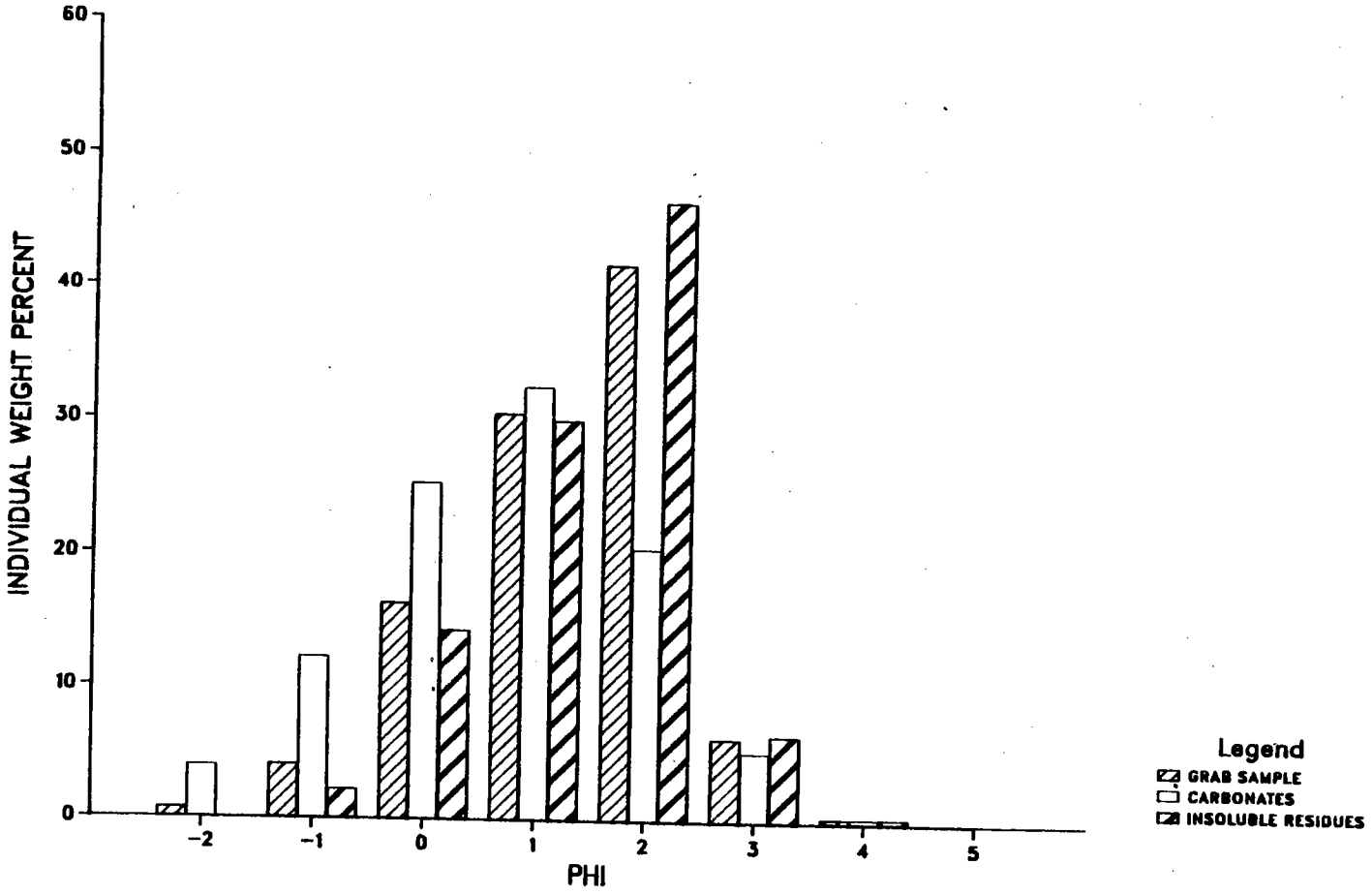
GRAIN SIZE DISTRIBUTION, SAMPLE 40



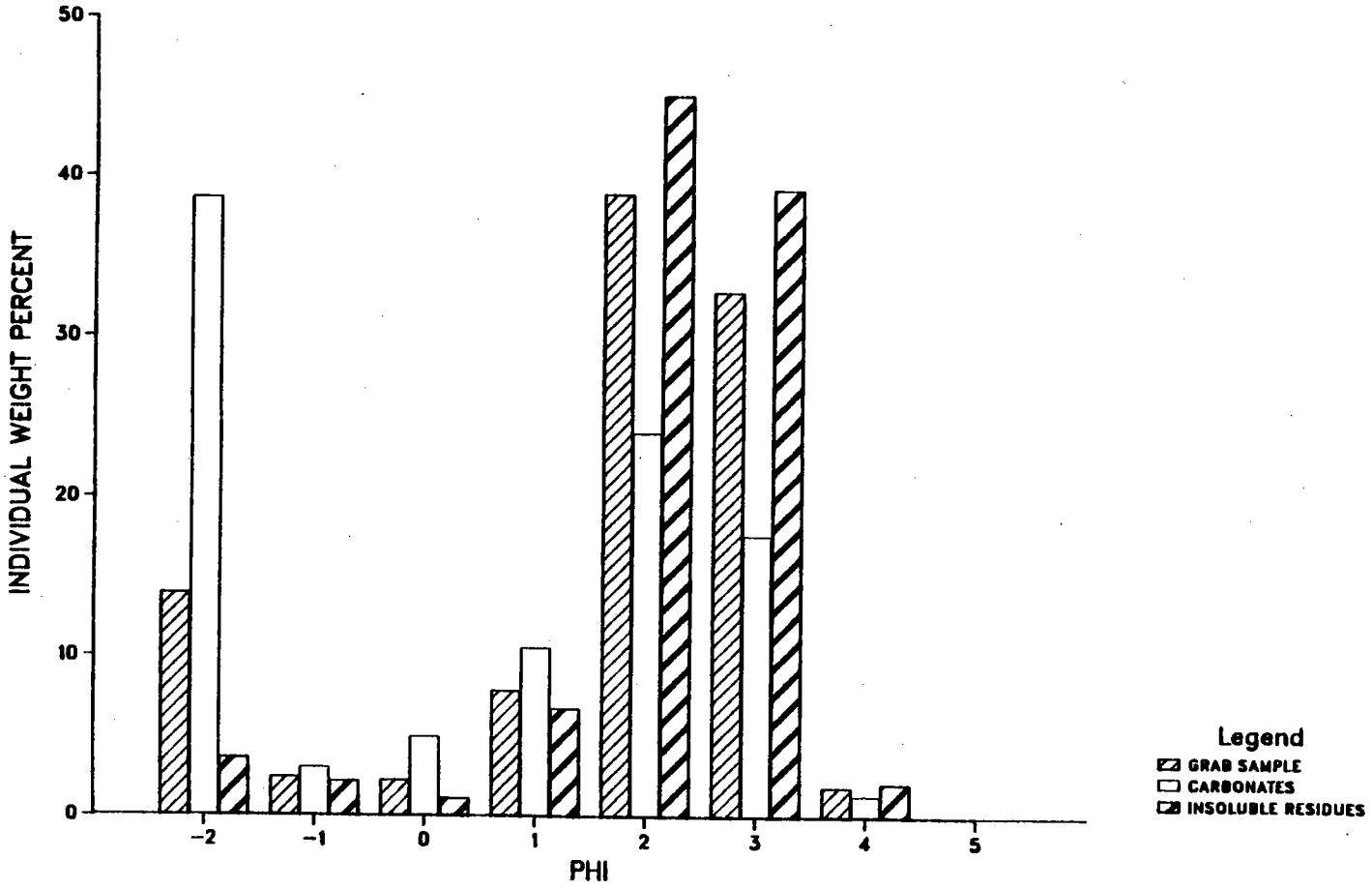
GRAIN SIZE DISTRIBUTION, SAMPLE 41



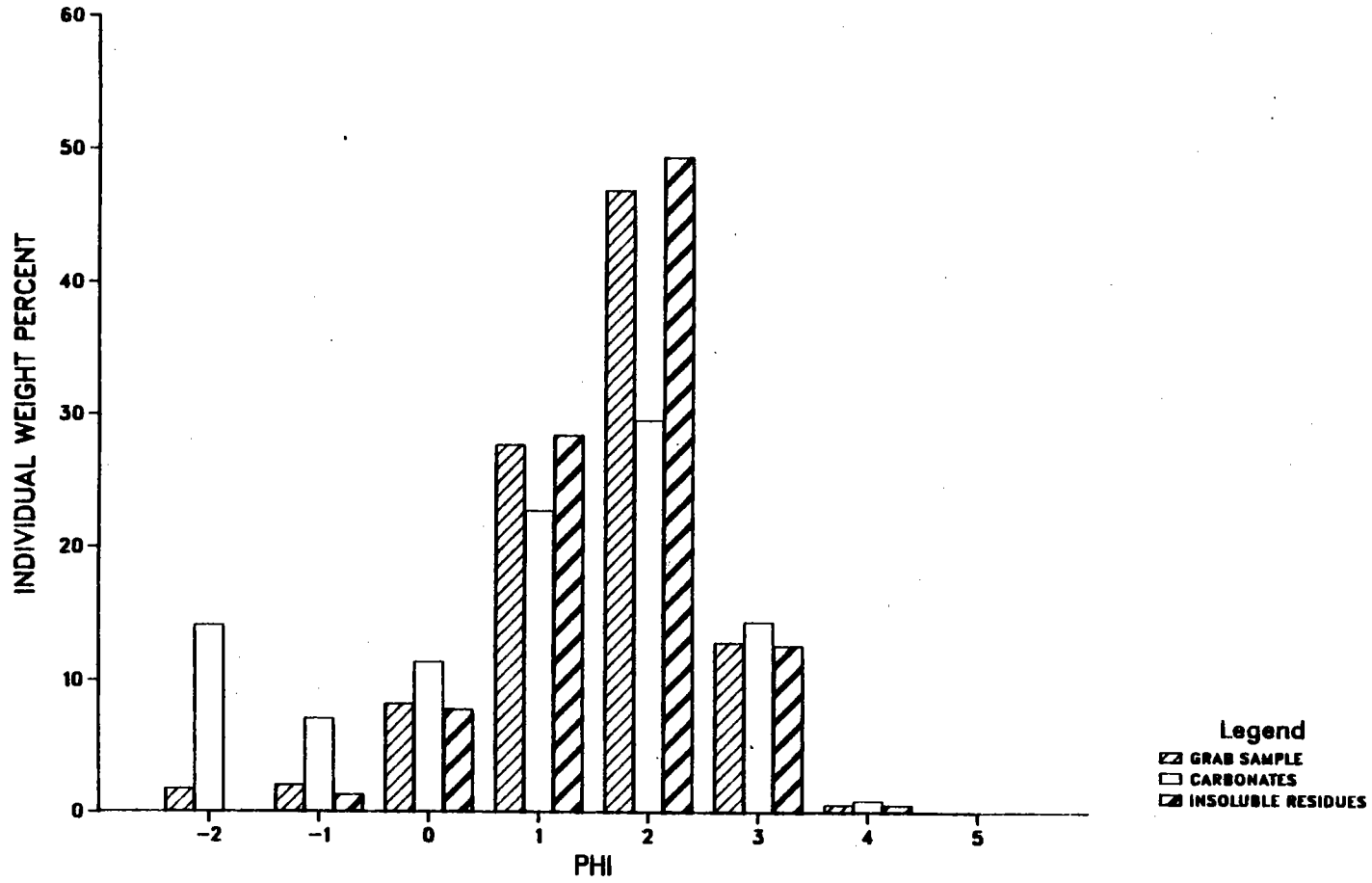
GRAIN SIZE DISTRIBUTION, SAMPLE 42



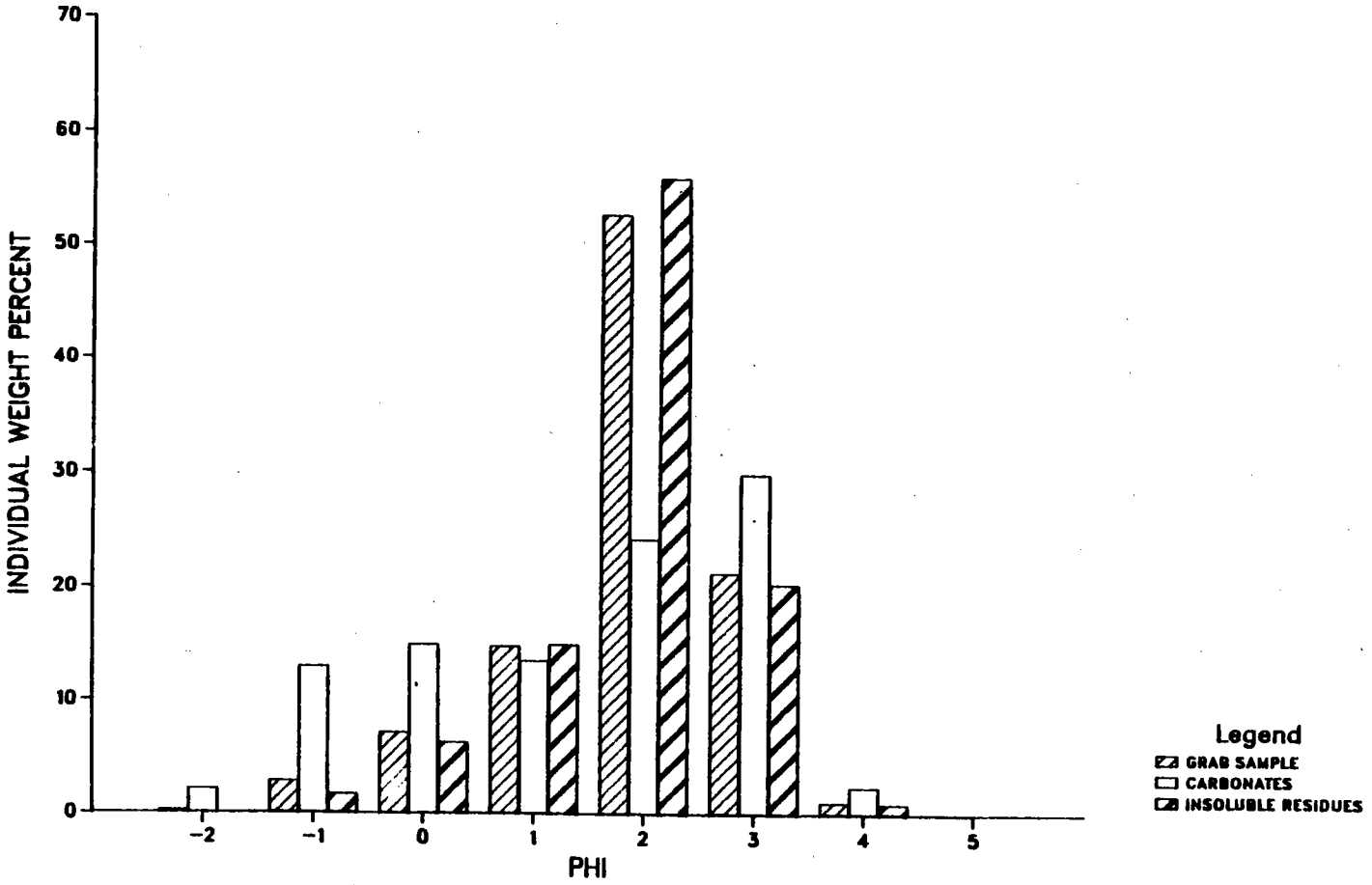
