SEDIMENTOLOGY OF A FRESHWATER TIDAL SYSTEM, PITT RIVER - PITT LAKE, BRITISH COLUMBIA

by

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ABSTRACT

Pitt River, 30 km inland from Vancouver, British Columbia at the southern margin of the Coast Mountains, links Fraser River estuary and Pitt Lake. Salt water seldom extends to within 10 km of Fraser - Pitt confluence; nevertheless, tides modulate Fraser flow and cause Pitt River to fluctuate 2 m and Pitt Lake as much as 1.2 m. There is an upstream movement of sediment in Pitt River from Fraser River, evidenced by identical mineralogy of Pitt River and Fraser River sediments, a decrease in grain size from the Fraser to Pitt Lake, and a predominance of flood-oriented bedforms in the river channel. A delta of 12 km^2 area has accumulated at the lower (draining) end of the lake.

The purposes of the study were to: (1) examine aspects of the hydrodynamics of Pitt River and Pitt Lake as a tidal system; (2) evaluate the effect of bidirectional flow on river and delta morphology; (3) determine processes of sediment movement in the river and of sediment dispersal on the delta; and (4) estimate present sedimentation rate on the delta.

Water Survey of Canada stage data from 3 locations in the system, used in conjunction with velocity measurements (profiles and tethered meter), revealed large seasonal and tidal variations in discharge. Calculations indicate that flood basal shear stress peaks early in the flow, whereas ebb currents have a lower basal shear stress which peaks late in the flow. Thus, sediment moves farther forward on a flood flow than it moves back on the succeeding ebb.

Studies of the river channel using hydrographic charts revealed regular meanders (λ_M = 6100 m) and evenly spaced riffles and pools which are scaled to the strongest flow (winter flood current, Q_e). Meander point bars are accreting on the "upstream" side indicating deposition by the flood-oriented flow. The three dimensional geometry of the large-scale bedforms which cover the sandy thalweg of both river and delta channel was determined by echo sounding and side-scan sonar. Three distinct sizes (height/spacing = 0.8 m/10-15m; 1.5 m/25-30 m; 3 m/50-60 m) of large-scale bedforms (sand waves) were found; their linear relationship of height vs. spacing (λ_B) on log-log plot suggests a common genesis. The size appears to be related to channel geometry, not to depth of flow. Largest forms are found in reaches which shallow in the direction of water movement and smallest forms occur on relatively flat topography. The following tentative relationship is suggested for sandy meandering rivers: $\lambda_M/\lambda_B \propto Q_e$.

Pitt delta morphology was studied with aerial photos and depth soundings. Its shape is considered an excellent example of sediment diffusion and deposition from a simple jet into a low energy lacustrine environment. Analysis of 190 sediment samples from river, delta, and lake bottom shows the sediment to be polymodal. Graphical partitioning of the cumulative probability plots reveals that sediments are composed of up to 4 log-normal distributions. Each distribution is interpreted as a population related to a process of sediment transport. Five subenvironments in the Pitt system are characterized by unique combinations of these "process" populations.

Cores in the delta topsets and lake bottom sediments reveal silt and clay rhythmites, interpreted as varves. The coarse layers are deposited during winter when discharge of Fraser River is low and tidally induced discharge in Pitt system is high. The fine layers are deposited during spring run-off when additional fines are added to the lake from the Pitt basin. ^{137}Cs dating of sediments shows that as much as 1.8 cm/yr are accumulating in the active portions of the delta with an estimated 150 ± 20 X 10^3 tonnes deposited annually.

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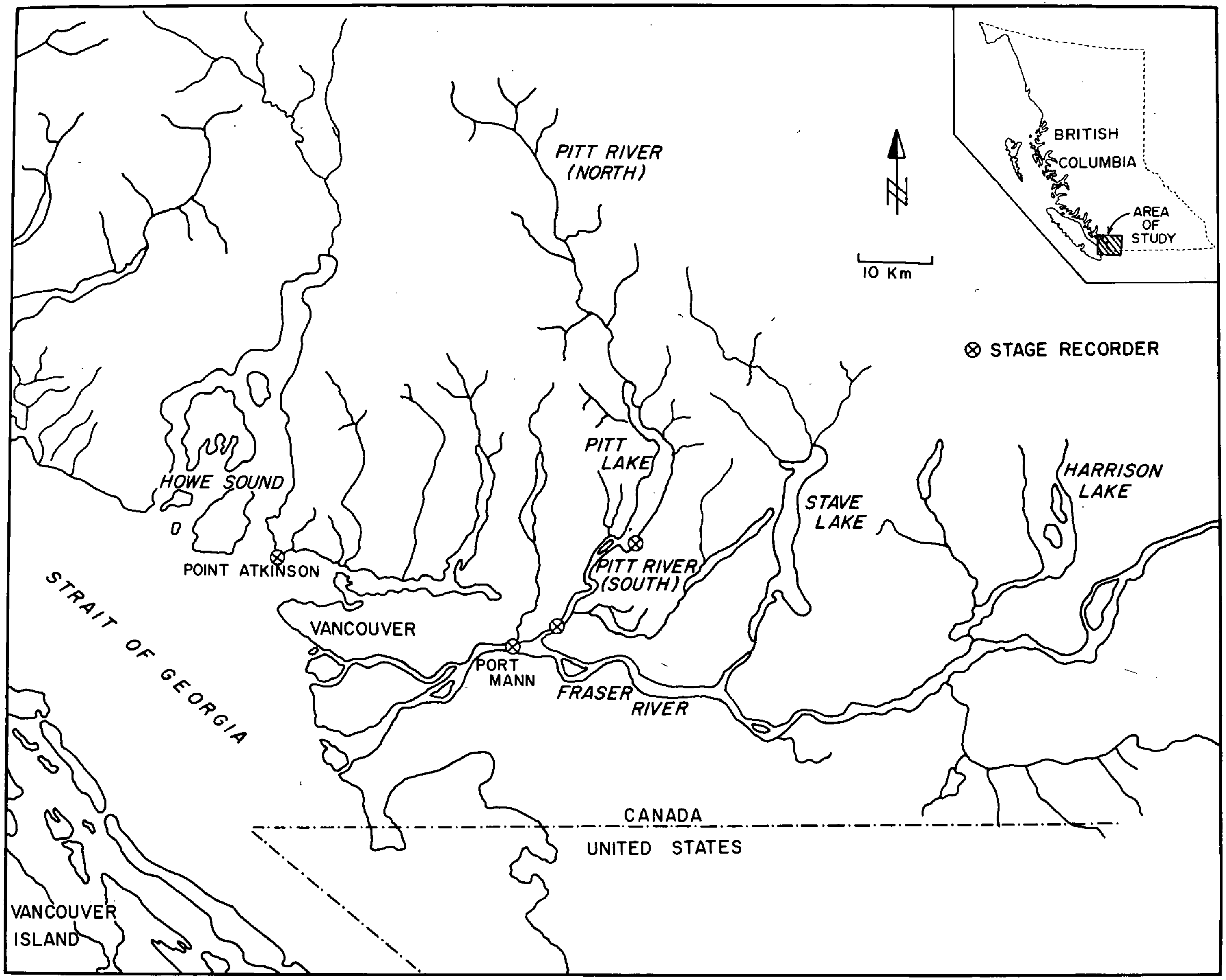
PART ONE: INTRODUCTION

Pitt River (North) - Pitt Lake - Pitt River (South) system is situated in a glacially scoured valley within the Coast Mountains, British Columbia, approximately 30 km inland from the port of Vancouver (Fig. 1). The valley of the Pitt, 70 km in length, opens abruptly into the Fraser lowland. Pitt River (North) drains 816 km^2 including several mountain glaciers and provides a mean discharge of 80 cu m/sec to the lake. Pitt River (North) is not included in this study and the term Pitt River will hereafter refer to Pitt River (South) which joins Pitt Lake to the Fraser River.

Pitt River and Pitt Lake are tidal, being connected to the ocean (Strait of Georgia) by lower Fraser River. Although water levels in the Pitt system respond to the tides, salt water seldom extends closer than 10 km downstream of the Fraser-Pitt confluence. Rising water (flood tide) in the Strait, retards flow of the Fraser and raises its elevation, or stage level, progressively eastward until the water level at the Fraser-Pitt confluence is higher than in Pitt River. Flow in the Pitt then reverses and water diverted from the Fraser flows northward up Pitt River into Pitt Lake.

FIGURE 1. Location map of Pitt River - Pitt Lake system.


PITT RIVER (NORTH)
BRITISH COLUMBIA
AREA OF STUDY
10 Km
⊗ STAGE RECORDER
PITT LAKE
HOWE SOUND
STAVE LAKE
HARRISON LAKE
POINT ATKINSON
PITT RIVER (SOUTH)
STRAIT OF GEORGIA
VANCOUVER
PORT MANN
FRASER RIVER
CANADA
UNITED STATES
VANCOUVER ISLAND

As the water elevation falls (ebb tide) in the Strait, Fraser River flow is accelerated. The surface elevation is lowered progressively eastward until the level at the Fraser-Pitt confluence is lower than that of the Pitt River. Flow then reverses in the Pitt system and drains toward the sea. Hereafter, flow northward away from the ocean and toward Pitt Lake is referred to as flood; flow returning to the Fraser River and ocean is ebb.

The Fraser River estuary, Pitt River, and Pitt Lake all exhibit a time-stage asymmetry. That is, water elevations rise more quickly during flood tide than levels fall on the ebb. This produces a velocity inequality such that the flood usually has the highest average peak velocities.

Although Pitt River is subjected to continually reversing flow it has few estuarine characteristics. Shallow estuaries often have a branching system of tidal channels whose numbers increase in an up-estuary direction. Also they commonly have separate channels for flood and ebb flow (Pritchard, 1967). The Pitt has only a single channel for both flow directions. At least two aspects of the Pitt system may account for the distinct lack of estuarine characteristics. (1) A shallow estuary whose depth would normally decrease up estuary has been replaced by a conduit (Pitt River) and a reservoir (Pitt Lake). This reservoir with large storage capacity allows flood tide water to flow through Pitt River with no more impedance than in a normal river channel. (2) Pitt basin drainage contributes a discharge which varies from 5% to 50% of the total volume of water moving through the system and thus is not always dominated by tidal flow. Pitt River is a tidal channel that can be thought of as a simple water course subjected to two different unidirectional flows with the stronger flow (flood) having the greater effect in shaping its morphology.

There is an apparent upstream movement of sediment in Pitt River from Fraser River to Pitt Lake. This is evidenced by a predominance of flood-oriented bedforms in the river channel and a decrease in grain size from the Fraser to the lake. A large area of sediment (12 km^2) is accumulating at the lower end of the lake. The purposes of this study are to examine the hydrodynamics of the Pitt as a tidal river and to evaluate the effect of bi-directional flow on both sediment movement and the development of the present day channel morphology.

GEOLOGIC HISTORY

During the Pleistocene Epoch, repeated glaciations aided by pre- and inter-glacial stream activity, have deeply eroded valleys oriented along a north-west and north-east oriented joint pattern occuring in the Coast Mountains (Peacock, 1935). Following the most recent deglaciation (15,000 - 11,000 B.P.) the melting ice left numerous elongate lakes in interior valleys and a coastline dominated by fiords. However, in early postglacial times the location of the shore fluctuated as a result of complex interaction of eustatic sealevel changes and crustal rebound (Mathews _et_ _al_., 1970). During this period of instability, ocean waters flooded past the mouth of Pitt Valley, as evidenced by marine shells (12,690 ± 190 B.P.; I5959, Mathewes, 1973) collected at an elevation of 107 m on the east side of Pitt valley. Glaciomarine sediment (up to 275 meters thick) was deposited in the valley during this post-glacial period. Isostatic uplift began around 13,000 B.P. and was essentially complete by 8,000 B.P. (Mathews, _et_ _al_., 1970). Fraser River, supplied by abundant glacial sediment, rapidly constructed a delta westward and by 8,290 ± 140 B.P. (G.S.C. 229, Dyck _et_ _al_., 1965) "Pitt Fiord" was sealed off at its southern end by this delta. It is likely that a short tidal channel maintained a connection between the fiord and Fraser estuary. Tidal currents flowing through this channel must have carried sediment from Fraser River into the fiord, building a flood tidal delta which continued to grow northward as the Fraser delta progressed westward. By 4,645 ± 95 B.P. (I7047; Mathews, 1976, pers. comm.) the leading edge of the Pitt delta stood at least 20 km north of Fraser River near the present outlet of Pitt Lake (Fig. 1). At some time during this period "Pitt Fiord" was flushed of saline water and became Pitt Lake. No salt water remains in the lake; not even in deepest basin (150 m). As the sea-land relationship has been much the same as at present since 5,500 B.P. (Mathews et al., 1970), it is probable that Pitt Lake has been in existence for at least six thousand years. During the last 4,700 years, Pitt tidal delta has advanced up to 6 km farther into Pitt Lake at an average rate of 1.28 $m.yr.^{-1}$. However, this sedimentation rate has most likely decreased exponentially, starting at meters per year and tapering off to the present rate of approximately a centimeter per year (Ashley, 1977).

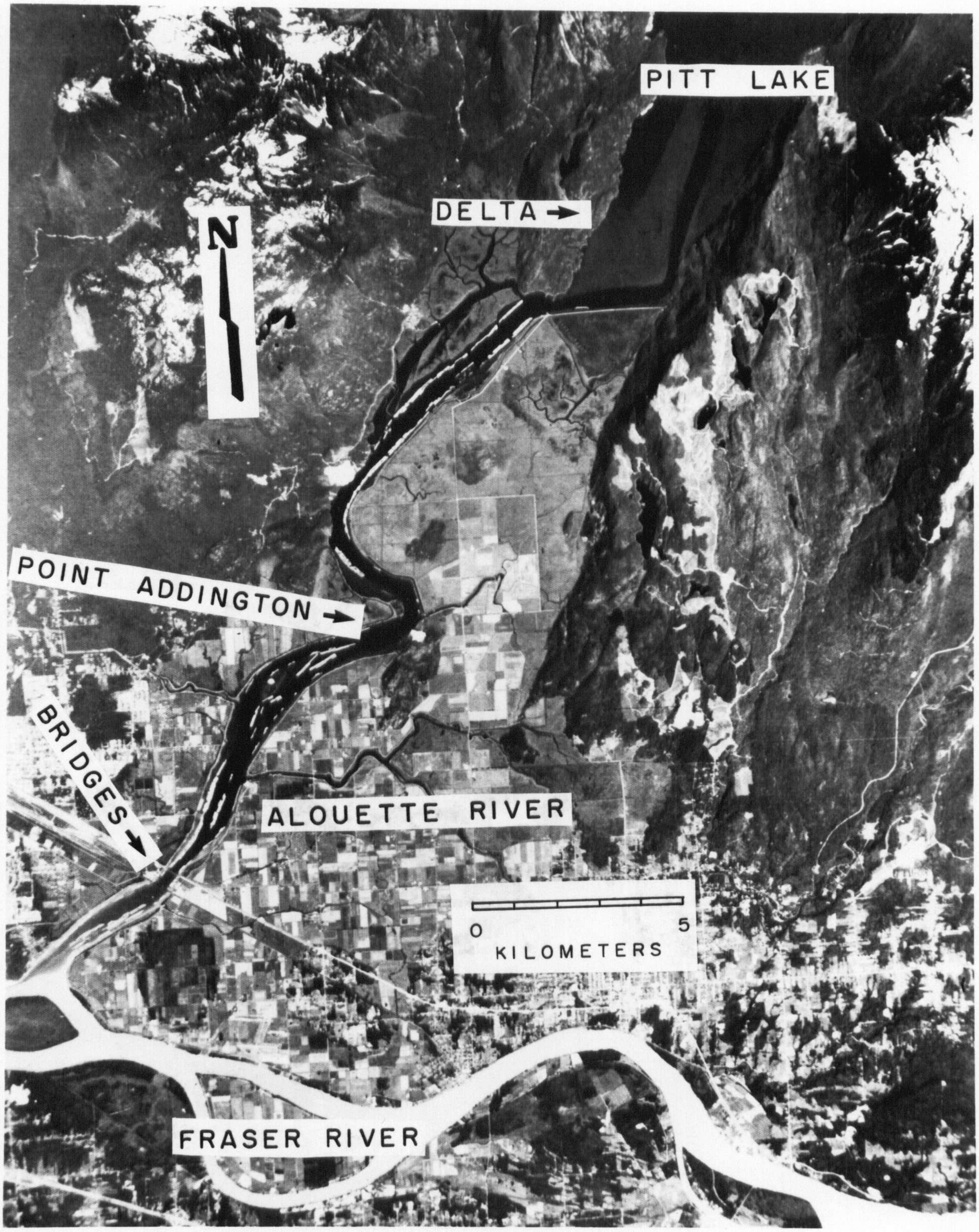
Pitt River presently flows along the western edge of the valley and there is no geomorphic evidence on the floodplain to suggest that the channel has migrated extensively during its development. Dikes built along 85% of the river shoreline during the last 50 years are for flood prevention rather than to prevent bank erosion and appear to have no effect on controlling river processes. On the other hand two bridges, and the log storage areas constructed along most of the river banks, islands, and mid-channel shoals locally effect erosion and sedimentation.

GEOMORPHOLOGY

The Pitt River floodplain occupies the complete width (ranging from 5-10 km) of the lower Pitt Valley and 17.2 km of its length from the banks of Fraser River to the outlet of Pitt Lake (Fig.2). The Pitt River channel (20.7 km) is only slightly longer than its floodplain, resulting in a low sinuosity (Schumm, 1963) of 1.2. The floodplain surface is of low relief, less than 3 meters above mean sea level (M.S.L.), and appears to be graded to the Fraser River floodplain located to the south and west. Bedrock knobs protrude through the plain, indicating that the bedrock surface is one of moderately high relief. Boreholes (Geol. Survey of Canada, unpublished data) through the Pitt sediments reveal a monotonous sequence (up to 275 m thick) of silt and clay with occasional thin units of sand. Salt water is commonly found below 25 m. The upper portion of the silts was likely deposited in Fraser delta and "Pitt Fiord" delta in their early stages. These sediments grade up into more recent Pitt River floodplain deposits which probably contain minor amounts of Fraser overbank material.

The detailed study of the Pitt channel geomorphology was based on large-scale bathymetric charts (Dept. Public Works, 1966, unpublished data) which were verified in the

FIGURE 2. Aerial photo of lower Pitt Lake and Pitt River floodplain.


PITT LAKE
DELTA →
N
POINT ADDINGTON →
BRIDGES →
ALOUETTE RIVER
0
5
KILOMETERS
FRASER RIVER

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field by depth soundings (Raytheon, model #DE-1190; Furuno, model #F-850 Mark II series) and sidescan sonar recordings (Klein, model #400). Aerial photographs (scale, 1:15,840 and 1:31,680) were used for interpretation of planimetric features of both channel and floodplain.

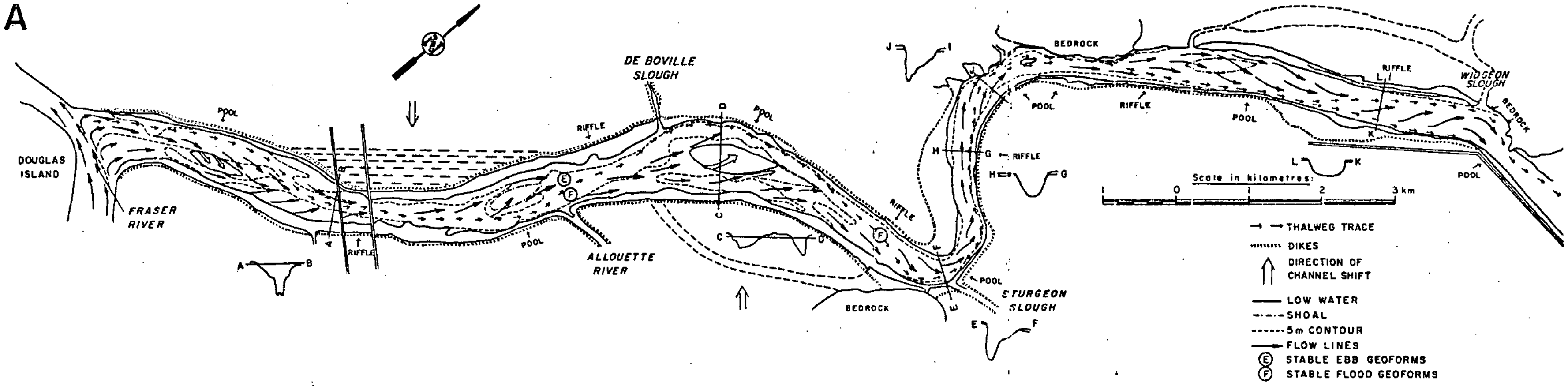
The morphology of Pitt River channel consists of several slightly curved reaches and one major s-shaped bend (Fig. 3). The location and shape of this bend appears to be mainly due to bedrock control but may be aided by tributaries entering the river at the points of maximum curvature. Bankful channel width (W) varies from 250 m to 900 m with an overall average of 600 m. The longitudinal profile (Fig. 4) shows great variability in depth with the deepest sections at the bridges and meander bends. Consequently cross-sectional area is also variable, ranging from 2390 m^2 to 4831 m^2 with a mean of 3251 m^2. Depth (d) varies from 8 m to 24.4 m, and mean depth is 12.1 m giving Pitt River a fairly low width/depth ratio of 50. Fisk (1951) and Schumm (1960) noted that rivers with fine grained bank materials would be expected to be narrow and deep, as well as slow to migrate.

The floodplain geomorphology reveals no evidence of extensive river channel migration from its present site on the west side of Pitt Valley. Since the Fraser Delta was prograding westward and ultimate base level for the

FIGURE 3A. Flow pattern of flood oriented currents. Flow lines drawn perpendicular to crests of large scale two-dimensional bed configurations (15 - 60 m in spacing, 1 - 3 m in height).

FIGURE 3B. Mean grain size (in mm) distribution map and location of current measurement sites.

A


DOUGLAS ISLAND
FRASER RIVER
POOL
RIFFLE
DE BOVILLE SLOUGH
ALLOUETTE RIVER
POOL
BEDROCK
STURGEON SLOUGH
BEDROCK
WIDGEON SLOUGH
BEDROCK
A
B
C
D
E
F
G
H
I
J
K
L
Scale in kilometres
1 0 1 2 3 km
THALWEG TRACE
DIKES
DIRECTION OF CHANNEL SHIFT
LOW WATER
SHOAL
5m CONTOUR
FLOW LINES
Ⓔ STABLE EBB GEOFORMS
Ⓕ STABLE FLOOD GEOFORMS

B

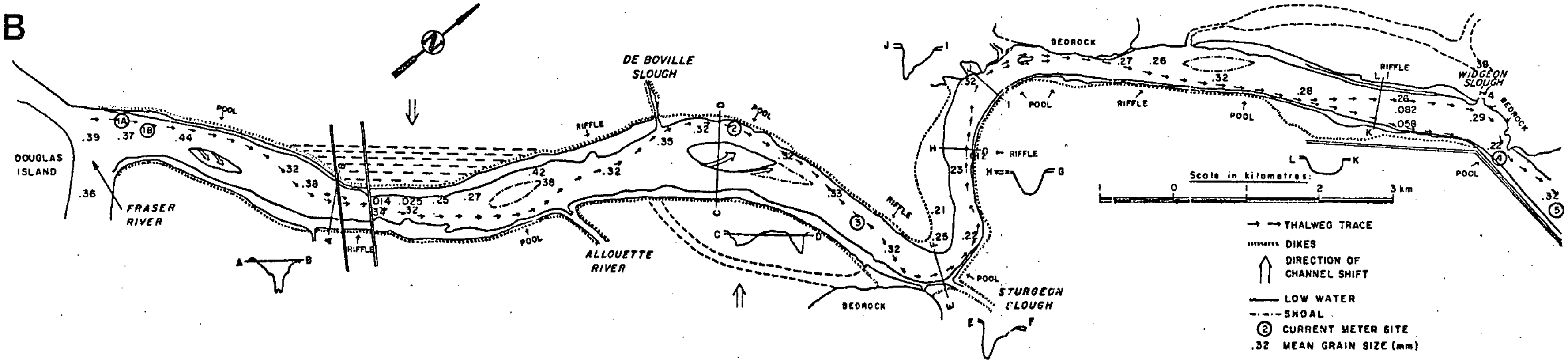
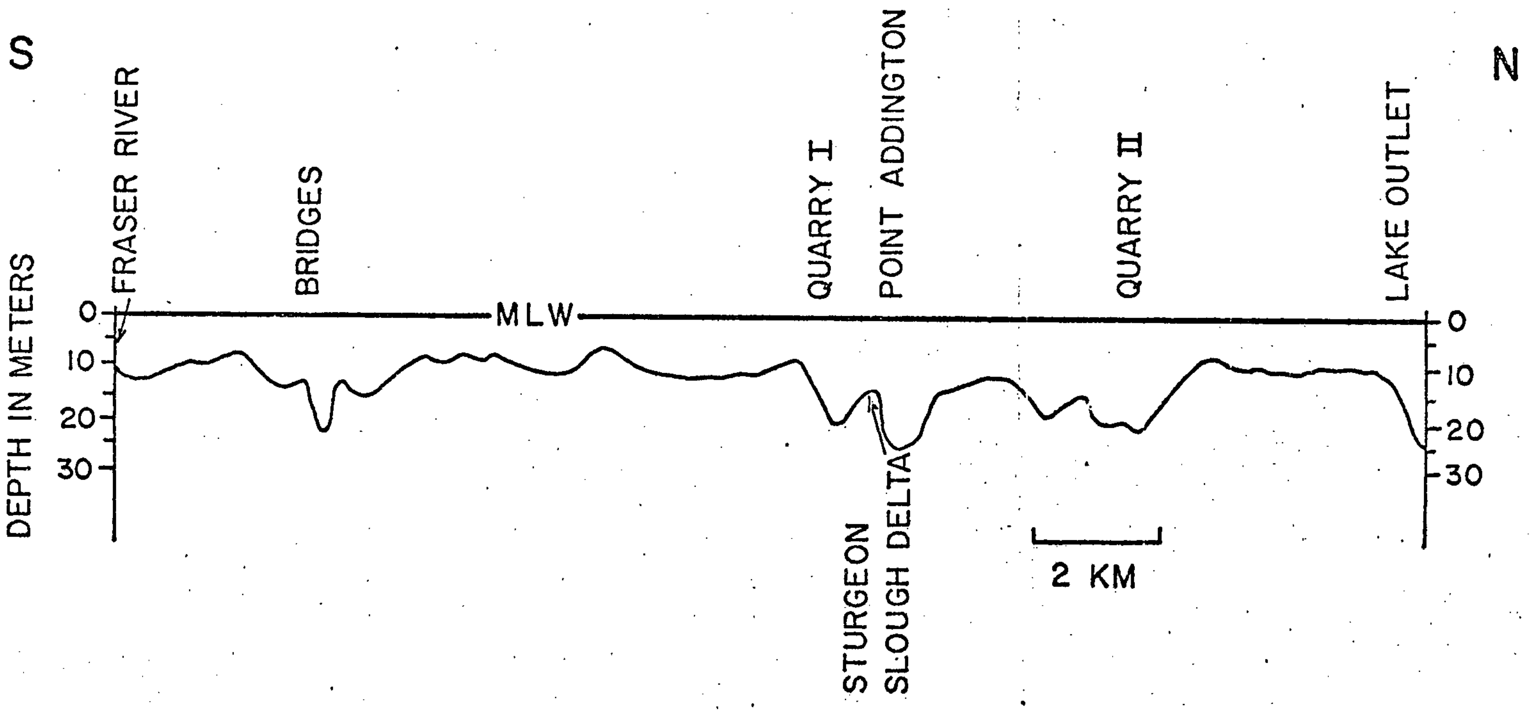

DOUGLAS ISLAND
FRASER RIVER
POOL
RIFFLE
DE BOVILLE SLOUGH
ALLOUETTE RIVER
BEDROCK
STURGEON SLOUGH
WIDGEON SLOUGH
.39
.37
.36
.44
.32
.38
.014
.025
.25
.27
.42
.38
.32
.35
.33
.21
.23
.25
.22
.27
.26
.28
.26
.082
.058
.29
.22
.32
Scale in kilometres
1 0 1 2 3 km
THALWEG TRACE
DIKES
DIRECTION OF CHANNEL SHIFT
LOW WATER
SHOAL
② CURRENT METER SITE
.32 MEAN GRAIN SIZE (mm)

FIGURE 4. Longitudinal profile along thalweg of Pitt River.

PITT RIVER
LONGITUDINAL PROFILE
THALWEG TRACE
VERT. Ex 80x



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former "Pitt Fiord" (the ocean) was also to the west, the early tidal channel was likely positioned on the valley's west side. As sediment gradually filled in the fiord and the channel lengthened it would tend to remain on the west. In addition, Alouette River (Fig. 2), the main tributary of Pitt River, flows westward and would reinforce this tendancy. Not only has the general location of the Pitt channel apparently been stable, but even locally there have been few major channel changes. Fig. 3 shows three displacements which in total have not had an appreciable effect in changing channel length. The two northern ones appear to have a similar origin. It is proposed that the shifts occurred by bifurcation of the channel with the growth of a mid-channel bar. The less-used channel on the inside of the bend was subsequently abandoned and another mid-channel bar would grow, again bifurcating the channel (Fig. 5). The three channel shifts occur in opposing directions so that the middle one counteracts the direction of shift of the other two. The southernmost channel displacement at the bridges appears to have occurred in small increments with no bar development. Bore-hole information (Peters, 1973) shows that the river is constrained here in its eastward movement by a deposit of organic-rich clayey silts (Fig. 6). Thus the bridges are located at the narrowest section of river where the channel is being forced against resistant bank material.

FIGURE 5. Aerial photo near Addington Point. Note meander scar and diverging flow pattern across island. Point bar is accreting on upstream side of meander.

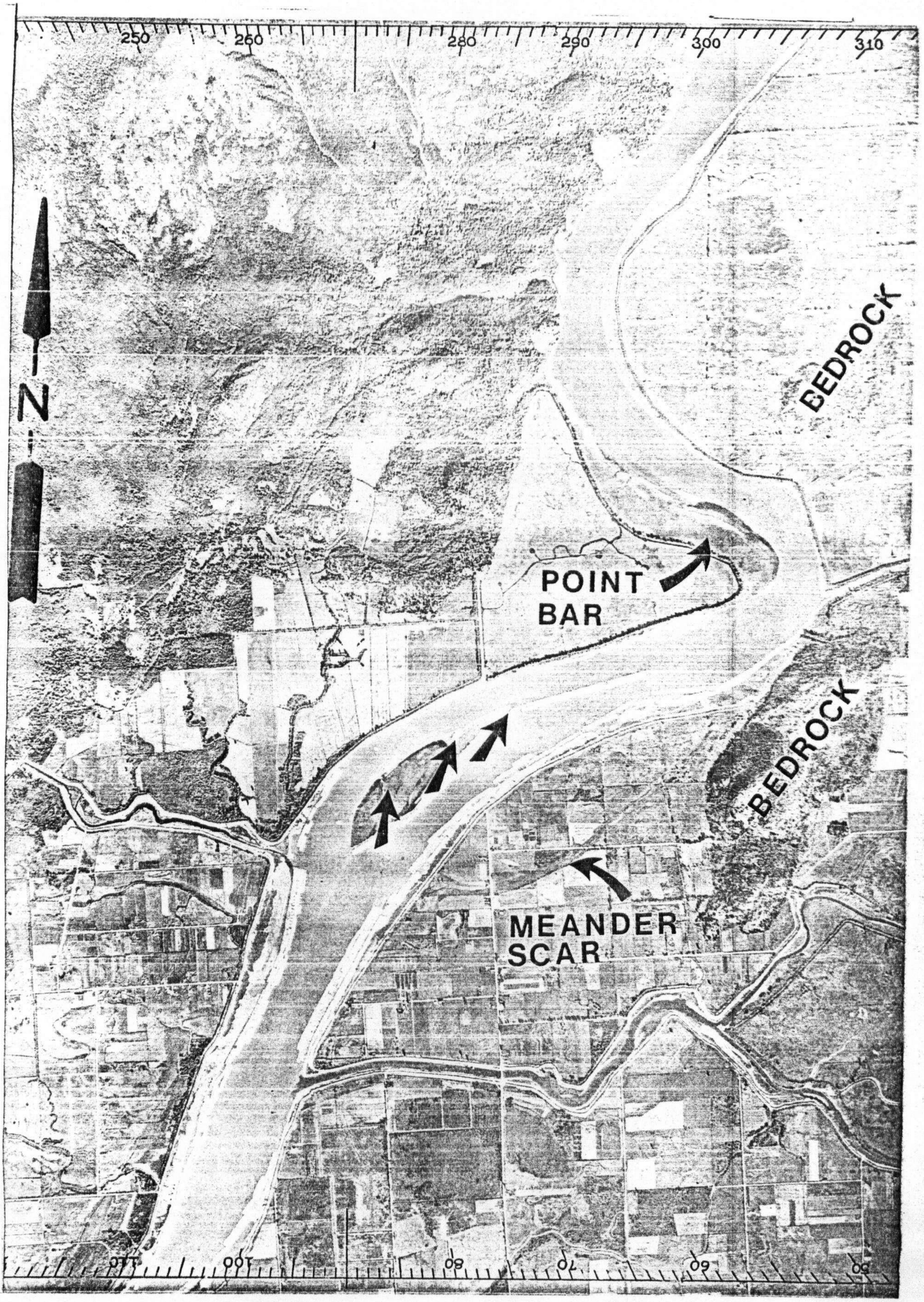
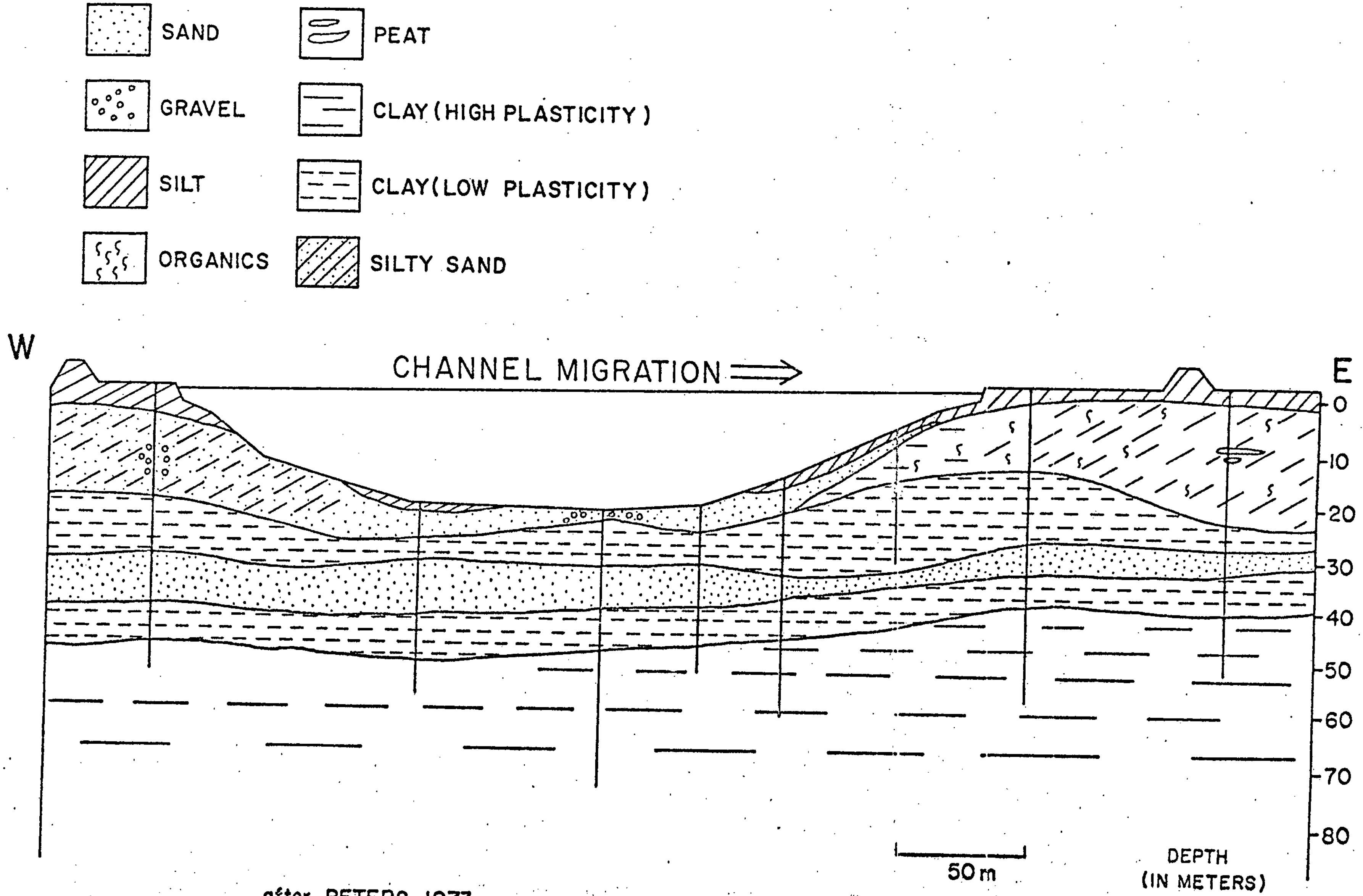

250
260
280
290
300
310
N
BEDROCK
POINT BAR
BEDROCK
MEANDER SCAR
110
100
80
70
60
50

FIGURE 6. Stratigraphic cross section at the bridges.



after, PETERS, 1973

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It is apparent from Figure 3A that the meandering pattern of the river channel is directly related to the meandering pattern of the thalweg trace. Both have an average wavelength (λ_M) of 6100 m and an average radius of curvature (r_M) of 1675 m (excluding the bedrock controlled meander, Fig. 5). Pools located at meander bends and riffles at cross-over locations of the thalweg are both spaced approximately 3000 m apart or five times channel width. A cross section at a pool shows a deep asymmetric channel (Fig. 3A-EF) whereas riffles (Fig. 3A-LK) are shallower and usually more symmetric. A section at the bridges (Fig. 3A-AB) shows a deep symmetric channel which results from the confined flow and scour around bridge pilings.

Leopold and Wolman (1960) stressed the concept that meanders form to lengthen the channel in order to minimize the time rate of energy expenditure. Also that a well developed pool and riffle sequence allows approximately equal expenditure of energy along succeeding reaches of a river. More specifically they found that there is a definite relationship in rivers between discharge, width, and radius of curvature. Figure 7 illustrates a good agreement between their findings and characteristics of the Pitt River.

Figure 8 summarizes the planform geometry of Pitt River. Several prominant bedrock outcrops, in addition to

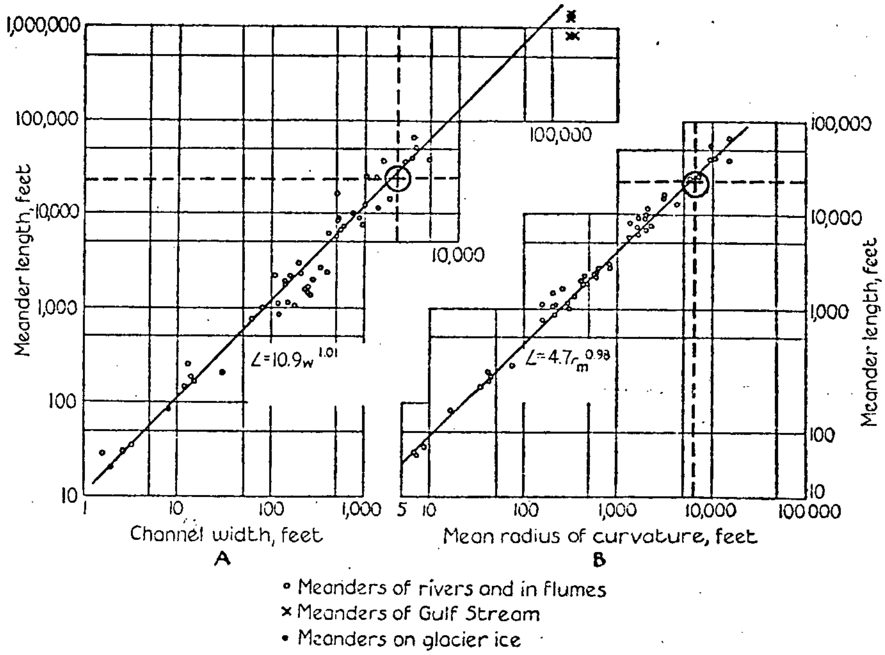
FIGURE 7. Location of Pitt hydraulic parameter values on Leopold and Wolman's (1960) plot of λ_M vs. W and λ_M vs. r_M. λ_M values ranged from 4300 to 8000 m. λ_M values (excluding the bedrock-controlled meander ranged from 1400 - 2100 m.

LEOPOLD and WOLMAN (1960)

PITT RIVER

LEOPOLD and WOLMAN (1960)	PITT RIVER
$\lambda = 10.9\ W^{1.01}$	$\lambda = 9.3\ W^{1.01}$
$\lambda = 4.7\ r_m^{.98}$	$\lambda = 4.3\ r_m^{.98}$
$r_m/w = 2-3$	$r_m/w = 2.75$

--⊕-- PITT DATA



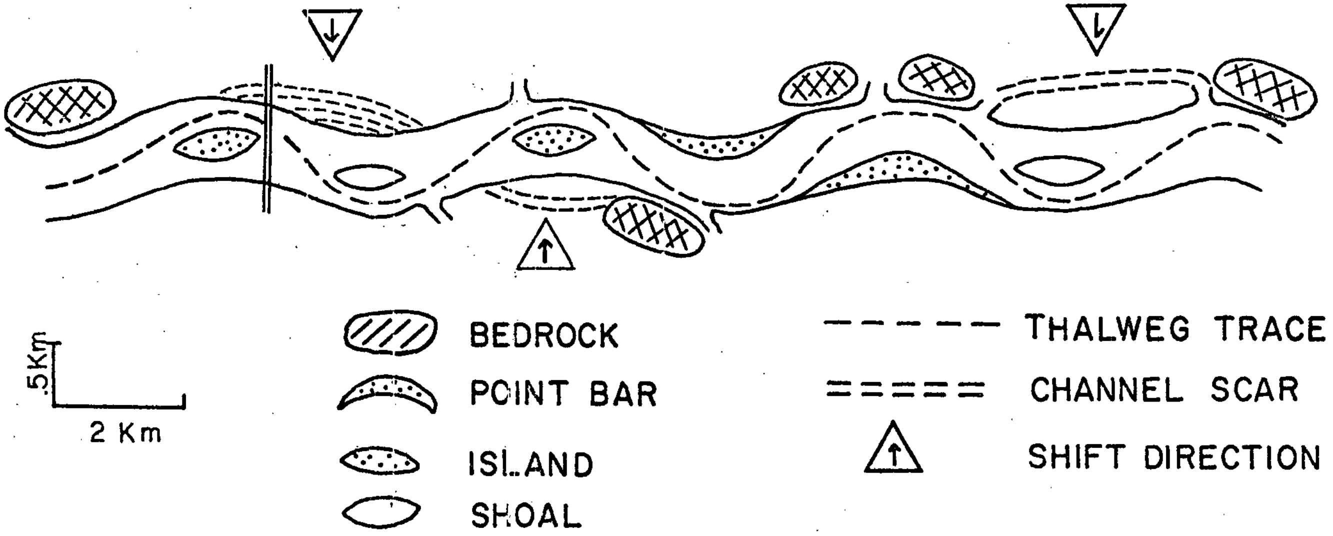
the fine-grained bank material, present physical constraints to channel migration. Either point bars, mid-channel shoals, or mid-channel bars (islands) have developed on the inside of each meander bend. A study was undertaken of the side-scan sonar and depth soundings recorded in all areas of the river to determine the pattern of flow in the channel and the origin of the mid-channel bars. Although details of this study will be covered in the section on bed configuration, results of some aspects are shown in Figure 3A. For this diagram the orientation of large scale two-dimensional bed configurations (15 - 60 m in spacing, 1 - 3 in height) were noted and flow lines drawn perpendicualr to crests. Using this information along with the topography of channel bottom the flow pattern was constructed. In general it appears to fit the converging-diverging flow model of de Leliavsky (1894) taking into consideration the effect of the bridges and bedrock outcrops on flow pattern. The pattern is drawn for the flood direction because the majority of the information available is for flood-oriented flow. Over 65% of the bed configurations on sounding records taken during all seasons and during both flood and ebb flows were flood oriented. The small amount of available information indicates that ebb flow pattern meanders with approximately the same wavelength as the flood and that it crosses the channel at the same locations (riffles). However, the position of maximum curvature of the ebb flow opposes the positon of maximum curvature of the flood (i.e., occurs on the opposite side of river).

In general each mid-channel bar (island or shoal) extends from the riffle area to the point opposite (and usually beyond) the deepest portion of the thalweg at the meander bend. The bars appear to be related to riffle formation. It is interpreted that they form by deposition during diverging flow (Fig. 5) and thus seem to be a physical extension of the riffle. However, since they form on the inside of the meander bend they also occupy the position of the point bar even though they are separated from the inside bank. Thus, at each bend in the thalweg there is either a point bar or a mid-channel bar (Fig. 8). It was not determined in this study why point bars are found at some bends and mid-channel bars at others. It should be noted, however, that point bars occur at bends of maximum curvature. In a normal river point bar deposits accrete on the downstream side of the bar and the deepest area of pools occurs on the downstream end of meander bends. Based on this premise, one may deduce that Point Addington (Fig. 5) is being constructed by flood-dominated flows and channel topography indicates that the flood-oriented current is the channel-forming flow with little modification occurring on the ebb.

FIGURE 8. Diagrammatic sketch of hydraulic geometry of Pitt River.

A = 3250 sq. m
W = 610 m
d = R = 12.1 m
λ = 6100 m
W/d = 50
CHANNEL LENGTH - 19.8 Km
SINUOSITY 1.20

Q WINTER-FLOOD = 2400 cu.m/sec. (85,000 cu.ft./sec.)
Q WINTER-EBB = 2080 cu.m/sec. (73,500 cu.ft./sec.)
Q FRESHET-FLOOD = 1800 cu.m/sec. (64,500 cu.ft./sec.)
Q FRESHET-EBB = 950 cu.m/sec. (33,500 cu.ft./sec.)
S WINTER FLOOD = +.000053
S WINTER EBB = -.000032
S FRESHET FLOOD = +.000018
S FRESHET EBB = -.000016



The interrelationship of hydraulic variables such as discharge (Q), velocity (V), depth (d), bankful width (W), resistance (n), and water slope (S_W) has long been recognized. However, the nature (dependent or independent) of the variables depends upon the hydraulic setting and the time scale under consideration. In the Pitt tidal system, Q and S_W are independent on both a short- and long-term basis while V, d, W, and n are dependent under both time scales. Q, S_W, d, W and V can all be measured and total resistance can be determined from a Manning-type equation ($n = \frac{d_*^{2/3}\ S^{1/2}}{V^2}$; d_* (mean flow depth) = $\frac{A}{W}$. Leopold and Maddock (1953) specified all five variables as power functions of discharge.

In Pitt River both water slope and discharge reverse direction regularly and vary between opposite maxima. Although, during the freshet when Pitt basin discharge is high, occasionally tidally induced backwater occurs without reversal in flow direction. Because of variable slope and discharge, it is problematic which values should be used to represent the Pitt as a hydraulic system. Both flood and ebb slopes within the Pitt can be calculated from simultaneous stage elevations as a mean over the distance between the stage recording stations (Fig. 1). Maximum possible slope on any flood or ebb of a tidal cycle would be determined by the difference in elevation between the recording stations

(Fig. 9). Discharge on any tidal cycle is determined from a product of velocity at .4 depth (measured from the bed) times an average cross sectional area (A). The actual values were probably slightly less, as the data point on Fraser River is 4 km downstream from the Fraser-Pitt confluence. Also, the maximum (or minimum) elevations in Pitt Lake and Fraser River did not occur simultaneously. The flow is non-uniform and at any point in time the water slope is variable along the system. Flow is also unsteady and the water slope varies with time at any point. To avoid this problem of variable slope, maximum slope values are chosen to characterize each flow direction and be used as a base for comparing flood and ebb flows.

The maximum water slope values for both freshet and winter measured during this study are plotted on Leopold and Wolman's (1957) slope-discharge diagram (Fig. 10). These authors intended the diagram only as a means of separating braided and meandering steams, but it can be used to illustrate the range of slope-discharge values that are found in a sampling of rivers. The Pitt data falls within the meandering regime; however, it is the maximum slope-discharge for the winter (2400 $m^3.sec^{-1}$) that is closest to the general scatter of river points. This implies that it is the winter discharge not the freshet (2080 $m^3.sec^{-1}$) which is most effective in defining the channel geometry.

FIGURE 9. Tidal range in Strait of Georgia, Fraser River, Pitt River, and Pitt Lake on four representative days in Dec., Mar., June, and Sept. Maximum mean water slope (ebb or flood) possible on a given day was calculated from the difference in elevation between Fraser River and Pitt Lake.

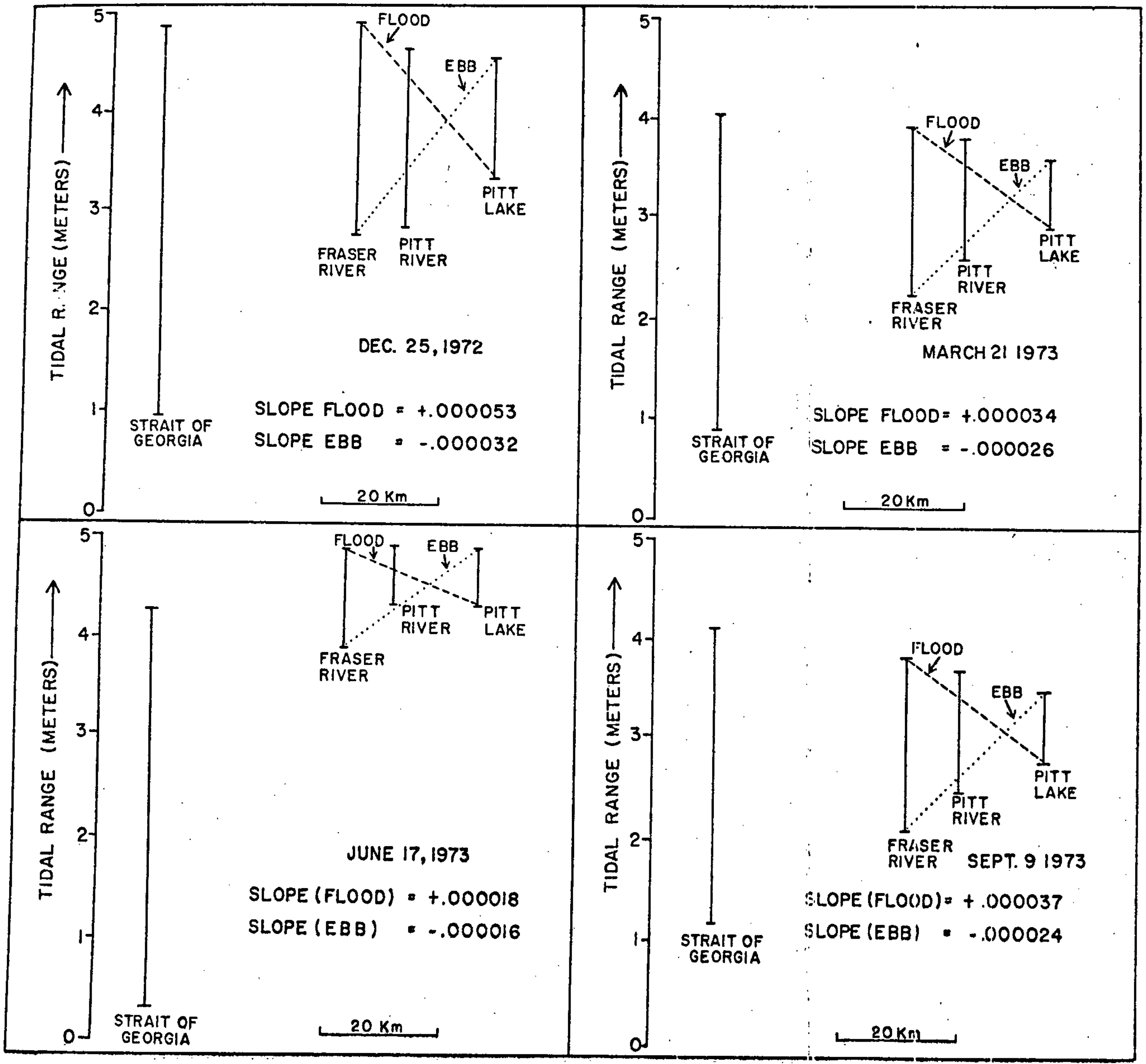
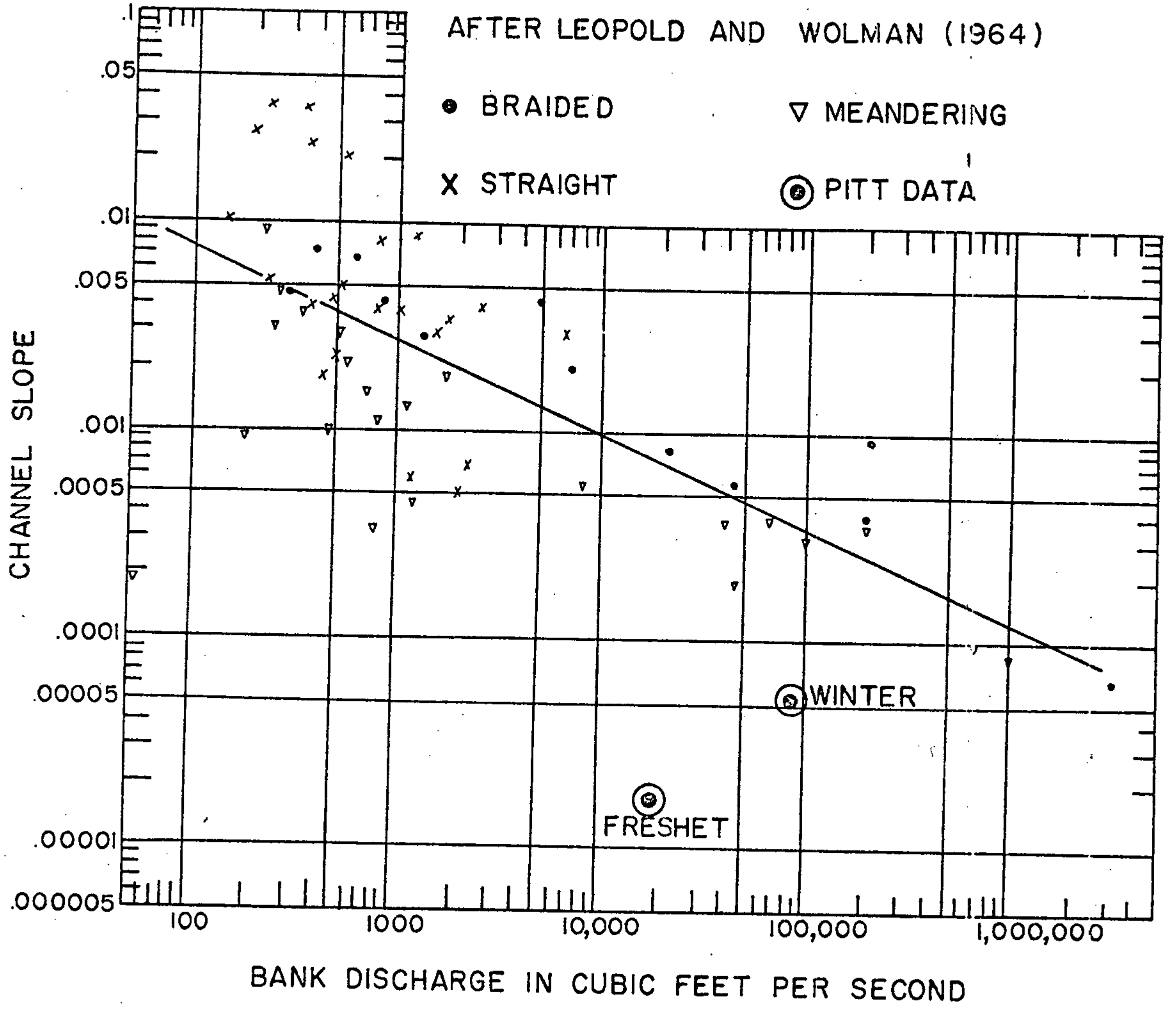

TIDAL RANGE (METERS)
0
1
2
3
4
5
STRAIT OF GEORGIA
FRASER RIVER
PITT RIVER
PITT LAKE
FLOOD
EBB
DEC. 25, 1972
SLOPE FLOOD = +.000053
SLOPE EBB = -.000032
20 Km
MARCH 21 1973
SLOPE FLOOD = +.000034
SLOPE EBB = -.000026
20 Km
JUNE 17, 1973
SLOPE (FLOOD) = +.000018
SLOPE (EBB) = -.000016
20 Km
SEPT. 9 1973
SLOPE (FLOOD) = +.000037
SLOPE (EBB) = -.000024
20 Km

FIGURE 10. Pitt parameters plotted on Leopold and Wolman's (1957) slope-discharge diagram. Pitt values plot with other meandering rivers, but winter values occur closest to the general scatter of points. This implies the winter flow is the channel-forming discharge.


AFTER LEOPOLD AND WOLMAN (1964)
● BRAIDED
∇ MEANDERING
X STRAIGHT
◎ PITT DATA
WINTER
FRESHET
CHANNEL SLOPE
.1
.05
.01
.005
.001
.0005
.0001
.00005
.00001
.000005
100
1000
10,000
100,000
1,000,000
BANK DISCHARGE IN CUBIC FEET PER SECOND

It is important to note that flood water slopes are higher than corresponding ebb water slopes (Fig. 9), and that winter water slopes are significantly higher than those of the freshet. As water slope is the most important driving force in a hydraulic system, it is interpreted that the Pitt system is dominated by winter flood flows.

Although the flow in Pitt River is similar to that in an estuary (bidirectional), the physical setting is significantly different from that of most estuaries. Pitt River is a conduit carrying water between the Fraser River and a reservoir (Pitt Lake) of large capacity. Because the reservoir provides a very large storage capacity, flow through the river is similar to other open channel flows. Energy is dissipated fairly evenly along the channel as evidence by the regular meanders and well developed pool and riffle sequence. However, other characteristics of the Pitt are definitely estuarine; for example, slope and discharge are determined by a complex interaction of the tidal range in the Strait of Georgia, discharge of the Fraser River, and discharge from the Pitt drainage system.

In conclusion, despite its bidirectional flow the geomorphology of the Pitt River has mainly riverine characteristics, rather than estuarine. The effective discharge (Q_e) or channel-forming discharge (bankful discharge) appears to be the winter peak flood flow. The regular meanders, the well developed pool and riffle sequence, and history of channel stability all imply that the processes acting in the river are in "quasi-equilibrium" with its reversing flow and continually changing discharge. The following observation made by Keller and Melhorn (1973) originally intended for unidirectional rivers, applies equally well to tidal Pitt River: "it appears that it is neither processes in alluvial stream channels which entirely control channel form, nor form which entirely controls process. Rather form and process evolve together in harmony as feedback mechanisms inherent to open systems approaching dynamic equilibrium".

SEDIMENTS

Channel bottom sediments of the Pitt River were sampled and analyzed for grain size distribution and mineralogy in order to compare them to Fraser River sediments and ascertain that the Fraser was their source. Mean grain size of bottom sediments in the Fraser near Pitt River was determined to be 0.42 mm (1.25 ϕ) (Tywoniuk and Stichling, 1973) with a range from 1.41 mm (-0.5 ϕ) to 0.044 mm (4.5 ϕ). This study found a mean grain size of 0.35 mm (1.35 ϕ) in bed material directly off Pitt River mouth.

Cores drilled at the bridges (Fig. 6) and other cores taken by the D.P.W. at Kilometers 2 and 8 (Fig. 3A) indicate that the channel is incised into silt and clay (probably older Fraser and Pitt River flood plain deposits). The channel is floored with a relatively thin blanket (5 - 15 m) of sand.

A total of 38 Pitt River samples were collected with a Dietz-Lafond grab sampler. Sandy samples from the thalweg were analyzed in a R.S.A. (Rapid Sediment Analyzer) settling tube of 12.7 cm diameter. Silty samples were sized by a combination of sieve (0.5 ϕ inteval - following the method of Folk, 1968) and Sedigraph (model 5000, Olivier et al., 1970/71) techniques. A fairly simple pattern of grain size distribution emerged from the study.

A steady decrease in mean grain size of sediments occurs in the thalweg from 0.37 mm (1.43 ϕ) at Pitt-Fraser confluence to 0.25 mm (2 ϕ) at the entrance to the Lake (Fig. 3B). A disruption of this trend occurs off the mouth of Widgeon Slough where slightly coarser material (mean grain size =0.34 mm (1.42 ϕ)) is debouched into the finer grained sediments of Pitt River, 0.26 mm (1.94 ϕ), resulting in an intermediate size of 0.29 mm (1.78 ϕ). In addition to the longitudinal decrease in size there is a lateral decrease from thalweg to river banks. For example at kilometer 19 mean grain size in the thalweg is 0.26 mm (1.96 ϕ) and decreases to 0.086 mm (3.6 ϕ) and 0.0625 mm (4.0 ϕ) at the inside of the meander. Areas of consistently low velocity such as the location upstream and landward of the bridge abutment have comparatively fine sediments (0.031 mm (5 ϕ) - 0.0156 mm (6 ϕ)).

In general sediments are well sorted, with 90% of a given sample occuring within 2 ϕ intervals. However, settling tube sizing techniques are insensitive to the small concentrations that occur in distribution tails thus samples may not actually be quite as well sorted as the analyses indicate.

The mineralogy of Fraser River has been examined by MacKintosh and Gardner, (1966); Garrison et al., (1969); and Pharo, (1972). The source material is heterogeneous (mostly Pleistocene deposits occupying the Fraser drainage basin). A comparison of Fraser River mineralogy with the Pitt system is shown in Table I. Mineralogies and proportions of minerals in the two rivers are essentially identical with a few minor exceptions. Proportion of volcanic rock fragments decrease while proportion of fresh hornblende and plagioclase increase from Fraser River to Pitt Lake.

Widgeon slough has similar mineralogy to Fraser and Pitt Rivers but different proportions: quartz (45%) with no quartzite or chert, feldspar (37%; 30% plagioclase and 7% K-spar), higher pyroxene (7%) and lower rock fragments (2%). Amphibole is mainly green hornblende and generally fresh. Thus, Widgeon Slough possesses a distinct mineralogy characterized by abundent fresh plagioclase, fresh green hornblende and no chert. Because the volume of material contributed by the slough is small in comparison with that contributed by Pitt River, Widgeon Slough minerals soon become diluted. Attempts to trace the direction of sediment movement from Widgeon Slough were unsuccessful.

In conclusion, Fraser River sediments are confirmed as source material for the Pitt River based on (1) essentially identical mineralogies, and (2) a gradual decrease in grain size (within the thalweg) from the Pitt-Fraser confluence up Pitt River to Pitt Lake.

TABLE I Summary of mineralogy of Fraser River, Pitt River, Pitt Lake, and Widgeon Slough.

LOCATION	GRAIN SIZE			
	> 2 µ			< 2 µ
	this study	Garrison et al(1969)	Pharo(1973)	Pharo(1973)
FRASER RIVER	quartz 10% chert 35% met.rock frag. 15% volc.rock frag. 20% feldspar 11% others 07% hornblende 02%	quartzite, quartz, chert 40% feldspar 11% rock fragments 45% other 04%	quartz feldspar amphibole mica garnet	chlorite montmorillonite illite quartz, feldspar, amphibole
	Pitt River	Widgeon Slough		Pitt Lake (Pharo, pers.comm)
PITT SYSTEM this study	quartz 20% chert 30% met.rock frag. 20% volc.rock frag. 06% feldspar 13% hornblende 04% opaque 04% mica 03%	quartz 45% plagioclase 30% K-spar 07% hornblende 07% mica(biotite) 05% others 06%		chlorite montmorillonite illite quartz, feldspar, amphibole, cuprite (trace)

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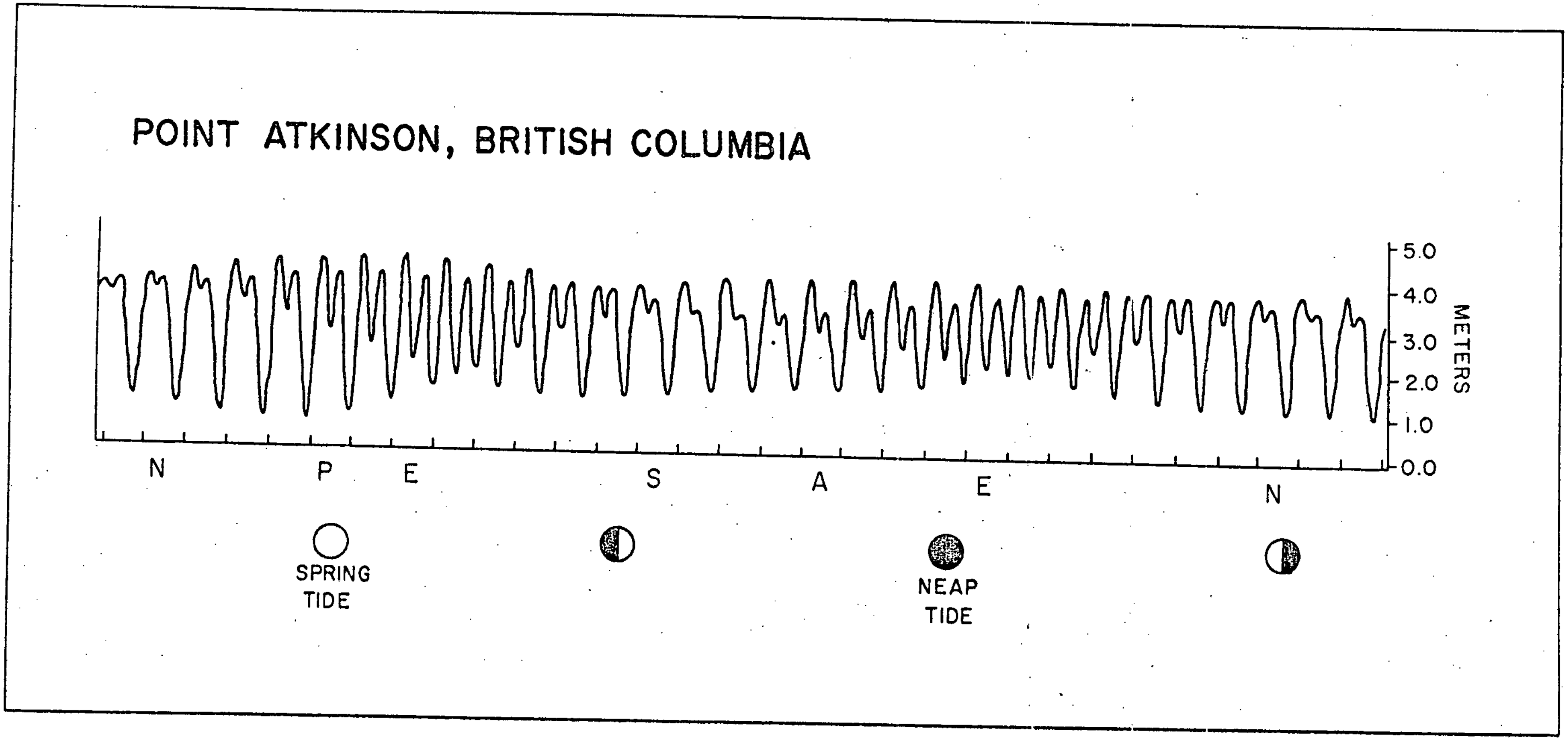
FLOW AND SEDIMENT TRANSPORT

Tides

The tide in the Strait of Georgia is the main driving force behind the hydrodynamics of the Pitt system. The tide is mixed, mainly diurnal, with a range of 3 - 5 meters. In addition to the mixed nature (diurnal inequality) of the tide, lunar cyclic variations also occur (Fig. 11). The difference in height (H) between successive high waters is usually less than the height difference between successive low waters.

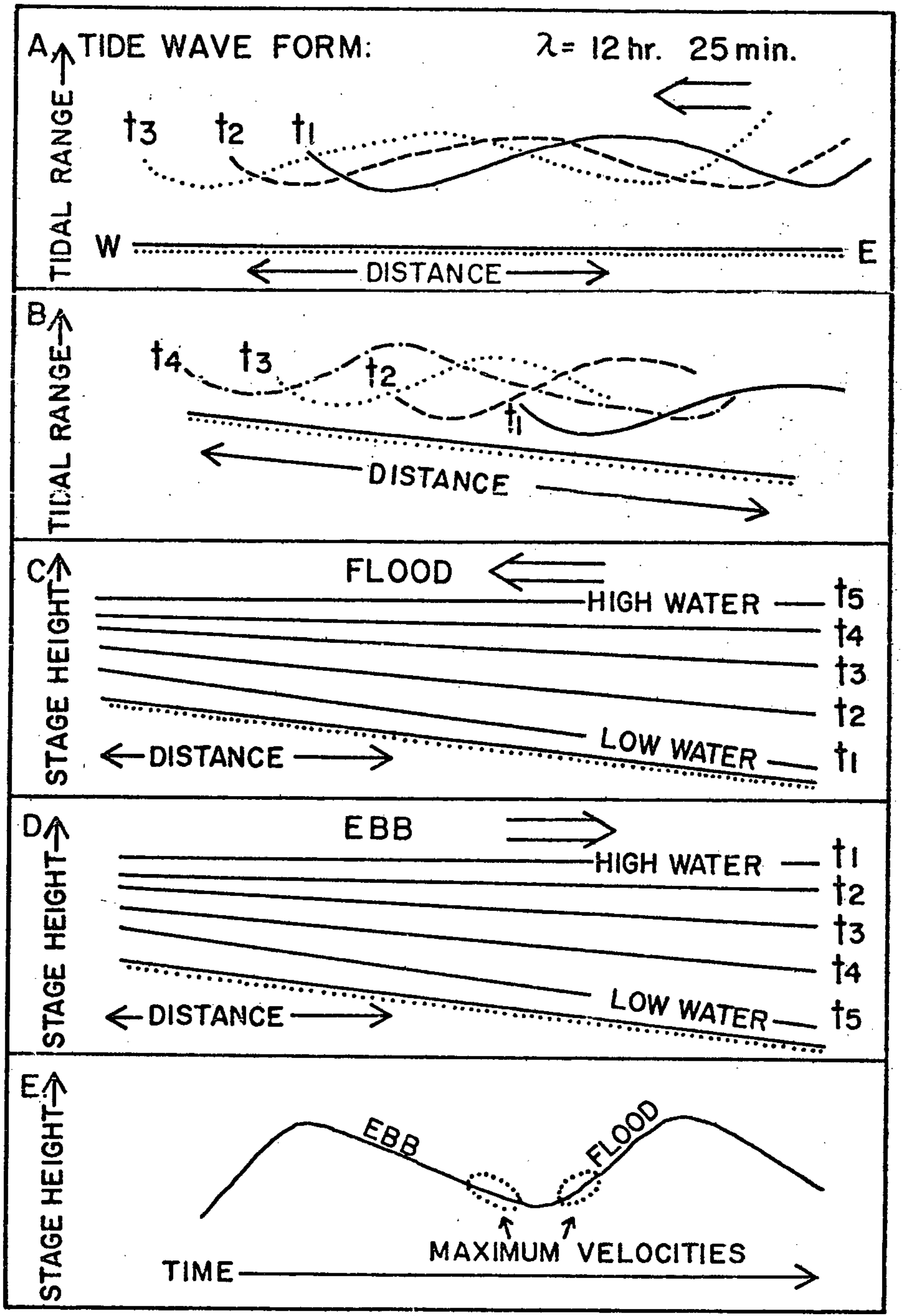
In theory (Bowditch, 1962), tides can be thought of as a symmetric water wave with a long wavelength (20,000 km) and short amplitude (30 cm). In a deep ocean this wave form (Fig. 12) would travel from east to west as the earth spins on its axis. The wave form (crest to crest) takes 12 hours and 25 minutes to pass a stationary reference point; i.e., one high tide to the next. Although the wave form moves forward the water motion is up and down. In shallowing water approaching land, frictional drag translates this vertical motion into horizontal motion; i.e., a progressive wave. Drag retards flow in the lower portion of the wave and, as the water level rises, faster moving water near the wave crest begins to overtake the

FIGURE 11. A representative tidal curve (month) for Strait of Georgia.



POINT ATKINSON, BRITISH COLUMBIA

FIGURE 12. Tidal theory: (A) Wave form over infinitely deep ocean; (B) Wave form with bottom friction; (C) dH/dT is highest at beginning of flood, but slows down near high water; (D) dH/dT is lowest at beginning of ebb and increases toward low water; (F) Maximum velocities occur at end of ebb and beginning of flood.

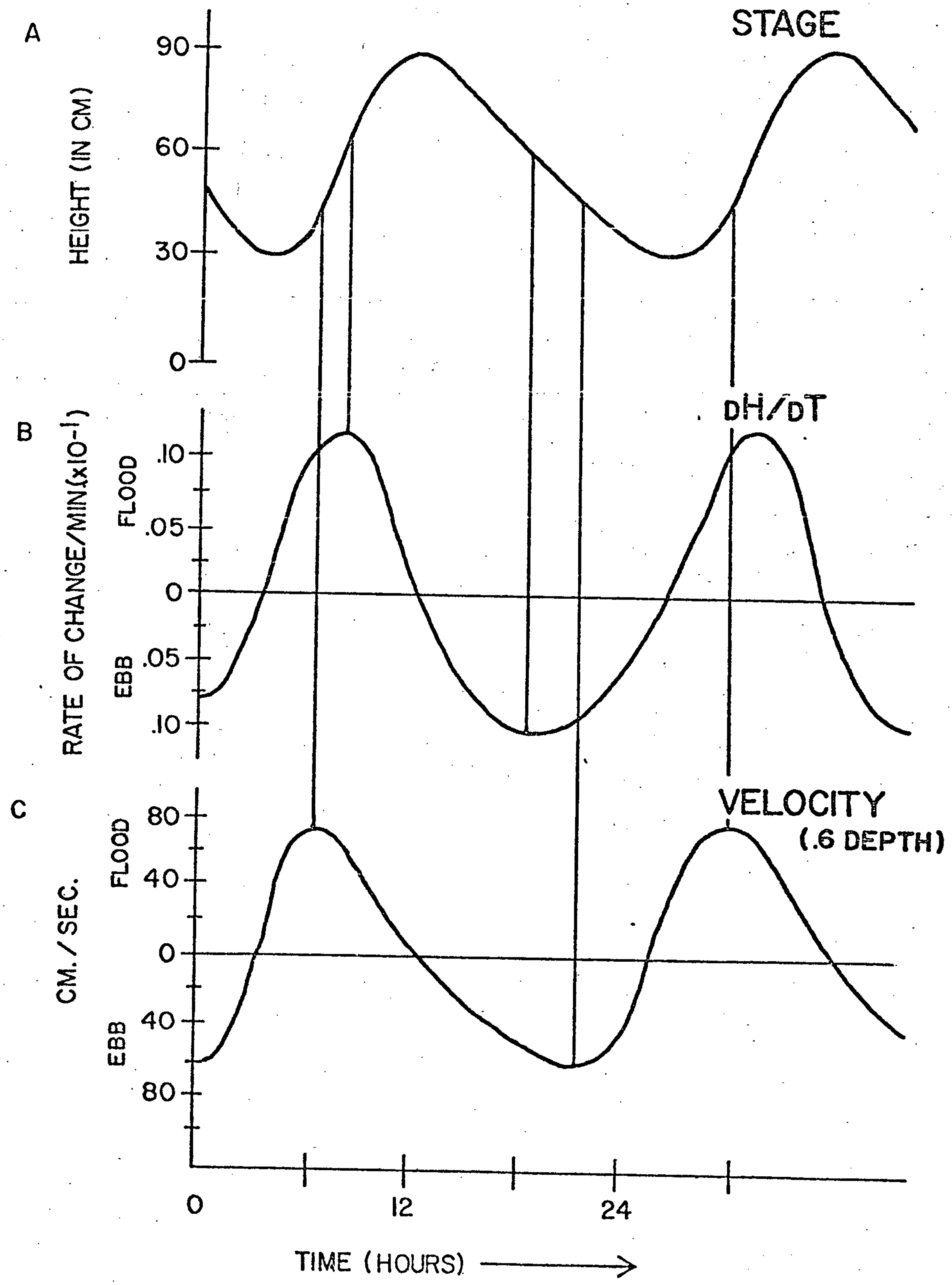

A
TIDAL RANGE
TIDE WAVE FORM:
λ= 12 hr. 25 min.
t3
t2
t1
W
E
DISTANCE
B
TIDAL RANGE
t4
t3
t2
t1
DISTANCE
C
STAGE HEIGHT
FLOOD
HIGH WATER
t5
t4
t3
t2
LOW WATER
t1
DISTANCE
D
STAGE HEIGHT
EBB
HIGH WATER
t1
t2
t3
t4
LOW WATER
t5
DISTANCE
E
STAGE HEIGHT
EBB
FLOOD
MAXIMUM VELOCITIES
TIME

no page 50

more slowly moving water at the wave front. An asymmetric wave form is thus developed (Fig. 12B). The asymmetry is accentuated within the confines of the estuarine channel by increased drag caused by boundary (wall) effects. Cross sectional area available for water transfer is reduced, thus altering form of progressive wave. Ignoring tidal backwater effects, stage-time asymmetry increases while magnitude of stage fluctuations, as well as proportion of time devoted to flood decreases (Ippen and Harleman, 1966). Slope (dH/dT) of the flood tide wave front is graphically shown with time lines (t_1 - t_5) in Figure 12C. On the ebb, water levels drop slowly at first but become faster with time as the water slope becomes greater (Fig. 12D). A stationary observer would see the entire passing tidal wave as a rapidly rising, then slowly falling water level. An idealized dH/dT plot of Pitt River is shown in Figure 12E where periods of fastest flow (which correspond to times of steepest water slope) are encircled. The relationship in time between stage level, water slope, and velocity (.4 depth measured from base of flow) is illustrated in Figure 13.

The tidal wave form is dampened as it progresses inland from the Strait of Georgia up Fraser and Pitt Rivers and into Pitt Lake. The tidal range is decreased and the shape of the stage level curve is modified. Other things being equal, the greater the magnitude of the tide

FIGURE 13. Stage, dH/dT, and velocity are asymmetric waves but slightly out of phase.


A
STAGE
HEIGHT (IN CM)
90
60
30
0
B
DH/DT
RATE OF CHANGE/MIN.(x10-1)
FLOOD
EBB
.10
.05
0
.05
.10
C
VELOCITY
(.6 DEPTH)
CM./SEC.
FLOOD
EBB
80
40
0
40
80
0
12
24
TIME (HOURS)

no page 54

in the Strait, the greater the water level fluctuations in the Pitt system. Figure 14 depicts 24-hour dH/dT curves for the Strait of Georgia (Point Atkinson), Fraser River (Port Mann Bridge), Pitt River (at the bridges), and Pitt Lake (southern end). The four sites are locations of continuously recording stage meters (Fig. 1) (unpublished data,Water Survey of Canada). Both the semi-diurnal (Fig. 14A) and mixed, mainly diurnal (Fig. 14B) tidal curves in the Strait are closely mimicked at the other three locations, but with a considerable time lag (approximately 5 hr and 15 min) between high water in the Strait and high water in Pitt Lake. It takes even longer (6 hr and 20 min) for the low water impulse to progress from the Strait to the lake. The approximate time lags that can be expected for the three inland stations are summarized in Table II.

In addition to the tidally induced oscillations in water level of Fraser estuary and Pitt systems, the absolute level of these oscillations changes seasonally with a maximum during Fraser River freshet run-off (May, June, and July) and a minimum during the winter (Dec., Jan., and Feb.). Discharge contributed to Pitt system from Pitt River (North) and small streams surrounding the lake varies from 210 m^3/sec (freshet) to 30 m^3/sec (winter). The result is that during the freshet more than 50% of water moving through the Pitt system is contributed by

FIGURE 14. Relationship of stage vs. time for four locations (Strait of Georgia, Fraser River, Pitt River, and Pitt Lake) for three representative days in (A) fall (B) winter (C) freshet (spring run-off).

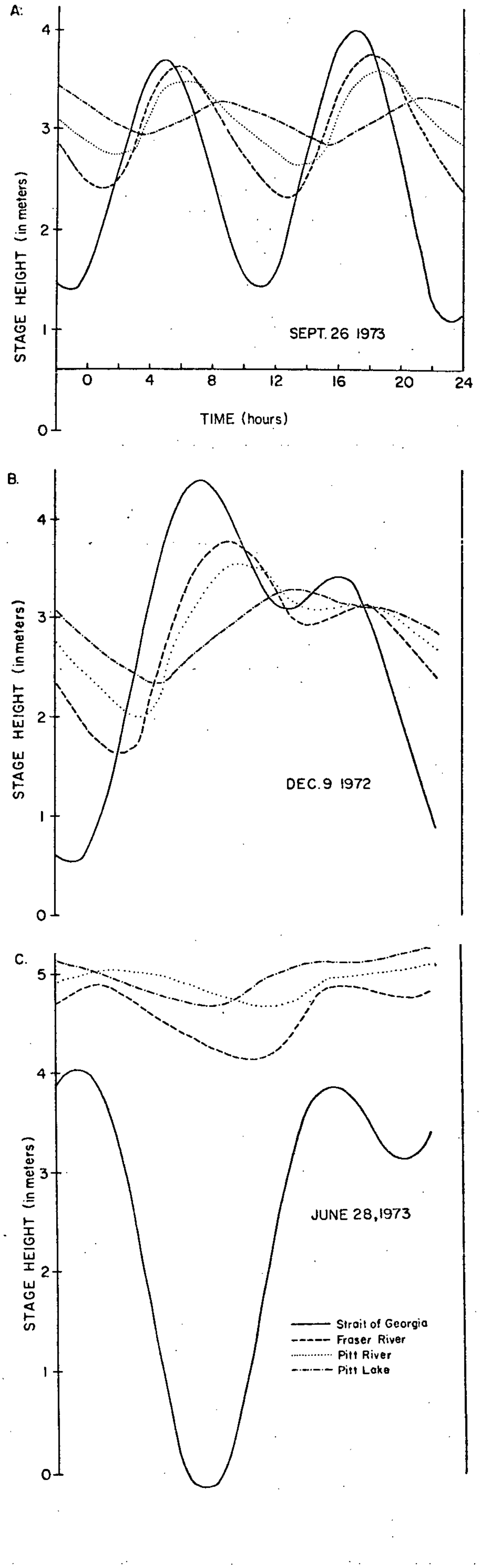

A:
STAGE HEIGHT (in meters)
0
1
2
3
4
0
4
8
12
16
20
24
TIME (hours)
SEPT. 26 1973
B.
STAGE HEIGHT (in meters)
0
1
2
3
4
DEC. 9 1972
C.
STAGE HEIGHT (in meters)
0
1
2
3
4
5
JUNE 28, 1973
Strait of Georgia
Fraser River
Pitt River
Pitt Lake

TABLE II Estimations of the delay for low-low water and high-high water to progress from Strait of Georgia to locations within the study area.

STAGE		STRAIT OF GEORGIA	PORT MANN BRIDGE FRASER R.	PITT RIVER	PITT LAKE
High-high Water (Flood Peak)	Freshet	0	2 hr	3 hr 15 m	15 hr 30 m
	Winter	0	1 hr 10 m	2 hr 30 m	5 h 15 m
Low-low Water (Ebb Peak)	Freshet	0	3 hr	4 hr 30 m	15 hr 30 m
	Winter	0	3 hr	4 hr 15 m	6 h 20 m

basin drainage contrasting with only 5% during the winter. Thus, there is an order of magnitude difference between winter and freshet conditions. In the winter (Fig. 14B) when discharge of Fraser and Pitt systems is low, the tidal effect is great. In contrast during freshet when runoff is high, tidal effect is minor (Fig. 14C). Stage fluctuations in Fraser and Pitt are irregular and out-of-phase. On this particular day (June 28, 1973) flow did not reverse in Pitt system.

The progressive nature of the tidal wave form in the Pitt system is reflected by the filling and emptying of the reservoir (Pitt Lake). This can be demonstrated by showing that the volume of water moving through the river during a tidal cycle is approximately equal to the volume lost or gained by the lake. The total volume moved through the river was calculated as the area under the time-discharge curve. Discharge curve for a tidal cycle was determined from a product of mean velocity measured at lake outlet and cross-sectional area (4100 m^2) at outlet. Total volume moved through river compares favorably with the volume actually added to the lake calculated from the relation: (lake stage height change,ΔH) X (lake area, A) + (volume contributed from drainage area during flood flow, Q_B) (Table III). The same was true for ebb flows. Total discharge passing through the river is comparable to the

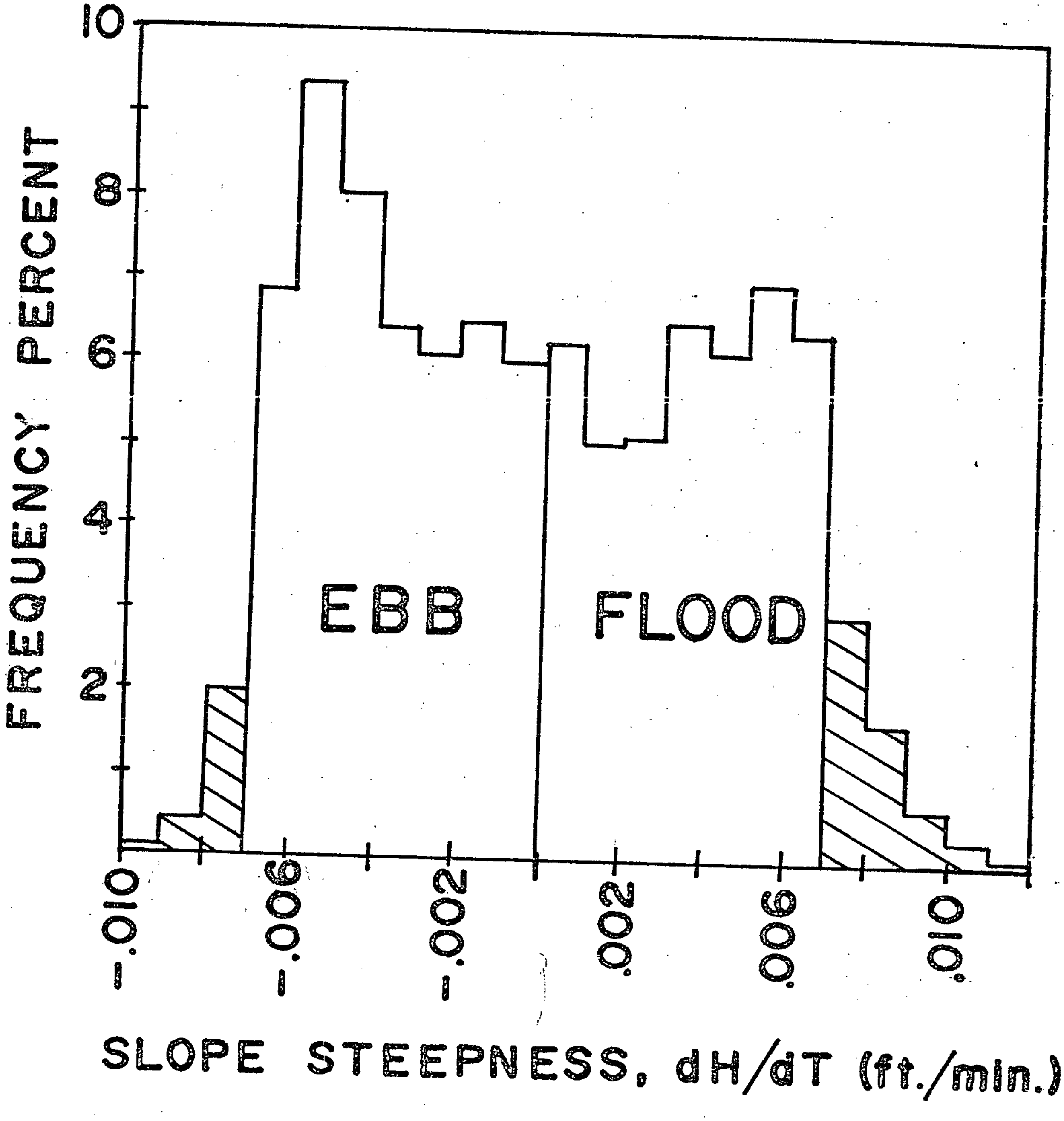
TABLE III Calculations demonstrating total discharge passing through the river is approximately equal to volume added or subtracted from the lake.

FLOOD	EBB
August 13, 1975 - Site (4)	May 9, 1975 - Site (2)
$A = 4100\ m^2$	$A = 2875\ m^2$
Flow Duration = 4.5 hrs.	Flow Duration = 8.5 hrs.
(Lake Basin) $Q_B = 113\ m^3.sec^{-1}$	(Lake Basin) $Q_B = 184\ m^3.sec^{-1}$
<u>Lake</u>	<u>Lake</u>
$A_L = 55 \times 10^6\ m^2$	$A_L = 55 \times 10^6\ m^2$
$X\Delta H = +.22\ m$	$X\Delta H = -.63\ m$
$VOL = 12.2 \times 10^6\ m^3$	$VOL = -\ 34.3 \times 10^6\ m^3$
<u>River</u>	<u>River</u>
total $Q = 11.4 \times 10^6\ m^3$	total $Q = -\ 40 \times 10^6\ m^3$
$+\ Q_B = 1.6 \times 10^6\ m^3$	$-\ Q_B = -\ 4.3 \times 10^6\ m^3$
$VOL = 13.0 \times 10^6\ m^3$	$VOL = -\ 35.8 \times 10^6\ m^3$

volume (ΔHA) that left the lake plus volume supplied by the drainage basin during the time of ebb flow.

Visually, all curves appear asymmetric with steepest slopes occurring on flood tide, implying that discharge and thus velocity is higher on flood. A statistical analysis was undertaken on the frequency of dH/dT values of Pitt Lake for winter months (Nov. 24, 1972 - April 30, 1973) when tidal effect is greatest. A slight adjustment was made to account for the effect of water volume contributed to the lake by the Pitt watershed. Watershed discharge would be dammed during flood flow increasing apparent rate of lake stage rise. Its continuous flow into the lake during ebb flow would reduce apparent rate of lake stage fall. However, watershed discharge is small, (5%) compared to tidally induced discharge contributed by Pitt River, and its effect is considered minor. It can be seen from the bar graph (Fig. 15) that the bulk of values for both flood and ebb lie below a dH/dT of .007 ft/min (.213 cm/min). Note that 5.7% of flood values are above this slope compared with 2.5% of ebb values. Thus over a 5-month period flood flows reach higher dH/dT values indicating higher peak velocities than ebb flows. This flood-dominated trend is confirmed by the velocity measurements presented in the following section.

FIGURE 15. Bargraph illustrating frequency precent of dH/dT values of Pitt Lake (reflecting rate of infilling) over a 6-month period. Highest dH/dT values occur on flood flows indicating a higher velocity than on the ebb.


10
8
6
4
2
FREQUENCY PERCENT
EBB
FLOOD
-.010
-.006
-.002
.002
.006
.010
SLOPE STEEPNESS, dH/dT (ft./min.)

Streamflow

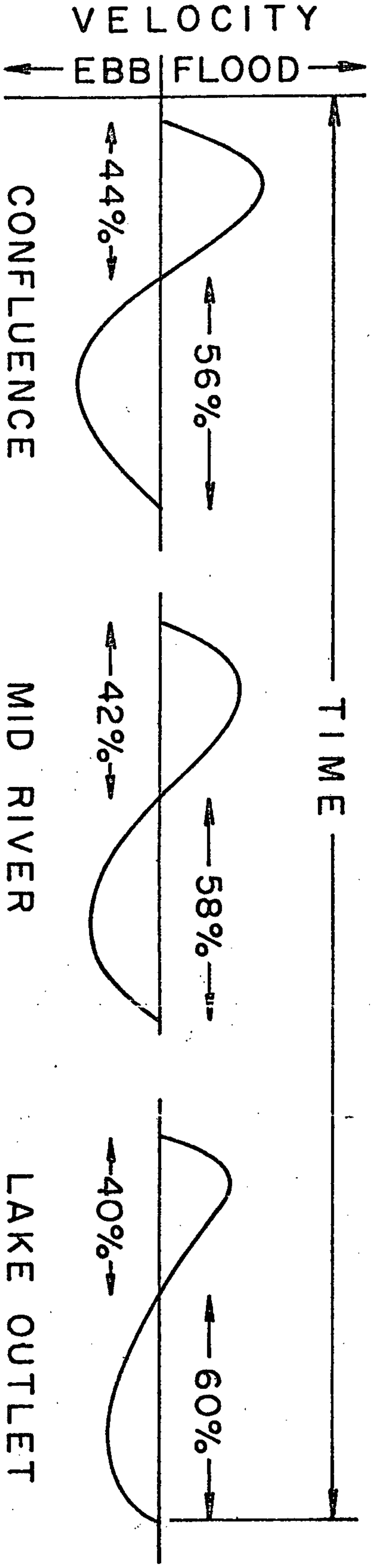
Velocity is one of the more important parameters used to characterize flow and a necessary variable for any sediment transport prediction. Unfortunately, velocity in the Pitt River is variable in direction and magnitude, both daily and seasonally. It was considered important to determine the range of velocities that could be expected to occur during any year, in particular, the maximum velocities and their duration. Two different methods of current measurements were used: (1) readings taken at 7.5-minute intervals, one meter from bottom, for 36 days; (2) current profiles taken at 30-minute intervals for flood or ebb cycles. Portions of 50 days of velocity data in both river and lake channel were taken in hopes of obtaining a representative sampling of the broad spectrum of flow conditions existing in the Pitt system.

Peak mean velocities measured at four sites (Fig. 3B) are summarized in Table IV and show that flood flows are, in general, stronger than ebb. This is true, in particular, when the hydrodynamic control conditions (tidal range in the Strait and Fraser discharge) are the same for the flood and ebb flows being compared. Estuaries with dominant flood velocities are common (Wright et al., 1973; Visher and Howard, 1974; Boggs and Jones, 1976) and, in fact, may be considered the rule for estuaries with low fresh water discharge (Meade, 1969). In all cases total

TABLE IV Summary of peak mean velocities determined from profile measurements; mean is at .4d, measured from bed.

Date	Site	Flood	Ebb	Date	Site	Flood	Ebb
March 11, 1975	(3)	52	40	August 6, 1975	(4)		57
March 13, 1975	(3)	64	42	August 11, 1975	(1B)	59	44
May 9, 1975	(2)		56	August 13, 1975	(4)	34	
May 21, 1975	(2)	40		Sept. 4, 1975	(1B)		62
June 12, 1975	(4)	50		Oct. 8, 1975	(2)	64	38
June 24, 1975	(4)	47		Feb. 20, 1976	(2)	70	
July 9, 1975	(4)		33				

FIGURE 16. Magnitude of velocity and the ratio of flood to ebb duration decreases from confluence to lake.


VELOCITY
EBB
FLOOD
CONFLUENCE
44%
56%
MID RIVER
42%
58%
LAKE OUTLET
40%
60%
TIME

discharge is greater on ebb than flood because of the volume added by the river. In reconciling this apparent contradiction Visher and Howard (1974) noted higher flood velocities at base of flow and higher ebb velocities at surface, whereas Meade (1969), Wright _et_ _al_. (1973), and this study have found that flood currents have a higher velocity, but flow for a shorter period of time than the corresponding ebb. In the Pitt system, the proportion of time devoted to flood and ebb flows changes progressively from river confluence to the lake (Fig. 16) with more and more time being devoted to ebb and less to flood.

Current profiles* were made from a boat anchored at one position in the thalweg during ebb and flood flows and under freshet (May - July) and "winter" (August - April) conditions. Each profile consisted of 8 points (10 cm from bottom, 30 cm from bottom, one meter from bottom, 0.2d, 0.4d (mean), 0.6d, 0.8d, and surface). The measurements (both magnitude and direction) at each depth were based on readings averaged over a two-minute period, thus each profile spans 15 to 20 minutes. A digital counter integrating electrical pulses over a 10-second period was used to average velocity fluctuations caused by micro- and macroturbulence (Matthes, 1947).

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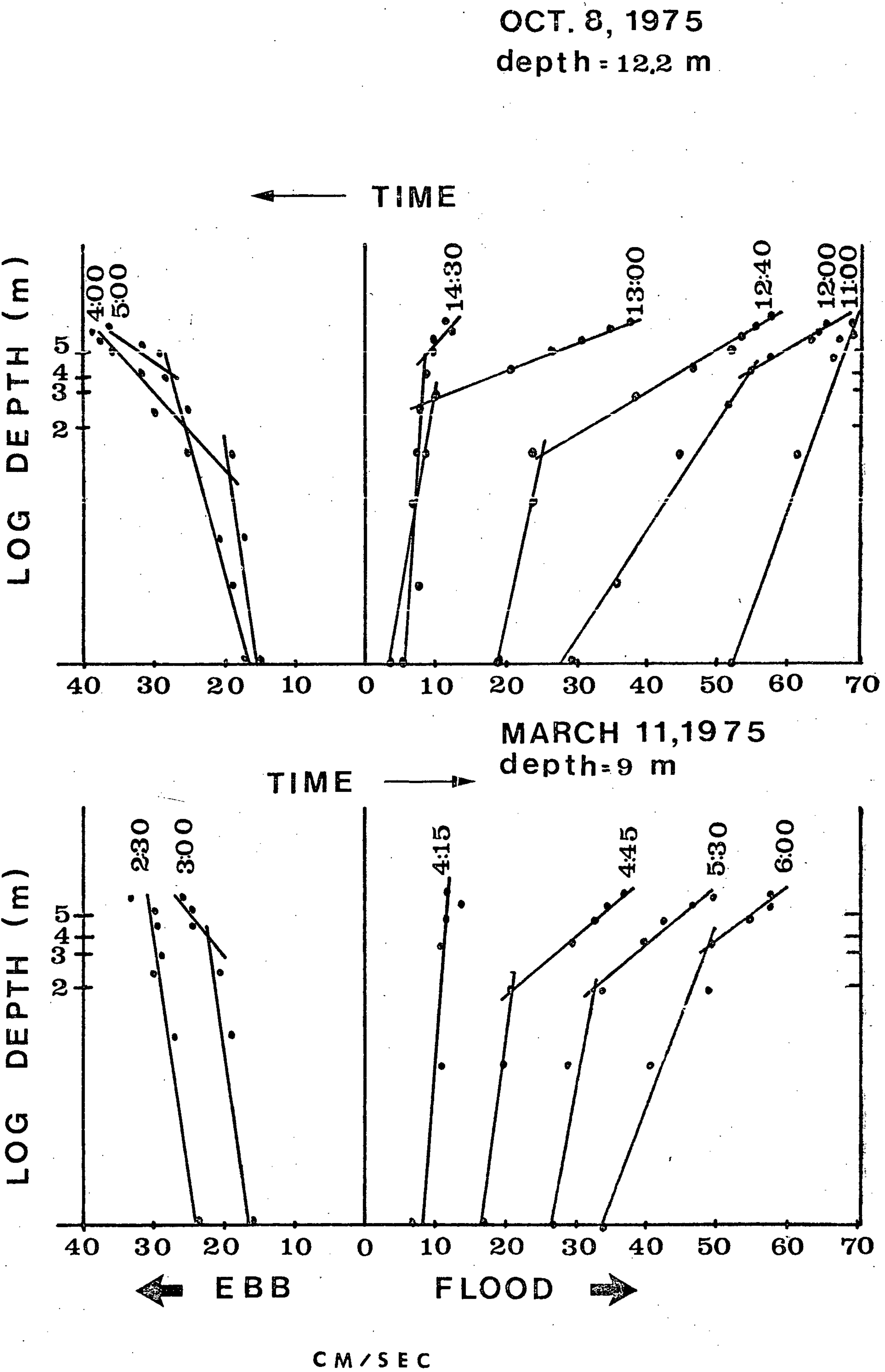
*Hydro Products, Savonius Rotor with a direct readout for current speed (model #460A) and direction (model #465A).

Profiles reveal that current direction changes gradually from surface to base of flow. The change in flow direction is dominantly to the left and in the order of 30°. Ludwick's (1974) data shows a similar trend, but he makes no comment as to the cause. Unfortunately, the current measurement sites in the Pitt were too few in number to evaluate properly whether this deflection was due to the effect of local channel morphology or some other factor.

Semi-log plots of velocity data for entire flow depth (boundary layer) reveal that most profiles are composed of two distinct zones. The break between the zones occurs between 2 m and 4 m above the bottom (Fig. 17). Within each zone the profile generally shows a logarithmic variation of velocity with depth (d, distance above the bed), however the slope ($dV/d\log d$) is higher in upper zone. The slope steepness changes during acceleration and deceleration of both flood and ebb oriented flows. Large-scale bedforms (1 - 3 m in height) cover the channel bottom and it is possible that their presence is instrumental in the development of the two zones. Considerably more data is needed to determine how flow structure changes during a tidal cycle and to ascertain the relationship between bedforms and the presence of flow zones.

FIGURE 17. Velocity profiles taken at A. Site 2 B. Site 3. Flow is divided into two distinct zones. Velocity varies logarithmically with depth, but at different rates in each zone. Division between the zones is at 2 - 4 m from bed. Flow structure may be related to bedforms (1 - 3 m in height) present on channel bottom.



OCT. 8, 1975
depth = 12,2 m

MARCH 11,1975
depth = 9 m

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Arithmetic depth-velocity plots indicate that the shape of "typical" flood and ebb curves are distinctly different for a given mean velocity (Fig. 18A). The shape of a velocity-depth plot depends mainly on extent of drag imposed on the flow. For a given depth, the greater the drag the greater the turbulence, which in turn produces a more gradual velocity profile toward the bed. Bedforms on channel bottom are predominantly flood oriented and the form resistance (drag coefficient) would be expected to change between flood and ebb. The slope angle of the exposed bedform surface (stoss side) presented to ebb flow is greater than slope angle of the surface (lee side) opposing flood-oriented flows (Fig. 19). Thus, it is interpreted that more drag occurs on the ebb resulting in a more gradual velocity profile toward the bed. Although Znamenskaya (1967) has attempted to relate bedform geometry and flow resistance, few quantitative data are available for the types of large-scale bedforms found in the Pitt River.

Velocity measurements taken near the Pitt-Fraser confluence (Fig. 3, site 1B) (Fig. 18B) are considered typical of most profiles measured. These time-velocity curves were drawn by eye to average scatter which presumably is due to low-frequency velocity fluctuations. Plots of mean velocity, velocity one meter from bottom and

FIGURE 18A. Diagrammatic comparison of "typical" flood and ebb current profiles.

FIGURE 18B. Velocity vs. time plot of data taken August 11, 1975 at current measurement site 1B (Fig. 3B). Line drawn at 32 cm/sec illustrates amount of flood time above critical velocity is greater than that of ebb. Bottom actually is 10 cm from bottom.

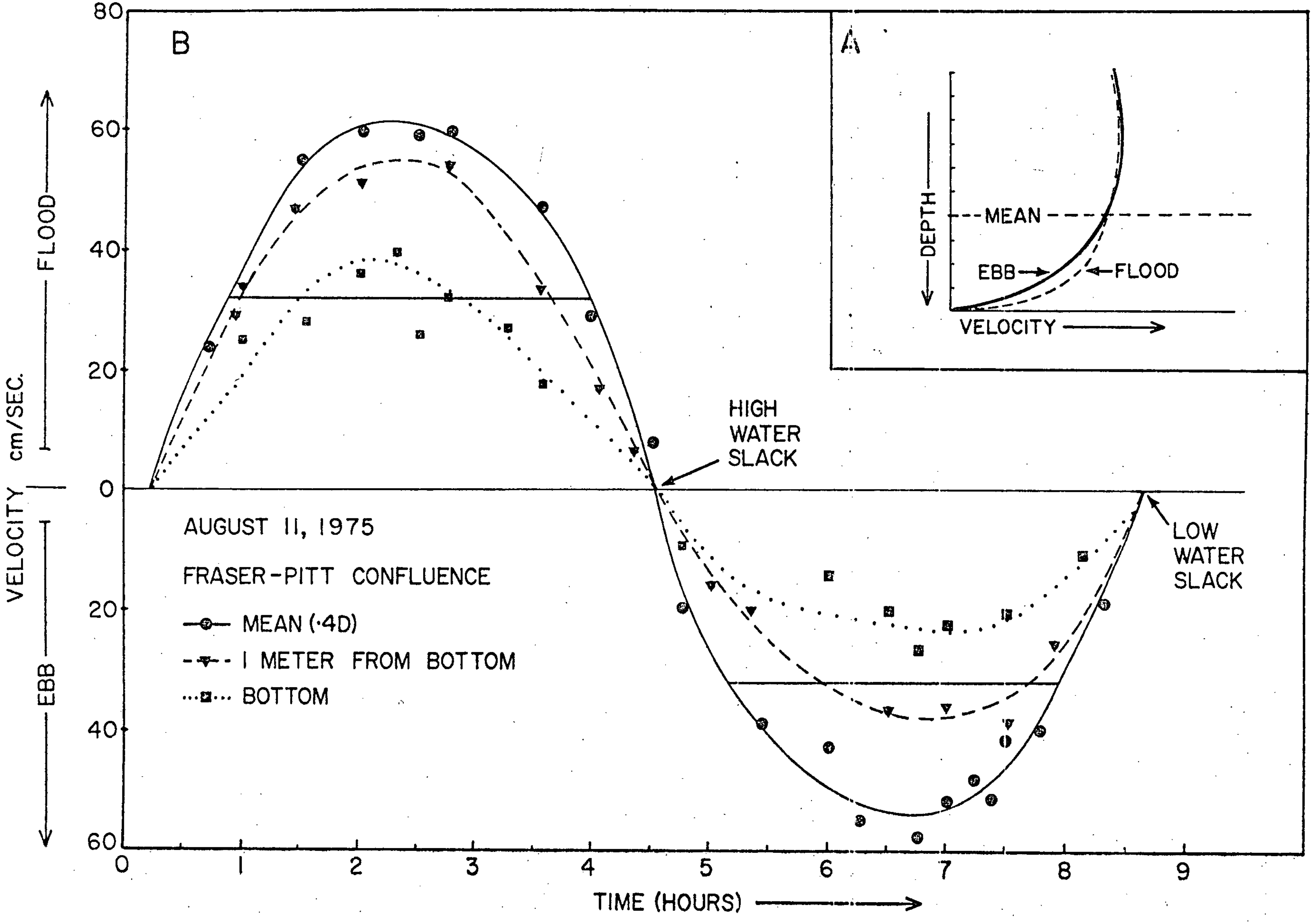
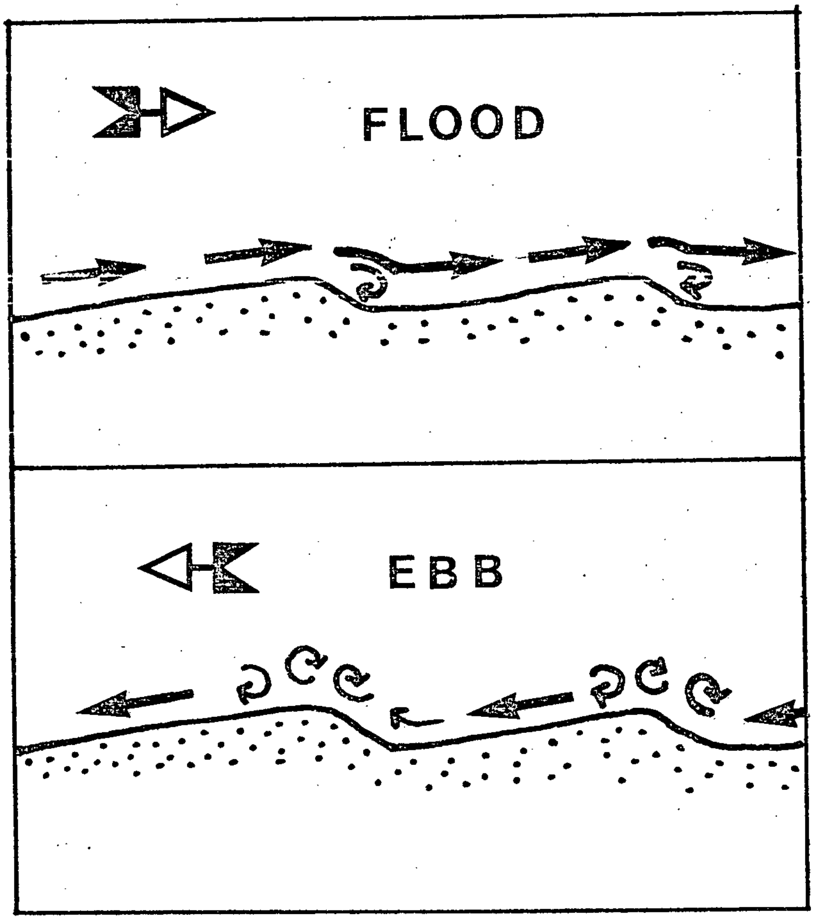

B
A
DEPTH
MEAN
EBB
FLOOD
VELOCITY
80
60
40
20
0
20
40
60
FLOOD
EBB
VELOCITY cm/SEC.
HIGH WATER SLACK
LOW WATER SLACK
AUGUST 11, 1975
FRASER-PITT CONFLUENCE
MEAN (·4D)
1 METER FROM BOTTOM
BOTTOM
0
1
2
3
4
5
6
7
8
9
TIME (HOURS)

FIGURE 19. Diagrammatic comparison between flood and ebb flows of turbulence created by the flood-oriented flows.


FLOOD
EBB

10 cm from bottom all exhibit similar shapes. The difference between flood and ebb mean velocity peaks is 7 cm/sec, however, the difference at one meter from bottom is substantially greater (17 cm/sec).. Visher and Howard (1974) noted a 20 cm/sec difference at one meter in Altahama Estuary, whereas, Klein (1970) found only 6 cm/sec difference at one meter from bottom in the portion of the Midas Basin characterized by flood-oriented sand waves. It should be noted that, in the Pitt, if an ebb or flood flow were of equal strength (equal mean velocities) the velocity near the base and thus basal shear stress and sediment entrainment potential would be greater for the flood. This is a consequence of the basic difference between the flood and ebb profiles (Fig. 18A). At first glance this interpretation may appear to contradict theory which assumes that turbulence intensity and shear increase together. However, the portion of total flow resistance borne by form resistance or that utilized on the grains differs between ebb and flood. On ebb, a greater portion of the resistance is borne by form resistance (Einstein and Barbarossa, 1952) because of increased drag (Fig. 19). The opposite is true of the flood where a greater portion of resistance is available for shear at grain level. It is only that portion of total resistance imparted on the grain which may lead to sediment entrainment.

The continuously recorded velocity measurements were taken by a positively buoyant meter (General Oceanics, Inc. film recording current meter (model #2010)), which was anchored to the channel bottom (Fig. 3B, site 1A) but free to sway with changing currents. The meter recorded on movie film instantaneous readings of magnitude and direction of flow (one meter off bottom) at 7.5-minute intervals. The meter was placed at sites 1A through 5 on a total of 7 occasions. Due to equipment failure only two readable records were obtained: a 17-day record in the river of site 1A (March, 1976) and a 19-day record at site 5 in the lake channel (Ashley, 1977). Portions of the river record are shown in Figure 20 and Table V gives a comparison of the proportion of time devoted to ebb and flood flow. Not only was a longer period of total time (56%) devoted to ebb flow than to flood (44%), but more time was devoted to ebb at any given velocity level. Since all other aspects of this study and others (Johnston, 1922; Morton, 1949; Ages and Wollard, 1976) point to a flood-dominated system these apparent anomalous data require examination.

The area of the Fraser-Pitt confluence is likely to be dominated by the hydrodynamics of the Fraser rather than the Pitt. Milliman (1977) has noted that ebb velocities in Fraser River are related to tidal range. Thus, analysis was made of data from site 1A and Pitt Lake channel (site 5) to determine if a similar relationship existed. A strong correlation (r = 0.866) was found in 1A data between tidal range in the Strait of Georgia and peak ebb velocity (Fig. 20, Table VI) and a poor (r = 0.064) correlation between peak flood velocity and tidal range. Peak velocities were based on an average of highest velocities over a 30-minute period. On the other hand, the lake channel data show a moderately good correlation (r = 0.631) between peak flood velocity and a poor one (r = 0.266) for peak ebb velocity. A negative correlation exists between Fraser River discharge and peak velocities at both sites under both flood and ebb flows. Thus, it is concluded that data from site 1A are strongly influenced by Fraser River conditions. To reinforce this conclusion a similar but more detailed comparison was made of site 1B (100 m upstream from site 1A) and site 5 against site 1A all under approximately equal tidal ranges (Table VII). Sites 1B and 5 both show a slight flood dominance interpreted as representing Pitt conditions while site 1A demonstrates a strong ebb dominance considered typical of the Fraser River.

An additional factor concerning site 1A data is that the meter site may have biased measurements taken such that most of the ebb discharge was recorded, but only a portion of the flood. Position of flow lines with respect to the current meter, determined by velocity measurements with the

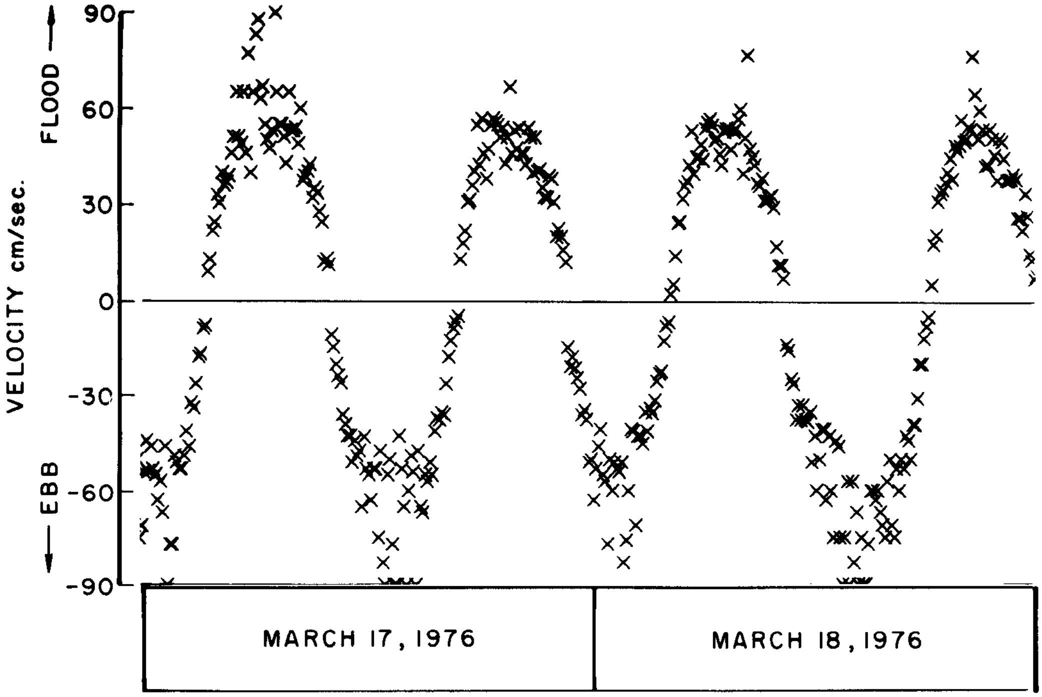
TABLE V Summary of "continuous" velocity data (March 16 - 31, 1976); 770 total hours of measurement at site 1A.

Time greater than;	EBB			FLOOD		
	Hours	Hrs(cum)	Cum.%	Hours	Hrs(cum)	Cum.%
80 cm/sec	15	15	2.0	1	1	0.0
70 cm/sec	20	36	4.6	2	3	.35
60 cm/sec	21	57	7.3	11	14	1.7
50 cm/sec	76	133	17.2	55	68	8.8
40 cm/sec	109	242	31.4	79	147	19.0
30 cm/sec	72	314	40.8	92	239	31.0
20 cm/sec	43	357	46.0	34	273	35.0
10 cm/sec	40	397	51.0	39	312	40.5
0 cm/sec	35	432	56.0	26	338	44.0

FIGURE 20A. Computer plot of velocity data from site 1A (Fig. 3B). Each data point represents an instantaneous recording of velocity taken at 7.5-minute intervals, one meter off bottom. March 17 - 18, 1976; mixed, mainly diurnal tides.

FIGURE 20B. A strong correlation exists between the tidal range in Strait of Georgia and maximum ebb velocity in current measurements taken at site 1A (March 16 - 31, 1976) (Fig. 3B). This implies data represents Fraser River hydraulics and not Pitt River.

A


90
60
30
0
-30
-60
-90
FLOOD
VELOCITY cm/sec.
EBB
MARCH 17, 1976
MARCH 18, 1976

B

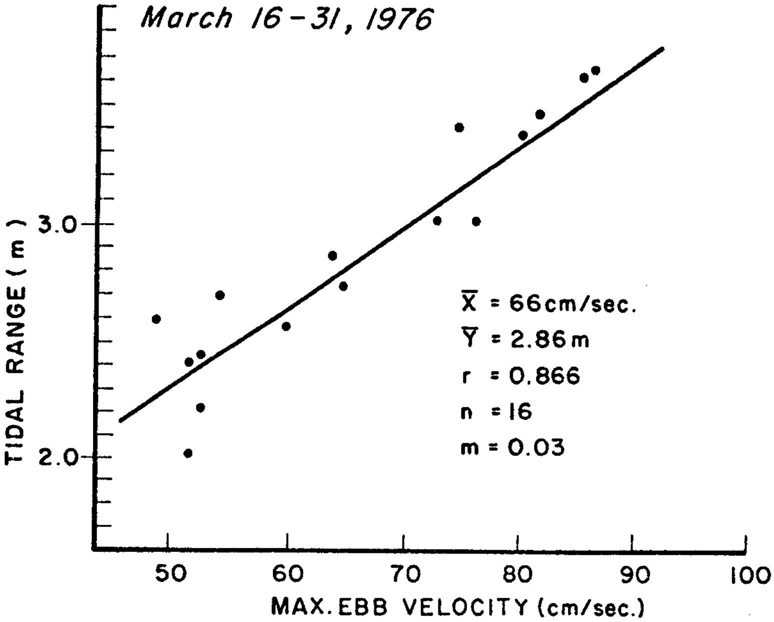

March 16-31, 1976
TIDAL RANGE (m)
3.0
2.0
50
60
70
80
90
100
MAX. EBB VELOCITY (cm/sec.)
X̄ = 66cm/sec.
Ȳ = 2.86m
r = 0.866
n = 16
m = 0.03

TABLE VI Relationship between tidal range (Strait) and peak velocities attained in Pitt system; Fraser discharge and velocities attained in Pitt system.

Site	Date	Tidal range (Strait) vs. peak vel.		Fraser Q vs. peak vel.	
		Ebb	Flood	Ebb	Flood
1A	3/16/76- 4/1/76	+0.866	+0.064	-0.116	-0.59
5	4/16/76- 5/4/76	+0.266	+0.631	-0.38	-0.165

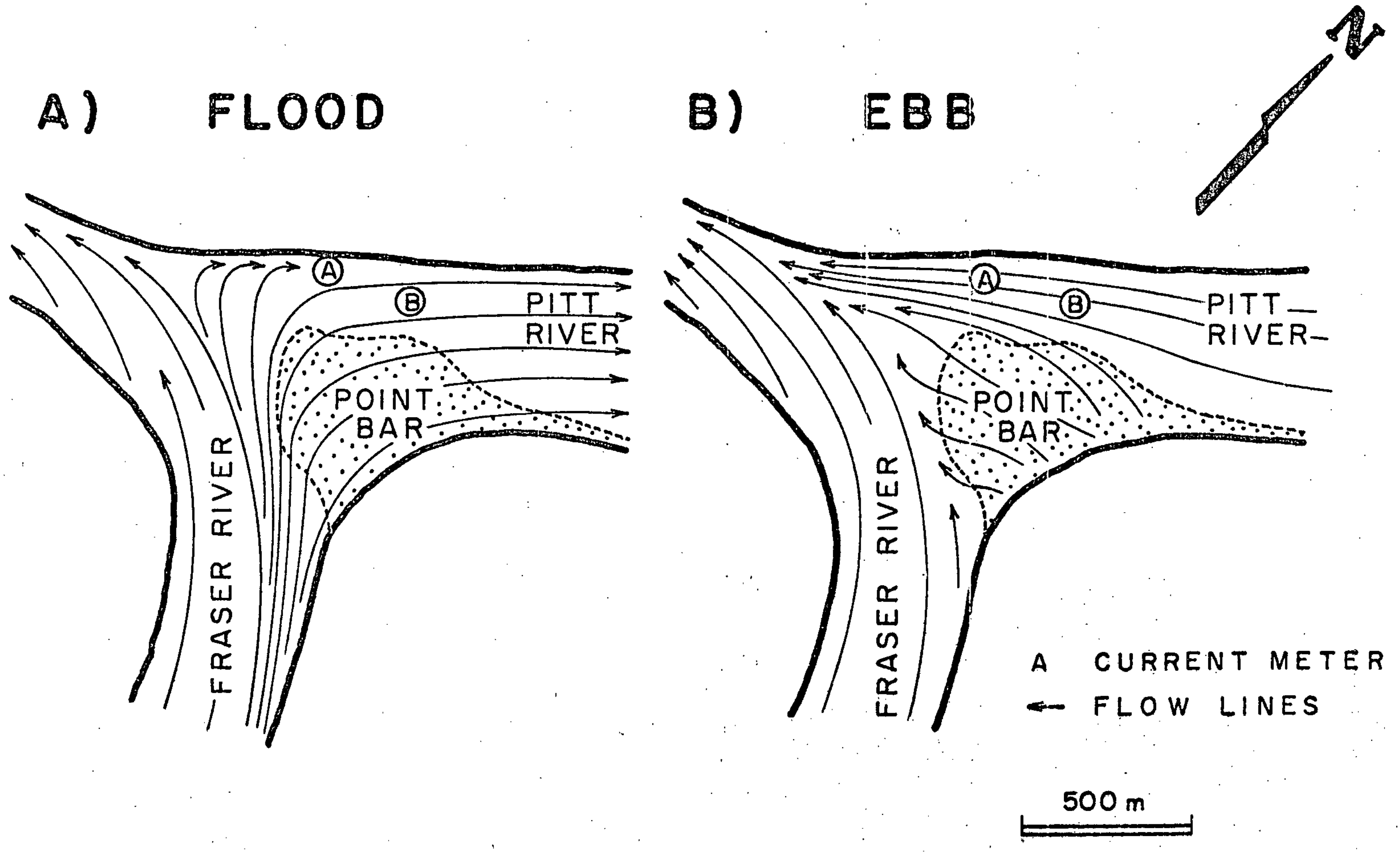
TABLE VII Comparison of maximum mean velocities reached in Pitt system under similar tidal ranges but differing Fraser discharge.

Meter site	Date	Tidal range (in Strait)	Fraser discharge	Max. mean flood vel.	Max. mean ebb vel.	Reference
1A	3/24/76	2.8 m	1020 cu m/sec	62 cm/sec	82	Fig. 17
1B	8/11/75	2.9 m	3285 cu m/sec	62 cm/sec	56	Fig. 18
5	4/28/76	2.8 m	3060 cu m/sec	54 cm/sec	38	Ashley,(1977)

Savonius rotor current meter and drogue observations are significantly different for ebb (Fig. 21A) and flood (Fig. 21B). Flood currents diverge and spread out across the Pitt River entrance while ebb currents converge and are concentrated near the west bank directly over meter site. Thus, it is concluded that the flow pattern can be more complex locally than the simple one presented in Figure 3A. In addition no one site by itself should be expected to exhibit average flow conditions for the entire river.

Both flood and ebb time-velocity plots are asymmetric. The asymmetry becomes more pronounced from confluence to lake in conjunction with a gradual decrease in the magnitude of peak velocities (Fig. 16). Peak velocities occur early in flood and late in ebb (Fig. 12E; Fig. 13) with reasons for this illustrated in Figure 12. The net result of the timing of peak flows is that the time before and after "low water slack" contains periods of high velocities on both flood and ebb. In contrast, time near "high water slack" has periods of relatively low velocities. This phenomenon is fairly common in estuaries (Postma, 1967) but not necessarily characteristic of all. The fact that stage and velocity cycles are out of phase plays an important part in the mechanism of sediment transport up the Pitt River. This mechanism will be outlined in the following section on sediment transport.

FIGURE 21. Flow pattern of flood (A) and ebb (B) at Pitt-Fraser confluence.


A) FLOOD
B) EBB
FRASER RIVER
PITT RIVER
POINT BAR
A
B
FRASER RIVER
PITT RIVER
POINT BAR
A
B
N
A CURRENT METER
FLOW LINES
500 m

In summary, velocity data collected in this study indicates that flood flows generally exhibit higher mean velocities but for shorter durations than ebb flows. The superiority of flood currents results from the asymmetry of the tidal cycle: i.e., the flood stage rises faster than the ebb stage falls. Thus, the unequal flow is a control imposed upon the system. However, sediment is introduced at the downstream end and is transported upstream as flood-oriented bedforms. The geometry of the forms alters the velocity of ebb currents and apparently reduces their capability of entraining sediment in comparison to flood currents. It is inferred then, that the flood-dominated nature of the Pitt River is maintained by a type of feedback mechanism.

Sediment transport

The study of mobile bed hydraulics, has advanced mainly by laboratory flume studies based on well established fluid mechanics principles. Unfortunately, applications of small-scale laboratory models to the large-scale reality of sediment transport in rivers has had only limited success. One of the major problems is that the equilibrium state of the river is difficult to determine on both a short and long-term basis. Thus, in examining behavior of natural streams it is important to differentiate between short-term (hourly) and long-term (yearly) interaction of channel and discharge. This is particularly important in Pitt River, where bidirectional, unsteady, and seasonal flow variations are the norm. The following section investigates the short-term (tidal cycle) interaction of water and sediment by examining conditions of sediment entrainment and long-term (seasonal) interaction by estimating total volume of sediment moved through the system in a year.

Bed load

The most challenging question related to the tidal Pitt system is how net water flow can be out of Pitt Lake while net sediment movement is in the opposite direction. Meade (1969); Wright et al., (1972); and Wright et al., (1973) have all noted a similar landward transport of sediment in other estuaries, explaining it in terms of salt wedges. The Pitt freshwater system clearly requires a model which is not based on the density difference between fresh and salt water. The steeper water slopes and higher velocities generated on the flood tide have been documented in previous sections and appear to provide a driving force for landward sediment transport. Sediment is continuously supplied to the lower Pitt River by its source (Fraser River). At the same time the gradational change in the hydrodynamics of the Pitt from the Fraser confluence to Pitt Lake (Fig. 16) may explain the systematic decrease observed in mean grain size up the river. To evaluate quantitatively these effects calculations have been carried out on the shear velocities necessary to entrain sediments.

Critical shear stress necessary for sediment entrainment, under various temperatures, was determined from Shields' diagram as modified by Briggs and Middleton (1965). The largest grains found near Pitt-Fraser confluence (and also in entire river) are 0.59 mm (0.76 ϕ), with mean grain size being 0.37 mm (1.43 ϕ), 0.28 mm (1.83 ϕ), and 0.25 mm (2.0 ϕ) at confluence, mid-river, and lake outlet, respectively. Table VIII summarizes shear stress, calculated for winter (5°C), spring and autumn (10°C), and summer (15°C) conditions. λ_o necessary to move the largest grains in winter is 3.14 dyne-cm/sec or a shear velocity V_* of 1.77 cm/sec., whereas V_* of 1.36 cm/sec will move mean grain size (0.25 mm) at lake outlet.

To estimate the extent of sediment transport on the flood and ebb it is necessary to determine flow conditions under which the critical shear velocity is reached and their duration. Charnock (1959), Sternberg (1966), and Nece and Smith (1970) have all measured current velocity profiles within 2 meters of the bottom in areas of fully turbulent tidal currents and verified that the profile near an hydraulically rough bed can be represented by the logarithmic flow law. Sternberg (1968) found 85% of his tidal

TABLE VIII Critical shear stress values determined from Shields' (1936) graph.

Grain Size mm	Temperature $^{\circ}C$	Dynes-cm/sec τ_o	V_* cm/sec
.59	5	3.14	1.77
	10	3.10	1.76
	15	3.05	1.74
.37	5	3.51	1.58
	10	2.33	1.52
	15	2.15	1.46
.28	5	2.26	1.50
	10	2.08	1.44
	15	1.94	1.39
.25	5	2.18	1.47
	10	2.06	1.43
	15	1.85	1.36

channels had logarithmic velocity profiles. This suggests the validity of applying the von Karman-Prandtl law of the wall:

$$\frac{V}{V_*} = \frac{2.3}{K} \log \left(\frac{d+z_o}{z_o}\right) \qquad (2)$$

where K is von Karman's constant, assumed to be 0.4, V is velocity at depth, d (measured from bed), and z_o is some measure of height of roughness elements at the boundary (i.e., grain size). Knowing z_o to be small in comparison to d, the equation can be rewritten:

$$\frac{V}{V_*} = 5.75 \frac{\log d}{\log z_o} \qquad (3)$$

Because it is a straight line

$$V_* = \frac{\frac{d\ V}{d \log d}}{5.75} + \log z_o \qquad (4)$$

where 1. slope of line = $\frac{d\ V}{d \log d}$

2. intercept = z_o

3. $V_* = \sqrt{\frac{\tau_o}{\rho}}$

Total depth of flow ranged from 9 m in the river to 42 m at the lake outlet, however only the bottom (2 - 4) meters plotted consistently as a straight line on a semi-log plot of velocity vs. log depth (Fig. 17). Basal shear velocity, V_*, was determined using equation (4) on the bottom 4 meters of each velocity profile for a total of 130 profiles on the 14 different days listed in Table IV. Measurements used were usually 10 cm, 30 cm, 100 cm, 200 cm, and 400 cm above bottom.

Unfortunately, velocity profile measurements were taken sequentially with one meter and not with an array of several. Thus, resulting shear stress calculations are only an approximation of conditions at bed. For more precise measurements a current meter array or Preston Tube (device for measuring Reynolds Stress directly) should be used. Nece and Smith (1970) have demonstrated that both methods produce comparable results. An additional problem is revealed by Dyer (1972) who found that the relationship of bed configuration and position of profile is important. He found that friction velocity can differ by as much as a factor of two depending upon location of the profiles relative to bedform morphology. Highest shear stress occurs near the bedform crest, lowest in the trough. However, it is important to note that the bedforms in Dyer's study had a wavelength of 200 m and a height of 7 m compared with the 15 - 60 m and 1 - 3 in the

Pitt. Thus, the uncertainty in the location of current profiles relative to bedforms may be less critical in Pitt River than Dyer's data suggest. Despite these problems, the consistency of the data and the qualitative agreement in the relation between τ_o and $\bar{V}$ with both Ludwick's (1974) and Gordon's (1975) studies support the validity of the data.

V_*, τ_o, and $\tau_o\bar{V}$ (stream power) calculations for one day's data (Fig. 18) are summarized in Table IX. It is important to note that shear stress changes proportionally with increase in mean velocity. This is not true with decelerating flow, as τ_o remains high then drops off rapidly. More specifically, shear stress is usually higher for the same mean velocity on decelerating flow than for accelerating flow. Shear stress was not seen to increase after peak mean velocity. McCave (1973) and Gordon (1975) have both noted a similar "hysteresis" in the relationship of shear stress and mean velocity. Kachel and Sternberg (1971) noticed an increase in bed load transport as ripples during decelerating flow. Gordon (1975) suggested that the increase of shear on decelerating flow occurs when longitudinal pressure gradient changes from favorable to adverse with change of stage. Because of the hysteretic relationship found in Pitt River, predictions of sediment entrainment using mean velocity as an indication of friction velocity will be minima.

TABLE IX V_*, τ_o, and $\bar{V}\tau_o$ calculations for August 11, 1975 at Pitt-Fraser confluence.

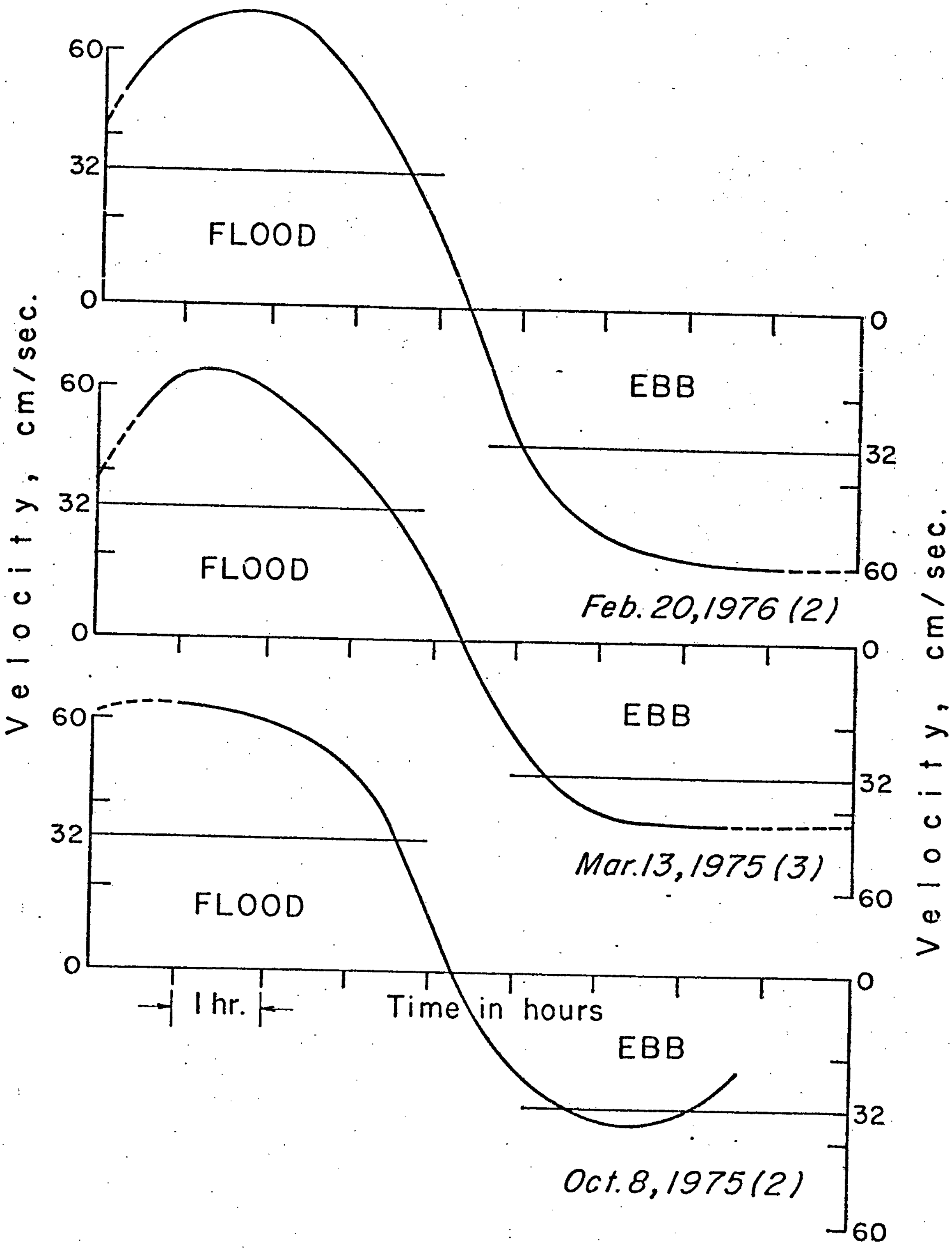
	Time	$dV/d\log d$	V_* $\frac{cm}{sec}$	$\bar{V}$ cm/sec	τ_o	$\bar{V}\tau_o$	$\bar{V}\tau_o$ ave. time-weighted
FLOOD	9:30	13.73	2.38	34	1.54	52.4	88.7
	10:00	18.28	3.17	55	1.78	97.9	
	10.30	16.00	2.78	61	1.66	101.7	
	11:00	26.59	4.62	57	2.15	122.0	
	11:15	16.07	2.79	59	1.67	98.5	
	12:00	15.86	2.75	44	1.65	72.9	
	1:00	6.61	1.15	05	1.07	5.4	
EBB	1:15	10.72	1.86	25	1.36	34.0	76.8
	2:30	27.59	4.79	40	2.19	87.5	
	3:00	24.44	4.25	54	2.06	111.0	
	3:30	21.20	3.68	47	1.91	90.0	
	4:00	21.89	3.80	42	1.94	81.8	
	4:30	15.65	2.72	35	1.65	57.7	

no page 96

Due to the nonlinear relationship between mean velocity and shear stress, their product stream power ($\lambda_o \bar{V}$) follows an intermediate trend. Stream power is considered a better indication of the ability of the flow to move sediment than either of the factors individually (Simons et al., 1965; Bagnold, 1963). Note in Table IX (for Aug. 11, 1975 data) that stream power values for flood averaged (time-weighted) 88.7 dynes-$(cm/sec)^2$ while ebb averaged 76.8 dynes-$(cm/sec)^2$ indicating a flood dominance.

Using the logarithmic velocity law it was determined that a mean velocity (.4d) of at least 32 cm/sec (i.e. $dV/d\log d=10$) was needed to create the $V_* = 1.77$ cm/sec necessary to move the largest Pitt sediment (0.59 mm). Even though highest mean velocities occur on the flood critical velocity (32 cm/sec) is maintained for a longer period of time during the ebb (Fig. 22A,B). As all other aspects of the Pitt indicate a flood-dominated system, it is concluded that the difference in peak flow velocities rather than actual time above critical velocity is the more important factor in determining direction of net sediment transport. It is suspected that the contrast between peak velocities occuring on flood and ebb would be even more accentuated during winter months (Dec. - Mar.). The highest values of V_* determined in this study, over 6.0 cm/sec, were recorded on March 13, 1975 and February 20, 1976. No V_*

FIGURE 22. Comparison of time duration of flood and ebb currents above the predicted critical velocity (32 cm/sec) for Pitt River.


Velocity, cm/sec.
60
32
0
FLOOD
EBB
Feb. 20, 1976 (2)
Mar. 13, 1975 (3)
Oct. 8, 1975 (2)
1 hr.
Time in hours
Velocity, cm/sec.

over 3.0 cm/sec was determined from freshet profiles and most were less than the needed critical friction velocity of 1.77 cm/sec. Figure 16 shows a decrease in maximum velocities from confluence to lake. Since magnitude of shear stress varies with mean velocity it is interpreted that shear stress or sediment entrainment potential would also decrease. This contention is supported by the decrease in mean grain size of channel bottom material from the Fraser to Pitt Lake.

On the basis of ^{137}Cs dating of sediment cores from Pitt Lake (Ashley, 1977) it has been estimated that 150 ± 20 x 10^3 tonnes of sediment (1% of Fraser's total load) are accumulating annually in the lower half of the lake. Grain size analysis of this sediment reveals that approximately 50% of this material (75,000 tonnes per year) is greater than 0.31 mm (5 ϕ) and thus probably moves as bed load (Einstein _et al_., 1950). An attempt was made to calculate bedload transport in Pitt River using the following simple form of Einstein's (1950) analytical equation:

$$\Phi = f(\Psi), \quad \Psi = \frac{\rho_s - \rho}{\rho} \frac{d}{S_w R_n}, \quad \Phi = \frac{g_s}{r_s} \quad \frac{\rho}{\rho_s - \rho} - \frac{1}{gD^3} \qquad (5)$$

The more complex form of this equation is based on the probability of grains moving under given hydraulic conditions and has been substantiated reasonably well by laboratory and field studies (Toffaleti, 1969; Kachel and Sternberg, 1971; Garg _et_. _al_., 1971; Einstein and Abdel-Aal, 1972).

Calculations were done at three cross sections along river (confluence, mid-river, and near lake outlet). The calculations were intended only as an approximation of bedload movement and the results are probably correct to within an order of magnitude of the actual values. A representative grain size (D_{65} bed material) was used and no correction was made for form resistance.

Calculations for the tidal Pitt River also necessitate comparing transport rates upriver under flood and downstream under ebb. At any cross section, the only parameter varying between ebb and flood is water slope. Since slope varies both with time and distance, seasonally and during both flood and ebb, a maximum value was determined for various seasons and flow directions (Fig. 9). A maximum value is consistent and serves as the means of objective comparison of the varied sets of conditions. In addition maximum transport would be expected to occur near times of maximum slope. Resulting calculations (Appendix) show a net flood-oriented transport with volumes of the order of magnitude (75,000 tonnes) predicted from accumulating lake sediments.

In conclusion, bedload estimations tend to support the velocity data; i.e., that flood flows have a greater transport capacity. However more field data, in particular direct bedload measurements, are needed to substantiate this unequivocally.

Even though the system appears to be flood dominated, ebb flow can still entrain and move sediment in the opposite direction. But because of the out-of-phase relationship between stage and velocity of flow (Fig. 13) and the fact that a lower velocity is required to transport a grain than entrain it, movement in the flood direction is favored. Figure 23 incorporates the hydraulic and sediment entrainment findings of this study into a model for net upriver movement.

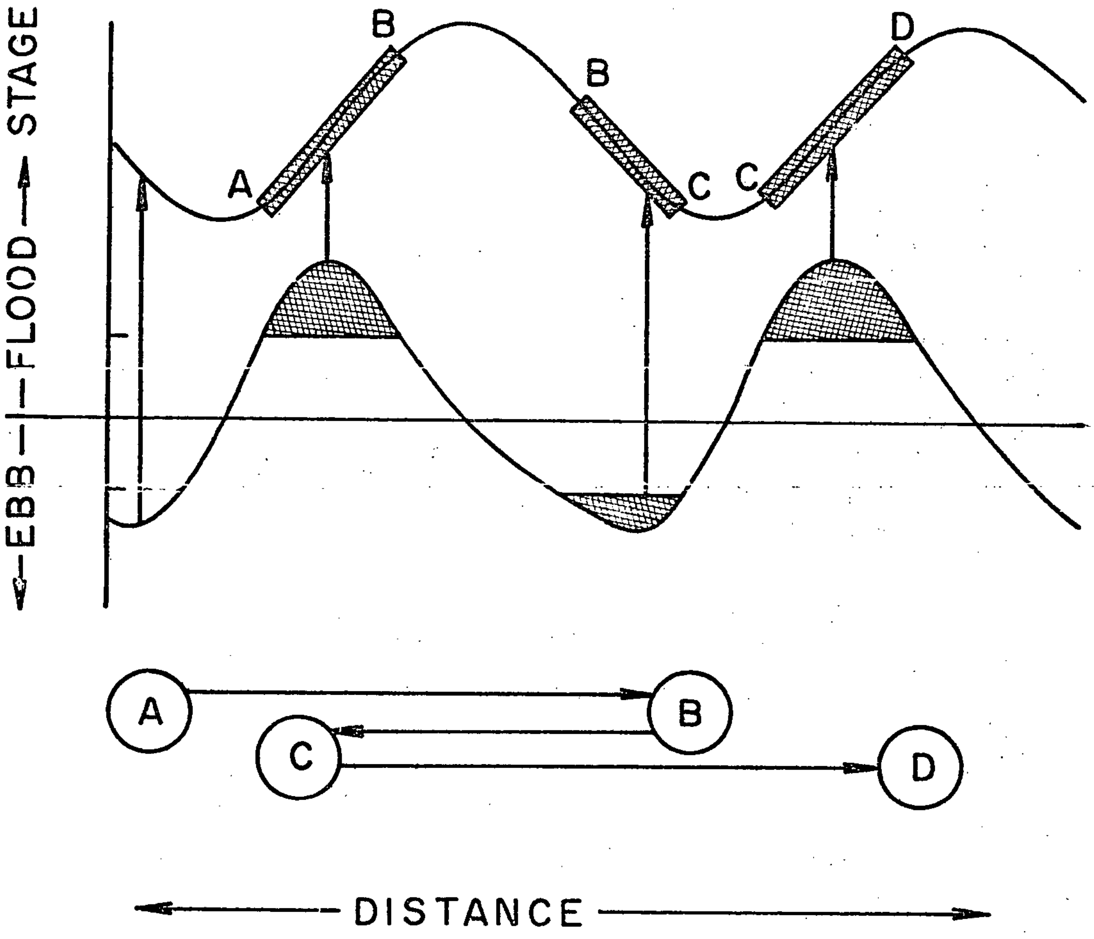
Critical shear stress (i.e., mean velocity of 32 cm/sec) is reached early in a flood cycle because of velocity curve asymmetry and its temporal relationship with stage changes. $\bar{V}$ increases rapidly and declines slowly until high water is reached. In contrast, on the ebb, $\bar{V}$ increases slowly until it reaches a peak late in the cycle, and then decreases quickly to low water. Once a grain is entrained it can be carried along by a current lower than the critical velocity. Because critical velocity occurs early in flood and late in ebb there is more time following critical flow in flood then in ebb. Thus the likelihood of additional transport under flood flow is increased. Although the proportion of total flood time that is above critical velocity appears to be less than the proportion of ebb time, higher velocities are reached during the flood. Grains move farther during a given time period on flood than they do in the opposite direction on the ebb. The result of the oscillating sediment movement results in a net upriver movement (after Postma, 1967).

Suspended Sediment

The suspended sediment content of Fraser River water fluctuates seasonally and ranges from an average of 62 mg/l during winter (lows are 1 mg/l) to a mean over 320 mg/l during freshet (Johnston, 1922). Water Survey of Canada for 1967-1969 at Port Mann Bridge found annual means 93, 105 and 73 mg/l respectively, ranging from a winter low of 18 mg/l to freshet high of 286 mg/l. Milliman (1977) measured a yearly mean of 135 mg/l at Port Mann Bridge 4 km seaward of Pitt River. Near bottom variations from 10 to 1500 mg/l occurred and Milliman observed that this fluctuation is due to an increase in sand content associated with increase in discharge and variations in tidal flow and that the silt and clay content remains essentially constant year round. By comparison, Pitt River water has very low suspended sediment (5 mg/l) as it drains only Pitt Lake and a few sluggish streams.

When part of the Fraser River is diverted into the Pitt system during flood tides the turbid waters first appear to move as a coherent body with a sharp line dividing muddy Fraser from relatively clear Pitt water.

FIGURE 23. Model for movement of sediment up Pitt River (after Postma, 1959).


STAGE
EBB
FLOOD
A
B
B
C
C
D
A
B
C
D
DISTANCE

Within half an hour mixing becomes obvious in the surface water and the contact becomes progressively more diffuse with time. The progression of the Fraser plume can be followed up the Pitt River visually by observing surface water or by repeated suspended sediment sampling. Table X tabulates results of surface and near bottom sediment sampling (at 2 km spacing) during a 4-hour period. Suspended sediment moved at 1.6 km/hr or 44 cm/sec or approximately the average velocity of the flow itself. However, since the river is 20.7 km long it would take over 12 hours for Fraser River water to reach the lake. Flood flows are seldom longer than 8 hours; thus, suspended sediment probably never reaches the lake on one tidal cycle, but would move in small increments over several tidal cycles. Areas of low velocity near log storage booms which line the river banks and mid-channel islands might provide a settling site for some of the suspended load, but it is suspected that the bulk of it returns to the Fraser on the ebb flow. Taking the yearly mean of 100 mg/l, 22,000 tonnes of suspended sediment enters Pitt River on the flood. However, less than 0.5% of this is required to remain in Pitt River after each flood and eventually reach the lake to account for the estimated 75,000 tonnes of suspended material (<0.31 mm) accumulating yearly in the lake.

TABLE X Pitt River suspended sediment measurements.
Stations (1) - (5) at 2-km intervals.

TIME	FRASER RIVER	PITT RIVER				
	(1)	(2)	(3)	(4)	(5)	(6)
0-.75 HR	31.06 36.25	15.29 15.23	8.29 13.98	7.94 13.21	9.64	
1.25-2.0 HR		32.85 38.59	33.82 31.23	17.54 14.13	12.90	
3.25-3.75 HR		24.87 29.27	24.70 36.93	27.25 34.98	8.76	3.86
INTERFACE ADVANCES 1.6 KM/HR (44 CM/SEC)						

BED CONFIGURATIONS

Observations

All observations of the configuration of the channel bottom were made remotely by depth sounders and a side-scan sonar. The precision of the depth sounding records is within 30 cm (vertical) and approximately 15 m (horizontal). The records have a vertical exaggeration of between 1:10 and 1:15. Side-scan sonar records can be read to within 1 m vertically and 15 m horizontally. Vertical exaggeration of side-scan records is 1:3. A distortion of the true bedform shape occurs on some depth sounding records due to orientation of slopes of varying steepness relative to direction of boat motion. However, as only the gross form (length and height) and proportion of length of stoss and lee sides of the bedforms were being examined from the depth soundings the distortion was not considered important.

The depth sounding program was initiated as part of the investigation of bedload transport. Repeated soundings were taken along all reaches of the river, concentrating in the thalweg. Most runs were carried out between the months of May and September with a lesser number in the winter to detect seasonal changes. Because a bewildering variety of bedform shapes and sizes was revealed during the 18-month survey, the side-scan sonar was used for a two-day period (June 1,2, 1975) to aid in the interpretation of the forms by determining their 3-dimensional geometry.

The large range of sizes and shapes of bedforms found in the channel presented a problem of bedform terminology. The classification of large-scale alluvial bedforms is in a state of confusion reflecting a general lack of understanding of their genesis. The most recent review of bedform terminology (Task Force, 1966) is based on an attempt to extrapolate bedform-hydraulic relationships developed in flume studies such as that of Simons *et al.*, (1965) to the natural environment. Unfortunately, the range of conditions found in rivers is not easily reproduced in flumes. In addition, the large-scale, low-amplitude bedforms found in shallow marine, estuarine, and riverine environments have no equivalent forms in the flume results of Simons *et al.*, (1965). These large bedforms have been termed giant ripples, sand ridges, dunes, sand waves, super ripples, transverse bars, sand dunes, and large scale ripples by various authors. Clearly, for the present, a viable bedform classification should be independent of genetic assumptions and based only on descriptive morphology.

A detailed study of the 3-dimensional geometry of bedforms in Pitt channel was made from the sounding records. Using plan geometry, form height and spacing, and form orientation with respect to flood or ebb flow direction, a classification of bedform shapes found in Pitt River was developed (Figure 24). On the basis of height/spacing proportions two major groups of forms can be discerned: small forms (spacing 5 m, ht/spacing ratio = 1/10) equivalent to "dunes" of Simons _et al._, (1965), and large forms (spacing 10 - 60 m, ht/spacing ratio = 1/20) equivalent to "sand waves" of Harms _et al_. (1975). Spacings in the large forms do not represent a continuum but occur in discrete groups (10 - 15 m, 25 - 30m, 50 - 60m) with few bedforms of 15 - 25 m and 30 - 50 m observed. The dominant form is 25 - 30 m in length, composing 70% of the total. The smaller forms (10 - 15 m) make up 25% and the large forms (50 - 60 m) about 5%.

Dunes (height/spacing = 0.3m/2 - 3m) are 3-dimensional with sinous crests and are found on the backs of the large 2-dimensional straight-crested sandwaves. Sandwaves occur in two basic shapes. Type one, characterized by a rounded stoss side (usually covered with dunes) and fairly steep lee slope (Fig. 24A,C) occurs in trains at only a few sites (E and F of Fig. 3A). This form referred to as a "humpback" sand wave (Fig. 25D, flood forms; Fig. 25F, ebb forms) is identical to ones found in Fraser River (Fig. 24B; Fig. 25A) developed under unidirectional flow. The second type (Fig. 24D-H) has uniformly sloping stoss and lee sides. However, the angle of slope and proportion of length of sides varies continuously from flood-oriented forms (60%

of total) through ebb-modified flood forms and fairly symmetrical shapes (25%) of ebb-oriented types (15%).

Bedforms occur along the entire sandy thalweg from Fraser River (Fig. 25A) to the lake outlet (Fig. 25G). The thalweg is approximately 100 - 150 m wide and bedforms usually cover the entire area. Sand wave crests are perpendicualr to the orientation of the thalweg and the superimposed dunes have crests parallel to the sand wave crests. Dunes also occur in sandy channel areas off the thalweg and on sandy shoals surrounding the islands. In contrast, side-scan records and visual observation indicate that ripples are typical of finer grained (silty) areas.

A general relationship between both bedform size and type and topography was found in the Pitt River. The largest forms are found at the base of ramps (areas of rapid shoaling, with slopes $\leq 1^{\circ}$) and the smallest forms are found on relatively flat topography. For example, sand waves (4.5 m/60m) occur on the ramp at the constricted area near a bedrock outcrop at km 15 (Fig. 3A). The channel shallows from 21 m toward the shoal to 10 m at the north end of the wave train. The reach north of Addington Point (Fig. 2) is deep (24 m) but relatively flat. Sand waves here are 1 m/30 m), identical with the average size found in other parts of the river at only 5 m depth. Several trains of small sandwaves (.8 m/10-15m) occur on flat shoals

FIGURE 24. Bedform shapes found in Pitt River drawn to true scale.

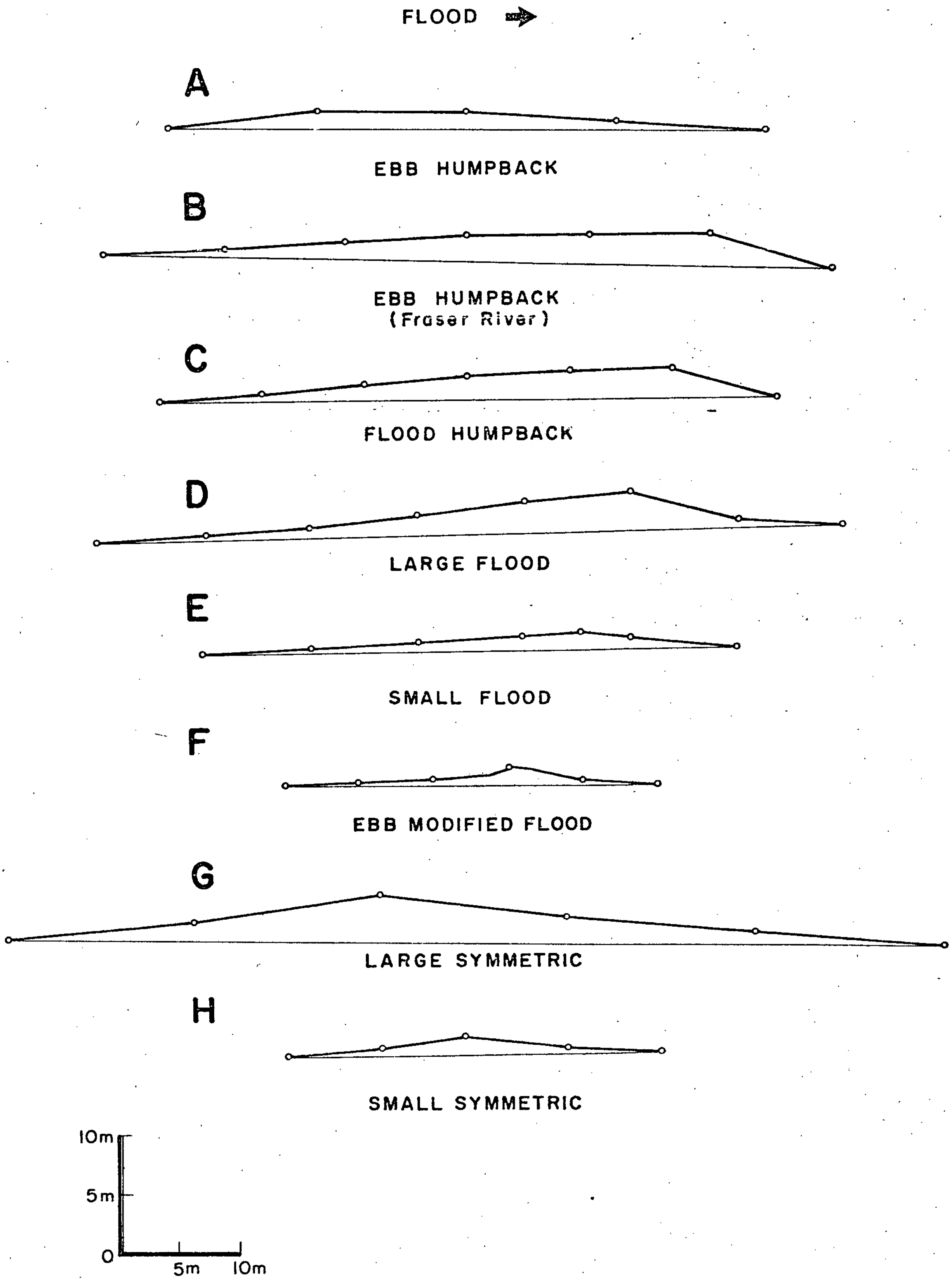

FLOOD
A
EBB HUMPBACK
B
EBB HUMPBACK
(Fraser River)
C
FLOOD HUMPBACK
D
LARGE FLOOD
E
SMALL FLOOD
F
EBB MODIFIED FLOOD
G
LARGE SYMMETRIC
H
SMALL SYMMETRIC
10m
5m
0
5m
10m

FIGURE 25. Depth sounding profiles:

(A) Fraser-Pitt confluence; Fraser has ebb forms, Pitt floodforms.

(B) Flood-oriented sandwaves with some ebb modified crests (km 3).

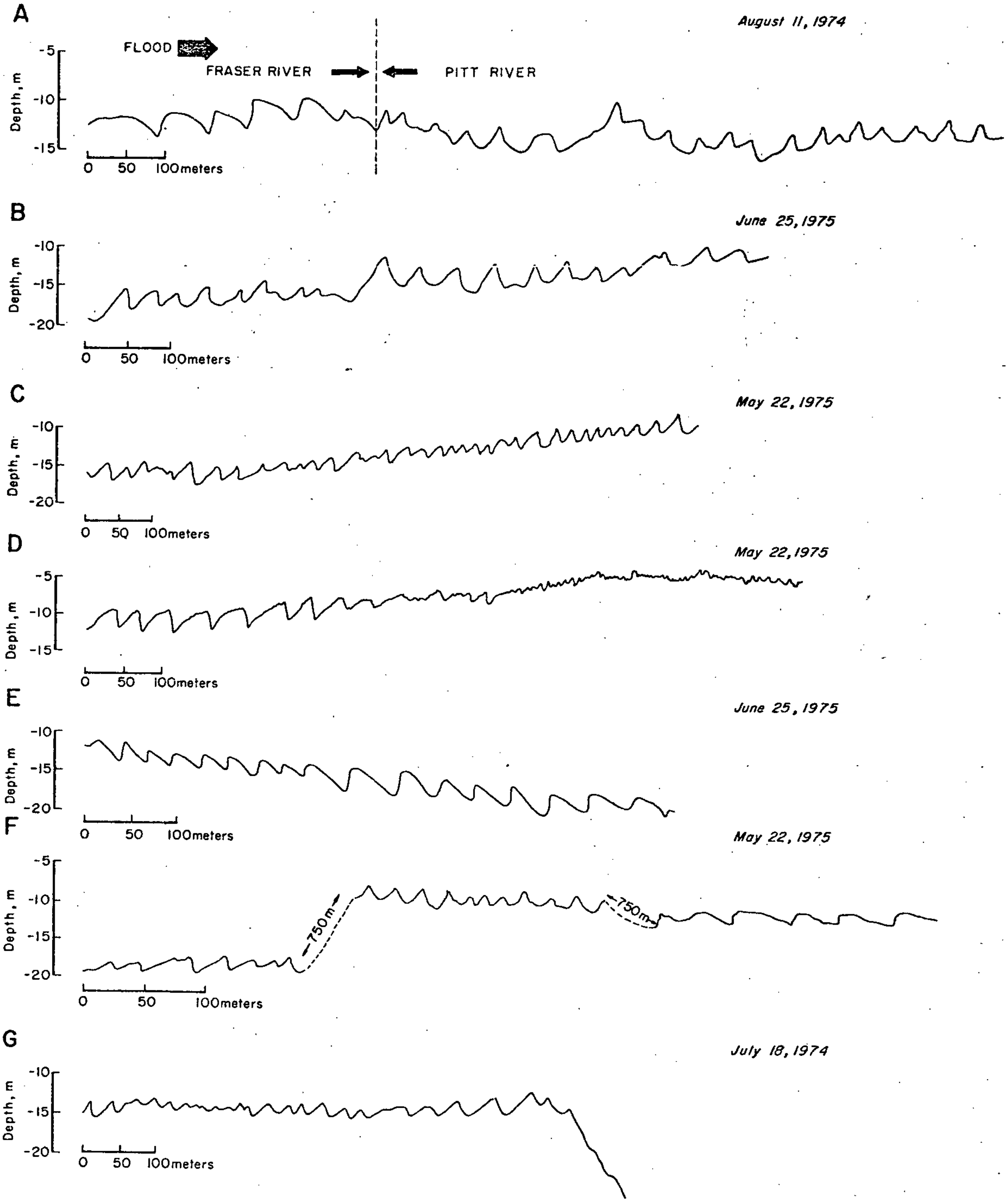
(C) Flood-oriented small scale sandwaves (10 - 15 m spacing) (km 8).

(D) Flood "humpback" forms and dunes on flat topography (km 9).

(E) Ebb "humpback" forms south of Point Addington (E on Fig. 3A).

(F) Flood-oriented, symmetric and ebb-modified, and ebb-oriented sand waves that occur on large mounds in channel.

(G) Bedforms at Pitt Lake outlet.


A
August 11, 1974
FLOOD
FRASER RIVER
PITT RIVER
Depth, m
-5
-10
-15
0 50 100meters
B
June 25, 1975
Depth, m
-10
-15
-20
0 50 100meters
C
May 22, 1975
Depth, m
-10
-15
-20
0 50 100meters
D
May 22, 1975
Depth, m
-5
-10
-15
0 50 100meters
E
June 25, 1975
Depth, m
-10
-15
-20
0 50 100meters
F
May 22, 1975
Depth, m
-5
-10
-15
-20
750m
750m
0 50 100meters
G
July 18, 1974
Depth, m
-10
-15
-20
0 50 100meters

surrounding the islands.

In most reaches large longitudinal "mounds" occur with a wavelength of 3 km (one half the meander wavelength, λ_M) and are thus presumably related to the meander sequence. Elevation difference from crest to trough of the mounds is 7 - 8 m. These major channel features are located on inside bends of midchannel islands or at riffles and present a ramp of shallowing channel to both flood and ebb oriented currents. Flood-oriented sand waves are found on the downstream side of these ramps, symmetrical forms on the shallow top, and ebb-oriented forms on the upstream side (Fig. 25F).

Repeated soundings over a period of months indicated a reorganization of different scales of sand waves. For example, it appeared that several (10 - 15m) forms merged to create a 30 m or 60 m bedform or, inversely, a large form would be replaced by smaller ones. Similar jumps in scale of bedforms have been noted in other rivers by Pretious and Blench (1951) in Fraser River, Znamenskaya (1963) in Polometi River (U.S.S.R.) and Neill (1969) in Red Deer River (Alberta, Canada). The nature of the transformation is not clear; however, intermediate size forms are transient if they exist at all. Although the exact flow conditions which might have caused "regrouping" in the Pitt could not be determined, the changes occurred mainly within the flood-oriented forms during winter flows and on the downstream side of the "mounds" (2 km, 6 km and

and 12 km: Fig. 3).

Repeated depth soundings over a tidal cycle provided evidence of bedform modification. Flood-oriented forms developed ebb-modified crests (Fig. 24F; Fig. 25F) during strong ebb flows (mean velocity of 50 - 60 cm/sec). A complete change from flood-oriented to ebb-oriented form or from ebb-to-flood was not observed..

Interpretation

Bedform Scaling

Because Pitt River has bidirectional flow, the state of equilibrium of the bedforms becomes an important factor. Unidirectional rivers commonly experience an annual high discharge event (spring flood) lasting several days or weeks. Bedforms have been observed to have a delayed response to the increasing or decreasing discharge, and this delay has been termed "lag". In tidal flows the discharge fluctuations have a time scale of hours, apparently insufficient for one event to have a significant effect on large bedforms (Ludwick, 1974). Thus a lag phenomenon would be difficult to measure in the tidal environment. In the Pitt, geometry of each bedform represents the summation of the modifications of both flow directions. Since soundings over an 18-month period determined that the majority of bedform types (Fig. 24) remained constant throughout the year, the forms are interpreted to be in quasi-equilibrium with the bidirectional flow. Thus, bedform shape maintains the imprint of the dominant flow conditions at that site. The humpback forms (Fig. 24A,C) are found in fairly protected areas of the channel. As they appear to be affected by only one current direction humpback forms are considered to be an equilibrium form. In general, the size and shape of the sand waves appears to be related to channel geometry and not to depth as was suggested by Allen (1968); Yalin (1974), and Jackson (1976B). Coleman (1969, Brahmaputra River) and Whetten and Fullam (1967, Columbia River) both found no correlation between scale of bedforms and depth, in agreement with the data from the Pitt.

Bed configurations in the Pitt are difficult to interpret because of the multiplicity of forms and the fact that they appear to reflect the average hydraulic conditions. Most research on sand waves has been done in shallow marine and estuarine environments. Characteristics of flow in these infinitely wide areas are distinctly different from those in channelized flow where lateral-boundary conditions are important. Although the Pitt River is tidal, it is clearly similar to unidirectional rivers in both channel morphology and bed configuration. Significantly, analysis reveals systematic relationships between the various bedform groups and channel parameters.

Plotting the average height and spacing of sand waves on a logarithmic scale results in a linear relationship. As these sand waves form at least 3 distinct groups, this linear relationship appears significant and suggests a common mode of genesis. A similar plot of estuarine sandwaves (Boothroyd and Hubbard, 1975; Fig. 3) shows a scatter of values but does suggest a distinction between subtidal, or deeper water forms, and intertidal, or more shallow water forms. The Pitt values fall within the field of the deep water sand waves on Boothroyd and Hubbard's plot. Dunes from the Pitt plot in the middle of the megaripple field on the same diagram and are assumed to be the same form.