GRAIN SIZE DISTRIBUTION, SAMPLE 43



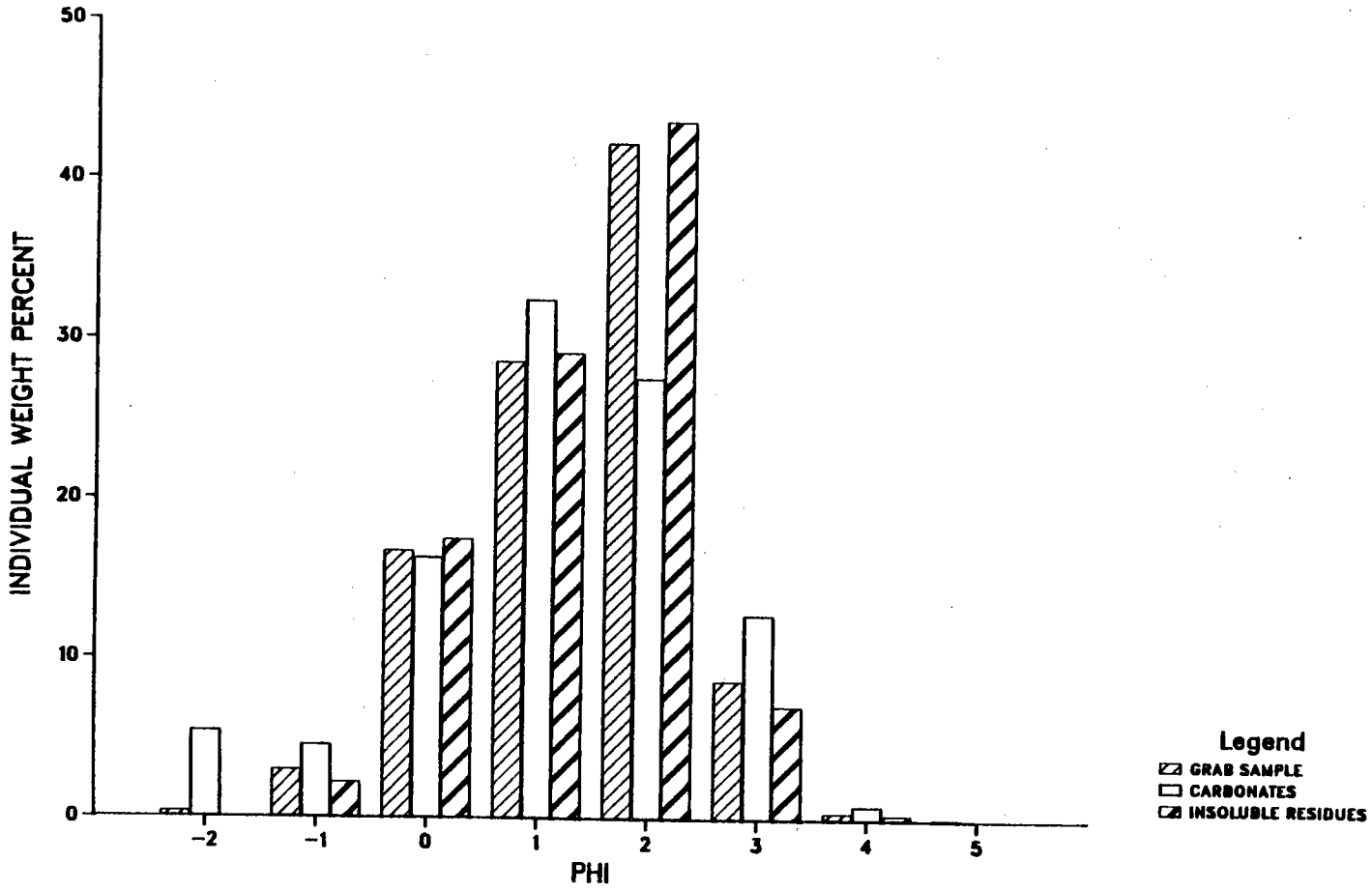
GRAIN SIZE DISTRIBUTION, SAMPLE 44



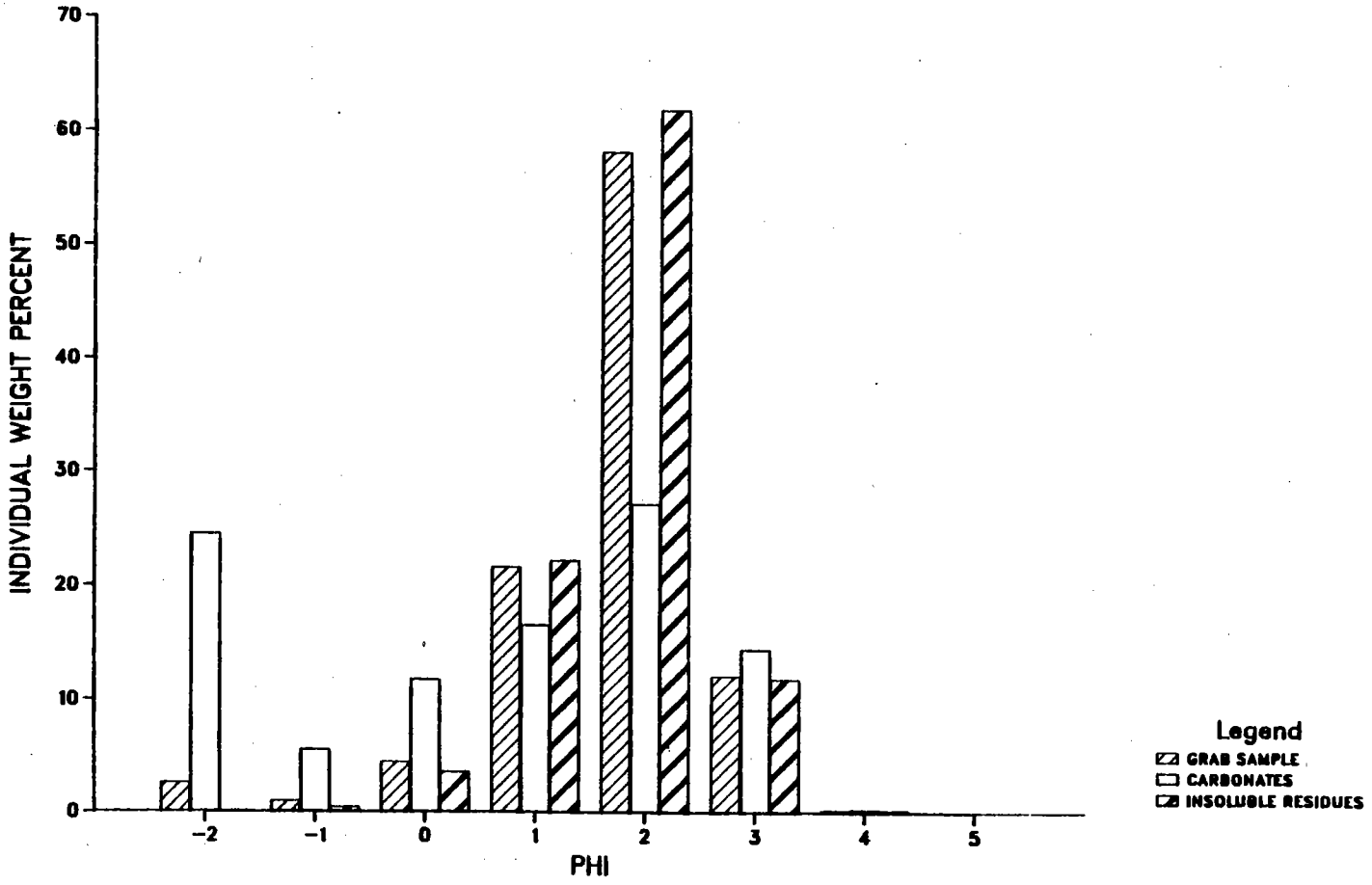
GRAIN SIZE DISTRIBUTION, SAMPLE 45



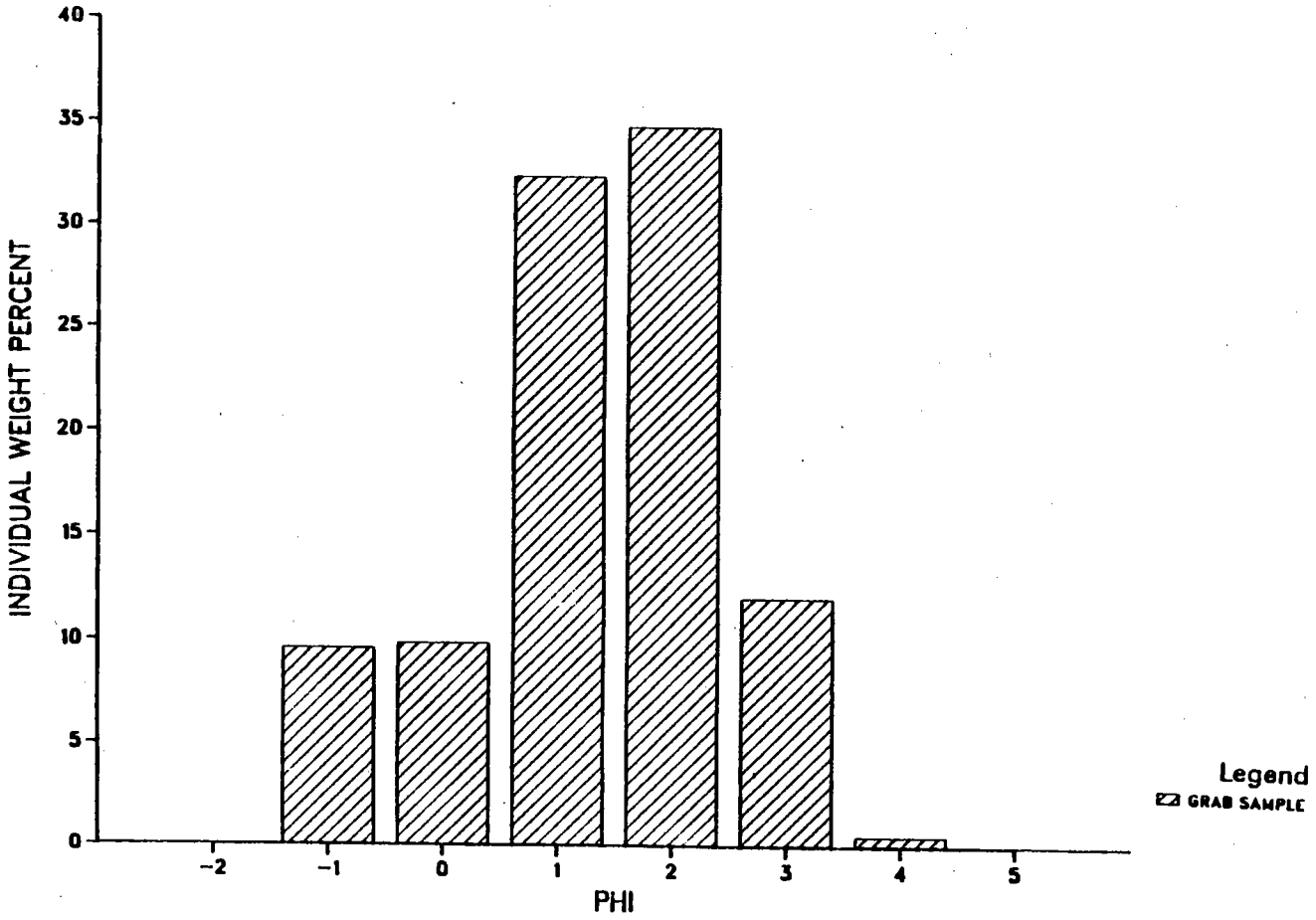