Theoretical models for the genesis of dunes and sandwaves are in a state of flux. Dune formation is thought by some to be related to large scale turbulence (Velikonov and Mikhailova, 1950; Znamenskaya, 1963). The regular spacing of dunes appears to be a direct function of the scale of the largest turbulent eddies (Znamenskaya, 1963; Grishanin, 1972; Jackson, 1975). Flow separation and associated slipface development provide alternating areas of erosion and deposition critical to sediment entrainment and transport. A detailed model of dune genesis has been presented by Costello (1974).

Although considerable progress has been made in understanding the mechanics of dune formation, none of the theoretical models proposed (Kennedy, 1969; Smith, 1970) predict the existence of sand waves.

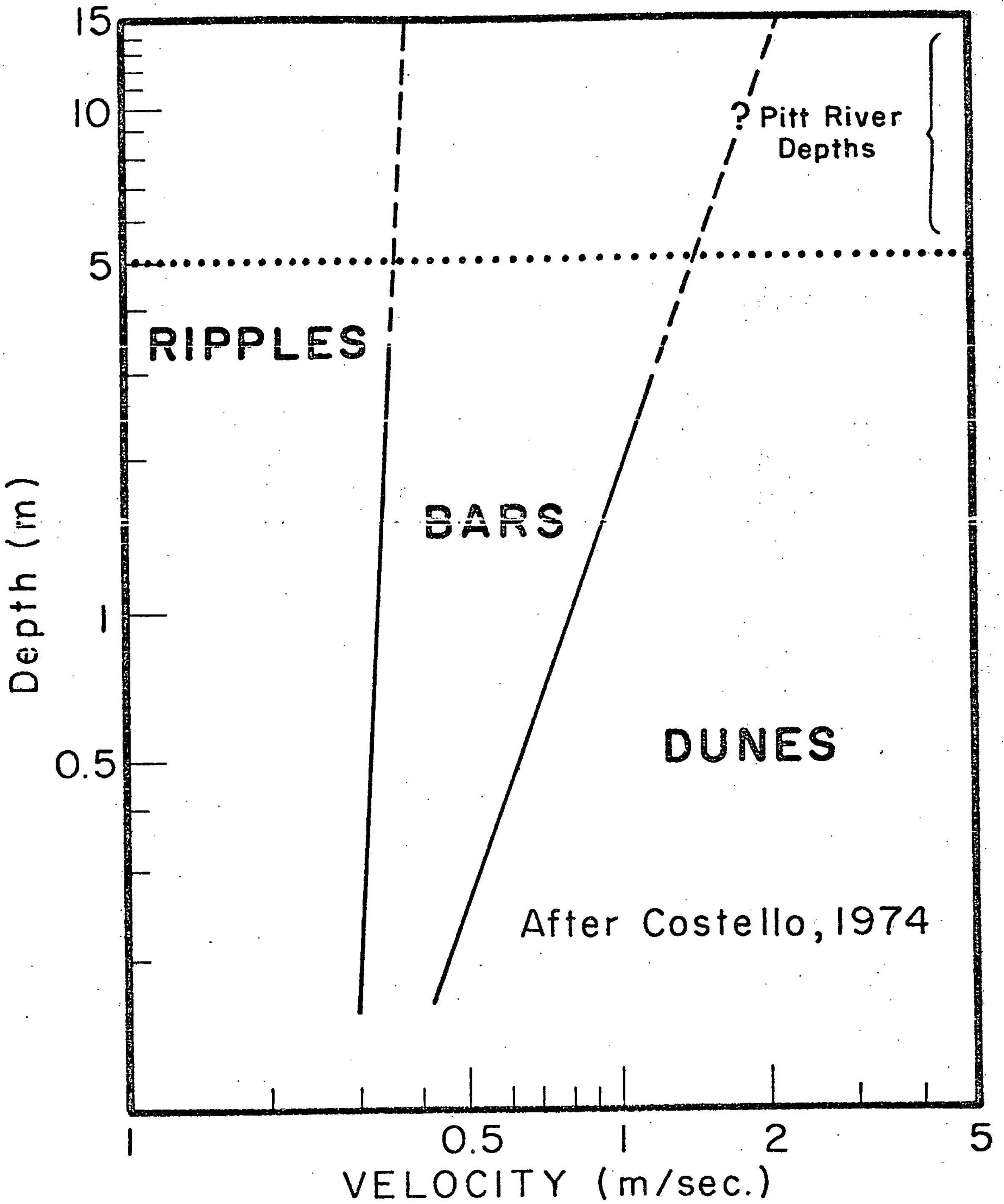
Recent flume studies (Pratt and Smith, 1972; Pratt, 1973; Costello, 1974) reveal bedforms intermediate between ripples and dunes. The flume bedforms were called "intermediate flattened dunes" by Pratt and "bars" by Costello, who equates them with sand waves. Costello adapted kinematic wave theory to explain the genesis of these forms. Although shallow water (≤ 3m) transverse bars (Smith, 1971; Jackson,1976A) may be adequately explained by "shock wave" aggradation of sediment, several characteristics of deep water sand waves in river channels are not consistent with Costello's model. For example, the regular geometry and spacing of sand wave trains in Pitt and other rivers (Pretious and Blench, 1951; Whetten and Fullam, 1969; Carey and Keller, 1957) conflict with Costello's conclusion that sand waves "are randomly generated and (that) this randomness carries over into their spacing and height". The occurrence of dunes in apparent equilibrium with sand waves at velocities considerably lower than predicted by Costello's depth-velocity diagram (Fig. 26) has been documented in a number of studies (Pretious and Blench, 1951; Coleman, 1969; Neill, 1969; Singh and Kumar, 1974; and many others). Jackson (1976A) has presented evidence that dunes and sand waves not only occur together but also migrate under essentially steady flow conditions.

It is unfortunate that these large-scale forms, characteristic of sandy rivers, estuaries, and marine shoals, are so poorly understood.

Relationship of meander wavelength to bedform spacing

Synthesis of quantitative data for rivers by Leopold and Wolman (1957) revealed a systematic relation between various parameters of channel geometry and bankful discharge or effective channel-forming discharge, Q_e. They demonstrated that meander wavelength (λ_M) or resistance to flow is proportional to Q_e according to the relation $\lambda_M \propto Q_e^{.5}$; however, the log-log plot of λ_M vs. Q_e shows considerable scatter. This scatter is not surprising as bed roughness and sediment transport, also important aspects of resistance, are not included. Leopold et al. (1964) suggested that channel geometry is controlled by continuous dissipation of energy by the river along its course. In addition, they showed that total resistance (the Manning n coefficient) is also a simple function of Q ($n = aQ^b$). Since form resistance is an important part of total resistance, it is reasonable to expect channel configuration (bed roughness) as well as λ_M to be scaled to flow. Bedform spacing, λ_B, is known to increase with increasing Q_e (usually with some time lag) through flood events (Pretious and Blench, 1951; Carey and Keller, 1957; Allen, 1976A; 1976B). Thus, it is reasonable to expect a

FIGURE 26. Depth-velocity diagram of the three lower flow regime beforms extrapolated to depths found in Pitt River (after Costello, 1974).


15
10
5
1
0.5
Depth (m)
RIPPLES
BARS
DUNES
? Pitt River Depths
After Costello, 1974
1
0.5
1
2
5
VELOCITY (m/sec.)

particular λ_B in addition to λ_M for a given Q_e.

An attempt was made to obtain comparable data of Q_e, λ_M, and λ_B from sandy meandering rivers with the criteria that are outlined in Table XI. Data are meager, as few studies have been concerned with both channel form and bed roughness. However, the most serious problem is the difficulty in ascertaining the bedform wavelength in equilibrium with bankful discharge. Compilation of available data from sandy rivers including the Pitt, reveal that neither λ_M or λ_B by itself is directly scaled (on arithmetic plot using English units) to Q_e, but the ratio λ_M:λ_B is (Fig. 27); thus, the two factors seem to be interrelated in their response to flow. There appears to be a correlation between the scale of energy input, Q_e, and the scale of energy-dissipating mechanisms (λ_M,λ_B). Based on the preliminary findings shown in Figure 27 the following relationship for sandy meandering rivers is suggested: $\lambda_M/\lambda_B \propto Q_e^{.5}$. It is important to emphasize that this tentative relationship refers to the effective or channel-forming discharge, i.e., that discharge related to λ_M and the dominant bedform size in apparent equilibrium with that discharge, accounting for lag effects when necessary.

The apparent interrelationship between λ_M and λ_B in response to flow which certainly requires further examination is shown in the following comparison: Congaree

TABLE XI Criteria of parameters used in bedform-meander scaling.

PARAMETERS	CRITERIA
Q_e	Effective discharge (channel-forming discharge or bankful discharge) not maximum or mean annual discharge. That flow which determines the λ_M.
λ_M	Meander wave length (twice distance between pools; in particular the "hydraulic" meander, which may not necessarily be the same as the river meander.
λ_B	Bedform wavelength, average or dominant size; that appears to be in equilibrium with Q_e. Not the largest wavelength or range of lengths present. λ_B>5m, usually >10m. Large-scale beforms are commonly referred to as sand waves, transverse bars, large dunes, or super ripples.

FIGURE 27. Plot of "resistance factors λ_M and λ_B against flow factor Q_e shows a systematic relationship in sandy rivers. This suggests that **bedform spacing** can be determined knowing bankfull discharge and meander wavelength.

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River, South Carolina (Levey, 1975) which has approximately the same discharge as Red Deer River (Neill, 1969) has sand waves which are twice as large. Significantly, the meander spacing is also doubled. Additional data would be necessary to firmly establish the empirical relation shown in Figure 27. However, the implication is that meander wavelength is not directly scaled to discharge, in agreement with Schumm's (1971) observation that λ_M can vary **tenfold at** constant Q_e. Although the underlying reasons for the variations in scale of meanders and sand wave length are unclear, it is interesting to note that the Congaree has coarser bed material (mean grain size, 0.59 mm) and higher sinuosity ($s = 1.75$) than the Red Deer River (mean grain size, .37 mm; $s = 1.11$). Thus, grain size may be a key factor in predicting the meander wavelength and bedform spacing for a given bankful discharge.

In conclusion, there appear to be several scales of sediment-flow interaction, all a function of energy dissipation. On a local level, small-scale turbulence (on the order of a few cm) and grains interact, resulting in sediment entrainment and transportation. Large-scale turbulence (on the order of meters), apparently related to scale of flow, interacts with the bed, molding it into a variety of configurations. Finally, interaction occurs on a regional scale (on the order of kilometers) where size of major channel features such as meanders, point bars, riffles, and mid-channel bars are determined by scale of flow. Data from Pitt River clearly show a regular channel pattern with alternating pools, riffles, and islands. The fairly regular spacing of sand waves (70% with length of 25 - 30 m), and the inferred common genesis of the three discrete sand wave sizes imply a governing hydraulic control. Discharge (flow) and not depth, width, or velocity alone appears to be the controlling mechanism.

SUMMARY AND CONCLUSIONS

Despite the tidal influence of Pitt River, it has few estuarine characteristics. This is related to its connection to Pitt Lake, which acts as a large reservoir, thus allowing bidirectional flow through Pitt River to occur with no more impedance than that of a normal river. The mineralogy of the channel sands is essentially identical to Fraser River mineralogy confirming the Fraser as provenance of Pitt River sediments. The river is a flood dominated system; although flow duration is shorter, flood flows have slighly higher peak velocities than the ebb. Thus, flood flow has higher basal shear stress, greater flow power and associated higher sediment entrainment potential. Water slopes are steeper on flooding tide during both winter and freshet. The steeper water slope provides the major driving force to move sediment (in flood direction) toward Pitt Lake even though the net discharge of water is in the opposite direction. Reflecting this direction of transport, mean grain size of bed material decreases from 0.37 mm at the Fraser-Pitt confluence to 0.25 mm at the entrance to Pitt Lake. ^{137}Cs dating of lake sediment indicates a total of $150 \pm 20 \times 10^3$ tonnes is accumulating annually in the delta at the lower end of the lake.

The thalweg bed is covered with large-scale, low-amplitude, and straight-crested bedforms herein termed sand waves. 60% are flood oriented, 25% symmetric or ebb-modified flood forms, and 15% are ebb oriented. The majority have smaller bedforms (dunes) on their stoss sides. Three distinct sizes (height/spacing = 0.8 m/10 - 15 m; 1.5 m/ 25 - 30 m; 3 m/ 50 - 60 m) of sand waves were found in the river and the linear relationship between log height and log spacing suggests a common genesis. The position of the various sand wave types and sizes appears to be related to channel geometry and not depth of flow. The largest forms, as well as the flood-oriented forms, occur on the downstream side of ramps (slope of $\leq 1^{\circ}$) and the smallest sand waves on relatively flat topography.

The interaction of flow and channel alluvium occurs on at least three distinct scales, all related to energy dissipation by the moving fluid. First, grains and small-scale turbulence (on the order of centimeters) interact resulting in sediment entrainment and transport. The second level of interaction of flow with sediment produces a variety of configurations of bed roughness (ripples, dunes, and sand waves) on the scale of meters. Third, interaction on a regional scale (order of kilometers) creates the channel configuration of evenly spaced pools, riffles and bars. The larger two scales of sediment-water interaction appear to be proportional to channel forming discharge, Q_e (peak winter flood tide flows).

In conclusion, Pitt River is in a state of quasi-equilibrium with bidirectional and seasonal changes in discharge. The channel has not migrated significantly in the past several thousand years. The configuration of the channel bottom and magnitude of sediment flux appears to be consistent from one year to the next. Both these observations indicate relative stability and a balance of hydraulic and frictional forces in this unusual depositional system.

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PART TWO: INTRODUCTION

Pitt River (North) - Pitt Lake - Pitt River (South) system is situated in a glacially scoured valley within the Coast Mountains of British Columbia approximately 30 km inland from the port of Vancouver (Fig. 1). The valley of the Pitt, 70 km in length opens abruptly into Fraser lowland. Pitt River (North) drains 816 km^2 including several mountain glaciers and provides a mean discharge of 80 m^3.sec^{-1} to the lake. A prominant sill, 5 km from northern end of lake, allows only clay-sized sediment to be carried to the lower end of the lake.

Pitt River (South) and Pitt Lake are tidal, being connected to the ocean (Strait of Georgia) by lower Fraser River. Although water levels in the Pitt system respond to the tides, salt water seldom extends closer than 10 km downstream of the Fraser - Pitt confluence. Rising water (flood tide) in the Strait retards flow of the Fraser and raises its elevation progressively eastward until the water level at the Fraser-Pitt confluence is higher than in Pitt River (South). Flow in the Pitt then reverses and water diverted from the Fraser flows northward up Pitt River (South) into Pitt Lake. As the water elevation falls (ebb tide) in the Strait, Fraser River flow is accelerated.

FIGURE 1. Location map of Pitt tidal system.

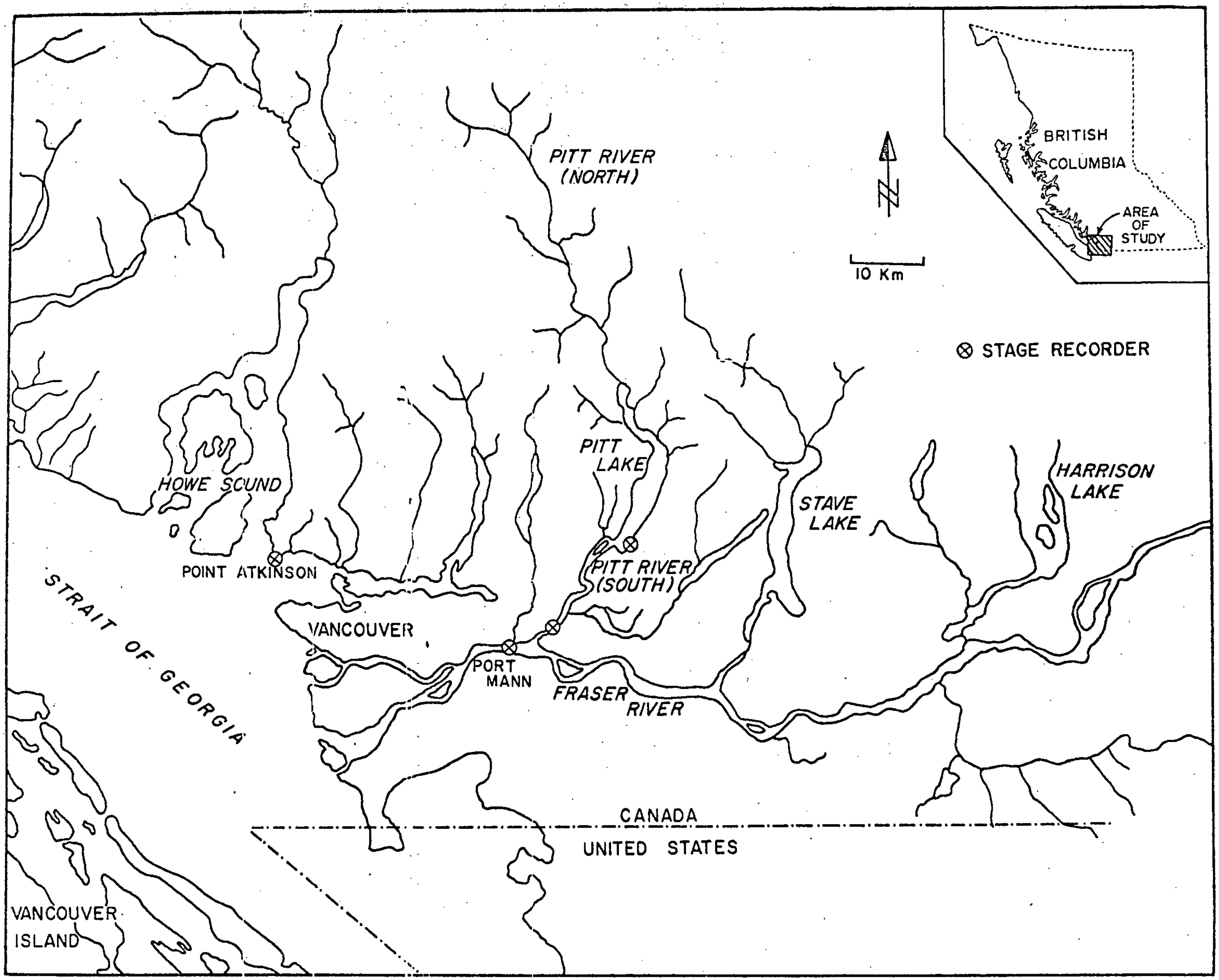

PITT RIVER (NORTH)
BRITISH COLUMBIA
AREA OF STUDY
10 Km
⊗ STAGE RECORDER
PITT LAKE
HOWE SOUND
HARRISON LAKE
STAVE LAKE
POINT ATKINSON
PITT RIVER (SOUTH)
STRAIT OF GEORGIA
VANCOUVER
PORT MANN
FRASER RIVER
CANADA
UNITED STATES
VANCOUVER ISLAND

FIGURE 2. Aerial photo showing the main physiographic features of the lower Pitt system. The bedrock high is outlined with dashed lines. Its extent is based on isolated bedrock knobs that protrude through the flood plain.


← GOOSE ISLAND
← DELTA
N
WIDGEON SLOUGH
← DIKE
ABANDONED TOPSETS
POINT ADDINGTON →
← BEDROCK RIDGE
PITT RIVER
0 5
KILOMETERS
FRASER RIVER
RS A30339-71

The surface elevation is lowered progressively eastward until the level at the Fraser - Pitt confluence is less than that of Pitt River (South). Flow then reverses in the Pitt system and drains toward the sea. The elevation and magnitude of water level oscillations in the Pitt system are a function of the complex interaction of Pitt basin drainage, Fraser River discharge, and the tidal prism.

Upstream movement of sediment in Pitt River from Fraser River toward Pitt Lake is indicated by: (1) a predominance of flood-oriented bedforms in the river channel; and, (2) a decrease in grain size from the Fraser to the lake. In addition, velocity and stage measurements demonstrate that flood flows have higher peak velocities and that flood flows persist for a shorter time period than ebb flows.

A large tidal delta with a surface area of 12 km^2, has accumulated at the distal (draining) end of the lake (Fig. 2). Because of the unusual position of the delta there has been speculation on whether it is actively growing or a relict feature from earlier post-glacial time. The purposes of the present study are twofold: first, to determine if the delta is active and to estimate the present sedimentation rate; and second, to examine the hydraulics of the lake channel and to evaluate the effect of bidirectional flow on sediment dispersal and delta morphology.

GEOLOGIC HISTORY

The Pitt tidal delta appears to represent a situation in which the past is the key to the present. An understanding of the historical development of the delta provides an important insight into the nature of the currently acting processes.

During the Pleistocene Epoch repeated glaciations aided by pre- and inter-glacial stream activity have eroded deeply the valleys along a northwest and northeast oriented joint pattern occuring in the Coast Mountains (Peacock, 1935). Following the most recent deglaciation (15,000 - 11,000 B.P.) the melting ice left numerous elongate lakes in interior valleys and a coastline dominated by fiords. However, in early postglacial time the exact location of the shore fluctuated as a result of a complex interaction of eustatic sea level changes and crustal rebound (Mathews et al., 1970). During the period of instability, ocean waters flooded past the mouth of Pitt Valley, as is evidenced by marine shells (12,690 ± 190 B.P.; I-5959, Mathewes, 1973) collected at an elevation of 107 m on the east side of Pitt valley. Isostatic uplift of the Fraser lowland began around 13,000 B.P. and was essentially complete by 8,000 B.P. (Mathews et al., 1970). Fraser River, supplied with abundant glacial sediment, rapidly constructed a delta westward and by 8,290 ± 140 B.P. (G.S.C. 229, Dyck et al., 1965) "Pitt Fiord" was isolated from the sea at its southern end by this delta. It is likely that a short tidal channel maintained a connection between the fiord and the Fraser estuary. Tidal currents flowing through this channel must have carried sediment from Fraser River into the fiord, building a flood tidal delta which continued to grow northward as Fraser delta progressed westward. By 4,645 ± 95 B.P. (I-7047; Mathews, 1972 pers. comm.) the leading edge of Pitt delta stood at least 20 km north of Fraser River near the present outlet of Pitt Lake (Fig. 1). The dated material was a log found in delta topsets 10 m north of the channel and buried under 60 cm of sediment. At some time during this period "Pitt Fiord" was flushed of saline water and became Pitt Lake; at present time no salt water is found anywhere in lake. As the sea-land relationship has been much the same as at present since 5,500 B.P. (Mathews et al., 1970), it is possible that Pitt Lake has been in existence for approximately 6000 years.

The boundary between Pitt River flood plain and Pitt Lake tidal delta has been a transitional one throughout their development. At present, dikes and ditches have created two entities, but the division is artificial. Historically, water flow and sedimentation have been a continuum from river to lake.

On the basis of aerial photo interpretation (scale 1:15,840; 1:31,680) of the Pitt River flood plain, it appears that the river has been consistently on its west side (Fig. 2). It is suspected that a bedrock ridge connects the isolated hills on the flood plain to the ridge bordering Pitt Lake's southwest shore and has prevented the river from flowing directly into the lake. This ridge may have separated lobes of ice disgorging from Widgeon and Pitt Valleys during the Pleistocene. The bedrock also deflects both flood and ebb flows at Addington Point, a sharp meander bend.

The triangular area directly south of the lake (Fig. 2) is abandoned delta surface and lies at approximately the same elevation as delta topsets in the lake. However, the area is slightly lower than the surrounding flood plain and diking in the 1920's on the east, south, and west borders and a dike placed on the north side (1959) have permanently sealed the location from further clastic sedimentation.

During the last 4,700 years the delta front has advanced from the present lake outlet approximately 6 km north into Pitt Lake at the average rate of 1.28 m/yr. However, with the change from paraglacial to nonglacial conditions sediment supply would decrease (Ryder and Church, 1973). In addition, containment of Fraser River within the last century may also have been important in altering sediment supply to the Pitt system. Thus this progradation rate most likely has decreased exponentially, starting at meters per year and decreasing to the probable present rate of centimeters per year. A map produced by Richards (1860) shows the delta with the same general configuration as present, but accurate delta growth rate calculations for the last 118 years could not be made from it.

GEOMORPHOLOGY

Delta

The present delta surface covers 12 sq. km. (5.8 km long and 2.2. km wide) and contains a single distributary channel with a right-angle bend (Fig. 3). Minor erosion in the form of a scalloped channel margin occurs near the bend (Fig. 4A); however a study of aerial photos dating back to 1940 indicates little change in 35 years. The channel is incised in the reach between the lake entrance and the bend, with nearly vertical channel banks in some places (Fig. 5). However, the channel banks gradually change from steep to gentle slopes toward the end of the delta (Fig. 5) in conjunction with a gradual shallowing of the channel. The delta surface is highest at its southern margin and slopes down ($6.0 \times 10^{-4\,\circ}$) toward the topset/foreset slope break. During low water in Pitt lake the southernmost kilometer of delta is exposed and minor southerly draining channels in a dendritic pattern are eroded into the topsets (Fig. 3; Fig. 4A) by water draining from the delta surface into the channel during ebb flow. The drainage channels are 2 - 3 m wide and 1 m deep at their widest cross section. Levees border both sides of the major delta channel (Fig. 4B) and a few minor flood exit grooves are eroded diagonally through the levees (about 1 km from end) marking

FIGURE 3. Geomorphology of Pitt tidal delta with lake bathymetry. Depth contour interval is 10 m. A topographic "high" on the lake bottom connects islands and the bedrock ridge bordering the southwest side of lake. This "high" is coincident with the 70 m depth contour and 6ϕ mean grain size contour (Fig. 11) and is used as an arbitrary division between delta foresets and bottomsets - lake bottom. Cross section (A-K) locations of Figure 5 are illustrated. Cores used for ^{137}Cs dating shown by *.

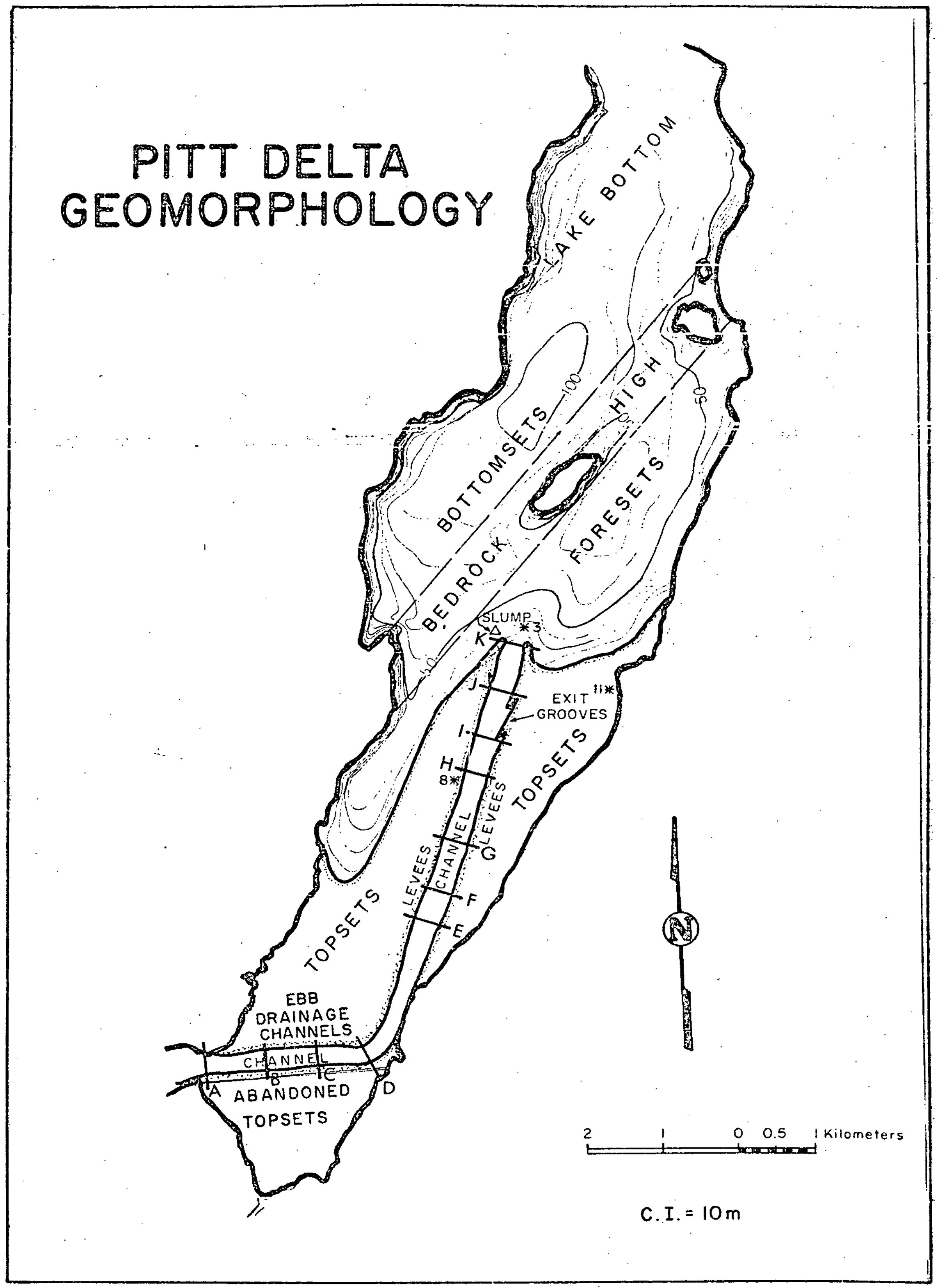

PITT DELTA
GEOMORPHOLOGY
LAKE BOTTOM
100
BOTTOMSETS
HIGH
50
BEDROCK
FORESETS
50
SLUMP
K
3
J
11
EXIT
GROOVES
I
H
8
TOPSETS
LEVEES
CHANNEL
LEVEES
G
F
E
TOPSETS
EBB
DRAINAGE
CHANNELS
CHANNEL
A
B
C
D
ABANDONED
TOPSETS
N
2
1
0
0.5
1 Kilometers
C.I. = 10m

FIGURE 4. A.Oblique aerial photo looking east at right-angle bend. Note ebb drainage channels and scalloped margin of topsets. Wind-generated waves cover water surface.

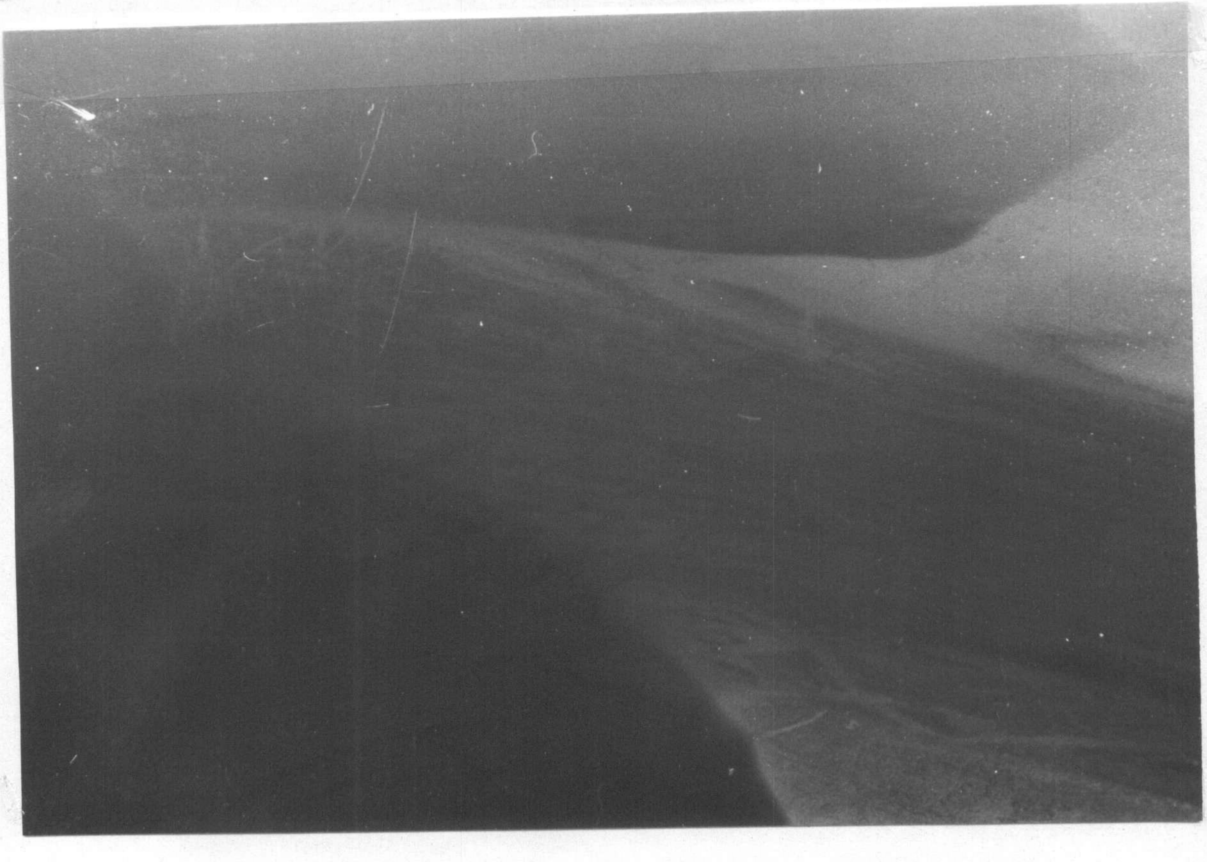
B.West side of delta topsets. Levees can be seen bordering topset margin in the foreground. Boat wake (30 m) for scale.

C.View looking east across end of delta. Channel in center (bordered by levees) leads to a pointed fan-shaped deposit on delta foresets just left of the photograph.

A

B

C



crevasse splays where sediment is carried up out of the channel onto the delta surface (Fig. 3).

A longitudinal profile along the thalweg (Fig. 6) shows the lake entrance and right-angle bend to be extremely deep (30 m) whereas the reach between the deeps is more shallow (10 m) and thus probably is an area of (temporary) deposition. The section of channel from bend to delta front is a ramp which shallows from 30 m to 4 m in a gentle slope of 0.3° to 0.05°. The thalweg appears to have one partial meander which is similar in length (λ_M = 600 m) to meanders of Pitt River (South) (Ashley, 1977). The channel bottom projects as a wedge-shaped tongue (flanked by levees) into the lake (Fig. 3; Fig. 4C) pointing northeast in the direction of delta-front progradation (east side of island).

The delta topset surface is flat and devoid of any major topographic features with the exception of the ebb drainage channels and the levees. Occasional scour holes (0.5 m deep) on the surface reveal a horizontally stratified, highly cohesive sediment. The occurrence of nearly vertical banks bordering the delta channel supports this conclusion. The binding agent is thought to be organic in nature as little clay is present in the sediment. <u>Isoetes echinospora</u> dur. (quillwort), is ubiquitous on the delta surface. Roots of this plant are thin, white,

FIGURE 5. Cross sections drawn from depth sounding profiles (8X vertical exaggeration). Profile locations shown on Figure 3. A general shallowing of the channel and change of channel bank slopes from almost vertical to gently dipping occurs along the delta from outlet to the end.

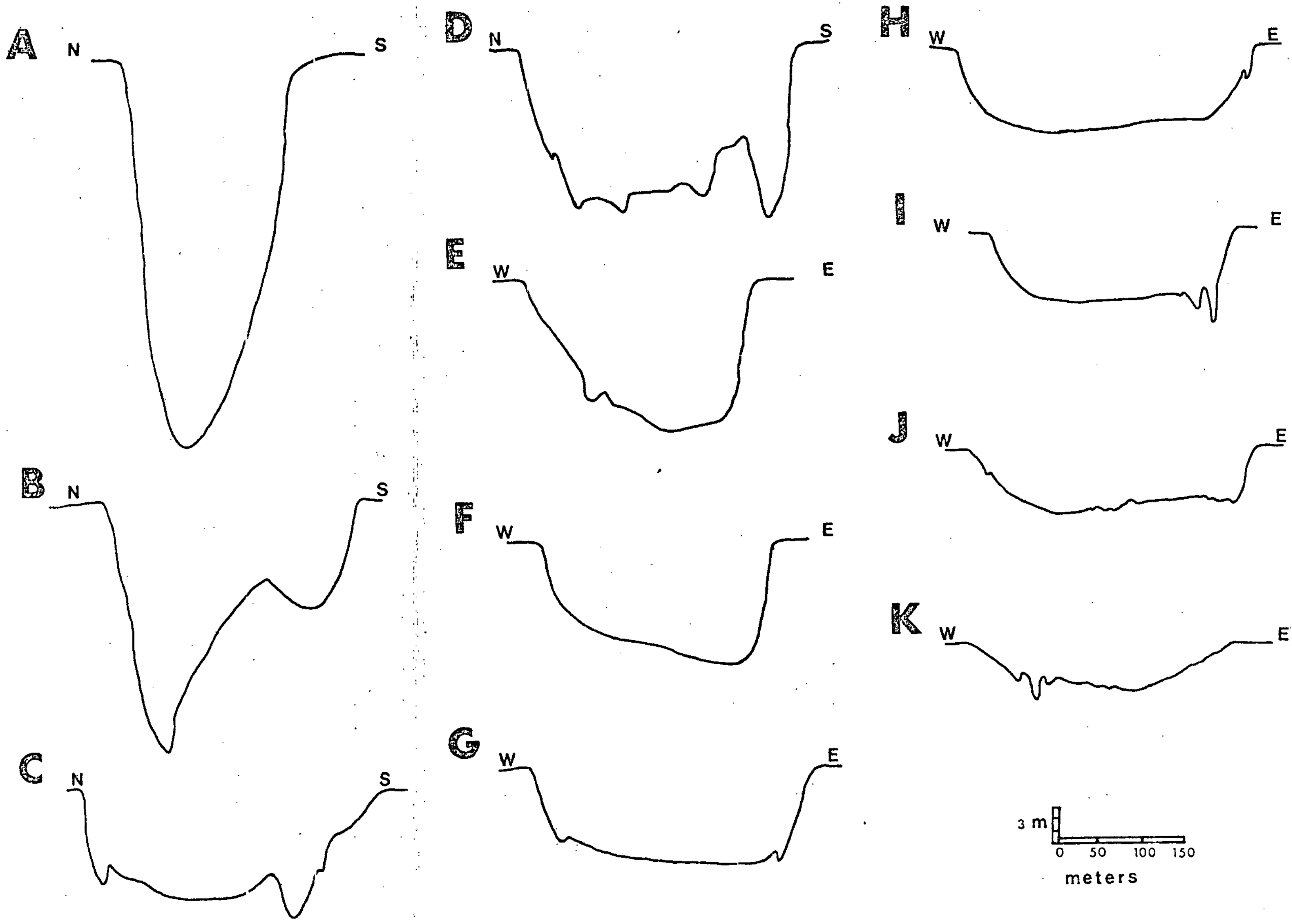
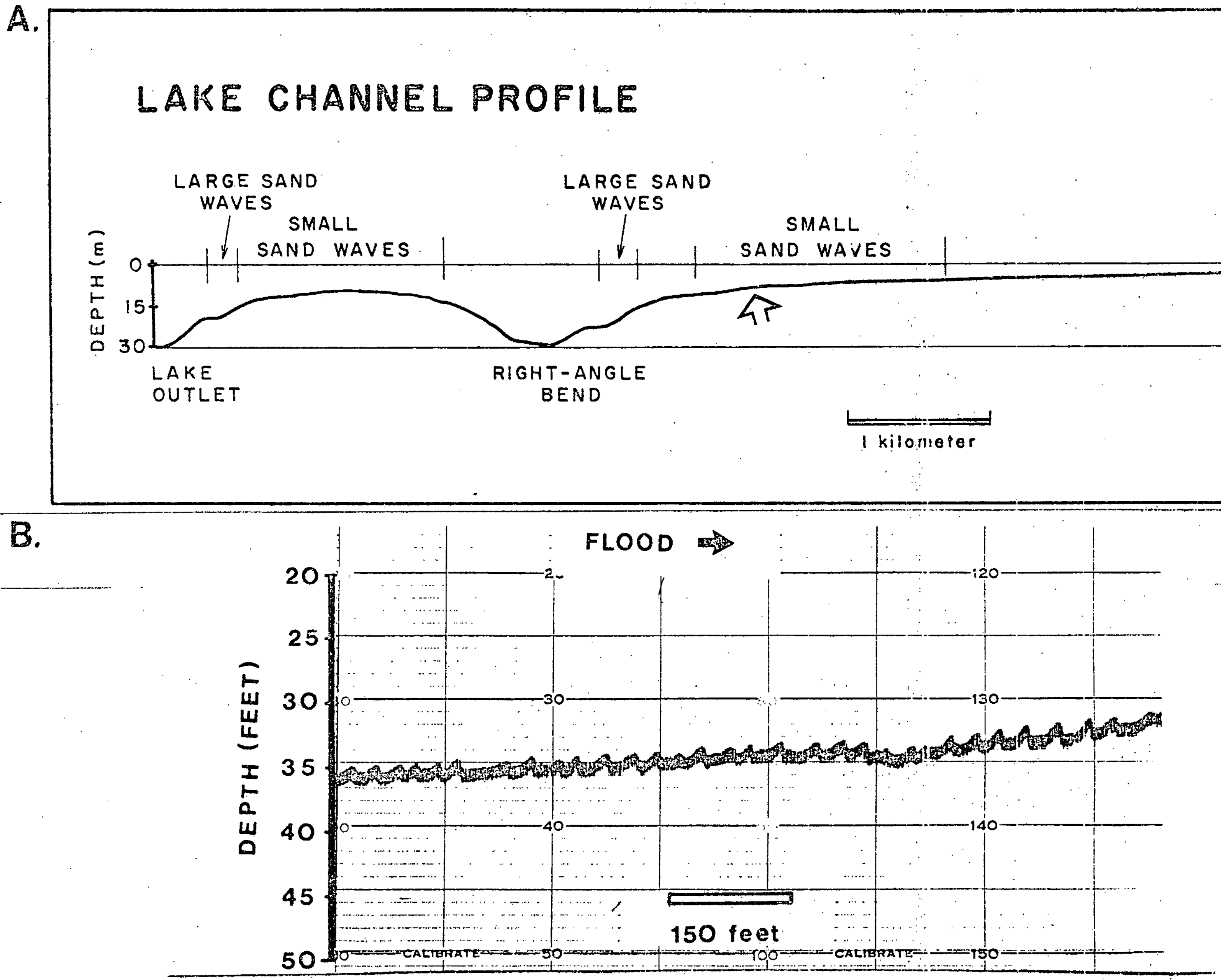

A
N
S
B
N
S
C
N
S
D
N
S
E
W
E
F
W
E
G
W
E
H
W
E
I
W
E
J
W
E
K
W
E
3 m
0
50
100
150
meters

FIGURE 6. A. Profile of thalweg of delta channel. Deep areas occur at outlet and right-angle bend. Large sand waves (L.S.W.) are found in areas of shallowing channel. Small sand waves are found to within 3 km of the end of the delta. The location of depth soundings taken in B. is indicated by arrow.

B. Depth sounding of small sand waves in delta channel: note flood orientation. Spacing is 8 m; height is 30 cm.


A.
LAKE CHANNEL PROFILE
LARGE SAND WAVES
SMALL SAND WAVES
LARGE SAND WAVES
SMALL SAND WAVES
DEPTH (m)
0
15
30
LAKE OUTLET
RIGHT-ANGLE BEND
DELTA FORESET
1 kilometer
B.
FLOOD
DEPTH (FEET)
20
25
30
35
40
45
50
150 feet
CALIBRATE
CALIBRATE
120
130
140
150
30
40
50
100

threadlike filaments which do not decompose readily: they were found in all surface samples. It is interpreted that this macrophyte is an important agent in binding the sediment. Other Macrophytes (_Scirpus_ _validus_ Vahl., _Myriophyllum_ _hippuroides_ Nutt., and _Potamogeton_ sp.) also populate the flats. Other possibilities for cementation are micro-organisms. Blue-green algae were found to be rare whereas diatoms are relatively abundant. Mucus produced by the diatoms may act as a temporary binding agent for the delta sediments. _Unio_ clams, spaced 1 m apart, occur on almost the entire surface and appear to feed at the sediment/water interface, causing little noticeable bioturbation in the underlying sediments.

The foreset slope (Fig. 3) was examined by depth sounding. The contact between topsets and foresets is a sharp break in slope and is outlined in the figure. The foreset/bottomset contact is a gradational change in slope from 4° - 1° to an essentially horizontal surface and is positioned arbitrarily at the bedrock ridge (Fig. 3). This ridge line approximates the 70 m depth contour and is also coincident with the mean grain size contour of 60. Delta foresets range in slope from 1° - 2° near the east shore to 4° - 6° at the end of the main channel and the "side-sets" bordering the western embayment have a slope of 10° - 20°. In general, the entire foreset-bottomset slope is gentler to the east side of Goose Island than to the west and the general shape of the delta indicates that sedimentation has occurred consistently on the east side of the lake. The foresets are generally smooth with a gentle concave upward profile. Only one slump feature (Fig. 3) was noted on the entire foreset apron, indicating a relatively stable slope. The slump has a relief of about 3 meters and occurs just west of the fan (Fig. 4C) created at the end of the distributary channel. Seismic data from the lake (Mathews, unpublished data, 1976) indicates that a topographic high (Fig. 3) exists between the bedrock ridge (bordering the southwest side of lake) and Goose Island essentially splitting the lower end of the lake into two basins.

Based on its geomorphology, the Pitt delta can best be described as a single talon of a birdfoot delta which has been welded to the eastern lake shore. A depositional model for the birdfoot delta includes progradation of the distributary channel into relatively deep water (Scruton, 1960). Sediment is conveyed along the delta channel and is brought out periodically and deposited on the delta surface as levees. Along each side of the major channel are interdistributary troughs which slowly fill with fine-grained sediment. As the distributary channel extends into standing water, it broadens, becomes more shallow and gradually looses its identity (Reineck and Singh, 1975).

The Pitt appears to fit this general model. It is clearly dominated by fluvial processes. The depositional environment is one of very low energy and little reworking of the fluviatile sediments occurs by waves or tidal currents.

Bed configurations in the channel

In conjunction with the study of Pitt delta geomorphology an examination was made of the bed configuration of the delta channel bottom. Soundings were made over an 18-month period, under both ebb and flood flows. Using depth sounding records (Raytheon, model #DE-119), side-scan sonar records (Klein, model #2000), and visual observation by divers, two bedform types were found; ripples/spacing ratio = 1:10; spacing 60cm) and sand waves (spacing ratio = 1:30, spacing 5m). Ripples are ubiquitous on the sandy substrate of the channel bottom, as well as on the sandy delta topsets. Small sand waves (10 - 15 m spacing and 0.15 - 0.3 m high) are found in the area between the outlet and the right-angle bend and on a portion of the ramp north of this bend (Fig. 6). Larger sand waves (25 m spacing and 0.7 m high) occur only in reaches of rapidly shallowing depth (Fig. 6A). All bedforms were found to be flood-oriented, which is interpreted as reflecting the dominant flow conditions and direction of net sediment transport (see Ashley, 1977).

HYDRAULICS

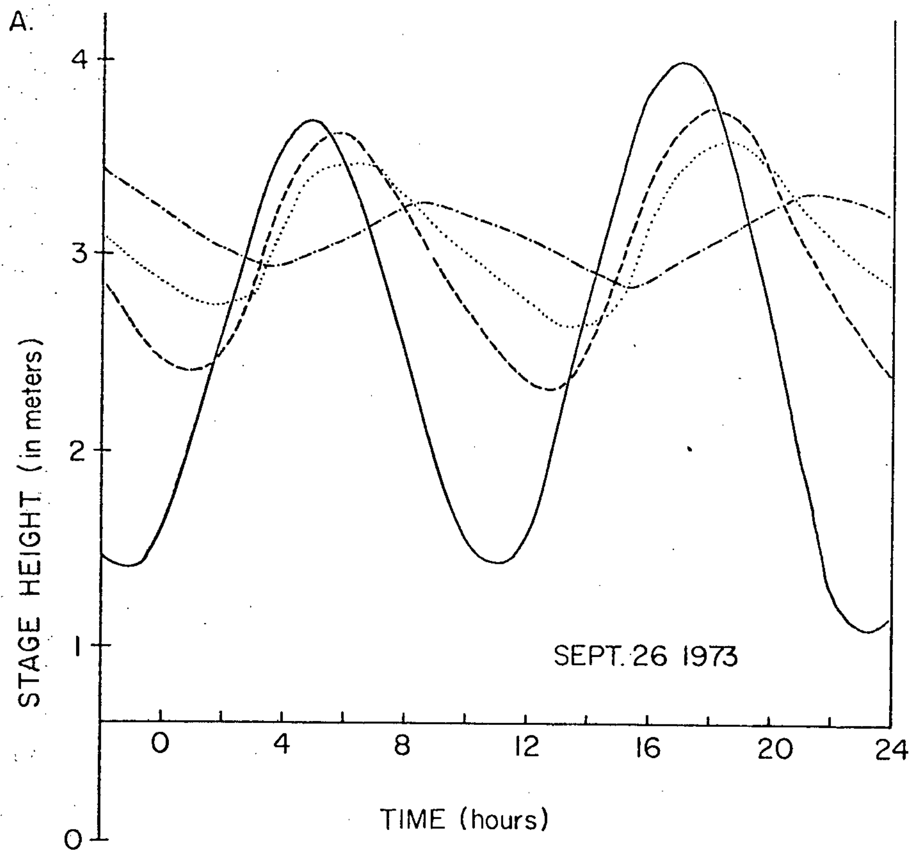
Tides

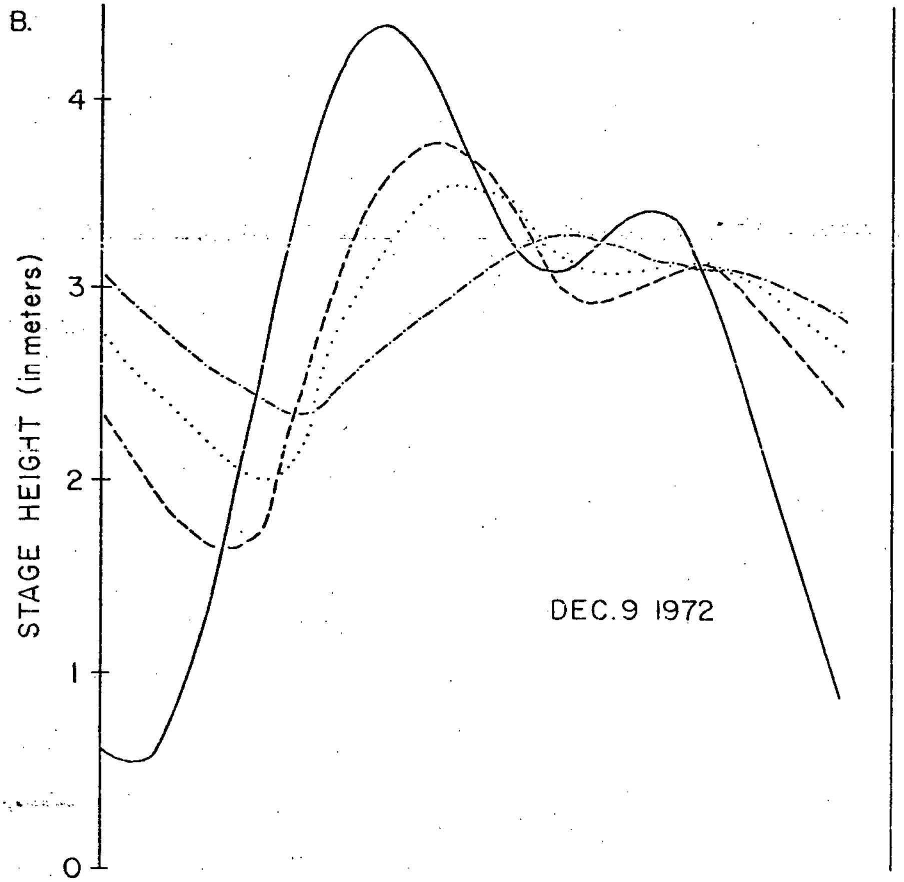
The main driving force behind the hydrodynamics of Pitt Lake is the tide. The mixed, mainly diurnal tide in the Strait of Georgia produces one or two tidal cycles a day in the lake, depending upon the nature of the tidal curve. Water level (stage) data used (Fig. 7) are unpublished records of the Water Survey of Canada. Minor features such as small stage fluctuations and quick short changes in flow direction are damped between the ocean and lake and are not expressed in lake stage. When flow conditions persist for several hours (symmetric diurnal tides in the Strait), diurnal lake stage curves are produced (Fig. 7A). On the other hand, highly asymmetric tidal curves, such as shown in Figure 7B, produce only one complete cycle a day. During winter, a delay of 5 hr 15 min. occurs between high tide in the Strait and high tide in the lake, while a 6 hr. 20 min. delay occurs for passage of low tide from Strait to lake. During the freshet when the contribution of Pitt basin drainage is high, it takes 15 hr 30 min for either high or low tide to pass from the Strait to the lake. Lake stage level fluctuations varied from 0.27 m to 1.16 m within a tidal cycle, during the

FIGURE 7. Time stage curves for Strait of Georgia ———, Fraser River - - - -, Pitt River ......, and Pitt Lake .-.-.-.-.

A. Semi-diurnal tide in the Strait creates semi-diurnal fluctuations in Pitt Lake.

B. The effect of mixed, mainly diurnal tide in the Strait is damped by the time it reaches the lake causing only one fluctuation in lake level.


A.
4
3
2
1
0
STAGE HEIGHT (in meters)
0
4
8
12
16
20
24
TIME (hours)
SEPT. 26 1973


B.
4
3
2
1
0
STAGE HEIGHT (in meters)
DEC. 9 1972

year (1973) of stage data examined in detail. Table I gives maximum, minimum, and mean ranges for four representative months.

In addition to tidally induced oscillations in water level in Pitt Lake, the absolute level of these oscillations changes seasonally with a maximum during freshet run off (May - July) and a minimum during winter (Dec. - Feb.). Discharge (Q) contributed to Pitt system from Pitt River (North) and small streams surrounding the lake varies from 210 m^3/sec. (freshet) to 30 m^3/sec. (winter) (Water Survey of Canada, 1966). The result is that during the freshet more than 50% of water moving through the Pitt Lake - Pitt River (South) system is contributed by basin drainage contrasting with only 5% during the winter.

The magnitude of discharge flowing through Pitt River (South) (Ashley, 1977) and into Pitt Lake is directly related to the magnitude of the tidal range in the Strait, if Fraser and Pitt basin discharge are constant. With high discharges in the Fraser and Pitt during the freshet the tidal effect in Pitt Lake is small; however, when discharges of Fraser and Pitt systems are low (winter), the tidal effect is great. Peak flows estimated for both seasons and both flow directions are compared in Table II. Estimates were made using lake area, lake stage curves, velocity measurements at lake outlet, and cross-sectional area of lake outlet. Thus, there are not only pronounced seasonal

TABLE I Range of lake stage levels (1973) in meters.

MONTH	MAXIMUM	MEAN	MINIMUM
March	1.04	.73	.67
June	.67	.45	.27
Sept.	.82	.64	.42
Dec.	1.16	1.04	.67

TABLE II Estimated peak discharges for Pitt system.

SEASON	FLOOD $m^3\ sec^{-1}$	EBB $m^3\ sec^{-1}$
WINTER	2400	2080
FRESHET	1800	950

differences, with winter having the highest discharge ($2400\ m^3.sec^{-1}$) but also during either season the largest flood discharge is greater than the largest ebb discharge. The greater difference in discharge between flood and ebb of freshet (Table II) compared to flood and ebb discharge of winter, is due to the increase in volume of water moving through the Fraser-Pitt systems (during the freshet). Water added by streams draining into Pitt Lake raises the elevation of the lake surface as much as 3 m. The elevation of Fraser River is also increased and the net effect is a decrease in the water slope of the upstream flow (flood) into the Pitt. The raised lake elevation also accentuates the time-stage asymmetry of the tidal cycle and thus changes the proportion of time devoted to flood (lesser) and ebb flow (greater). The ebb current flows for a longer period of time (65% - 75% of total) at a lower discharge which produces a lower ebb water slope compared to the winter.

Flow pattern over the delta is significantly different on flood and ebb. Flow entering the lake from the river is mainly confined within the deep distributary channel (Fig. 8A). The flow is then deflected northward at the east side of lake causing considerable scour (35 m deep). Continuing along the delta, flood currents generally remain confined in the channel to within 1.5 - 1 km from the end where they spread out across the topsets. Some "over bank" flow occurs along the length of the distributary as evidenced by the levees. Ebb flow has a much more diffuse pattern (Fig. 8B). During the beginning of the ebb, water drains off the topsets into the channel taking the shortest, most direct route. At lower ebb stage, flow becomes more channelized and is confined in the distributary.

Velocity in channel

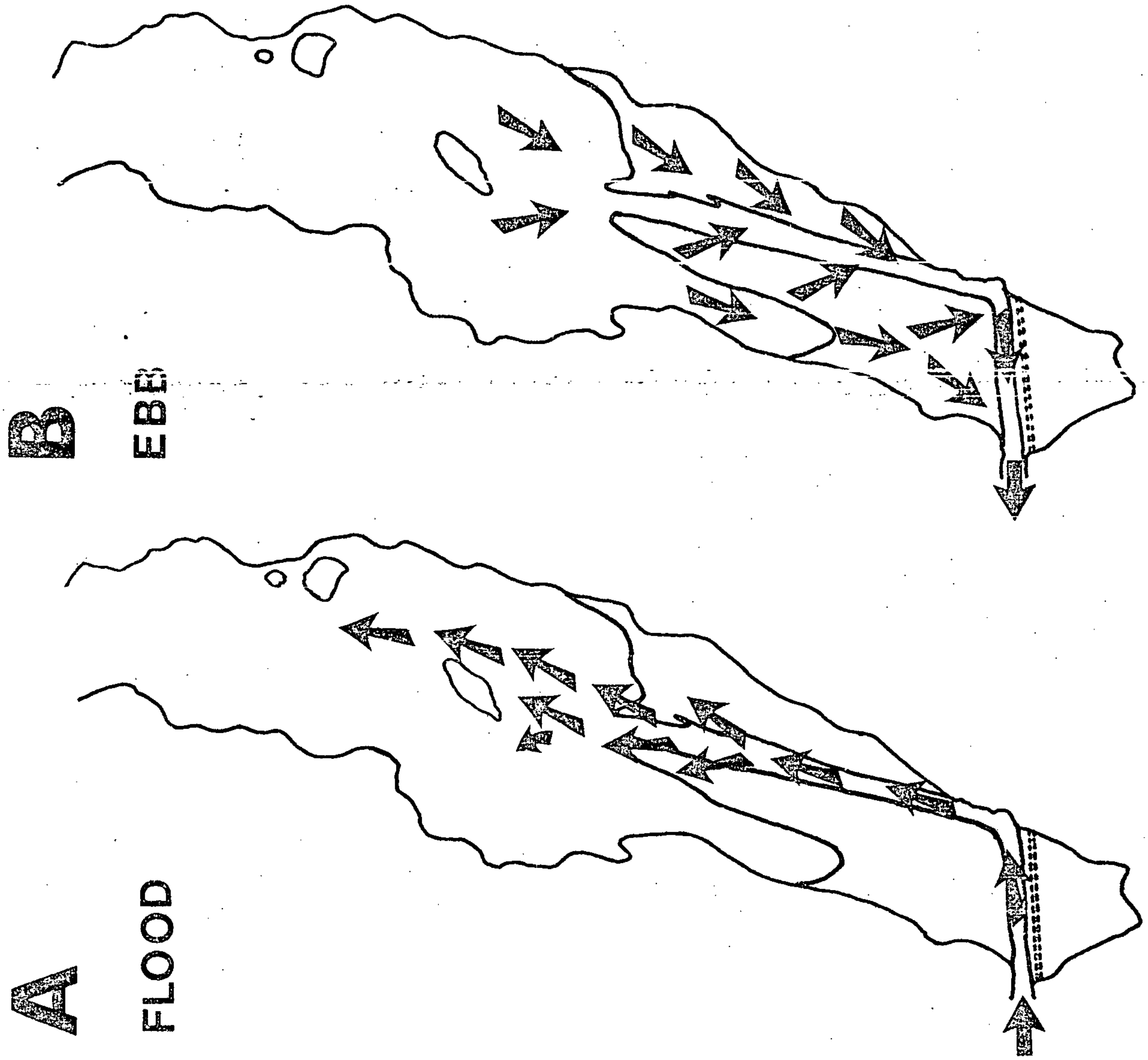
A study of velocity was undertaken at the lake outlet and in the delta channel to determine the flow conditions that would likely entrain and transport channel bed material. Two different methods of current measurement were used: (1) four days of current profiles, taken at 30-minute intervals over a flood or ebb cycle, (2) readings taken at 7.5-minute intervals, with a tethered meter, one meter from bottom (19 days).

Current profiles (Hydro Products, Inc. Savonius Rotor with a direct readout for current speed (model #460A) and direction (model #465A)) were made from a boat anchored at the lake outlet. Each profile included measurements at 7 depths (d) (10 cm from bottom, one meter from bottom, 0.2d, 0.4d (mean), 0.6d, 0.8d, and surface). The measurements (both magnitude and direction) at each depth were based on readings averaged over a two-minute period, thus each profile spans 15 to 20 minutes. A digital counter integrating electrical pulses over a 10-second period was

FIGURE 8. Tidal flow pattern.

A. Flood: flow is channelized until 2 km from end where it spreads over topsets in overbank flow. Flow pattern into lake appears to be that of a simple jet oriented to the northeast, i.e., east of Goose Island.

B. Ebb: flow drains off topsets by shortest route to delta channel then along channel to outlet.


A
FLOOD
B
EBB

used to average velocity fluctuations caused by micro- and macroturbulence (Matthes, 1947). Mean velocity and velocity at 10 cm from bottom for one complete flood cycle (June 24, 1975) are shown in Fig. 9. Peak mean velocity (47 cm/sec) occurs early in the flood cycle. In contrast, ebb examples revealed that peak velocity occurs late in the cycle. This time-velocity asymmetry was found to be characteristic of velocity curves from Pitt River as well (Ashley, 1977).

Critical shear stress necessary for sediment entrainment at the lake outlet and in the channel near the outlet was determined from Shields' diagram as modified from Briggs and Middleton (1965). A friction velocity, V_*, of 1.47 cm/sec is necessary to move sediment (mean grain size = 0.25 mm) at the outlet while $V_* = 1.54$ cm/sec is required to move material (mean grain size = 0.32 mm) in the southern delta channel.

The log velocity law (Prandtl-Von Karman equation) (Inman, 1963) was used on the lake profile data (June, July, and August) to calculate the basal shear stress. Results showed that a critical shear (friction) velocity 1.47 cm/sec was seldom reached in the outlet during this time period. Time series measurements were taken to determine if this were true for other seasons and for the lake channel as well.

The continuously recorded velocity measurements were made by a positively buoyant meter (General Oceanics, Inc. Film Recording current meter (model #2010)) anchored to the channel bottom but free to sway with changing currents. The meter was located in the middle of the delta channel approximately 1 km from the lake outlet and recorded on film instantaneous readings of magnitude and direction of flow (one meter off bottom) at 7.5-minute intervals. The meter was placed in channel on several occasions, but only one record (April 15 - May 4, 1976) was readable. Portions of this record are shown in Figure 10; Table III summarizes the proportion of total time devoted to ebb (60%) and flood flow (40%). It is important to note that although total time of ebb flow is longer than flood, velocities are significantly lower. For instance, about 1% of ebb time flow is greater than 40 cm/sec in contrast to 13% of time under flood flow.

Analysis of the 19 days of data found that peak velocity and average velocity were higher on flood flows than on ebb (Table IV). It is inferred from this that mean velocity (0.4d measured from bed) is also higher on the flood. In both river and lake data the mean velocity of a profile was found to equal or exceed the velocity at 1 m (see Appendix). The use of the log velocity law on Pitt River velocity profile data (Ashley, 1977) demonstrated

FIGURE 9. Profile data from lake outlet, June 24, 1975. Mean velocity (0.4 depth) reaches maximum of 47 cm/sec. Time-velocity is asymmetric, i.e., peak is reached early, then decreases gradually.

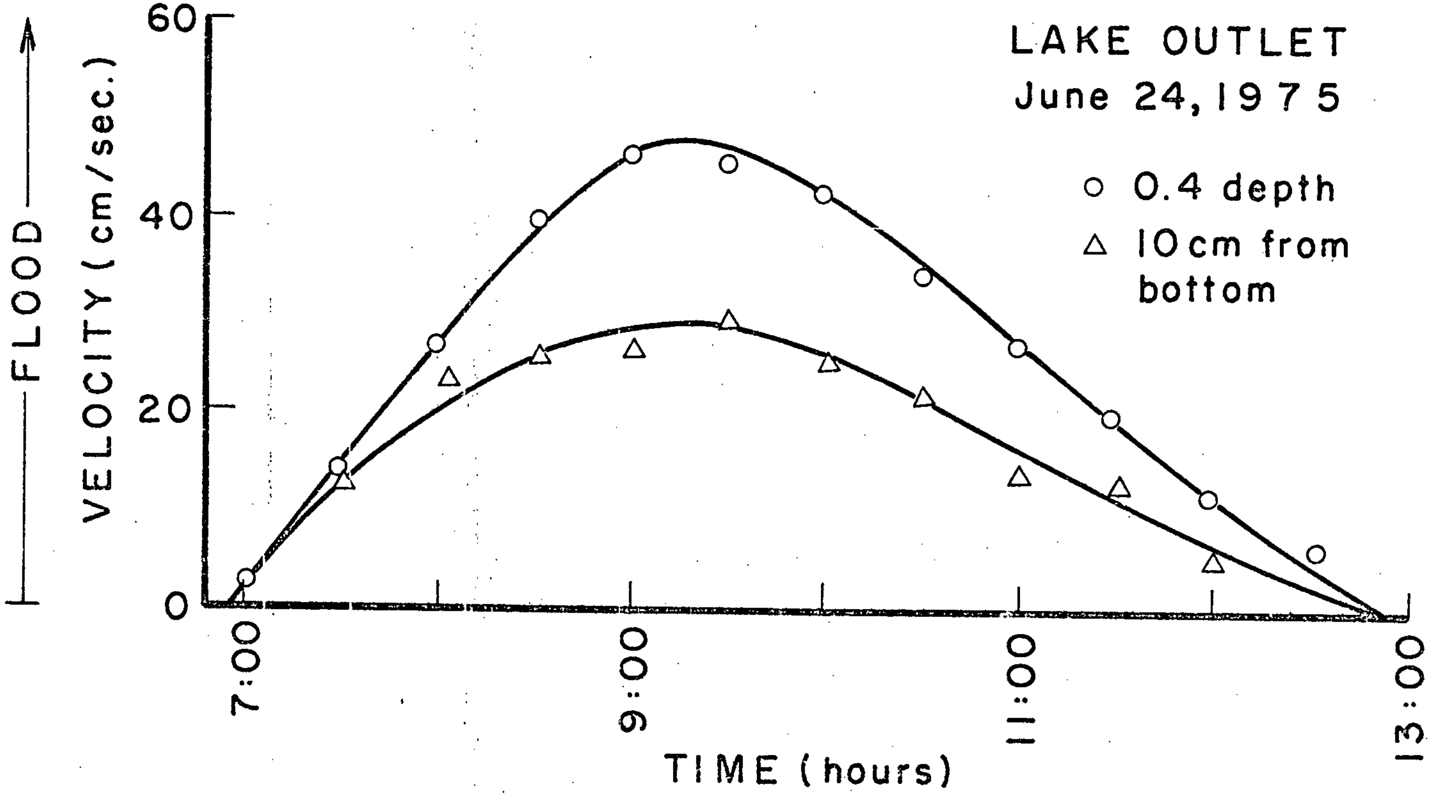
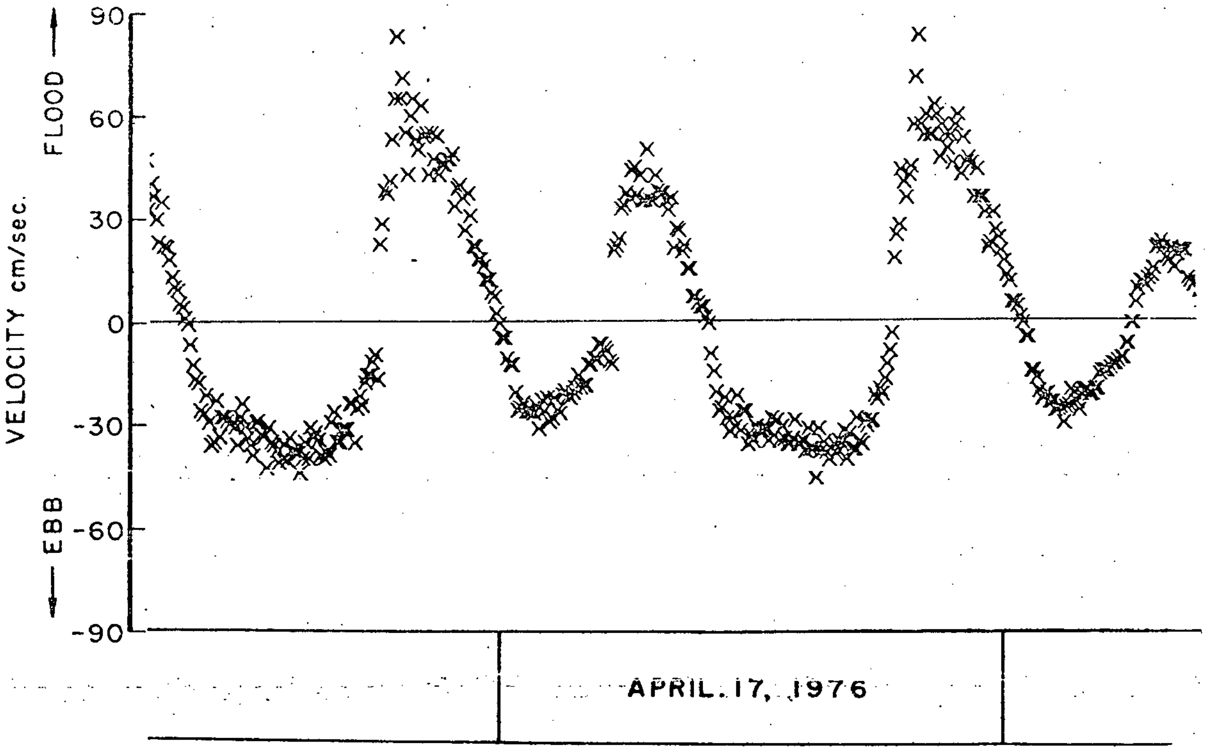

LAKE OUTLET
June 24, 1975
○ 0.4 depth
△ 10 cm from bottom
FLOOD
VELOCITY (cm/sec.)
60
40
20
0
7:00
9:00
11:00
13:00
TIME (hours)

FIGURE 10. Computer plot of "continuously" recorded velocity data from southern delta channel. Each X represents an instantaneous velocity (magnitude and direction) measurement at 7.5-minute intervals. Measurements are one meter from bottom. Note flood velocities are higher than ebb. A. April 16-18, 1976; B. April 26-27, 1976. Data of entire record is summarized in Tables III and IV.

A


FLOOD
VELOCITY cm/sec.
EBB
90
60
30
0
-30
-60
-90
APRIL 17, 1976

B

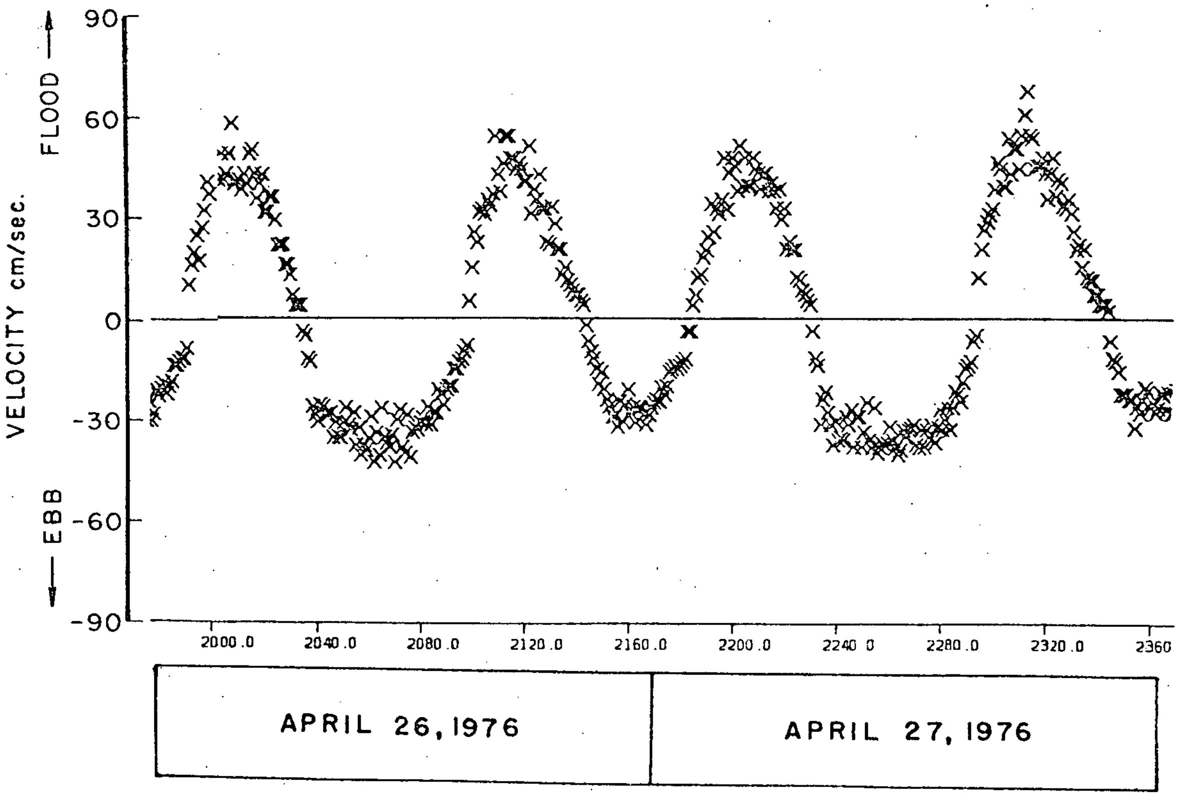

FLOOD
VELOCITY cm/sec.
EBB
90
60
30
0
-30
-60
-90
2000.0
2040.0
2080.0
2120.0
2160.0
2200.0
2240.0
2280.0
2320.0
2360
APRIL 26, 1976
APRIL 27, 1976

TABLE III Summary of velocity measurements (at one meter above bed) in lake channel April 15 - May 4, 1976: the proportion of time devoted to flood and ebb at 10 cm/sec intervals of velocity.

VELOCITY (cm/sec)	EBB				FLOOD			
	Data Pts.	Hrs.	Cum Hrs.	% Total	Data Pts.	Hrs.	Cum Hrs.	% Total
Vel. 80	0	0	0	0	3	0.75	0.75	0.08
Vel. 70	0	0	0	0	14	3.50	4.25	0.47
Vel. 60	0	0	0	0	29	7.25	11.50	1.30
Vel. 50	2	0.50	0.50	0.05	166	41.50	53.00	5.90
Vel. 40	45	11.25	11.75	1.30	244	61.00	114.00	12.75
Vel. 30	602	150.50	162.25	18.10	291	72.75	186.75	20.80
Vel. 20	764	191.00	353.25	39.50	183	45.75	232.50	26.00
Vel. 10	555	138.75	492.00	55.00	273	68.25	300.75	33.50
Vel. 0	175	43.75	535.75	60.00	230	57.5	358.25	40.00
TOTAL	2143	535.75	535.75	60.00	1433	358.25	358.25	40.00

TABLE IV Summary of velocity measurements (one meter off bottom in lake channel) (April 15 - 30, 1976); velocity in cm/sec.

Date (April, 1976)	Max. flood vel.	Ave. flood vel.	Max. ebb vel.	Ave. ebb vel.	Date (April, 1976)	Max. flood vel.	Ave. flood vel.	Max. ebb vel.	Ave. ebb vel.
15	55.5	35.0			23	15.0 45.0	10.0 38.0	31.0 32.0	22.0 22.0
16	41.0 71.0	27.0 39.0	30.5 40.0	20 30	24	52.0 24.0	37.5 14.0	32.0 28.0	26.5 22.5
17	42.0 67.0	31.5 40.0	27.0 38.0	20 31	25	51.0 34.0	32.0 21.0	38.0	27.0
18	22.0 68.0	13.0 40.5	27.0 41.0	18 30	26	47.5 51.0	31.0 30.0	29.0 38.0	22.5 28.5
19	16.0 68.0	10.0 40.0	19.0 45.0	17 28	27	42.5 59.0	29.5 33.0	29.0 38.5	20.5 29.5
20	15.0	10.0	23.0 42.0	16 28	28	38.0 54.0	26.0 32.0	26.0 38.0	20.0 29.0
21	61.0	42.5	28.5 36.0	22 28	29	33.0 55.0	23.5 35.0	27.5 39.0	19.0 29.0
22	61.0	38.0	31.0 33.0	23 23	30	30.0 59.0	22.0 37.0	26.5 36.5	20.0 28.0

that mean velocity of 32 cm/sec was necessary to obtain a critical velocity ($V_* = 1.77$) at base of flow. It follows that a slightly lower mean velocity (approximately 30 cm/sec) would be necessary to create the $V_* = 1.54$ needed to entrain sediment in the delta channel. When mean velocity is at 30 cm/sec, velocity at one meter from bottom is between 25 and 28 cm/sec. It can be seen in Table IV that more flood time (20.8%) is above 30 cm/sec compared to total ebb time (18.1%). However, the proportion changes drastically at velocity of 20 cm/sec; flood 26%, ebb 39.5%. Thus, it appears that there is more time devoted to ebb flow above critical velocity than to flood, even though the flood velocities are of greater magnitude. In a similar finding in the river data, it was concluded that as most aspects of the study indicate a flood-dominated system the higher velocities are more important in influencing the direction of net transport than total time above critical velocity.

In conclusion, a complex interaction of the tidal prism and varying discharge of Fraser River and Pitt basin results in a flood-dominated system. Highest peak discharges and related basal shear stresses occur during flood (winter) flows. Thus, net sediment transport would occur during the winter. The greater efficiency for entraining and moving sediment under flood flow supports the conclusions based on the morphology of the delta, that it is presently active and being constructed under flood conditions by Fraser derived sediments.

SEDIMENTS

Stratigraphy of delta and lake bottom

Sediments of Pitt tidal delta can be grouped into three general environments: topset, foreset, and bottomset-lake bottom. The topset beds consist of fine sand to coarse silt and are horizontally laminated. The foresets consist of silt and clay layers, some of which are rhythmically layered, whereas the bottomset-lake bottom beds are laminated clays. Of the 160 samples in the study area, 60 were grab samples on delta topsets and in the delta channel and 100 were cores (3.5 cm in diameter) taken from delta foresets and bottomset-lake bottom (Figure 11). Cores ranged from 24 cm to 53 cm in length.

Topset beds consist of a monotonous section of laminated silts and sands. No cross beds and only a few graded beds were noted. On the other hand, the foreset beds were found to contain a variety of bedding structures. The nature of the layering ranges from well developed rhythmic silt and clay layers to stringy and discontinuous clay laminations (Fig. 12). In the rhythmites, silt layers are thicker than clay, but the absolute thickness of the individual layers varies with distance from the delta. Silt layers range in thickness from 1.3 cm at the distributary

FIGURE 11. Mean grain size distribution map. C.I. is 0.5 Ø. Grain size distribution reflects the flood flow pattern (Fig. 8A). The pattern is a good example of sedimentation by diffusion from a simple jet with little, if any, reworking by waves or tidal currents.

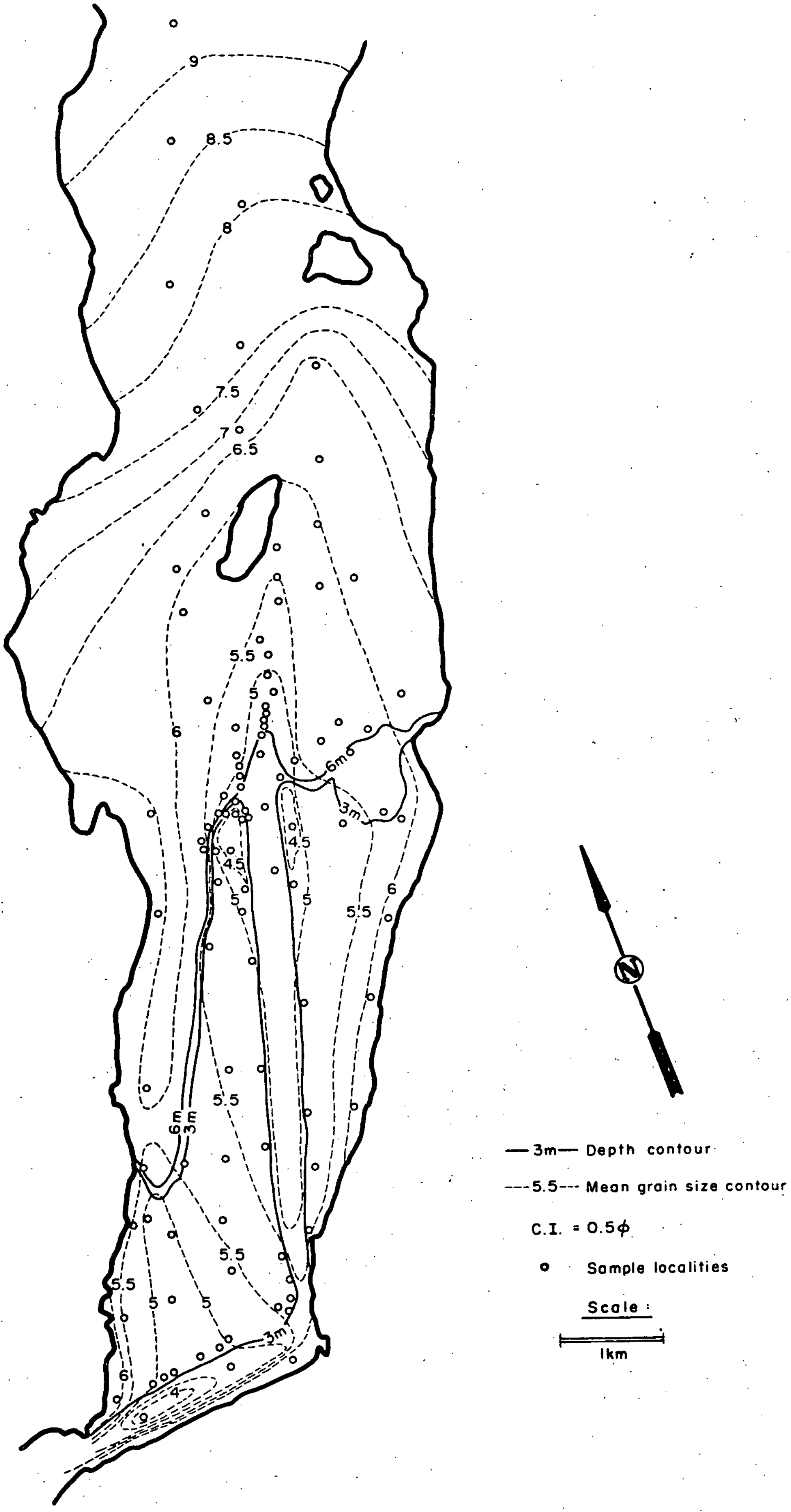
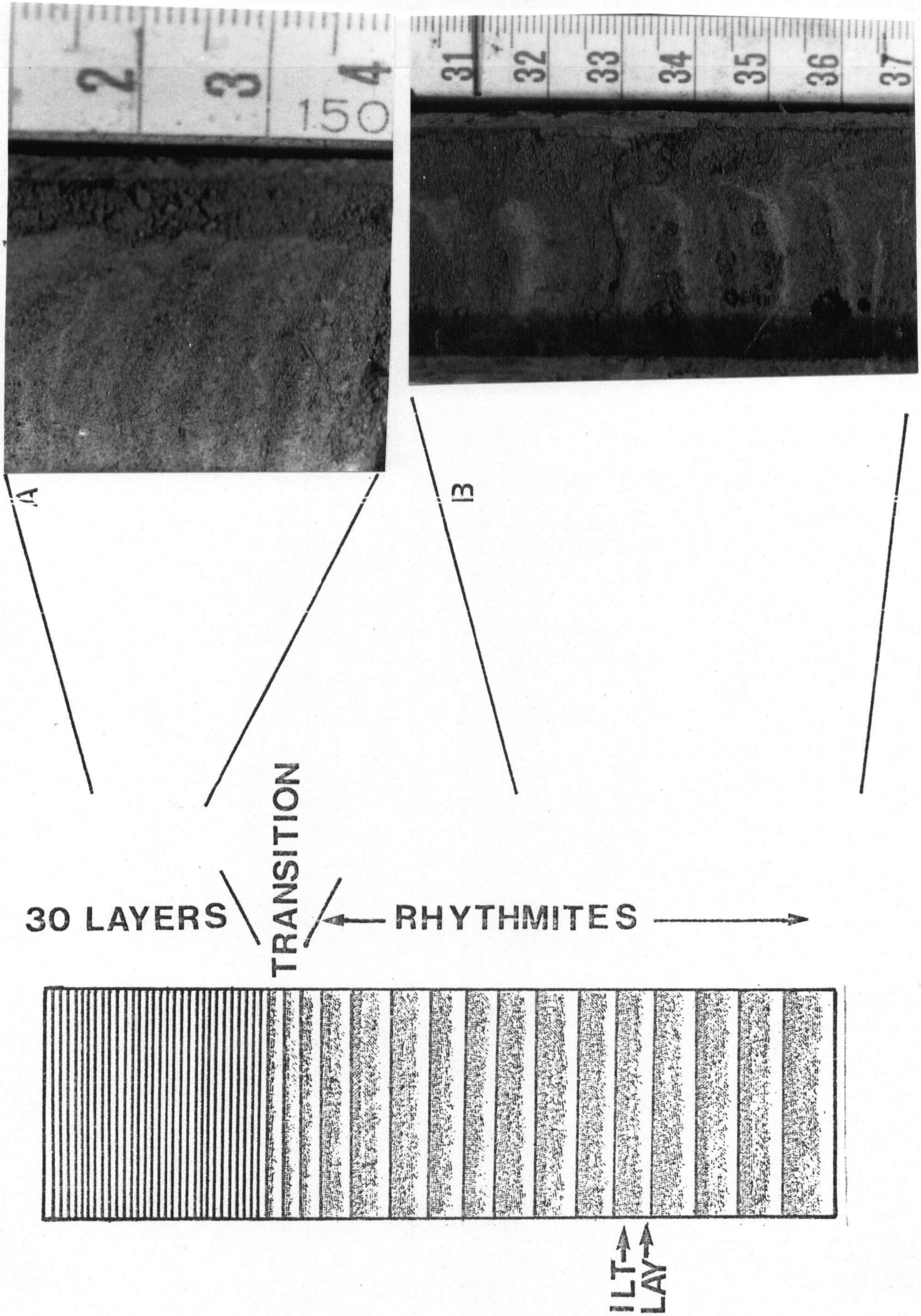

9
8.5
8
7.5
7
6.5
5.5
5
6
6m
3m
4.5
5
5.5
6
4
—3m— Depth contour
---5.5--- Mean grain size contour
C.I. = 0.5φ
o Sample localities
Scale :
1km

FIGURE 12. Diagramatic sketch of stratigraphy showing change from regular rhythmites through a few transitional couplets into thinly bedded sediments (30 laminations).

A. 3.5 cm diam. core. Top of stratigraphic section showing a sharp decrease in sedimentation rate from (B).

B. 3.5 cm. diam. core. Rhythmites are interpreted as varves deposited by the following mechanism: silt deposited during winter when tidal effect is great and clay during the freshet when tidal effect is minimal. Note large vesicles formed during escape of gas (methane?).


2
3
4
150
31
32
33
34
35
36
37
A
B
30 LAYERS
TRANSITION
RHYTHMITES
SILT
CLAY

mouth to 0.016 cm, 2 km north of the mouth. Clay layers seldom are thicker than 0.016 cm near the delta and thin to an average thickness of 0.008 cm in the lake bottom sediments beyond Goose Island. All cores showed evidence that gas (methane?) had escaped after sampling. Houbolt and Jonker (1968) found gas "pockets" were ubiquitous in Lake Geneva sediments. Cores, cut open soon after sampling, have continuous layering with scattered gas vesicles (Fig. 12). Cores which were stored allowing gas to escape slowly, have streaky, uneven and discontinuous layers with no vesicles.

The best-developed rhythmic layering was found in cores to the west of the main delta lobe. The thickness of the layers was found to decrease abruptly at about 10 cm (or approximately 30 laminations) from the top of the sediment section (Fig. 12). Couplets below the 10 cm level are about 1 cm thick whereas those above are only 0.2 cm thick. The decrease (80%) in thickness occurs gradually over 4 - 6 couplets and suggests a sharp decrease in sediment reaching the site. This can be interpreted as a shift in locus of sedimentation from the west to east side of Goose Island. Another interpretation is that sedimentation has decreased over all the lake, but without rhythmic layering the change is not evident. Since the configuration of the delta has been constant since at least 1860 (Richards, 1860), the latter explanation is favored.

The rhythmic layering was previously noted by Johnston (1922) in his work on Pitt Lake. His interpretation was that the alternating laminations were tidal in origin. It appears more likely that they are annual layers (varves). The coarse layer (silt and fine sand) is brought in as bedload and suspended load during winter (November - March) when discharges of Fraser and Pitt systems are low and thus tidal effect is great. The fine layer (mainly clay) is deposited during the rest of the year. Presumably clay (9ϕ) is supplied to the lake mainly during spring run-off (May - July) and continues to settle during summer and fall. The volume of sediment represented in an average couplet for the entire foreset-bottomset-lake bottom area shown in Figure 3 was calculated to be $150 \pm 20 \times 10^3$ tonnes. Calculations were based on average thickness of layers near tops of cores and their approximate areal distribution.

^{137}Cesium dating

An unexpected "spin-off" of atmospheric nuclear testing (1952 - 1972) is the subsequent use of radioactive isotopes released during the tests (such as ^{137}Cs) for dating of recent sediments (Pennington, 1973; Robbins and Edgington, 1975; Ritchie, 1975). ^{137}Cesium was created during the nuclear testing and disseminated throughout the world by air currents and rainfall. In fresh water, Cs is preferentially adsorbed, or "fixed", onto the micaceous (illite) component of the sediment (Francis and Brinkley, 1976), presumably trapped along grain (phyllosilicate minerals) boundaries. Once in contact, ^{137}Cs is firmly attached so that further movement by natural chemical processes is limited (Davis, 1963; Tamura, 1964). Thus, the variation in ^{137}Cs content present in the stratigraphic column can be compared with the local ^{137}Cs activity record (usually measured in rainfall or in milk) to determine sedimentation rate.

In order to determine the present annual sedimentation rate on the Pitt tidal delta, 11 large diameter (6.3 cm) cores were taken on the delta topsets and foresets (Fig. 3; Fig. 13). A Kullenberg gravity corer (weighing 130 kg) was dropped from an anchored raft. Core lengths ranged from 15 cm to 85 cm and three cores with undisturbed bedding were chosen for dating (samples # 3, # 8, and # 11). Mean grain size variation of the cores is limited, ranging from coarse silt to very fine sand (50 - 70μ). As ^{137}Cs is associated with micas or illites and as these minerals most often occur in the finer fractions, total ^{137}Cs content would be expected to vary with grain size. Thus the homogeneous grain size of the Pitt samples made them particularly appropriate for dating by the ^{137}Cs dating technique.

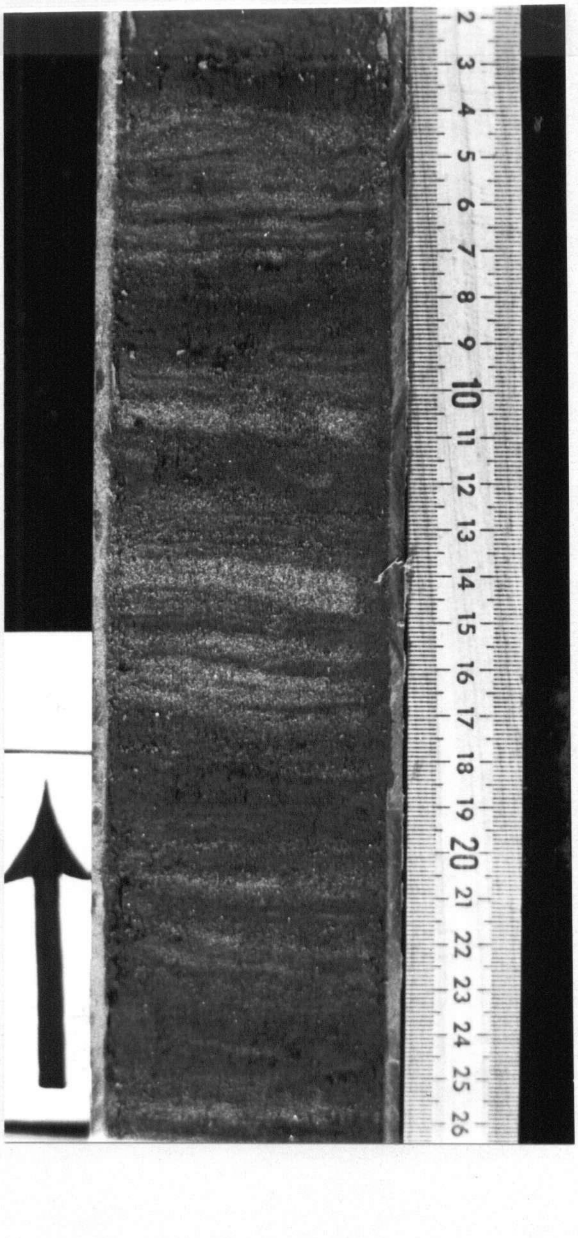
Method

Cores were split horizontally along bedding planes into 1.5 cm thick slices. The samples were then dried, disaggregated by hand and placed in plastic vials. Each sample was analyzed for ^{137}Cs using a standard detector for gamma ray spectroscopy (Ge(Li) detector) coupled to 1024-channel pulse height analyzer system (Fig. 14). The gamma ray energy of each isotope is unique and the detector converts gamma radiation to a pulse proportional to the energy of ray. This method assures clear separation of the 661 KeV energy of ^{137}Cs from those of ^{208}Ti(583 KeV) and ^{214}Bi (609 KeV). Each sample was counted for 800 minutes, resulting in a detection threshold of 0.1 picocuries per gram of sediment.

Results

An exceptionally good record (Fig. 15) was found in core # 3 collected off the mouth of the distributary channel in 50 m of water (Fig. 3). Average rate of sediment accumulation at this site from 1954 to 1972 was 1.8 cm/yr (no correction was made for compaction). The fluctuation in ^{137}Cs content is consistent with that measured in Vancouver (milk) (G.Griffiths, pers. comm.). Lake stratigraphy from Lake Windermere, England (Pennington, 1973) and fallout

FIGURE 13. Photo of core # 3 (Fig. 3) which was dated by ^{137}Cs. Note that although the stratification is not rhythmic, it is undisturbed. Core diameter is 6.3 cm.


2
3
4
5
6
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16
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18
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21
22
23
24
25
26

FIGURE 14. Diagram of the system involving gamma ray spectroscopy used in ^{137}Cs dating. Samples were analyzed with a Ge(Li) detector coupled to 1024 channels of a pulse height system.

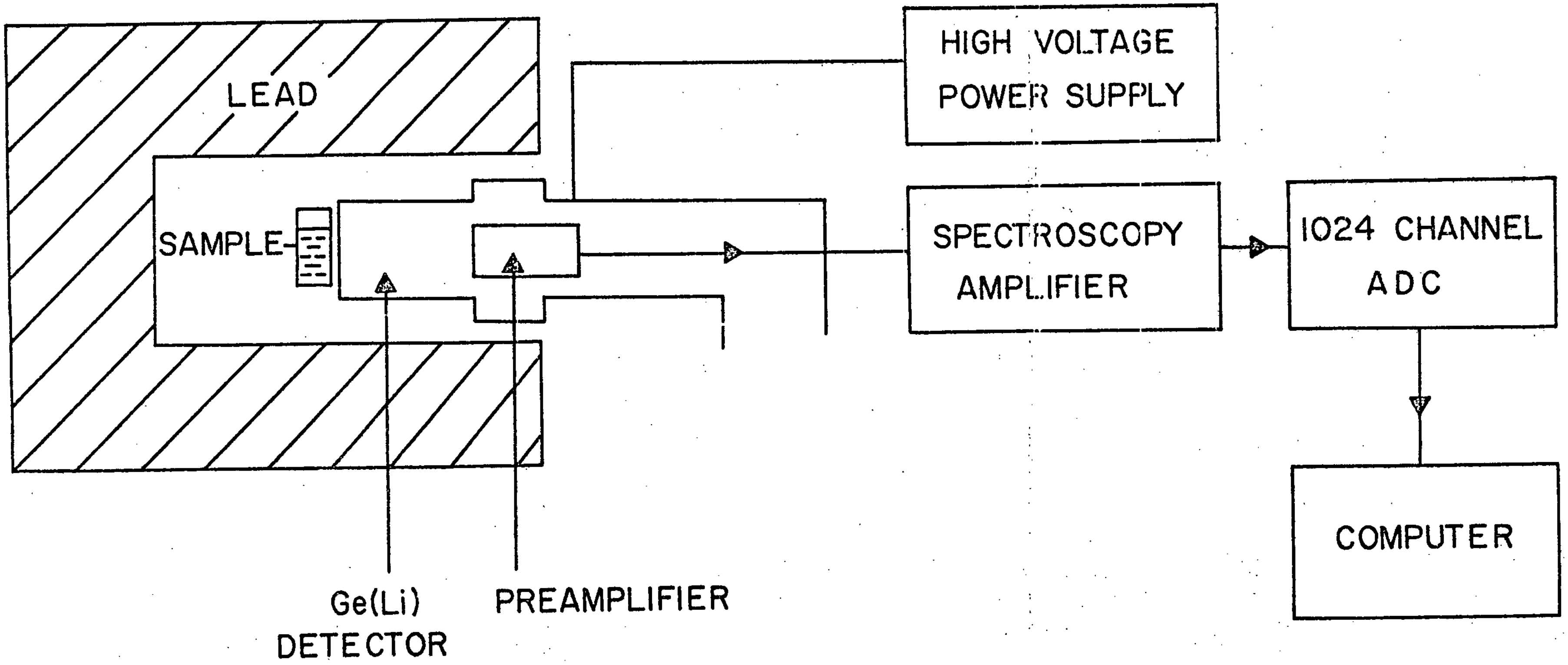
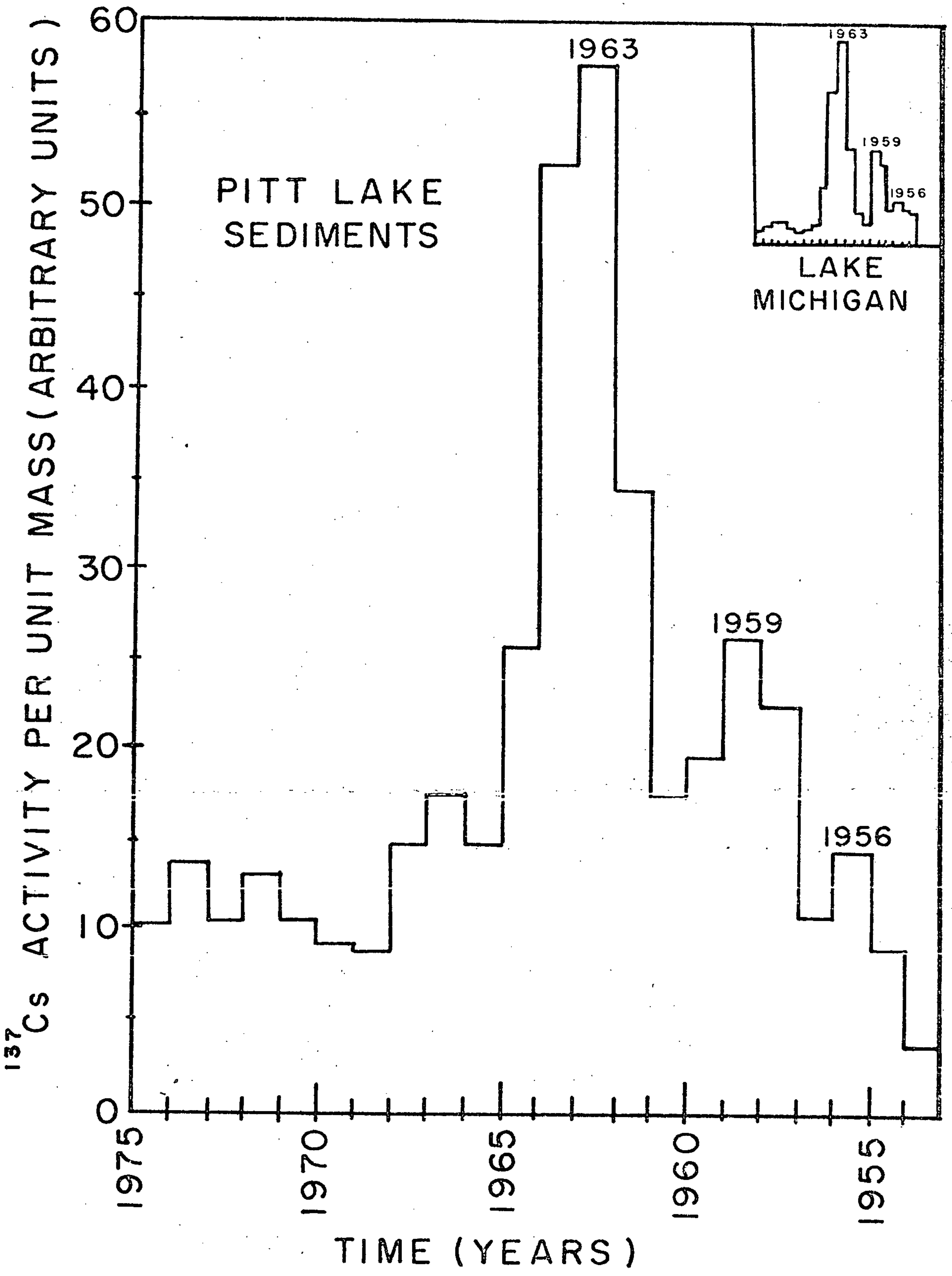

LEAD
SAMPLE
HIGH VOLTAGE POWER SUPPLY
SPECTROSCOPY AMPLIFIER
1024 CHANNEL ADC
COMPUTER
Ge(Li) DETECTOR
PREAMPLIFIER

FIGURE 15. Plot of ^{137}Cs dating results from core # 3 from Pitt Lake delta foresets. Cesium concentration per unit mass plotted against time (depth) results in a graph similar to the estimated annual flux of ^{137}Cs to surface of Lake Michigan (Robbins and Edgington, 1975) shown in the inset.


60
50
40
30
20
10
0
137Cs ACTIVITY PER UNIT MASS (ARBITRARY UNITS)
PITT LAKE
SEDIMENTS
1963
1959
1956
1963
1959
1956
LAKE
MICHIGAN
1975
1970
1965
1960
1955
TIME (YEARS)

recorded in Tallahatchie River watershed (Ritchie, 1973) showed a similar record. All show a minor peak in 1959 and a major one in 1963 with the ^{137}Cs concentration dropping off to low levels thereafter. Core # 11 showed high levels of ^{137}Cs equal to core # 3 on the delta front, but in a compressed record indicating a slow sedimentation rate of 3 mm/yr. The source of this cesium is probably slope wash from the nearby shore. However, core # 8 (Fig. 3) contained no excessive ^{137}Cs, indicating no deposition occurred during the last 25 years at that site on the delta.

The above records are considered indisputable evidence for recent deposition and slow, but regular sedimentation on the delta. In addition, the difference in records from the three sites gives further information on the pattern of present day deposition which is examined in the following section.

Grain size analysis

A study of the grain size distribution of Pitt Lake sediments was carried out in order to gain insight into the nature of sedimentary processes active on the delta and lake bottom. Sediment samples were collected with a Dietz-LaFond grab sampler and a Phleger corer. A total of 190 samples were analyzed by one or more of the following analytical methods.

(1) Rapid Sediment Analyzer (R.S.A.) - settling tube with automatic recording of weight accumulated versus time (Woods Hole Settling Tube, Univ. of R.I.).

(2) Sieving - standard sieving procedure (Folk, 1968) using sieves with 0.5 ϕ interval.

(3) Quantimet 720 - image analyzing computer (Perrie and Peach, 1973), Brock University.

(4) Sedigraph 5000 (Micrometrics, Inc.) - particle size analyzer which measures the concentration of particles remaining suspended as a function of settling time using a finely collimated beam of x-rays (Olivier, _et al_., 1970/71).

(5) Hydrometer - standard method for grain size analysis of soils (A.S.T.M. D422-63).

The range of sizes over which these methods were used in this study is shown in Figure 16. Weight percent for each 0.5ϕ class was used to compute statistical parameters (using method of moments) and cumulative probability plots.

Analysis of polymodal sediments

It became evident during the early stages of grain size analysis that the sediments were polymodal. Bargraphs and cumulative curves (see Appendix) revealed complicated distributions with grain sizes 2 ϕ, 4.5 ϕ, and 8.5 ϕ being the areas of the distributions which consistently showed irregularities. Attempts were made to resize some sediments by methods (Fig. 16) that would analyze across "problem" areas with a single method. The 4.5 ϕ size which is near the normal break between mechanical (sieve) and settling (hydrometer or pipette) sizing techniques needed particular attention and was examined by two additional methods.

As the interpretation of polymodal sediments is a controversial subject, a brief introduction to the problem will provide a background on which to present the results of this study.

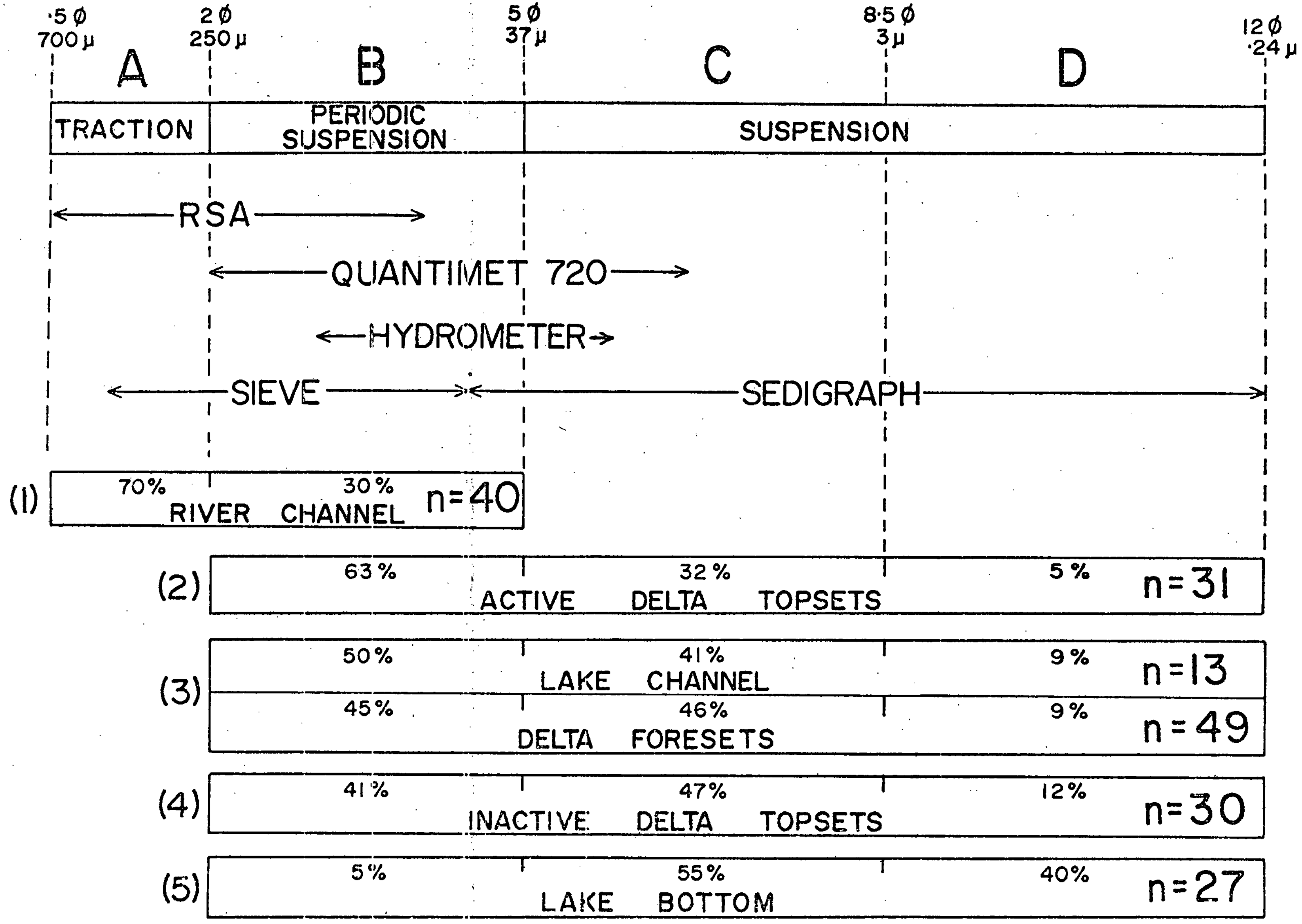
Introduction

During the last two decades there have been significant advances in environmental interpretation of grain size analysis. Syndowski (1957) attempted to relate a particular cumulative log probability curve shape to a specific environment. At the same time Folk and Ward (1957) quantified curve interpretation by utilizing statistical parameters to characterize the curve and bivariate plots of statistical measures to distinguish environments. Because most sediments are polymodal, curve shape and statistical measures (such as skewness and kurtosis) simply reflect the relative magnitude and separation of modes. Although this problem was recognized early (Folk and Robles, 1964), the use of statistical parameters on polymodal sediments has persisted (Duane, 1964; Martins, 1965; Friedman, 1967; Moiola and Weiser, 1968).

An alternative approach to the problem is to separate the constituent populations (modes) and to relate these to sedimentary processes and ultimately to an environment of deposition. Visher (1969) and Middleton (1976) have both separated subpopulations at breaks between fitted straight line segments of cumulative probability plots. However, this method makes the unlikely assumption that all the subpopulations are truncated distributions. Fuller (1962) and Spencer (1963) have separated overlapping modes by partitioning cumulative probability curves following the graphical method of Harding (1949). This technique is simple and shows the most promise in being able to break the sum into meaningful parts without the tedious calculations involved in the numerical methods (Clark, 1976).

Any attempts to relate grain size distributions to specific sedimentary environments should be based on a clear understanding of the polymodal distribution, in particular, the size distribution and proportions of the individual subpopulations. The proportions of modes between environments should reflect different sediment transport processes or at least varying intensity of these processes. Secondly, the effect of variability (grain size, mineralogy, etc.) of the sediment source material should be considered in the interpretation.

FIGURE 16. The range of grain sizes covered by the five sizing techniques used in this study. The percentage of each mode for each environment is summarized. 'n' is the number of samples used in each summary.



·5 Ø 700 µ
2 Ø 250 µ
5 Ø 37 µ
8·5 Ø 3 µ
12 Ø ·24 µ
A
B
C
D
TRACTION
PERIODIC SUSPENSION
SUSPENSION
RSA
QUANTIMET 720
HYDROMETER
SIEVE
SEDIGRAPH
(1) 70% 30% RIVER CHANNEL n=40
(2) 63% 32% 5% ACTIVE DELTA TOPSETS n=31
(3) 50% 41% 9% LAKE CHANNEL n=13
45% 46% 9% DELTA FORESETS n=49
(4) 41% 47% 12% INACTIVE DELTA TOPSETS n=30
(5) 5% 55% 40% LAKE BOTTOM n=27

Five environments in the Pitt system have been delineated on the basis of the morphology as determined by air photo interpretation and bathymetry (Fig. 17). River channel, lake channel, inactive delta topsets, active topsets, delta front, and lake bottom can each be characterized by water depth, flow type (unidirectional or bidirectional), average velocity, and presence of macrophytes.

The analysis of polymodal sediments is based on 190 samples (160 stations) collected from the five environments. The purpose of this study is to partition representative samples using Harding's (1949) method and to interpret the significance of the resultant subpopulations in terms of hydraulic conditions of sedimentation.

Statistical method

There are three basic approaches to partitioning polymodal probability curves: analytical, numerical, and graphical (Clark, 1976). The analytical method is not practical for sediments as, at present, there are no solutions for a case with three components. A numerical method for trimodal populations has recently become available (Clark, 1970 in Clark, 1976); however, the procedure is relatively complex and access to an "on line" computing facility is desirable. Generally, the numerical method involves an iterative scheme where initial estimates of the component parameters are improved, according to least squares criteria.

Harding's (1949) graphical method, which has been extensively used in exploration geochemistry, has been reviewed by Sinclair (1974, 1976). It provides a straightforward approach to partitioning distributions with up to four modes; however, the technique is subjective and may not always yield a unique solution for the curve being analyzed.

Briefly, Harding's method assumes that subpopulations (A,B,C,) composing a trimodal curve have lognormal distributions. Positive inflection points on the curve indicate the approximate proportions of, or the fraction (f) of, the total mixture that each mode comprises (Fig. 18). The cumulative probability of the modal mixture P_M at any point on the curve is equal to the sum of the products of the fraction, $f_{A,B,C,}$ of each component in the mixture and the cumulative probability of each component, $P_{A,B,C}$:

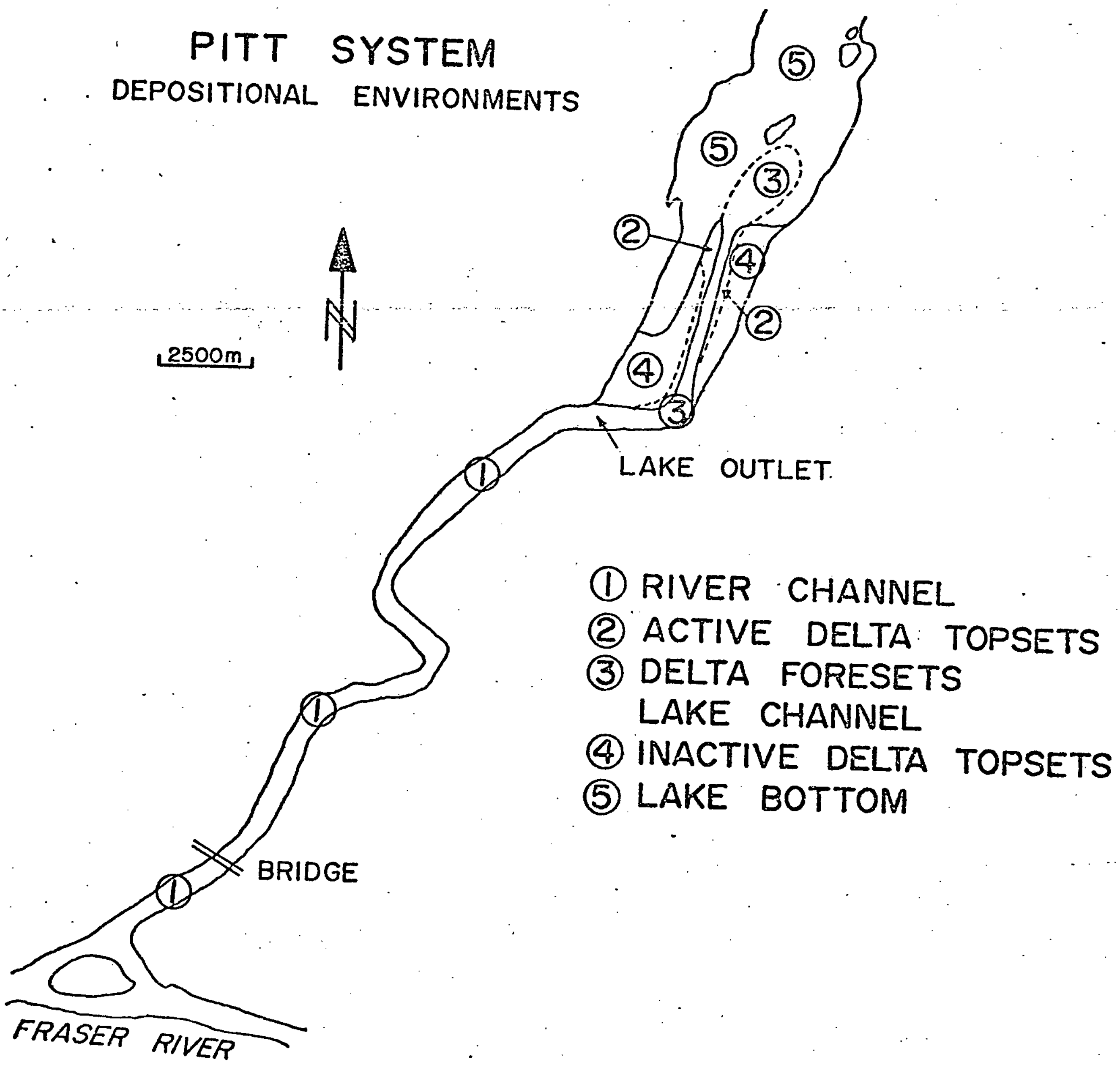
$$P_M = P_A f_A + P_B f_B + P_C f_C \qquad (1)$$

Using the point on the curve PL22A at 6 ϕ (Fig. 19F) as an example:

$$P_M = (98.7\%)(.24) + (42\%)(.46) + (1\%)(.3)$$

$$P_M = 43.01\%$$

FIGURE 17. Map of depositional environments with the Pitt system.



PITT SYSTEM
DEPOSITIONAL ENVIRONMENTS

FIGURE 18. Bimodal and trimodal cumulative probability plots are constructed from equal proportions of two and three (respectively) lognormal populations (after Sinclair, 1976, Fig. VI - I).

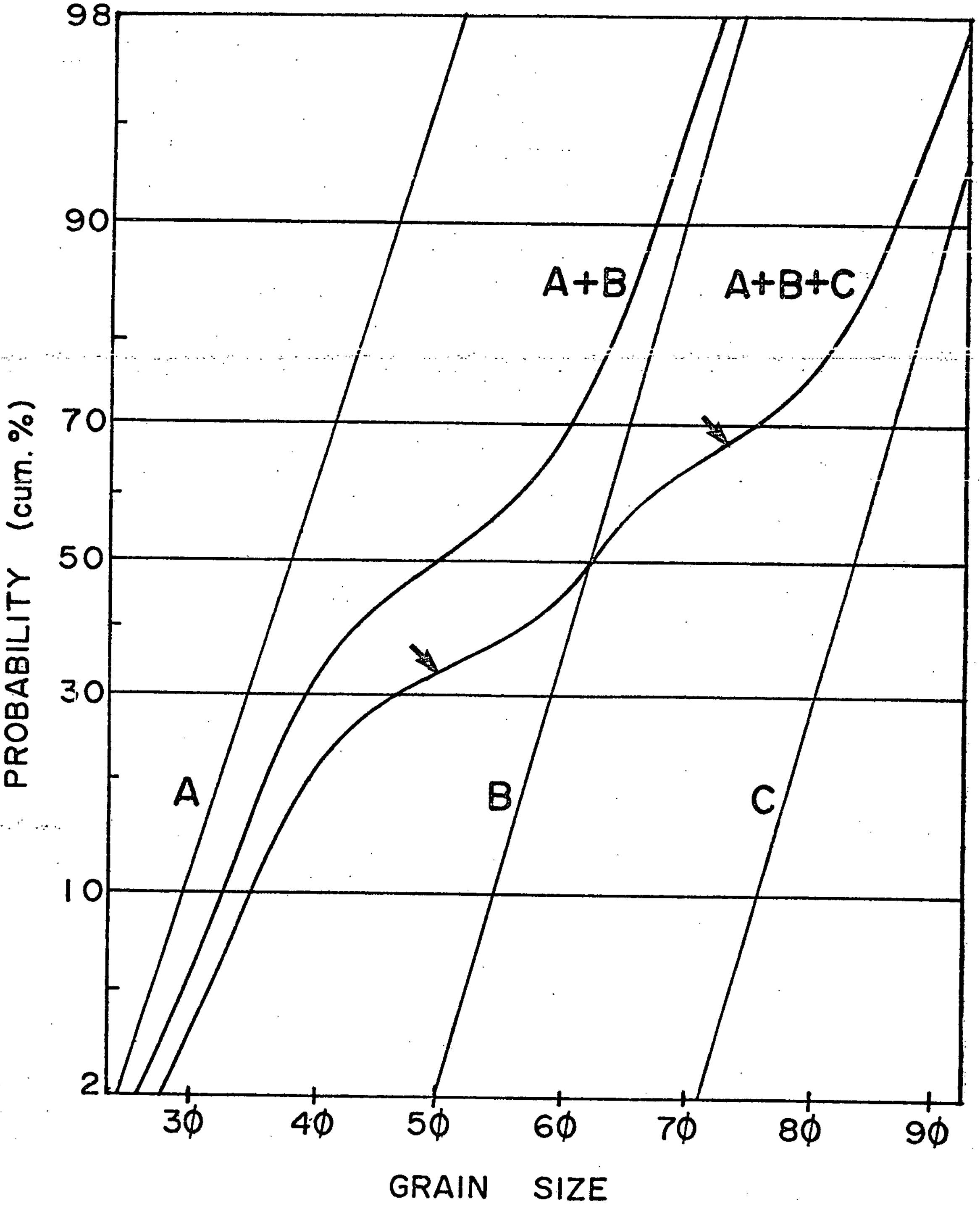
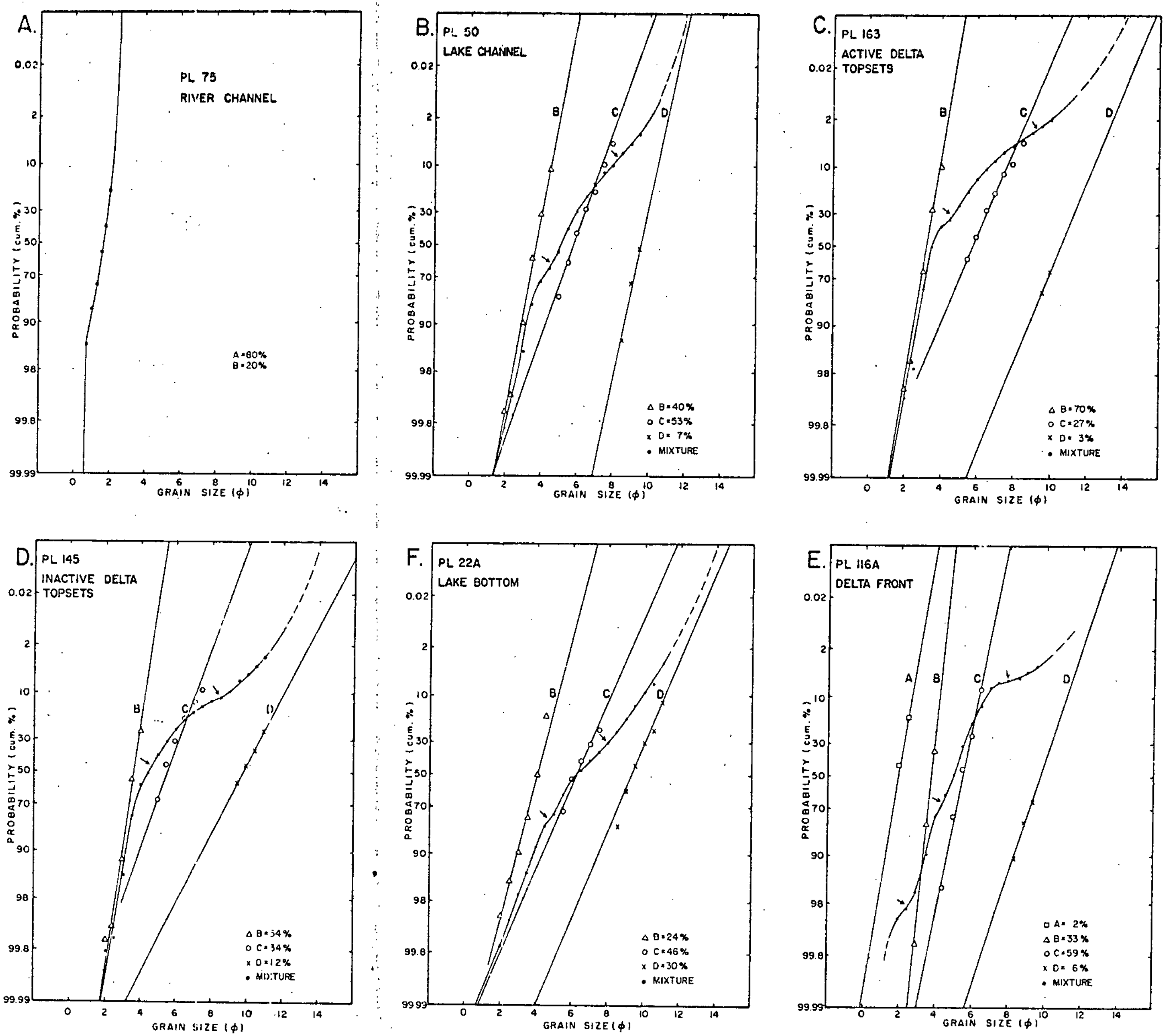

98
90
70
50
30
10
2
PROBABILITY (cum. %)
A+B
A+B+C
A
B
C
3ϕ
4ϕ
5ϕ
6ϕ
7ϕ
8ϕ
9ϕ
GRAIN SIZE

FIGURE 19. A polymodal cumulative probability curve from each of the five environments is shown with the lognormal subpopulations derived by partitioning from the curve. Examples from both the lake channel and the delta front are shown for environment (3). Arrows mark inflection points on the curves and are assumed to be points of modal overlap.


A.
PL 75
RIVER CHANNEL
A=80%
B=20%
B.
PL 50
LAKE CHANNEL
B
C
D
△ B=40%
○ C=53%
x D= 7%
• MIXTURE
C.
PL 163
ACTIVE DELTA
TOPSETS
B
C
D
△ B=70%
○ C=27%
x D= 3%
• MIXTURE
D.
PL 145
INACTIVE DELTA
TOPSETS
B
C
D
△ B=54%
○ C=34%
x D=12%
• MIXTURE
F.
PL 22A
LAKE BOTTOM
B
C
D
△ B=24%
○ C=46%
x D=30%
• MIXTURE
E.
PL 116A
DELTA FRONT
A
B
C
D
□ A= 2%
△ B=33%
○ C=59%
x D= 6%
• MIXTURE
PROBABILITY (cum. %)
0.02
2
10
30
50
70
90
98
99.8
99.99
GRAIN SIZE (ϕ)
0
2
4
6
8
10
12
14

no page 212

A sampling of cumulative probability plots from the Pitt system (Fig. 19) shows positively skewed curves with irregularities at 2ϕ , 5ϕ , and 8.5ϕ . Their shape is, in general, similar to that of the curve constructed from equal proportions of three lognormal populations (Sinclair, 1976) (Fig. 18). Thus, an effort was made to partition a number of curves into subpopulations. Almost all modes define a straight line on arithmetic probability paper inferring that each mode has a lognormal distribution. Note in Figure 16 the progressive changes from environment (1) through (5) in the proportion of modes. A and B proportions decrease with a corresponding increase in C and D. The five environments were originally defined on morphology, but are substantiated by the grain-size distribution study as each shows unique proportions of the four modes. Twenty probability plots were partitioned and the average of the medians (M_D) and the average of the standard deviations (σ) of each individual mode are summarized in Table V. The four modes and the inflection points where they overlap are shown schematically in Figure 20.

FIGURE 20. A schematic diagram showing standard deviation and median of the four modes. Arrows mark modal overlap and are coincident with the inflection points on curves (Fig. 18). Modal proportions for this particular example are:

A - 7%; B = 33%, C = 50%, and D = 10%.

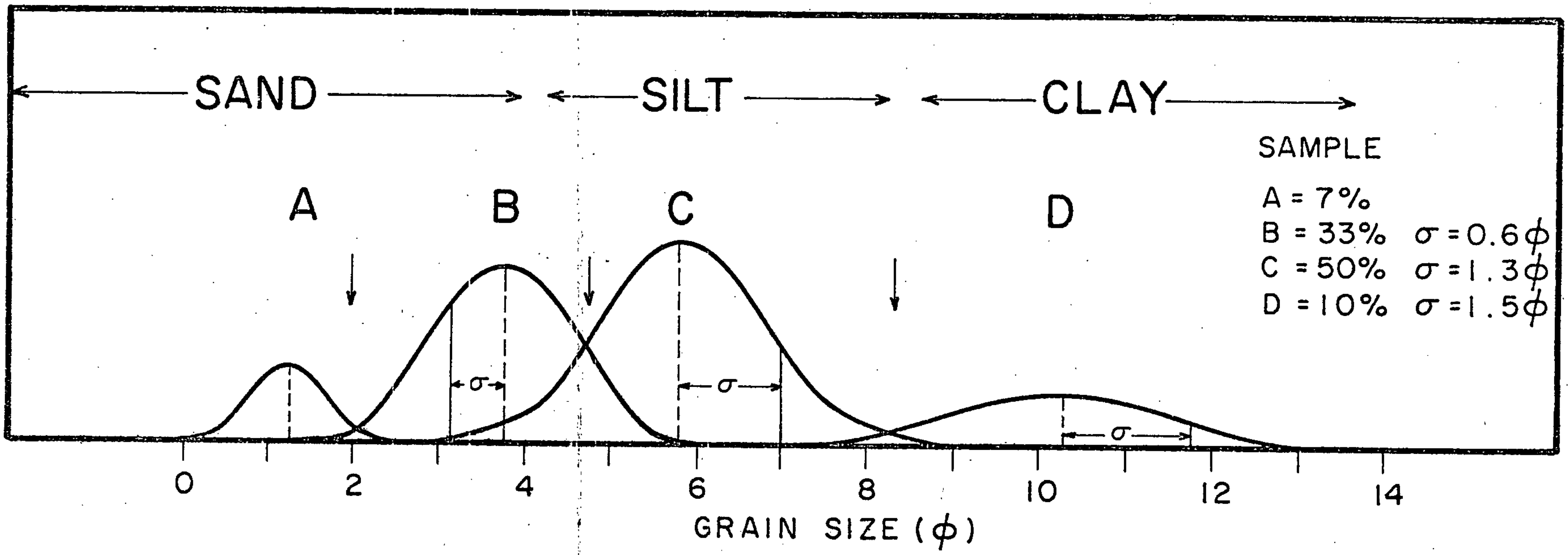

SAND
SILT
CLAY
SAMPLE
A = 7%
B = 33% σ = 0.6φ
C = 50% σ = 1.3φ
D = 10% σ = 1.5φ
A
B
C
D
σ
σ
σ
0
2
4
6
8
10
12
14
GRAIN SIZE (φ)

TABLE V Summary of modal statistics.

Mode	Avg. M_D	σ Avg.	Range of M_D
A	1.2 ϕ		
B	3.8 ϕ	0.6 ϕ	3.3 ϕ - 4.4 ϕ
C	5.8 ϕ	1.3 ϕ	5.2 ϕ - 6.3 ϕ
D	10.3 ϕ	1.5 ϕ	8.6 ϕ - 10.9 ϕ

SEDIMENTOLOGICAL PROCESSES

Sediment mixing

Grain size analysis and subsequent partitioning of the cumulative probability curves revealed four distinct populations that were either mixed prior to deposition, or during deposition. The technique of partitioning allows "unmixing" and provides an opportunity to examine each population by itself in order to gain further insight into their origin.

2 ϕ inflection

Most Pitt River sediments show an inflection near 2 ϕ. However Rapid Sediment Analyzer results are insensitive to small concentrations (in the tails of distribution curves) and resulting plots were not appropriate for partitioning. Few grains coarser than 2 ϕ are found within the delta or lake environments. Thus, the 2 ϕ inflection is interpreted to represent the division between the coarser grain sizes carried mainly by traction (population A) and fine-grained material (population B) moved mainly by periodic or intermittent suspension. Einstein *et al*. (1940) recognized a similar boundary at 1.5 ϕ and Fuller (1961) interpreted a curve irregularity at 2 ϕ as the grain size which separates grains affected by Impact Law and Stokes Law. A recent paper by Middleton (1976) relates the grain size at the traction-intermittant suspension truncation point on cumulative probability plots to the hydraulics of flow. He theorized that the shear velocity of flow, V_*, should be greater than or equal to the fall velocity of the grain, ω, at the truncation point described above. This idea was substantiated with data from Pitt River (Table VI).

5 ϕ inflection

This inflection point could be interpreted as overlapping modes resulting from: (1) two distinct processes - periodic suspension (population B) and continuous suspension (population C); or (2) a single process, suspension, operating under the distinctly different summer and winter hydraulic conditions existing in the Pitt system.

Flume studies of suspension transport (Sengupta, 1975) are technically difficult and have been limited in scope. Sengupta's results are ambiguous in that, depending on flow conditions, either a single mode or a bimodal grain size distribution was found in the suspended material. Attempts at grain size analysis of natural suspended populations are hindered by the problems of low concentrations necessitating very large samples.

Available data (Visher and Howard, 1974) suggests that natural suspended material is polymodal. Milliman (pers. comm. 1976) noted in his work on suspended sediments of

TABLE VI Pitt data applied to Middleton's (1976) shear velocity - settling velocity relationship.

$U_* = gds$

(DuBoys Formula)

$\frac{\omega}{U_*} \leq 1$ (Middleton's criteria)

$\frac{3 \text{ cm/sec}}{6.2 \text{ cm/sec}} < 1$

U_* = shear velocity

ω = settling velocity

g = acceleration of gravity

s = slope

d = depth

g = 980 cm/sec^2

s = .000053 (max. flood slope)

d = 963 cm (ave. depth)

ω of 2Φ (.25 mm) = 3 cm/sec

ω **determined** from Blatt et al. (1972, Fig 3-12)

Reference: Blatt, H.; Middleton, G.; and Murray, R. 1972, Origin of Sedimentary Rocks: Prentice Hall, Inc., Englewood Cliffs, New Jersey.

Fraser River that the fine silt and clay concentration remained fairly constant throughout the year irrespective of discharge. This fine material can be referred to as continuous suspension or wash load. He also found that sand and coarse silt concentrations fluctuated directly with change in velocity. Data published annually by the Water Survey of Canada gives grain size distribution of the suspended sediment in whole ϕ class intervals. Analysis was carried out to 9 ϕ only and thus there is not enough detail to determine bimodality. Evidence presented in this study of the Pitt system shows a consistent change in the proportion of populations B and C with sedimentary environment. This change is best explained by (1) above, the existence of two distinct suspension processes (periodic and continuous). Field studies clearly documenting the existence of two suspension processes are rare and the problem requires further study.

8.5 ϕ inflection

This inflection point occurs near the silt-clay boundary and is probably a grain shape effect. Silt grains are more or less equant in shape whereas clay size particles tend to be more platey and may settle more slowly than expected by Stokes Law. Pharo (1972) found a similar curve inflection in plots of grain size distributions of Strait of Georgia sediment.

Flocculation is not thought to be significant as water is fresh and clay size minerals are predominantly chlorite. It is suspected that all grains finer than 5 ϕ are carried mainly by suspension, however the mechanisms creating the two populations need further examination.

Conclusions

Cumulative probability curves of grain size data from the Pitt system can be partitioned into subpopulations which plot as straight lines on lognormal probability paper. These lognormal distributions are interpreted as populations produced by different methods of sediment transport in the river, delta, and lake environments: traction mode (0.5 ϕ - 2 ϕ), periodic suspension (2 ϕ - 5 ϕ), continuous suspension, silt (5 ϕ - 8.5 ϕ), and continuous suspension, clay (8.5 ϕ - 14 ϕ).

Each environment within the system is composed of a unique combination of proportions of the modes. As the source of sediment (Fraser River) is the same for all environments the difference in the proportions of modes between environments is a reflection of the relative importance of various processes acting within each environment.

Grain size distribution

Figure 11 depicts with size contours (C.I. = 0.5 ϕ) the aerial distribution of mean grain size of each grab sample and sample from the top of each core. Mean grain size is fine (5.5 ϕ) in the deep areas of the channel at the outlet and right-angle bend, with coarser (2 ϕ - 4 ϕ) material in between. The rest of the channel distributary out to the delta tongue is coarse silt with a mean grain size of 5 ϕ (.03 mm).

In general, mean grain size contours follow the channel, diverging near the end, mimicking the flood flow pattern (Fig. 8A). The one exception to this generality, the triangle of coarser sediment in the middle of the southern topsets, is probably a result of removal of some fines during ebb flow. Ebb drainage channels on the southern margin of this area (Fig. 3; Fig. 4A) indicate that ebb-oriented flow has a pronounced effect on this portion of the delta. The coarsest sediment, with a mean grain size of 0.044 mm (4.5 ϕ) to 0.075 mm (3.7 ϕ), is found at the northern top end of the delta topsets immediately adjacent to the channel. As this material is slightly coarser than that in the channel from which it originated, winnowing is suspected.

Subsamples were taken from top, the middle, and bottom of 15 cores from the foresets and bottomsets to determine any vertical change in grain size within the couple hundred years of sedimentation present. Cores within 0.5 km of the end of the distributary channel show increasing grain size from bottom to top of core. Cores 0.5 km to 7 km (farthest removed sample) away from the channel show a slight upward decrease in grain size (generally less than 0.5 ϕ). The implication from these changes in grain size stratigraphically is that the delta is prograding, but at a lesser rate than in the past.

On the delta foresets and bottomsets, mean grain size becomes finer away from the end of the distributary channel and the contour pattern indicates sedimentation occurs mainly to the east side of Goose Island. The distribution pattern depicted in Figure 11 is a reasonably good example of sedimentation by diffusion from a simple jet with little if any reworking by waves and tidal currents.

The application of the theory of submerged free jets to delta formation has been strongly influenced by the work of Bates (1953). He believed that the diffusion pattern depends on the relative densities of the two fluids (moving and stationary bodies of water). However, one of the major limitations of Bates' theory is the assumption that there are no boundary effects. Clearly, the basic assumptions for any theoretical model of sediment diffusion by jet flow (delta formation) should directly reflect the complexities of the natural environment and not an ideal situation.

A recent laboratory and computer model study by Ramsayer (1974) incorporated the effect of lateral and basal shear on jet flow under steady uniform flow. He explains morphological features such as levees and distributary bars found at a delta distributary mouth by a model which predicts the distribution of effective bed shear stress. Time dependent runs using fine sand produced a sediment distribution pattern strikingly similar to that of the Pitt (Fig. 11). Thus, the Pitt appears to fit the general model of deposition from a jet. However, one feature of the model that is missing in the Pitt, is the distributary mouth bar. Jopling (1960), suggests that if the frontal slope over which the flow expands is less than 10°, the flow will not separate from the boundary at all (assuming the flow is homopycnal) and thus deposition in the form of a bar would not occur. This seems to explain the lack of bar development on the Pitt delta as the foreset slope is less than 4° and the system possesses homopycnal flow for most of the year.

In conclusion, the areal distribution of mean grain size substantiates the interpretation that flood flow is the dominant current in moving sediment across the delta. Sediment is then dispersed by jet flow oriented in a north-east direction into the lake.

Sediment dispersal and accumulation

The observations of delta morphology, the presence of bedforms in the channel, and the distribution (pattern) of grain size enable the processes involved in sediment dispersal to be delineated.

The single distributary channel, flanked by levees, which leads to a fan-shaped delta foreset indicates that the channel is the avenue for sediment movement. The fact that the channel is deeply incised along the southern margin and that the carbon-dated material (4.645 ± 95 B.P.) from the southern topsets was buried by only 60 cm of sediment suggests that the flow is channelized in this reach and little sediment is brought up onto the delta surface. Velocity data and orientation of large-scale bedforms reflect the dominance of the flood current moving through the channel.

North of the right-angle bend the distributary shallows and channel banks become less steep. Small flood-oriented sand waves (10 m in spacing) are found in the channel for the first 2 - 3 km where flow is more-or-less confined. However, in the last 3 km, only ripples are found on the channel bottom and channel bank slopes are low enough for flow to spill and spread over the topsets. Mean grain size distribution reflects this pattern of flow. Once sediment is on the delta surface it is winnowed and moved by wave-driven currents in addition to the tidal currents. Large waves and swells were observed to occur frequently in the lake, particularly during the winter months, shifting sediment in the form of ripples. Orientation of these ripples, which cover the outer topsets, reflects the direction of currents at the time. Wind-generated currents were observed to incorporate and carry sediment into the lake as a plume.

No attempt was made to study mechanics of sediment dispersal from the end of distributary out into the lake. However, as medium silt is found as far out as 5 km, some type of density flow mechanism is probable for at least part of the year.

Stratigraphic data presented previously suggests that a total volume of (150 ± 20 X 10^3 tonnes) of sediment is accumulating annually in the southern half of Pitt Lake. ^{137}Cs dating has confirmed the existence of a steady sediment flux since at least 1954. 50% of the annual sediment accumulation is coarser than 5 ϕ and thus probably moves in the form of bedload and periodic suspension. This volume (75 x 10^3 tonnes) is on the same order of magnitude as the annual sediment flux calculated for the Pitt River (South) by Ashley (1977). It is suspected that the other 50% consists of: (1) material that is continually reentrained at points along the river and delta channels by flood flows and eventually arrives at the lake; and (2) fine silt and clay that is washed in from the Pitt watershed. ^{137}Cs dating substantiates, first, the interpretation of the foreset rhythmites as annual couplets (varves) and, second, that the sedimentation rate on delta topsets is minor.

The possibility of a sharp decrease in sedimentation rate approximately 30 years ago is suggested by the stratigraphy (Fig. 12). Most cores taken away from the active delta channel show a decrease in grain size upsection indicating a slight waning in delta growth rate. Although definitive evidence is lacking, this apparent decrease in sedimentation rate is intriguingly coincident with the initiation of large-scale dredging in lower Fraser River. This dredging probably has had the effect of increasing the cross-sectional area of Fraser estuary and thus decreasing the magnitude (and thus competency) of tidally induced currents in Pitt River.

CONCLUSIONS

The Pitt tidal delta is presently building into the lower end of Pitt lake. Its unusual position can be readily explained in terms of tidal dynamics. Unequal velocities of tidal currents (flood is greater) have caused landward transport of sediment up Pitt River (South) from the Fraser and into the lake. A complex interaction of Fraser discharge, Pitt basin drainage, and the tidal prism creates unequal tidal flow on a seasonal basis (winter has strongest flows).

Both the geomorphology and grain size distribution reflect the dominant flood flow pattern. Basically flow is channelized as it enters the lake and remains in the channel until its bank slopes are shallow enough to allow overflow onto delta topsets. Annually $150 \pm 20 \times 10^3$ tonnes of sediment (1% of Fraser's total load; Mathews _et_ _al_., 1970) are being deposited as varved couplets. The greatest thickness is on delta foresets in the vicinity of the main channel, with the best developed stratigraphy occurring adjacent to the delta lobe. These varved couplets are unusual in that the coarser silty layer forms during the winter and the clay layer during the summer, reflecting seasonal changes in the strength of tidal currents.

The present-day delta has been constructed during the last 6000 years at an average rate of 1.28 m . yr^{-1}; however, delta growth would be expected to have decreased exponentially. ^{137}Cs dating and varve chronology suggest that the present growth rate is on the order of centimeters per year. A slight decrease in mean grain size upsection in cores (representing a couple hundred years sedimentation) also suggests a waning delta growth. Varve stratigraphy has revealed a sharp decrease in sedimentation rate 30 years before present. This decrease may be a response to large-scale dredging in the lower Fraser estuary.

Despite bidirectional flow and daily and seasonal fluctuations in lake stage, the delta has a simple constructional morphology. The morphology, the sand waves in channel, and sediment dispersal pattern are dominated by flood conditions. Weaker ebb currents make only minor modifications despite the average discharge of 1700 m^3 . sec^{-1} which drains daily from the lake.

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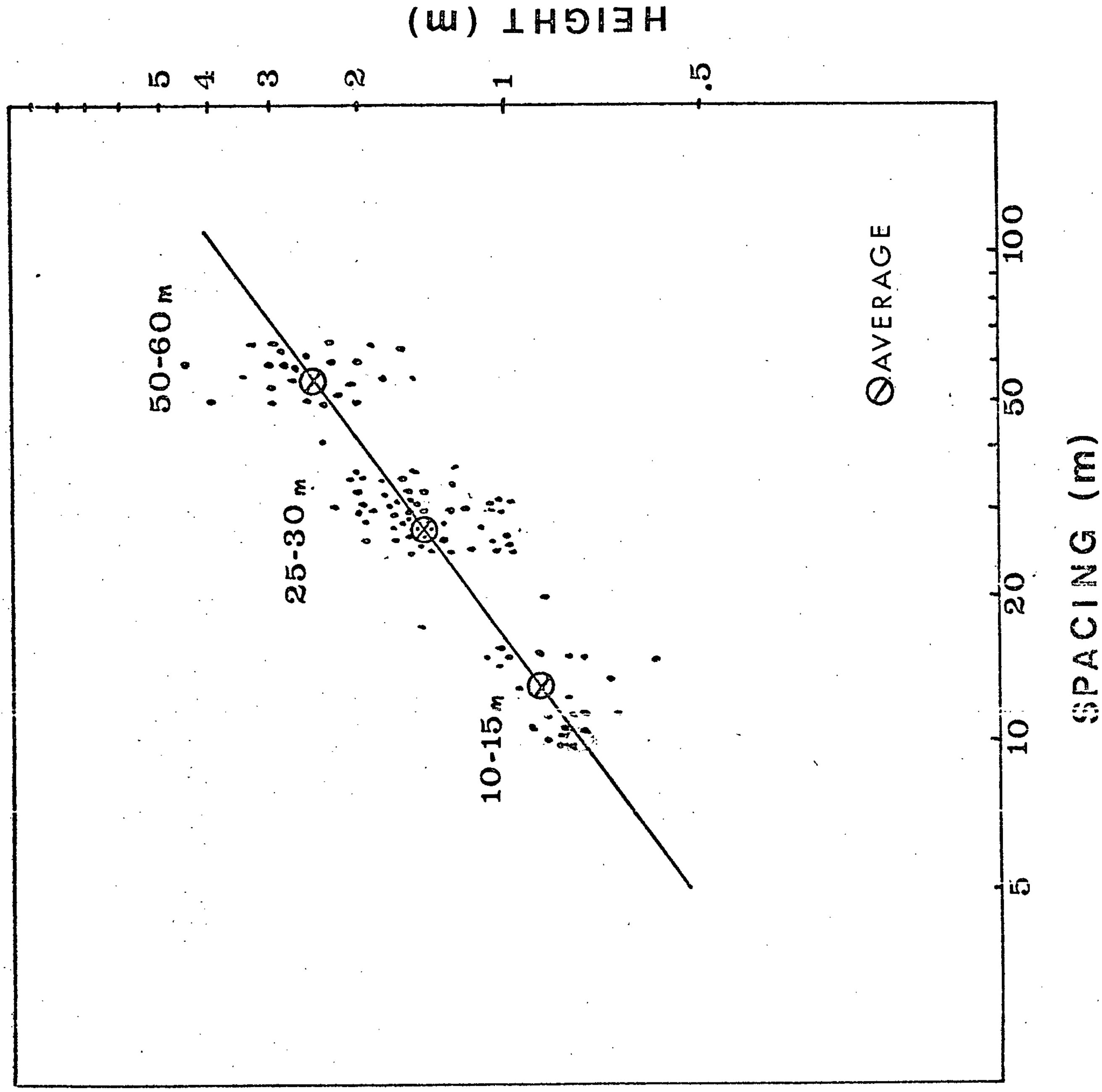
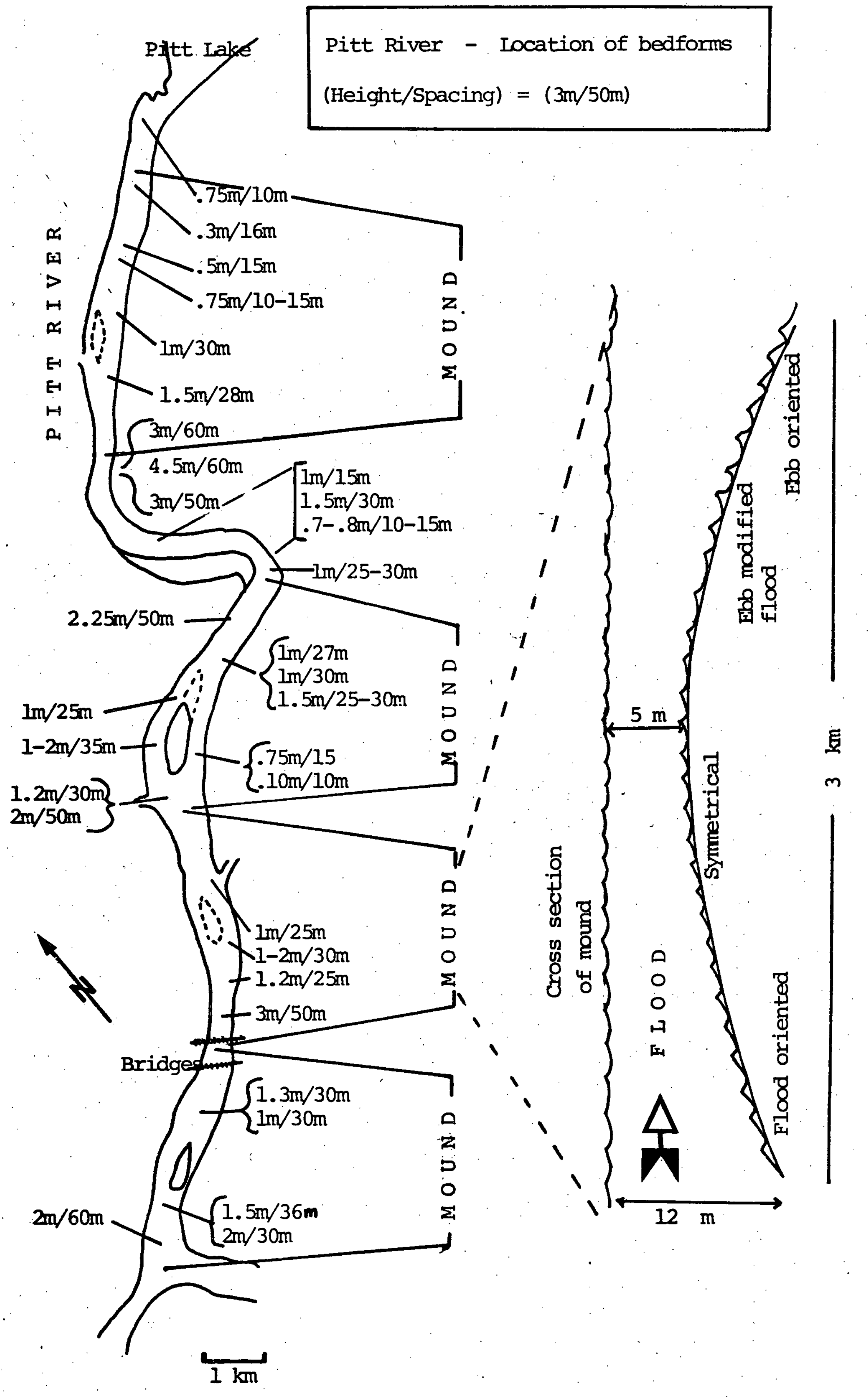
APPENDIX 1.



Log spacing-log height plot of sand waves found in Pitt River.



Pitt River - Location of bedforms

(Height/Spacing) = (3m/50m)

DATA USED IN THE MEANDER WAVELENGTH - BEDFORM WAVELENGTH SCALING RELATIONSHIP

River	λ_M (in feet)	λ_B (in feet)	λ_M/λ_B	Q_e	$\sqrt{Q_e}$	Sinuosity	Grain Size	Reference
Beaver	750	10	75	5,500	74	1.3	sand	Neill,1973
Columbia (dammed)	43,000	67	641	400,000	632	-	sand	Whetten and Fullam, 1967
Congaree	13,120	88	149	17,650	133	1.75	0.59 mm	Levey, 1975
Fraser	47,500	94	505	435,000	660	-	coarse sand	Pretious and Blench, 1951
Klaralven	4,692	37	126	23,000	152	-	sand	Sundborg,1956
Missouri	7,000	40	175	33,340	182	-	sand	Annambhotla et.al. 1972
Pitt	20,000	98	203	85,000	291	1.2	0.34 mm	This study
Red Deer	5,800	33	176	40,000	200	1.11	0.37 mm	Neill, 1973
Wabash	22,500	82	273	70,575	266	-	sand	Jackson,1975

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Neill,C., 1973, Observations on river channel processes in Alberta: In Fluvial processes and sedimentation, Proc. of Hydrology Smposium, Univ. of Alberta, Edmonton, Alberta.

APPENDIX 2

VELOCITY PROFILE DATA

March 11,1975 site (3)
depth 8.8-9.7 m
time - 1400 - 1830

	depth (m)	vel. (cm/sec)
1400	0	35
ebb	2.00	38
	4.00	37
	6.00	38
	7.00	35
	8.25	29
	8.90	24
1430	0.00	33
ebb	2.00	30
	4.00	30
	6.00	29
	7.00	30
	8.25	27
	8.80	24
1500	0	26
ebb	2.00	24
	4.00	24
	6.00	21
	7.00	20
	8.25	19
	8.80	17
1530		
ebb	0	14
	2.00	15
	4.00	15
	6.00	12
	7.00	13
	8.25	08
	8.80	05
Turn from ebb to flood		
1600	0	08
flood	2.00	05
	4.00	12
	6.00	03
	7.00	09
	8.00	12
	8.90	05
1630	0	20
flood	2.00	20
	4.00	20
	6.00	20
	8.00	20
	9.00	15
		12

March 11, 1975 (cont)

	depth (m)	vel. (cm/sec)
1700	0	41
flood	2.00	40
	4.00	37
	6.00	37
	8.00	34
	9.00	27
	9.30	24
1730		
flood	0	50
	2.00	47
	4.00	43
	6.00	40
	8.00	34
	9.00	29
	9.50	27
1800	0	58
flood	2.00	58
	4.00	55
	6.00	50
	8.00	49
	9.00	41
	9.50	34
1830	0	58
flood	2.00	58
	4.00	55
	6.00	44
	8.00	43
	9.00	40
	9.50	38

March 13, 1975 site (3)
depth 8.8 - 9.2 m
time - 730 - 1400

	depth (m)	vel. (cm/sec)
730	0	70
flood	2.00	64
	4.00	64
	6.00	61
	8.00	58
	8.60	42
	9.20	40

March 13, 1975 (cont)

	depth (m)	vel. (cm/sec)
800	0	73
flood	2.00	67
	4.00	69
	6.00	58
	8.00	50
	8.60	30
	9.20	26
830	0	70
flood	2.00	70
	4.00	66
	6.00	55
	8.00	43
	8.60	37
	9.20	30
900	0	56
flood	2.00	56
	4.00	58
	6.00	56
	8.00	44
	9.00	30
	9.20	26
930	0	47
flood	2.00	43
	4.00	46
	6.00	40
	8.00	27
	9.20	18
1000	0	37
flood	2.00	37
	4.00	35
	6.00	32
	8.00	28
	9.40	11
1030	0	21
flood	2.00	20
	4.00	18
	6.00	17
	8.00	17
	9.00	12
	9.40	06
Turn from flood to ebb		

March 13, 1975 (cont)

	depth (m)	vel. (cm/sec)
1100	0	05
flood	2.00	07
	4.00	06
	6.00	06
	8.00	07
	9.00	06
	9.50	05
1130	0	23
flood	2.00	24
	4.00	21
	6.00	21
	8.00	20
	9.00	20
1200	0	34
flood	2.00	35
	4.00	34
	6.00	30
	7.00	37
	8.00	30
	9.00	27
1230	0	41
flood	2.00	43
	4.00	40
	6.00	43
	7.00	41
	8.40	37
	9.00	28
	0	44
1300	2.00	44
flood	4.00	44
	6.00	43
	7.00	43
	8.40	38
	9.00	34
1400	0	41
	2.00	43
	4.00	43
	6.00	37
	7.00	40
	8.40	38
	8.80	30

May 9, 1975 site (2)
depth 11 -11.6 m
time - 900 -1730

	depth (m)	vel. (cm/sec)
900 ebb	0	27
	2.00	26
	4.00	22
	6.00	19
	8.00	19
	10.00	18
	11.60	12
930 ebb	0	48
	2.00	46
	4.00	39
	6.00	33
	8.00	31
	10.00	26
	11.60	24
1000 ebb	0	50
	2.00	51
	4.00	51
	6.00	50
	8.00	39
	10.00	33
	11.60	26
1030 ebb	0	77
	2.00	57
	4.00	57
	6.00	51
	8.00	51
	10.00	41
	11.50	33
1100 ebb	0	51
	2.00	49
	4.00	49
	6.00	49
	8.00	45
	10.00	31
	11.50	28
1130 ebb	0	57
	2.00	64
	4.00	59
	6.00	59
	8.00	51
	10.00	41
	11.40	36

May 9, 1975 (cont)

	depth (m)	vel. (cm/sec)
1200 ebb	0	59
	2.00	62
	4.00	59
	6.00	54
	8.00	54
	10.00	49
	11.40	30
1230 ebb	0	59
	2.00	62
	4.00	54
	6.00	59
	8.00	51
	10.00	44
	11.30	26
1300 ebb	0	54
	2.00	62
	4.00	77
	6.00	57
	7.00	54
	8.00	49
	10.00	46
	11.30	26
1330 ebb	0	51
	2.00	64
	4.00	57
	6.00	57
	8.00	54
	10.00	41
	11.20	36
1400 ebb	0	54
	2.00	59
	4.00	54
	6.00	51
	8.00	49
	10.00	44
	11.20	41
1430 ebb	0	57
	2.00	59
	4.00	57
	6.00	54
	8.00	51
	10.00	51
	11.10	46

May 9, 1975 (cont)

	depth (m)	vel. (cm/sec)
1500 ebb	0	54
	2.00	59
	4.00	54
	6.00	51
	8.00	51
	10.00	49
	11.10	45
1530 ebb	0	51
	2.00	51
	4.00	51
	6.00	51
	8.00	46
	10.00	46
	11.10	45
1600 ebb	0	51
	2.00	49
	4.00	46
	6.00	44
	8.00	39
	10.00	28
	11.10	36(turbulent)
1630 ebb	0	39
	2.00	41
	4.00	40
	6.00	41
	8.00	39
	10.00	36
	11.10	24
1700 ebb	0	21
	2.00	21
	4.00	18
	6.00	18
	8.00	18
	10.00	21
	11.00	10

ebb to flood at 1715

May 21, 1975 site (2)
depth 9.1 m and 10.9 m
time - 1500 - 1900

1500 flood	0	08
	2.00	08
	4.00	09=
	6.00	08
	8.00	08
	9.10	04

May 21,1975 (cont)

	depth (m)	vel. (cm/sec)	
1530 flood	0	02	
	2.00	03	
	4.00	03	
	6.00	03	
	8.00	02	
	9.10	02	
1600 flood	0	10	
	2.00	10	
	4.00	09	
	6.00	09	
	8.00	05	
	8.80	04	
1630 flood	0	31	moved location
	2.00	31	
	4.00	25	
	6.00	25	
	8.00	25	
	10.00	17	
	10.90	17	
1700 flood	0	39	
	2.00	39	
	4.00	39	
	6.00	39	
	8.00	31	
	10.00	26	
	10.90	23	
1730 flood	0	42	
	2.00	44	
	4.00	41	
	6.00	40	
	8.00	40	
	10.00	32	
	10.90	26	
1800 flood	0	40	
	2.00	40	
	4.00	41	
	6.00	40	
	8.00	38	
	10.00	35	
	10.90	28	
1830 flood	0	33	
	2.00	36	
	4.00	40	
	6.00	35	
	8.00	33	
	10.00	27	
	10.90	23	

May 21, 1975 (cont)

	depth (m)	vel. (cm/sec)
1900 flood	0	28
	2.00	31
	4.00	28
	6.00	28
	8.00	28
	10.00	26
	10.90	23
1930 flood	0	21
	2.00	22
	4.00	19
	6.00	21
	8.00	19
	10.00	17
	10.90	14
2000 flood	0	12
	2.00	12
	4.00	09
	6.00	08
	8.00	06
	10.00	05
	10.9.	05

Turn from flood to ebb 2045

June 12, 1975 site (4)
depth 11 - 12.2 m
time - 1200 -2030

	depth (m)	vel. (cm/sec)
1200 ebb	0	26
	2.00	36
	4.00	36
	6.00	35
	8.00	39
	9.10	31
	11.00	21
	12.20	10
1230 ebb	0	31
	2.00	39
	4.00	42
	6.00	35
	8.00	32
	9.10	26
	11.00	21
	12.20	15

June 12, 1975 (cont)

	depth (m)	vel. (cm/sec)
1300 ebb	0	36
	2.00	44
	4.00	46
	6.00	41
	8.00	28
	9.10	32
	11.00	26
	12.20	18
1330 ebb	0	45
	2.00	41
	4.00	46
	6.00	46
	8.00	41
	9.10	39
	11.00	28
	12.20	23
1400 ebb	0	45
	2.00	49
	4.00	49
	6.00	46
	8.00	45
	9.10	37
	11.00	31
	12.20	26
1430 ebb	0	44
	2.00	49
	4.00	46
	6.00	51
	8.00	46
	9.10	42
	11.00	28
	12.20	24
1500 ebb	0	44
	2.00	46
	4.00	51
	6.00	50
	8.00	46
	9.10	39
	11.00	30
	12.20	26
1600 ebb	0	51
	2.00	57
	4.00	51
	6.00	51
	8.00	49
	9.10	49
	11.00	39
	12.20	28

June 12, 1975 (cont)

	depth (m)	vel. (cm/sec)	
1630 ebb	0	41	
	2.00	51	
	4.00	46	
	6.00	49	
	8.00	51	
	9.10	49	(turbulent)
	11.00	28	
	12.00	28	
1515 ebb	0	44	
	2.00	51	
	4.00	49	moved position slightly
	6.00	49	
	8.00	46	
	9.10	36	
	11.00	32	
1800 ebb	0	36	
	2.00	40	
	4.00	45	
	6.00	46	
	8.00	41	
	9.10	39	
	11.00	22	
1830 ebb	0	36	
	2.00	41	
	4.00	39	
	6.00	45	
	8.00	44	
	9.10	30	
	11.00	15	
1900 ebb	0	31	
	2.00	39	
	4.00	39	
	6.00	32	
	8.00	31	
	9.10	30	
	11.00	13	
2000 ebb	0	13	
	2.00	13	
	4.00	17	
	6.00	15	
	8.00	12	
	9.10	12	
	11.00	08	

Ebb to flood at 2040

June 24, 1975 site (4)
depth 42 m
time 700 -1230

	depth (m)	vel. (cm/sec)
730 flood	0	04
	6	13
	12	14
	18	15
	24	14
	30	12
	36	12
	42	12
800 fl00d	0	27
	6	30
	12	30
	18	27
	24	24
	30	24
	36	20
	42	20
830 flood	0	38
	6	42
	12	42
	18	43
	24	40
	30	36
	36	33
	42	25
900 flood	0	47
	6	47
	12	44
	18	47
	24	38
	30	36
	36	35
	42	25
930 flood	0	40
	6	44
	12	45
	18	46
	24	47
	30	43
	36	34
	42	29
1000 flood	0	44
	6	47
	12	45
	18	44
	24	43
	30	43
	36	33
	42	25

June 24, 1975 (cont)

	depth (m)	vel. cm/sec)
1030	0	40
flood	6	43
	12	40
	18	35
	24	34
	30	31
	36	25
	42	22
1100	0	40
flood	6	35
	12	35
	18	28
	24	27
	30	19
	36	19
	42	13
1130	0	33
flood	6	31
	12	30
	18	24
	24	20
	30	21
	36	17
	42	12
1200	0	27
flood	6	24
	12	21
	18	20
	24	12
	30	11
	36	11
	42	05
1230	0	17
flood	6	15
	12	12
	18	10
	24	08
	30	08
	36	08
	42	06

July 9, 1975 site (4)
depth 28.5 - 31 m ; time 1030-1630

	depth (m)	(vel. cm/sec)
1030	0	28
ebb	5	30
	10	31
	15	31
	20	28
	25	31
	31	10
1100	0	29
ebb	5	30
	10	30
	15	28
	20	29
	25	27
	31	13
1145	0	35
ebb	5	32
	10	27
	15	25
	20	29
	25	28
	31	17
1215	0	35
ebb	5	35
	10	30
	15	27
	20	26
	25	26
	31	17
1245	0	34
ebb	5	34
	10	37
	15	29
	20	29
	25	28
	31	10
1315	0	38
ebb	5	37
	10	28
	15	31
	20	32
	25	24
	31	16

July 9, 1975 (cont)			
	depth (m)	vel. (cm/sec)	
1400 ebb	0	37	
	5	39	
	10	30	
	15	30	
	20	33	
	25	30	drifted from position in channel
	30	12	
1430 ebb	0	34	
	5	40	
	10	34	
	15	32	
	20	29	
	25	27	
	30	13	
1515 ebb	0	42	
	5	40	
	10	33	
	15	31	
	20	33	
	25	28	
	29	16	
1545 ebb	0	39	
	5	38	
	10	28	
	15	18	
	20	21	
	25	21	
	29	09	
August 6, 1975 site (1B) depth 8 - 10 m time - 1030 -1815			
1030 ebb	0	35	
	2.0	32	
	4.0	31	
	6.0	27	
	7.6	33	
	8.0	26	
1100 ebb	0	33	
	2.0	33	
	4.0	32	
	6.0	28	
	7.6	28	
	8.0	31	