GRAIN SIZE DISTRIBUTION, SAMPLE 46



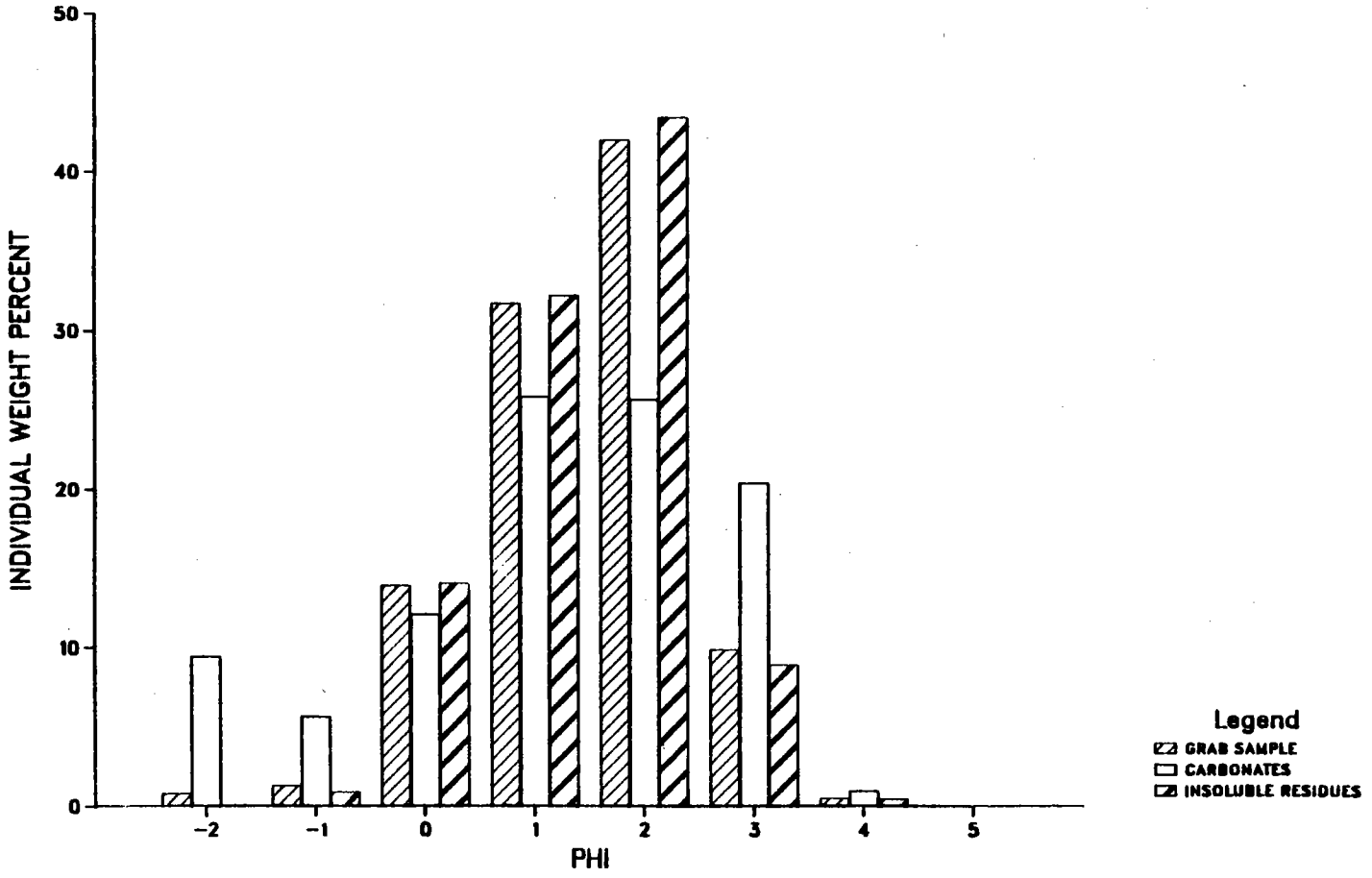
GRAIN SIZE DISTRIBUTION, SAMPLE 47



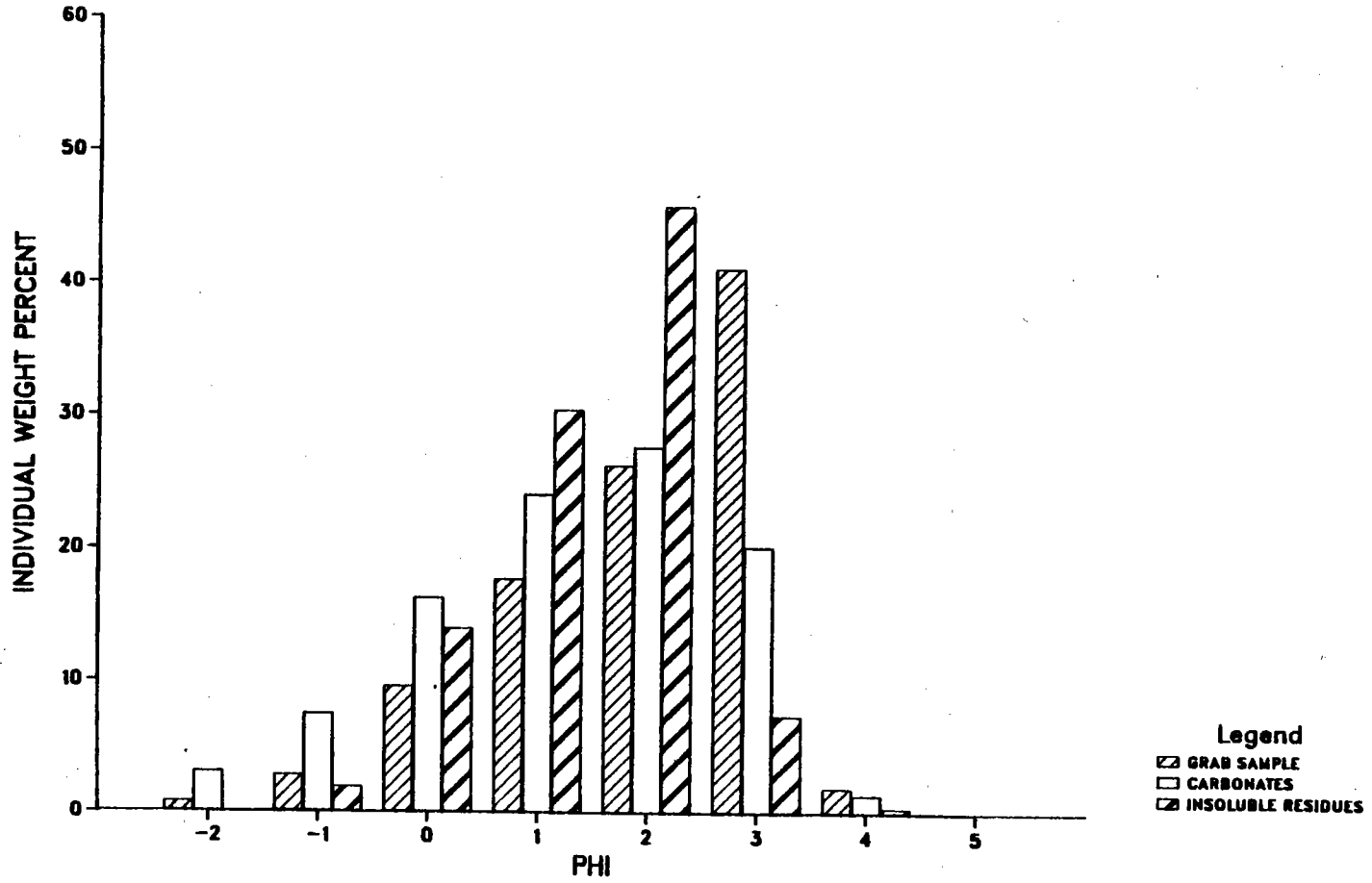
GRAIN SIZE DISTRIBUTION, SAMPLE 48



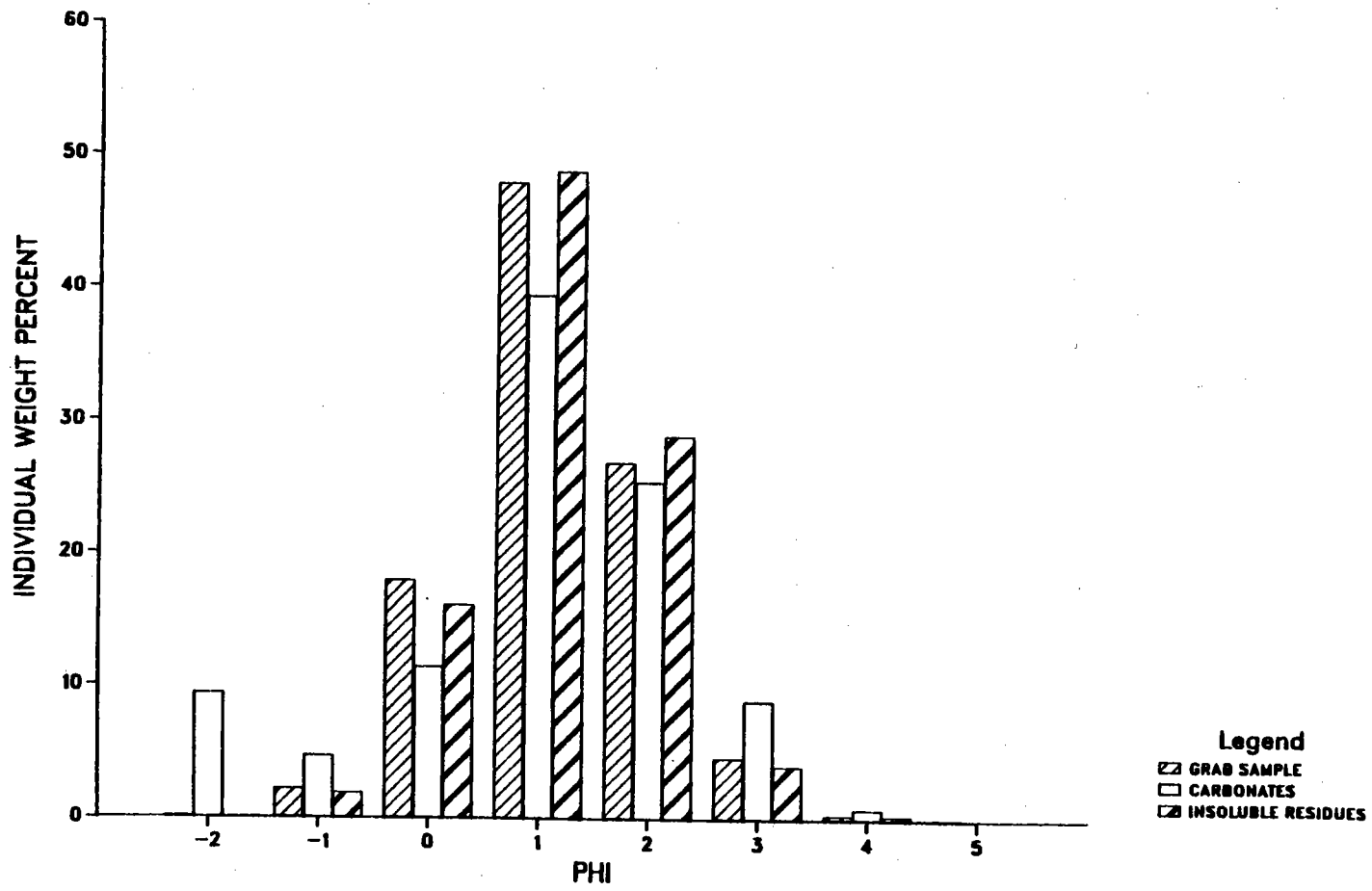
GRAIN SIZE DISTRIBUTION, SAMPLE 49