August 6, 1975 (cont)			
	depth (m)	vel. (cm/sec)	
1130 ebb	0	33	
	2.0	33	
	4.0	32	
	6.0	28	
	7.6	26	
	8.0	26	
1200 ebb	0	33	
	2.0	33	
	4.0	31	
	6.0	28	
	7.6	26	
	8.0	23	
1230 ebb	0	33	
	2.0	33	
	4.0	31	
	6.0	28	
	7.6	26	
	8.0	15	
1300 ebb	0	36	
	2.0	33	
	4.0	32	
	6.0	33	
	7.0	46	
	7.6	39	
	8.0	27	
1330 ebb	0	39	
	2.0	35	
	4.0	33	
	6.0	46	
	7.0	46	
	7.6	33	
	8.0	28	
1400 ebb	0	36	
	2.0	40	
	4.0	62	turbulent
	6.0	55	
	7.0	46	
	7.6	31	
	8.0	29	
1500 ebb	0	71	
	2.0	65	
	4.0	59	
	6.0	49	
	7.0	36	
	7.6	22	
	8.0	17	

August 6, 1975 (cont)			
	depth (m)	vel. (cm/sec)	
1530 ebb	0	65	
	2.0	60	
	4.0	57	
	6.0	47	
	7.0	35	
	7.6	28	
	8.0	21	
1615 ebb	0	47	
	2.0	41	
	4.0	35	moved position
	6.0	33	
	8.0	19	
	9.0	09	
	9.7	07	
	10.0	07	
Turned from ebb to flood 1645			
1700 flood	0	12	
	2.0	14	
	4.0	16	moved position
	6.0	09	
	7.0	10	
	7.6	07	
	8.0	12	
1715 flood	0	14	
	2.0	12	
	4.0	14	
	6.0	15	
	7.0	24	
	7.6	18	
	8.0	12	
1745 flood	0	44	
	2.0	46	
	4.0	49	
	6.0	46	
	7.0	56	
	7.6	47	
	8.0	33	
1800 flood	0	69	
	2.0	62	
	4.0	68	
	6.0	65	
	7.0	66	
	7.6	61	
	8.0	56	

August 6, 1975 (cont)		
	depth (m)	vel. (cm/sec)
1815 flood	0	75
	2.0	71
	4.0	72
	6.0	73
	7.0	71
	7.6	69
	8.0	52
August 11, 1975 site (1B) depth 6.6 - 8 m time - 930 -1600		
930 flood	0	29
	2.0	32
	4.0	34
	5.6	37
	6.0	27
	6.6	25
1000 flood	0	53
	2.0	56
	4.0	55
	5.3	55
	6.0	47
	6.3	28
1030 flood	0	58
	2.0	61
	4.0	61
	5.0	51
	6.0	36
1100	0	65
	2.0	65
	4.0	57
	5.0	37
	6.0	26
1115 flood	0	58
	2.0	59
	4.0	59
	6.0	59
	7.5	54
	8.0	46
	8.5	33
1200 flood	0	45
	2.0	45
	4.0	47
	6.0	40
	7.2	35
	8.0	26
	8.2	18

August 11, 1975 (cont)

	depth (m)	vel. (cm/sec)
1300 flood	0	11
	2.0	09
	4.0	06
	6.0	03
	7.0	03
	8.0	03

Turned from flood to ebb at 1315

	depth (m)	vel. (cm/sec)
1400 ebb	0	27
	2.0	32
	4.0	30
	6.0	20
	7.0	16
1430 ebb	0	50
	2.0	49
	4.0	43
	6.0	31
	6.5	12
	7.5	14
1500 ebb	0	59
	2.0	55
	4.0	54
	5.3	37
	6.0	22
	6.2	20
1530 ebb	0	58
	2.0	56
	4.0	44
	5.3	36
	6.0	25
	6.3	23
1600 ebb	0	55
	2.0	55
	4.0	42
	5.5	39
	6.0	26
	6.5	21

August 13, 1975 site (4)
depth 25 - 32 m
time - 1030 -1530

	depth (m)	vel. (cm/sec)
1030 ebb	0	34
	6.0	36
	12.0	34
	18.0	28
	24.0	10
	25.5	01

August 13, 1975 (cont)

	depth (m)	vel. (cm/sec)
1100 ebb	0	29
	6	19
	12	19
	18	18
	24.5	04
	25.5	03

Turn from ebb to flood at 1115.

	depth (m)	vel. (cm/sec)
1200 flood	0	14
	6.0	19
	12.0	19
	18.0	17
	24.0	17
	29.5	19
	30.5	06
1230 flood	0	31
	6	30
	12	28
	18	30
	24	29
	30	28
	31.5	24
	32.5	22
1330 flood	0	40
	6	36
	12	35
	18	31
	24	30
	30	27
	31.5	24
	32.5	19
1400 flood	0	43
	6	32
	12	29
	18	27
	24	19
	30	16
	31	11
1530 flood	0	26
	6	13
	12	12
	18	09
	24	07
	29	03
	30	02

September 4, 1975 site (1A)
depth 33 - 39 ft****
time - 1030 -1715

	depth (ft) ******	vel. (cm/sec)
1030	0	30
ebb	6	64
	12	64
	18	62
	24	59
	30	57
	33	53
	34	35
1100	0	62
ebb	6	62
	12	60
	18	59
	24	55
	30	50
	33	28
	34	25
1130	0	67
ebb	6	65
	12	64
	18	63
	24	60
	30	57
	33	53
	34	32
1230	0	61
ebb	6	61
	12	62
	18	60
	24	60
	30	45
	35	46
	36	21
1300	0	65
ebb	6	60
	12	58
	18	57
	24	54
	30	54
	33	38
	34	15
1330	0	57
ebb	6	59
	12	57
	18	55
	24	51
	30	47
	35	44
	36	27

September 4, 1975 (cont)

	depth (m)	vel. (cm/sec)
1430	0	59
ebb	6	60
	12	52
	18	52
	24	53
	30	51
	35	43
	36	13
1500	0	49
ebb	6	50
	12	50
	18	44
	24	45
	30	30
	35	18
	36	17
1530	0	39
	6	40
	12	37
	18	32
	24	28
	30	18
	33	13
	36	12
1600	0	29
ebb	6	25
	12	17
	18	15
	24	13
	30	12
	35	10
	36	10

Turned ebb to flood at 1615

1700 - Very turbulent

1715	0	56
flood	6	57
	12	57
	18	53
	24	37
	30	40
	34	33

October 8, 1975 site (2)
depth 12- 13 m time 1100 - 1700

	depth (m)	vel. (cm/sec)
1100 flood	0	70
	2.0	70
	4.0	68
	6.0	67
	8.0	60
	10.0	62
	11.0	53
	12.0	52
1215 flood	0	66
	2.0	65
	4.0	64
	6.0	58
	8.0	55
	10.0	52
	11.2	45
	12.0	36
	12.2	30
1300 flood	0	58
	2.0	56
	4.0	54
	6.0	53
	8.0	47
	10.0	39
	11.6	24
	12.0	24
	12.6	19
1345 flood	0	38
	4.0	31
	6.0	27
	8.0	21
	10.0	10
	11.6	09
	12.0	09
	12.6	07

Turn from flood to ebb at 1430.

	depth (m)	vel. (cm/sec)
1530 ebb	0	21
	2.0	20
	4.0	24
	6.0	27
	8.0	27
	10.0	26
	11.0	23
	12.0	12

October 8, 1975 (cont)

	depth (m)	vel. (cm/sec)
1600 ebb	0	36
	2.0	39
	4.0	38
	6.0	36
	8.0	32
	10.0	30
	11.2	21
	12.0	21
	12.2	15
1700 ebb	0	37
	2.0	41
	4.0	31
	6.0	31
	8.0	31
	10.0	26
	11.0	26
	12.0	20
	12.1	16

November 5, 1975 site (2)
depth 13 m
time - 945 - 1100

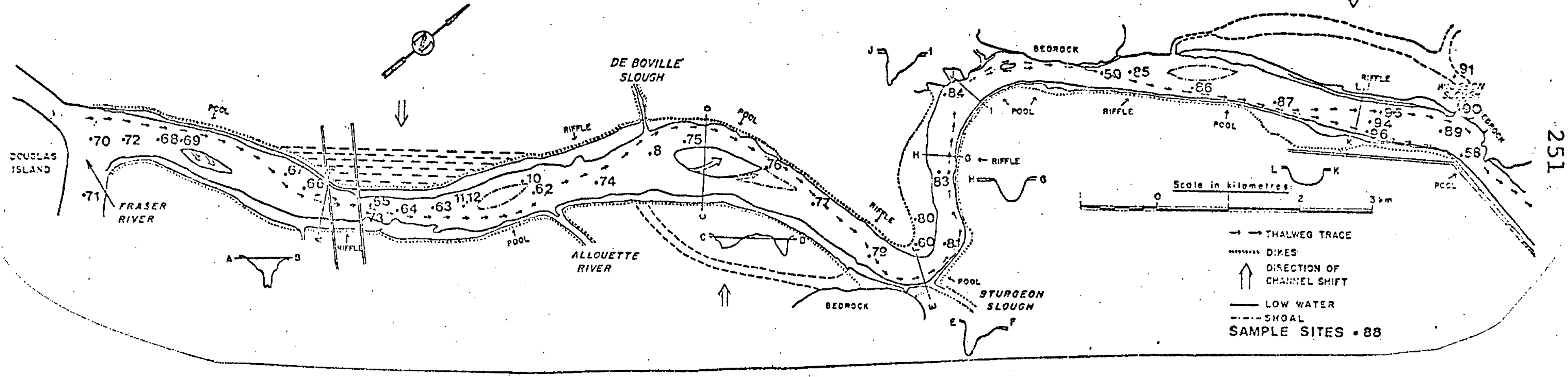
	depth (m)	vel. (cm/sec)
945 flood	0	46
	2.0	40
	4.0	36
	6.0	43
	8.0	35
	10.0	25
	12.0	23
	13.0	14
1100 flood	0	32
	2.0	23
	4.0	22
	6.0	15
	8.0	16
	10.0	20 turbulent
	12.0	06
	13.0	06

February 20, 1976 site (2)
depth = 13 m
time - 900 - 1430

	depth (m)	vel. (cm/sec)
900 flood	0	72
	2.0	51
	5.2	64
	7.0	64
	9.0	64
	11.0	59
	12.0	51
	12.8	36
	13.0	21
1145 flood	0	59
	2.0	59
	4.0	57
	6.0	51
	8.0	51
	10.0	41
	12.0	28
turned from flood to ebb at 1330.		
1400 ebb	0	21
	2.0	21
	4.0	26
	6.0	28
	8.0	33
	10.0	31
	12.0	10
1430 ebb	0	33
	2.0	51
	4.0	54
	6.0	49
	8.0	49
	10.0	15
	12.0	10

PITT RIVER - SEDIMENT SAMPLE LOCATIONS

APPENDIX 3



Sediments sized with R.S.A. (Rapid Sediment Analyzer)

Pitt River(North)#4

φ	Cum.%
0.64	0.0
0.75	4.00
1.00	12.80
1.25	23.20
1.50	40.00
1.75	54.40
2.00	74.00
2.12	100.00

PLC #6

φ	Cum.%
1.0	0.0
1.5	4.35
1.75	8.50
2.00	16.00
2.25	36.9
2.50	60.0
3.00	78.0
3.50	83.0
4.00	89.6

PRSC #8

φ	Cum.%
0.56	0.0
0.75	7.08
1.00	16.81
1.25	25.66
1.50	46.90
1.75	62.83
2.00	84.07
2.18	100.00

PRSC #10

φ	Cum.%
0.43	0.0
0.50	2.99
0.75	13.79
1.00	26.44
1.25	52.29
1.50	65.57
1.75	86.21
1.86	100.00

PRSC #11

φ	Cum.%
0.97	0.0
1.00	1.02
1.25	8.77
1.50	21.54
1.75	32.62
2.00	47.60
2.25	84.31
2.47	100.00

PRC #12

φ	Cum.%
1.26	0.0
1.50	13.70
1.75	26.03
2.00	42.81
2.25	83.56
2.40	100.00

PRC #58

φ	Cum.%
1.26	0.0
1.50	8.31
1.75	10.00
2.00	19.14
2.25	61.06
2.50	93.19
2.53	100.00

PRC #59

φ	Cum.%
1.43	0.0
1.50	6.74
1.75	24.35
2.00	50.77
2.18	100.00

PRC #60

φ	Cum.%
1.18	0.0
1.25	2.08
1.50	12.47
1.75	21.30
2.00	34.29
2.25	65.45
2.50	91.95
2.53	100.00

PRC #62

φ	Cum.%
0.51	0.0
0.75	9.79
1.00	22.68
1.25	36.08
1.50	51.55
1.75	71.13
1.89	100.00

PRC #63

φ	Cum.%
0.83	0.0
1.00	4.37
1.25	10.92
1.50	25.14
1.75	32.51
2.00	45.90
2.25	77.56
2.47	100.00

PRC #66

φ	Cum.%
0.53	0.0
0.75	8.42
1.00	15.17
1.25	35.39
1.50	58.99
1.75	79.21
1.84	100.00

PRC #67

φ	Cum.%
0.73	0.0
0.75	9.52
1.00	10.08
1.25	19.76
1.50	36.82
1.75	50.39
2.00	73.64
2.13	100.00

φ	Cum.%
PRC #68	
0.51	0.0
0.75	15.38
1.00	32.31
1.25	52.31
1.50	84.62
1.60	100.00
PRC #69	
0.47	0.0
0.50	1.12
0.75	6.74
1.00	24.72
1.25	26.40
1.50	39.33
1.75	62.92
1.78	100.00
PRC #70	
0.47	0.0
0.50	0.51
0.75	10.71
1.00	21.43
1.25	35.71
1.50	55.10
1.75	82.34
1.88	100.00
FRC #71	
0.56	0.0
0.75	1.25
1.00	12.50
1.25	27.06
1.50	42.50
1.75	68.75
1.78	100.00
FRC #72	
0.97	0.0
1.00	1.94
1.25	11.63
1.50	28.68
1.75	42.63
2.00	65.50
2.18	100.00

φ	Cum.%
PRC #73	
0.64	0.0
0.75	4.00
1.00	12.80
1.25	22.40
1.50	44.00
1.75	58.40
2.00	77.60
2.12	100.00
PRC #74	
0.97	0.0
1.00	1.65
1.25	14.50
1.50	35.00
1.75	54.00
2.00	77.50
2.06	100.00
PRC #75	
0.65	0.0
0.75	5.35
1.00	14.29
1.25	25.89
1.50	44.20
1.75	61.61
2.00	80.58
2.06	100.00
PRC #76	
0.57	0.0
0.75	3.02
1.00	15.09
1.25	24.90
1.50	40.75
1.75	53.58
2.00	71.69
2.12	100.00
PRC #77	
0.89	0.0
1.00	6.32
1.25	20.00
1.50	42.11
1.75	60.53
2.00	86.32
2.06	100.00

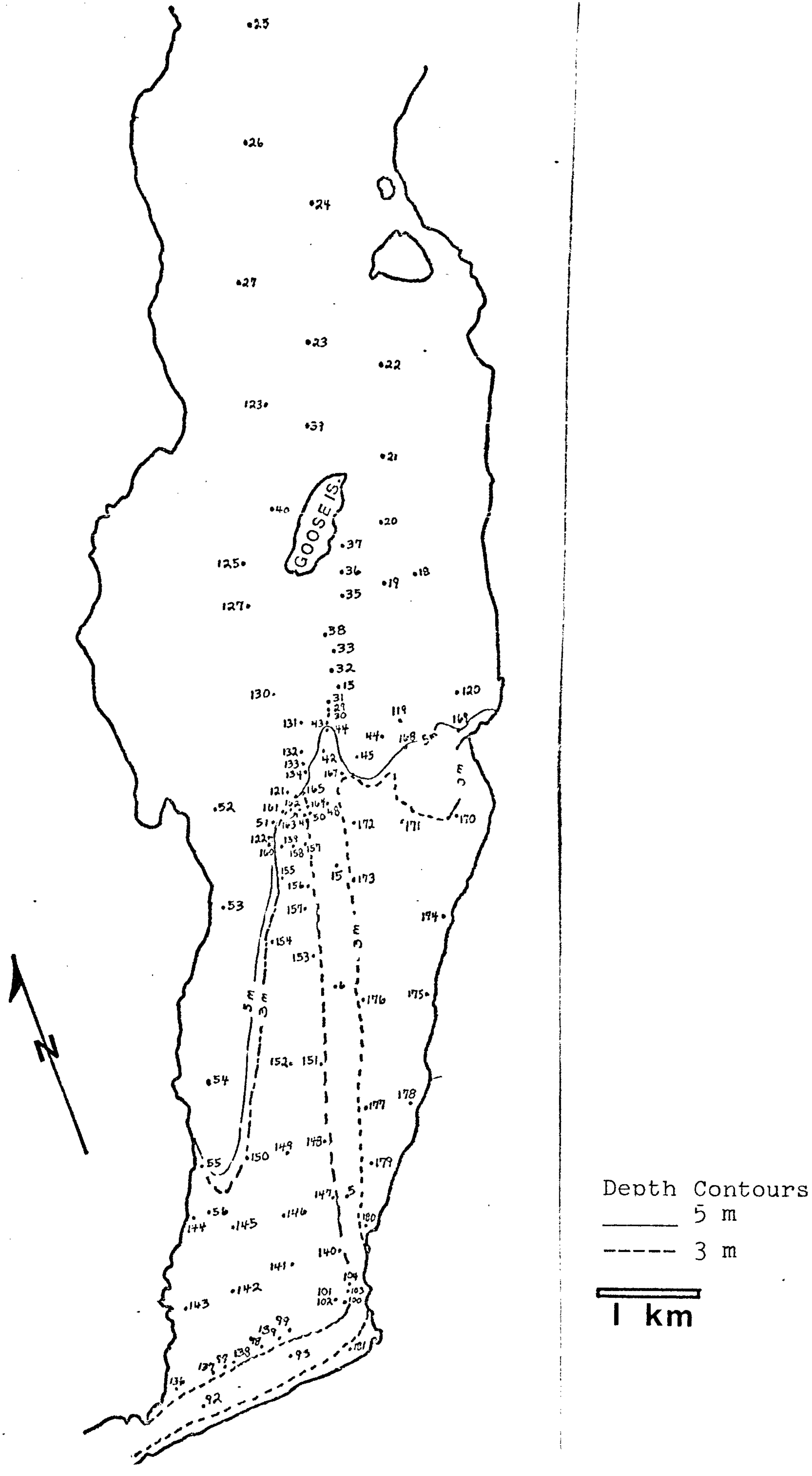
φ	Cum.%
PRC #79	
0.84	0.0
1.00	8.06
1.25	17.74
1.50	35.08
1.75	49.60
2.00	69.76
2.12	100.00
PRC #80	
1.39	0.0
1.50	3.85
1.75	10.77
2.00	22.12
2.25	45.00
2.50	73.08
2.73	100.00
PRC #81	
0.62	0.0
0.75	0.74
1.00	5.18
1.25	8.52
1.50	14.81
1.75	21.11
2.00	30.37
2.25	48.89
2.50	65.93
2.75	94.81
2.80	100.00

	Cum.%
PRC #83	
24	0.0
25	0.68
50	9.15
75	17.39
00	28.61
25	55.84
50	86.96
56	100.00
PRC #84	
64	0.0
75	5.56
00	17.78
25	31.11
50	55.56
75	74.44
89	100.00
PRC #85	
12	0.00
25	5.53
50	18.46
75	29.54
00	44.62
25	80.62
39	100.00
PRC #86	
90	0.0
00	5.58
25	17.20
50	37.21
75	53.49
00	76.28
12	100.00
PRC #87	
77	0.0
00	2.86
25	8.57
50	17.14
75	27.14
00	60.07
25	97.14
26	100.00

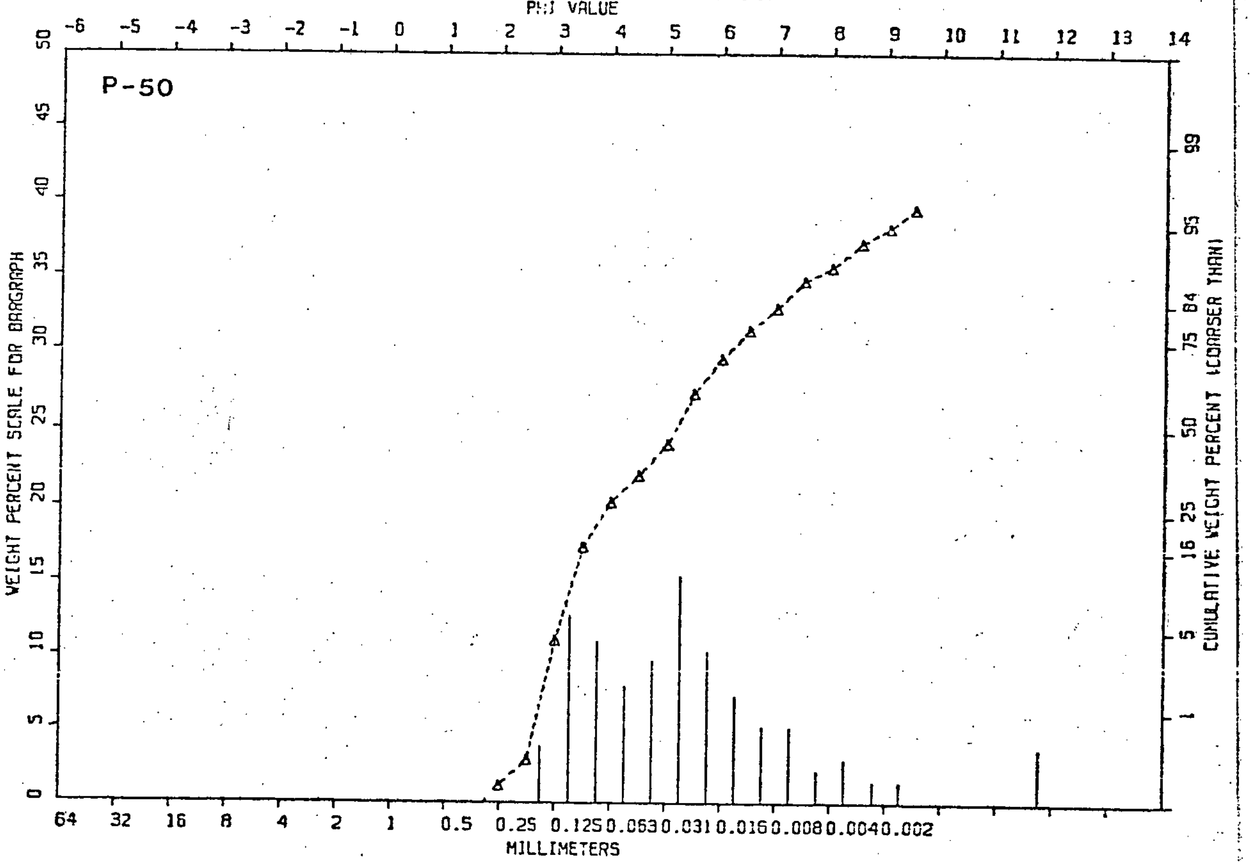
φ	Cum.%
PRC #89	
0.83	0.0
1.00	1.76
1.25	5.99
1.50	29.99
1.75	42.61
2.00	59.86
2.18	100.00
Widgeon S.90	
0.43	0.0
0.50	1.38
0.75	8.62
1.00	16.21
1.25	23.10
1.50	39.66
1.75	53.45
2.00	68.97
2.18	100.00
Widgeon S.91	
0.19	0.0
0.25	1.49
0.50	7.20
0.75	16.00
1.00	25.20
1.25	34.80
1.50	52.00
1.75	66.40
2.00	86.00
2.25	90.00
2.28	100.00
PLC #92	
0.73	0.0
0.75	1.16
1.00	8.91
1.25	19.37
1.50	34.49
1.75	48.84
2.00	73.64
2.11	100.00

φ	Cum.%
PRC #94	
2.40	0.00
2.50	1.00
2.75	11.30
3.00	25.00
3.25	39.00
3.50	54.00
4.00	72.00
PLC #96	
1.18	0.0
1.25	2.10
1.50	14.97
1.75	25.75
2.00	40.42
2.25	76.05
2.47	100.00

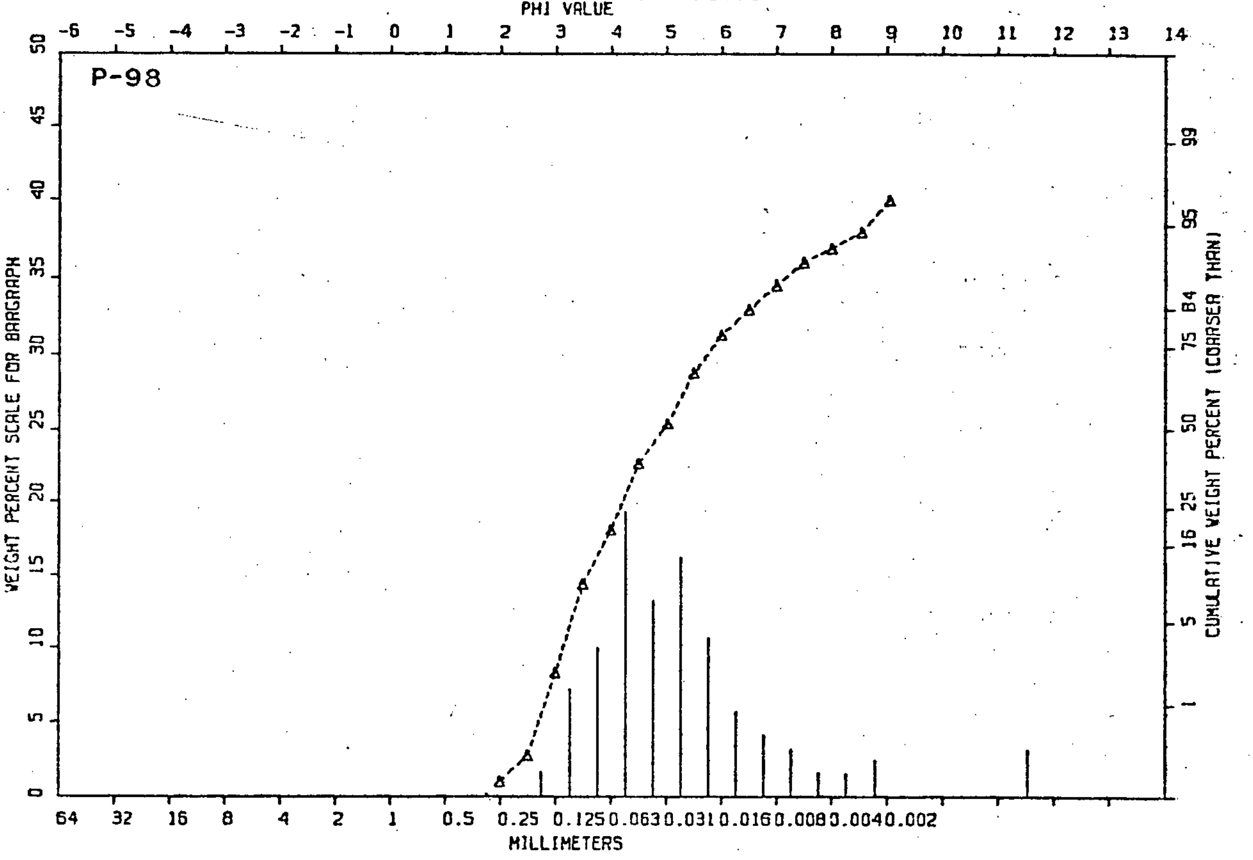
PITT LAKE - SEDIMENT SAMPLE LOCATIONS

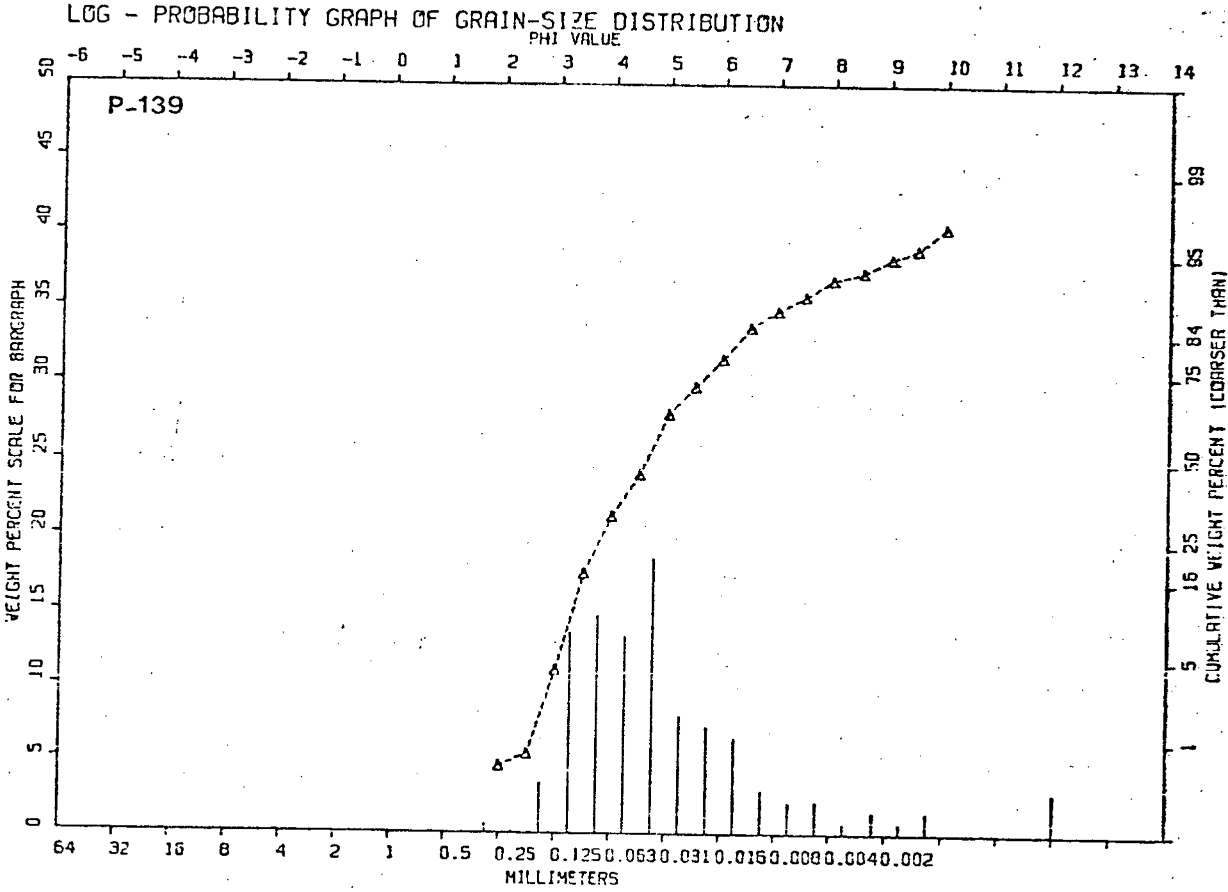


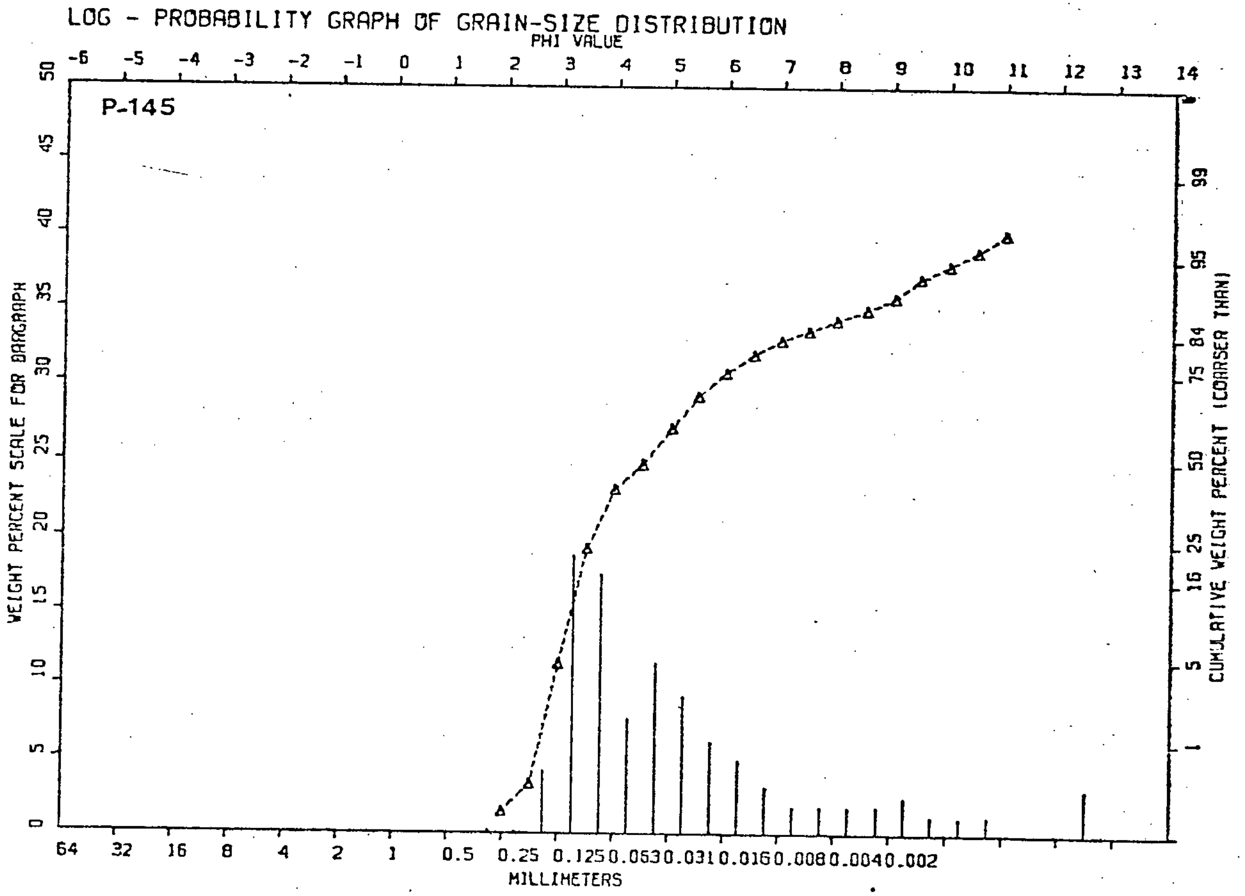
LOG - PROBABILITY GRAPH OF GRAIN-SIZE DISTRIBUTION



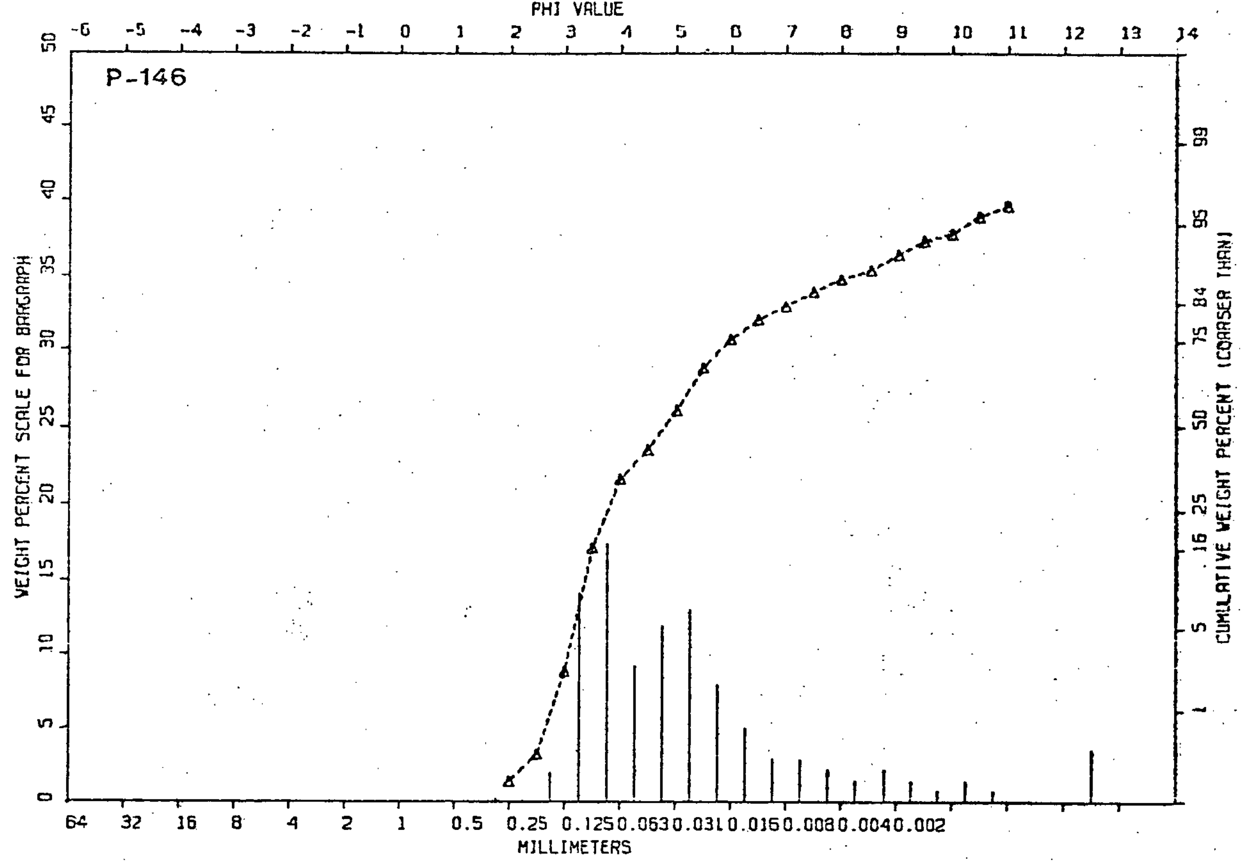
LOG - PROBABILITY GRAPH OF GRAIN-SIZE DISTRIBUTION



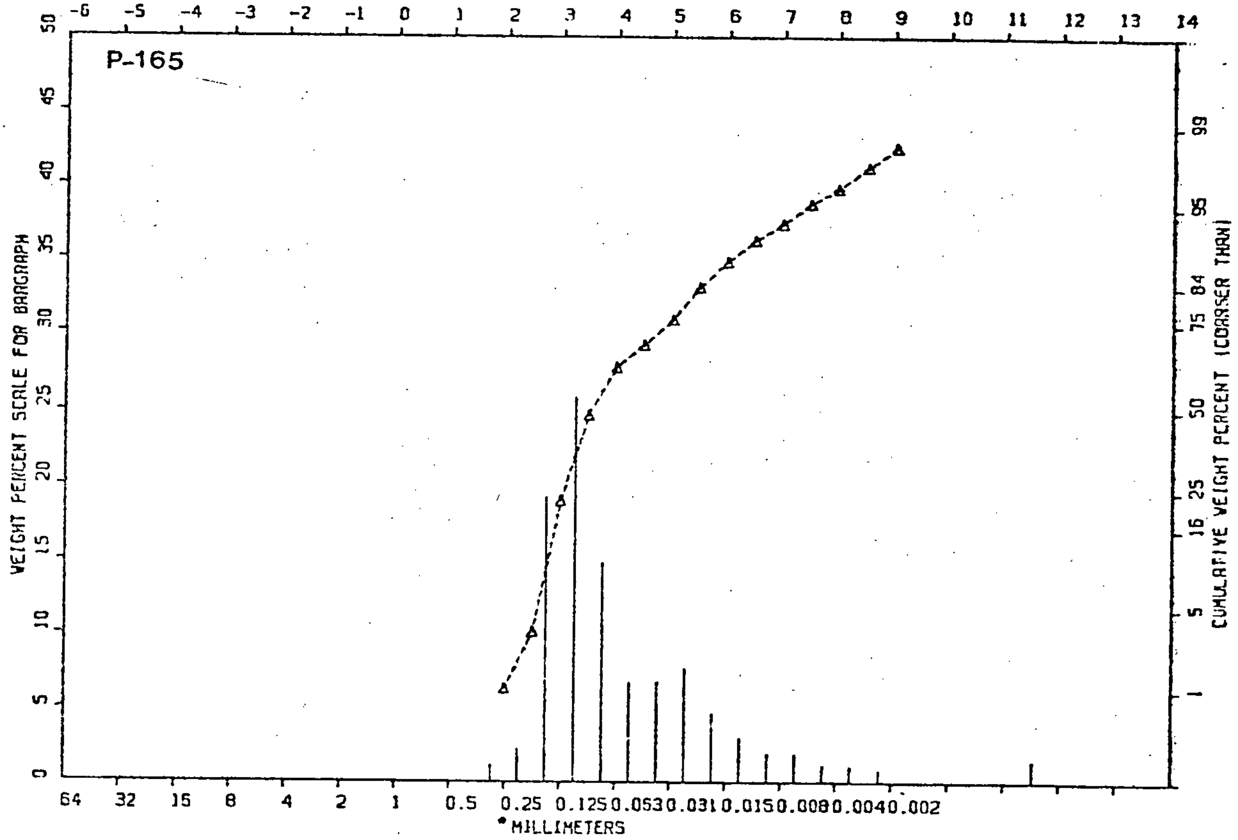

LOG - PROBABILITY GRAPH OF GRAIN-SIZE DISTRIBUTION
PHI VALUE
-6 -5 -4 -3 -2 -1 0 1 2 3 4 5 6 7 8 9 10 11 12 13 14
P-139
WEIGHT PERCENT SCALE FOR BARGRAPH
0 5 10 15 20 25 30 35 40 45 50
CUMULATIVE WEIGHT PERCENT (COARSER THAN)
1 5 16 25 50 75 84 95 99
64 32 16 8 4 2 1 0.5 0.25 0.125 0.063 0.031 0.016 0.008 0.004 0.002
MILLIMETERS


LOG - PROBABILITY GRAPH OF GRAIN-SIZE DISTRIBUTION
PHI VALUE
-6 -5 -4 -3 -2 -1 0 1 2 3 4 5 6 7 8 9 10 11 12 13 14
P-145
WEIGHT PERCENT SCALE FOR BARGRAPH
0 5 10 15 20 25 30 35 40 45 50
CUMULATIVE WEIGHT PERCENT (COARSER THAN)
1 5 16 25 50 75 84 95 99
64 32 16 8 4 2 1 0.5 0.25 0.125 0.063 0.031 0.016 0.008 0.004 0.002
MILLIMETERS

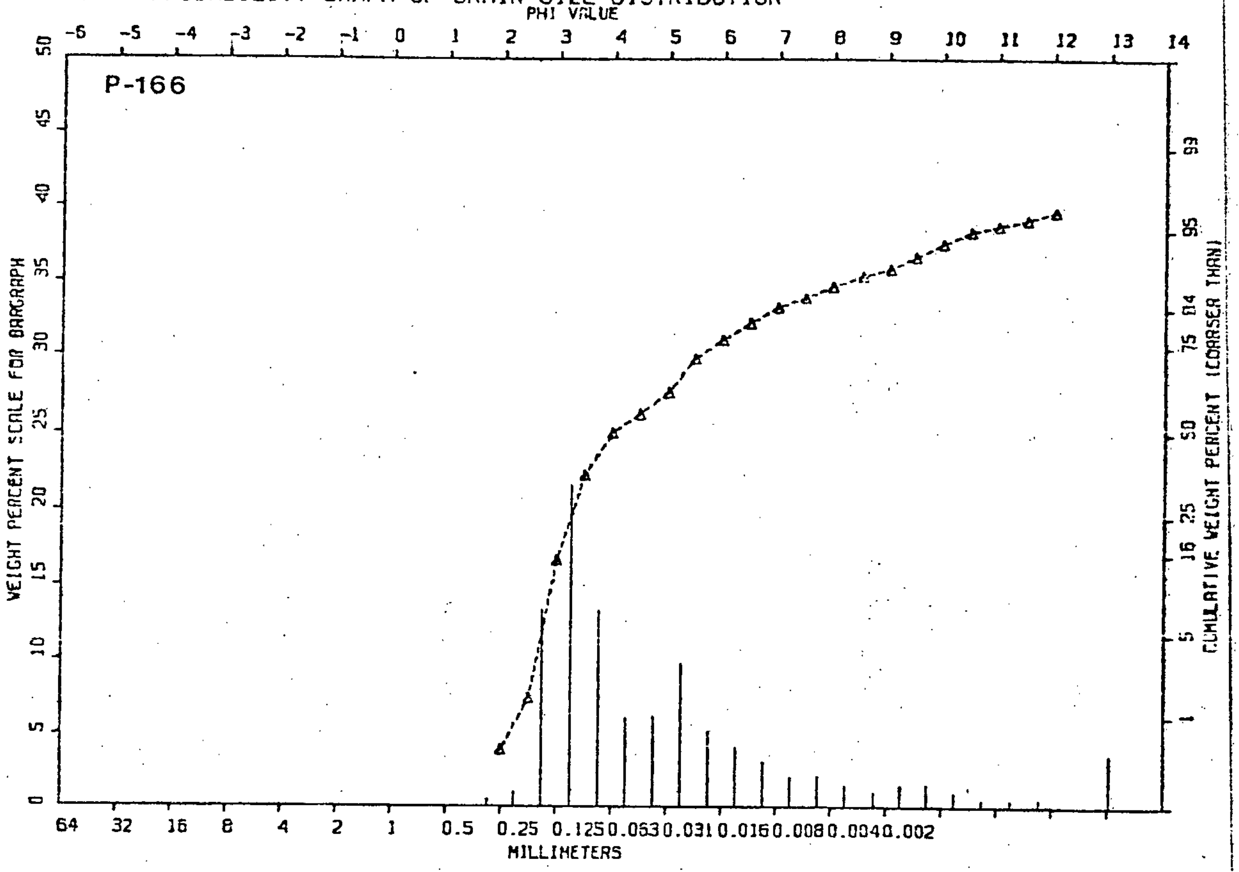
LOG - PROBABILITY GRAPH OF GRAIN-SIZE DISTRIBUTION



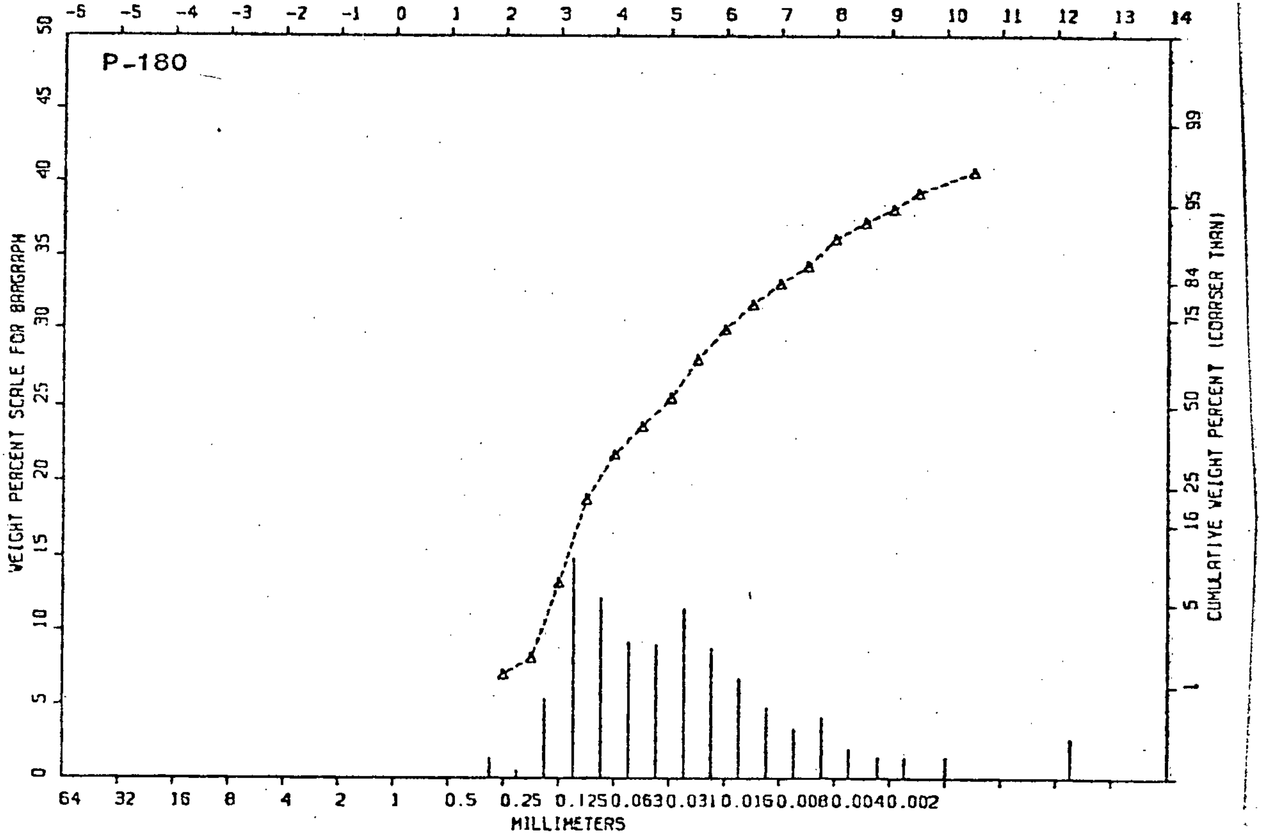
LOG - PROBABILITY GRAPH OF GRAIN-SIZE DISTRIBUTION



LOG - PROBABILITY GRAPH OF GRAIN-SIZE DISTRIBUTION



LOG - PROBABILITY GRAPH OF GRAIN-SIZE DISTRIBUTION



```
 PI++ 2        0   0.0     0   0.0      0                                         ****************************
                                                                                  ****                    ****
                                                                                  ***    MULTIMODAL SAMPLE   ***
                                                                                  ****                    ****
                                                                                  ****************************

              WET WT      DRY WT      SALT     ORGANIC   MOISTURE                 WEIGHT LOSS DUE TO HANDLING    0.0
           1000.0000      3.6200      0.0        0.0        0.0   (GRAMS)         GRAVEL CORRECTION FACTOR       1.000
            100.0000    100.0000      0.0        0.0        0.0   (PCT WET WT)    SIZES ELIMINATED (<0.01%)       NONE
                                                                                  TRASK SORTING COEFFECIENT      2.555
                                                                                  USING PROBABILITY EXTRAP.      2.545
                                                                                  MEAN CUBED DEVIATION           7.347
                                                                                  USING PROBABLITY EXTRAP.       4.591

 PERCENTAGE          TABLE OF STATISTICAL DATA IN PHI UNITS                 PERCENTILES   LINEAR EXTRAP.        PROBABLILITY EXTRAP.
 COMPOSITION
                                     MEAN     STD DEV SKEWNESS KURTOSIS                   MM.      PHI UNITS      MM.      PHI UNITS
 GRAVEL     0.0      MOMENT         5.79256   2.43440  0.50919  3.44447          5.0    0.29265    1.77276     0.26576    1.91181
 SAND      22.65     P-MOMENT       5.77423   2.31737  0.36888  2.97328         10.0    0.18966    2.39853     0.18923    2.40180
 SILT      63.12     FOLK           5.62766   2.41173  0.00397  1.30856         16.0    0.09682    3.36861     0.09622    3.37749
 CLAY      14.23     P-FOLK         5.62721   2.38469  0.01222  1.29174         25.0    0.05259    4.24898     0.05236    4.25541
 MUD       77.35     INMAN          5.57278   2.20417 -0.07470  0.96075         50.0    0.01874    5.73743     0.01875    5.73708
 S/M        0.29     P-INMAN        5.57227   2.19479 -0.07509  0.93552         75.0    0.00805    6.95614     0.00808    6.95100
                     KRUMBEIN                 2.00530 -0.13487  0.20735         84.0    0.00456    7.77695     0.00459    7.76707
                     P-KRUM.                  1.99674 -0.13387  0.20680         90.0    0.00206    8.92647     0.00207    8.91910
                     FOLK (TRANSFORMED)                         0.56683         95.0    0.00073   10.41642     0.00074   10.40793
                     P-FOLK (TRANSFORMED)                       0.56365

                                  DATA FOR CONSTN OF BARGRAPHS AND CUM. CURVES

                       SIZE FRACTION       WT.(GMS)     WT.PCT. WT.PCT.  MID PHI(LINEAR)  MID PHI(PROB.)  MODE
                        MM        PHI    UNCOR    COR    COR    CUMUL.     PHI      MM      PHI      MM

                     0.250000  2.000    0.330   0.330   9.116    9.116  1.751  0.29707  1.926  0.26318    1
                     0.177000  2.496    0.040   0.040   1.105   10.221  2.249  0.21036  2.254  0.20960    0
                     0.125000  3.000    0.100   0.100   2.762   12.983  2.749  0.14875  2.760  0.14765    0
                     0.088000  3.506    0.150   0.150   4.144   17.127  3.253  0.10488  3.265  0.10404    0
                     0.062500  4.000    0.200   0.200   5.525   22.652  3.753  0.07416  3.764  0.07363    1
                     0.044000  4.506    0.173   0.173   4.775   27.427  4.253  0.05244  4.260  0.05221    0
                     0.031000  5.012    0.341   0.341   9.432   36.859  4.759  0.03693  4.767  0.03673    1
                     0.022000  5.506    0.143   0.143   3.946   40.805  5.259  0.02612  5.261  0.02608    0
                     0.015600  6.002    0.714   0.714  19.732   60.537  5.754  0.01853  5.754  0.01853    1*
                     0.011000  6.506    0.057   0.057   1.577   62.115  6.254  0.01310  6.254  0.01311    0
                     0.007800  7.002    0.514   0.514  14.207   76.322  6.754  0.00926  6.741  0.00935    1
                     0.005500  7.506    0.200   0.200   5.525   81.847  7.254  0.00655  7.244  0.00659    0
                     0.003900  8.002    0.143   0.143   3.946   85.793  7.754  0.00463  7.744  0.00466    0
                     0.002700  8.533    0.086   0.086   2.369   88.162  8.268  0.00325  8.259  0.00326    0
                     0.001900  9.040    0.086   0.086   2.367   90.529  8.786  0.00227  8.776  0.00228    0
                     0.001380  9.501    0.057   0.057   1.579   92.108  9.270  0.00162  9.263  0.00163    0
                     0.000980  9.995    0.057   0.057   1.579   93.686  9.748  0.00116  9.737  0.00117    1
                     0.000690 10.501    0.057   0.057   1.577   95.264 10.248  0.00082 10.234  0.00083    0
                     0.000490 10.995    0.057   0.057   1.579   96.843 10.748  0.00058 10.728  0.00059    0
                     0.000061 14.000    0.114   0.114   3.157  100.000 12.497  0.00017 11.464  0.00035    0
                   TOTALS               3.620   3.620 100.0
```

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                                                                          ****************************
                                                                          ****                    ****
P1++ 5          0   0.0     0   0.0     0                                 ***   MULTIMODAL SAMPLE   ***
                                                                          ****                    ****
                                                                          ****************************

            WET WT      DRY WT     SALT    ORGANIC   MOISTURE             WEIGHT LOSS DUE TO HANDLING    0.0
          1000.0000     4.8800     0.0       0.0       0.0    (GRAMS)     GRAVEL CORRECTION FACTOR       1.000
           100.0001   100.0000     0.0       0.0       0.0    (PCT WET WT) SIZES ELIMINATED (<0.01%)     NONE
                                                                          TRASK SORTING COEFFECIENT      3.104
                                                                          USING PROBABILITY EXTRAP.      3.091
                                                                          MEAN CUBED DEVIATION          16.003
                                                                          USING PROBABLITY EXTRAP.      13.096


PERCENTAGE       TABLE OF STATISTICAL DATA IN PHI UNITS                 PERCENTILES   LINEAR EXTRAP.         PROBABLILITY EXTRAP.
COMPOSITION
                                MEAN     STD DEV  SKEWNESS KURTOSIS                 MM.      PHI UNITS      MM.      PHI UNITS
GRAVEL      0.0  MOMENT       5.22997  2.50875  1.01353  3.88768           5.0    0.22834    2.13076     0.22101    2.17783
SAND      34.63  P-MOMENT     5.21929  2.42354  0.92001  3.48396          10.0    0.17632    2.50374     0.17604    2.50598
SILT      53.47  FOLK         5.04375  2.42763  0.11248  1.06285          16.0    0.15306    2.70782     0.14920    2.74470
CLAY      11.90  P-FOLK       5.05297  2.40780  0.11881  1.05965          25.0    0.12211    3.03374     0.12195    3.03560
MUD       65.37  INMAN        4.99458  2.28677 -0.06450  0.85328          50.0    0.02832    5.14208     0.02834    5.14124
S/M        0.53  P-INMAN      5.00884  2.26414 -0.05847  0.85939          75.0    0.01267    6.30211     0.01276    6.29211
                 KRUMBEIN              2.42101 -0.47415  0.26165          84.0    0.00643    7.28135     0.00647    7.27298
                 P-KRUM.               2.41223 -0.47738  0.26105          90.0    0.00232    8.74946     0.00233    8.74343
                 FOLK (TRANSFORMED)                      0.51523          95.0    0.00064   10.60678     0.00065   10.59768
                 P-FOLK (TRANSFORMED)                    0.51448


                      DATA FOR CONSTN OF BARGRAPHS AND CUM. CURVES

                  SIZE FRACTION       WT.(GMS)      WT.PCT. WT.PCT.  MID PHI(LINEAR)   MID PHI(PROB.)   MODE
                   MM       PHI    UNCOR     COR     COR    CUMUL.    PHI      MM       PHI      MM

                0.250000  2.000    0.160    0.160    3.279    3.279  1.751  0.29707   1.923  0.26379    0
                0.177000  2.498    0.320    0.320    6.557    9.836  2.249  0.21036   2.300  0.20303    0
                0.125000  3.000    0.720    0.720   14.754   24.590  2.749  0.14875   2.785  0.14507    1*
                0.088000  3.500    0.300    0.300    6.148   30.738  3.253  0.10488   3.260  0.10438    0
                0.062500  4.000    0.190    0.190    3.893   34.631  3.753  0.07416   3.756  0.07401    0
                0.044000  4.506    0.400    0.400    8.197   42.828  4.253  0.05244   4.257  0.05230    1
                0.031000  5.012    0.180    0.180    3.689   46.516  4.759  0.03693   4.760  0.03691    0
                0.022000  5.506    0.644    0.644   13.206   59.722  5.259  0.02612   5.257  0.02614    1
                0.015600  6.002    0.516    0.516   10.565   70.287  5.754  0.01853   5.747  0.01861    0
                0.011000  6.506    0.387    0.387    7.923   78.210  6.254  0.01310   6.244  0.01319    0
                0.007800  7.002    0.193    0.193    3.962   82.172  6.754  0.00926   6.747  0.00931    0
                0.005500  7.506    0.161    0.161    3.301   85.473  7.254  0.00655   7.246  0.00659    0
                0.003900  8.002    0.129    0.129    2.641   88.115  7.754  0.00463   7.746  0.00466    0
                0.002700  8.533    0.064    0.064    1.321   89.436  8.268  0.00325   8.262  0.00326    0
                0.001900  9.040    0.064    0.064    1.321   90.756  8.786  0.00227   8.780  0.00227    0
                0.001380  9.501    0.064    0.064    1.321   92.077  9.270  0.00162   9.264  0.00163    1
                0.000980  9.995    0.064    0.064    1.321   93.398  9.748  0.00116   9.739  0.00117    0
                0.000690 10.501    0.064    0.064    1.320   94.717 10.248  0.00082  10.237  0.00083    0
                0.000490 10.995    0.064    0.064    1.321   96.038 10.748  0.00058  10.734  0.00059    0
                0.000340 11.522    0.064    0.064    1.321   97.359 11.259  0.00041  11.237  0.00041    0
                0.000061 14.000    0.129    0.129    2.641  100.000 12.761  0.00014  11.915  0.00026    0
                      TOTALS                4.880    4.880  100.0
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                                                                              ******************************
                                                                              ****                      ****
 P1++ 15         0   0.0     0   0.0      0                                   ***   MULTIMODAL SAMPLE    ***
                                                                              ****                      ****
                                                                              ******************************

              WET WT     DRY WT      SALT     ORGANIC    MOISTURE                WEIGHT LOSS DUE TO HANDLING      0.0
            1000.0000    6.3300      0.0        0.0        0.0   (GRAMS)         GRAVEL CORRECTION FACTOR         1.000
             100.0000  100.0000      0.0        0.0        0.0   (PCT WET WT)    SIZES ELIMINATED (<0.01%)         NONE
                                                                                 TRASK SORTING COEFFECIENT        2.124
                                                                                 USING PROBABILITY EXTRAP.        2.113
                                                                                 MEAN CUBED DEVIATION            19.308
                                                                                 USING PROBABLITY EXTRAP.        15.238


 PERCENTAGE          TABLE OF STATISTICAL DATA IN PHI UNITS                 PERCENTILES   LINEAR EXTRAP.           PROBABLILITY EXTRAP.
 COMPOSITION
                                      MEAN    STD DEV SKEWNESS KURTOSIS                      MM.      PHI UNITS       MM.      PHI UNITS
 GRAVEL      0.0     MOMENT         5.06196  2.23041  1.74020  6.21881           5.0     0.15332    2.70542     0.14483    2.78756
 SAND       36.97    P-MOMENT       5.04539  2.12064  1.59785  5.48084          10.0     0.12387    3.01307     0.12344    3.01810
 SILT       53.83    FOLK           4.72309  1.94749  0.38863  1.41123          16.0     0.10664    3.22915     0.10395    3.26599
 CLAY        9.20    P-FOLK         4.73492  1.92434  0.40346  1.40403          25.0     0.08509    3.55482     0.08479    3.55991
 MUD        63.03    INMAN          4.85614  1.62699  0.24532  1.30008          50.0     0.04553    4.45700     0.04551    4.45780
 S/M         0.59    P-INMAN        4.87347  1.60748  0.25858  1.30047          75.0     0.01886    5.72838     0.01899    5.71878
                     KRUMBEIN                1.61004  0.18460  0.22709          84.0     0.01118    6.48313     0.01120    6.48096
                     P-KRUM.                 1.59916  0.18154  0.22619          90.0     0.00449    7.79884     0.00452    7.79026
                     FOLK (TRANSFORMED)                        0.58527          95.0     0.00086   10.18982     0.00086   10.18350
                     P-FOLK (TRANSFORMED)                      0.58403


                               DATA FOR CONSTN OF BARGRAPHS AND CUM. CURVES

                       SIZE FRACTION       WT.(GMS)      WT.PCT. WT.PCT.  MID PHI(LINEAR)   MID PHI(PROB.)  MODE
                        MM        PHI    UNCOR     COR     COR    CUMUL.     PHI      MM      PHI       MM

                     0.250000  2.000    0.020    0.020    0.316    0.316  1.751  0.29707  1.894  0.26915     0
                     0.177000  2.498    0.090    0.090    1.422    1.738  2.249  0.21036  2.333  0.19845     0
                     0.125000  3.000    0.500    0.500    7.899    9.637  2.749  0.14875  2.827  0.14094     0
                     0.088000  3.506    0.890    0.890   14.060   23.697  3.253  0.10488  3.269  0.10229     1
                     0.062500  4.000    0.840    0.840   13.270   36.967  3.753  0.07416  3.765  0.07353     0
                     0.044000  4.506    0.914    0.914   14.440   51.407  4.253  0.05244  4.257  0.05232     1*
                     0.031000  5.012    0.416    0.416    6.571   57.978  4.759  0.03693  4.758  0.03696     0
                     0.022000  5.506    0.873    0.873   13.788   71.766  5.259  0.02612  5.250  0.02628     1
                     0.015600  6.002    0.457    0.457    7.223   78.989  5.754  0.01853  5.744  0.01865     0
                     0.011000  6.506    0.333    0.333    5.253   84.242  6.254  0.01310  6.243  0.01320     0
                     0.007800  7.002    0.166    0.166    2.626   86.868  6.754  0.00926  6.747  0.00931     0
                     0.005500  7.506    0.125    0.125    1.970   88.838  7.254  0.00655  7.247  0.00658     0
                     0.003900  8.002    0.125    0.125    1.970   90.808  7.754  0.00463  7.746  0.00466     1
                     0.002700  8.533    0.083    0.083    1.313   92.121  8.268  0.00325  8.260  0.00326     0
                     0.001900  9.040    0.042    0.042    0.656   92.777  8.786  0.00227  8.782  0.00227     0
                     0.001380  9.501    0.083    0.083    1.314   94.091  9.270  0.00162  9.261  0.00163     1
                     0.000980  9.995    0.042    0.042    0.656   94.747  9.748  0.00116  9.742  0.00117     0
                     0.000690 10.501    0.042    0.042    0.656   95.404 10.248  0.00082 10.241  0.00083     0
                     0.000490 10.995    0.042    0.042    0.657   96.061 10.748  0.00058 10.740  0.00058     1
                     0.000340 11.522    0.042    0.042    0.656   96.717 11.259  0.00041 11.249  0.00041     0
                     0.000061 14.000    0.208    0.208    3.283  100.000 12.761  0.00014 11.908  0.00026     0


                   TOTALS               6.330    6.330  100.0
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PITT17                    SIEVE, SH. PIP., SEDIGRAPH  SAMPLE WT.=  4.8300

  PHI   PCT.  CUMPCT.
  1.50
          0.21
  2.00           0.21
          0.41
  2.50           0.62
          0.83             *
  3.00           1.45
          1.65             **
  3.50           3.10
          3.31             ***
  4.00           6.41
          5.73             ******
  4.50          12.14
         14.32             **************
  5.00          26.47
         18.14             ******************
  5.50          44.61
         14.32             **************
  6.00          58.94
         10.50             ***********
  6.50          69.44
          5.73             ******
  7.00          75.17
          5.73             ******
  7.50          80.90
          4.77             *****
  8.00          85.68
          3.82             ****
  8.50          89.50
          1.91             **
  9.00          91.41
          1.91             **
  9.50          93.32
          1.91             **
 10.00          95.23
          4.77             *****
 12.00         100.00

   MEAN   ST.DEV. SKEWNESS KURTOSIS
 ✓ 5.87    1.47     0.27     0.26     KRUMBEIN+PETTIJOHN(1938) MONENT MEASURES
                                      FOR SIZE PANGE  2.0 TO  10.0 PHI

   6.05    1.73     0.36     1.37     FOLK GRAPHIC STATISTICAL PARAMETERS
                                          FOLK AND WARD,1957

 PERCENTILES   MEDIAN  5.69      5TH  3.79      16TH  4.63      25TH  4.95
                                75TH  6.99      84TH  7.82      95TH  9.94

 PER CENT  GRAVEL   0.0   SAND   6.41  SILT  79.63 ( 79.26)  CLAY  13.96 ( 14.32)


 GRAVEL + SAND   6.41   SILT/(SILT+CLAY)  84.69PCT  GRAV+SAND/SILT+CLAY   0.07
                                                     Sand      Mud
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                                                                                    ******************************
                                                                                    ****                      ****
   P1++ 18        C   0.0    0   0.0      0                                         ***    MULTIMODAL SAMPLE   ***
                                                                                    ****                      ****
                                                                                    ******************************

             WET WT     DRY WT     SALT     ORGANIC    MOISTURE                     WEIGHT LOSS DUE TO HANDLING      0.0
          1000.0000     3.5400     0.0        0.0        0.0    (GRAMS)             GRAVEL CORRECTION FACTOR         1.000
           100.0000   100.0000     0.0        0.0        0.0    (PCT WET WT)        SIZES ELIMINATED (<0.01%)         NONE
                                                                                    TRASK SORTING COEFFECIENT        2.320
                                                                                    USING PROBABILITY EXTRAP.        2.306
                                                                                    MEAN CUBED DEVIATION            13.558
                                                                                    USING PROBABLITY EXTRAP.        10.015


   PERCENTAGE         TABLE OF STATISTICAL DATA IN PHI UNITS                 PERCENTILES   LINEAR EXTRAP.        PROBABLILITY EXTRAP.
   COMPOSITION
                                         MEAN    STD DEV SKEWNESS KURTOSIS                   MM.      PHI UNITS       MM.      PHI UNITS
   GRAVEL     0.0    MOMENT           6.40609  2.33263  1.06816  3.75640           5.0     0.08893   3.49115       0.08869    3.49505
   SAND      10.73   P-MOMENT       ~~6.37418~~  2.21769  0.91829  3.25227          10.0     0.06534   3.93581       0.06474    3.94914
   SILT      69.21   FOLK             6.43950  2.26371  0.43590  1.31216          16.0     0.04123   4.59598       0.04071    4.61856
   CLAY      20.06   P-FOLK           6.44436  2.25597  0.43869  1.31897          25.0     0.03274   4.93280       0.03247    4.94470
   MUD       89.27   INMAN            6.77205  2.17206  0.45931  0.78923          50.0     0.01827   5.77440       0.01827    5.77460
   S/M        0.12   P-INMAN          6.77924  2.16068  0.46496  0.79554          75.0     0.00609   7.36049       0.00611    7.35565
                     KRUMBEIN                  1.79829  0.37225  0.20021          84.0     0.00203   8.94411       0.00204    8.93992
                     P-KRUM.                   1.78589  0.37558  0.19929          90.0     0.00098   9.99855       0.00098    9.99815
                     FOLK (TRANSFORMED)                           0.56750          95.0     0.00041  11.26381       0.00041   11.25423
                     P-FOLK (TRANSFORMED)                         0.56877


                                     DATA FOR CONSTN OF BARGRAPHS AND CUM. CURVES

                        SIZE FRACTION       WT.(GMS)      WT.PCT. WT.PCT.  MID PHI(LINEAR)  MID PHI(PROB.)  MODE
                         MM        PHI    UNCOR     COR     COR    CUMUL.    PHI      MM       PHI      MM

                       0.250000  2.000   0.010    0.010   0.282    0.282  1.751  0.29707  1.891  0.26959    0
                       0.177000  2.498   0.020    0.020   0.565    0.847  2.249  0.21036  2.307  0.20205    0
                       0.125000  3.000   0.050    0.050   1.412    2.260  2.749  0.14875  2.800  0.14357    0
                       0.088000  3.506   0.100    0.100   2.825    5.085  3.253  0.10488  3.294  0.10194    0
                       0.062500  4.000   0.200    0.200   5.650   10.734  3.753  0.07416  3.788  0.07242    1
                       0.044000  4.506   0.097    0.097   2.733   13.468  4.253  0.05244  4.263  0.05208    0
                       0.031000  5.012   0.484    0.484  13.662   27.130  4.759  0.03693  4.785  0.03627    0
                       0.022000  5.506   0.548    0.548  15.484   42.614  5.259  0.02612  5.269  0.02593    1*
                       0.015600  6.002   0.484    0.484  13.664   56.278  5.754  0.01853  5.755  0.01852    0
                       0.011000  6.506   0.355    0.355  10.020   66.298  6.254  0.01310  6.250  0.01314    0
                       0.007800  7.002   0.193    0.193   5.465   71.763  6.754  0.00926  6.750  0.00929    0
                       0.005500  7.506   0.161    0.161   4.555   76.318  7.254  0.00655  7.249  0.00658    0
                       0.003900  8.002   0.129    0.129   3.643   79.961  7.754  0.00463  7.748  0.00465    0
                       0.002700  8.533   0.064    0.064   1.822   81.783  8.268  0.00325  8.264  0.00325    0
                       0.001900  9.040   0.097    0.097   2.733   84.516  8.786  0.00227  8.780  0.00228    1
                       0.001380  9.501   0.097    0.097   2.732   87.247  9.270  0.00162  9.263  0.00163    0
                       0.000980  9.995   0.097    0.097   2.733   89.980  9.748  0.00116  9.737  0.00117    1
                       0.000690 10.501   0.097    0.097   2.733   92.713 10.248  0.00082 10.233  0.00083    0
                       0.000490 10.995   0.065    0.065   1.822   94.535 10.748  0.00058 10.734  0.00059    0
                       0.000340 11.522   0.032    0.032   0.911   95.446 11.259  0.00041 11.249  0.00041    0
                       0.000061 14.000   0.161    0.161   4.554  100.000 12.761  0.00014 11.899  0.00026    0


                TOTALS                    3.540    3.540 100.0
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PITT19                             SIEVE, SH. PIP., SEDIGRAPH  SAMPLE WT.=  4.0100

  PHI   PCT. CUMPCT.
 1.50
         0.25
 2.00          0.25
         0.25
 2.50          0.50
         0.25
 3.00          0.75
         3.50              ***
 3.50          4.24
         6.49              ******
 4.00         10.74
         9.92              **********
 4.50         20.65
        11.72              ************
 5.00         32.38
        15.33              ***************
 5.50         47.70
        11.72              ************
 6.00         59.43
         7.21              *******
 6.50         66.64
         4.51              *****
 7.00         71.15
         4.51              *****
 7.50         75.66
         2.70              ***
 8.00         78.36
         2.70              ***
 8.50         81.07
         3.61              ****
 9.00         84.67
         1.80              **
 9.50         86.48
         1.80              **
10.00         88.28
         1.80              **
10.50         90.08
         1.80              **
11.00         91.89
         1.80              **
11.50         93.69
         1.80              **
12.00         95.49
         4.51              *****
12.00        100.00

   MEAN  ST.DEV. SKEWNESS KURTOSIS

✓  6.07    2.08     0.50     0.41      KRUMBEIN+PETTIJOHN(1938) MONENT MEASURES
                                       FOR SIZE RANGE  2.0 TO  12.0 PHI

   6.26    2.42     0.47     1.00      FOLK GRAPHIC STATISTICAL PARAMETERS
                                           FOLK AND WARD,1957

PERCENTILES   MEDIAN  5.60     5TH  3.56     16TH  4.27     25TH  4.69
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PITT20                          SIEVE, SH. PIP., SEDIGRAPH  SAMPLE WT.=  3.2600

  PHI  PCT. CUMPCT.

 1.50
        0.31
 2.00          0.31
        0.92             *
 2.50          1.23
        1.23             *
 3.00          2.46
        2.46             **
 3.50          4.92
        3.69             ****
 4.00          8.60
        3.73             ****
 4.50         12.33
       11.19             ***********
 5.00         23.52
       15.85             ****************
 5.50         39.38
       13.99             **************
 6.00         53.37
        9.33             *********
 6.50         62.69
        6.53             *******
 7.00         69.22
        4.66             *****
 7.50         73.89
        3.73             ****
 8.00         77.62
        3.73             ****
 8.50         81.35
        2.80             ***
 9.00         84.15
        2.80             ***
 9.50         86.94
        2.80             ***
10.00         89.74
        1.87             **
10.50         91.61
        1.87             **
11.00         93.47
        1.87             **
11.50         95.34
        0.93             *
12.00         96.27
        3.73             ****
12.00        100.00

 MEAN  ST.DEV. SKEWNESS KUPTOSIS

✓ 6.29     2.01     0.37     0.20     KRUMBEIN+PETTIJOHN(1938) MONENT MEASURES
                                      FOR SIZE RANGE  2.0 TO  12.0 PHI

  6.51     2.27     0.42     1.57     FOLK GRAPHIC STATISTICAL PARAMETERS
                                          FOLK AND WARD,1957



PERCENTILES   MEDIAN  5.88     5TH  3.51     16TH  4.66     25TH  5.05
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PITT21A                          SIEVE, SH. PIP., SEDIGRAPH  SAMPLE WT.=  5.1100

   PHI   PCT. CUMPCT.
  1.50
        0.20
  2.00          0.20         *
        0.59
  2.50          0.78         *
        1.17
  3.00          1.96
        2.74                 ***
  3.50          4.70
        4.31                 ****
  4.00          9.00
        4.64                 *****
  4.50         13.64
       11.14                 ***********
  5.00         24.79
       17.64                 ******************
  5.50         42.43
       14.86                 ***************
  6.00         57.29
       12.07                 ************
  6.50         69.36
        7.43                 *******
  7.00         76.79
        6.50                 ******
  7.50         83.29
        3.71                 ****
  8.00         87.00
        2.79                 ***
  8.50         89.79
        2.79                 ***
  9.00         92.57
        1.86                 **
  9.50         94.43
        1.86                 **
 10.00         96.29
        3.71                 ****
 12.00        100.00

   MEAN   ST.DEV. SKEWNESS KURTOSIS

✓   5.87     1.49     0.20     0.25     KRUMBEIN+PETTIJOHN(1938) MONENT MEASURES
                                        FOR SIZE RANGE  2.0 TO  10.0 PHI

    5.99     1.67     0.25     1.42     FOLK GRAPHIC STATISTICAL PARAMETERS
                                            FOLK AND WARD,1957


 PERCENTILES   MEDIAN  5.75     5TH  3.54     16TH  4.61     25TH  5.01

                                 75TH  6.88     84TH  7.60     95TH  9.65

 PER CENT  GRAVEL   0.0   SAND   9.00  SILT  78.28 ( 78.00)  CLAY  12.72 ( 13.00)



 GRAVEL + SAND   9.00   SILT/(SILT+CLAY)  85.71PCT  GRAV+SAND/SILT+CLAY    0.10
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```
 PITT21B                        SIEVE, SH. PIP., SEDIGRAPH  SAMPLE WT.=  3.5900

   PHI  PCT. CUMPCT.

  3.00
         1.67              **
  3.50          1.67
         2.79              ***
  4.00          4.46
         1.93              **
  4.50          6.39
         5.79              ******
  5.00         12.18
        13.51              **************
  5.50         25.69
        12.55              *************
  6.00         38.24
        10.62              ***********
  6.50         48.85
         5.79              ******
  7.00         54.64
         7.72              ********
  7.50         62.36
         4.83              *****
  8.00         67.19
         5.79              ******
  8.50         72.98
         3.86              ****
  9.00         76.84
         4.83              *****
  9.50         81.66
         4.83              *****
 10.00         86.49
         3.86              ****
 10.50         90.35
         3.86              ****
 11.00         94.21
         1.93              **
 11.50         96.14
         3.86              ****
 12.00        100.00

   MEAN   ST.DEV. SKEWNESS KURTOSIS

    6.96     1.99     0.22    -0.74     KRUMBEIN+PETTIJOHN(1938) MOMENT MEASURES
                                        FOR SIZE RANGE  3.5 TO  11.5 PHI

    7.16     2.22     0.34     1.23     FOLK GRAPHIC STATISTICAL PARAMETERS
                                            FOLK AND WARD,1957

 PERCENTILES   MEDIAN  6.60     5TH  4.14      16TH  5.14      25TH  5.47

                                75TH  8.76      84TH  9.74      95TH 11.20

 PER CENT   GRAVEL   0.0   SAND   4.46  SILT  63.46 ( 62.73)  CLAY  32.08 ( 32.81)



 GRAVEL + SAND   4.46   SILT/(SILT+CLAY)  65.66PCT  GRAV+SAND/SILT+CLAY    0.05
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 PITT22A                           SIEVE, SH. PIP., SEDIGRAPH  SAMPLE WT.=  4.0000

   PHI  PCT. CUMPCT.
  1.50
        0.25
  2.00         0.25
        0.75             *
  2.50         1.00
        1.50             **
  3.00         2.50
        3.25             ***
  3.50         5.75
        6.75             *******
  4.00        12.50
        7.95             ********
  4.50        20.45
        5.30             *****
  5.00        25.76
       12.37             ************
  5.50        38.13
        7.95             ********
  6.00        46.09
        7.07             *******
  6.50        53.16
        5.30             *****
  7.00        58.46
        6.19             ******
  7.50        64.65
        5.30             *****
  8.00        69.95
        6.19             ******
  8.50        76.14
        6.19             ******
  9.00        82.32
        4.42             ****
  9.50        86.74
        4.42             ****
 10.00        91.16
        2.65             ***
 10.50        93.81
        2.65             ***
 11.00        96.46
        3.54             ****
 12.00       100.00

   MEAN   ST.DEV. SKEWNESS KURTOSIS

✓  6.45    2.12    0.11    -0.90    KRUMBEIN+PETTIJOHN(1938) MUNENT MEASURES
                                    FOR SIZE RANGE  2.0 TO  11.0 PHI

   6.56    2.35    0.19     1.24    FOLK GRAPHIC STATISTICAL PARAMETERS
                                        FOLK AND WARD,1957

 PERCENTILES   MEDIAN  6.28     5TH  3.38     16TH  4.22     25TH  4.93

                                75TH  8.41    84TH  9.19     95TH 10.72
```

```
  PITT228                          SIEVE, SH. PIP., SEDIGRAPH  SAMPLE WT.=  3.9600

    PHI  PCT. CUMPCT.
   1.50
          0.25
   2.00           0.25
          0.51            *
   2.50           0.76
          1.01            *
   3.00           1.77
          2.02            **
   3.50           3.79
          4.04            ****
   4.00           7.83
          4.66            *****
   4.50          12.48
          5.59            ******
   5.00          18.07
         14.90            ***************
   5.50          32.97
         13.03            *************
   6.00          46.00
          6.52            *******
   6.50          52.52
          7.45            *******
   7.00          59.97
          5.59            ******
   7.50          65.55
          4.66            *****
   8.00          70.21
          4.66            *****
   8.50          74.86
          4.66            *****
   9.00          79.52
          4.66            *****
   9.50          84.17
          3.72            ****
  10.00          87.90
          3.72            ****
  10.50          91.62
          3.72            ****
  11.00          95.34
          0.93            *
  11.50          96.28
          3.72            ****
  12.00         100.00

    MEAN   ST.DEV. SKEWNESS KURTOSIS

 ✓  6.65     2.07     0.19    -0.65      KRUMBEIN+PETTIJOHN(1938) MOMENT MEASURES
                                         FOR SIZE RANGE   2.0 TO   11.5 PHI

    6.87     2.27     0.32     1.28      FOLK GRAPHIC STATISTICAL PARAMETERS
                                             FOLK AND WARD,1957

  PERCENTILES   MEDIAN  6.31      5TH  3.65      16TH  4.81      25TH  5.23


                                  75TH  8.51     84TH  9.48     95TH 10.95
```

```
PITT22C                        SIEVE, SH. PIP., SEDIGRAPH  SAMPLE WT.=  4.0000

  PHI  PCT. CUMPCT.
 2.50
       0.25
 3.00         0.25
       0.75              *
 3.50         1.00
       1.75              **
 4.00         2.74
       1.95              **
 4.50         4.69
       4.86              *****
 5.00         9.55
      12.64              *************
 5.50        22.19
      12.64              *************
 6.00        34.84
       9.73              **********
 6.50        44.56
       8.75              *********
 7.00        53.32
       7.78              ********
 7.50        61.10
       5.84              ******
 8.00        66.93
       6.81              *******
 8.50        73.74
       6.81              *******
 9.00        80.55
       4.86              *****
 9.50        85.41
       4.86              *****
10.00        90.27
       2.92              ***
10.50        93.19
       2.92              ***
11.00        96.11
       3.89              ****
12.00       100.00

  MEAN  ST.DEV. SKEWNESS KURTOSIS

✓ 6.98     1.78     0.15    -0.73      KRUMBEIN+PETTIJOHN(1938) MOMENT MEASURES
                                       FOR SIZE RANGE  3.0 TO  11.0 PHI

   7.14     1.98     0.26     1.16      FOLK GRAPHIC STATISTICAL PARAMETERS
                                            FOLK AND WARD,1957

PERCENTILES   MEDIAN  6.81      5TH  4.53      16TH  5.26      25TH  5.61

                               75TH  8.59      84TH  9.35      95TH 10.81

PER CENT  GRAVEL  0.0   SAND   2.74  SILT  64.21 ( 64.19)  CLAY  33.04 ( 33.07)


GRAVEL + SAND   2.74    SILT/(SILT+CLAY)  66.00PCT  GRAV+SAND/SILT+CLAY    0.03
```

```
PITT23A                        SIEVE, SH. PIP., SEDIGRAPH  SAMPLE WT.=  2.5600

   PHI   PCT.  CUMPCT.
   3.50
          1.56                **
   4.00          1.56
          0.98                *
   4.50          2.54
          3.94                ****
   5.00          6.48
          5.91                ******
   5.50         12.39
         10.83                ***********
   6.00         23.22
          8.86                *********
   6.50         32.08
          6.89                *******
   7.00         38.97
          6.89                *******
   7.50         45.86
          7.88                ********
   8.00         53.73
          6.89                *******
   8.50         60.62
          5.91                ******
   9.00         66.53
          6.89                *******
   9.50         73.42
          4.92                *****
  10.00         78.34
          3.94                ****
  10.50         82.28
          4.92                *****
  11.00         87.20
          5.91                ******
  11.50         93.11
          3.94                ****
  12.00         97.05
          2.95                ***
  12.00        100.00

    MEAN   ST.DEV. SKEWNESS KURTOSIS

✓   7.84     2.10      0.10    -0.98     KRUMBEIN+PETTIJOHN(1938) MONENT MEASURES
                                         FOR SIZE RANGE  4.0 TO  12.0 PHI

    8.03     2.30      0.16     1.15     FOLK GRAPHIC STATISTICAL PARAMETERS
                                              FOLK AND WARD,1957

 PERCENTILES   MEDIAN  7.76      5TH  4.81      16TH  5.67      25TH  6.10

                                 75TH   9.66     84TH 10.67      95TH 11.74

 PER CENT  GRAVEL   0.0   SAND   1.56  SILT  52.63 ( 52.17)  CLAY  45.81 ( 46.27)


 GRAVEL + SAND   1.56   SILT/(SILT+CLAY)  53.00PCT  GRAV+SAND/SILT+CLAY    0.02
```

```
PITT23B                          SIEVE, SH. PIP., SEDIGRAPH  SAMPLE WT.=  2.7900

  PHI  PCT. CUMPCT.
 3.50
       2.15             **
 4.00         2.15
       1.96             **
 4.50         4.11
       2.94             ***
 5.00         7.05
       6.85             *******
 5.50        13.90
       6.85             *******
 6.00        20.75
       8.81             *********
 6.50        29.55
       4.89             *****
 7.00        34.44
       4.89             *****
 7.50        39.34
       6.85             *******
 8.00        46.18
       7.83             ********
 8.50        54.01
       6.85             *******
 9.00        60.86
       5.87             ******
 9.50        66.73
       4.89             *****
10.00        71.62
       5.87             ******
10.50        77.50
       4.89             *****
11.00        82.39
       6.85             *******
11.50        89.24
       4.89             *****
12.00        94.13
       5.87             ******
12.00       100.00

  MEAN  ST.DEV. SKEWNESS KURTOSIS
✓  8.03    2.21     0.00    -1.07     KRUMBEIN+PETTIJOHN(1938) MOMENT MEASURES
                                      FOR SIZE RANGE  4.0 TO  12.0 PHI

   8.34    2.48     0.04     1.13     FOLK GRAPHIC STATISTICAL PARAMETERS
                                         FOLK AND WARD,1957

PERCENTILES   MEDIAN  8.24     5TH  4.65     16TH  5.65     25TH  6.24

                              75TH 10.29     84TH 11.12     95TH 12.00

PER CENT  GRAVEL    0.0   SAND   2.15  SILT  43.99 ( 44.03)  CLAY  53.86 ( 53.82)
```

```
   PITT23C                     SEDIGRAPH ANALYSIS

     PHI   PCT.  CUMPCT.
   4.00
         0.0
   4.50        0.0
         1.00          *
   5.00        1.00
         1.00          *
   5.50        2.00
         3.00          ***
   6.00        5.00
         6.00          ******
   6.50       11.00
         9.00          *********
   7.00       20.00
        12.00          ************
   7.50       32.00
        13.00          *************
   8.00       45.00
        11.00          ***********
   8.50       56.00
         9.00          *********
   9.00       65.00
         8.00          ********
   9.50       73.00
         7.00          *******
  10.00       80.00
         5.00          *****
  10.50       85.00
         4.00          ****
  11.00       89.00
         4.00          ****
  11.50       93.00
         4.00          ****
  12.00       97.00
         3.00          ***
  12.00      100.00

    MEAN   ST.DEV.  SKEWNESS  KURTOSIS

    8.36    1.62     0.14    -0.55      KRUMBEIN+PETTIJOHN(1938) MOMENT MEASURES
                                        FOR SIZE RANGE   4.5 TO  12.0 PHI

    8.47    1.78     0.21     1.18      FOLK GRAPHIC STATISTICAL PARAMETERS
                                            FOLK AND WARD,1957

  PERCENTILES    MEDIAN  8.23      5TH  6.00      16TH  6.78      25TH  7.21

                                  75TH  9.64      84TH 10.40      95TH 11.75

  PER CENT  GRAVEL   0.00  SAND   0.0   SILT   0.0  ( 56.00)  CLAY   0.0  ( 44.00)

  GRAVEL + SAND   0.00   SILT/(SILT+CLAY)  56.00PCT  GRAV+SAND/SILT+CLAY     0.00


  LABELS SHEPARD -CLAYEY SILT FOLK(GMS)-MUD              (SCS)-MUD
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```
PITT24A                        SIEVE, SH. PIP., SEDIGRAPH  SAMPLE WT.=  3.8500

   PHI  PCT. CUMPCT.

  3.50
         1.82            **
  4.00          1.82
         2.95            ***
  4.50          4.77
         2.95            ***
  5.00          7.71
         5.89            ******
  5.50         13.60
         4.91            *****
  6.00         18.51
         8.84            *********
  6.50         27.35
         6.87            *******
  7.00         34.22
         7.85            ********
  7.50         42.07
         8.84            *********
  8.00         50.91
         4.91            *****
  8.50         55.82
         7.85            ********
  9.00         63.67
         6.87            *******
  9.50         70.55
         5.89            ******
 10.00         76.44
         3.93            ****
 10.50         80.36
         2.95            ***
 11.00         83.31
         4.91            *****
 11.50         88.22
         3.93            ****
 12.00         92.15
         3.93            ****
 12.50         96.07
         3.93            ****
 12.00        100.00

   MEAN   ST.DEV. SKEWNESS KURTOSIS

✓  8.03     2.21      0.07     -0.84      KRUMBEIN+PETTIJOHN(1938) MOMENT MEASURES
                                          FOR SIZE RANGE   4.0 TO   12.5 PHI

    8.25     2.52      0.15      1.31      FOLK GRAPHIC STATISTICAL PARAMETERS
                                              FOLK AND WARD,1957

  PERCENTILES    MEDIAN  7.95      5TH   4.54      16TH   5.74      25TH   6.37
                                  75TH   9.88      84TH  11.07      95TH  12.36

  PER CENT   GRAVEL    0.0    SAND    1.82   SILT   49.42 ( 49.09)   CLAY   48.76 ( 49.09)
```

```
 PITT24B                     SIEVE, SH. PIP., SEDIGRAPH  SAMPLE WT.=  3.7900

   PHI   PCT. CUMPCT.
  3.50
         1.06                 *
  4.00           1.06
         2.97                 ***
  4.50           4.02
         5.94                 ******
  5.00           9.96
         7.92                 ********
  5.50          17.88
         6.93                 *******
  6.00          24.80
         8.91                 *********
  6.50          33.71
         4.95                 *****
  7.00          38.65
         8.91                 *********
  7.50          47.56
         6.93                 *******
  8.00          54.49
         6.93                 *******
  8.50          61.41
         6.93                 *******
  9.00          68.34
         6.93                 *******
  9.50          75.26
         3.96                 ****
 10.00          79.22
         4.95                 *****
 10.50          84.17
         2.97                 ***
 11.00          87.14
         3.96                 ****
 11.50          91.10
         3.96                 ****
 12.00          95.05
         4.95                 *****
 12.00         100.00

   MEAN  ST.DEV. SKEWNESS KURTOSIS

✓   7.65     2.10     0.11    -0.91     KRUMBEIN+PETTIJOHN(1938) MONENT MEASURES
                                        FOR SIZE RANGE  4.0 TO  12.0 PHI

    7.85     2.40     0.13     1.25     FOLK GRAPHIC STATISTICAL PARAMETERS
                                            FOLK AND WARD,1957

 PEFCENTILES   MEDIAN  7.68      5TH  4.58      16TH  5.38      25TH  6.01

                                 75TH  9.48      84TH 10.48      95TH 11.99

 PER CENT  GRAVEL   0.0   SAND  1.06  SILT  53.43 ( 53.43)  CLAY  45.51 ( 45.51)


 GRAVEL + SAND   1.06    SILT/(SILT+CLAY)  54.00PCT  GRAV+SAND/SILT+CLAY     0.01
```

```
    PITT24C                          SIEVE, SH. PIP., SEDIGRAPH   SAMPLE WT.=  3.0400

      PHI   PCT. CUMPCT.
     3.50
            0.66              *
     4.00           0.66
            0.99              *
     4.50           1.65
            0.99              *
     5.00           2.64
            3.97              ****
     5.50           6.62
            4.97              *****
     6.00          11.58
            8.94              *********
     6.50          20.53
            6.95              *******
     7.00          27.48
            8.94              *********
     7.50          36.42
           10.93              ***********
     8.00          47.35
            7.95              ********
     8.50          55.30
            7.95              ********
     9.00          63.24
            6.95              *******
     9.50          70.20
            5.96              ******
    10.00          76.16
            3.97              ****
    10.50          80.13
            2.98              ***
    11.00          83.11
            4.97              *****
    11.50          88.08
            3.97              ****
    12.00          92.05
            3.97              ****
    12.50          96.03
            3.97              ****
    12.00         100.00

      MEAN   ST.DEV. SKEWNESS KURTOSIS

       8.28     2.00     0.12    -0.67     KRUMBEIN+PETTIJOHN(1938) MOMENT MEASURES
                                           FOR SIZE RANGE  4.0 TO  12.5 PHI

       8.50     2.28     0.20     1.28     FOLK GRAPHIC STATISTICAL PARAMETERS
                                                FOLK AND WARD,1957

    PERCENTILES   MEDIAN  8.17      5TH  5.30      16TH  6.25      25TH  6.82

                                   75TH  9.90      84TH 11.09      95TH 12.37


    PER CENT  GRAVEL   0.0   SAND   0.66  SILT  46.80 ( 46.69)  CLAY  52.55 ( 52.65)
```

```
PITT25A                      SIEVE, SH. PIP., SEDIGRAPH  SAMPLE WT.=  3.6400

  PHI   PCT. CUMPCT.
  3.50
        0.55           *
  4.00         0.55
        0.99           *
  4.50         1.54
        0.99           *
  5.00         2.54
        1.99           **
  5.50         4.53
        0.99           *
  6.00         5.52
        4.97           *****
  6.50        10.49
        5.97           ******
  7.00        16.46
       12.93           *************
  7.50        29.39
       10.94           ***********
  8.00        40.33
        9.95           **********
  8.50        50.27
        9.95           **********
  9.00        60.22
        6.96           *******
  9.50        67.18
        5.97           ******
 10.00        73.15
        6.96           *******
 10.50        80.11
        4.97           *****
 11.00        85.08
        6.96           *******
 11.50        92.04
        6.96           *******
 12.00        99.01
        0.99           *
 12.00       100.00

   MEAN   ST.DEV. SKEWNESS KURTOSIS

    8.62    1.82    -0.02    -0.55     KRUMBEIN+PETTIJOHN(1938) MOMENT MEASURES
                                       FOR SIZE RANGE   4.0 TO  12.0 PHI

    8.78    1.89     0.15     1.14     FOLK GRAPHIC STATISTICAL PARAMETERS
                                           FOLK AND WARD,1957

PERCENTILES    MEDIAN  8.49      5TH  5.74      16TH  6.96      25TH  7.33

                                 75TH 10.13      84TH 10.89      95TH 11.71

PER CENT  GRAVEL   0.0   SAND   0.55  SILT  39.78 ( 39.78)  CLAY  59.67 ( 59.67)


GRAVEL + SAND   0.55    SILT/(SILT+CLAY)  40.00PCT  GRAV+SAND/SILT+CLAY    0.01
```

```
PITT25B                     SEDIGRAPH ANALYSIS

  PHI   PCT. CUMPCT.

 4.00
        0.0
 4.50          0.0
        0.0
 5.00          0.0
        2.00              **
 5.50          2.00
        1.00              *
 6.00          3.00
        3.00              ***
 6.50          6.00
        8.00              ********
 7.00         14.00
       11.00              ***********
 7.50         25.00
       13.00              *************
 8.00         38.00
       12.00              ************
 8.50         50.00
        6.00              ******
 9.00         56.00
        7.00              *******
 9.50         63.00
        7.00              *******
10.00         70.00
        6.00              ******
10.50         76.00
        8.00              ********
11.00         84.00
        6.00              ******
11.50         90.00
        8.00              ********
12.00         98.00
        2.00              **
12.00        100.00

  MEAN   ST.DEV. SKEWNESS KURTOSIS

   8.81    1.72     0.08    -0.97     KRUMBEIN+PETTIJOHN(1938) MONENT MEASURES
                                      FOR SIZE RANGE  4.5 TO  12.0 PHI

   8.86    1.81     0.24     1.02     FOLK GRAPHIC STATISTICAL PARAMETERS
                                          FOLK AND WARD,1957

PERCENTILES    MEDIAN  8.50      5TH  6.33      16TH  7.09      25TH  7.50

                                75TH 10.42      84TH 11.00      95TH 11.81

PER CENT  GRAVEL   0.00  SAND   0.0   SILT   0.0  ( 50.00)  CLAY   0.0  ( 50.00)

GRAVEL + SAND   0.00   SILT/(SILT+CLAY)  50.00PCT  GRAV+SAND/SILT+CLAY     0.00


LABELS SHEPARD -CLAYEY SILT FOLK(GMS)-MUD                   (SCS)-MUD
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```
PITT25C                      SIEVE, SH. PIP., SEDIGRAPH  SAMPLE WT.=  4.6200

  PHI  PCT. CUMPCT.

 3.50
        0.87          *
 4.00         0.87
        0.99          *
 4.50         1.86
        0.99          *
 5.00         2.85
        0.99          *
 5.50         3.84
        1.98          **
 6.00         5.82
        5.95          ******
 6.50        11.77
        8.92          *********
 7.00        20.69
       11.90          ************
 7.50        32.59
       12.89          *************
 8.00        45.48
       10.90          ***********
 8.50        56.38
        8.92          *********
 9.00        65.30
        7.93          ********
 9.50        73.23
        6.94          *******
10.00        80.17
        4.96          *****
10.50        85.13
        3.97          ****
11.00        89.10
        3.97          ****
11.50        93.06
        3.97          ****
12.00        97.03
        2.97          ***
12.00       100.00

  MEAN  ST.DEV. SKEWNESS KURTOSIS

   8.31    1.70     0.03    -0.22     KRUMBEIN+PETTIJOHN(1938) MOMENT MEASURES
                                      FOR SIZE RANGE  4.0 TO  12.0 PHI

   8.44    1.81     0.19     1.22     FOLK GRAPHIC STATISTICAL PARAMETERS
                                          FOLK AND WARD,1957


PERCENTILES   MEDIAN  8.21      5TH  5.79      16TH  6.74      25TH  7.18

                                75TH  9.63      84TH 10.39      95TH 11.74


PER CENT  GRAVEL   0.0   SAND   0.87  SILT   44.42 ( 44.61)  CLAY   54.71 ( 54.52)



GRAVEL + SAND   0.87    SILT/(SILT+CLAY)  45.00PCT  GRAV+SAND/SILT+CLAY     0.01
```

```
PITT26A                    SEDIGRAPH ANALYSIS

  PHI   PCT.  CUMPCT.
 4.00
        1.00                  *
 4.50          1.00
        0.0
 5.00          1.00
        2.00                  **
 5.50          3.00
        2.00                  **
 6.00          5.00
        5.00                  *****
 6.50         10.00
        5.00                  *****
 7.00         15.00
       10.00                  **********
 7.50         25.00
       11.00                  ***********
 8.00         36.00
       11.00                  ***********
 8.50         47.00
       10.00                  **********
 9.00         57.00
        8.00                  ********
 9.50         65.00
        5.00                  *****
10.00         70.00
        5.00                  *****
10.50         75.00
        5.00                  *****
11.00         80.00
        2.00                  **
11.50         82.00
        9.00                  *********
12.00         91.00
        5.00                  *****
12.50         96.00
        4.00                  ****
12.00        100.00

  MEAN   ST.DEV. SKEWNESS KURTOSIS

   8.80     1.89     0.08    -0.67      KRUMBEIN+PETTIJOHN(1938) MOMENT MEASURES
                                        FOR SIZE RANGE  4.5 TO  12.5 PHI

   9.10     2.11     0.24     1.18      FOLK GRAPHIC STATISTICAL PARAMETERS
                                            FOLK AND WARD,1957


PERCENTILES   MEDIAN  8.65     5TH  6.00      16TH  7.05      25TH  7.50

                              75TH 10.50      84TH 11.61      95TH 12.40

PER CENT  GRAVEL   0.00  SAND   1.00  SILT   0.0  ( 46.00)  CLAY   0.0  ( 53.00)
```

```
PITT268                    SEDIGRAPH ANALYSIS

  PHI  PCT. CUMPCT.
 4.00
       1.00                 *
 4.50         1.00
       1.00                 *
 5.00         2.00
       3.00                 ***
 5.50         5.00
       3.00                 ***
 6.00         8.00
       5.00                 *****
 6.50        13.00
       7.00                 *******
 7.00        20.00
       8.00                 ********
 7.50        28.00
      11.00                 ***********
 8.00        39.00
      11.00                 ***********
 8.50        50.00
      10.00                 **********
 9.00        60.00
       6.00                 ******
 9.50        66.00
       8.00                 ********
10.00        74.00
       6.00                 ******
10.50        80.00
       5.00                 *****
11.00        85.00
       5.00                 *****
11.50        90.00
       5.00                 *****
12.00        95.00
       5.00                 *****
12.00       100.00

  MEAN  ST.DEV. SKEWNESS KURTOSIS

    8.48    1.79   -0.01    -0.63    KRUMBEIN+PETTIJOHN(1938) MONENT MEASURES
                                     FOR SIZE RANGE  4.5 TO  12.0 PHI

    8.70    2.03    0.11     1.25    FOLK GRAPHIC STATISTICAL PARAMETERS
                                         FOLK AND WARD,1957

PERCENTILES   MEDIAN  8.50     5TH  5.50     16TH  6.71     25TH  7.31

                                75TH 10.08     84TH 10.90     95TH 12.00

PER CENT  GRAVEL   0.00  SAND   1.00  SILT   0.0  ( 49.00)  CLAY   0.0  ( 50.00)

GRAVEL + SAND   1.00    SILT/(SILT+CLAY)  49.49PCT  GRAV+SAND/SILT+CLAY     0.01


LABELS SHEPARD -SILTY CLAY  FOLK(GMS)-MUD                (SCS)-MUD
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PITT26C                     SEDIGRAPH ANALYSIS

   PHI   PCT. CUMPCT.
  4.00
          1.00                  *
  4.50            1.00
          2.00                  **
  5.00            3.00
          3.00                  ***
  5.50            6.00
          3.00                  ***
  6.00            9.00
          6.00                  ******
  6.50           15.00
          9.00                  *********
  7.00           24.00
         11.00                  ***********
  7.50           35.00
         12.00                  ************
  8.00           47.00
         10.00                  **********
  8.50           57.00
          8.00                  ********
  9.00           65.00
          8.00                  ********
  9.50           73.00
          6.00                  ******
 10.00           79.00
          6.00                  ******
 10.50           85.00
          5.00                  *****
 11.00           90.00
          6.00                  ******
 11.50           96.00
          4.00                  ****
 12.00          100.00

   MEAN  ST.DEV. SKEWNESS KURTOSIS

    8.16   1.70    0.01    -0.65    KRUMBEIN+PETTIJOHN(1938) MOMENT MEASURES
                                    FOR SIZE RANGE  4.5 TO  11.5 PHI

    8.37   1.89    0.12    1.20     FOLK GRAPHIC STATISTICAL PARAMETERS
                                         FOLK AND WARD,1957

PERCENTILES   MEDIAN  8.15     5TH  5.33     16TH  6.56     25TH  7.05

                               75TH  9.67     84TH 10.42     95TH 11.42

PER CENT  GRAVEL   0.00  SAND   1.00  SILT   0.0  ( 56.00)  CLAY   0.0  ( 43.00)

GRAVEL + SAND   1.00   SILT/(SILT+CLAY)  56.57PCT  GRAV+SAND/SILT+CLAY    0.01

LABELS SHEPARD -CLAYEY SILT FOLK(GMS)-MUD                 (SCS)-MUD
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    PITT27A                        SEDIGRAPH ANALYSIS

      PHI   PCT. CUMPCT.
    4.00
           0.0
    4.50          0.0
           2.00             **
    5.00          2.00
           3.00             ***
    5.50          5.00
           4.00             ****
    6.00          9.00
           6.00             ******
    6.50         15.00
           7.00             *******
    7.00         22.00
           9.00             *********
    7.50         31.00
          11.00             ***********
    8.00         42.00
           8.00             ********
    8.50         50.00
           9.00             *********
    9.00         59.00
           8.00             ********
    9.50         67.00
           5.00             *****
   10.00         72.00
           6.00             ******
   10.50         78.00
           5.00             *****
   11.00         83.00
           5.00             *****
   11.50         88.00
           6.00             ******
   12.00         94.00
           6.00             ******
   12.00        100.00

     MEAN   ST.DEV. SKEWNESS KURTOSIS
     8.44    1.85     0.05    -0.83      KRUMBEIN+PETTIJOHN(1938) MOMENT MEASURES
                                         FOR SIZE RANGE  4.5 TO  12.0 PHI

     8.72    2.12     0.11     1.10      FOLK GRAPHIC STATISTICAL PARAMETERS
                                              FOLK AND WARD,1957

   PERCENTILES    MEDIAN  8.50      5TH  5.50      16TH  6.57      25TH  7.17

                                   75TH 10.25      84TH 11.10      95TH 12.00

   PER CENT   GRAVEL   0.00  SAND   0.0   SILT   0.0  ( 50.00)  CLAY   0.0  ( 50.00)

   GRAVEL + SAND   0.00    SILT/(SILT+CLAY)  50.00PCT  GRAV+SAND/SILT+CLAY     0.00


   LABELS SHEPARD -CLAYEY SILT FOLK(GMS)-MUD                    (SCS)-MUD
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PITT27B                    SEDIGRAPH ANALYSIS

   PHI   PCT.  CUMPCT.
   4.00
          0.0
   4.50          0.0
          3.00                ***
   5.00          3.00
          4.00                ****
   5.50          7.00
          5.00                *****
   6.00         12.00
          6.00                ******
   6.50         18.00
          7.00                *******
   7.00         25.00
          9.00                *********
   7.50         34.00
          9.00                *********
   8.00         43.00
          9.00                *********
   8.50         52.00
          8.00                ********
   9.00         60.00
          5.00                *****
   9.50         65.00
          6.00                ******
  10.00         71.00
          6.00                ******
  10.50         77.00
          5.00                *****
  11.00         82.00
          5.00                *****
  11.50         87.00
          6.00                ******
  12.00         93.00
          5.00                *****
  12.50         98.00
          2.00                **
  12.00        100.00

   MEAN  ST.DEV. SKEWNESS KURTOSIS

   8.53     2.07     0.06    -0.96      KRUMBEIN+PETTIJOHN(1938) MONENT MEASURES
                                        FOR SIZE RANGE  4.5 TO  12.5 PHI

   8.64     2.27     0.13     1.20      FOLK GRAPHIC STATISTICAL PARAMETERS
                                            FOLK AND WARD,1957

  PERCENTILES   MEDIAN  8.39     5TH  5.25      16TH  6.33      25TH  7.00

                                75TH 10.33     84TH 11.20      95TH 12.20

  PER CENT  GRAVEL   0.00  SAND   0.0   SILT   0.0  ( 52.00)  CLAY   0.0  ( 48.00)


  GRAVEL + SAND   0.00    SILT/(SILT+CLAY)  52.00PCT  GRAV+SAND/SILT+CLAY     0.00
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                                                                                        ****                     ****
 P1++ 29      0   0.0    0   0.0     0                                                  ***   MULTIMODAL SAMPLE   ***
                                                                                        ****                     ****
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            WET WT      DRY WT      SALT     ORGANIC   MOISTURE                  WEIGHT LOSS DUE TO HANDLING     0.0
         1000.0000     5.7300     0.0         0.0        0.0    (GRAMS)          GRAVEL CORRECTION FACTOR        1.000
           99.9999   100.0000     0.0         0.0        0.0    (PCT WET WT)     SIZES ELIMINATED (<0.01%)        NONE
                                                                                 TRASK SORTING COEFFICIENT       2.233
                                                                                 USING PROBABILITY EXTRAP.       2.200
                                                                                 MEAN CUBED DEVIATION           11.488
                                                                                 USING PROBABLITY EXTRAP.        9.866

 PERCENTAGE        TABLE OF STATISTICAL DATA IN PHI UNITS               PERCENTILES   LINEAR EXTRAP.         PROBABLILITY EXTRAP.
 COMPOSITION
                              MEAN    STD DEV SKEWNESS KURTOSIS                     MM.      PHI UNITS      MM.      PHI UNITS
 GRAVEL    0.0     MOMENT    4.72744  1.96908  1.50475  5.33991           5.0     0.15522   2.68760     0.14373   2.79854
 SAND     47.62    P-MOMENT  4.73349  1.90676  1.42318  4.75520          10.0     0.13147   2.92722     0.12826   2.96284
 SILT     44.19    FOLK      4.51920  1.77215  0.47828  1.11145          16.0     0.11675   3.09849     0.11428   3.12938
 CLAY      7.99    P-FOLK    4.52651  1.74455  0.49838  1.11090          25.0     0.10179   3.29632     0.09935   3.33138
 MUD      52.18    INMAN     4.73787  1.63937  0.40016  0.91726          50.0     0.05905   4.08186     0.05909   4.08096
 S/M       0.92    P-INMAN   4.74929  1.61991  0.41257  0.90392          75.0     0.02041   5.61431     0.02052   5.60701
                   KRUMBEIN           1.71703  0.37345  0.25860          84.0     0.01203   6.37724     0.01210   6.36920
                   P-KRUM.            1.68565  0.38824  0.25631          90.0     0.00589   7.40830     0.00591   7.40204
                   FOLK (TRANSFORMED)                   0.52639          95.0     0.00199   8.97383     0.00200   8.96683
                   P-FOLK (TRANSFORMED)                 0.52627

                       DATA FOR CONSTN OF BARGRAPHS AND CUM. CURVES

                 SIZE FRACTION        WT.(GMS)      WT.PCT. WT.PCT.  MID PHI(LINEAR)   MID PHI(PROB.)   MODE
                  MM        PHI     UNCOR     COR     COR    CUMUL.    PHI      MM      PHI      MM

               0.250000   2.000    0.020    0.020    0.349    0.349  1.751  0.29707  1.896  0.26877     0
               0.177000   2.498    0.040    0.040    0.698    1.047  2.249  0.21036  2.307  0.20209     0
               0.125000   3.000    0.600    0.600   10.471   11.518  2.749  0.14875  2.850  0.13871     0
               0.088000   3.506    1.320    1.320   23.037   34.555  3.253  0.10488  3.292  0.10213     1*
               0.062500   4.000    0.760    0.760   13.264   47.819  3.753  0.07416  3.758  0.07392     0
               0.044000   4.506    0.773    0.773   13.491   61.310  4.253  0.05244  4.251  0.05253     1
               0.031000   5.012    0.020    0.020    0.353   61.662  4.759  0.03693  4.759  0.03694     0
               0.022000   5.506    0.671    0.671   11.715   73.377  5.259  0.02612  5.250  0.02628     1
               0.015600   6.002    0.427    0.427    7.455   80.832  5.754  0.01853  5.743  0.01867     0
               0.011000   6.506    0.244    0.244    4.259   85.091  6.254  0.01310  6.244  0.01319     0
               0.007800   7.002    0.183    0.183    3.195   88.286  6.754  0.00926  6.744  0.00933     0
               0.005500   7.506    0.122    0.122    2.129   90.415  7.254  0.00655  7.245  0.00659     0
               0.003900   8.002    0.092    0.092    1.598   92.013  7.754  0.00463  7.746  0.00466     0
               0.002700   8.533    0.092    0.092    1.598   93.611  8.268  0.00325  8.256  0.00327     1
               0.001900   9.040    0.091    0.091    1.597   95.208  8.786  0.00227  8.772  0.00229     0
               0.001380   9.501    0.061    0.061    1.065   96.273  9.270  0.00162  9.259  0.00163     0
               0.000980   9.995    0.061    0.061    1.065   97.338  9.748  0.00116  9.731  0.00118     0
               0.000690  10.501    0.061    0.061    1.065   98.402 10.248  0.00082 10.221  0.00084     0
               0.000490  10.995    0.031    0.031    0.533   98.935 10.748  0.00058 10.726  0.00059     0
               0.000061  14.000    0.061    0.061    1.065  100.000 12.497  0.00017 11.521  0.00034     0
             TOTALS                5.730    5.730  100.0
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                                                                                           ****                    ****
  PI** 30        0    0.0     0    0.0      0                                              ***   MULTIMODAL SAMPLE   ***
                                                                                           ****                    ****
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          WET WT     DRY WT     SALT     ORGANIC   MOISTURE                        WEIGHT LOSS DUE TO HANDLING    0.0
        1000.0000    5.8000     0.0        0.0       0.0    (GRAMS)                GRAVEL CORRECTION FACTOR       1.000
         100.000)  100.0000     0.0        0.0       0.0    (PCT WET WT)           SIZES ELIMINATED (<0.01%)       NONE
                                                                                   TRASK SORTING COEFFECIENT      2.001
                                                                                   USING PROBABILITY EXTRAP.      1.989
                                                                                   MEAN CUBED DEVIATION          11.522
                                                                                   USING PROBABLITY EXTRAP.       6.508

  PERCENTAGE          TABLE OF STATISTICAL DATA IN PHI UNITS                PERCENTILES   LINEAR EXTRAP.          PROBABLILITY EXTRAP.
  COMPOSITION
                                 MEAN    STD DEV  SKEWNESS KURTOSIS                      MM.      PHI UNITS        MM.       PHI UNITS
  GRAVEL      0.0     MOMENT    4.88612  1.88910  1.70917  6.52778           5.0      0.13433    2.89616        0.13042    2.93874
  SAND       38.28    P-MOMENT  4.85164  1.70458  1.31400  4.59443          10.0      0.11450    3.12657        0.11062    3.17634
  SILT       54.79    FOLK      4.65156  1.59984  0.39850  1.15719          16.0      0.10026    3.31611        0.09715    3.36362
  CLAY        6.93    P-FOLK    4.66296  1.57862  0.41214  1.15851          25.0      0.08248    3.59987        0.08184    3.61097
  MUD        61.72    INMAN     4.80498  1.48688  0.30955  0.90071          50.0      0.04922    4.34471        0.04917    4.34598
  S/M         0.62    P-INMAN   4.82146  1.45783  0.32615  0.92342          75.0      0.02059    5.60169        0.02069    5.59489
                      KRUMBEIN           1.48283  0.25607  0.24474          84.0      0.01276    6.29186        0.01287    6.27929
                      P-KRUM.            1.46957  0.25695  0.24642          90.0      0.00672    7.21628        0.00679    7.20185
                      FOLK (TRANSFORMED)                   0.53643          95.0      0.00267    8.54840        0.00267    8.54680
                      P-FOLK (TRANSFORMED)                 0.53672

                             DATA FOR CONSTN OF BARGRAPHS AND CUM. CURVES

                  SIZE FRACTION       WT.(GMS)     WT.PCT. WT.PCT.  MID PHI(LINEAR)  MID PHI(PROB.)  MODE
                   MM       PHI    UNCOR     COR    COR    CUMUL.    PHI      MM      PHI      MM

                0.250000  2.000   0.030   0.030   0.517   0.517   1.751  0.29707  1.903  0.26745     0
                0.177000  2.498   0.030   0.030   0.517   1.034   2.249  0.21036  2.286  0.20499     0
                0.125000  3.000   0.290   0.290   5.000   6.034   2.749  0.14875  2.832  0.14048     0
                0.088000  3.506   0.920   0.920  15.862  21.897   3.253  0.10488  3.307  0.10107     0
                0.062500  4.000   0.950   0.950  16.379  38.276   3.753  0.07416  3.769  0.07337     0
                0.044000  4.506   0.999   0.999  17.221  55.497   4.253  0.05244  4.255  0.05236     1*
                0.031000  5.012   0.280   0.280   4.823  60.320   4.759  0.03693  4.757  0.03697     0
                0.022000  5.506   0.767   0.767  13.227  73.547   5.259  0.02612  5.249  0.02630     1
                0.015600  6.002   0.438   0.438   7.559  81.105   5.754  0.01853  5.743  0.01868     0
                0.011000  6.506   0.292   0.292   5.039  86.144   6.254  0.01310  6.242  0.01322     0
                0.007800  7.002   0.146   0.146   2.519  88.663   6.754  0.00926  6.746  0.00932     0
                0.005500  7.506   0.183   0.183   3.149  91.812   7.254  0.00655  7.239  0.00662     1
                0.003900  8.002   0.073   0.073   1.259  93.072   7.754  0.00463  7.746  0.00466     0
                0.002700  8.533   0.110   0.110   1.890  94.961   8.268  0.00325  8.251  0.00328     1
                0.001900  9.040   0.073   0.073   1.259  96.221   8.786  0.00227  8.772  0.00229     0
                0.001330  9.551   0.037   0.037   0.630  96.851   9.270  0.00162  9.262  0.00163     0
                0.000061 14.000   0.183   0.183   3.149 100.000  11.751  0.00029 10.203  0.00085     0
              TOTALS              5.800   5.800 100.0
    0.250000     0.320000
    0.177000     0.030000
    0.125000     1.970000
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                                                                                     ****                    ****
P1++ 31A      0   0.0    0   0.0     0                                               ***    MULTIMODAL SAMPLE   ***
                                                                                     ****                    ****
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                WET WT     DRY WT     SALT     ORGANIC   MOISTURE                    WEIGHT LOSS DUE TO HANDLING      0.0
              1000.0000    4.5200     0.0        0.0       0.0    (GRAMS)            GRAVEL CORRECTION FACTOR         1.000
               100.0000  100.0000     0.0        0.0       0.0    (PCT WET WT)       SIZES ELIMINATED (<0.01%)         NONE
                                                                                     TRASK SORTING COEFFECIENT        1.250
                                                                                     USING PROBABILITY EXTRAP.        1.216
                                                                                     MEAN CUBED DEVIATION             8.121
                                                                                     USING PROBABLITY EXTRAP.         7.353

PERCENTAGE          TABLE OF STATISTICAL DATA IN PHI UNITS                  PERCENTILES   LINEAR EXTRAP.          PROBABLILITY EXTRAP.
COMPOSITION
                                 MEAN    STD DEV SKEWNESS KURTOSIS                          MM.        PHI UNITS      MM.        PHI UNITS
GRAVEL      0.0     MOMENT      3.43493  1.24395  4.21908 24.84883                5.0     0.17023    2.55442     0.15758    2.66584
SAND       90.93    P-MOMENT    3.46090  1.19926  4.26338 24.36111               10.0     0.16192    2.62666     0.14757    2.76052
SILT        7.06    FOLK        3.21719  0.70759  0.34727  1.87162               16.0     0.15248    2.71334     0.14011    2.83535
CLAY        2.01    P-FOLK      3.24288  0.65056  0.44671  2.05238               25.0     0.13933    2.84337     0.13224    2.91673
MUD         9.07    INMAN       3.23773  0.52439  0.11751  1.80293               50.0     0.11064    3.17611     0.11118    3.16898
S/M        10.02    P-INMAN     3.27983  0.44448  0.24938  2.18001               75.0     0.08918    3.48707     0.08942    3.48324
                    KRUMBEIN             0.47682 -0.01089  0.23993               84.0     0.07370    3.76212     0.07566    3.72431
                    P-KRUM.              0.41815  0.03200  0.23615               90.0     0.06390    3.96808     0.06445    3.95575
                    FOLK (TRANSFORMED)                     0.65176               95.0     0.02219    5.49407     0.02221    5.49277
                    P-FOLK (TRANSFORMED)                   0.67239

                              DATA FOR CONSTN OF BARGRAPHS AND CUM. CURVES

                    SIZE FRACTION       WT.(GMS)     WT.PCT. WT.PCT.  MID PHI(LINEAR)  MID PHI(PROB.)  MODE
                     MM        PHI    UNCOR    COR     COR    CUMUL.     PHI      MM      PHI      MM

                    0.250000  2.000   0.020   0.020   0.442    0.442  1.751  0.29707  1.900  0.26794     0
                    0.177000  2.498   0.030   0.030   0.664    1.106  2.249  0.21036  2.298  0.20337     0
                    0.125000  3.000   1.570   1.570  34.735   35.841  2.749  0.14875  2.861  0.13768     0
                    0.088000  3.506   1.840   1.840  40.708   76.549  3.253  0.10488  3.242  0.10572     1*
                    0.062500  4.000   0.650   0.650  14.381   90.929  3.753  0.07416  3.716  0.07611     0
                    0.044000  4.506   0.052   0.052   1.146   92.075  4.253  0.05244  4.247  0.05267     0
                    0.031000  5.012   0.069   0.069   1.528   93.603  4.759  0.03693  4.749  0.03720     1
                    0.022000  5.506   0.065   0.065   1.433   95.036  5.259  0.02612  5.247  0.02634     0
                    0.015600  6.002   0.043   0.043   0.955   95.990  5.754  0.01853  5.744  0.01866     0
                    0.011000  6.506   0.030   0.030   0.668   96.658  6.254  0.01310  6.245  0.01319     0
                    0.007800  7.002   0.026   0.026   0.573   97.231  6.754  0.00926  6.745  0.00933     0
                    0.005500  7.506   0.017   0.017   0.382   97.613  7.254  0.00655  7.246  0.00659     0
                    0.003900  8.002   0.017   0.017   0.382   97.995  7.754  0.00463  7.745  0.00466     0
                    0.002700  8.533   0.017   0.017   0.383   98.377  8.268  0.00325  8.256  0.00327     1
                    0.001900  9.040   0.009   0.009   0.190   98.568  8.786  0.00227  8.779  0.00228     0
                    0.001380  9.501   0.013   0.013   0.287   98.854  9.270  0.00162  9.259  0.00163     1
                    0.000980  9.995   0.009   0.009   0.191   99.045  9.748  0.00116  9.738  0.00117     0
                    0.000690 10.501   0.009   0.009   0.190   99.236 10.248  0.00082 10.236  0.00083     0
                    0.000490 10.995   0.009   0.009   0.191   99.427 10.748  0.00058 10.732  0.00059     1
                    0.000340 11.522   0.009   0.009   0.191   99.618 11.259  0.00041 11.235  0.00041     1
                    0.000061 14.000   0.017   0.017   0.382  100.000 12.761  0.00014 12.034  0.00024     0

                 TOTALS           4.520   4.520 100.0
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                                                                        ****                      ****
P1++ 31B      0   0.0     0   0.0      0                                ***   MULTIMODAL SAMPLE    ***
                                                                        ****                      ****
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          WET WT      DRY WT      SALT     ORGANIC    MOISTURE               WEIGHT LOSS DUE TO HANDLING     0.0
       1000.0000      3.8200      0.0        0.0        0.0   (GRAMS)        GRAVEL CORRECTION FACTOR       1.000
        100.0001    100.0000      0.0        0.0        0.0   (PCT WET WT)   SIZES ELIMINATED (<0.01%)       NONE
                                                                             TRASK SORTING COEFFECIENT      2.305
                                                                             USING PROBABILITY EXTRAP.      2.286
                                                                             MEAN CUBED DEVIATION          21.826
                                                                             USING PROBABLITY EXTRAP.      18.351

PERCENTAGE         TABLE OF STATISTICAL DATA IN PHI UNITS              PERCENTILES   LINEAR EXTRAP.           PROBABLILITY EXTRAP.
COMPOSITION
                                    MEAN    STD DEV SKEWNESS KURTOSIS                    MM.      PHI UNITS       MM.       PHI UNITS
GRAVEL      0.0    MOMENT         5.09407  2.36776  1.64424  5.70868       5.0      0.15981    2.64558      0.14829     2.75345
SAND       37.70   P-MOMENT       5.08708  2.27659  1.55528  5.22502      10.0      0.13915    2.84526      0.13270     2.91571
SILT       51.91   FOLK           4.80978  2.17330  0.42492  1.36110      16.0      0.11846    3.07756      0.11716     3.09348
CLAY       10.40   P-FOLK         4.81427  2.15129  0.43737  1.35515      25.0      0.09434    3.40602      0.09340     3.42035
MUD        62.30   INMAN          4.99939  1.92183  0.29598  1.08180      50.0      0.04637    4.43057      0.04634     4.43158
S/M         0.61   P-INMAN        5.00561  1.91213  0.30021  1.06275      75.0      0.01776    5.81540      0.01787     5.80605
                   KRUMBEIN                1.78472  0.18014  0.22896      84.0      0.00825    6.92122      0.00827     6.91774
                   P-KRUM.                 1.76719  0.18163  0.22997      90.0      0.00363    8.10677      0.00364     8.10060
                   FOLK (TRANSFORMED)                        0.57647      95.0      0.00062   10.64733      0.00063    10.64193
                   P-FOLK (TRANSFORMED)                      0.57540

                                 DATA FOR CONSTN OF BARGRAPHS AND CUM. CURVES

                    SIZE FRACTION       WT.(GMS)      WT.PCT. WT.PCT.  MID PHI(LINEAR)  MID PHI(PROB.)  MODE
                     MM        PHI    UNCOR    COR     COR    CUMUL.     PHI       MM     PHI      MM

                   0.250000  2.000   0.010   0.010   0.262   0.262   1.751  0.29707  1.889  0.26991    0
                   0.177000  2.498   0.040   0.040   1.047   1.309   2.249  0.21036  2.330  0.19390    0
                   0.125000  3.000   0.480   0.480  12.565  13.874   2.749  0.14875  2.847  0.13900    0
                   0.088000  3.506   0.530   0.530  13.874  27.749   3.253  0.10488  3.279  0.10303    1
                   0.062500  4.000   0.380   0.380   9.948  37.696   3.753  0.07416  3.761  0.07377    0
                   0.044000  4.506   0.553   0.553  14.469  52.165   4.253  0.05244  4.256  0.05233    1*
                   0.031000  5.012   0.216   0.216   5.651  57.816   4.759  0.03693  4.758  0.03696    0
                   0.022000  5.506   0.471   0.471  12.331  70.147   5.259  0.02612  5.252  0.02625    1
                   0.015600  6.002   0.297   0.297   7.788  77.935   5.754  0.01853  5.745  0.01865    0
                   0.011000  6.506   0.149   0.149   3.894  81.829   6.254  0.01310  6.247  0.01317    0
                   0.007800  7.002   0.099   0.099   2.596  84.424   6.754  0.00926  6.748  0.00930    0
                   0.005500  7.506   0.099   0.099   2.596  87.020   7.254  0.00655  7.247  0.00659    0
                   0.003900  8.002   0.099   0.099   2.597  89.617   7.754  0.00463  7.745  0.00466    1
                   0.002700  8.533   0.074   0.074   1.946  91.563   8.268  0.00325  8.257  0.00327    0
                   0.001900  9.040   0.050   0.050   1.298  92.861   8.786  0.00227  8.778  0.00228    0
                   0.001380  9.501   0.025   0.025   0.649  93.511   9.270  0.00162  9.266  0.00162    0
                   0.000980  9.995   0.025   0.025   0.649  94.160   9.748  0.00116  9.743  0.00117    1
                   0.000690 10.501   0.025   0.025   0.648  94.808  10.248  0.00082 10.242  0.00083    0
                   0.000490 10.995   0.025   0.025   0.649  95.457  10.748  0.00058 10.741  0.00058    0
                   0.000340 11.522   0.025   0.025   0.649  96.106  11.259  0.00041 11.250  0.00041    0
                   0.000240 12.025   0.025   0.025   0.649  96.755  11.773  0.00029 11.764  0.00029    0


                   0.000061 14.000   0.124   0.124   3.245 100.000  13.012  0.00012 12.332  0.00019    0
                 TOTALS              3.820   3.820 100.0
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PITT 32        0  0.0    0  0.0     0                                               ***    MULTIMODAL SAMPLE     ***
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            WET WT    DRY WT     SALT    ORGANIC   MOISTURE                    WEIGHT LOSS DUE TO HANDLING     0.0
         1000.0000    4.4500     0.0       0.0       0.0   (GRAMS)             GRAVEL CORRECTION FACTOR        1.000
          100.0000  100.0000     0.0       0.0       0.0   (PCT WET WT)        SIZES ELIMINATED (<0.01%)       NONE
                                                                               TRASK SORTING COEFFECIENT       2.466
                                                                               USING PROBABILITY EXTRAP.       2.453
                                                                               MEAN CUBED DEVIATION           18.075
                                                                               USING PROBABLITY EXTRAP.       15.011


 PERCENTAGE           TABLE OF STATISTICAL DATA IN PHI UNITS               PERCENTILES   LINEAR EXTRAP.          PROBABLILITY EXTRAP.
 COMPOSITION
                                      MEAN    STD DEV SKEWNESS KURTOSIS                  MM.      PHI UNITS       MM.      PHI UNITS
 GRAVEL      0.0      MOMENT        5.62304  2.41749  1.27933  3.93355         5.0    0.11548     3.11422     0.11086     3.17312
 SAND       27.64     P-MOMENT      5.60987  2.32965  1.16720  3.50748        10.0    0.09546     3.38901     0.09297     3.42713
 SILT       55.37     FOLK          5.62875  2.31720  0.45063  1.21012        16.0    0.08081     3.62939     0.07935     3.65563
 CLAY       16.99     P-FOLK        5.63546  2.29816  0.45967  1.20571        25.0    0.06625     3.91592     0.06559     3.93047
 MUD        72.36     INMAN         5.93345  2.30406  0.39674  0.66882        50.0    0.03083     5.01934     0.03084     5.01921
 S/M         0.38     P-INMAN       5.94359  2.28796  0.40402  0.66472        75.0    0.01089     6.52036     0.01090     6.51979
                      KRUMBEIN               1.92921  0.19879  0.21047        84.0    0.00331     8.23751     0.00333     8.23154
                      P-KRUM.                1.91802  0.20592  0.21073        90.0    0.00131     9.57623     0.00131     9.57084
                      FOLK (TRANSFORMED)                       0.54754        95.0    0.00056    10.80435     0.00056    10.79072
                      P-FOLK (TRANSFORMED)                     0.54663


                               DATA FOR CONSTN OF BARGRAPHS AND CUM. CURVES

                       SIZE FRACTION      WT.(GMS)     WT.PCT. WT.PCT.  MID PHI(LINEAR)   MID PHI(PROB.)   MODE
                        MM       PHI    UNCOR    COR     COR    CUMUL.   PHI      MM       PHI      MM

                      0.250000  2.000   0.010   0.010   0.225   0.225  1.751  0.29707   1.886  0.27057     0
                      0.177000  2.498   0.020   0.020   0.449   0.674  2.249  0.21036   2.308  0.20200     0
                      0.125000  3.000   0.100   0.100   2.247   2.921  2.749  0.14875   2.822  0.14140     0
                      0.088000  3.506   0.410   0.410   9.213  12.135  3.253  0.10488   3.318  0.10027     0
                      0.062500  4.000   0.690   0.690  15.506  27.640  3.753  0.07416   3.783  0.07262     0
                      0.044000  4.506   0.873   0.873  19.615  47.255  4.253  0.05244   4.264  0.05205     1*
                      0.031000  5.012   0.113   0.113   2.536  49.791  4.759  0.03693   4.759  0.03693     0
                      0.022000  5.506   0.591   0.591  13.291  63.062  5.259  0.02612   5.256  0.02618     1
                      0.015600  6.002   0.329   0.329   7.383  70.465  5.754  0.01853   5.749  0.01860     0
                      0.011000  6.506   0.197   0.197   4.430  74.896  6.254  0.01310   6.249  0.01315     0
                      0.007800  7.002   0.164   0.164   3.692  78.588  6.754  0.00926   6.749  0.00930     0
                      0.005500  7.506   0.099   0.099   2.215  80.802  7.254  0.00655   7.250  0.00657     0
                      0.003900  8.002   0.099   0.099   2.216  83.018  7.754  0.00463   7.750  0.00465     1
                      0.002700  8.533   0.099   0.099   2.215  85.233  8.268  0.00325   8.261  0.00326     0
                      0.001900  9.040   0.099   0.099   2.216  87.448  8.786  0.00227   8.779  0.00228     1
                      0.001380  9.501   0.099   0.099   2.215  89.663  9.270  0.00162   9.262  0.00163     0
                      0.000980  9.995   0.099   0.099   2.215  91.878  9.748  0.00116   9.737  0.00117     0
                      0.000690 10.501   0.099   0.099   2.216  94.093 10.248  0.00082  10.233  0.00083     1
                      0.000490 10.995   0.066   0.066   1.476  95.570 10.748  0.00058  10.734  0.00059     0
                      0.000340 11.522   0.066   0.066   1.476  97.046 11.259  0.00041  11.237  0.00041     0
                      0.000061 14.000   0.131   0.131   2.954 100.000 12.761  0.00014  11.911  0.00026     0


                    TOTALS              4.450   4.450 100.0
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P1++ 33        0   0.0    0   0.0    0                                            ***    MULTIMODAL SAMPLE   ***
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         WET WT      DRY WT      SALT     ORGANIC    MOISTURE                WEIGHT LOSS DUE TO HANDLING      0.0
       1000.0000     4.6700      0.0        0.0        0.0    (GRAMS)        GRAVEL CORRECTION FACTOR         1.000
        100.0000   100.0000      0.0        0.0        0.0    (PCT WET WT)   SIZES ELIMINATED (<0.01%)         NONE
                                                                             TRASK SORTING COEFFICIENT        2.118
                                                                             USING PROBABILITY EXTRAP.        2.102
                                                                             MEAN CUBED DEVIATION            14.353
                                                                             USING PROBABLITY EXTRAP.        10.695

PERCENTAGE          TABLE OF STATISTICAL DATA IN PHI UNITS             PERCENTILES    LINEAR EXTRAP.          PROBABLILITY EXTRAP.
COMPOSITION
                               MEAN    STD DEV  SKEWNESS KURTOSIS                     MM.     PHI UNITS        MM.      PHI UNITS
GRAVEL     0.0   MOMENT       5.28558  2.09413  1.56290  5.58731            5.0    0.11956   3.06415       0.11590    3.10900
SAND      30.84  P-MOMENT     5.26826  1.97827  1.38154  4.66799           10.0    0.10381   3.26800       0.09923    3.33314
SILT      59.06  FOLK         5.11205  1.88119  0.34786  1.26772           16.0    0.08769   3.51141       0.08762    3.51261
CLAY      10.10  P-FOLK       5.11207  1.87162  0.35220  1.26986           25.0    0.07141   3.80781       0.07043    3.82833
MUD       69.16  INMAN        5.24395  1.73253  0.22839  0.93315           50.0    0.03472   4.84825       0.03471    4.84848
S/M        0.45  P-INMAN      5.24386  1.73125  0.22838  0.91755           75.0    0.01592   5.97336       0.01594    5.97118
                 KRUMBEIN              1.60411  0.04234  0.22769           84.0    0.00794   6.97648       0.00795    6.97511
                 P-KRUM.               1.58730  0.05127  0.22851           90.0    0.00384   8.02355       0.00385    8.02184
                 FOLK (TRANSFORMED)                      0.55903           95.0    0.00115   9.76265       0.00116    9.74653
                 P-FOLK (TRANSFORMED)                    0.55944

                           DATA FOR CONSTN OF BARGRAPHS AND CUM. CURVES

                 SIZE FRACTION       WT.(GMS)      WT.PCT.  WT.PCT.   MID PHI(LINEAR)    MID PHI(PROB.)   MODE
                  MM        PHI    UNCOR     COR     COR     CUMUL.    PHI       MM      PHI      MM

               0.250000   2.000    0.010    0.010    0.214    0.214   1.751  0.29707   1.885  0.27079     0
               0.177000   2.498    0.010    0.010    0.214    0.428   2.249  0.21036   2.287  0.20487     0
               0.125000   3.000    0.140    0.140    2.998    3.426   2.749  0.14875   2.846  0.13906     0
               0.088000   3.506    0.580    0.580   12.420   15.846   3.253  0.10488   3.320  0.10012     0
               0.062500   4.000    0.700    0.700   14.989   30.835   3.753  0.07416   3.776  0.07301     1*
               0.044000   4.506    0.655    0.655   14.036   44.872   4.253  0.05244   4.260  0.05218     0
               0.031000   5.012    0.354    0.354    7.578   52.450   4.759  0.03693   4.759  0.03692     0
               0.022000   5.506    0.673    0.673   14.409   66.859   5.259  0.02612   5.253  0.02622     1
               0.015600   6.002    0.404    0.404    8.646   75.504   5.754  0.01853   5.745  0.01864     0
               0.011000   6.506    0.269    0.269    5.763   81.268   6.254  0.01310   6.245  0.01319     0
               0.007800   7.002    0.135    0.135    2.882   84.150   6.754  0.00926   6.748  0.00931     0
               0.005500   7.506    0.135    0.135    2.882   87.032   7.254  0.00655   7.246  0.00659     0
               0.003900   8.002    0.135    0.135    2.881   89.913   7.754  0.00463   7.743  0.00467     0
               0.002700   8.533    0.101    0.101    2.162   92.075   8.268  0.00325   8.256  0.00327     0
               0.001900   9.040    0.034    0.034    0.721   92.796   8.786  0.00227   8.782  0.00227     0
               0.001380   9.501    0.067    0.067    1.441   94.237   9.270  0.00162   9.260  0.00163     1
               0.000980   9.995    0.067    0.067    1.441   95.678   9.748  0.00116   9.734  0.00117     1
               0.000690  10.501    0.034    0.034    0.719   96.397  10.248  0.00082  10.239  0.00083     0
               0.000490  10.995    0.034    0.034    0.721   97.118  10.748  0.00058  10.737  0.00059     0
               0.000061  14.000    0.135    0.135    2.882  100.000  12.497  0.00017  11.467  0.00035     0
             TOTALS                4.670    4.670  100.0
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 Pl++ 35        0   0.0    0   0.0     0                                                  ***    MULTIMODAL SAMPLE   ***
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            WET WT     DRY WT      SALT    ORGANIC   MOISTURE                      WEIGHT LOSS DUE TO HANDLING    0.0
         1000.0000     3.8600      0.0       0.0       0.0    (GRAMS)              GRAVEL CORRECTION FACTOR       1.000
          100.0000   100.0000      0.0       0.0       0.0    (PCT WET WT)         SIZES ELIMINATED (<0.01%)      NONE
                                                                                   TRASK SORTING COEFFECIENT      2.294
                                                                                   USING PROBABILITY EXTRAP.      2.281
                                                                                   MEAN CUBED DEVIATION          14.090
                                                                                   USING PROBABLITY EXTRAP.      10.240

 PERCENTAGE        TABLE OF STATISTICAL DATA IN PHI UNITS                    PERCENTILES   LINEAR EXTRAP.            PROBABLILITY EXTRAP.
 COMPOSITION
                                MEAN    STD DEV SKEWNESS KURTOSIS                          MM.      PHI UNITS       MM.      PHI UNITS
 GRAVEL      0.0   MOMENT     5.28066   2.19625  1.38670  4.72712               5.0      0.13101    2.93224       0.12768    2.96714
 SAND      33.16   P-MOMENT   5.25327   2.05477  1.18032  3.79626              10.0      0.11305    3.14491       0.10897    3.19799
 SILT      54.68   FOLK       5.10409   2.02668  0.38567  1.19081              16.0      0.09827    3.34710       0.09551    3.38813
 CLAY      12.16   P-FOLK     5.11484   2.00770  0.39520  1.19193              25.0      0.07824    3.67603       0.07749    3.66991
 MUD       66.84   INMAN      5.29069   1.94359  0.28802  0.79108              50.0      0.03766    4.73089       0.03766    4.73083
 S/M        0.50   P-INMAN    5.30685   1.91872  0.30021  0.80304              75.0      0.01486    6.07219       0.01490    6.06896
                   KRUMBEIN             1.77494  0.14322  0.22139              84.0      0.00664    7.23428       0.00668    7.22557
                   P-KRUM.              1.76226  0.14860  0.22208              90.0      0.00266    8.55661       0.00266    8.55420
                   FOLK (TRANSFORMED)                     0.54355              95.0      0.00105    9.89451       0.00106    9.88617
                   P-FOLK (TRANSFORMED)                   0.54378


                            DATA FOR CONSTN OF BARGRAPHS AND CUM. CURVES

                     SIZE FRACTION      WT.(GMS)     WT.PCT. WT.PCT.  MID PHI(LINEAR)  MID PHI(PROB.)  MODE
                      MM      PHI    UNCOR    COR      COR    CUMUL.    PHI      MM      PHI     MM

                  0.250000  2.000    0.010   0.010    0.259    0.259  1.751  0.29707  1.889  0.26995    0
                  0.177000  2.498    0.010   0.010    0.259    0.518  2.249  0.21036  2.287  0.20489    0
                  0.125000  3.000    0.200   0.200    5.181    5.699  2.749  0.14875  2.855  0.13824    0
                  0.088000  3.506    0.580   0.580   15.026   20.725  3.253  0.10488  3.307  0.10101    1*
                  0.062500  4.000    0.480   0.480   12.435   33.161  3.753  0.07416  3.768  0.07342    0
                  0.044000  4.506    0.545   0.545   14.108   47.268  4.253  0.05244  4.259  0.05223    1
                  0.031000  5.012    0.237   0.237    6.146   53.415  4.759  0.03693  4.759  0.03694    0
                  0.022000  5.506    0.495   0.495   12.828   66.242  5.259  0.02612  5.254  0.02621    1
                  0.015600  6.002    0.313   0.313    8.102   74.345  5.754  0.01853  5.747  0.01863    0
                  0.011000  6.506    0.182   0.182    4.725   79.070  6.254  0.01310  6.247  0.01316    0
                  0.007800  7.002    0.130   0.130    3.376   82.446  6.754  0.00926  6.748  0.00931    0
                  0.005500  7.506    0.130   0.130    3.377   85.823  7.254  0.00655  7.245  0.00659    1
                  0.003900  8.002    0.078   0.078    2.025   87.847  7.754  0.00463  7.748  0.00465    0
                  0.002700  8.533    0.078   0.078    2.026   89.873  8.268  0.00325  8.259  0.00326    0
                  0.001900  9.040    0.104   0.104    2.701   92.574  8.786  0.00227  8.772  0.00229    1
                  0.001380  9.501    0.052   0.052    1.350   93.924  9.270  0.00162  9.261  0.00163    0
                  0.000980  9.995    0.052   0.052    1.351   95.275  9.748  0.00116  9.736  0.00117    1
                  0.000690 10.501    0.052   0.052    1.350   96.624 10.248  0.00082 10.231  0.00083    0
                  0.000061 14.000    0.130   0.130    3.376  100.000 12.251  0.00021 11.044  0.00047    0
                TOTALS               3.860   3.860  100.0
     0.250000   0.010000
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P1++ 36         0   0.0     0   0.0      0                                                         ***    MULTIMODAL SAMPLE   ***
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              WET WT      DRY WT      SALT      ORGANIC    MOISTURE                          WEIGHT LOSS DUE TO HANDLING     0.0
           1000.0000      3.9100      0.0         0.0        0.0    (GRAMS)                  GRAVEL CORRECTION FACTOR        1.000
            100.0001    100.0000      0.0         0.0        0.0    (PCT WET WT)             SIZES ELIMINATED (<0.01%)       NONE
                                                                                             TRASK SORTING COEFFECIENT       2.714
                                                                                             USING PROBABILITY EXTRAP.       2.698
                                                                                             MEAN CUBED DEVIATION           20.875
                                                                                             USING PROBABLITY EXTRAP.       18.217

PERCENTAGE          TABLE OF STATISTICAL DATA IN PHI UNITS                        PERCENTILES    LINEAR EXTRAP.               PROBABLILITY EXTRAP.
COMPOSITION
                                        MEAN     STD DEV SKEWNESS KURTOSIS                       MM.        PHI UNITS         MM.        PHI UNITS
GRAVEL      0.0     MOMENT            6.04913  2.57011  1.22959  3.95281             5.0       0.10952     3.19077         0.10439     3.25989
SAND       20.46    P-MOMENT          6.03790  2.49830  1.16822  3.68918            10.0       0.08654     3.53044         0.08609     3.53795
SILT       59.85    FOLK              5.95107  2.54515  0.41997  1.24959            16.0       0.07180     3.79977         0.07038     3.82868
CLAY       19.69    P-FOLK            5.96001  2.52622  0.42927  1.24683            25.0       0.05545     4.17272         0.05487     4.16784
MUD        79.54    INMAN             6.22810  2.42833  0.34224  0.80875            50.0       0.02373     5.39703         0.02371     5.39813
S/M         0.26    P-INMAN           6.24095  2.41228  0.34939  0.80588            75.0       0.00753     7.05383         0.00754     7.05169
                    KRUMBEIN                   2.13415  0.21625  0.22452            84.0       0.00248     8.65642         0.00248     8.65323
                    P-KRUM.                    2.12137  0.22163  0.22352            90.0       0.00101     9.94670         0.00102     9.94418
                    FOLK (TRANSFORMED)                           0.55547            95.0       0.00025    11.97526         0.00025    11.97245
                    P-FOLK (TRANSFORMED)                         0.55493


                              DATA FOR CONSTN OF BARGRAPHS AND CUM. CURVES

                    SIZE FRACTION        WT.(GMS)      WT.PCT.  WT.PCT.  MID PHI(LINEAR)   MID PHI(PROB.)   MODE
                     MM        PHI     UNCOR     COR     COR     CUMUL.     PHI      MM      PHI      MM

                   0.250000  2.000   0.010    0.010    0.256    0.256  1.751  0.29707  1.889  0.27001      0
                   0.177000  2.498   0.020    0.020    0.512    0.767  2.249  0.21036  2.307  0.20203      0
                   0.125000  3.000   0.060    0.060    1.535    2.302  2.749  0.14875  2.806  0.14301      0
                   0.088000  3.506   0.280    0.280    7.161    9.463  3.253  0.10488  3.319  0.10518      0
                   0.062500  4.000   0.430    0.430   10.997   20.460  3.753  0.07416  3.785  0.07257      0
                   0.044000  4.506   0.520    0.520   13.307   33.767  4.253  0.05244  4.269  0.05187      1
                   0.031000  5.012   0.185    0.185    4.733   38.500  4.759  0.03693  4.762  0.03686      0
                   0.022000  5.506   0.577    0.577   14.761   53.261  5.259  0.02612  5.261  0.02607      1*
                   0.015600  6.002   0.417    0.417   10.660   63.921  5.754  0.01853  5.751  0.01857      0
                   0.011000  6.506   0.289    0.289    7.380   71.301  6.254  0.01310  6.248  0.01315      0
                   0.007800  7.002   0.128    0.128    3.280   74.581  6.754  0.00926  6.751  0.00929      0
                   0.005500  7.506   0.160    0.160    4.100   78.680  7.254  0.00655  7.248  0.00658      1
                   0.003900  8.002   0.064    0.064    1.639   80.320  7.754  0.00463  7.751  0.00464      0
                   0.002700  8.533   0.128    0.128    3.280   83.600  8.268  0.00325  8.260  0.00326      1
                   0.001900  9.040   0.064    0.064    1.641   85.241  8.766  0.00227  8.782  0.00227      0
                   0.001380  9.501   0.128    0.128    3.280   88.521  9.270  0.00162  9.260  0.00165      1
                   0.000980  9.995   0.064    0.064    1.639   90.160  9.748  0.00116  9.741  0.00117      0
                   0.000690 10.501   0.064    0.064    1.641   91.801 10.248  0.00082 10.239  0.00083      1
                   0.000490 10.995   0.064    0.064    1.639   93.440 10.748  0.00058 10.737  0.00059      0
                   0.000340 11.522   0.032    0.032    0.820   94.260 11.259  0.00041 11.252  0.00041      0
                   0.000240 12.025   0.032    0.032    0.821   95.081 11.773  0.00029 11.766  0.00029      1