GRAIN SIZE DISTRIBUTION, SAMPLE 50



GRAIN SIZE DISTRIBUTION, SAMPLE 51



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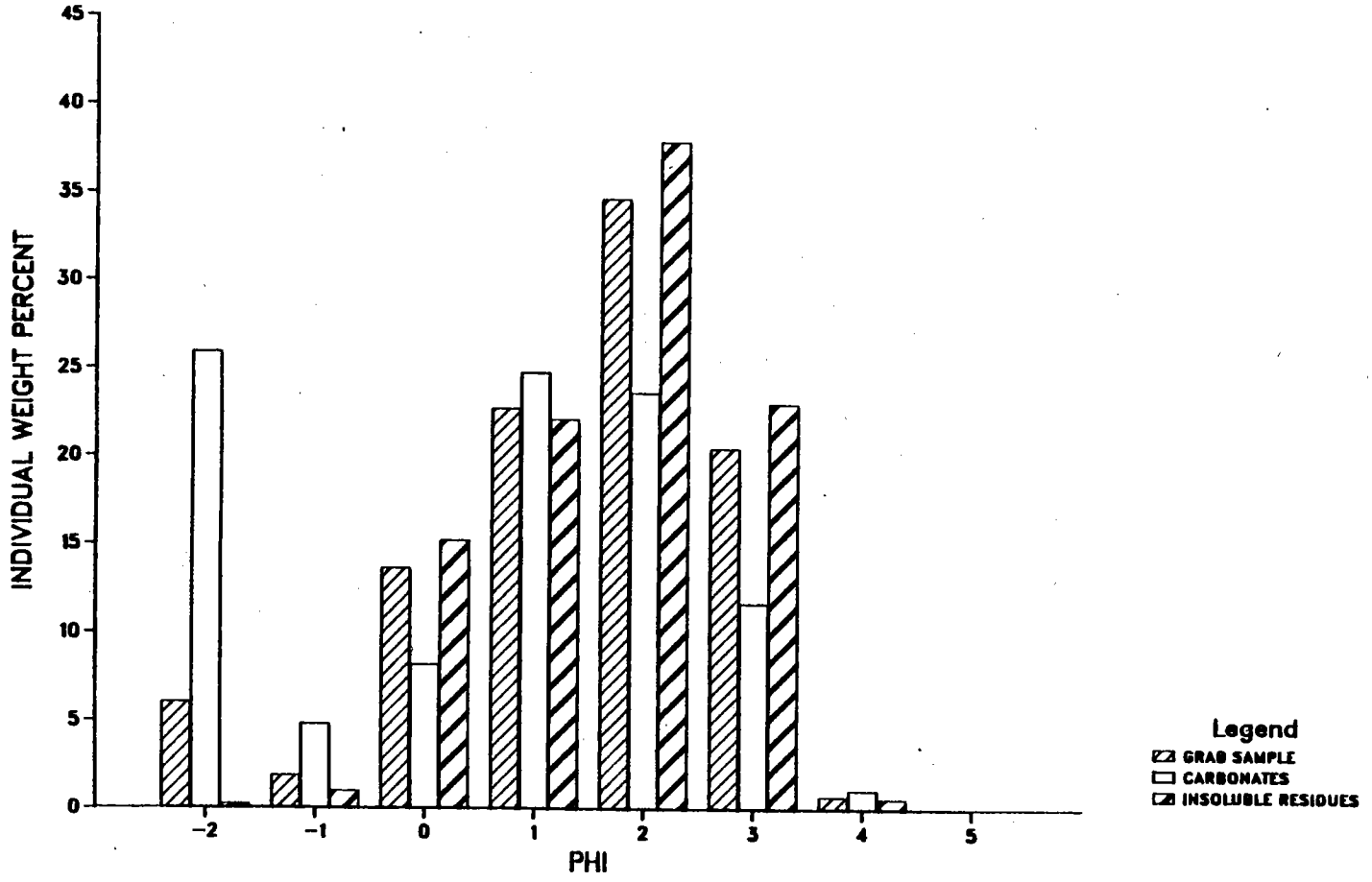
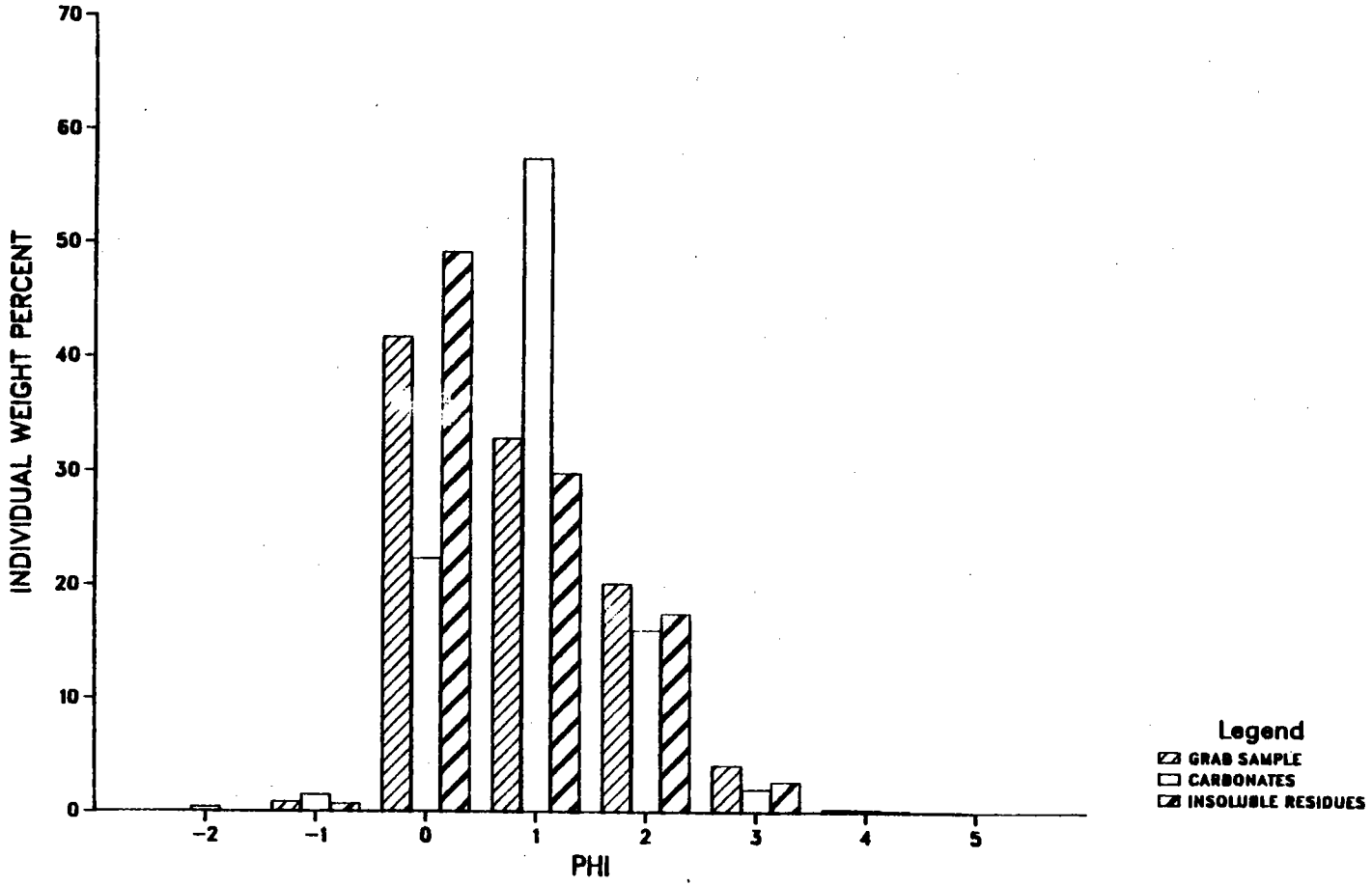
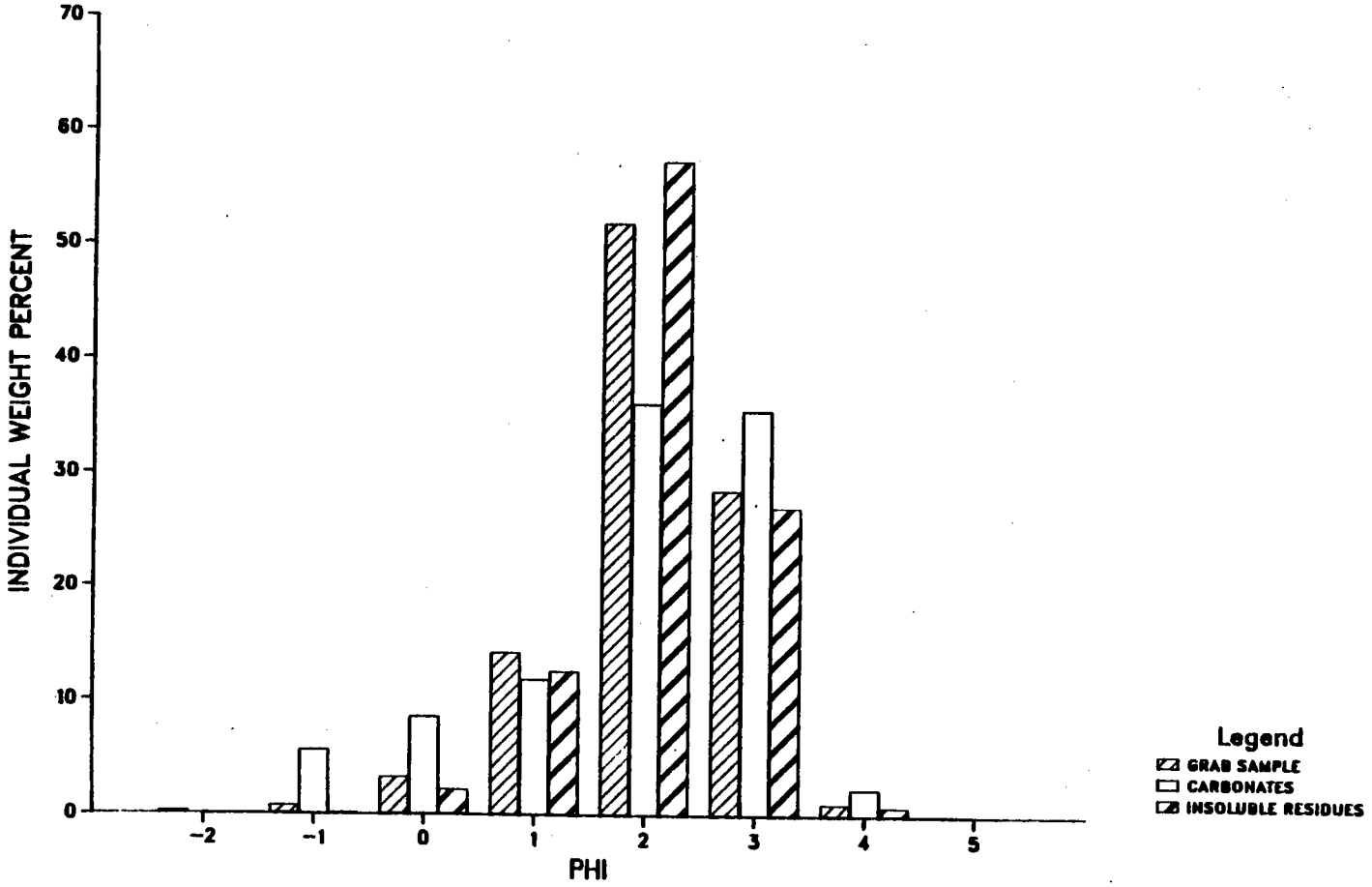