                   0.000170 12.522   0.032    0.032    0.820   95.900 12.273  0.00020 12.264  0.00020      0
                   0.000061 14.000   0.160    0.160    4.100  100.000 13.261  0.00010 12.749  0.00015      0
                 TOTALS              3.910    3.910  100.0
```

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                                                                        ****************************
 P1++ 37        0   0.0    0   0.0     0                                ****                    ****
                                                                        ***    MULTIMODAL SAMPLE  ***
                                                                        ****                    ****
                                                                        ****************************

                WET WT     DRY WT       SALT     ORGANIC   MOISTURE                       WEIGHT LOSS DUE TO HANDLING      0.0
             1000.0000     4.5900       0.0       0.0        0.0     (GRAMS)              GRAVEL CORRECTION FACTOR         1.000
              100.0000   100.0000       0.0       0.0        0.0     (PCT WET WT)         SIZES ELIMINATED (<0.01%)        NONE
                                                                                          TRASK SORTING COEFFECIENT        2.180
                                                                                          USING PROBABILITY EXTRAP.        2.168
                                                                                          MEAN CUBED DEVIATION             6.657
                                                                                          USING PROBABLITY EXTRAP.         4.737

 PERCENTAGE         TABLE OF STATISTICAL DATA IN PHI UNITS                   PERCENTILES   LINEAR EXTRAP.          PROBABLILITY EXTRAP.
 COMPOSITION
                                      MEAN    STD DEV SKEWNESS KURTOSIS                       MM.      PHI UNITS      MM.     PHI UNITS
 GRAVEL      0.0    MOMENT         5.57841  1.80635  1.12940  4.85231             5.0     0.10306   3.27648     0.09799   3.35118
 SAND       20.70   P-MOMENT       5.50803  1.72197  0.92777  3.85024            10.0     0.08309   3.58517     0.08151   3.61694
 SILT       69.58   FOLK           5.44714  1.71080  0.19269  1.04429            16.0     0.07082   3.81959     0.06917   3.85365
 CLAY        9.73   P-FOLK         5.45497  1.68749  0.20393  1.03772            25.0     0.05414   4.20710     0.05364   4.22044
 MUD        79.30   INMAN          5.50452  1.68492  0.10215  0.70067            50.0     0.02482   5.33239     0.02479   5.33386
 S/M         0.26   P-INMAN        5.51552  1.66187  0.10929  0.70087            75.0     0.01139   6.45626     0.01141   6.45313
                    KRUMBEIN                1.66605 -0.00072  0.25742            84.0     0.00685   7.18944     0.00691   7.17738
                    P-KRUM.                 1.65384  0.00290  0.25743            90.0     0.00402   7.95788     0.00403   7.95340
                    FOLK (TRANSFORMED)                        0.51083            95.0     0.00194   9.00949     0.00195   9.00443
                    P-FOLK (TRANSFORMED)                      0.50926

                                     DATA FOR CONSTN OF BARGRAPHS AND CUM. CURVES

                    SIZE FRACTION        WT.(GMS)       WT.PCT. WT.PCT.  MID PHI(LINEAR)   MID PHI(PROB.)   MODE
                     MM        PHI     UNCOR     COR      COR    CUMUL.     PHI       MM      PHI       MM

                   0.250000  2.000    0.010    0.010    0.218    0.218   1.751   0.29707  1.885   0.27071     0
                   0.177000  2.498    0.020    0.020    0.436    0.654   2.249   0.21036  2.308   0.20200     0
                   0.125000  3.000    0.040    0.040    0.871    1.525   2.749   0.14875  2.794   0.14417     0
                   0.088000  3.506    0.290    0.290    6.318    7.843   3.253   0.10488  3.330   0.09945     0
                   0.062500  4.000    0.590    0.590   12.854   20.697   3.753   0.07416  3.793   0.07215     1
                   0.044000  4.506    0.483    0.483   10.520   31.217   4.253   0.05244  4.267   0.05196     0
                   0.031000  5.012    0.260    0.260    5.665   36.881   4.759   0.03693  4.763   0.03683     0
                   0.022000  5.506    0.929    0.929   20.231   57.112   5.259   0.02612  5.261   0.02607     1*
                   0.015600  6.002    0.520    0.520   11.329   68.441   5.754   0.01853  5.748   0.01860     0
                   0.011000  6.506    0.334    0.334    7.282   75.723   6.254   0.01310  6.246   0.01317     0
                   0.007800  7.002    0.297    0.297    6.474   82.197   6.754   0.00926  6.743   0.00934     0
                   0.005500  7.506    0.223    0.223    4.855   87.052   7.254   0.00655  7.241   0.00661     0
                   0.003900  8.002    0.149    0.149    3.237   90.290   7.754   0.00463  7.742   0.00467     0
                   0.002700  8.533    0.111    0.111    2.427   92.717   8.268   0.00325  8.253   0.00328     0
                   0.001900  9.040    0.111    0.111    2.428   95.145   8.786   0.00227  8.766   0.00230     1
                   0.001380  9.501    0.074    0.074    1.619   96.764   9.270   0.00162  9.252   0.00164     0
                   0.000980  9.995    0.037    0.037    0.808   97.572   9.748   0.00116  9.733   0.00117     0
                   0.000690 10.501    0.037    0.037    0.809   98.381  10.248   0.00082 10.226   0.00083     0
                   0.000061 14.000    0.074    0.074    1.619  100.000  12.251   0.00021 11.083   0.00046     0
                 TOTALS               4.590    4.590  100.0
     0.250000    0.010000
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  PITT38                            SIEVE, SH. PIP., SEDIGRAPH  SAMPLE WT.=  6.3100

     PHI   PCT. CUMPCT.

    1.50
           0.48
    2.00           0.48
           0.32
    2.50           0.79
           1.27             *
    3.00           2.06
           4.75             *****
    3.50           6.81
           7.61             ********
    4.00          14.42
           8.64             *********
    4.50          23.07
          15.56             ****************
    5.00          38.63
          18.15             ******************
    5.50          56.78
          11.24             ***********
    6.00          68.02
           8.64             *********
    6.50          76.66
           5.19             *****
    7.00          81.85
           5.19             *****
    7.50          87.03
           4.32             ****
    8.00          91.36
           3.46             ***
    8.50          94.81
           3.46             ***
    9.00          98.27
           1.73             **
   12.00         100.00

     MEAN   ST.DEV. SKEWNESS KURTOSIS

     5.48    1.44     0.19    -0.21      KRUMBEIN+PETTIJOHN(1938) MONENT MEASURES
                                         FOR SIZE RANGE  2.0 TO   9.0 PHI

     5.54    1.57     0.22     1.22      FOLK GRAPHIC STATISTICAL PARAMETERS
                                              FOLK AND WARD,1957

    PERCENTILES    MEDIAN  5.31      5TH  3.31      16TH  4.09      25TH  4.56

                                    75TH  6.40      84TH  7.21      95TH  8.53

    PER CENT  GRAVEL    0.0   SAND  14.42  SILT  77.26 ( 76.93)  CLAY   8.32 (  8.64)

    GRAVEL + SAND  14.42   SILT/(SILT+CLAY)  89.90PCT  GRAV+SAND/SILT+CLAY    0.17

    LABELS SHEPARD -SILT        FOLK(GMS)-SANDY MUD           (SCS)-SANDY SILT
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PITT39                          SIEVE, SH. PIP., SEDIGRAPH  SAMPLE WT.=  4.8000

  PHI   PCT.  CUMPCT.
  3.00
        0.42
  3.50         0.42
        1.67               **
  4.00         2.08
        1.96               **
  4.50         4.04
        2.94               ***
  5.00         6.98
        7.83               ********
  5.50        14.81
        8.81               *********
  6.00        23.63
       10.77               ***********
  6.50        34.40
        6.85               *******
  7.00        41.25
        6.85               *******
  7.50        48.10
        7.83               ********
  8.00        55.94
        4.90               *****
  8.50        60.83
        2.94               ***
  9.00        63.77
       11.75               ************
  9.50        75.52
        4.90               *****
 10.00        80.42
        4.90               *****
 10.50        85.31
        4.90               *****
 11.00        90.21
        4.90               *****
 11.50        95.10
        4.90               *****
 12.00       100.00
   MEAN   ST.DEV. SKEWNESS KURTOSIS

    7.63     2.01     0.06    -1.01     KRUMBEIN+PETTIJOHN(1938) MOMENT MEASURES
                                        FOR SIZE RANGE  3.5 TO  11.5 PHI

    7.85     2.23     0.14     1.17     FOLK GRAPHIC STATISTICAL PARAMETERS
                                            FOLK AND WARD,1957


 PERCENTILES   MEDIAN  7.62      5TH  4.66      16TH  5.57      25TH  6.06

                                  75TH  9.48     84TH 10.37      95TH 11.49

 PER CENT  GRAVEL   0.0   SAND   2.08  SILT  54.17 ( 53.85)  CLAY  43.75 ( 44.06)


 GRAVEL + SAND   2.08   SILT/(SILT+CLAY)  55.00PCT  GRAV+SAND/SILT+CLAY     0.02
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 PITT40A                              SIEVE, SH. PIP., SEDIGRAPH  SAMPLE WT.=  3.4200

   PHI   PCT. CUMPCT.
   3.50
          1.17             *
   4.00         1.17
          1.98             **
   4.50         3.15
          2.96             ***
   5.00         6.11
          5.93             ******
   5.50        12.04
          6.92             *******
   6.00        18.96
          4.94             *****
   6.50        23.90
          4.94             *****
   7.00        28.84
          6.92             *******
   7.50        35.76
          6.92             *******
   8.00        42.68
          7.91             ********
   8.50        50.59
          9.88             **********
   9.00        60.47
          5.93             ******
   9.50        66.40
          5.93             ******
  10.00        72.33
          5.93             ******
  10.50        78.26
          6.92             *******
  11.00        85.18
          5.93             ******
  11.50        91.11
          1.98             **
  12.00        93.08
          6.92             *******
  12.00       100.00

    MEAN   ST.DEV. SKEWNESS KURTOSIS

     8.11     2.05    -0.06    -0.96     KRUMBEIN+PETTIJOHN(1938) MOMENT MEASURES
                                         FOR SIZE RANGE   4.0 TO   12.0 PHI

     8.39     2.37    -0.03     1.19     FOLK GRAPHIC STATISTICAL PARAMETERS
                                                FOLK AND WARD,1957

  PERCENTILES   MEDIAN  8.46     5TH  4.81     16TH  5.79     25TH  6.61

                                 75TH 10.23     84TH 10.92     95TH 12.00

  PER CENT  GRAVEL   0.0   SAND   1.17  SILT  41.73 ( 41.51)  CLAY  57.10 ( 57.32)
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PITT40B                    SEDIGRAPH ANALYSIS

   PHI  PCT. CUMPCT.
  4.00
        0.0
  4.50          0.0
        2.00              **
  5.00          2.00
        6.00              ******
  5.50          8.00
       10.00              **********
  6.00         18.00
        9.00              *********
  6.50         27.00
        9.00              *********
  7.00         36.00
       11.00              ***********
  7.50         47.00
        8.00              ********
  8.00         55.00
        6.00              ******
  8.50         61.00
       13.00              *************
  9.00         74.00
        9.00              *********
  9.50         83.00
        4.00              ****
 10.00         87.00
        3.00              ***
 10.50         90.00
        2.00              **
 11.00         92.00
        2.00              **
 11.50         94.00
        1.00              *
 12.00         95.00
        5.00              *****
 12.00        100.00

   MEAN   ST.DEV. SKEWNESS KURTOSIS

    7.68     1.64     0.14    -0.67     KRUMBEIN+PETTIJOHN(1938) MONENT MEASURES
                                        FOR SIZE RANGE  4.5 TO  12.0 PHI

    7.74     1.95     0.16     1.32     FOLK GRAPHIC STATISTICAL PARAMETERS
                                            FOLK AND WARD,1957


 PERCENTILES   MEDIAN  7.69      5TH  5.25      16TH  5.90      25TH  6.39

                                  75TH  9.06      84TH  9.63      95TH 12.00


 PER CENT  GRAVEL   0.00  SAND   0.0   SILT   0.0  ( 61.00)  CLAY   0.0  ( 39.00)


 GRAVEL + SAND   0.00    SILT/(SILT+CLAY)  61.00PCT  GRAV+SAND/SILT+CLAY     0.00



 LABELS SHEPARD -CLAYEY SILT FOLK(GMS)-MUD                (SCS)-MUD
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                                                                                  *****************************
                                                                                  ****                     ****
    P1++ 41         0   0.0     0   0.0      0                                    ***    MULTIMODAL SAMPLE   ***
                                                                                  ****                     ****
                                                                                  *****************************


              WET WT     DRY WT      SALT     ORGANIC   MOISTURE                  WEIGHT LOSS DUE TO HANDLING     0.0
           1000.0000     5.1800      0.0        0.0        0.0    (GRAMS)         GRAVEL CORRECTION FACTOR        1.000
            100.0000   100.0000      0.0        0.0        0.0    (PCT WET WT)    SIZES ELIMINATED (<0.01%)        NONE
                                                                                  TRASK SORTING COEFFECIENT       2.101
                                                                                  USING PROBABILITY EXTRAP.       2.088
                                                                                  MEAN CUBED DEVIATION           15.544
                                                                                  USING PROBABLITY EXTRAP.       13.367


  PERCENTAGE          TABLE OF STATISTICAL DATA IN PHI UNITS                PERCENTILES   LINEAR EXTRAP.         PROBABLILITY EXTRAP.
  COMPOSITION
                                       MEAN   STD DEV SKEWNESS KURTOSIS                      MM.      PHI UNITS       MM.      PHI UNITS
  GRAVEL      0.0     MOMENT        5.36141  2.11961  1.63230  5.96058            5.0     0.11645    3.10219      0.11171    3.10221
  SAND       28.19    P-MOMENT      5.35819  2.05163  1.54784  5.45989           10.0     0.09841    3.34505      0.09496    3.39656
  SILT       61.65    FOLK          5.18880  1.88250  0.27868  1.32931           16.0     0.08274    3.59532      0.08165    3.61441
  CLAY       10.17    P-FOLK        5.19261  1.86668  0.28770  1.32852           25.0     0.06725    3.89420      0.06651    3.91018
  MUD        71.81    INMAN         5.25513  1.65981  0.11987  1.09276           50.0     0.03006    5.05616      0.03008    5.05516
  S/M         0.39    P-INMAN       5.26164  1.64723  0.12535  1.08965           75.0     0.01524    6.03606      0.01526    6.03392
                      KRUMBEIN               1.58657 -0.09103  0.22610           84.0     0.00829    6.91493      0.00832    6.90886
                      P-KRUM.                1.57314 -0.08311  0.22882           90.0     0.00380    8.04015      0.00381    8.03720
                      FOLK (TRANSFORMED)                       0.57069           95.0     0.00094   10.04936      0.00095   10.04647
                      P-FOLK (TRANSFORMED)                     0.57064


                                 DATA FOR CONSTN OF BARGRAPHS AND CUM. CURVES

                       SIZE FRACTION       WT.(GMS)     WT.PCT. WT.PCT.  MID PHI(LINEAR)  MID PHI(PROB.)   MODE
                        MM        PHI    UNCOR     COR     COR    CUMUL.    PHI      MM     PHI      MM

                      0.250000  2.000    0.010    0.010    0.193    0.193  1.751  0.29707  1.882  0.27128      0
                      0.177000  2.498    0.020    0.020    0.386    0.579  2.249  0.21036  2.308  0.20197      0
                      0.125000  3.000    0.120    0.120    2.317    2.896  2.749  0.14875  2.828  0.14080      0
                      0.088000  3.506    0.540    0.540   10.425   13.320  3.253  0.10488  3.322  0.10003      0
                      0.062500  4.000    0.770    0.770   14.865   28.185  3.753  0.07416  3.780  0.07278      0
                      0.044000  4.506    0.878    0.878   16.948   45.133  4.253  0.05244  4.263  0.05208      1*
                      0.031000  5.012    0.174    0.174    3.363   48.496  4.759  0.03693  4.759  0.03692      0
                      0.022000  5.506    0.864    0.864   16.684   65.181  5.259  0.02612  5.254  0.02620      1
                      0.015600  6.002    0.488    0.488    9.431   74.611  5.754  0.01853  5.745  0.01864      0
                      0.011000  6.506    0.301    0.301    5.803   80.414  6.254  0.01310  6.245  0.01318      0
                      0.007800  7.002    0.225    0.225    4.352   84.767  6.754  0.00926  6.744  0.00933      0
                      0.005500  7.506    0.113    0.113    2.177   86.943  7.254  0.00655  7.248  0.00658      0
                      0.003900  8.002    0.150    0.150    2.902   89.845  7.754  0.00463  7.743  0.00467      1
                      0.002700  8.533    0.113    0.113    2.176   92.020  8.268  0.00325  8.256  0.00327      0
                      0.001900  9.040    0.075    0.075    1.451   93.471  8.786  0.00227  8.777  0.00228      0
                      0.001380  9.501    0.038    0.038    0.726   94.197  9.270  0.00162  9.265  0.00163      0
                      0.000980  9.995    0.038    0.038    0.725   94.922  9.748  0.00116  9.741  0.00117      0
                      0.000690 10.501    0.038    0.038    0.726   95.648 10.248  0.00082 10.240  0.00083      1
                      0.000490 10.995    0.038    0.038    0.725   96.373 10.748  0.00058 10.739  0.00059      0
                      0.000340 11.522    0.038    0.038    0.726   97.099 11.259  0.00041 11.246  0.00041      1
                      0.000240 12.025    0.038    0.038    0.725   97.823 11.773  0.00029 11.758  0.00029      0


                      0.000061 14.000    0.113    0.113    2.177  100.000 13.012  0.00012 12.343  0.00019      0
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PITT45                            SIEVE, SH. PIP., SEDIGRAPH  SAMPLE WT.=  5.0400

  PHI   PCT. CUMPCT.

  3.00
         1.59                  **
  3.50          1.59
         3.57                  ****
  4.00          5.16
         6.77                  *******
  4.50         11.94
        10.64                  ***********
  5.00         22.58
        17.42                  *****************
  5.50         40.00
        16.45                  ****************
  6.00         56.45
        10.64                  ***********
  6.50         67.10
         7.74                  ********
  7.00         74.84
         5.81                  ******
  7.50         80.65
         4.84                  *****
  8.00         85.48
         3.87                  ****
  8.50         89.36
         1.94                  **
  9.00         91.29
         0.97                  *
  9.50         92.26
         0.97                  *
 10.00         93.23
         0.97                  *
 10.50         94.19
         0.97                  *
 11.00         95.16
         4.84                  *****
 12.00        100.00

   MEAN  ST.DEV. SKEWNESS KURTOSIS

   5.99    1.47     0.43     0.79     KRUMBEIN+PETTIJOHN(1938) MONENT MEASURES
                                      FOR SIZE RANGE  3.5 TO  11.0 PHI

   6.11    1.84     0.38     1.58     FOLK GRAPHIC STATISTICAL PARAMETERS
                                          FOLK AND WARD,1957

PERCENTILES   MEDIAN  5.80     5TH  3.98     16TH  4.69     25TH  5.07

                             75TH  7.01     84TH  7.85     95TH 10.92

PER CENT  GRAVEL   0.0  SAND   5.16  SILT  80.44 ( 80.32)  CLAY  14.40 ( 14.52)

GRAVEL + SAND   5.16   SILT/(SILT+CLAY)  84.69PCT  GRAV+SAND/SILT+CLAY    0.05


LABELS SHEPARD -SILT        FOLK(GMS)-MUD              (SCS)-SILT
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                                                                                   ****************************
P1++ 42        0   0.0    0   0.0     0                                             ****                    ****
                                                                                   ***   MULTIMODAL SAMPLE    ***
                                                                                   ****                    ****
                                                                                   ****************************

                 WET WT     DRY WT      SALT     ORGANIC    MOISTURE                     WEIGHT LOSS DUE TO HANDLING    0.0
               1000.0000    6.3100      0.0        0.0        0.0   (GRAMS)              GRAVEL CORRECTION FACTOR       1.000
                100.0000  100.0000      0.0        0.0        0.0   (PCT WET WT)         SIZES ELIMINATED (<0.01%)       NONE
                                                                                         TRASK SORTING COEFFECIENT      1.930
                                                                                         USING PROBABILITY EXTRAP.      1.908
                                                                                         MEAN CUBED DEVIATION           8.229
                                                                                         USING PROBABLITY EXTRAP.       3.847

 PERCENTAGE            TABLF OF STATISTICAL DATA IN PHI UNITS                  PERCENTILES   LINEAR EXTRAP.          PROBABLILITY FXTRAP.
 COMPOSITION
                                      MEAN    STD DEV SKEWNESS KURTCSIS                      MM.        PHI UNITS       MM.        PHI UNITS
 GRAVEL     0.0        MOMENT        5.00619  1.68268  1.72719  7.38736          5.0       0.11629     3.10416       0.11181     3.16087
 SAND      29.64       P-MOMENT      4.96703  1.48859  1.16629  4.67062         10.0       0.09699     3.36605       0.09406     3.41033
 SILT      66.05       FOLK          4.84360  1.38834  0.28719  1.02392         16.0       0.08230     3.60304       0.08099     3.62614
 CLAY       4.32       P-FOLK        4.84389  1.36578  0.29655  1.02547         25.0       0.06863     3.86504       0.06762     3.88644
 MUD       70.36       INMAN         4.94371  1.34068  0.22401  0.76732         50.0       0.04001     4.64239       0.04002     4.64296
 S/M        0.42       P-INMAN       4.94436  1.31822  0.22865  0.76906         75.0       0.01843     5.76181       0.01858     5.75044
                       KRUMBEIN               1.40501  0.17003  0.27529         84.0       0.01283     6.28439       0.01302     6.26258
                       P-KRUM.                1.38074  0.17548  0.27529         90.0       0.00891     6.81106       0.00900     6.79588
                       FOLK (TRANSFORMED)                       0.50591         95.0       0.00436     7.84298       0.00441     7.82489
                       P-FOLK (TRANSFORMED)                     0.50629


                                       DATA FOR CONSTN OF BARGRAPHS AND CUM. CURVES

                      SIZE FRACTION      WT.(GMS)      WT.PCT.  WT.PCT.   MID PHI(LINEAR)   MID PHI(PROB.)   MODE
                       MM        PHI    UNCOR   COR     COR     CUMUL.     PHI       MM      PHI      MM

                      0.250000   2.000  0.030   0.030   0.475    0.475   1.751   0.29707  1.901   0.26771     0
                      0.177000   2.498  0.030   0.030   0.475    0.951   2.249   0.21036  2.286   0.20497     0
                      0.125000   3.000  0.130   0.130   2.060    3.011   2.749   0.14875  2.808   0.14282     0
                      0.088000   3.506  0.610   0.610   9.667   12.678   3.253   0.10488  3.318   0.10025     0
                      0.062500   4.000  1.070   1.070  16.957   29.635   3.753   0.07416  3.784   0.07262     0
                      0.044000   4.506  1.122   1.122  17.788   47.424   4.253   0.05244  4.262   0.05212     1*
                      0.031000   5.012  0.599   0.599   9.496   56.920   4.759   0.03693  4.758   0.03695     0
                      0.022000   5.506  0.861   0.861  13.642   70.562   5.259   0.02612  5.251   0.02626     1
                      0.015600   6.002  0.544   0.544   8.616   79.178   5.754   0.01853  5.743   0.01867     0
                      0.011000   6.506  0.544   0.544   8.616   87.794   6.254   0.01310  6.233   0.01330     1
                      0.007800   7.002  0.227   0.227   3.590   91.384   6.754   0.00926  6.739   0.00936     0
                      0.005500   7.506  0.136   0.136   2.154   93.538   7.254   0.00655  7.241   0.00661     0
                      0.003900   8.002  0.136   0.136   2.154   95.692   7.754   0.00463  7.735   0.00470     0
                      0.002700   8.533  0.045   0.045   0.718   96.410   8.268   0.00325  8.258   0.00327     0
                      0.001900   9.040  0.045   0.045   0.719   97.128   8.786   0.00227  8.775   0.00228     0
                      0.000061  14.000  0.181   0.181   2.872  100.000  11.520   0.00034  9.820   0.00111     0
                        TOTALS          6.310   6.310 100.0
       0.250000     0.040000
       0.177000     0.080000
       0.125000     0.760000
       0.088000     1.020000
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                                                                   ******************************
                                                                   ****                      ****
                                                                   ***    MULTIMODAL SAMPLE   ***
                                                                   ****                      ****
                                                                   ******************************
 PI++ 43        0  0.0   0  0.0    0

                                                                   WEIGHT LOSS DUE TO HANDLING     0.0
        WET WT      DRY WT     SALT    ORGANIC   MOISTURE          GRAVEL CORRECTION FACTOR        1.000
      1000.0000     5.7800     0.0       0.0       0.0   (GRAMS)   SIZES ELIMINATED (<0.01%)        NONE
       100.0000   100.0000     0.0       0.0       0.0   (PCT WET WT)  TRASK SORTING COEFFECIENT   2.326
                                                                   USING PROBABILITY EXTRAP.       2.298
                                                                   MEAN CUBED DEVIATION           13.147
                                                                   USING PROBABLITY EXTRAP.        9.634

                                                           PERCENTILES   LINEAR EXTRAP.         PROBABLILITY EXTRAP.
 PERCENTAGE       TABLE OF STATISTICAL DATA IN PHI UNITS
 COMPOSITION                                                            MM.      PHI UNITS      MM.      PHI UNITS
                               MEAN   STD DEV SKEWNESS KURTOSIS
 GRAVEL    0.0    MOMENT      4.77598 2.05552  1.51377  5.56451    5.0   0.16383  2.60976    0.15460   2.69336
 SAND     45.50   P-MOMENT    4.76377 1.94277  1.31380  4.48585   10.0   0.14353  2.80058    0.13644   2.87361
 SILT     47.18   FOLK        4.55761 1.84208  0.42579  1.08576   16.0   0.12309  3.02223    0.12259   3.02809
 CLAY      7.31   P-FOLK      4.55853 1.82703  0.43688  1.08696   25.0   0.10291  3.28046    0.10112   3.30581
 MUD      54.50   INMAN       4.75091 1.72868  0.33546  0.86647   50.0   0.05551  4.17100    0.05554   4.17031
 S/M       0.83   P-INMAN     4.75264 1.72455  0.33767  0.84611   75.0   0.01902  5.71627    0.01915   5.70662
                  KRUMBEIN            1.80430  0.32736  0.26332   84.0   0.01121  6.47959    0.01122   6.47719
                  P-KRUM.             1.77838  0.33590  0.26408   90.0   0.00582  7.42578    0.00584   7.41914
                  FOLK (TRANSFORMED)                    0.52056   95.0   0.00187  9.06283    0.00187   9.06076
                  P-FOLK (TRANSFORMED)                  0.52083

                        DATA FOR CONSTN OF BARGRAPHS AND CUM. CURVES

              SIZE FRACTION      WT.(GMS)    WT.PCT. WT.PCT.  MID PHI(LINEAR)  MID PHI(PROB.)  MODE
               MM       PHI    UNCOR    COR     COR    CUMUL.   PHI      MM      PHI      MM

            0.250000  2.000   0.040   0.040    0.692    0.692  1.751  0.29707  1.907  0.26661   0
            0.177000  2.498   0.080   0.080    1.364    2.076  2.249  0.21036  2.306  0.20227   0
            0.125000  3.000   0.760   0.760   13.149   15.225  2.749  0.14875  2.833  0.14030   0
            0.088000  3.506   1.020   1.020   17.647   32.872  3.253  0.10488  3.280  0.10298   1*
            0.062500  4.000   0.730   0.730   12.630   45.502  3.753  0.07416  3.759  0.07387   0
            0.044000  4.506   0.770   0.770   13.318   58.820  4.253  0.05244  4.252  0.05248   1
            0.031000  5.012   0.139   0.139    2.413   61.234  4.759  0.03693  4.758  0.03696   0
            0.022000  5.506   0.617   0.617   10.675   71.908  5.259  0.02612  5.251  0.02626   1
            0.015600  6.002   0.422   0.422    7.304   79.212  5.754  0.01853  5.744  0.01866   0
            0.011000  6.506   0.292   0.292    5.056   84.268  6.254  0.01310  6.243  0.01320   0
            0.007800  7.002   0.195   0.195    3.371   87.639  6.754  0.00926  6.744  0.00933   0
            0.005500  7.506   0.162   0.162    2.810   90.449  7.254  0.00655  7.243  0.00660   0
            0.003900  8.002   0.130   0.130    2.247   92.696  7.754  0.00463  7.742  0.00467   0
            0.002700  8.533   0.065   0.065    1.124   93.820  8.268  0.00325  8.259  0.00326   0
            0.001900  9.040   0.065   0.065    1.124   94.944  8.786  0.00227  8.776  0.00228   1
            0.001380  9.501   0.065   0.065    1.124   96.067  9.270  0.00162  9.259  0.00163   0
            0.000980  9.995   0.065   0.065    1.124   97.191  9.748  0.00116  9.731  0.00118   1
            0.000690 10.501   0.032   0.032    0.561   97.753 10.248  0.00082 10.236  0.00083   0
            0.000061 14.000   0.130   0.130    2.247  100.000 12.251  0.00021 11.063  0.00047   0
           .TOTALS            5.780   5.780  100.0
 0.250000  0.160000
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PITT44                          SIEVE, SH. PIP., SEDIGRAPH  SAMPLE WT.=  4.4900

  PHI  PCT. CUMPCT.

 3.50
       4.68                *****
 4.00         4.68
       6.88                *******
 4.50        11.56
      11.79                ************
 5.00        23.35
      17.69                ******************
 5.50        41.04
      17.69                ******************
 6.00        58.73
      14.74                ***************
 6.50        73.47
       8.84                *********
 7.00        82.31
       6.88                *******
 7.50        89.19
       4.91                *****
 8.00        94.10
       1.97                **
 8.50        96.07
       1.97                **
 9.00        98.03
       1.97                **
12.00       100.00

  MEAN  ST.DEV. SKEWNESS KURTOSIS

   5.82     1.14     0.19    -0.21     KRUMBEIN+PETTIJOHN(1938) MONENT MEASURES
                                       FOR SIZE RANGE  4.0 TO   9.0 PHI

   5.85     1.25     0.15     1.06     FOLK GRAPHIC STATISTICAL PARAMETERS
                                           FOLK AND WARD,1957

PERCENTILES   MEDIAN  5.75     5TH  4.02     16TH  4.69     25TH  5.05

                                75TH  6.59     84TH  7.12     95TH  8.23

PER CENT  GRAVEL   0.0   SAND   4.68  SILT  89.74 ( 89.42)  CLAY   5.57 (  5.90)

GRAVEL + SAND   4.68   SILT/(SILT+CLAY)  93.81PCT  GRAV+SAND/SILT+CLAY    0.05

LABELS SHEPARD -SILT       FOLK(GMS)-MUD                  (SCS)-SILT
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PITT46                          SIEVE, SH. PIP., SEDIGRAPH  SAMPLE WT.=  5.4600

  PHI  PCT. CUMPCT.
  1.50
        0.37
  2.00         0.37
        0.55          *
  2.50         0.92
        1.28          *
  3.00         2.20
        2.38          **
  3.50         4.58
        4.76          *****
  4.00         9.34
        5.44          *****
  4.50        14.78
       12.69          *************
  5.00        27.47
       19.04          *******************
  5.50        46.51
       10.88          ***********
  6.00        57.39
        7.25          *******
  6.50        64.64
        4.53          *****
  7.00        69.18
        2.72          ***
  7.50        71.90
        2.72          ***
  8.00        74.62
        1.81          **
  8.50        76.43
        1.81          **
  9.00        78.24
        1.81          **
  9.50        80.05
        0.91          *
 10.00        80.96
        0.91          *
 10.50        81.87
        0.91          *
 11.00        82.77
       17.23          *****************
 12.00       100.00

  MEAN  ST.DEV. SKEWNESS KURTOSIS

   5.67    1.62    0.44     1.10    KRUMBEIN+PETTIJOHN(1938) MOMENT MEASURES
                                    FOR SIZE RANGE  2.0 TO  11.0 PHI

   7.09    2.87    0.57     1.45    FOLK GRAPHIC STATISTICAL PARAMETERS
                                        FOLK AND WARD,1957

 PERCENTILES   MEDIAN  5.66     5TH  3.54    16TH  4.55     25TH  4.90

                                 75TH  8.11     84TH 11.07     95TH 11.71
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                                                                    *****************************
                                                                    ****                     ****
 P1++ 48          0   0.0    0   0.0     0                          ***   MULTIMODAL SAMPLE   ***
                                                                    ****                     ****
                                                                    *****************************

             WET WT     DRY WT      SALT     ORGANIC    MOISTURE                 WEIGHT LOSS DUE TO HANDLING      0.0
          1000.0000     6.5400      0.0        0.0        0.0    (GRAMS)         GRAVEL CORRECTION FACTOR         1.000
           100.0000   100.0000      0.0        0.0        0.0    (PCT WET WT)    SIZES ELIMINATED (<0.01%)         NONE
                                                                                 TRASK SORTING COEFFECIENT        2.315
                                                                                 USING PROBABILITY EXTRAP.        2.296
                                                                                 MEAN CUBED DEVIATION            16.174
                                                                                 USING PROBABLITY EXTRAP.        11.921

 PERCENTAGE            TABLE OF STATISTICAL DATA IN PHI UNITS                 PERCENTILES   LINEAR EXTRAP.            PROBABLILITY EXTRAP.
 COMPOSITION
                                      MEAN   STD DEV SKEWNESS KURTOSIS                    MM.        PHI UNITS        MM.        PHI UNITS
 GRAVEL      0.0       MOMENT        5.36295 2.33600  1.26879  4.59543          5.0     0.16914     2.56368       0.16659     2.58562
 SAND       29.97      P-MOMENT      5.33456 2.21157  1.10204  3.91024         10.0     0.12410     3.01041       0.12363     3.01356
 SILT       57.87      FOLK          5.16853 2.15329  0.20843  1.34345         16.0     0.10135     3.30260       0.09941     3.33043
 CLAY       12.16      P-FOLK        5.17613 2.14207  0.21428  1.35303         25.0     0.07436     3.74930       0.07370     3.76223
 MUD        70.03      INMAN         5.20367 1.90107  0.05545  1.08783         50.0     0.02919     5.09826       0.02922     5.09691
 S/M         0.43      P-INMAN       5.21574 1.88531  0.06303  1.09943         75.0     0.01388     6.17094       0.01398     6.16006
                       KRUMBEIN              1.79381 -0.13814  0.20958         84.0     0.00727     7.10474       0.00728     7.10106
                       P-KRUM.               1.77617 -0.13577  0.20787         90.0     0.00226     8.78776       0.00227     8.78114
                       FOLK (TRANSFORMED)                      0.57328         95.0     0.00069    10.50187       0.00069    10.50178
                       P-FOLK (TRANSFORMED)                    0.57502


                                    DATA FOR CONSTN OF BARGRAPHS AND CUM. CURVES

                       SIZE FRACTION      WT.(GMS)     WT.PCT. WT.PCT.  MID PHI(LINEAR)   MID PHI(PROB.)  MODE
                         MM       PHI   UNCOR    COR     COR    CUMUL.    PHI      MM      PHI      MM

                       0.250000  2.000  0.160   0.160   2.446    2.446  1.751  0.29707  1.921  0.26414     1
                       0.177000  2.498  0.120   0.120   1.835    4.281  2.249  0.21036  2.277  0.20626     0
                       0.125000  3.000  0.360   0.360   5.505    9.786  2.749  0.14875  2.788  0.14477     0
                       0.088000  3.506  0.680   0.680  10.398   20.184  3.253  0.10488  3.283  0.10271     1
                       0.062500  4.000  0.640   0.640   9.786   29.969  3.753  0.07416  3.766  0.07350     0
                       0.044000  4.506  0.844   0.844  12.901   42.870  4.253  0.05244  4.261  0.05216     1
                       0.031000  5.012  0.278   0.278   4.250   47.120  4.759  0.03693  4.760  0.03691     0
                       0.022000  5.506  1.075   1.075  16.436   63.556  5.259  0.02612  5.255  0.02618     1*
                       0.015600  6.002  0.561   0.561   8.575   72.131  5.754  0.01853  5.747  0.01862     0
                       0.011000  6.506  0.561   0.561   8.575   80.706  6.254  0.01310  6.242  0.01322     1
                       0.007800  7.002  0.187   0.187   2.859   83.564  6.754  0.00926  6.748  0.00930     0
                       0.005500  7.506  0.140   0.140   2.144   85.708  7.254  0.00655  7.248  0.00658     0
                       0.003900  8.002  0.140   0.140   2.144   87.852  7.754  0.00463  7.747  0.00465     1
                       0.002700  8.533  0.093   0.093   1.430   89.281  8.268  0.00325  8.262  0.00326     0
                       0.001900  9.040  0.093   0.093   1.429   90.710  8.786  0.00227  8.780  0.00228     0
                       0.001380  9.501  0.093   0.093   1.429   92.139  9.270  0.00162  9.263  0.00163     0
                       0.000980  9.995  0.093   0.093   1.430   93.569  9.748  0.00116  9.738  0.00117     1
                       0.000690 10.501  0.093   0.093   1.429   94.998 10.248  0.00082 10.235  0.00083     0
                       0.000450 10.995  0.093   0.093   1.430   96.427 10.748  0.00058 10.731  0.00059     0
                       0.000061 14.000  0.234   0.234   3.573  100.000 12.497  0.00017 11.460  0.00036     0
                     TOTALS             6.540   6.540 100.0
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                                                                          ****                    ****
 P1++ 49      0   0.0    0   0.0     0                                    ***   MULTIMODAL SAMPLE   ***
                                                                          ****                    ****
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            WET WT     DRY WT     SALT    ORGANIC   MOISTURE                    WEIGHT LOSS DUE TO HANDLING    0.0
          1000.0000    6.3300     0.0       0.0       0.0   (GRAMS)             GRAVEL CORRECTION FACTOR       1.000
           100.0000  100.0000     0.0       0.0       0.0   (PCT WET WT)        SIZES ELIMINATED (<0.01%)      NONE
                                                                                TRASK SORTING COEFFECIENT      2.275
                                                                                USING PROBABILITY EXTRAP.      2.255
                                                                                MEAN CUBED DEVIATION          10.557
                                                                                USING PROBABLITY EXTRAP.       6.177

 PERCENTAGE         TABLE OF STATISTICAL DATA IN PHI UNITS              PERCENTILES   LINEAR EXTRAP.          PROBABLILITY EXTRAP.
 COMPOSITION
                                MEAN    STD DEV SKEWNESS KURTOSIS                     MM.       PHI UNITS       MM.       PHI UNITS
 GRAVEL      0.0    MOMENT     4.58694  1.92786  1.47344  5.45582          5.0      0.16812     2.57243      0.16074     2.63720
 SAND       50.24   P-MOMENT   4.55945  1.76433  1.12472  3.72803         10.0      0.15043     2.73286      0.14211     2.81487
 SILT       43.72   FOLK       4.39308  1.71206  0.43579  1.00115         16.0      0.13164     2.92537      0.12893     2.95527
 CLAY        6.04   P-FOLK     4.39878  1.68948  0.44862  0.99818         25.0      0.11036     3.17976      0.10871     3.20142
 MUD        49.76   INMAN      4.59410  1.66872  0.36137  0.73570         50.0      0.06289     3.99106      0.06288     3.99122
 S/M         1.01   P-INMAN    4.60257  1.64729  0.37112  0.73452         75.0      0.02133     5.55114      0.02138     5.54772
                    KRUMBEIN            1.75657  0.37439  0.26894         84.0      0.01302     6.26282      0.01314     6.24986
                    P-KRUM.             1.73799  0.38335  0.27161         90.0      0.00708     7.14166      0.00712     7.13405
                    FOLK (TRANSFORMED)                    0.50029         95.0      0.00303     8.36522      0.00306     8.35173
                    P-FOLK (TRANSFORMED)                  0.49954

                                    DATA FOR CONSTN OF BARGRAPHS AND CUM. CURVES

                     SIZE FRACTION        WT.(GMS)     WT.PCT.  WT.PCT.   MID PHI(LINEAR)   MID PHI(PROB.)   MODE
                      MM       PHI     UNCOR     COR     COR     CUMUL.     PHI      MM       PHI      MM

                    0.250000  2.000   0.050    0.050    0.790    0.790   1.751  0.29707  1.909  0.26627      0
                    0.177000  2.498   0.120    0.120    1.896    2.686   2.249  0.21036  2.311  0.20153      0
                    0.125000  3.000   0.990    0.990   15.640   18.325   2.749  0.14875  2.829  0.14076      0
                    0.088000  3.506   1.190    1.190   18.799   37.125   3.253  0.10488  3.275  0.10331      1*
                    0.062500  4.000   0.830    0.830   13.112   50.237   3.753  0.07416  3.756  0.07399      0
                    0.044000  4.506   0.673    0.673   10.628   60.865   4.253  0.05244  4.251  0.05253      0
                    0.031000  5.012   0.250    0.250    3.949   64.814   4.759  0.03693  4.757  0.03699      0
                    0.022000  5.506   0.604    0.604    9.550   74.364   5.259  0.02612  5.250  0.02627      1
                    0.015600  6.002   0.446    0.446    7.038   81.402   5.754  0.01853  5.743  0.01867      0
                    0.011000  6.506   0.318    0.318    5.026   86.428   6.254  0.01310  6.241  0.01322      0
                    0.007800  7.002   0.191    0.191    3.016   89.444   6.754  0.00926  6.743  0.00933      0
                    0.005500  7.506   0.127    0.127    2.011   91.455   7.254  0.00655  7.245  0.00659      0
                    0.003900  8.002   0.159    0.159    2.513   93.968   7.754  0.00463  7.738  0.00468      1
                    0.002700  8.533   0.095    0.095    1.508   95.476   8.268  0.00325  8.252  0.00328      0
                    0.001900  9.040   0.127    0.127    2.010   97.487   8.786  0.00227  8.756  0.00231      0
                    0.000061 14.000   0.159    0.159    2.513  100.000  11.520  0.00034  9.829  0.00110      0
                    TOTALS            6.330    6.330  100.0
      0.250000    0.010000
      0.177000    0.010000
      0.125000    0.240000
      0.088000    0.810000
```

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                                                                            ******************************
                                                                            ****                      ****
                                                                            ***    MULTIMODAL SAMPLE   ***
 P1++ 50         0   0.0      0   0.0       0                               ****                      ****
                                                                            ******************************

           WET WT     DRY WT      SALT      ORGANIC    MOISTURE               WEIGHT LOSS DUE TO HANDLING     0.0
         1000.0000     6.3500     0.0         0.0         0.0    (GRAMS)      GRAVEL CORRECTION FACTOR        1.000
          100.0000   100.0000     0.0         0.0         0.0    (PCT WET WT) SIZES ELIMINATED (<0.01%)        NONE
                                                                              TRASK SORTING COEFFECIENT       2.310
                                                                              USING PROBABILITY EXTRAP.       2.293
                                                                              MEAN CUBED DEVIATION            9.540
                                                                              USING PROBABLITY EXTRAP.        4.822

 PERCENTAGE         TABLE OF STATISTICAL DATA IN PHI UNITS                 PERCENTILES   LINEAR EXTRAP.          PROBABLILITY EXTRAP.
 COMPOSITION
                                 MEAN     STD DEV  SKEWNESS  KURTOSIS                    MM.      PHI UNITS       MM.      PHI UNITS
 GRAVEL     0.0     MOMENT      5.39806   1.97154   1.24488   4.90284           5.0     0.12192   3.03593       0.11977    3.06166
 SAND      27.72    P-MOMENT    5.35234   1.78161   0.85259   3.37179          10.0     0.10625   3.23441       0.10170    3.29758
 SILT      62.78    FOLK        5.23941   1.81696   0.17628   1.02439          16.0     0.09008   3.47258       0.08937    3.48402
 CLAY       9.50    P-FOLK      5.24039   1.80771   0.18198   1.02847          25.0     0.06808   3.87657       0.06752    3.88861
 MUD       72.28    INMAN       5.27653   1.80395   0.06173   0.67380          50.0     0.02787   5.16516       0.02769    5.16415
 S/M        0.38    P-INMAN     5.27850   1.79448   0.06372   0.67433          75.0     0.01276   6.29260       0.01284    6.28320
                    KRUMBEIN              1.78965  -0.08058   0.25963          84.0     0.00739   7.08047       0.00743    7.07299
                    P-KRUM.               1.77377  -0.07825   0.26126          90.0     0.00422   7.88725       0.00424    7.88037
                    FOLK (TRANSFORMED)                        0.50602          95.0     0.00185   9.07461       0.00186    9.07078
                    P-FOLK (TRANSFORMED)                      0.50702

                            DATA FOR CONSTN OF BARGRAPHS AND CUM. CURVES

                SIZE FRACTION        WT.(GMS)      WT.PCT.  WT.PCT.   MID PHI(LINEAR)   MID PHI(PROB.)   MODE
                 MM        PHI      UNCOR    COR     COR     CUMUL.    PHI      MM       PHI      MM

              0.250000   2.000     0.010    0.010    0.157    0.157   1.751  0.29707   1.877  0.27231     1
              0.177000   2.498     0.010    0.010    0.157    0.315   2.249  0.21036   2.287  0.20484     0
              0.125000   3.000     0.240    0.240    3.780    4.094   2.749  0.14875   2.862  0.13758     0
              0.088000   3.506     0.810    0.810   12.756   16.850   3.253  0.10488   3.315  0.10050     1
              0.062500   4.000     0.690    0.690   10.866   27.717   3.753  0.07416   3.771  0.07327     0
              0.044000   4.506     0.502    0.502    7.902   35.619   4.253  0.05244   4.260  0.05220     0
              0.031000   5.012     0.611    0.611    9.621   45.240   4.759  0.03693   4.763  0.03684     0
              0.022000   5.506     0.974    0.974   15.332   60.572   5.259  0.02612   5.257  0.02615     1*
              0.015600   6.002     0.649    0.649   10.222   70.795   5.754  0.01853   5.747  0.01862     0
              0.011000   6.506     0.464    0.464    7.302   78.096   6.254  0.01310   6.245  0.01319     0
              0.007800   7.002     0.325    0.325    5.111   83.207   6.754  0.00926   6.744  0.00933     0
              0.005500   7.506     0.325    0.325    5.111   88.318   7.254  0.00655   7.239  0.00662     1
              0.003900   8.002     0.139    0.139    2.190   90.508   7.754  0.00463   7.745  0.00466     0
              0.002700   8.553     0.185    0.185    2.921   93.429   8.268  0.00325   8.249  0.00329     1
              0.001900   9.040     0.093    0.093    1.460   94.889   8.766  0.00227   8.774  0.00228     0
              0.001380   9.501     0.093    0.093    1.461   96.350   9.270  0.00162   9.255  0.00164     0
              0.000061  14.000     0.232    0.232    3.650  100.000  11.751  0.00029  10.196  0.00085     0
             TOTALS                6.350    6.350  100.0
    0.250000     0.100000
    0.177000     0.190000
    0.125000     0.860000
```

```
PITT51                              SIEVE, SH. PIP., SEDIGRAPH  SAMPLE WT.=  4.9900

   PHI  PCT. CUMPCT.
  2.00
        0.20
  2.50          0.20
        0.80              *
  3.00          1.00
        4.01              ****
  3.50          5.02
        6.22              ******
  4.00         11.23
        9.76              **********
  4.50         21.00
       15.98              ****************
  5.00         36.98
       18.64              *******************
  5.50         55.62
       12.43              ************
  6.00         68.04
        7.99              ********
  6.50         76.03
        5.33              *****
  7.00         81.36
        6.21              ******
  7.50         87.57
        4.44              ****
  8.00         92.01
        2.66              ***
  8.50         94.67
        1.78              **
  9.00         96.45
        0.89              *
  9.50         97.34
        2.65              ***
 12.00        100.00

   MEAN  ST.DEV. SKEWNESS KURTOSIS

    5.51     1.36     0.26    -0.08      KRUMBEIN+PETTIJOHN(1938) MONENT MEASURES
                                         FOR SIZE RANGE  2.5 TO   9.5 PHI

    5.60     1.51     0.26     1.20      FOLK GRAPHIC STATISTICAL PARAMETERS
                                             FOLK AND WARD,1957

PERCENTILES   MEDIAN  5.35     5TH  3.50     16TH  4.24     25TH  4.63

                               75TH  6.44     84TH  7.21     95TH  8.59

PER CENT  GRAVEL   0.0   SAND  11.23  SILT  80.74 ( 80.78)  CLAY   8.02 (  7.99)

GRAVEL + SAND  11.23   SILT/(SILT+CLAY)  91.00PCT  GRAV+SAND/SILT+CLAY     0.13

LABELS SHEPARD -SILT       FOLK(GMS)-SANDY MUD            (SCS)-SANDY SILT
```

```
PITT52                          SIEVE, SH. PIP., SEDIGRAPH  SAMPLE WT.=  5.1400

  PHI  PCT. CUMPCT.
 3.50
         7.01              *******
 4.00            7.01
         9.30              *********
 4.50           16.31
        26.04              **************************
 5.00           42.35
        15.81              ****************
 5.50           58.15
         6.51              *******
 6.00           64.66
         7.44              *******
 6.50           72.10
         4.65              *****
 7.00           76.75
         4.65              *****
 7.50           81.40
         2.79              ***
 8.00           84.19
         2.79              ***
 8.50           86.98
         1.86              **
 9.00           88.84
         3.72              ****
 9.50           92.56
         1.86              **
10.00           94.42
         1.86              **
10.50           96.28
         3.72              ****
12.00          100.00

  MEAN  ST.DEV. SKEWNESS KURTOSIS

  5.75    1.62     0.56     0.44     KRUMBEIN+PETTIJOHN(1938) MOMENT MEASURES
                                     FOR SIZE RANGE  4.0 TO  10.5 PHI

  5.90    1.82     0.56     1.37     FOLK GRAPHIC STATISTICAL PARAMETERS
                                         FOLK AND WARD,1957

PERCENTILES   MEDIAN  5.24      5TH  3.86      16TH  4.48      25TH  4.67

                                 75TH  6.81      84TH  7.97      95TH 10.16

PER CENT  GRAVEL   0.0   SAND   7.01  SILT  76.92 ( 77.18)  CLAY  16.07 ( 15.81)

GRAVEL + SAND   7.01   SILT/(SILT+CLAY)  83.00PCT  GRAV+SAND/SILT+CLAY    0.08
LABELS SHEPARD -SILT         FOLK(GMS)-MUD                  (SCS)-SILT
```

```
PITT53                              SIEVE, SH. PIP., SEDIGRAPH  SAMPLE WT.=  5.0300

  PHI  PCT. CUMPCT.

 2.50
        0.80                  *
 3.00          0.80
        2.98                  ***
 3.50          3.78
        5.77                  ******
 4.00          9.54
        7.38                  *******
 4.50         16.93
       22.15                  **********************
 5.00         39.08
       14.77                  ***************
 5.50         53.85
        7.38                  *******
 6.00         61.23
        7.38                  *******
 6.50         68.62
        5.54                  ******
 7.00         74.16
        5.54                  ******
 7.50         79.69
        3.69                  ****
 8.00         83.39
        4.62                  *****
 8.50         88.00
        2.77                  ***
 9.00         90.77
        3.69                  ****
 9.50         94.46
        1.85                  **
10.00         96.31
        3.69                  ****
12.00        100.00

  MEAN  ST.DEV. SKEWNESS KURTOSIS

   5.78     1.63     0.39    -0.29    KRUMBEIN+PETTIJOHN(1938) MONENT MEASURES
                                      FOR SIZE RANGE  3.0 TO  10.0 PHI

   5.96     1.82     0.45     1.25    FOLK GRAPHIC STATISTICAL PARAMETERS
                                          FOLK AND WARD,1957

PERCENTILES   MEDIAN  5.37     5TH  3.61     16TH  4.44     25TH  4.68

                              75TH  7.08     84TH  8.07     95TH  9.65

PER CENT  GRAVEL   0.0   SAND   9.54  SILT  74.55 ( 73.84)  CLAY  15.90 ( 16.61)

GRAVEL + SAND   9.54   SILT/(SILT+CLAY)  81.63PCT  GRAV+SAND/SILT+CLAY    0.11

LABELS SHEPARD -CLAYEY SILT FOLK(GMS)-MUD                  (SCS)-SILT
```

```
PITT541                          SIEVE, SH. PIP., SEDIGRAPH  SAMPLE WT.=  4.5500

   PHI   PCT. CUMPCT.
  3.50
         5.29               *****
  4.00          5.29
         7.73               ********
  4.50         13.02
        17.40               *****************
  5.00         30.41
        15.46               ***************
  5.50         45.88
         8.70               *********
  6.00         54.58
         9.66               **********
  6.50         64.24
         5.80               ******
  7.00         70.04
         5.80               ******
  7.50         75.84
         4.83               *****
  8.00         80.67
         3.87               ****
  8.50         84.54
         4.83               *****
  9.00         89.37
         2.90               ***
  9.50         92.27
         2.90               ***
 10.00         95.17
         4.83               *****
 12.00        100.00

   MEAN   ST.DEV. SKEWNESS KURTOSIS

    6.04    1.59     0.34    -0.49     KRUMBEIN+PETTIJOHN(1938) MONENT MEASURES
                                       FOR SIZE RANGE   4.0 TO  10.0 PHI

    6.25    1.87     0.41     1.19     FOLK GRAPHIC STATISTICAL PARAMETERS
                                           FOLK AND WARD,1957


 PERCENTILES   MEDIAN  5.74      5TH   3.97      16TH  4.59      25TH  4.84

                                 75TH  7.43      84TH  8.43      95TH  9.97


 PER CENT  GRAVEL   0.0   SAND   5.29  SILT  75.44 ( 75.38)  CLAY  19.27 ( 19.33)


 GRAVEL + SAND   5.29   SILT/(SILT+CLAY)  79.59PCT  GRAV+SAND/SILT+CLAY     0.06

 LABELS SHEPARD -SILT         FOLK(GMS)-MUD                 (SCS)-SILT
```

```
PITT542                          SIEVE, SH. PIP., SEDIGRAPH  SAMPLE WT.=  4.6900

  PHI  PCT. CUMPCT.
  3.50
        3.42                ***
  4.00         3.42
        6.76                *******
  4.50        10.18
       17.39                *****************
  5.00        27.56
       17.39                *****************
  5.50        44.95
       10.62                ***********
  6.00        55.57
       10.62                ***********
  6.50        66.20
        6.76                *******
  7.00        72.96
        5.80                ******
  7.50        78.75
        3.86                ****
  8.00        82.61
        3.86                ****
  8.50        86.48
        4.83                *****
  9.00        91.31
        2.90                ***
  9.50        94.20
        2.90                ***
 10.00        97.10
        2.90                ***
 12.00       100.00

   MEAN  ST.DEV. SKEWNESS KURTOSIS

    6.07    1.53    0.38   -0.31    KRUMBEIN+PETTIJOHN(1938) MONENT MEASURES
                                    FOR SIZE RANGE  4.0 TO  10.0 PHI

    6.19    1.71    0.40    1.18    FOLK GRAPHIC STATISTICAL PARAMETERS
                                        FOLK AND WARD,1957

 PERCENTILES   MEDIAN  5.74     5TH  4.12      16TH  4.67      25TH  4.93

                                75TH  7.18      84TH  8.18      95TH  9.64

 PER CENT  GRAVEL   0.0   SAND   3.41  SILT  78.98 ( 79.20)  CLAY  17.61 ( 17.39)

 GRAVEL + SAND   3.41    SILT/(SILT+CLAY)  82.00PCT  GRAV+SAND/SILT+CLAY     0.04

 LABELS SHEPARD -SILT        FOLK(GMS)-MUD                   (SCS)-SILT
```

```
PITT55                          SIEVE, SH. PIP., SEDIGRAPH  SAMPLE WT.=  4.0300

  PHI  PCT. CUMPCT.

 2.00
        0.99             *
 2.50          0.99
        1.99             **
 3.00          2.98
        3.48             ***
 3.50          6.46
        5.96             ******
 4.00         12.42
        7.01             *******
 4.50         19.43
       12.26             ************
 5.00         31.69
       19.27             *******************
 5.50         50.96
       10.51             ***********
 6.00         61.47
        8.76             *********
 6.50         70.22
        7.01             *******
 7.00         77.23
        5.25             *****
 7.50         82.48
        4.38             ****
 8.00         86.86
        3.50             ****
 8.50         90.37
        2.63             ***
 9.00         92.99
        2.63             ***
 9.50         95.62
        4.38             ****
12.00        100.00

  MEAN  ST.DEV. SKEWNESS KURTOSIS

   5.66     1.53      0.18     -0.19     KRUMBEIN+PETTIJOHN(1938) MONENT MEASURES
                                         FOR SIZE RANGE  2.5 TO   9.5 PHI

   5.80     1.78      0.28      1.34     FOLK GRAPHIC STATISTICAL PARAMETERS
                                              FOLK AND WARD,1957

PERCENTILES   MEDIAN  5.48      5TH  3.29      16TH  4.26      25TH  4.73

                                 75TH  6.84      84TH  7.67      95TH  9.38

PER CENT  GRAVEL   0.0   SAND  12.42  SILT  79.50 ( 74.44)  CLAY   8.07 ( 13.14)

GRAVEL + SAND  12.42   SILT/(SILT+CLAY)  85.00PCT  GRAV+SAND/SILT+CLAY     0.14

LABELS SHEPARD -CLAYEY SILT FOLK(GMS)-SANDY MUD           (SCS)-SANDY SILT
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```
PITT56                          SIEVE, SH. PIP., SEDIGRAPH  SAMPLE WT.=  4.8900

 PHI  PCT. CUMPCT.

 1.50
        0.41
 2.00          0.41
        0.61            *
 2.50          1.02
        2.04            **
 3.00          3.07
       11.45            ***********
 3.50         14.52
       13.91            **************
 4.00         28.43
       15.75            ****************
 4.50         44.17
       19.33            *******************
 5.00         63.50
       14.31            **************
 5.50         77.81
        9.30            *********
 6.00         87.12
        6.44            ******
 6.50         93.56
        3.58            ****
 7.00         97.14
        2.86            ***
12.00        100.00

 MEAN  ST.DEV. SKEWNESS KURTOSIS

  4.62    1.01     0.04    -0.47     KRUMBEIN+PETTIJOHN(1938) MONENT MEASURES
                                     FOR SIZE RANGE  2.0 TO   7.0 PHI

  4.68    1.12     0.09     0.91     FOLK GRAPHIC STATISTICAL PARAMETERS
                                         FOLK AND WARD,1957

PERCENTILES   MEDIAN  4.65      5TH  3.08      16TH  3.55      25TH  3.88

                                 75TH  5.40      84TH  5.83      95TH  6.70

PER CENT  GRAVEL   0.0   SAND  28.43  SILT   7.67 ( 71.57)  CLAY  63.91 (  0.0 )

GRAVEL + SAND  28.43   SILT/(SILT+CLAY) 100.00PCT  GRAV+SAND/SILT+CLAY     0.40

LABELS SHEPARD -SANDY SILT  FOLK(GMS)-SANDY MUD           (SCS)-SANDY SILT
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```
PITT57                          SIEVE, SH. PIP., SEDIGRAPH  SAMPLE WT.=  6.0000

  PHI  PCT. CUMPCT.

 1.50
        0.17
 2.00          0.17
        0.17
 2.50          0.33
        3.17            ***
 3.00          3.50
       13.83            **************
 3.50         17.33
       15.17            ***************
 4.00         32.50
       17.05            *****************
 4.50         49.55
       18.41            ******************
 5.00         67.95
       15.00            ***************
 5.50         82.95
        8.86            *********
 6.00         91.82
        4.77            *****
 6.50         96.59
        3.41            ***
12.00        100.00

  MEAN  ST.DEV. SKEWNESS KURTOSIS

   4.46    0.92    0.02   -0.74    KRUMBEIN+PETTIJOHN(1938) MONENT MEASURES
                                   FOR SIZE RANGE  2.0 TO   6.5 PHI

   4.51    1.02    0.05    0.84    FOLK GRAPHIC STATISTICAL PARAMETERS
                                        FOLK AND WARD,1957

PERCENTILES   MEDIAN  4.51      5TH  3.05      16TH  3.45      25TH  3.75

                                75TH  5.23      84TH  5.56      95TH  6.33

PER CENT  GRAVEL   0.0   SAND  32.50  SILT  15.42 ( 67.50)  CLAY  52.08 (  0.0 )

GRAVEL + SAND  32.50    SILT/(SILT+CLAY) 100.00PCT  GRAV+SAND/SILT+CLAY     0.48

LABELS SHEPARD -SANDY SILT  FOLK(GMS)-SANDY MUD            (SCS)-SANDY SILT
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```
    PITT641                    SIEVE, SH. PIP., SEDIGRAPH  SAMPLE WT.=  6.0600

      PHI   PCT. CUMPCT.
     1.50
           8.75            *********
     2.00        8.75
           0.99            *
     2.50        9.74
           2.64            ***
     3.00       12.39
           5.62            ******
     3.50       18.00
           7.27            *******
     4.00       25.27
           8.39            ********
     4.50       33.66
          11.44            ***********
     5.00       45.10
          15.25            ***************
     5.50       60.35
          12.96            *************
     6.00       73.31
           8.39            ********
     6.50       81.70
           6.10            ******
     7.00       87.80
           3.05            ***
     7.50       90.85
           3.81            ****
     8.00       94.66
           0.76            *
     8.50       95.42
           4.54            *****
     9.00       99.97
           0.01
     9.50       99.98
           0.02
    12.00      100.00

      MEAN  ST.DEV. SKEWNESS KURTOSIS

       5.06    1.74   -0.02    -0.24    KRUMBEIN+PETTIJOHN(1938) MOMENT MEASURES
                                        FOR SIZE RANGE  2.0 TO   9.5 PHI

       5.06    1.82   -0.07     1.41    FOLK GRAPHIC STATISTICAL PARAMETERS
                                           FOLK AND WARD,1957

    PERCENTILES   MEDIAN  5.16      5TH  1.79      16TH  3.32      25TH  3.98

                                   75TH  6.10      84TH  6.69      95TH  8.22

    PER CENT  GRAVEL   0.0   SAND  25.27  SILT  69.36 ( 69.39)  CLAY   5.37 (  5.34)

    GRAVEL + SAND  25.27    SILT/(SILT+CLAY)  92.86PCT  GRAV+SAND/SILT+CLAY     0.34


   LABELS SHEPARD -SANDY SILT   FOLK(GMS)-SANDY MUD           (SCS)-SANDY SILT
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 PITT642                        SIEVE, SH. PIP., SEDIGRAPH  SAMPLE WT.=  5.4800

  PHI  PCT. CUMPCT.

 1.50
        6.39                ******
 2.00          6.39
        0.73                *
 2.50          7.12
        2.01                **
 3.00          9.13
        3.47                ***
 3.50         12.60
        6.58                *******
 4.00         19.18
        7.42                *******
 4.50         26.60
       14.84                ***************
 5.00         41.45
       14.84                ***************
 5.50         56.29
       11.55                ************
 6.00         67.84
        9.07                *********
 6.50         76.91
        5.77                ******
 7.00         82.68
        5.77                ******
 7.50         88.45
        3.30                ***
 8.00         91.75
        3.30                ***
 8.50         95.05
        1.65                **
 9.00         96.70
        0.82                *
 9.50         97.53
        0.82                *
10.00         98.35
        1.65                **
12.00        100.00

  MEAN  ST.DEV. SKEWNESS KURTOSIS

   5.30     1.70   -0.01     0.04    KRUMBEIN+PETTIJOHN(1938) MOMENT MEASURES
                                     FOR SIZE RANGE  2.0 TO  10.0 PHI

   5.39     1.84    0.03     1.49    FOLK GRAPHIC STATISTICAL PARAMETERS
                                       FOLK AND WARD,1957

 PERCENTILES    MEDIAN  5.29      5TH  1.89      16TH  3.76      25TH  4.39

                                  75TH  6.39      84TH  7.11      95TH  8.49

 PER CENT  GRAVEL   0.0   SAND  19.18  SILT  72.60 ( 72.57)  CLAY   8.22 (  8.25)
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PITT65                          SIEVE, SH. PIP., SEDIGRAPH  SAMPLE WT.=  5.8100

  PHI  PCT. CUMPCT.

 2.50
        1.20            *
 3.00         1.20
        1.72            **
 3.50         2.93
        3.27            ***
 4.00         6.20
        4.69            *****
 4.50        10.89
        9.38            *********
 5.00        20.27
       15.01            ***************
 5.50        35.28
       15.01            ***************
 6.00        50.28
       11.26            ***********
 6.50        61.54
        8.44            ********
 7.00        69.98
        7.50            ********
 7.50        77.49
        4.69            *****
 8.00        82.18
        3.75            ****
 8.50        85.93
        2.81            ***
 9.00        88.74
        1.88            **
 9.50        90.62
        1.88            **
10.00        92.50
        1.88            **
10.50        94.37
        1.88            **
11.00        96.25
        3.75            ****
12.00       100.00

  MEAN  ST.DEV. SKEWNESS KURTOSIS

   6.23     1.67     0.33     0.30     KRUMBEIN+PETTIJOHN(1938) MOMENT MEASURES
                                       FOR SIZE RANGE  3.0 TO  11.0 PHI

   6.34     1.91     0.33     1.48     FOLK GRAPHIC STATISTICAL PARAMETERS
                                           FOLK AND WARD,1957

PERCENTILES   MEDIAN  5.99      5TH  3.82      16TH  4.77      25TH  5.16

                                75TH  7.33      84TH  8.24      95TH 10.67

PER CENT   GRAVEL   0.0    SAND    6.20  SILT   76.16 ( 75.98)  CLAY   17.64 ( 17.82)


GRAVEL + SAND   6.20    SILT/(SILT+CLAY)  81.00PCT  GRAV+SAND/SILT+CLAY     0.07
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PITT82                        SIEVE, SH. PIP., SEDIGRAPH  SAMPLE WT.=  3.7300

   PHI  PCT. CUMPCT.

  3.50
         0.80               *
  4.00          0.80
         0.99               *
  4.50          1.80
         7.94               ********
  5.00          9.73
        16.86               *****************
  5.50         26.60
        17.86               ******************
  6.00         44.45
        14.88               ***************
  6.50         59.33
         8.93               *********
  7.00         68.26
         8.93               *********
  7.50         77.19
         3.97               ****
  8.00         81.15
         4.96               *****
  8.50         86.11
         3.97               ****
  9.00         90.08
         2.98               ***
  9.50         93.06
         2.98               ***
 10.00         96.03
         3.97               ****
 12.00        100.00

   MEAN   ST.DEV. SKEWNESS KURTOSIS

    6.43     1.34     0.38    -0.11     KRUMBEIN+PETTIJOHN(1938) MOMENT MEASURES
                                        FOR SIZE RANGE  4.0 TO  10.0 PHI

    6.55     1.55     0.39     1.17     FOLK GRAPHIC STATISTICAL PARAMETERS
                                            FOLK AND WARD,1957


 PERCENTILES   MEDIAN  6.19      5TH  4.70      16TH  5.19      25TH  5.45

                                 75TH  7.38      84TH  8.29      95TH  9.83


 PER CENT  GRAVEL   0.0   SAND   0.80  SILT  80.43 ( 80.35)  CLAY  18.77 ( 18.85)


 GRAVEL + SAND   0.80    SILT/(SILT+CLAY)  81.00PCT  GRAV+SAND/SILT+CLAY     0.01

 LABELS SHEPARD -SILT        FOLK(GMS)-MUD                 (SCS)-SILT
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                                                                        ****                    ****
 PI++ 951       0   C.0    0   0.0     0                                ***   MULTIMODAL SAMPLE   ***
                                                                        ****                    ****
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             WET WT    DRY WT      SALT     ORGANIC   MOISTURE                 WEIGHT LOSS DUE TO HANDLING    0.0
          1000.0000    6.3900      0.0        0.0        0.0   (GRAMS)         GRAVEL CORRECTION FACTOR       1.000
           100.0000  100.0000      0.0        0.0        0.0   (PCT WET WT)    SIZES ELIMINATED (<0.01%)       NONE
                                                                               TRASK SORTING COEFFECIENT      2.242
                                                                               USING PROBABILITY EXTRAP.      2.224
                                                                               MEAN CUBED DEVIATION           9.380
                                                                               USING PROBABLITY EXTRAP.       5.372

 PERCENTAGE           TABLE OF STATISTICAL DATA IN PHI UNITS              PERCENTILES   LINFAR EXTRAP.          PROBABLILITY EXTRAP.
 COMPOSITION
                                    MEAN     STD DEV  SKEWNESS KURTOSIS                  MM.      PHI UNITS      MM.      PHI UNITS
 GRAVEL      0.0      MOMENT       4.74961  1.91004  1.34607  5.67573          5.0     0.17490    2.51538     0.17335    2.52825
 SAND       39.12     P-MOMENT     4.72235  1.76116  0.98339  3.97031         10.0     0.15370    2.70181     0.14729    2.76322
 SILT       55.33     FOLK         4.55532  1.71081  0.21660  1.00573         16.0     0.13162    2.92553     0.12951    2.94891
 CLAY        5.54     P-FOLK       4.55836  1.69731  0.21885  1.01146         25.0     0.10050    3.31470     0.09944    3.32996
 MUD        60.88     INMAN        4.61461  1.68908  0.10531  0.69245         50.0     0.04617    4.43674     0.04615    4.43747
 S/M         0.64     P-INMAN      4.61881  1.66990  0.10859  0.70418         75.0     0.01999    5.64453     0.02011    5.63616
                      KRUMBEIN              1.72580  0.04288  0.27225         84.0     0.01266    6.30569     0.01279    6.28870
                      P-KRUM.               1.70830  0.04559  0.27358         90.0     0.00792    6.98061     0.00793    6.97603
                      FOLK (TRANSFORMED)                      0.50143         95.0     0.00332    8.23277     0.00335    8.21986
                      P-FOLK (TRANSFORMED)                    0.50285

                                DATA FOR CONSTN OF BARGRAPHS AND CUM. CURVES

                       SIZE FRACTION        WT.(GMS)     WT.PCT.  WT.PCT.  MID PHI(LINEAR)  MID PHI(PROB.)  MODE
                        MM        PHI     UNCOR     COR    COR     CUMUL.     PHI      MM      PHI      MM

                      0.250000  2.000    0.100    0.100    1.565    1.565  1.751  0.29707  1.917  0.26483    0
                      0.177000  2.498    0.190    0.190    2.973    4.538  2.249  0.21036  2.302  0.20278    0
                      0.125000  3.000    0.860    0.860   13.459   17.997  2.749  0.14875  2.808  0.14280    1
                      0.088000  3.506    0.720    0.720   11.268   29.264  3.253  0.10488  3.270  0.10566    0
                      0.062500  4.000    0.630    0.630    9.859   39.124  3.753  0.07416  3.760  0.07381    0
                      0.044000  4.506    0.806    0.806   12.610   51.733  4.253  0.05244  4.255  0.05236    1
                      0.031000  5.012    0.491    0.491    7.682   59.415  4.759  0.03693  4.757  0.03698    0
                      0.022000  5.506    0.864    0.864   13.528   72.944  5.259  0.02612  5.249  0.02629    1*
                      0.015600  6.002    0.472    0.472    7.380   80.323  5.754  0.01853  5.743  0.01867    0
                      0.011000  6.506    0.393    0.393    6.149   86.472  6.254  0.01310  6.239  0.01324    0
                      0.007800  7.002    0.236    0.236    3.669   90.161  6.754  0.00926  6.740  0.00935    0
                      0.005500  7.506    0.157    0.157    2.460   92.621  7.254  0.00655  7.241  0.00661    0
                      0.003900  8.002    0.118    0.118    1.844   94.466  7.754  0.00463  7.740  0.00468    0
                      0.002700  8.533    0.079    0.079    1.230   95.696  8.268  0.00325  8.254  0.00328    0
                      0.001900  9.040    0.079    0.079    1.230   96.926  8.786  0.00227  8.769  0.00229    0
                      0.001380  9.501    0.039    0.039    0.615   97.541  9.270  0.00162  9.260  0.00163    0
                      0.000061 14.000    0.157    0.157    2.459  100.000 11.751  0.00029 10.218  0.00084    0
                    TOTALS               6.390    6.390  100.0
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                                                                                    ****                      ****
  P1++ 952        0   0.0     0   0.0      0                                        ***   MULTIMODAL SAMPLE    ***
                                                                                    ****                      ****
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              WET WT     DRY WT      SALT     ORGANIC   MOISTURE                WEIGHT LOSS DUE TO HANDLING      0.0
           1000.0000     5.7900      0.0        0.0        0.0    (GRAMS)       GRAVEL CORRECTION FACTOR         1.000
            100.0000   100.0000      0.0        0.0        0.0    (PCT WET WT)  SIZES ELIMINATED (<0.01%)        NONE
                                                                                TRASK SORTING COEFFECIENT        2.426
                                                                                USING PROBABILITY EXTRAP.        2.421
                                                                                MEAN CUBED DEVIATION            17.675
                                                                                USING PROBABLITY EXTRAP.        13.842

 PERCENTAGE          TABLE OF STATISTICAL DATA IN PHI UNITS                 PERCENTILES   LINEAR EXTRAP.            PROBABLILITY EXTRAP.
 COMPOSITION
                                    MEAN     STD DEV  SKEWNESS KURTOSIS                    MM.      PHI UNITS         MM.      PHI UNITS
 GRAVEL      0.0     MOMENT        5.15597  2.33109  1.39538  5.10602          5.0      0.17082    2.54946        0.16682    2.58360
 SAND       35.58    P-MOMENT      5.13887  2.22652  1.25405  4.44919         10.0      0.14731    2.76310        0.14130    2.82316
 SILT       54.00    FOLK          4.92506  2.15752  0.29696  1.21506         16.0      0.12302    3.02303        0.12269    3.02686
 CLAY       10.42    P-FOLK        4.92543  2.14984  0.30026  1.21529         25.0      0.08975    3.47796        0.08954    3.48139
 MUD        64.42    INMAN         5.03339  2.01036  0.16166  0.89156         50.0      0.03825    4.70839        0.03825    4.70837
 S/M         0.55    P-INMAN       5.03396  2.00710  0.16222  0.88469         75.0      0.01525    6.03483        0.01527    6.03274
                     KRUMBEIN               1.89398  0.04800  0.23891         84.0      0.00758    7.04375        0.00759    7.04107
                     P-KRUM.                1.88989  0.04869  0.24140         90.0      0.00361    8.11419        0.00363    8.10767
                     FOLK (TRANSFORMED)                       0.54936         95.0      0.00088   10.15487        0.00088   10.14913
                     P-FOLK (TRANSFORMED)                     0.54859

                               DATA FOR CONSTN OF BARGRAPHS AND CUM. CURVES

                       SIZE FRACTION      WT.(GMS)     WT.PCT. WT.PCT.  MID PHI(LINEAR)  MID PHI(PROB.)  MODE
                        MM       PHI    UNCOR    COR    COR    CUMUL.    PHI      MM      PHI      MM

                     0.250000  2.000   0.080   0.080   1.382    1.382  1.751  0.29707  1.916  0.26305     0
                     0.177000  2.498   0.140   0.140   2.418    3.800  2.249  0.21036  2.300  0.20306     0
                     0.125000  3.000   0.680   0.680  11.744   15.544  2.749  0.14875  2.811  0.14253     1
                     0.088000  3.506   0.580   0.580  10.017   25.561  3.253  0.10488  3.272  0.10354     0
                     0.062500  4.000   0.580   0.580  10.017   35.579  3.753  0.07416  3.762  0.07370     0
                     0.044000  4.506   0.764   0.764  13.191   48.769  4.253  0.05244  4.257  0.05229     1
                     0.031000  5.012   0.178   0.178   3.077   51.846  4.759  0.03693  4.759  0.03693     0
                     0.022000  5.506   0.867   0.867  14.967   66.814  5.259  0.02612  5.253  0.02622     1*
                     0.015600  6.002   0.452   0.452   7.808   74.622  5.754  0.01853  5.747  0.01863     0
                     0.011000  6.506   0.339   0.339   5.857   80.478  6.254  0.01310  6.245  0.01319     0
                     0.007800  7.002   0.188   0.188   3.254   83.732  6.754  0.00926  6.747  0.00931     0
                     0.005500  7.506   0.188   0.188   3.253   86.985  7.254  0.00655  7.245  0.00659     0
                     0.003900  8.002   0.151   0.151   2.603   89.588  7.754  0.00463  7.745  0.00466     0
                     0.002700  8.533   0.113   0.113   1.953   91.541  8.268  0.00325  8.257  0.00327     0
                     0.001900  9.040   0.075   0.075   1.301   92.842  8.786  0.00227  8.778  0.00228     0
                     0.001380  9.501   0.075   0.075   1.301   94.143  9.270  0.00162  9.261  0.00163     0
                     0.000980  9.995   0.038   0.038   0.651   94.794  9.748  0.00116  9.742  0.00117     0
                     0.000690 10.501   0.038   0.038   0.650   95.445 10.248  0.00082 10.241  0.00083     0
                     0.000490 10.995   0.038   0.038   0.651   96.096 10.748  0.00058 10.740  0.00058     1
                     0.000340 11.522   0.038   0.038   0.650   96.746 11.259  0.00041 11.249  0.00041     0
                     0.000061 14.000   0.188   0.188   3.254  100.000 12.761  0.00014 11.908  0.00026     0

                     TOTALS                5.790   5.790 100.0
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                                                                              ****                      ****
P1++ 97          0   0.0      0   0.0       0                                 ***    MULTIMODAL SAMPLE    ***
                                                                              ****                      ****
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                WET WT     DRY WT       SALT     ORGANIC    MOISTURE                     WEIGHT LOSS DUE TO HANDLING      0.0
             1000.0000     6.0100       0.0        0.0        0.0   (GRAMS)              GRAVEL CORRECTION FACTOR         1.000
              100.0000   100.0000       0.0        0.0        0.0   (PCT WET WT)         SIZES ELIMINATED (<0.01%)         NONE
                                                                                         TRASK SORTING COEFFECIENT        1.743
                                                                                         USING PROBABILITY EXTRAP.        1.732
                                                                                         MEAN CUBED DEVIATION            12.479
                                                                                         USING PROBABLITY EXTRAP.         7.249


PERCENTAGE          TABLE OF STATISTICAL DATA IN PHI UNITS                  PERCENTILES   LINEAR EXTRAP.           PROBABLILITY EXTRAP.
COMPOSITION
                                  MEAN     STD DEV  SKEWNESS  KURTOSIS                       MM.      PHI UNITS       MM.      PHI UNITS
GRAVEL      0.0     MOMENT       4.50460   1.76030   2.28783   9.36697          5.0      0.15035    2.73359      0.14137    2.82240
SAND       45.26    P-MOMENT     4.47299   1.57140   1.86831   6.89688         10.0      0.12296    3.02368      0.12202    3.03475
SILT       49.61    FOLK         4.26561   1.38597   0.35018   1.36292         16.0      0.10948    3.19119      0.10624    3.23461
CLAY        5.13    P-FOLK       4.27898   1.36080   0.37602   1.35473         25.0      0.09198    3.44246      0.09134    3.45736
MUD        54.74    INMAN        4.34791   1.15672   0.21344   1.30402         50.0      0.05827    4.10102      0.05840    4.09797
S/M         0.83    P-INMAN      4.36948   1.13487   0.23924   1.30697         75.0      0.03028    5.04528      0.03036    5.04143
                    KRUMBEIN               1.18727   0.14286   0.24082         84.0      0.02203    5.50463      0.02203    5.50435
                    P-KRUM.                1.17339   0.15142   0.23959         90.0      0.01225    6.35145      0.01234    6.34056
                    FOLK (TRANSFORMED)                         0.57679         95.0      0.00374    8.06381      0.00375    8.05863
                    P-FOLK (TRANSFORMED)                       0.57532


                              DATA FOR CONSTN OF BARGRAPHS AND CUM. CURVES

                    SIZE FRACTION        WT.(GMS)     WT.PCT.  WT.PCT.   MID PHI(LINEAR)    MID PHI(PROB.)   MODE
                      MM        PHI     UNCOR    COR    COR     CUMUL.    PHI       MM       PHI      MM

                   0.250000   2.000    0.030    0.030    0.499    0.499  1.751   0.29707   1.902   0.26756      0
                   0.177000   2.498    0.050    0.050    0.832    1.331  2.249   0.21036   2.301   0.20296      0
                   0.125000   3.000    0.470    0.470    7.820    9.151  2.749   0.14875   2.835   0.14011      0
                   0.088000   3.506    1.090    1.090   18.136   27.288  3.253   0.10488   3.295   0.10185      1
                   0.062500   4.000    1.080    1.080   17.970   45.258  3.753   0.07416   3.764   0.07362      0
                   0.044000   4.506    1.428    1.428   23.766   69.024  4.253   0.05244   4.246   0.05270      1*
                   0.031000   5.012    0.319    0.319    5.315   74.339  4.759   0.03693   4.753   0.03708      0
                   0.022000   5.506    0.583    0.583    9.694   84.033  5.259   0.02612   5.242   0.02643      1
                   0.015600   6.002    0.240    0.240    3.992   88.025  5.754   0.01853   5.742   0.01863      0
                   0.011000   6.506    0.171    0.171    2.851   90.876  6.254   0.01310   6.242   0.01321      0
                   0.007800   7.002    0.103    0.103    1.711   92.587  6.754   0.00926   6.745   0.00933      0
                   0.005500   7.506    0.103    0.103    1.710   94.298  7.254   0.00655   7.242   0.00661      0
                   0.003900   8.002    0.034    0.034    0.570   94.868  7.754   0.00463   7.749   0.00465      0
                   0.002700   8.533    0.069    0.069    1.141   96.008  8.268   0.00325   8.254   0.00328      1
                   0.001900   9.040    0.034    0.034    0.571   96.579  8.766   0.00227   8.778   0.00228      0
                   0.001360   9.501    0.034    0.034    0.570   97.149  9.270   0.00162   9.262   0.00163      0
                   0.000061  14.000    0.171    0.171    2.851  100.000 11.751   0.00029  10.209   0.00084      0
                 TOTALS                6.010    6.010  100.0
     0.250000     0.010000
     0.177000     0.010000
     0.125000     0.110000
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                                                                                         ****                      ****
P1++ 98          0   0.0     0   0.0       0                                             ***   MULTIMODAL SAMPLE    ***
                                                                                         ****                      ****
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                                                                                   WEIGHT LOSS DUE TO HANDLING      0.0
              WET WT     DRY WT       SALT      ORGANIC    MOISTURE                GRAVEL CORRECTION FACTOR         1.000
           1000.0000     6.7700       0.0         0.0        0.0    (GRAMS)        SIZES ELIMINATED (<0.01%)         NONE
            100.0000   100.0000       0.0         0.0        0.0    (PCT WET WT)   TRASK SORTING COEFFECIENT        1.801
                                                                                   USING PROBABILITY EXTRAP.        1.782
                                                                                   MEAN CUBED DEVIATION             8.605
                                                                                   USING PROBABLITY EXTRAP.         4.133


PERCENTAGE           TABLE OF STATISTICAL DATA IN PHI UNITS                  PERCENTILES   LINEAR EXTRAP.          PROBABLILITY EXTRAP.
COMPOSITION
                                   MEAN    STD DEV SKEWNESS KURTOSIS                          MM.     PHI UNITS        MM.      PHI UNITS
GRAVEL      0.0      MOMENT       5.26624  1.73119  1.65843  6.55374             5.0        0.10766   3.21544        0.10213   3.29147
SAND       19.06     P-MOMENT     5.22036  1.52912  1.15610  4.27895            10.0        0.08548   3.54833        0.08478   3.56005
SILT       73.65     FOLK         5.11119  1.49720  0.26747  1.31726            16.0        0.06946   3.84762        0.06833   3.87139
CLAY        7.29     P-FOLK       5.11869  1.47607  0.26043  1.31773            25.0        0.05608   4.15642        0.05531   4.17634
MUD        80.94     INMAN        5.18855  1.34094  0.17309  1.03455            50.0        0.03221   4.95645        0.03219   4.95716
S/M         0.24     P-INMAN      5.19945  1.32806  0.18244  1.01780            75.0        0.01729   5.85407        0.01742   5.84324
                     KRUMBEIN              1.25752  0.04879  0.22412            84.0        0.01082   6.52949        0.01084   6.52751
                     P-KRUM.               1.23474  0.05263  0.22151            90.0        0.00619   7.33570        0.00625   7.32265
                     FOLK (TRANSFORMED)                      0.56846            95.0        0.00245   8.67187        0.00249   8.65097
                     P-FOLK (TRANSFORMED)                    0.56854


                                  DATA FOR CONSTN OF BARGRAPHS AND CUM. CURVES

                      SIZE FRACTION       WT.(GMS)     WT.PCT. WT.PCT.  MID PHI(LINEAR)   MID PHI(PROB.)  MODE
                      MM        PHI    UNCOR     COR     COR    CUMUL.    PHI       MM      PHI       MM

                   0.250000   2.000    0.010    0.010    0.148    0.148  1.751  0.29707  1.875  0.27265    0
                   0.177000   2.498    0.010    0.010    0.148    0.295  2.249  0.21036  2.287  0.20483    0
                   0.125000   3.000    0.110    0.110    1.625    1.920  2.749  0.14875  2.840  0.13963    0
                   0.088000   3.506    0.490    0.490    7.238    9.158  3.253  0.10488  3.326  0.09973    0
                   0.062500   4.000    0.670    0.670    9.897   19.055  3.753  0.07416  3.783  0.07262    0
                   0.044000   4.506    1.303    1.303   19.244   38.298  4.253  0.05244  4.274  0.05169    1*
                   0.031000   5.012    0.885    0.889   13.134   51.433  4.759  0.03693  4.762  0.03686    0
                   0.022000   5.506    1.096    1.096   16.189   67.622  5.259  0.02612  5.253  0.02623    1
                   0.015600   6.002    0.712    0.712   10.523   78.145  5.754  0.01853  5.742  0.01368    0
                   0.011000   6.506    0.384    0.384    5.666   83.811  6.254  0.01310  6.243  0.01321    0
                   0.007800   7.002    0.274    0.274    4.047   87.858  6.754  0.00926  6.742  0.00934    0
                   0.005500   7.506    0.219    0.219    3.238   91.096  7.254  0.00655  7.240  0.00661    0
                   0.003900   8.002    0.110    0.110    1.619   92.715  7.754  0.00463  7.745  0.00466    0
                   0.002700   8.533    0.110    0.110    1.619   94.334  8.268  0.00325  8.255  0.00327    0
                   0.001900   9.040    0.164    0.164    2.428   96.762  8.786  0.00227  8.758  0.00231    0
                   0.000061  14.000    0.219    0.219    3.238  100.000 11.520  0.00034  9.812  0.00111    0
                  TOTALS               6.770    6.770  100.0
       0.250000        0.020000
       0.177000        0.020000
       0.125000        0.210000
       0.088000        0.670000
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 P1++ 99       0   0.0    0   0.0      0                                             ***    MULTIMODAL SAMPLE   ***
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           WET WT     DRY WT       SALT     ORGANIC    MOISTURE                  WEIGHT LOSS DUE TO HANDLING     0.0
        1000.0000     5.4300       0.0        0.0        0.0    (GRAMS)          GRAVEL CORRECTION FACTOR        1.000
         100.0000   100.0000       0.0        0.0        0.0    (PCT WET WT)     SIZES ELIMINATED (<0.01%)        NONE
                                                                                 TRASK SORTING COEFFECIENT       2.193
                                                                                 USING PROBABILITY EXTRAP.       2.176
                                                                                 MEAN CUBED DEVIATION           16.012
                                                                                 USING PROBABLITY EXTRAP.       11.598

  PERCENTAGE          TABLE OF STATISTICAL DATA IN PHI UNITS               PERCENTILES   LINEAR EXTRAP.         PROBABLILITY EXTRAP.
  COMPOSITION
                                       MEAN     STD DEV SKEWNESS KURTOSIS                      MM.      PHI UNITS        MM.     PHI UNITS
  GRAVEL       0.0    MOMENT          5.33060   2.19224  1.51979  5.34212          5.0      0.12360    3.01623       0.12263    3.02757
  SAND        31.12   P-MOMENT        5.30534   2.06007  1.32656  4.44995         10.0      0.10721    3.22142       0.10293    3.28023
  SILT        58.21   FOLK            5.11276   1.92846  0.31398  1.26067         16.0      0.09039    3.46764       0.08963    3.47989
  CLAY        10.66   P-FOLK          5.11580   1.92270  0.31674  1.27099         25.0      0.07245    3.78682       0.07148    3.80624
  MUD         68.88   INMAN           5.21293   1.74529  0.17218  0.99634         50.0      0.03321    4.91242       0.03320    4.91256
  S/M          0.45   P-INMAN         5.21742   1.73753  0.17546  1.00169         75.0      0.01507    6.05220       0.01510    6.04924
                      KRUMBEIN                  1.67806  0.00709  0.22545         84.0      0.00804    6.95822       0.00806    6.95495
                      P-KRUM.                   1.66148  0.01518  0.22618         90.0      0.00329    8.24550       0.00331    8.23863
                      FOLK (TRANSFORMED)                          0.55765         95.0      0.00099    9.98463       0.00099    9.98357
                      P-FOLK (TRANSFORMED)                        0.55966


                                 DATA FOR CONSTN OF BARGRAPHS AND CUM. CURVES

                       SIZE FRACTION       WT.(GMS)     WT.PCT. WT.PCT.  MID PHI(LINEAR)  MID PHI(PROB.)  MODE
                        MM        PHI    UNCOR     COR    COR    CUMUL.     PHI     MM       PHI     MM

                      0.250000   2.000   0.020   0.020   0.368   0.368  1.751  0.29707  1.897  0.26858     0
                      0.177000   2.498   0.020   0.020   0.368   0.737  2.249  0.21036  2.287  0.20494     0
                      0.125000   3.000   0.210   0.210   3.867   4.604  2.749  0.14875  2.836  0.14009     0
                      0.088000   3.506   0.670   0.670  12.339  16.943  3.253  0.10488  3.310  0.10083     0
                      0.062500   4.000   0.770   0.770  14.180  31.123  3.753  0.07416  3.774  0.07312     0
                      0.044000   4.506   0.801   0.801  14.758  45.881  4.253  0.05244  4.260  0.05218     1*
                      0.031000   5.012   0.278   0.278   5.124  51.006  4.759  0.03693  4.759  0.03692     0
                      0.022000   5.506   0.733   0.733  13.491  64.496  5.259  0.02612  5.255  0.02619     1
                      0.015600   6.002   0.540   0.540   9.941  74.437  5.754  0.01853  5.745  0.01864     0
                      0.011000   6.506   0.308   0.308   5.680  80.118  6.254  0.01310  6.245  0.01318     0
                      0.007800   7.002   0.231   0.231   4.261  84.378  6.754  0.00926  6.745  0.00932     0
                      0.005500   7.506   0.116   0.116   2.130  86.508  7.254  0.00655  7.248  0.00658     0
                      0.003900   8.002   0.154   0.154   2.841  89.349  7.754  0.00463  7.744  0.00466     1
                      0.002700   8.533   0.077   0.077   1.420  90.769  8.268  0.00325  8.261  0.00326     0
                      0.001900   9.040   0.077   0.077   1.421  92.190  8.786  0.00227  8.778  0.00228     1
                      0.001380   9.501   0.077   0.077   1.420  93.610  9.270  0.00162  9.262  0.00163     0
                      0.000980   9.995   0.077   0.077   1.420  95.029  9.748  0.00116  9.736  0.00117     0
                      0.000690  10.501   0.039   0.039   0.710  95.739 10.248  0.00082 10.240  0.00083     0
                      0.000490  10.995   0.039   0.039   0.710  96.449 10.748  0.00058 10.739  0.00059     0
                      0.000061  14.000   0.193   0.193   3.551 100.000 12.497  0.00017 11.460  0.00036     0
                    TOTALS               5.430   5.430 100.0
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     P1++ 100        0   0.0     0   0.0      0                                        ***   MULTIMODAL SAMPLE  ***
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              WET WT     DRY WT       SALT     ORGANIC   MOISTURE                   WEIGHT LOSS DUE TO HANDLING     0.0
           1000.0000     4.7200       0.0        0.0       0.0     (GRAMS)          GRAVEL CORRECTION FACTOR        1.000
            100.0000   100.0000       0.0        0.0       0.0     (PCT WET WT)     SIZES ELIMINATED (<0.01%)        NONE
                                                                                    TRASK SORTING COEFFECIENT       2.195
                                                                                    USING PROBABILITY EXTRAP.       2.182
                                                                                    MEAN CUBED DEVIATION           12.218
                                                                                    USING PROBABLITY EXTRAP.        7.380


     PERCENTAGE          TABLE OF STATISTICAL DATA IN PHI UNITS             PERCENTILES   LINEAR EXTRAP.        PROBABLILITY EXTRAP.
   . COMPOSITION
                                     MEAN      STD DEV SKEWNESS KURTOSIS                    MM.     PHI UNITS        MM.     PHI UNITS
     GRAVEL     0.0      MOMENT      5.09805   2.07450  1.36855  5.37042          5.0    0.16576   2.59280     0.16121   2.63301
     SAND      33.05     P-MOMENT    5.05963   1.91164  1.05644  4.07106         10.0    0.13111   2.93116     0.12931   2.95103
     SILT      58.82     FOLK        4.90006   1.87253  0.18781  1.23182         16.0    0.10562   3.24303     0.10364   3.27035
     CLAY       8.12     P-FOLK      4.90657   1.85647  0.19445  1.23268         25.0    0.07917   3.65892     0.07850   3.67107
     MUD       66.95     INMAN       4.92217   1.67914  0.03951  1.03006         50.0    0.03453   4.85583     0.03453   4.85601
     S/M        0.49     P-INMAN     4.93186   1.66151  0.04565  1.03721         75.0    0.01643   5.92716     0.01649   5.92183
                         KRUMBEIN              1.68018 -0.06279  0.24599         84.0    0.01030   6.60131     0.01036   6.59336
                         P-KRUM.               1.66723 -0.05956  0.24529         90.0    0.00537   7.54152     0.00538   7.53897
                         FOLK (TRANSFORMED)                      0.55193         95.0    0.00147   9.41031     0.00148   9.40272
                         P-FOLK (TRANSFORMED)                    0.55211


                                  DATA FOR CONSTN OF BARGRAPHS AND CUM. CURVES

                          SIZE FRACTION       WT.(GMS)     WT.PCT. WT.PCT.  MID PHI(LINEAR)  MID PHI(PROB.)  MODE
                           MM        PHI    UNCOR     COR     COR    CUMUL.     PHI       MM     PHI      MM

                         0.250000  2.000    0.080    0.080    1.695    1.695  1.751  0.29707  1.918  0.26469     0
                         0.177000  2.498    0.090    0.090    1.907    3.602  2.249  0.21036  2.288  0.20482     0
                         0.125000  3.000    0.350    0.350    7.415   11.017  2.749  0.14875  2.801  0.14350     0
                         0.088000  3.506    0.490    0.490   10.381   21.398  3.253  0.10488  3.280  0.10293     0
                         0.062500  4.000    0.550    0.550   11.653   33.051  3.753  0.07416  3.766  0.07348     0
                         0.044000  4.506    0.590    0.590   12.492   45.542  4.253  0.05244  4.259  0.05224     1
                         0.031000  5.012    0.304    0.304    6.444   51.986  4.759  0.03693  4.759  0.03692     0
                         0.022000  5.506    0.734    0.734   15.554   67.540  5.259  0.02612  5.253  0.02623     1*
                         0.015600  6.002    0.415    0.415    8.791   76.332  5.754  0.01853  5.745  0.01865     0
                         0.011000  6.506    0.319    0.319    6.762   83.093  6.254  0.01310  6.242  0.01322     0
                         0.007800  7.002    0.223    0.223    4.734   87.827  6.754  0.00926  6.741  0.00935     0
                         0.005500  7.506    0.096    0.096    2.029   89.856  7.254  0.00655  7.246  0.00659     0
                         0.003900  8.002    0.096    0.096    2.029   91.885  7.754  0.00463  7.744  0.00466     1
                         0.002700  8.533    0.032    0.032    0.677   92.562  8.268  0.00325  8.263  0.00325     0
                         0.001900  9.040    0.064    0.064    1.353   93.914  8.786  0.00227  8.776  0.00228     1
                         0.001380  9.501    0.064    0.064    1.352   95.266  9.270  0.00162  9.259  0.00163     0
                         0.000980  9.995    0.064    0.064    1.353   96.619  9.748  0.00116  9.731  0.00118     0
                         0.000061 14.000    0.160    0.160    3.381  100.000 11.997  0.00024 10.617  0.00064     0
                       TOTALS               4.720    4.720  100.0
        0.250000       0.010000
        0.177000       0.010000
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PI++ 101       0   0.0    0   0.0     0                                             ***    MULTIMODAL SAMPLE   ***
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          WET WT     DRY WT      SALT     ORGANIC   MOISTURE                        WEIGHT LOSS DUE TO HANDLING     0.0
        1000.0000    4.8400      0.0        0.0       0.0    (GRAMS)                GRAVEL CORRECTION FACTOR        1.000
         100.0000  100.0000      0.0        0.0       0.0    (PCT WET WT)           SIZES ELIMINATED (<0.01%)        NONE
                                                                                    TRASK SORTING COEFFECIENT       2.126
                                                                                    USING PROBABILITY EXTRAP.       2.111
                                                                                    MEAN CUBED DEVIATION           10.845
                                                                                    USING PROBABLITY EXTRAP.        5.890


PERCENTAGE          TABLE OF STATISTICAL DATA IN PHI UNITS              PERCENTILES   LINEAR EXTRAP.         PROBABLILITY EXTRAP.
COMPOSITION
                              MEAN     STD DEV  SKEWNESS KURTOSIS                     MM.      PHI UNITS       MM.      PHI UNITS
GRAVEL     0.0      MOMENT    5.52242  2.01606  1.32339  5.18020          5.0       0.12375   3.01445      0.12310   3.02204
SAND      21.69     P-MOMENT  5.47572  1.83114  0.95931  3.76718         10.0       0.10109   3.30621      0.09816   3.34874
SILT      69.49     FOLK      5.38578  1.87543  0.23600  1.19936         16.0       0.07912   3.65986      0.07819   3.67688
CLAY       8.81     P-FOLK    5.38791  1.86673  0.23842  1.20819         25.0       0.05576   4.16463      0.05532   4.17596
MUD       78.31     INMAN     5.48106  1.82120  0.15694  0.74826         50.0       0.02729   5.19524      0.02731   5.19443
S/M        0.28     P-INMAN   5.48466  1.80779  0.16055  0.75761         75.0       0.01234   6.34061      0.01242   6.33160
                    KRUMBEIN           1.61184  0.05738  0.23710         84.0       0.00634   7.30225      0.00638   7.29245
                    P-KRUM.            1.59677  0.05935  0.23792         90.0       0.00420   7.89491      0.00425   7.87886
                    FOLK (TRANSFORMED)                   0.54532         95.0       0.00150   9.38232      0.00150   9.37680
                    P-FOLK (TRANSFORMED)                 0.54714


                              DATA FOR CONSTN OF BARGRAPHS AND CUM. CURVES

                     SIZE FRACTION      WT.(GMS)      WT.PCT. WT.PCT.  MID PHI(LINEAR)   MID PHI(PROB.)   MODE
                      MM        PHI    UNCOR    COR     COR    CUMUL.     PHI     MM       PHI      MM

                    0.250000  2.000   0.010   0.010   0.207    0.207  1.751  0.29707  1.884  0.27096     0
                    0.177000  2.498   0.010   0.010   0.207    0.413  2.249  0.21036  2.287  0.20487     0
                    0.125000  3.000   0.210   0.210   4.339    4.752  2.749  0.14875  2.857  0.13801     0
                    0.088000  3.506   0.420   0.420   8.678   13.430  3.253  0.10488  3.301  0.10149     1
                    0.062500  4.000   0.400   0.400   8.264   21.694  3.753  0.07416  3.772  0.07321     0
                    0.044000  4.506   0.492   0.492  10.166   31.861  4.253  0.05244  4.265  0.05200     0
                    0.031000  5.012   0.591   0.591  12.207   44.067  4.759  0.03693  4.765  0.03677     0
                    0.022000  5.506   0.774   0.774  15.981   60.049  5.259  0.02612  5.258  0.02614     1*
                    0.015600  6.002   0.464   0.464   9.588   69.636  5.754  0.01853  5.748  0.01861     0
                    0.011000  6.506   0.387   0.387   7.991   77.627  6.254  0.01310  6.244  0.01319     0
                    0.007800  7.002   0.193   0.193   3.995   81.622  6.754  0.00926  6.747  0.00931     0
                    0.005500  7.506   0.193   0.193   3.996   85.618  7.254  0.00655  7.244  0.00660     0
                    0.003900  8.002   0.271   0.271   5.593   91.211  7.754  0.00463  7.733  0.00470     1
                    0.002700  8.533   0.077   0.077   1.598   92.809  8.268  0.00325  8.257  0.00327     0
                    0.001900  9.040   0.077   0.077   1.598   94.407  8.786  0.00227  8.774  0.00228     0
                    0.001380  9.501   0.039   0.039   0.799   95.206  9.270  0.00162  9.263  0.00163     0
                    0.000980  9.995   0.039   0.039   0.800   96.005  9.748  0.00116  9.739  0.00117     0
                    0.000061 14.000   0.193   0.193   3.995  100.000 11.997  0.00024 10.610  0.00064     0
                  TOTALS              4.840   4.840 100.0
     0.250000     0.020000
     0.177000     0.020000
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PI++ 102      0   0.0    0   0.0      0                                             ***   MULTIMODAL SAMPLE    ***
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              WET WT     DRY WT      SALT     ORGANIC   MOISTURE                    WEIGHT LOSS DUE TO HANDLING      0.0
            1000.0000     5.4100     0.0        0.0        0.0    (GRAMS)           GRAVEL CORRECTION FACTOR         1.000
             100.0000   100.0000     0.0        0.0        0.0    (PCT WET WT)      SIZES ELIMINATED (<0.01%)         NONE
                                                                                    TRASK SORTING COEFFECIENT        2.017
                                                                                    USING PROBABILITY EXTRAP.        2.002
                                                                                    MEAN CUBED DEVIATION            12.881
                                                                                    USING PROBABLITY EXTRAP.         7.662