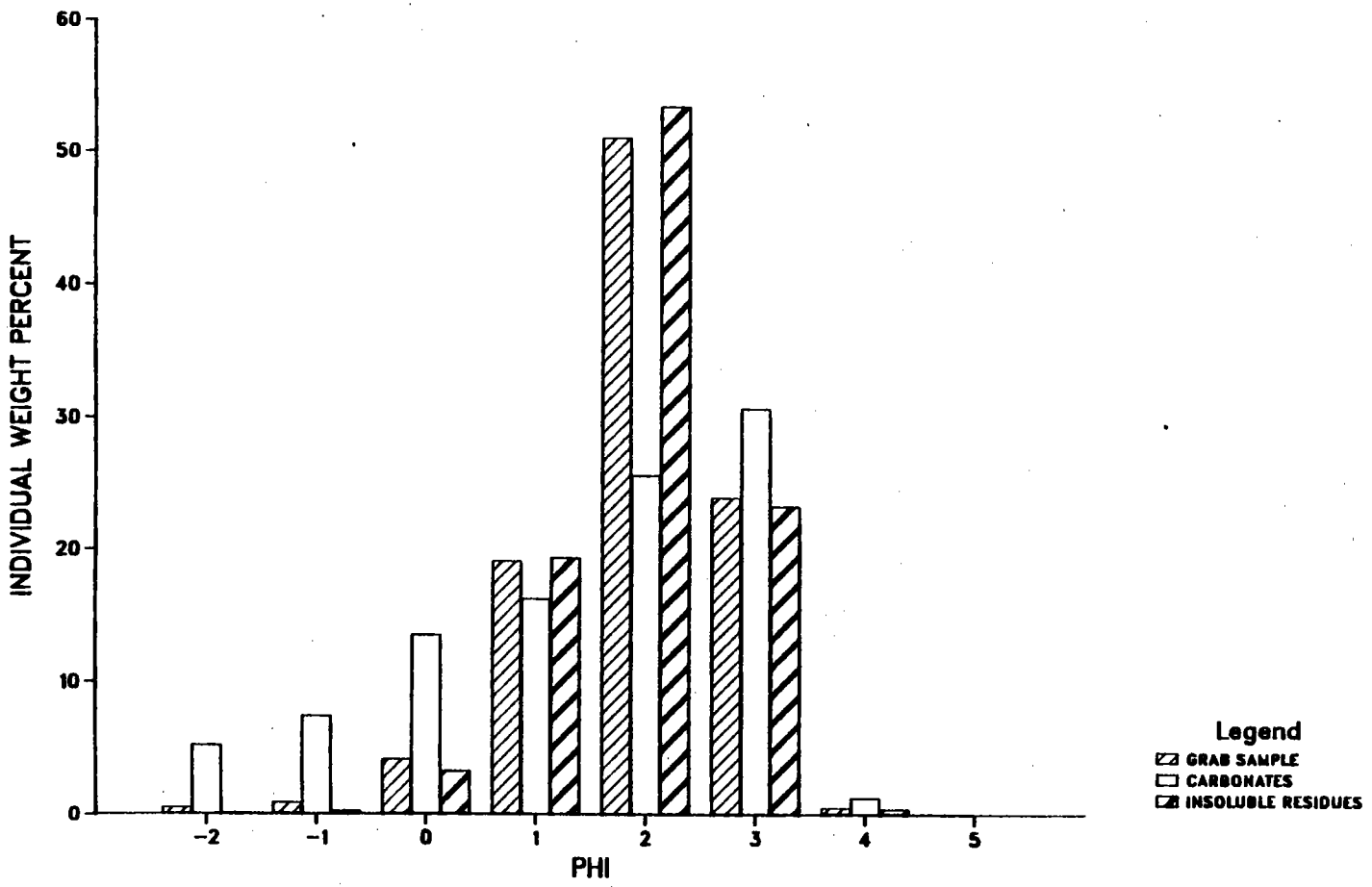
GRAIN SIZE DISTRIBUTION, SAMPLE 53



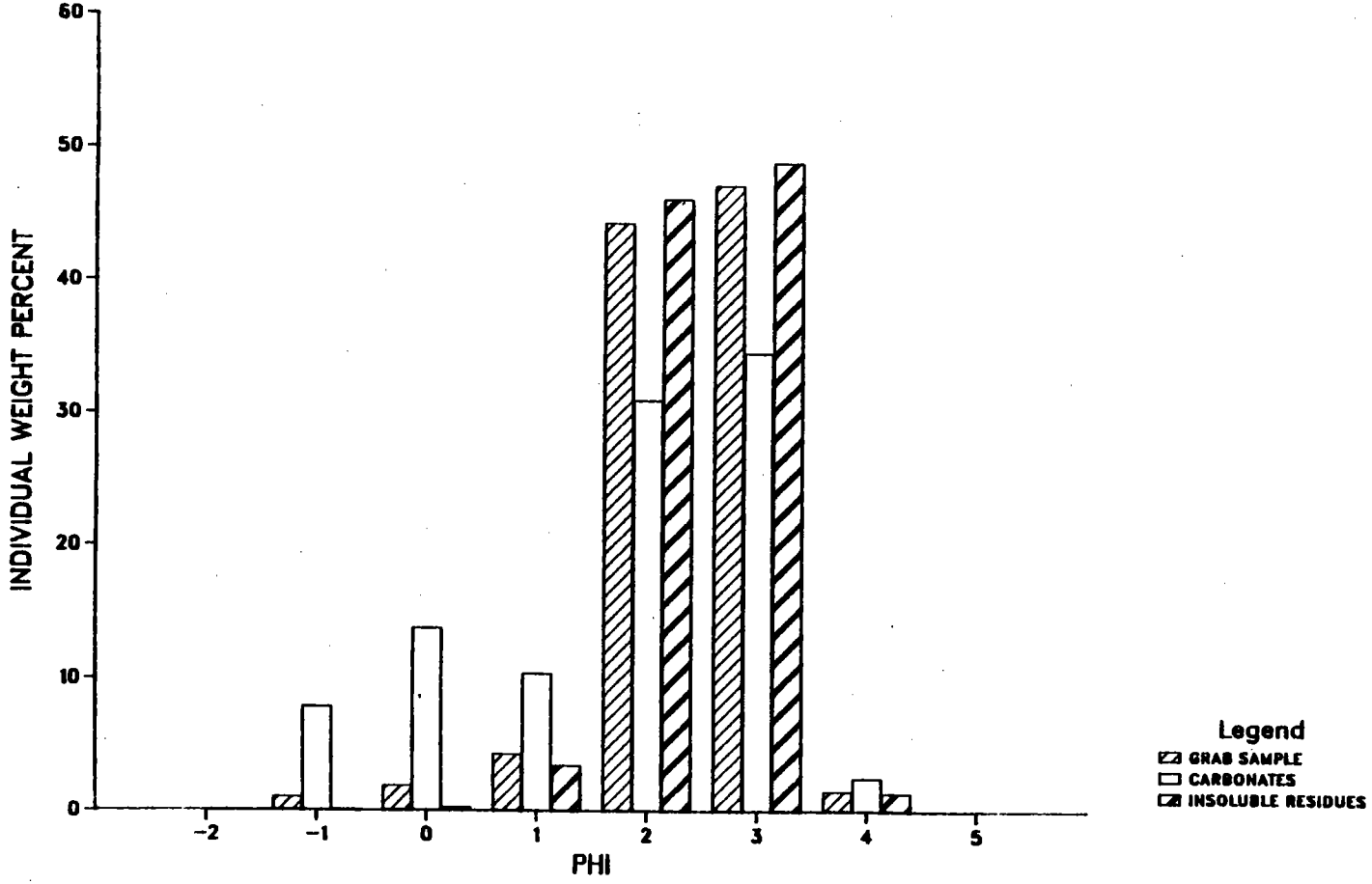
GRAIN SIZE DISTRIBUTION, SAMPLE 54



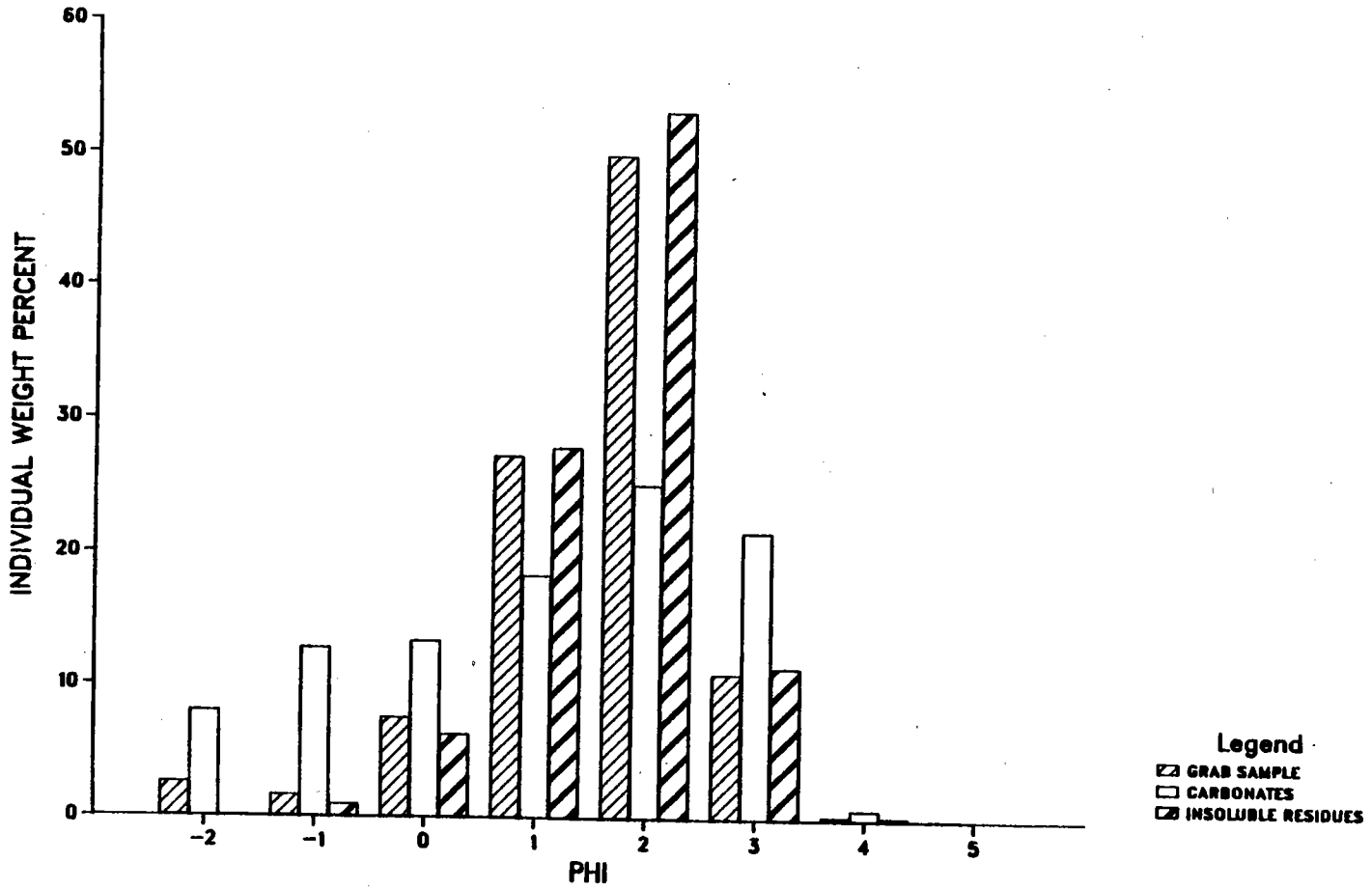
GRAIN SIZE DISTRIBUTION, SAMPLE 55



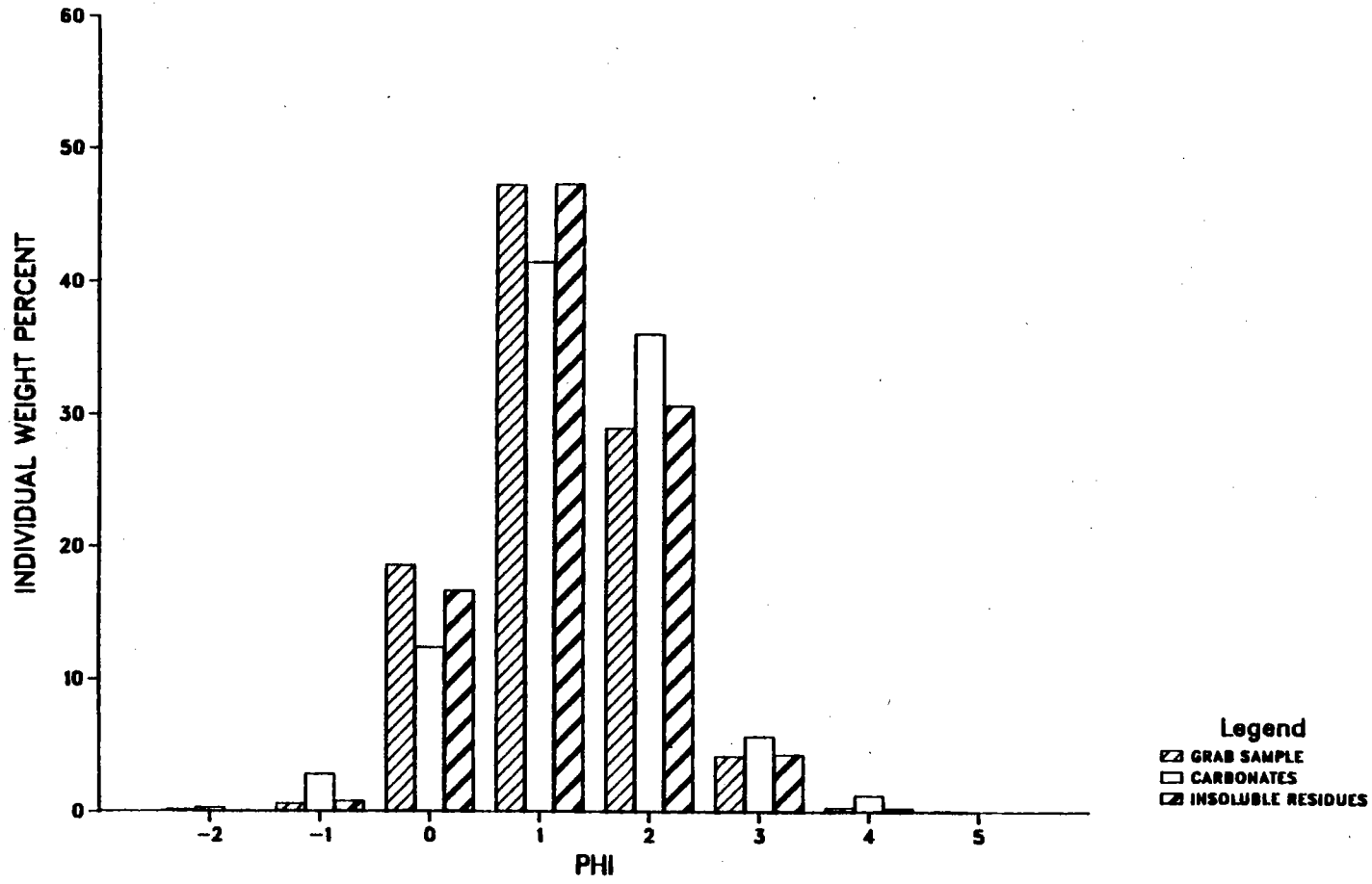
GRAIN SIZE DISTRIBUTION, SAMPLE 56



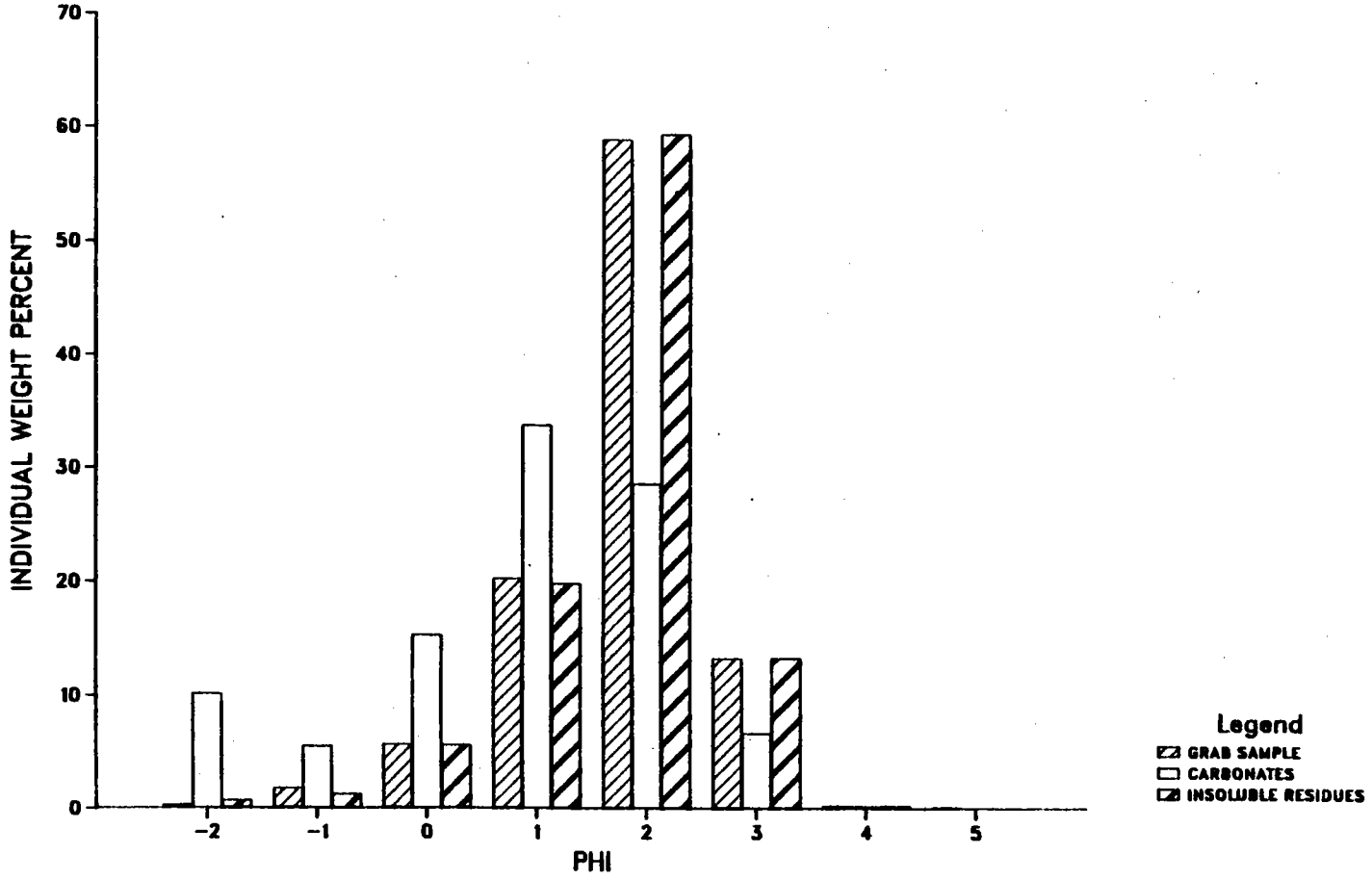
GRAIN SIZE DISTRIBUTION, SAMPLE 57



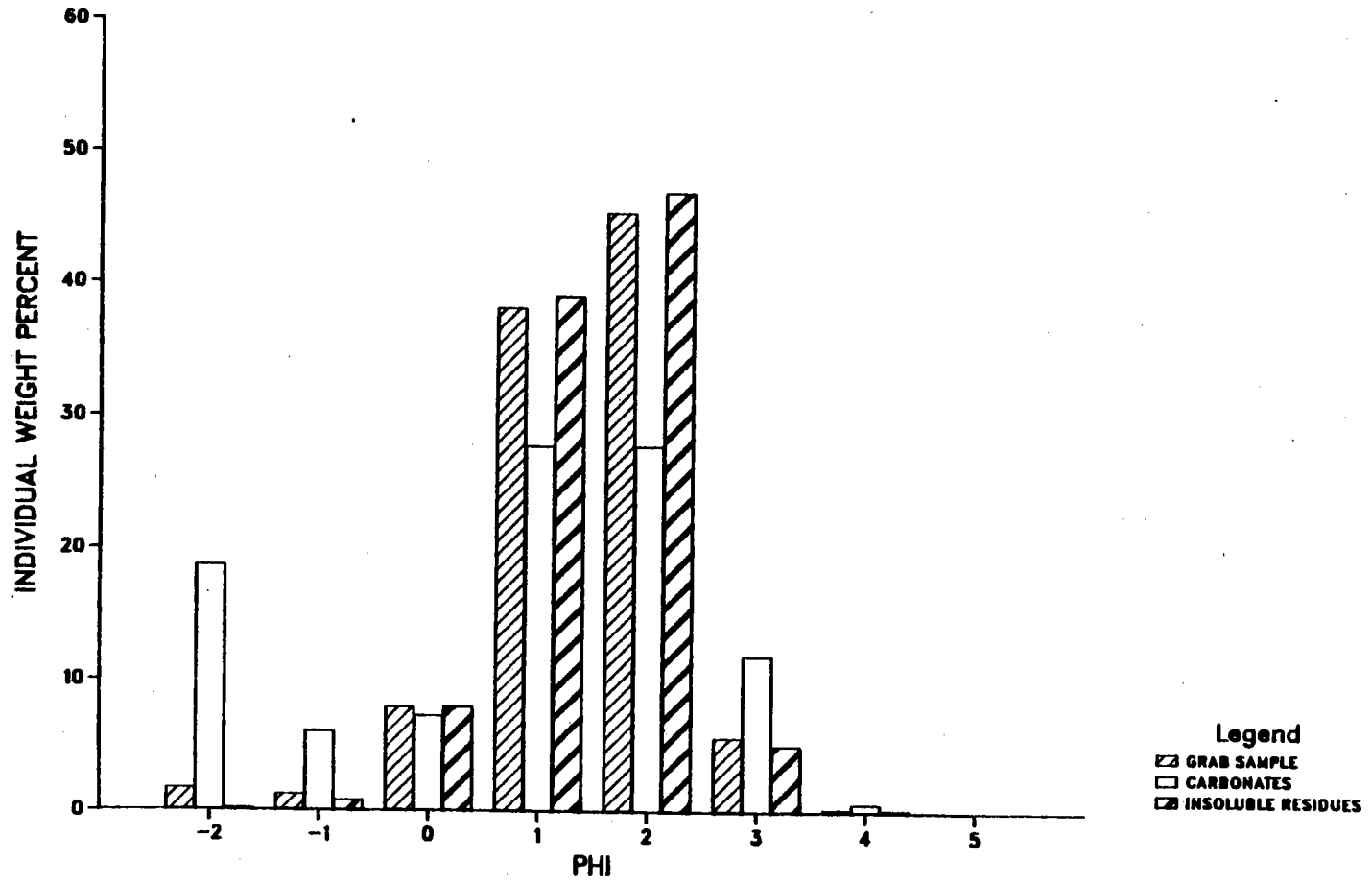
GRAIN SIZE DISTRIBUTION, SAMPLE 58



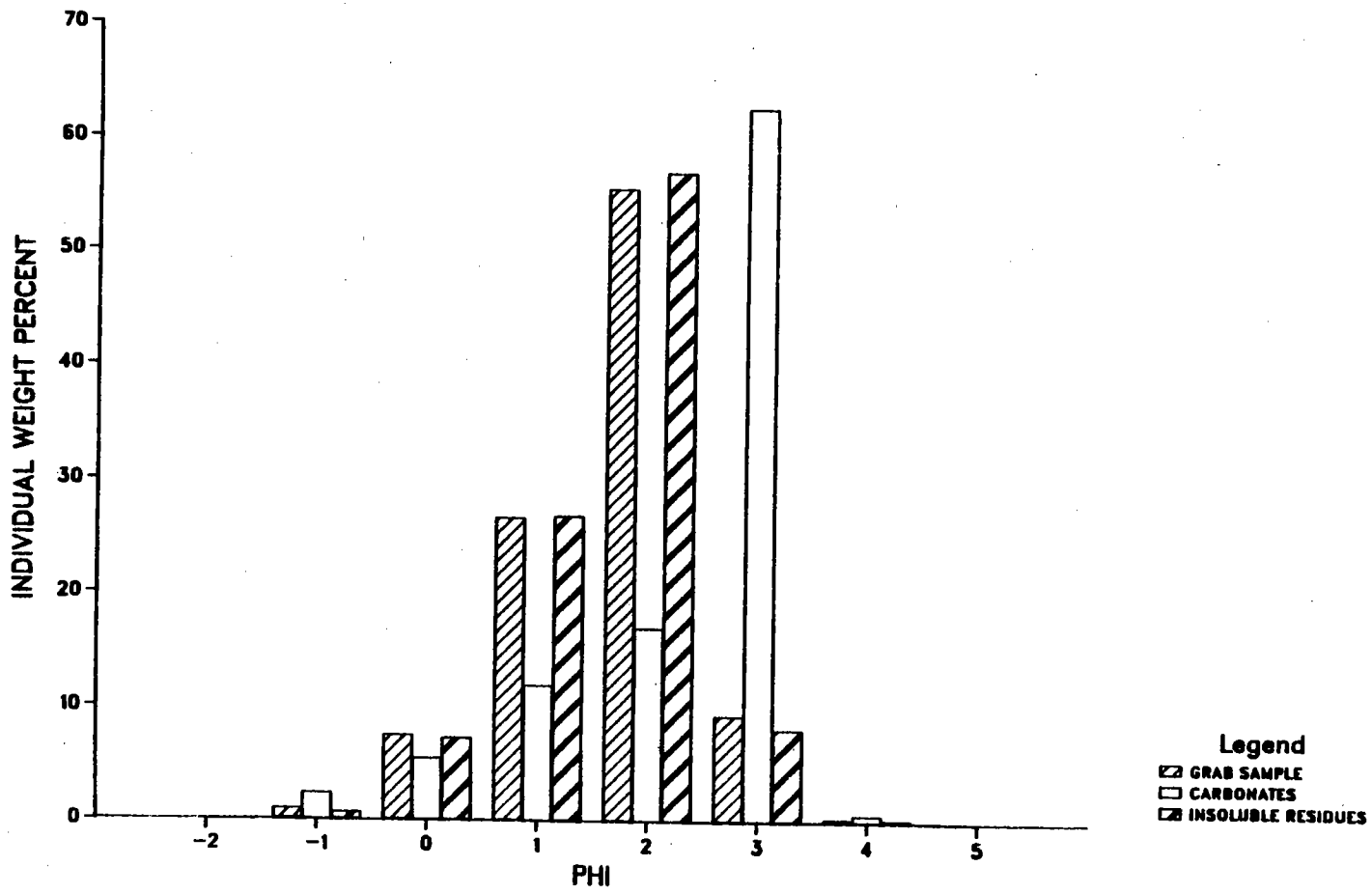
GRAIN SIZE DISTRIBUTION, SAMPLE 59



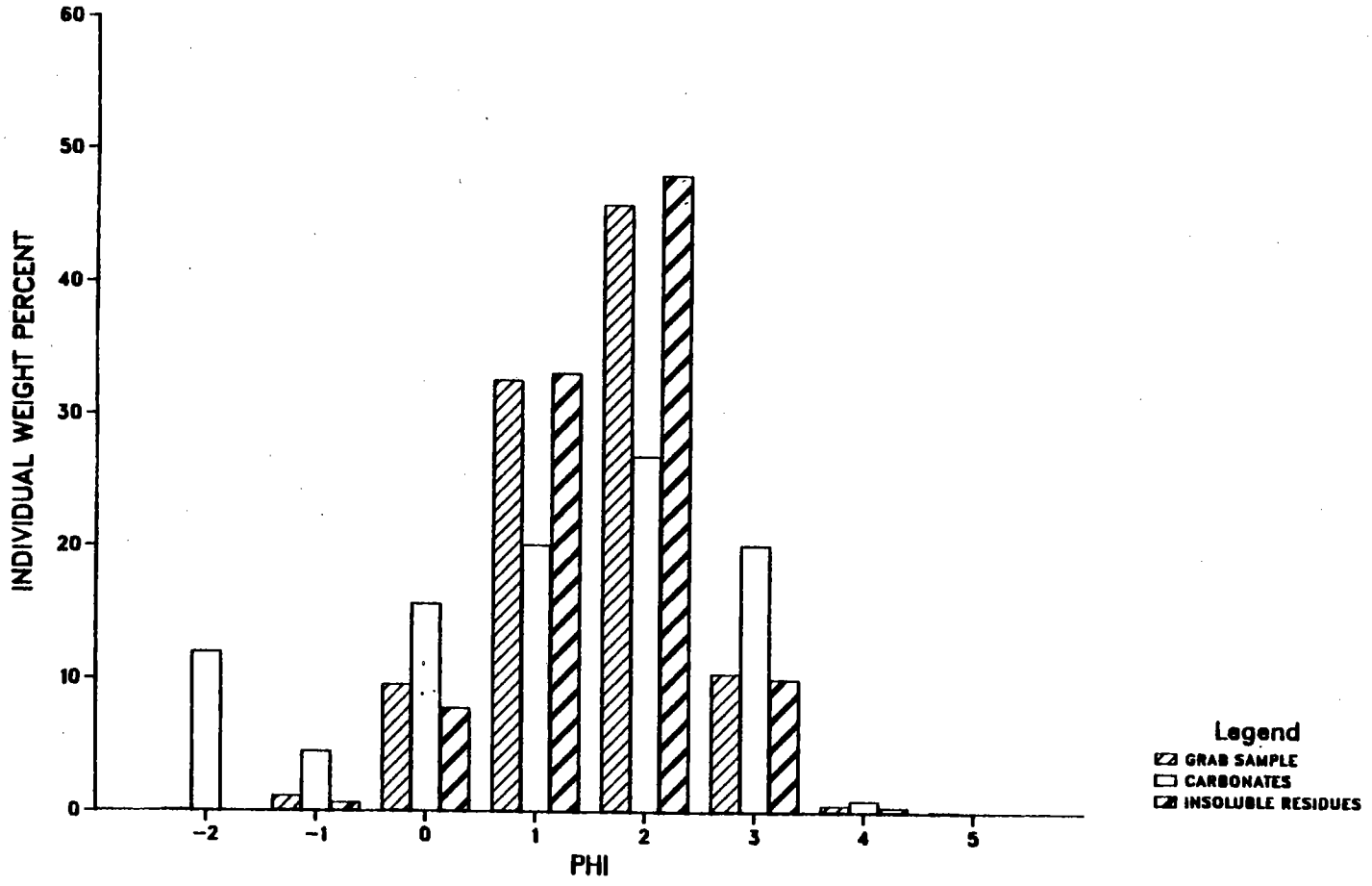
GRAIN SIZE DISTRIBUTION, SAMPLE 60



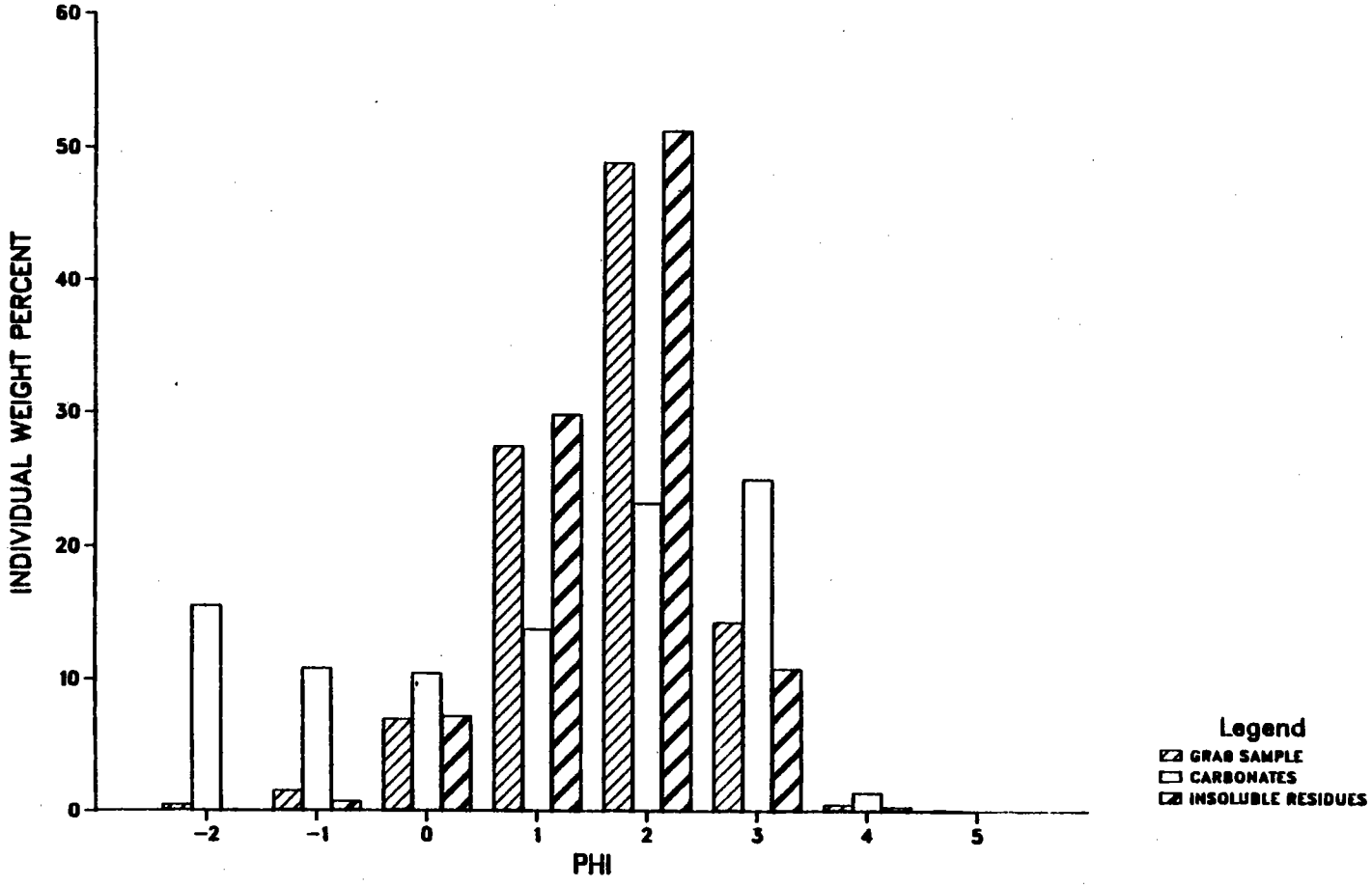
GRAIN SIZE DISTRIBUTION, SAMPLE 61



GRAIN SIZE DISTRIBUTION, SAMPLE 62



GRAIN SIZE DISTRIBUTION, SAMPLE 63



Appendix IV

SAS Cluster Program, Input Data Set, and Cluster Results

SAS Cluster Program

```
CMS FILEDEF IN DISK DEBIA DATA A;
DATA ONE; INFILE IN; INPUT V1 V2 V3 V4 V5 V6 V7 V8 V9 V10 V11 V12/
    V13 V14 V15 V16 V17 V18 V19 V20 V21 V22 V23 V24/
    V25 V26 V27 V28 V29 V30 V31 V32 V33 V34/
    V35 V36 V37 V38 V39;
PROC CLUSTER METHOD=AVE OUTTREE=TWO;
VAR V1-V39;
PROC TREE;
```

Variables

Number	Variable
1	-2ϕ weight percent, grab sample
2	-1ϕ weight percent, grab sample
3	0ϕ weight percent, grab sample
4	1ϕ weight percent, grab sample
5	2ϕ weight percent, grab sample
6	3ϕ weight percent, grab sample
7	4ϕ weight percent, grab sample
8	≥5ϕ weight percent, grab sample
9	median, grab sample
10	mean-grain-size, grab sample
11	inclusive graphic standard deviation, grab sample
12	inclusive graphic skewness, grab sample
13	graphic kurtosis, grab sample
14	-2ϕ weight percent, insoluble residues
15	-1ϕ weight percent, insoluble residues
16	0ϕ weight percent, insoluble residues
17	1ϕ weight percent, insoluble residues
18	2ϕ weight percent, insoluble residues
19	3ϕ weight percent, insoluble residues
20	4ϕ weight percent, insoluble residues
21	median, insoluble residues
22	mean-grain-size, insoluble residues
23	inclusive graphic standard deviation, insoluble residues
24	inclusive graphic skewness, insoluble residues
25	graphic kurtosis, insoluble residues
26	-2ϕ weight percent, carboates
27	-1ϕ weight percent, carbonates
28	0ϕ weight percent, carbonates
29	1ϕ weight percent, carbonates
30	2ϕ weight percent, carbonates
31	3ϕ weight percent, carbonates
32	4ϕ weight percent, carbonates
33	median, carbonates
34	mean-grain-size, carbonates
35	inclusive graphic standard deviation, carbonates
36	inclusive graphic skewness, carbonates
37	graphic kurtosis, carbonates
38	ratio of shell fragments to quartz grains
39	percent skeletal grains

Corresponding SAS Observation Numbers and Sample Numbers

SAS Observation Number	Sample Number
1	3
2	5
3	7
4	9
5	10
6	11
7	12
8	13
9	14
10	15
11	16
12	17
13	18
14	19
15	20
16	21
17	22
18	23
19	24
20	25
21	26
22	27
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SAS Observation Number	Sample Number
30	35
31	36
32	37
33	38
34	39
35	40
36	41
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40	45
41	46
42	47
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57	62
58	63

SAS

OBS	V1	V2	V3	V4	V5	V6	V7	V8	V9	V10	V11	V12	V13	V14	V15	V16	V17	V18	V19	V20
1	0.05	0.22	3.76	25.60	51.41	17.84	1.00	0.03	1.40	1.34	0.84	-0.04	1.06	0.00	0.08	3.23	25.95	53.12	16.87	0.76
2	0.74	2.90	9.69	17.50	24.32	40.44	2.06	0.06	1.72	1.51	1.20	-0.31	0.88	0.00	1.51	7.64	15.08	24.53	49.53	2.07
3	0.00	6.76	6.20	17.72	55.05	13.20	0.12	0.03	1.35	1.16	1.05	-0.32	1.43							
4	1.03	0.99	4.58	24.65	50.94	17.37	0.44	0.00	1.36	1.28	0.90	-0.13	1.14	0.00	0.20	3.83	25.69	53.42	16.51	0.35
5	0.00	0.28	2.52	18.94	58.37	20.07	0.20	0.02	1.49	1.47	0.78	-0.04	1.26	0.00	0.08	3.13	18.06	60.70	17.62	0.40
6	0.00	0.62	6.77	20.73	44.02	24.99	0.86	0.01	1.48	1.43	0.98	-0.11	1.10	0.00	0.06	3.71	18.20	58.46	18.84	0.71
7	0.76	1.65	9.75	34.03	44.28	9.03	0.30	0.00	1.09	1.02	0.92	-0.12	1.04	0.00	1.37	9.50	34.88	45.25	8.35	0.45
8	9.57	3.22	5.31	7.32	26.82	43.74	3.46	0.02	1.92	1.41	1.61	-0.55	1.42	0.34	0.32	1.68	4.78	33.46	54.41	5.01
9	0.24	2.45	18.39	40.70	32.08	6.84	0.15	0.02	0.71	0.71	0.99	0.01	1.02	0.04	2.73	17.64	41.84	35.48	2.22	0.04
10	2.97	1.47	6.12	25.04	49.55	18.06	0.71	0.03	1.32	1.23	1.04	-0.17	1.17	0.00	0.78	5.16	24.96	52.71	15.62	0.78
11	2.42	1.34	8.42	25.31	42.93	18.26	1.12	0.00	1.28	1.20	1.06	-0.15	1.10	0.00	1.02	8.49	24.40	45.68	17.42	0.99
12	0.92	5.06	19.72	27.68	31.79	13.76	1.04	0.12	0.88	0.78	1.20	-0.09	0.93	0.31	3.37	17.69	31.33	37.95	8.69	0.66
13	1.06	0.66	4.52	13.95	47.63	31.29	1.10	0.04	1.62	1.61	0.93	-0.11	1.14	0.00	0.06	3.17	13.18	57.95	25.14	0.90
14	0.00	0.93	11.09	26.86	45.32	13.42	0.37	0.07	1.20	1.10	0.95	-0.14	1.03	0.00	0.89	12.14	33.95	45.26	7.48	0.28
15	0.00	0.83	4.52	14.76	49.46	29.12	1.30	0.00	1.60	1.61	0.89	-0.07	1.11	0.00	0.39	3.80	14.84	50.98	28.82	1.17
16	0.00	0.43	3.80	22.40	48.01	14.78	0.24	0.01	1.48	1.51	1.76	0.35	3.12	0.00	0.17	4.59	27.00	55.32	12.66	0.26
17	1.27	0.91	3.47	22.16	50.30	18.94	0.73	0.01	1.40	1.33	0.95	-0.14	1.20	0.04	0.28	4.16	22.52	53.42	18.82	0.77
18	3.67	2.92	12.37	22.82	43.64	13.80	0.77	0.05	1.19	0.97	1.19	-0.29	1.16	0.00	1.19	8.80	23.40	52.38	13.44	0.80
19	0.12	0.48	1.72	5.75	33.97	54.98	2.98	0.00	2.14	2.09	0.76	-0.27	0.93	0.00	0.00	0.94	5.37	35.57	55.41	2.70
20	1.26	3.34	14.50	29.92	40.98	7.43	0.25	0.02	0.96	0.82	1.04	-0.18	0.95	0.45	1.82	14.92	27.14	46.08	9.22	0.37
21	0.58	2.47	9.91	24.27	43.90	17.90	0.56	0.02	1.29	1.19	1.05	-0.16	1.07	0.00	0.76	7.76	25.28	51.01	14.83	0.35
22	0.50	2.03	11.35	31.48	46.80	4.96	0.63	0.04	1.10	1.00	0.92	-0.18	1.02	0.02	0.85	9.94	32.55	49.27	6.96	0.42
23	0.56	1.76	12.45	31.28	41.65	11.50	0.84	0.05	1.09	1.02	0.98	-0.11	1.02	0.00	1.10	11.45	33.10	42.68	11.12	0.55
24	0.49	2.00	9.53	25.24	44.76	13.26	1.18	0.04	1.27	1.14	1.00	-0.17	1.13	0.18	1.85	9.87	26.44	48.00	12.98	0.68
25	1.20	4.09	15.63	24.91	31.06	19.92	1.08	0.05	1.15	1.07	1.28	-0.10	0.92	0.12	2.61	12.38	25.05	34.42	19.79	3.62

OBS	V21	V22	V23	V24	V25	V26	V27	V28	V29	V30	V31	V32	V33	V34	V35	V36	V37	V38	V39
1	1.40	1.32	0.81	-0.05	1.07	1.18	0.78	3.53	26.67	38.43	27.45	1.96	1.46	1.45	0.98	-0.04	0.86		
2	2.03	1.74	1.08	-0.43	0.94	2.84	7.24	14.94	25.04	31.14	17.44	1.34	1.00	0.85	1.37	-0.18	1.02	0.390	26.67
3		1.54												0.68				0.170	13.67
4	1.38	1.30	0.80	-0.08	1.06	12.69	9.89	13.06	12.87	22.95	27.05	1.49	1.06	0.62	1.86	-0.33	0.76	0.068	6.00
5	1.47	1.43	0.75	-0.06	1.31	0.00	3.36	10.64	16.04	34.17	38.10	1.68	1.70	1.49	1.18	-0.30	1.04	0.064	5.67
6	1.47	1.45	0.79	-0.05	1.30	0.57	3.00	10.73	17.45	42.92	23.89	1.43	1.42	1.30	1.14	-0.20	1.09	0.190	10.67
7	1.09	1.03	0.89	-0.11	1.02	8.10	4.30	12.15	25.82	34.94	13.67	1.01	0.98	0.75	1.44	-0.30	1.24	0.094	8.00
8	2.17	2.08	0.75	-0.25	0.91	34.28	4.72	7.74	7.90	20.11	21.99	3.26	0.41	0.10	2.11	-0.16	0.55	0.131	10.33
9	0.71	0.69	0.89	-0.08	0.92	8.36	9.55	24.78	35.22	18.81	2.69	0.60	0.21	0.11	1.28	-0.16	1.08	0.171	14.00
10	1.36	1.26	0.85	-0.12	1.11	7.59	5.38	12.50	18.35	28.32	26.26	1.98	1.22	0.97	1.59	-0.30	1.00	0.093	8.00
11	1.31	1.23	0.87	-0.15	1.07	22.17	5.76	7.89	16.42	20.47	28.16	2.13	0.86	0.34	2.04	-0.31	0.64	0.103	8.67
12	0.91	0.81	1.09	-0.11	0.95	26.36	8.18	21.25	19.14	14.76	8.94	1.18	-0.28	-0.36	1.82	0.00	0.72	0.104	8.67
13	1.98	1.65	0.77	-0.03	1.24	0.00	2.85	9.48	18.49	44.66	22.21	2.11	1.42	1.33	1.10	-0.17	1.14	0.176	14.00
14	1.67	0.99	0.89	-0.14	0.98	3.52	5.87	20.35	27.98	29.94	11.55	0.78	0.72	0.64	1.30	-0.11	0.99	0.087	7.33
15	1.61	1.63	0.85	-0.03	1.09	0.00	4.42	10.31	14.18	37.20	31.49	2.39	1.57	1.41	1.20	-0.25	1.02	0.137	11.00
16	1.33	1.23	0.78	-0.10	1.04	4.30	7.24	14.03	17.19	31.00	23.11	1.13	1.23	0.99	1.49	-0.28	0.93	0.057	5.00
17	1.43	1.38	0.84	-0.06	1.14	9.30	7.73	11.76	13.44	26.23	29.72	1.81	1.30	0.99	1.73	-0.37	0.86	0.026	2.33
18	1.32	1.18	0.92	-0.20	1.16	2.66	15.98	18.91	19.44	20.90	19.97	2.13	0.64	0.59	1.98	-0.05	0.76	0.112	9.33
19	2.15	2.06	0.70	-0.22	0.84	1.03	4.12	7.63	8.66	21.65	51.55	9.36	2.13	1.77	1.23	-0.50	1.16	0.139	11.00
20	1.12	0.97	0.99	-0.20	0.99	6.55	11.84	23.94	24.51	20.61	11.70	1.29	0.33	0.33	1.51	-0.02	0.94	0.064	5.67
21	1.32	1.20	0.90	-0.17	1.11	7.63	12.92	17.47	17.18	25.84	17.91	1.03	0.70	0.50	1.66	-0.18	0.84	0.086	7.33
22	1.14	1.04	0.86	-0.17	0.99	5.02	6.89	21.23	28.26	26.54	10.62	1.43	0.60	0.55	1.38	-0.08	1.01	0.096	8.33
23	1.10	1.03	0.94	-0.10	1.02	0.85	5.51	15.14	18.79	16.74	42.00	1.00	1.58	1.29	1.38	-0.33	0.76	0.148	12.33
24	1.24	1.12	0.96	-0.18	1.09	4.55	4.61	6.68	11.46	38.54	33.48	0.67	1.59	1.38	1.35	-0.35	1.33	0.178	14.33
25	1.27	1.23	1.15	-0.08	0.98	8.22	12.57	18.58	15.33	16.99	22.79	5.52	0.69	0.62	1.81	-0.09	0.77	0.170	13.33

SAS

OBS	V1	V2	V3	V4	V5	V6	V7	V8	V9	V10	V11	V12	V13	V14	V15	V16	V17	V18	V19	V20
51	0.00	0.99	1.87	4.27	44.28	47.10	1.49	0.00	1.97	1.95	0.74	-0.12	0.90	0.00	0.05	0.24	3.43	46.10	48.82	1.35
52	2.54	1.59	7.47	27.26	49.91	10.92	0.25	0.03	1.22	1.10	0.96	-0.22	1.15	0.03	0.92	6.24	27.91	53.24	11.44	0.22
53	0.13	0.55	18.56	47.28	28.96	4.18	0.31	0.04	0.65	0.69	0.86	-0.02	0.96	0.00	0.77	16.65	47.33	30.68	4.30	0.26
54	0.28	1.74	5.62	20.22	59.93	13.21	0.19	0.09	1.38	1.25	0.85	-0.22	1.35	0.67	1.22	5.57	19.78	59.31	13.25	0.20
55	1.66	1.20	7.88	38.12	49.36	3.60	0.17	0.02	2.02	1.98	0.84	-0.15	0.98	0.11	0.77	7.94	39.06	46.96	5.04	0.13
56	0.00	0.90	7.45	26.64	55.49	9.26	0.26	0.05	1.27	1.15	0.84	-0.20	1.10	0.00	0.65	7.22	26.84	56.97	8.12	0.20
57	0.06	1.10	9.51	32.99	45.81	10.38	0.48	0.03	1.15	1.07	0.91	-0.12	1.04	0.00	0.63	7.77	33.19	48.06	10.00	0.39
58	0.44	1.49	6.90	27.43	48.85	14.24	0.46	0.03	1.28	1.17	0.92	-0.16	1.11	0.02	0.70	7.14	29.81	51.26	10.77	0.31

OBS	V21	V22	V23	V24	V25	V26	V27	V28	V29	V30	V31	V32	V33	V34	V35	V36	V37	V38	V39
51	2.00	1.99	0.64	-0.03	0.74	0.00	7.87	13.77	10.38	30.95	34.52	2.50	1.58	1.26	1.40	-0.34	0.87	0.139	11.33
52	1.28	1.17	0.84	-0.16	1.08	7.96	12.78	13.33	16.33	25.18	21.67	0.74	0.87	0.60	1.70	-0.24	0.82	0.101	8.67
53	0.69	0.74	0.84	0.02	0.95	0.28	2.84	12.38	41.49	36.10	5.67	1.23	0.83	0.86	0.92	0.00	1.03	0.206	16.00
54	1.38	1.26	0.95	-0.22	1.37	10.15	5.48	15.28	33.74	28.55	6.63	0.17	0.56	0.42	1.39	-0.22	1.12	0.186	15.00
55	1.04	1.00	0.78	-0.15	0.88	18.71	6.04	7.24	27.77	27.77	11.87	0.60	0.65	0.12	1.82	-0.32	0.87	0.091	8.00
56	1.27	1.14	0.82	-0.21	1.08	0.00	2.35	9.45	11.90	16.98	62.70	0.62	2.21	1.88	1.04	-0.53	1.09	0.111	9.33
57	1.18	1.10	0.86	-0.11	1.02	11.96	4.91	15.60	20.10	26.86	20.10	0.87	0.89	0.68	1.65	-0.24	0.96	0.091	8.00
58	1.24	1.14	0.86	-0.15	1.05	15.92	10.80	10.41	13.75	23.18	24.95	1.38	0.96	0.47	1.93	-0.33	0.71	0.092	5.33

SAS

AVERAGE LINKAGE CLUSTER ANALYSIS

EIGENVALUES OF THE COVARIANCE MATRIX

	EIGENVALUE	DIFFERENCE	PROPORTION	CUMULATIVE
1	797.403	479.431	0.539877	0.53988
2	317.972	200.658	0.215281	0.75516
3	117.314	22.007	0.079427	0.83459
4	95.307	39.516	0.064527	0.89911
5	55.791	23.151	0.037773	0.93688
6	32.640	4.150	0.022098	0.95898
7	28.489	12.597	0.019288	0.97827
8	15.892	11.206	0.010759	0.98903
9	4.686	0.125	0.003173	0.99220
10	4.561	1.632	0.003088	0.99529
11	2.929	1.682	0.001983	0.99728
12	1.247	0.232	0.000845	0.99812
13	1.015	0.451	0.000687	0.99881
14	0.564	0.165	0.000382	0.99919
15	0.399	0.031	0.000270	0.99946
16	0.368	0.214	0.000249	0.99971
17	0.154	0.069	0.000104	0.99981
18	0.085	0.040	0.000058	0.99987
19	0.046	0.009	0.000031	0.99990
20	0.036	0.005	0.000025	0.99993
21	0.032	0.010	0.000021	0.99995
22	0.021	0.007	0.000014	0.99996
23	0.014	0.002	0.000009	0.99997
24	0.012	0.004	0.000008	0.99998
25	0.008	0.002	0.000006	0.99998
26	0.006	0.001	0.000004	0.99999
27	0.006	0.002	0.000004	0.99999
28	0.004	0.002	0.000003	1.00000
29	0.002	0.000	0.000001	1.00000
30	0.002	0.001	0.000001	1.00000
31	0.001	0.000	0.000001	1.00000
32	0.001	0.000	0.000000	1.00000
33	0.000	0.000	0.000000	1.00000
34	0.000	0.000	0.000000	1.00000
35	0.000	0.000	0.000000	1.00000
36	0.000	0.000	0.000000	1.00000
37	0.000	0.000	0.000000	1.00000
38	0.000	0.000	0.000000	1.00000
39	0.000		0.000000	1.00000

ROOT-MEAN-SQUARE TOTAL-SAMPLE STANDARD DEVIATION = 6.15402
ROOT-MEAN-SQUARE DISTANCE BETWEEN OBSERVATIONS = 54.3509

SAS

AVERAGE LINKAGE CLUSTER ANALYSIS

NUMBER OF CLUSTERS	CLUSTERS JOINED		FREQUENCY OF NEW CLUSTER	NORMALIZED RMS DISTANCE
54	OB27	OB52	2	0.131249
53	OB4	OB17	2	0.159792
52	OB10	OB16	2	0.174430
51	OB15	OB49	2	0.177119
50	OB14	OB22	2	0.178174
49	OB44	OB45	2	0.185103
48	OB34	OB40	2	0.187085
47	OB19	OB35	2	0.195790
46	OB18	OB21	2	0.200618
45	OB39	OB57	2	0.227868
44	CL53	CL52	4	0.236343
43	OB28	OB46	2	0.245165
42	OB6	OB13	2	0.247261
41	OB41	CL49	3	0.252763
40	CL54	OB38	3	0.261014
39	OB9	OB50	2	0.262219
38	OB7	CL50	3	0.264871
37	CL38	CL41	4	0.278895
36	CL40	CL48	4	0.285480
35	CL51	OB33	3	0.298080
34	OB30	OB55	3	0.302779
33	CL43	OB53	3	0.318857
32	CL37	OB20	3	0.332171
31	CL46	CL36	7	0.332916
30	CL44	CL31	11	0.339874
29	OB32	CL34	4	0.374458
28	OB5	CL35	4	0.391437
27	OB9	CL33	4	0.403025
26	CL30	OB11	12	0.412598
25	OB29	OB51	2	0.439190
24	CL28	CL42	5	0.444480
23	CL32	OB37	3	0.454175
22	CL45	OB24	3	0.468619
21	OB43	OB54	3	0.474402
20	CL24	CL29	11	0.482601
19	CL23	CL39	4	0.494095
18	CL47	CL27	40	0.495103
17	OB12	OB47	2	0.529633
16	CL17	OB25	3	0.544239
15	CL22	CL19	12	0.597242
14	OB8	OB58	3	0.602547
13	OB23	OB56	3	0.611742
12	CL15	CL21	32	0.624464
11	CL13	CL16	32	0.687946
10	CL12	OB26	3	0.762271
9	CL11	CL20	32	0.780270
8	CL27	OB31	3	0.799909
7	OB22	CL18	4	0.832414
6	CL9	CL10	4	0.902826
5	CL7	CL14	7	0.926059
4	CL8	OB48	4	0.995014
3	CL5	OB36	7	1.001047
2	CL6	CL4	47	1.235953
1	CL3	CL2	55	1.360230

Appendix V

Grain Count Data - Number Frequencies

Grain count data were obtained by the line method for mineralogical analysis of grain thin sections.

> "The result of the line method is a 'number frequency' ... that simply shows how often particular species were encountered during the count. The number frequency is related to, but distinctly different from the ... [area or volumle percent (modal analysis)] ... or the number percent. The number frequency is larger than the number percent for larger grains and smaller than the number percent for smaller grains. Because of ... [the built-in bias of number frequencies,] ... number frequencies cannot be treated statistically in the same manner as number or area percents ..."

(Galehouse, 1971, p. 392-394).

Samples 1, 2, 4, 6, and 8 are missing; they are not included in the sample set.

Sample 48 was too small for making a thin section.

Grain type	Sample number								
	5	7	9	10	11	12	13	14	15
Quartz	205	241	264	264	246	255	236	246	257
Shell fragments	80	41	18	17	32	24	31	42	24
Phosphate	4	5	8	6	9	4	9	2	10
Microcline	7	4	2	4	4	7	8	2	3
Plagioclase	0	1	1	1	0	1	0	0	1
Orthoclase	3	6	2	5	7	6	12	6	2
Total feldspars	10	11	5	10	11	14	20	8	6
Hornblende	0	0	1	1	0	2	0	1	3
Staurolite	0	1	1	0	1	0	1	0	0
Micas	0	1	0	0	0	0	0	0	0
Opaques	1	0	3	2	0	1	0	1	0
Others	0	1	0	0	0	0	3	0	0
Total	300	300	300	300	300	300	300	300	300

Grain type	Sample number								
	16	17	18	19	20	21	22	23	24
Quartz	252	249	238	252	241	265	268	250	238
Shell fragments	26	26	42	22	33	15	7	28	33
Phosphate	13	7	11	5	7	9	5	7	10
Microcline	4	6	3	7	9	4	4	2	9
Plagioclase	0	1	0	2	0	0	0	1	0
Orthoclase	3	7	3	7	6	5	9	9	4
Total feldspars	7	14	6	16	15	9	13	12	13
Hornblende	1	2	1	4	4	1	3	1	4
Staurolite	1	0	1	0	0	0	2	1	0
Micas	0	0	0	0	0	0	0	0	1
Opaques	0	1	0	0	0	1	1	1	1
Others	0	1	1	0	0	0	1	0	0
Total	300	300	300	300	300	300	300	300	300

Grain type	Sample number								
	25	26	27	28	29	30	31	32	33
Quartz	265	256	260	250	241	235	231	259	244
Shell fragments	17	22	25	37	43	40	46	30	43
Phosphate	5	9	4	6	7	8	10	2	2
Microcline	3	6	4	3	2	8	1	3	3
Plagioclase	0	1	0	1	1	1	1	0	0
Orthoclase	6	2	3	2	4	4	3	5	8
Total feldspars	9	9	7	6	7	13	5	8	11
Hornblende	1	2	2	1	2	1	7	1	0
Staurolite	2	2	2	0	0	0	0	0	0
Micas	0	0	0	0	0	2	1	0	0
Opaques	1	0	0	0	0	1	0	0	0
Others	0	0	0	0	0	0	0	0	0
Total	300	300	300	300	300	300	300	300	300

Grain type	Sample number								
	34	35	36	37	38	39	40	41	42
Quartz	224	254	233	254	262	262	255	241	216
Shell fragments	41	31	42	27	18	19	21	26	63
Phosphate	11	3	6	8	5	7	9	16	6
Microcline	6	3	3	6	3	3	3	5	7
Plagioclase	0	0	1	0	1	0	3	0	0
Orthoclase	9	7	7	5	7	2	5	4	3
Total feldspars	15	10	11	11	11	5	11	9	10
Hornblende	6	0	3	0	3	5	3	4	3
Staurolite	2	1	2	0	0	1	0	0	1
Micas	0	0	0	0	1	0	0	0	0
Opaques	1	1	3	0	0	1	1	2	1
Others	0	0	0	0	0	0	0	2	0
Total	300	300	300	300	300	300	300	300	300

Grain type	Sample number								
	43	44	45	46	47	49	50	51	52
Quartz	195	253	249	270	270	266	264	253	229
Shell fragments	77	33	26	15	22	18	16	30	52
Phosphate	10	5	11	8	2	8	13	8	10
Microcline	2	3	3	1	2	4	0	4	4
Plagioclase	0	2	1	1	0	0	0	0	1
Orthoclase	7	4	8	2	3	3	4	2	0
Total feldspars	9	9	12	4	5	7	4	6	5
Hornblende	3	0	1	0	0	0	0	0	2
Staurolite	1	0	0	0	0	0	0	2	0
Micas	0	0	0	0	0	0	0	0	0
Opaques	5	0	0	0	0	1	1	1	2
Others	0	0	1	1	0	0	2	0	0
Total	300	300	300	300	300	300	300	300	300

Grain type	Sample number								
	53	54	55	56	57	58	59	60	61
Quartz	211	249	256	245	257	233	242	264	253
Shell fragments	78	26	22	34	26	48	45	24	28
Phosphate	0	9	15	9	8	3	5	1	4
Microcline	3	7	1	2	3	8	3	4	5
Plagioclase	0	1	0	1	1	1	0	0	1
Orthoclase	5	4	4	5	2	4	3	7	4
Total feldspars	8	12	5	8	6	13	6	11	10
Hornblende	1	2	0	3	0	2	2	0	3
Staurolite	0	1	1	0	2	0	0	0	0
Micas	0	0	0	0	0	0	0	0	0
Opaques	1	0	1	1	1	0	0	0	2
Others	1	1	0	0	0	1	0	1	0
Total	300	300	300	300	300	300	300	300	300

Grain type	Sample number	
	62	63
Quartz	264	174
Shell fragments	24	16
Phosphate	3	16
Microcline	6	6
Plagioclase	0	0
Orthoclase	3	2
Total feldspars	9	8
Hornblende	0	3
Staurolite	0	2
Micas	0	0
Opaques	0	1
Others	0	0
Total	300	300