 PERCENTAGE          TABLE OF STATISTICAL DATA IN PHI UNITS               PERCENTILES   LINEAR EXTRAP.          PROBABLILITY EXTRAP.
 COMPOSITION
                                   MEAN    STD DEV  SKEWNESS KURTOSIS                      MM.       PHI UNITS       MM.       PHI UNITS
 GRAVEL     0.0      MOMENT       5.08636  1.97381  1.67507  6.37854          5.0       0.13293    2.91127       0.12919    2.95247
 SAND      30.31     P-MOMENT     5.04873  1.79259  1.33018  4.78206         10.0       0.11359    3.13814       0.10966    3.18889
 SILT      61.86     FOLK         4.84776  1.71079  0.26086  1.23885         16.0       0.09868    3.34105       0.09590    3.38230
 CLAY       7.83     P-FOLK       4.86036  1.69333  0.27275  1.24351         25.0       0.07580    3.72170       0.07517    3.73370
 MUD       69.69     INMAN        4.90792  1.56687  0.11519  0.95312         50.0       0.03775    4.72744       0.03776    4.72710
 S/M        0.44     P-INMAN      4.92698  1.54468  0.12940  0.96756         75.0       0.01863    5.74650       0.01875    5.73706
                     KRUMBEIN              1.49985  0.00666  0.23910         84.0       0.01124    6.47479       0.01127    6.47167
                     P-KRUM.               1.48397  0.00828  0.24001         90.0       0.00604    7.37236       0.00608    7.36245
                     FOLK (TRANSFORMED)                      0.55334         95.0       0.00191    9.03183       0.00191    9.03099
                     P-FOLK (TRANSFORMED)                    0.55427

                                 DATA FOR CONSTN OF BARGRAPHS AND CUM. CURVES

                       SIZE FRACTION       WT.(GMS)     WT.PCT. WT.PCT.  MID PHI(LINEAR)  MID PHI(PROB.)  MODE
                        MM        PHI    UNCOR    COR     COR    CUMUL.    PHI      MM     PHI      MM

                     0.250000   2.000    0.020   0.020   0.370   0.370   1.751  0.29707  1.897  0.26656    1
                     0.177000   2.498    0.020   0.020   0.370   0.739   2.249  0.21036  2.287  0.20494    0
                     0.125000   3.000    0.280   0.280   5.176   5.915   2.749  0.14875  2.844  0.13931    0
                     0.088000   3.506    0.810   0.810  14.972  20.687   3.253  0.10488  3.306  0.10111    1*
                     0.062500   4.000    0.510   0.510   9.427  30.314   3.753  0.07416  3.765  0.07355    0
                     0.044000   4.506    0.726   0.726  13.424  43.738   4.253  0.05244  4.261  0.05217    0
                     0.031000   5.012    0.774   0.774  14.308  58.046   4.759  0.03693  4.758  0.03695    1
                     0.022000   5.506    0.731   0.731  13.510  71.556   5.259  0.02612  5.250  0.02627    0
                     0.015600   6.002    0.385   0.385   7.111  78.667   5.754  0.01853  5.745  0.01865    0
                     0.011000   6.506    0.308   0.308   5.689  84.356   6.254  0.01310  6.242  0.01321    0
                     0.007800   7.002    0.192   0.192   3.555  87.911   6.754  0.00926  6.743  0.00933    0
                     0.005500   7.506    0.154   0.154   2.845  90.756   7.254  0.00655  7.242  0.00561    0
                     0.003900   8.002    0.077   0.077   1.422  92.178   7.754  0.00463  7.747  0.00466    0
                     0.002700   8.533    0.077   0.077   1.422  93.601   8.268  0.00325  8.257  0.00327    1
                     0.001900   9.040    0.077   0.077   1.421  95.022   8.786  0.00227  8.774  0.00228    0
                     0.001360   9.501    0.038   0.038   0.712  95.734   9.270  0.00162  9.263  0.00163    0
                     0.000980   9.995    0.038   0.038   0.711  96.445   9.748  0.00116  9.739  0.00117    0
                     0.000061  14.000    0.192   0.192   3.555 100.000  11.997  0.00024 10.614  0.00064    0
                   TOTALS                5.410   5.410 100.0
    0.250000       0.040000
    0.177000       0.040000
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   P1++ 103      0   0.0     0   0.0      0                                       ***    MULTIMODAL SAMPLE    ***
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              WET WT     DRY WT      SALT     ORGANIC   MOISTURE                 WEIGHT LOSS DUE TO HANDLING     0.0
           1000.0000     5.2300      0.0        0.0       0.0    (GRAMS)         GRAVEL CORRECTION FACTOR        1.000
            100.0000   100.0000      0.0        0.0       0.0    (PCT WET WT)    SIZES ELIMINATED (<0.01%)       NONE
                                                                                 TRASK SORTING COEFFECIENT       2.322
                                                                                 USING PROBABILITY EXTRAP.       2.303
                                                                                 MEAN CUBED DEVIATION           13.387
                                                                                 USING PROBABLITY EXTRAP.        8.913


   PERCENTAGE          TABLE OF STATISTICAL DATA IN PHI UNITS                PERCENTILES   LINEAR EXTRAP.            PROBABLILITY EXTRAP.
   COMPOSITION
                                     MEAN    STD DEV  SKEWNESS KURTOSIS                       MM.     PHI UNITS       MM.      PHI UNITS
   GRAVEL     0.0      MOMENT       5.42565  2.16972  1.27502  4.62765             5.0     0.13451   2.89417       0.13122   2.92994
   SAND      28.87     P-MOMENT     5.39094  2.04531  1.04163  3.67795            10.0     0.11036   3.17974       0.10678   3.22725
   SILT      59.62     FOLK         5.28508  2.01018  0.23695  1.17038            16.0     0.09185   3.44456       0.09082   3.46080
   CLAY      11.51     P-FOLK       5.28703  1.99569  0.24147  1.17304            25.0     0.07015   3.83338       0.06944   3.84807
   MUD       71.13     INMAN        5.36103  1.91647  0.11889  0.81136            50.0     0.02849   5.13318       0.02852   5.13193
   S/M        0.41     P-INMAN      5.36458  1.90377  0.12221  0.80932            75.0     0.01301   6.26456       0.01309   6.25496
                       KRUMBEIN              1.80088 -0.08421  0.22622            84.0     0.00645   7.27749       0.00649   7.26835
                       P-KRUM.               1.78288 -0.08041  0.22600            90.0     0.00266   8.55334       0.00266   8.55226
                       FOLK (TRANSFORMED)                      0.53925            95.0     0.00109   9.83695       0.00111   9.81902
                       P-FOLK (TRANSFORMED)                    0.53982


                                   DATA FOR CONSTN OF BARGRAPHS AND CUM. CURVES

                         SIZE FRACTION      WT.(GMS)      WT.PCT. WT.PCT.  MID PHI(LINEAR)   MID PHI(PROB.)   MODE
                          MM       PHI    UNCOR     COR     COR    CUMUL.    PHI      MM      PHI      MM

                       0.250000  2.000    0.040    0.040    0.765    0.765  1.751  0.29707  1.909  0.26635     0
                       0.177000  2.498    0.040    0.040    0.765    1.530  2.249  0.21036  2.286  0.20505     0
                       0.125000  3.000    0.230    0.230    4.398    5.927  2.749  0.14875  2.815  0.14214     0
                       0.088000  3.506    0.600    0.600   11.472   17.400  3.253  0.10488  3.300  0.10152     0
                       0.062500  4.000    0.630    0.600   11.472   28.872  3.753  0.07416  3.771  0.07327     0
                       0.044000  4.506    0.658    0.658   12.579   41.451  4.253  0.05244  4.261  0.05214     1
                       0.031000  5.012    0.244    0.244    4.663   46.115  4.759  0.03693  4.760  0.03690     0
                       0.022000  5.506    0.827    0.827   15.807   61.922  5.259  0.02612  5.256  0.02616     1*
                       0.015600  6.002    0.488    0.488    9.339   71.261  5.754  0.01853  5.747  0.01861     0
                       0.011000  6.506    0.376    0.376    7.185   78.447  6.254  0.01310  6.245  0.01319     0
                       0.007800  7.002    0.188    0.188    3.592   82.038  6.754  0.00926  6.747  0.00931     0
                       0.005500  7.506    0.188    0.188    3.593   85.631  7.254  0.00655  7.245  0.00659     1
                       0.003900  8.002    0.150    0.150    2.874   88.505  7.754  0.00463  7.745  0.00466     0
                       0.002700  8.533    0.075    0.075    1.437   89.942  8.268  0.00325  8.261  0.00326     0
                       0.001900  9.040    0.075    0.075    1.437   91.379  8.786  0.00227  8.779  0.00228     0
                       0.001380  9.501    0.113    0.113    2.155   93.534  9.270  0.00162  9.258  0.00163     0
                       0.000980  9.995    0.113    0.113    2.156   95.689  9.748  0.00116  9.728  0.00118     1
                       0.000690 10.501    0.038    0.038    0.718   96.407 10.248  0.00082 10.239  0.00083     0
                       0.000061 14.000    0.188    0.188    3.593  100.000 12.251  0.00021 11.042  0.00047     0
                     TOTALS               5.230    5.230  100.0
      0.250000     0.010000
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   PI++ 104        0   0.0     0   0.0      0                                      ***    MULTIMODAL SAMPLE  ***
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              WET WT     DRY WT      SALT     ORGANIC    MOISTURE                 WEIGHT LOSS DUE TO HANDLING     0.0
            1000.0000    5.4300      0.0        0.0        0.0   (GRAMS)          GRAVEL CORRECTION FACTOR        1.000
             100.0000  100.0000      0.0        0.0        0.0   (PCT WET WT)     SIZES ELIMINATED (<0.01%)        NONE
                                                                                  TRASK SORTING COEFFECIENT       1.958
                                                                                  USING PROBABILITY EXTRAP.       1.936
                                                                                  MEAN CUBED DEVIATION           10.132
                                                                                  USING PROBABLITY EXTRAP.        4.940

 . PERCENTAGE        TABLE OF STATISTICAL DATA IN PHI UNITS                PERCENTILES   LINEAR EXTRAP.         PROBABLILITY EXTRAP.
   COMPOSITION
                                MEAN    STD DEV SKEWNESS KURTOSIS                        MM.      PHI UNITS      MM.      PHI UNITS
   GRAVEL     0.0    MOMENT    4.98991  1.80668  1.71812  6.62580               5.0    0.11947    3.06524     0.11558    3.11305
   SAND      33.52   P-MOMENT  4.94479  1.59203  1.22423  4.29290              10.0    0.10447    3.25887     0.09961    3.32748
   SILT      60.37   FOLK      4.78595  1.52050  0.40064  1.10450              16.0    0.08893    3.49122     0.08858    3.49694
   CLAY       6.12   P-FOLK    4.78548  1.50650  0.40603  1.10872              25.0    0.07409    3.75449     0.07291    3.77781
   MUD       66.48   INMAN     4.94883  1.45761  0.33522  0.79239              50.0    0.04543    4.46021     0.04539    4.46143
   S/M        0.50   P-INMAN   4.94751  1.45057  0.33509  0.77724              75.0    0.01933    5.69335     0.01945    5.68373
                     KRUMBEIN           1.43620  0.26371  0.24844              84.0    0.01179    6.40644     0.01186    6.39808
                     P-KRUM.            1.41179  0.26934  0.24931              90.0    0.00699    7.16100     0.00704    7.14987
                     FOLK (TRANSFORMED)                   0.52483              95.0    0.00319    8.29045     0.00324    8.26907
                     P-FOLK (TRANSFORMED)                 0.52578

                               DATA FOR CONSTN OF BARGRAPHS AND CUM. CURVES

                      SIZE FRACTION      WT.(GMS)     WT.PCT. WT.PCT.  MID PHI(LINEAR)  MID PHI(PROB.)  MODE
                      MM          PHI   UNCOR    COR    COR    CUMUL.   PHI       MM     PHI      MM

                     0.250000  2.000   0.010   0.010   0.184   0.184  1.751  0.29707  1.881  0.27151     0
                     0.177000  2.498   0.010   0.010   0.184   0.368  2.249  0.21036  2.287  0.20485     0
                     0.125000  3.000   0.160   0.160   2.947   3.315  2.749  0.14875  2.851  0.13865     0
                     0.088000  3.506   0.710   0.710  13.076  16.390  3.253  0.10488  3.323  0.09996     0
                     0.062500  4.000   0.930   0.930  17.127  33.518  3.753  0.07416  3.777  0.07297     0
                     0.044000  4.506   0.985   0.985  18.134  51.652  4.253  0.05244  4.259  0.05224     1*
                     0.031000  5.012   0.378   0.378   6.966  58.618  4.759  0.03693  4.758  0.03697     0
                     0.022000  5.506   0.737   0.737  13.568  72.186  5.259  0.02612  5.250  0.02628     1
                     0.015600  6.002   0.405   0.405   7.462  79.648  5.754  0.01853  5.744  0.01866     0
                     0.011000  6.506   0.295   0.295   5.427  85.076  6.254  0.01310  6.242  0.01321     0
                     0.007800  7.002   0.221   0.221   4.070  89.145  6.754  0.00926  6.741  0.00935     0
                     0.005500  7.506   0.147   0.147   2.714  91.859  7.254  0.00655  7.241  0.00661     0
                     0.003900  8.002   0.110   0.110   2.035  93.894  7.754  0.00463  7.741  0.00468     0
                     0.002700  8.533   0.111   0.111   2.036  95.930  8.268  0.00325  8.246  0.00329     1
                     0.001900  9.040   0.037   0.037   0.678  96.608  8.786  0.00227  8.777  0.00228     0
                     0.000061 14.000   0.184   0.184   3.392 100.000 11.520  0.00034  9.810  0.00111     0
                    TOTALS             5.430   5.430 100.0
      0.250000    0.020000
      0.177000    0.020000
      0.125000    0.190000
      0.088000    0.810000
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 P1++ 115A     0   0.0     0   0.0     0                          ****************************
                                                                  ****                    ****
                                                                  ***   MULTIMODAL SAMPLE  ***
                                                                  ****                    ****
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           WET WT     DRY WT       SALT     ORGANIC   MOISTURE               WEIGHT LOSS DUE TO HANDLING     0.0
        1000.0000     4.2400       0.0         0.0        0.0  (GRAMS)       GRAVEL CORRECTION FACTOR        1.000
         100.0000   100.0000       0.0         0.0        0.0  (PCT WET WT)  SIZES ELIMINATED (<0.01%)        NONE
                                                                             TRASK SORTING COEFFECIENT       1.777
                                                                             USING PROBABILITY EXTRAP.       1.769
                                                                             MEAN CUBED DEVIATION           11.550
                                                                             USING PROBABLITY EXTRAP.        6.598

 PERCENTAGE         TABLE OF STATISTICAL DATA IN PHI UNITS             PERCENTILES   LINEAR EXTRAP.          PROBABLILITY EXTRAP.
 COMPOSITION
                                   MEAN    STD DEV  SKEWNESS KURTOSIS                  MM.      PHI UNITS       MM.      PHI UNITS
 GRAVEL     0.0     MOMENT       4.58070  1.72858  2.23617  9.26206          5.0     0.12919    2.95245      0.12735    2.97308
 SAND      47.64    P-MOMENT     4.55306  1.54303  1.79597  6.68905         10.0     0.11492    3.12126      0.11042    3.17887
 SILT      47.94    FOLK         4.37085  1.34299  0.44121  1.18163         16.0     0.10293    3.28029      0.09892    3.33764
 CLAY       4.41    P-FOLK       4.38490  1.32036  0.45895  1.18334         25.0     0.08739    3.51641      0.08729    3.51802
 MUD       52.36    INMAN        4.51655  1.23626  0.35357  0.93489         50.0     0.05915    4.07945      0.05920    4.07834
 S/M        0.91    P-INMAN      4.53819  1.20055  0.38303  0.97932         75.0     0.02767    5.17572      0.02789    5.16400
                    KRUMBEIN              1.22912  0.26661  0.25528         84.0     0.01854    5.75282      0.01873    5.73874
                    P-KRUM.               1.21924  0.26267  0.25903         90.0     0.01208    6.37125      0.01221    6.35602
                    FOLK (TRANSFORMED)                      0.54163         95.0     0.00469    7.73652      0.00472    7.72562
                    P-FOLK (TRANSFORMED)                    0.54199

                              DATA FOR CONSTN OF BARGRAPHS AND CUM. CURVES

                     SIZE FRACTION       WT.(GMS)      WT.PCT. WT.PCT.  MID PHI(LINEAR)   MID PHI(PROB.)   MODE
                      MM        PHI    UNCOR     COR     COR    CUMUL.    PHI       MM      PHI      MM

                   0.250000   2.000    0.020    0.020   0.472    0.472  1.751  0.29707  1.901  0.26774     0
                   0.177000   2.498    0.020    0.020   0.472    0.943  2.249  0.21036  2.287  0.20497     0
                   0.125000   3.000    0.190    0.190   4.481    5.425  2.749  0.14875  2.832  0.14048     0
                   0.088000   3.506    0.810    0.810  19.104   24.528  3.253  0.10488  3.314  0.10056     0
                   0.062500   4.000    0.980    0.980  23.113   47.642  3.753  0.07416  3.767  0.07344     1*
                   0.044000   4.506    0.637    0.637  15.027   62.669  4.253  0.05244  4.250  0.05256     0
                   0.031000   5.012    0.391    0.391   9.223   71.892  4.759  0.03693  4.752  0.03712     0
                   0.022000   5.506    0.397    0.397   9.369   81.261  5.259  0.02612  5.245  0.02637     1
                   0.015600   6.002    0.234    0.234   5.512   86.772  5.754  0.01853  5.740  0.01871     0
                   0.011000   6.506    0.187    0.187   4.409   91.182  6.254  0.01310  6.236  0.01327     0
                   0.007800   7.002    0.070    0.070   1.653   92.835  6.754  0.00926  6.745  0.00933     0
                   0.005500   7.506    0.070    0.070   1.653   94.488  7.254  0.00655  7.241  0.00661     1
                   0.003900   8.002    0.047    0.047   1.103   95.591  7.754  0.00463  7.743  0.00467     0
                   0.002700   8.533    0.023    0.023   0.551   96.142  8.268  0.00325  8.260  0.00326     0
                   0.001900   9.040    0.023    0.023   0.552   96.693  8.786  0.00227  8.778  0.00228     1
                   0.001380   9.501    0.023    0.023   0.551   97.244  9.270  0.00162  9.262  0.00163     0
                   0.000061  14.000    0.117    0.117   2.756  100.000 11.751  0.00029 10.211  0.00084     0
                 TOTALS                4.240    4.240 100.0
 0.250000       0.050000
 0.177000       0.020000
 0.125000       0.190000
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 P1++ 1158     0   0.0    0   0.0     0                                   ******************************
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                                                                          ***    MULTIMODAL SAMPLE   ***
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           WET WT      DRY WT     SALT     ORGANIC    MOISTURE                        WEIGHT LOSS DUE TO HANDLING    0.0
         1000.0000     6.2900     0.0        0.0        0.0    (GRAMS)                GRAVEL CORRECTION FACTOR       1.000
          100.0000   100.0000     0.0        0.0        0.0    (PCT WET WT)           SIZES ELIMINATED (<0.01%)       NONE
                                                                                      TRASK SORTING COEFFECIENT      1.925
                                                                                      USING PROBABILITY EXTRAP.      1.913
                                                                                      MEAN CUBED DEVIATION          10.794
                                                                                      USING PROBABLITY EXTRAP.       5.238

 PERCENTAGE          TABLE OF STATISTICAL DATA IN PHI UNITS                    PERCENTILES   LINEAR EXTRAP.           PROBABLILITY EXTRAP.
 COMPOSITION
                                     MEAN    STD DEV SKEWNESS KURTOSIS                        MM.       PHI UNITS        MM.      PHI UNITS
 GRAVEL     0.0      MOMENT        5.21379  1.86293  1.66949  6.79074            5.0        0.12088    3.04840        0.11874    3.07415
 SAND      26.23     P-MOMENT      5.16084  1.64495  1.17674  4.74734           10.0        0.09959    3.32778        0.09661    3.37172
 SILT      67.48     FOLK          5.02099  1.59659  0.19652  1.25864           16.0        0.08176    3.61253        0.08064    3.63230
 CLAY       6.29     P-FOLK        5.02698  1.58596  0.20184  1.26323           25.0        0.06455    3.95333        0.06423    3.96069
 MUD       73.77     INMAN         5.04721  1.43468  0.05481  1.02242           50.0        0.03194    4.96857        0.03192    4.96945
 S/M        0.36     P-INMAN       5.05575  1.42345  0.06063  1.02675           75.0        0.01742    5.84290        0.01755    5.83266
                     KRUMBEIN               1.39968 -0.07046  0.24649           84.0        0.01119    6.48188        0.01121    6.47920
                     P-KRUM.                1.38665 -0.07277  0.24788           90.0        0.00699    7.16068        0.00705    7.14774
                     FOLK (TRANSFORMED)                       0.55726           95.0        0.00216    8.85144        0.00218    8.84409
                     P-FOLK (TRANSFORMED)                     0.55815

                          DATA FOR CONSTN OF BARGRAPHS AND CUM. CURVES

                  SIZE FRACTION       WT.(GMS)      WT.PCT.  WT.PCT.  MID PHI(LINEAR)   MID PHI(PROB.)  MODE
                    MM       PHI    UNCOR     COR     COR    CUMUL.    PHI      MM       PHI      MM

                 0.250000  2.000    0.050    0.050    0.795    0.795  1.751  0.29707   1.909  0.26826    1
                 0.177000  2.498    0.020    0.020    0.318    1.113  2.249  0.21036   2.267  0.20772    0
                 0.125000  3.000    0.190    0.190    3.021    4.134  2.749  0.14875   2.814  0.14219    0
                 0.088000  3.506    0.570    0.570    9.062   13.196  3.253  0.10488   3.306  0.10111    0
                 0.062500  4.000    0.820    0.820   13.037   26.232  3.753  0.07416   3.779  0.07287    1
                 0.044000  4.506    0.586    0.586    9.309   35.541  4.253  0.05244   4.262  0.05214    0
                 0.031000  5.012    0.994    0.994   15.804   51.345  4.759  0.03693   4.763  0.03682    0
                 0.022000  5.506    1.086    1.086   17.265   68.610  5.259  0.02612   5.252  0.02625    1*
                 0.015600  6.002    0.592    0.592    9.417   78.026  5.754  0.01853   5.743  0.01867    0
                 0.011000  6.506    0.395    0.395    6.278   84.304  6.254  0.01310   6.241  0.01322    0
                 0.007800  7.002    0.296    0.296    4.709   89.014  6.754  0.00926   6.739  0.00936    0
                 0.005500  7.506    0.197    0.197    3.139   92.153  7.254  0.00655   7.239  0.00662    0
                 0.003900  8.002    0.099    0.099    1.569   93.722  7.754  0.00463   7.744  0.00467    0
                 0.002700  8.533    0.049    0.049    0.785   94.506  8.268  0.00325   8.261  0.00326    0
                 0.001900  9.040    0.049    0.049    0.785   95.292  8.786  0.00227   8.778  0.00228    1
                 0.001380  9.501    0.049    0.049    0.785   96.076  9.270  0.00162   9.262  0.00163    0
                 0.000061 14.000    0.247    0.247    3.924  100.000 11.751  0.00029  10.192  0.00085    0
               TOTALS               6.290    6.290  100.0
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PI++ 116A      0   0.0     0   0.0      0                                           ***   MULTIMODAL SAMPLE   ***
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              WET WT     DRY WT       SALT      ORGANIC    MOISTURE                WEIGHT LOSS DUE TO HANDLING      0.0
           1000.0000     5.9300       C.0         0.0         0.0    (GRAMS)       GRAVEL CORRECTION FACTOR         1.000
             99.9999   100.0000       0.0         0.0         0.0    (PCT WET WT)  SIZES ELIMINATED (<0.01%)        NONE
                                                                                   TRASK SORTING COEFFECIENT        1.848
                                                                                   USING PROBABILITY EXTRAP.        1.835
                                                                                   MEAN CUBED DEVIATION            10.817
                                                                                   USING PROBABLITY EXTRAP.         5.243

PERCENTAGE          TABLE OF STATISTICAL DATA IN PHI UNITS                 PERCENTILES   LINEAR EXTRAP.          PROBABLILITY EXTRAP.
COMPOSITION
                                 MEAN   STD DEV SKEWNESS KURTOSIS                          MM.      PHI UNITS        MM.       PHI UNITS
GRAVEL      0.0     MOMENT      5.15673 1.80248  1.84723  7.73735              5.0      0.11391    3.13405       0.10968     3.18857
SAND       25.63    P-MOMENT    5.10501 1.57916  1.33131  5.52828             10.0      0.08992    3.47526       0.08928     3.48546
SILT       68.23    FOLK        4.95639 1.49148  0.18272  1.30527             16.0      0.07766    3.68668       0.07583     3.72107
CLAY        6.14    P-FOLK      4.96211 1.46894  0.19179  1.30543             25.0      0.06340    3.97941       0.06321     3.98375
MUD        74.37    INMAN       4.96015 1.27347  0.00884  1.21497             50.0      0.03238    4.94888       0.03236     4.94971
S/M         0.34    P-INMAN     4.96830 1.24723  0.01491  1.23660             75.0      0.01857    5.75073       0.01877     5.73530
                    KRUMBEIN            1.31208 -0.08381  0.27039             84.0      0.01329    6.23361       0.01346     6.21554
                    P-KRUM.             1.29744 -0.09019  0.26996             90.0      0.00929    6.75071       0.00942     6.72960
                    FOLK (TRANSFORMED)                    0.56621             95.0      0.00228    8.77542       0.00229     8.76768
                    P-FOLK (TRANSFORMED)                  0.56624

                                DATA FOR CONSTN OF BARGRAPHS AND CUM. CURVES

                      SIZE FRACTION      WT.(GMS)     WT.PCT. WT.PCT.  MID PHI(LINEAR)  MID PHI(PRCB.)  MODE
                        MM       PHI    UNCOR    CCR    COR    CUMUL.    PHI      MM      PHI     MM

                    0.250000  2.000   0.070   0.070   1.180    1.180  1.751  0.29707  1.914  0.26536     1
                    0.177000  2.498   0.030   0.030   0.506    1.686  2.249  0.21036  2.268  0.20760     0
                    0.125000  3.000   0.080   0.080   1.349    3.035  2.749  0.14875  2.780  0.14362     0
                    0.088000  3.506   0.440   0.440   7.420   10.455  3.253  0.10488  3.311  0.10076     0
                    0.062500  4.000   0.900   0.900  15.177   25.632  3.753  0.07416  3.787  0.07242     1
                    0.044000  4.506   0.734   0.734  12.373   38.005  4.253  0.05244  4.264  0.05206     0
                    0.031000  5.012   0.812   0.812  13.694   51.699  4.759  0.03693  4.762  0.03686     0
                    0.022000  5.506   1.046   1.046  17.634   69.333  5.259  0.02612  5.251  0.02626     1*
                    0.015600  6.002   0.682   0.682  11.500   80.833  5.754  0.01853  5.739  0.01873     0
                    0.011000  6.506   0.409   0.409   6.901   87.734  6.254  0.01310  6.236  0.01327     0
                    0.007800  7.002   0.273   0.273   4.599   92.333  6.754  0.00926  6.733  0.00940     0
                    0.005500  7.506   0.046   0.046   0.767   93.100  7.254  0.00655  7.249  0.00657     0
                    0.003900  8.002   0.045   0.045   0.766   93.867  7.754  0.00463  7.749  0.00465     0
                    0.002700  8.533   0.045   0.045   0.766   94.633  8.268  0.00325  8.261  0.00326     0
                    0.001900  9.040   0.045   0.045   0.766   95.400  8.786  0.00227  8.778  0.00228     0
                    0.001380  9.501   0.045   0.045   0.767   96.167  9.270  0.00162  9.262  0.00163     0
                    0.000061 14.000   0.227   0.227   3.833  100.000 11.751  0.00029 10.193  0.00085     0
                  TOTALS              5.930   5.930 100.0
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P1++ 116B      0   0.0     0   0.0      0                                 ***    MULTIMODAL SAMPLE   ***
                                                                          ****                      ****
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          WET WT     DRY WT      SALT     ORGANIC   MOISTURE              WEIGHT LOSS DUE TO HANDLING      0.0
       1000.0000     4.8900      0.0        0.0       0.0   (GRAMS)       GRAVEL CORRECTION FACTOR         1.000
         99.9999   100.0000      0.0        0.0       0.0   (PCT WET WT)  SIZES ELIMINATED (<0.01%)        NONE
                                                                          TRASK SORTING COEFFECIENT        1.957
                                                                          USING PROBABILITY EXTRAP.        1.945
                                                                          MEAN CUBED DEVIATION            13.643
                                                                          USING PROBABLITY EXTRAP.         9.070

PERCENTAGE           TABLE OF STATISTICAL DATA IN PHI UNITS              PERCENTILES   LINEAR EXTRAP.            PROBABLILITY EXTRAP.
COMPOSITION
                                MEAN   STD DEV SKEWNESS KURTOSIS                    MM.       PHI UNITS      MM.      PHI UNITS
GRAVEL    0.0     MOMENT       5.89548  2.13343  1.40491  5.23066         5.0     0.09685    3.36806      0.09532    3.39106
SAND     11.86    P-MOMENT     5.85612  1.98350  1.16222  4.31919        10.0     0.06934    3.85024      0.06811    3.87592
SILT     74.77    FOLK         5.70610  1.93011  0.37507  1.54871        16.0     0.05334    4.22859      0.05248    4.25214
CLAY     13.37    P-FOLK       5.71438  1.91940  0.38101  1.55666        25.0     0.04028    4.63364      0.03989    4.64769
MUD      88.14    INMAN        5.86983  1.64124  0.29928  1.23082        50.0     0.02404    5.37665      0.02401    5.38021
S/M       0.13    P-INMAN      5.88146  1.62933  0.30764  1.23750        75.0     0.01051    6.57143      0.01054    6.56733
                  KRUMBEIN              1.43540  0.22389  0.19866        84.0     0.00548    7.51107      0.00548    7.51079
                  P-KRUM.               1.42195  0.22730  0.19817        90.0     0.00236    8.72731      0.00237    8.71941
                  FOLK (TRANSFORMED)                      0.60764        95.0     0.00061   10.69068      0.00061   10.68230
                  P-FOLK (TRANSFORMED)                    0.60886

                              DATA FOR CONSTN OF BARGRAPHS AND CUM. CURVES

              SIZE FRACTION       WT.(GMS)     WT.PCT.  WT.PCT.  MID PHI(LINEAR)   MID PHI(PROB.)  MODE
               MM      PHI     UNCOR    COR     COR     CUMUL.    PHI      MM       PHI      MM

           0.250000  2.000    0.040   0.040    0.818    0.818   1.751  0.29707   1.910  0.26618     1
           0.177000  2.498    0.040   0.040    0.818    1.636   2.249  0.21036   2.286  0.20507     0
           0.125000  3.000    0.070   0.070    1.431    3.067   2.749  0.14875   2.782  0.14541     0
           0.088000  3.506    0.130   0.130    2.658    5.726   3.253  0.10488   3.285  0.10262     0
           0.062500  4.000    0.300   0.300    6.135   11.861   3.753  0.07416   3.786  0.07248     0
           0.044000  4.506    0.448   0.448    9.168   21.029   4.253  0.05244   4.276  0.05160     0
           0.031000  5.012    0.771   0.771   15.761   36.789   4.759  0.03693   4.776  0.03651     0
           0.022000  5.506    0.871   0.871   17.806   54.595   5.259  0.02612   5.262  0.02606     1*
           0.015600  6.002    0.522   0.522   10.683   65.278   5.754  0.01853   5.750  0.01858     0
           0.011000  6.506    0.435   0.435    8.904   74.182   6.254  0.01310   6.246  0.01313     0
           0.007800  7.002    0.305   0.305    6.231   80.413   6.754  0.00926   6.745  0.00933     0
           0.005500  7.506    0.174   0.174    3.561   83.974   7.254  0.00655   7.246  0.00659     0
           0.003900  8.002    0.131   0.131    2.671   86.645   7.754  0.00463   7.747  0.00466     0
           0.002700  8.523    0.131   0.131    2.672   89.317   8.268  0.00325   8.257  0.00327     1
           0.001900  9.040    0.087   0.087    1.780   91.097   8.786  0.00227   8.778  0.00228     0
           0.001380  9.501    0.087   0.087    1.780   92.877   9.270  0.00162   9.261  0.00163     1
           0.000980  9.995    0.044   0.044    0.891   93.768   9.748  0.00116   9.742  0.00117     0
           0.000690 10.501    0.044   0.044    0.891   94.658  10.248  0.00082  10.240  0.00083     1
           0.000490 10.995    0.044   0.044    0.890   95.548  10.748  0.00058  10.739  0.00059     0
           0.000061 14.000    0.218   0.218    4.452  100.000  12.497  0.00017  11.453  0.00036     0
         TOTALS                4.890   4.890  100.0
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                                                                                  ****                    ****
  PI++ 118        0   0.0     0   0.0       0                                     ***   MULTIMODAL SAMPLE   ***
                                                                                  ****                    ****
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                WET WT     DRY WT       SALT     ORGANIC    MOISTURE                    WEIGHT LOSS DUE TO HANDLING    0.0
             1000.0000     4.8300       0.0        0.0        0.0    (GRAMS)            GRAVEL CORRECTION FACTOR       1.000
              100.0000   100.0000       0.0        0.0        0.0    (PCT WET WT)       SIZES ELIMINATED (<0.01%)       NONE
                                                                                        TRASK SORTING COEFFECIENT      1.443
                                                                                        USING PROBABILITY EXTRAP.      1.428
                                                                                        MEAN CUBED DEVIATION           7.686
                                                                                        USING PROBABLITY EXTRAP.       5.293


  PERCENTAGE            TABLE OF STATISTICAL DATA IN PHI UNITS                   PERCENTILES   LINEAR EXTRAP.         PROBABLILITY EXTRAP.
  COMPOSITION
                                           MEAN      STD DEV  SKEWNESS KURTOSIS                      MM.       PHI UNITS        MM.       PHI UNITS
  GRAVEL       0.0      MOMENT           3.82359   1.48994   2.32373  10.20519         5.0       0.17297     2.53142       0.16799     2.57357
  SAND        75.57     P-MOMENT         3.82697   1.38361   1.99818   7.45830        10.0       0.16155     2.62995       0.15216     2.71635
  SILT        22.06     FOLK.            3.76933   1.25574   0.54434   1.65215        16.0       0.14884     2.74818       0.14071     2.82919
  CLAY         2.37     P-FOLK           3.79157   1.22255   0.57257   1.68106        25.0       0.13162     2.92553       0.12896     2.95494
  MUD         24.43     INMAN            3.96596   1.21778   0.48439   0.75285        50.0       0.09632     3.37608       0.09603     3.38043
  S/M          3.09     P-INMAN          3.99714   1.16796   0.52803   0.80426        75.0       0.06317     3.98456       0.06326     3.98244
                        KRUMBEIN                   0.78446   0.07896   0.17496        84.0       0.02751     5.18375       0.02787     5.16510
                        P-KRUM.                    0.76111   0.08826   0.17556        90.0       0.01983     5.65636       0.02002     5.64271
                        FOLK (TRANSFORMED)                              0.62295        95.0       0.00897     6.80060       0.00905     6.78817
                        P-FOLK (TRANSFORMED)                            0.62701


                                 DATA FOR CONSTN OF BARGRAPHS AND CUM. CURVES

                         SIZE FRACTION        WT.(GMS)     WT.PCT.  WT.PCT.   MID PHI(LINEAR)   MID PHI(PROB.)   MODE
                          MM         PHI     UNCOR     COR     COR     CUMUL.     PHI      MM       PHI      MM

                        0.250000   2.000    0.080    0.080    1.656    1.656   1.751  0.29707  1.917  0.26473      0
                        0.177000   2.498    0.080    0.080    1.656    3.313   2.249  0.21036  2.285  0.20523      0
                        0.125000   3.000    1.230    1.230   25.466   28.778   2.749  0.14875  2.830  0.14064      0
                        0.088000   3.506    1.380    1.380   28.571   57.350   3.253  0.10488  3.262  0.10426      1*
                        0.062500   4.000    0.880    0.880   18.219   75.569   3.753  0.07416  3.740  0.07486      0
                        0.044000   4.506    0.210    0.210    4.348   79.917   4.253  0.05244  4.246  0.05270      0
                        0.031000   5.012    0.069    0.069    1.432   81.349   4.759  0.03693  4.756  0.03701      0
                        0.022000   5.506    0.368    0.368    7.618   88.967   5.259  0.02612  5.237  0.02651      1
                        0.015600   6.002    0.165    0.165    3.415   92.382   5.754  0.01853  5.737  0.01874      0
                        0.011000   6.506    0.089    0.089    1.839   94.221   6.254  0.01310  6.241  0.01322      0
                        0.007800   7.002    0.063    0.063    1.314   95.534   6.754  0.00926  6.742  0.00934      0
                        0.005500   7.506    0.051    0.051    1.051   96.585   7.254  0.00655  7.241  0.00661      0
                        0.003900   8.002    0.051    0.051    1.051   97.636   7.754  0.00463  7.735  0.00469      0
                        0.002700   8.533    0.038    0.038    0.788   98.423   8.268  0.00325  8.245  0.00330      0
                        0.001900   9.040    0.025    0.025    0.526   98.949   8.786  0.00227  8.764  0.00230      0
                        0.000061  14.000    0.051    0.051    1.051  100.000  11.520  0.00034  9.910  0.00104      0
                      TOTALS                4.830    4.830  100.0
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3334

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  PITT119                          SIEVE, SH. PIP., SEDIGRAPH  SAMPLE WT.=  4.8800

     PHI   PCT.  CUMPCT.
    3.50
            2.05             **
    4.00           2.05
            2.00             **
    4.50           4.05
            9.99             **********
    5.00          14.05
           17.99             ******************
    5.50          32.04
           17.99             ******************
    6.00          50.03
           14.99             ***************
    6.50          65.02
            9.00             *********
    7.00          74.01
            6.00             ******
    7.50          80.01
            6.00             ******
    8.00          86.01
            4.00             ****
    8.50          90.01
            2.00             **
    9.00          92.00
            2.00             **
    9.50          94.00
            1.00             *
   10.00          95.00
            5.00             *****
   12.00         100.00

     MEAN   ST.DEV. SKEWNESS KURTOSIS

     6.15     1.24     0.35     0.21     KRUMBEIN+PETTIJOHN(1938) MONENT MEASURES
                                         FOR SIZE RANGE   4.0 TO   10.0 PHI

     6.30     1.52     0.39     1.29     FOLK GRAPHIC STATISTICAL PARAMETERS
                                              FOLK AND WARD,1957

   PERCENTILES   MEDIAN  6.00      5TH  4.55      16TH  5.05      25TH  5.30

                                   75TH  7.08      84TH  7.83      95TH 10.00

   PER CENT  GRAVEL   0.0   SAND   2.05  SILT  84.10 ( 83.96)  CLAY  13.85 ( 13.99)

   GRAVEL + SAND   2.05   SILT/(SILT+CLAY)  85.71PCT  GRAV+SAND/SILT+CLAY     0.02

   LABELS SHEPARD -SILT        FOLK(GMS)-MUD                  (SCS)-SILT
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PITT120                              SIEVF, SH. PIP., SEDIGRAPH  SAMPLE WT.=  4.7100

  PHI  PCT. CUMPCT.
 3.50
        0.21
 4.00          0.21
        2.99              ***
 4.50          3.21
        7.98              ********
 5.00         11.19
       18.96              *******************
 5.50         30.15
       14.97              ***************
 6.00         45.12
       12.97              *************
 6.50         58.09
        6.99              *******
 7.00         65.07
        4.99              *****
 7.50         70.06
        3.99              ****
 8.00         74.06
        2.99              ***
 8.50         77.05
        2.99              ***
 9.00         80.04
        3.99              ****
 9.50         84.03
        2.99              ***
10.00         87.03
        2.99              ***
10.50         90.02
        2.00              **
11.00         92.02
        3.99              ****
11.50         96.01
        3.99              ****
12.00        100.00

  MEAN  ST.DEV. SKEWNESS KURTOSIS

   6.73    1.88    0.49   -0.09    KRUMBEIN+PETTIJOHN(1938) MONENT MEASURES
                                   FOR SIZE RANGE  4.0 TO  11.5 PHI

   6.94    2.12    0.52    1.29    FOLK GRAPHIC STATISTICAL PARAMETERS
                                       FOLK AND WARD,1957

PERCENTILES   MEDIAN  6.19     5TH  4.61     16TH  5.13     25TH  5.36

                              75TH  8.16     84TH  9.50     95TH 11.37

PER CENT  GRAVEL   0.0   SAND   0.21  SILT  74.31 ( 73.84)  CLAY  25.48 ( 25.94)

GRAVEL + SAND   0.21   SILT/(SILT+CLAY)  74.00PCT  GRAV+SAND/SILT+CLAY     0.00


LABELS SHEPARD -CLAYEY SILT FOLK(GMS)-MUD                  (SCS)-SILT
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                                                                               ****                      ****
 P1++ 122A      0   0.0      0   0.0       0                                   ***    MULTIMODAL SAMPLE   ***
                                                                               ****                      ****
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              WET WT      DRY WT       SALT      ORGANIC    MOISTURE                 WEIGHT LOSS DUE TO HANDLING      0.0
           1000.0000      3.5400       0.0         0.0         0.0   (GRAMS)         GRAVEL CORRECTION FACTOR         1.000
            100.0000    100.0000       0.0         0.0         0.0   (PCT WET WT)    SIZES ELIMINATED (<0.01%)         NONE
                                                                                     TRASK SORTING COEFFECIENT        1.962
                                                                                     USING PROBABILITY EXTRAP.        1.957
                                                                                     MEAN CUBED DEVIATION             8.923
                                                                                     USING PROBABLITY EXTRAP.         3.927

 PERCENTAGE            TABLE OF STATISTICAL DATA IN PHI UNITS                  PERCENTILES   LINEAR EXTRAP.             PROBABLILITY EXTRAP.
 COMPOSITION
                                    MEAN     STD DEV SKEWNESS KURTOSIS                         MM.       PHI UNITS        MM.       PHI UNITS
 GRAVEL      0.0       MOMENT        4.79367  1.74082  1.69138  6.77620          5.0         0.13068    2.93586        0.12778    2.96825
 SAND       41.53      P-MOMENT      4.74921  1.51900  1.12054  4.06657         10.0         0.11503    3.11995        0.11074    3.17473
 SILT       54.11      FOLK          4.64034  1.45677  0.26156  1.03185         16.0         0.10256    3.28541        0.09875    3.34012
 CLAY        4.36      P-FOLK        4.65495  1.43295  0.27466  1.02509         25.0         0.08632    3.53420        0.08610    3.53790
 MUD        58.47      INMAN         4.71567  1.43025  0.15800  0.71117         50.0         0.04451    4.48968        0.04451    4.48981
 S/M         0.71      P-INMAN       4.73752  1.39740  0.17727  0.73395         75.0         0.02243    5.47835        0.02248    5.47538
                       KRUMBEIN               1.44011  0.01660  0.25746         84.0         0.01412    6.14592        0.01423    6.13493
                       P-KRUM.                1.43517  0.01684  0.26100         90.0         0.00840    6.89556        0.00845    6.88643
                       FOLK (TRANSFORMED)                       0.50784         95.0         0.00439    7.83069        0.00444    7.81431
                       P-FOLK (TRANSFORMED)                     0.50619


                              DATA FOR CONSTN OF BARGRAPHS AND CUM. CURVES

                        SIZE FRACTION      WT.(GMS)      WT.PCT.  WT.PCT.   MID PHI(LINEAR)   MID PHI(PROB.)  MODE
                         MM        PHI    UNCOR    COR      COR    CUMUL.    PHI        MM      PHI       MM

                       0.250000   2.000   0.010   0.010    0.282    0.282   1.751   0.29707   1.891   0.26959     0
                       0.177000   2.498   0.010   0.010    0.282    0.565   2.249   0.21036   2.287   0.20490     0
                       0.125000   3.000   0.180   0.180    5.085    5.650   2.749   0.14875   2.852   0.13354     0
                       0.088000   3.506   0.650   0.650   18.362   24.011   3.253   0.10488   3.312   0.10071     1
                       0.062500   4.000   0.620   0.620   17.514   41.525   3.753   0.07416   3.767   0.07346     0
                       0.044000   4.506   0.310   0.310    8.763   50.288   4.253   0.05244   4.255   0.05239     0
                       0.031000   5.012   0.438   0.438   12.387   62.675   4.759   0.03693   4.756   0.03702     0
                       0.022000   5.506   0.462   0.462   13.064   75.739   5.259   0.02612   5.247   0.02633     1
                       0.015600   6.002   0.242   0.242    6.843   82.582   5.754   0.01853   5.742   0.01868     0
                       0.011000   6.506   0.176   0.176    4.976   87.558   6.254   0.01310   6.240   0.01323     0
                       0.007800   7.002   0.110   0.110    3.112   90.670   6.754   0.00926   6.741   0.00935     0
                       0.005500   7.506   0.110   0.110    3.110   93.780   7.254   0.00655   7.235   0.00664     0
                       0.003900   8.002   0.066   0.066    1.866   95.646   7.754   0.00463   7.737   0.00469     0
                       0.002700   8.533   0.044   0.044    1.244   96.890   8.268   0.00325   8.249   0.00329     0
                       0.000061  14.000   0.110   0.110    3.110  100.000  11.266   0.00041   9.387   0.00149     0
                           TOTALS         3.540   3.540  100.0
      0.250000     0.070000
      0.177000     0.030000
      0.125000     0.150000
      0.088000     0.810000
      0.062500     1.230000
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```
  PITT1228                        SIEVE, SH. PIP., SEDIGRAPH  SAMPLE WT.=  4.8500

    PHI  PCT. CUMFCT.
   2.00
         0.82              *
   2.50         0.82
         1.44              *
   3.00         2.27
         3.09              ***
   3.50         5.36
         5.98              ******
   4.00        11.34
         8.14              ********
   4.50        19.48
        14.48              **************
   5.00        33.96
         9.95              **********
   5.50        43.91
        21.71              **********************
   6.00        65.62
         9.05              *********
   6.50        74.67
         5.43              *****
   7.00        80.10
         6.33              ******
   7.50        86.43
         3.62              ****
   8.00        90.05
         1.81              **
   8.50        91.86
         2.71              ***
   9.00        94.57
         0.90              *
   9.50        95.48
         4.52              *****
  12.00       100.00

    MEAN  ST.DEV. SKEWNESS KURTOSIS

     5.58    1.38     0.15     0.04     KRUMBEIN+PETTIJOHN(1938) MONENT MEASURES
                                        FOR SIZE RANGE  2.5 TO   9.5 PHI

     5.74    1.63     0.17     1.35     FOLK GRAPHIC STATISTICAL PARAMETERS
                                            FOLK AND WARD,1957

  PERCENTILES   MEDIAN  5.64     5TH  3.44     16TH  4.29     25TH  4.69

                                  75TH  6.53     84TH  7.31     95TH  9.24

  PER CENT  GRAVEL    0.0   SAND  11.34  SILT  78.87 ( 78.71)  CLAY   9.79 (  9.95)

  GRAVEL + SAND  11.34   SILT/(SILT+CLAY)  88.78PCT  GRAV+SAND/SILT+CLAY     0.13

  LABELS SHEPARD -SILT        FOLK(GMS)-SANDY MUD            (SCS)-SANDY SILT
```

```
PITT121                        SIEVE, SH. PIP., SEDIGRAPH  SAMPLE WT.=  3.4600

   PHI   PCT.  CUMPCT.
  3.50
         3.76              ****
  4.00          3.76
         6.80              *******
  4.50         10.57
        20.41              ********************
  5.00         30.98
        19.44              *******************
  5.50         50.42
        13.61              **************
  6.00         64.03
         7.78              ********
  6.50         71.81
         5.83              ******
  7.00         77.64
         5.83              ******
  7.50         83.47
         3.89              ****
  8.00         87.36
         1.94              **
  8.50         89.31
         1.94              **
  9.00         91.25
         1.94              **
  9.50         93.20
         1.94              **
 10.00         95.14
         4.86              *****
 12.00        100.00

  MEAN   ST.DEV.  SKEWNESS  KURTOSIS

  5.79     1.36     0.52     0.65     KRUMBEIN+PETTIJOHN(1938) MOMENT MEASURES
                                      FOR SIZE RANGE  4.0 TO  10.0 PHI

  5.90     1.62     0.47     1.35     FOLK GRAPHIC STATISTICAL PARAMETERS
                                          FOLK AND WARD,1957

 PERCENTILES    MEDIAN  5.49      5TH  4.09      16TH  4.63      25TH  4.85

                                 75TH  6.77      84TH  7.57      95TH  9.96

 PER CENT  GRAVEL   0.0   SAND   3.76  SILT  83.94 ( 83.60)  CLAY  12.30 ( 12.64)

 GRAVEL + SAND   3.76   SILT/(SILT+CLAY)  86.87PCT  GRAV+SAND/SILT+CLAY     0.04

 LABELS SHEPARD -SILT        FOLK(GMS)-MUD                 (SCS)-SILT
```

```
  PITT123A                          SIEVE, SH. PIP., SEDIGRAPH  SAMPLE WT.=  4.9000

     PHI   PCT. CUMPCT.
    3.50
           0.41
    4.00          0.41
           1.00              *
    4.50          1.40
           1.99              **
    5.00          3.40
           1.99              **
    5.50          5.39
           4.98              *****
    6.00         10.37
           4.98              *****
    6.50         15.35
           6.97              *******
    7.00         22.32
          10.96              ***********
    7.50         33.27
          11.95              ************
    8.00         45.22
           9.96              **********
    8.50         55.18
          10.96              ***********
    9.00         66.14
           8.96              *********
    9.50         75.10
           5.98              ******
   10.00         81.08
           4.98              *****
   10.50         86.06
           3.98              ****
   11.00         90.04
           3.98              ****
   11.50         94.02
           1.99              **
   12.00         96.02
           3.98              ****
   12.00        100.00

     MEAN   ST.DEV. SKEWNESS KURTOSIS

      8.18     1.70    -0.01    -0.38    KRUMBEIN+PETTIJOHN(1938) MONENT MEASURES
                                         FOR SIZE RANGE  4.0 TO  12.0 PHI

      8.36     1.90     0.10     1.32    FOLK GPAPHIC STATISTICAL PARAMETERS
                                             FOLK AND WARD,1957

  PERCENTILES   MEDIAN  8.24      5TH  5.40      16TH  6.55      25TH  7.12

                                   75TH  9.49      84TH 10.29      95TH 11.74

  PER CENT  GRAVEL   0.0   SAND   0.41  SILT  44.94 ( 44.82)  CLAY  54.65 ( 54.78)



  GRAVEL + SAND   0.41   SILT/(SILT+CLAY)  45.00PCT  GRAV+SAND/SILT+CLAY     0.00
```

```
PITT1238                    SIEVE, SH. PIP., SEDIGRAPH  SAMPLE WT.=  4.2600

  PHI  PCT. CUMPCT.
 3.50
       0.71          *
 4.00        0.71
       0.99          *
 4.50        1.70
       2.98          ***
 5.00        4.68
       4.96          *****
 5.50        9.64
       5.96          ******
 6.00       15.60
       9.93          **********
 6.50       25.53
       7.94          ********
 7.00       33.47
      13.90          **************
 7.50       47.37
      10.92          ***********
 8.00       58.30
       9.93          **********
 8.50       68.23
       7.94          ********
 9.00       76.17
       6.95          *******
 9.50       83.12
       5.96          ******
10.00       89.08
       2.98          ***
10.50       92.06
       2.98          ***
11.00       95.04
       4.96          *****
12.00      100.00

  MEAN  ST.DEV. SKEWNESS KURTOSIS

   7.56    1.56     0.00    -0.56    KRUMBEIN+PETTIJOHN(1938) MONENT MEASURES
                                     FOR SIZE RANGE  4.0 TO  11.0 PHI

   7.74    1.79     0.12     1.22    FOLK GRAPHIC STATISTICAL PARAMETERS
                                        FOLK AND WARD,1957

PERCENTILES   MEDIAN  7.62     5TH  5.03      16TH  6.02      25TH  6.47

                               75TH  8.93      84TH  9.57      95TH 10.99

PER CENT  GRAVEL   0.0   SAND   0.70  SILT  57.58 ( 57.59)  CLAY  41.72 ( 41.70)

GRAVEL + SAND   0.70   SILT/(SILT+CLAY)  58.0CPCT  GRAV+SAND/SILT+CLAY     0.01
LABELS SHEPARD -CLAYEY SILT FOLK(GMS)-MUD                 (SCS)-MUD
```

```
PITT1258                     SIEVE, SH. PIP., SEDIGRAPH  SAMPLE WT.=  5.2300

  PHI   PCT. CUMPCT.

 2.00
        0.58           *
 2.50          0.58
        1.15           *
 3.00          1.73
        2.30           **
 3.50          4.03
        4.41           ****
 4.00          8.44
        4.67           *****
 4.50         13.11
       12.15           ************
 5.00         25.25
       14.95           ***************
 5.50         40.20
       13.08           *************
 6.00         53.28
       11.21           ***********
 6.50         64.50
        5.61           ******
 7.00         70.10
        5.61           ******
 7.50         75.71
        4.67           *****
 8.00         80.38
        3.74           ****
 8.50         84.12
        3.74           ****
 9.00         87.85
        2.80           ***
 9.50         90.66
        2.80           ***
10.00         93.46
        1.87           **
10.50         95.33
        4.67           *****
12.00        100.00

  MEAN  ST.DEV. SKEWNESS KURTOSIS

  6.09    1.71     0.26    -0.16     KRUMBEIN+PETTIJOHN(1938) MONENT MEASURES
                                     FOR SIZE RANGE  2.5 TO  10.5 PHI

   6.33    2.00     0.34     1.39    FOLK GRAPHIC STATISTICAL PARAMETERS
                                         FOLK AND WARD,1957

PERCENTILES   MEDIAN  5.87     5TH  3.61     16TH  4.62     25TH  4.99

                                75TH  7.44     84TH  8.48     95TH 10.41

PER CENT  GRAVEL   0.0   SAND   8.44  SILT  72.39 ( 71.94)  CLAY  19.18 ( 19.62)


GRAVEL + SAND   8.44    SILT/(SILT+CLAY)  78.57PCT  GRAV+SAND/SILT+CLAY      0.09
```

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```
     PITT125C                   SIEVE, SH. PIP., SEDIGRAPH  SAMPLE WT.=  4.8300

       PHI  PCT. CUMPCT.

     3.00
            2.07             **
     3.50         2.07
            4.15             ****
     4.00         6.22
            4.78             *****
     4.50        11.00
           12.44             ************
     5.00        23.44
           16.27             ****************
     5.50        39.71
           12.44             ************
     6.00        52.15
           11.48             ***********
     6.50        63.64
            7.66             ********
     7.00        71.29
            4.78             *****
     7.50        76.08
            6.70             *******
     8.00        82.77
            3.83             ****
     8.50        86.60
            2.87             ***
     9.00        89.47
            2.87             ***
     9.50        92.34
            1.91             **
    10.00        94.26
            1.91             **
    10.50        96.17
            3.83             ****
    12.00       100.00

      MEAN  ST.DEV. SKEWNESS KURTOSIS

      6.14     1.60     0.32    -0.11     KRUMBEIN+PETTIJOHN(1938) MONENT MEASURES
                                          FOR SIZE RANGE  3.5 TO  10.5 PHI

      6.26     1.83     0.32     1.33     FOLK GRAPHIC STATISTICAL PARAMETERS
                                              FOLK AND WARD,1957

     PERCENTILES   MEDIAN  5.91     5TH  3.85     16TH  4.70     25TH  5.05

                                     75TH  7.39     84TH  8.16     95TH 10.19

     PER CENT  GRAVEL   0.0   SAND   6.22  SILT  76.68 ( 76.56)  CLAY  17.10 ( 17.23)

     GRAVEL + SAND   6.22   SILT/(SILT+CLAY)  81.63PCT  GRAV+SAND/SILT+CLAY     0.07

     LABELS SHEPARD -SILT        FOLK(GMS)-MUD                (SCS)-SILT
```

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```
PITT127A                    SIEVE, SH. PIP., SEDIGRAPH  SAMPLE WT.=  5.3000

 PHI  PCT. CUMPCT.

2.00
       0.76            *
2.50          0.76
       1.32            *
3.00          2.08
       2.64            ***
3.50          4.72
       5.10            *****
4.00          9.82
       8.45            ********
4.50         18.27
      17.85            ******************
5.00         36.12
      16.91            *****************
5.50         53.03
      11.27            ***********
6.00         64.30
       6.58            *******
6.50         70.88
       6.58            *******
7.00         77.46
       5.64            ******
7.50         83.09
       4.70            *****
8.00         87.79
       2.82            ***
8.50         90.61
       3.76            ****
9.00         94.36
       0.94            *
9.50         95.30
       4.70            *****
12.00       100.00

 MEAN  ST.DEV. SKEWNESS KURTOSIS

  5.61     1.45     0.23    -0.18     KPUMBEIN+PETTIJOHN(1938) MONENT MEASURES
                                      FOR SIZE RANGE  2.5 TO   9.5 PHI

  5.79     1.69     0.35     1.27     FOLK GRAPHIC STATISTICAL PARAMETERS
                                          FOLK AND WAKD,1957

PERCENTILES   MEDIAN  5.41     5TH  3.53      16TH  4.37      25TH  4.69
                                75TH  6.81      84TH  7.60      95TH  9.34

PER CENT  GRAVEL   0.0   SAND   9.82  SILT  78.38 ( 77.97)  CLAY  11.80 ( 12.21)

GRAVEL + SAND   9.82   SILT/(SILT+CLAY)  86.46PCT  GRAV+SAND/SILT+CLAY     0.11

LABELS SHEPAPD -SILT        FOLK(GMS)-MUD                  (SCS)-SILT
```

```
PITT1278                          SIEVE, SH. PIP., SEDIGRAPH  SAMPLE WT.=  4.1100

   PHI  PCT. CUMPCT.
   2.00
        0.73               *
   2.50         0.73
        1.95               **
   3.00         2.68
        2.92               ***
   3.50         5.60
        5.60               ******
   4.00        11.19
        8.33               ********
   4.50        19.52
       17.58               ******************
   5.00        37.09
       18.50               *******************
   5.50        55.60
       11.10               ***********
   6.00        66.70
       10.18               **********
   6.50        76.87
        4.63               *****
   7.00        81.50
        5.55               ******
   7.50        87.05
        3.70               ****
   8.00        90.75
        3.70               ****
   8.50        94.45
        2.78               ***
   9.00        97.22
        2.78               ***
  12.00       100.00

   MEAN   ST.DEV. SKEWNESS KURTOSIS

    5.51     1.38     0.19    -0.09    KRUMBEIN+PETTIJOHN(1938) MOMENT MEASURES
                                       FOR SIZE RANGE  2.5 TO   9.0 PHI

    5.62     1.52     0.26     1.24    FOLK GRAPHIC STATISTICAL PARAMETERS
                                           FOLK AND WARD,1957

PERCENTILES   MEDIAN  5.35     5TH  3.40     16TH  4.29     25TH  4.66

                               75TH  6.41     84TH  7.23     95TH  8.60

PER CENT  GRAVEL   0.0   SAND  11.19  SILT  79.68 ( 79.56)  CLAY   9.12 (  9.25)

GRAVEL + SAND  11.19    SILT/(SILT+CLAY)  89.58PCT  GRAV+SAND/SILT+CLAY    0.13

LABELS SHEPARD -SILT          FOLK(GMS)-SANDY MUD          (SCS)-SANDY SILT
```

```
  PITT127C                    SIEVE, SH. PIP., SEDIGRAPH  SAMPLE WT.=  5.8000

   PHI  PCT. CUMPCT.

  2.00
         0.86           *
  2.50         0.86
         1.90           **
  3.00         2.76
         3.63           ****
  3.50         6.39
         6.39           ******
  4.00        12.78
         8.09           ********
  4.50        20.87
        13.49           *************
  5.00        34.36
        14.39           **************
  5.50        48.75
        17.08           *****************
  6.00        65.83
         9.89           **********
  6.50        75.72
         7.19           *******
  7.00        82.92
         6.29           ******
  7.50        89.21
         3.60           ****
  8.00        92.81
         3.60           ****
  8.50        96.40
         1.80           **
  9.00        98.20
         1.80           **
 12.00       100.00

   MEAN  ST.DEV. SKEWNESS KURTOSIS

    5.54    1.37    0.08    -0.24    KRUMBEIN+PETTIJOHN(1938) MONENT MEASURES
                                     FOR SIZE RANGE  2.5 TO   9.0 PHI

    5.61    1.48    0.09     1.18    FOLK GRAPHIC STATISTICAL PARAMETERS
                                         FOLK AND WARD,1957

  PERCENTILES   MEDIAN  5.54     5TH  3.31     16TH  4.20     25TH  4.65

                                75TH  6.46     84TH  7.09     95TH  8.30

  PER CENT  GRAVEL   0.0   SAND  12.78  SILT  80.31 ( 80.03)  CLAY   6.91 (  7.19)

  GRAVEL + SAND  12.78   SILT/(SILT+CLAY)  91.75PCT  GRAV+SAND/SILT+CLAY    0.15
  LABELS SHEPARD -SILT        FOLK(GMS)-SANDY MUC           (SCS)-SANDY SILT
```

```
     PITT130A                                SIEVF, SH. PIP., SEDIGRAPH  SAMPLE WT.=  4.2500

       PHI   PCT. CUMFCT.

      2.50
             0.47
      3.00          0.47
             3.53              ****
      3.50          4.00
             5.89              ******
      4.00          9.89
             9.10              *********
      4.50         19.00
            17.29              *****************
      5.00         36.29
            18.20              ******************
      5.50         54.49
            10.01              **********
      6.00         64.50
             8.19              ********
      6.50         72.70
             4.55              *****
      7.00         77.25
             4.55              *****
      7.50         81.80
             4.55              *****
      8.00         86.35
             4.55              *****
      8.50         90.90
             1.82              **
      9.00         92.72
             3.64              ****
      9.50         96.36
             3.64              ****
     12.00        100.00

       MEAN   ST.DEV. SKEWNESS KURTOSIS

       5.67     1.50     0.34    -0.17      KRUMBEIN+PETTIJOHN(1938) MONENT MEASURES
                                            FOR SIZE RANGE  3.0 TO   9.5 PHI

       5.82     1.72     0.38     1.27      FOLK GRAPHIC STATISTICAL PARAMETERS
                                                FOLK AND WARD,1957

     PERCENTILES   MEDIAN  5.38      5TH  3.58      16TH  4.34      25TH  4.67

                                    75TH  6.75      84TH  7.74      95TH  9.31

     PER CENT  GRAVEL   0.0   SAND   9.89  SILT  77.15 ( 76.45)  CLAY  12.96 ( 13.65)

     GRAVEL + SAND   9.89    SILT/(SILT+CLAY)  84.85PCT  GRAV+SAND/SILT+CLAY     0.11
     LABELS SHEPARD -SILT          FOLK(GMS)-MUD                    (SCS)-SILT
```

```
PITT1308                         SIEVE, SH. PIP., SEDIGRAPH  SAMPLE WT.=  4.6700

  PHI  PCT. CUMPCT.
  2.50
        0.43
  3.00        0.43
        4.07                ****
  3.50        4.50
        9.22                *********
  4.00       13.72
       13.21                *************
  4.50       26.93
       18.49                ******************
  5.00       45.41
       16.73                *****************
  5.50       62.14
        9.68                **********
  6.00       71.83
        7.92                ********
  6.50       79.75
        4.40                ****
  7.00       84.15
        4.40                ****
  7.50       88.55
        3.52                ****
  8.00       92.08
        2.64                ***
  8.50       94.72
        1.76                **
  9.00       96.48
        3.52                ****
 12.00      100.00

  MEAN  ST.DEV. SKEWNESS KURTOSIS

   5.31    1.30     0.35     0.01     KRUMBEIN+PETTIJOHN(1938) MONENT MEASURES
                                      FOR SIZE RANGE  3.0 TO   9.0 PHI

   5.40    1.49     0.32     1.20     FOLK GRAPHIC STATISTICAL PARAMETERS
                                          FOLK AND WARD,1957

PERCENTILES   MEDIAN  5.14      5TH  3.53      16TH  4.09      25TH  4.43

                                75TH  6.20      84TH  6.98      95TH  8.58

PER CENT  GRAVEL   0.0   SAND  13.72  SILT  78.24 ( 78.36)  CLAY   8.04 (  7.92)

GRAVEL + SAND  13.72    SILT/(SILT+CLAY)  90.82PCT  GRAV+SAND/SILT+CLAY     0.16

LABELS SHEPARD -SILT        FOLK(GMS)-SANDY MUD          (SCS)-SANDY SILT
```

```
PITT130C                        SIEVE, SH. PIP., SEDIGRAPH  SAMPLE WT.=  4.3800

   PHI  PCT. CUMPCT.
  1.50
        0.23
  2.00        0.23
        0.23
  2.50        0.46
        0.91          *
  3.00        1.37
        5.02          *****
  3.50        6.39
        6.85          *******
  4.00       13.24
        5.31          *****
  4.50       18.55
       15.05          ***************
  5.00       33.60
       15.94          ****************
  5.50       49.54
       12.39          ************
  6.00       61.93
        9.74          **********
  6.50       71.67
        6.20          ******
  7.00       77.87
        6.20          ******
  7.50       84.06
        5.31          *****
  8.00       89.38
        3.54          ****
  8.50       92.92
        2.66          ***
  9.00       95.57
        4.43          ****
 12.00      100.00

   MEAN  ST.DEV. SKEWNESS KURTOSIS

    5.60    1.42    0.12    -0.40    KRUMBEIN+PETTIJOHN(1938) MONENT MEASURES
                                     FOR SIZE RANGE  2.0 TO   9.0 PHI

    5.76    1.65    0.22     1.23    FOLK GRAPHIC STATISTICAL PARAMETERS
                                         FOLK AND WARD,1957

  PERCENTILES   MEDIAN  5.52     5TH  3.36     16TH  4.26     25TH  4.71

                                75TH  6.77     84TH  7.49      95TH  8.89

  PER CENT   GRAVEL   0.0   SAND  13.24  SILT  76.48 ( 76.13)  CLAY  10.27 ( 10.62)

  GRAVEL + SAND  13.24    SILT/(SILT+CLAY)  87.76PCT  GRAV+SAND/SILT+CLAY     0.15

  LABELS SHEPARD -SILT        FOLK(GMS)-SANDY MUD           (SCS)-SANDY SILT
```

```
 PITT131A                              SIEVE, SH. PIP., SEDIGRAPH  SAMPLE WT.=  4.7800

  PHI   PCT. CUMPCT.

 1.50
          0.63              *
 2.00            0.63
          0.21
 2.50            0.84
          0.63              *
 3.00            1.46
          6.07              ******
 3.50            7.53
         10.88              ***********
 4.00           18.41
         12.62              *************
 4.50           31.03
         21.87              **********************
 5.00           52.90
         15.98              ****************
 5.50           68.88
          9.25              *********
 6.00           78.13
          6.73              *******
 6.50           84.86
          2.52              ***
 7.00           87.38
          2.52              ***
 7.50           89.91
          2.52              ***
 8.00           92.43
          0.84              *
 8.50           93.27
          1.68              **
 9.00           94.95
          0.84              *
 9.50           95.79
          0.84              *
10.00           96.64
          0.84              *
10.50           97.48
          2.52              ***
12.00          100.00

  MEAN   ST.DEV. SKEWNESS KURTCSIS

   5.15     1.43     0.57     1.87     KRUMBEIN+PETTIJOHN(1938) MONENT MEASURES
                                       FOR SIZE RANGE  2.0 TO  10.5 PHI

   5.09     1.51     0.30     1.43     FOLK GRAPHIC STATISTICAL PARAMETERS
                                           FOLK AND WARD,1957

 PERCENTILES   MEDIAN  4.93     5TH  3.29     16TH  3.89     25TH  4.26

                                75TH  5.83     84TH  6.44     95TH  9.03


 PER CENT  GRAVEL   0.0   SAND  18.41  SILT  74.27 ( 74.02)  CLAY   7.32 (  7.57)

 GRAVEL + SAND  18.41    SILT/(SILT+CLAY)  90.72PCT  GRAV+SAND/SILT+CLAY     0.23
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     PITT131B                        SIEVE, SH. PIP., SEDIGRAPH  SAMPLE WT.=  3.9400

       PHI  PCT. CUMPCT.
      1.50
           0.25
      2.00       0.25
           0.76           *
      2.50       1.02
           1.52           **
      3.00       2.54
           6.61           *******
      3.50       9.15
           7.62           ********
      4.00      16.77
           8.67           *********
      4.50      25.44
          19.07           *******************
      5.00      44.52
          15.61           ****************
      5.50      60.12
          12.14           ************
      6.00      72.26
           6.94           *******
      6.50      79.19
           5.20           *****
      7.00      84.39
           4.33           ****
      7.50      88.73
           2.60           ***
      8.00      91.33
           1.73           **
      8.50      93.06
           1.73           **
      9.00      94.80
           1.73           **
      9.50      96.53
           0.87           *
     10.00      97.40
           2.60           ***
     12.00     100.00

        MEAN  ST.DEV. SKEWNESS KURTOSIS

        5.33    1.48     0.34     0.51    KRUMBEIN+PETTIJOHN(1938) MONENT MEASURES
                                          FOR SIZE RANGE  2.0 TO  10.0 PHI

        5.36    1.64     0.25     1.41    FOLK GRAPHIC STATISTICAL PARAMETERS
                                                 FOLK AND WARD,1957

     PERCENTILES   MEDIAN  5.18      5TH  3.19      16TH  3.95      25TH  4.47

                                    75TH  6.20      84TH  6.96      95TH  9.06

     PER CENT  GRAVEL   0.0   SAND  16.77  SILT  74.97 ( 74.56)  CLAY   8.26 (  8.67)


     GRAVEL + SAND  16.77   SILT/(SILT+CLAY)  89.58PCT  GRAV+SAND/SILT+CLAY    0.20
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  PITT131C                    SIEVE, SH. PIP., SEDIGRAPH  SAMPLE WT.=  4.7100

     PHI  PCT. CUMPCT.
    2.00
           0.21
    2.50         0.21
           1.28              *
    3.00         1.49
           5.95              ******
    3.50         7.44
           7.01              *******
    4.00        14.45
           7.06              *******
    4.50        21.51
          17.64              ******************
    5.00        39.15
          18.52              *******************
    5.50        57.67
          12.35              ************
    6.00        70.01
           7.94              ********
    6.50        77.95
           5.29              *****
    7.00        83.24
           4.41              ****
    7.50        87.65
           3.53              ****
    8.00        91.18
           1.76              **
    8.50        92.94
           1.76              **
    9.00        94.71
           1.76              **
    9.50        96.47
           3.53              ****
   12.00       100.00

     MEAN   ST.DEV. SKEWNESS KURTOSIS

      5.42     1.39      0.30      0.26     KRUMBEIN+PETTIJOHN(1938) MONENT MEASURES
                                            FOR SIZE RANGE  2.5 TO   9.5 PHI

      5.50     1.62      0.26      1.39     FOLK GRAPHIC STATISTICAL PARAMETERS
                                                FOLK AND WARD,1957

   PERCENTILES    MEDIAN  5.29      5TH  3.30      16TH  4.11      25TH  4.60

                                     75TH  6.31      84TH  7.09      95TH  9.08

   PER CENT   GRAVEL    0.0    SAND  14.45  SILT  77.05 ( 76.73)  CLAY   8.50 (  8.82)

   GRAVEL + SAND  14.45    SILT/(SILT+CLAY)  89.69PCT  GRAV+SAND/SILT+CLAY     0.17

   LABELS SHEPARD -SILT     .   FOLK(GMS)-SANDY MUD             (SCS)-SANDY SILT
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                                                                                          ****                  ****
  P1++ 132A      0   0.0      0   0.0      0                                              ***    MULTIMODAL SAMPLE   ***
                                                                                          ****                  ****
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              WET WT     DRY WT      SALT      ORGANIC    MOISTURE                        WEIGHT LOSS DUE TO HANDLING     0.0
            1000.0000    7.9100      0.0         0.0        0.0    (GRAMS)                GRAVEL CORRECTION FACTOR        1.000
             100.0000  100.0000      0.0         0.0        0.0    (PCT WET WT)           SIZES ELIMINATED (<0.01%)       NONE
                                                                                          TRASK SORTING COEFFECIENT       2.260
                                                                                          USING PROBABILITY EXTRAP.       2.239
                                                                                          MEAN CUBED DEVIATION           21.166
                                                                                          USING PROBABLITY EXTRAP.       17.671

  PERCENTAGE            TABLE OF STATISTICAL DATA IN PHI UNITS                    PERCENTILES   LINEAR EXTRAP.          PROBABLILITY EXTRAP.
  COMPOSITION
                                    MEAN     STD DEV  SKEWNESS KURTOSIS                         MM.       PHI UNITS       MM.       PHI UNITS
  GRAVEL     0.0        MOMENT     5.54481   2.39540  1.53990  5.14592               5.0       0.11736    3.09094      0.11315    3.14368
  SAND      28.95       P-MOMENT   5.53067   2.30231  1.44798  4.70631              10.0       0.09888    3.33818      0.09546    3.38894
  SILT      58.32       FOLK       5.31179   2.18554  0.38535  1.43714              16.0       0.08311    3.58885      0.08205    3.60741
  CLAY      12.72       P-FOLK     5.31566   2.16908  0.39231  1.44184              25.0       0.06818    3.87457      0.06731    3.89313
  MUD       71.05       INMAN      5.45978   1.87093  0.23731  1.20491              50.0       0.03091    5.01580      0.03091    5.01573
  S/M        0.41       P-INMAN    5.46562   1.85821  0.24211  1.20207              75.0       0.01335    6.22739      0.01342    6.21935
                        KRUMBEIN             1.74283  0.03518  0.20979              84.0       0.00621    7.33071      0.00624    7.32384
                        P-KRUM.              1.72312  0.04051  0.20947              90.0       0.00203    8.94569      0.00203    8.94160
                        FOLK (TRANSFORMED)                     0.58968              95.0       0.00039   11.34142      0.00039   11.32750
                        P-FOLK (TRANSFORMED)                   0.59047

                                 DATA FOR CONSTN OF BARGRAPHS AND CUM. CURVES

                         SIZE FRACTION        WT.(GMS)      WT.PCT.  WT.PCT.   MID PHI(LINEAR)    MID PHI(PROB.)   MODE
                         MM        PHI      UNCOR     COR     COR     CUMUL.     PHI        MM      PHI       MM

                       0.250000   2.000    0.070    0.070    0.885    0.885   1.751   0.29707   1.911   0.26599      1
                       0.177000   2.498    0.030    0.030    0.379    1.264   2.249   0.21036   2.268   0.20757      0
                       0.125000   3.000    0.150    0.150    1.896    3.161   2.749   0.14875   2.796   0.14396      0
                       0.088000   3.506    0.810    0.810   10.240   13.401   3.253   0.10488   3.318   0.10026      0
                       0.062500   4.000    1.230    1.230   15.550   28.951   3.753   0.07416   3.781   0.07276      1*
                       0.044000   4.506    0.895    0.895   11.314   40.265   4.253   0.05244   4.261   0.05216      0
                       0.031000   5.012    0.761    0.761    9.626   49.891   4.759   0.03693   4.761   0.03688      0
                       0.022000   5.506    1.006    1.006   12.714   62.606   5.259   0.02612   5.256   0.02617      1
                       0.015600   6.002    0.769    0.769    9.723   72.328   5.754   0.01853   5.747   0.01862      0
                       0.011000   6.506    0.473    0.473    5.983   78.311   6.254   0.01310   6.246   0.01317      0
                       0.007800   7.002    0.296    0.296    3.740   82.051   6.754   0.00926   6.747   0.00931      0
                       0.005500   7.506    0.237    0.237    2.992   85.042   7.254   0.00655   7.247   0.00658      0
                       0.003900   8.002    0.177    0.177    2.243   87.286   7.754   0.00463   7.747   0.00465      0
                       0.002700   8.533    0.118    0.118    1.496   88.782   8.268   0.00325   8.262   0.00326      0
                       0.001900   9.040    0.118    0.118    1.496   90.277   8.786   0.00227   8.780   0.00228      0
                       0.001380   9.501    0.118    0.118    1.496   91.773   9.270   0.00162   9.263   0.00163      1
                       0.000980   9.995    0.059    0.059    0.748   92.521   9.748   0.00116   9.744   0.00117      0
                       0.000690  10.501    0.059    0.059    0.748   93.269  10.248   0.00082  10.243   0.00083      1
                       0.000490  10.995    0.059    0.059    0.748   94.017  10.748   0.00058  10.742   0.00058      0
                       0.000340  11.522    0.118    0.118    1.496   95.513  11.259   0.00041  11.243   0.00041      1
                       0.000240  12.025    0.059    0.059    0.748   96.260  11.773   0.00029  11.764   0.00029      0


                       0.000061  14.000    0.296    0.296    3.740  100.000  13.012   0.00012  12.329   0.00019      0
                     TOTALS                7.910    7.910  100.0
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                                                                                   ****                    ****
P1++ 1328      0   0.0     0   0.0      0                                          ***   MULTIMODAL SAMPLE   ***
                                                                                   ****                    ****
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              WET WT    DRY WT     SALT    ORGANIC   MOISTURE                 WEIGHT LOSS DUE TO HANDLING    0.0
           1000.0000    8.9200     0.0       0.0       0.0    (GRAMS)         GRAVEL CORRECTION FACTOR       1.000
             99.9999  100.0000     0.0       0.0       0.0    (PCT WET WT)    SIZES ELIMINATED (<0.01%)       NONE
                                                                              TRASK SORTING COEFFECIENT      2.452
                                                                              USING PROBABILITY EXTRAP.      2.438
                                                                              MEAN CUBED DEVIATION          30.729
                                                                              USING PROBABLITY EXTRAP.      25.422

 PERCENTAGE        TABLE OF STATISTICAL DATA IN PHI UNITS              PERCENTILES   LINEAR EXTRAP.          PROBABLILITY EXTRAP.
 COMPOSITION
                                MEAN    STD DEV SKEWNESS KURTOSIS                       MM.      PHI UNITS       MM.      PHI UNITS
  GRAVEL     0.0   MOMENT      5.32545  2.72786  1.51384  4.54831          5.0      0.15305    2.70790      0.14333    2.80257
  SAND      41.93  P-MOMENT    5.30363  2.60885  1.43171  4.18397         10.0      0.12545    2.99484      0.12524    2.99726
  SILT      43.69  FOLK        5.03235  2.52832  0.54917  1.49793         16.0      0.11102    3.17111      0.10809    3.20965
  CLAY      14.38  P-FOLK      5.04487  2.48586  0.56148  1.47352         25.0      0.09267    3.43168      0.09166    3.44754
  MUD       58.07  INMAN       5.36139  2.19028  0.45068  1.15930         50.0      0.04822    4.37427      0.04820    4.37486
  S/M        0.72  P-INMAN     5.37988  2.17023  0.46309  1.12994         75.0      0.01541    6.01967      0.01542    6.01887
                   KRUMBEIN             1.91703  0.35141  0.18956         84.0      0.00533    7.55167      0.00534    7.55011
                   P-KRUM.              1.90469  0.35835  0.18854         90.0      0.00111    9.82129      0.00111    9.81640
                   FOLK (TRANSFORMED)                     0.59967         95.0      0.00022   12.16687      0.00024   12.04749
                   P-FOLK (TRANSFORMED)                   0.59572

                         DATA FOR CONSTN OF BARGRAPHS AND CUM. CURVES

                SIZE FRACTION      WT.(GMS)    WT.PCT. WT.PCT.  MID PHI(LINEAR)  MID PHI(PROB.)  MODE
                 MM       PHI     UNCOR   COR    COR    CUMUL.   PHI      MM      PHI      MM

               0.250000  2.000   0.080   0.080   0.897   0.897  1.751  0.29707  1.911  0.26596     1
               0.177000  2.498   0.040   0.040   0.448   1.345  2.249  0.21036  2.271  0.20720     0
               0.125000  3.000   0.780   0.780   8.744  10.090  2.749  0.14875  2.838  0.13987     0
               0.088000  3.506   1.560   1.560  17.489  27.578  3.253  0.10488  3.292  0.10211     1*
               0.062500  4.000   1.280   1.280  14.350  41.928  3.753  0.07416  3.763  0.07367     0
               0.044000  4.506   0.974   0.974  10.920  52.848  4.253  0.05244  4.254  0.05240     0
               0.031000  5.012   0.468   0.468   5.244  58.093  4.759  0.03693  4.758  0.03696     0
               0.022000  5.506   0.961   0.961  10.776  68.869  5.259  0.02612  5.253  0.02623     1
               0.015600  6.002   0.534   0.534   5.987  74.855  5.754  0.01853  5.748  0.01861     0
               0.011000  6.506   0.374   0.374   4.191  79.047  6.254  0.01310  6.248  0.01316     0
               0.007800  7.002   0.214   0.214   2.395  81.441  6.754  0.00926  6.750  0.00929     0
               0.005500  7.506   0.214   0.214   2.395  83.836  7.254  0.00655  7.249  0.00658     1
               0.003900  8.002   0.160   0.160   1.796  85.632  7.754  0.00463  7.749  0.00465     0
               0.002700  8.533   0.107   0.107   1.197  86.829  8.268  0.00325  8.264  0.00325     0
               0.001900  9.040   0.107   0.107   1.197  88.026  8.786  0.00227  8.782  0.00227     0
               0.001380  9.501   0.107   0.107   1.197  89.224  9.270  0.00162  9.266  0.00162     0
               0.000980  9.995   0.107   0.107   1.197  90.421  9.748  0.00116  9.743  0.00117     0
               0.000690 10.501   0.107   0.107   1.197  91.618 10.248  0.00082 10.242  0.00083     0
               0.000490 10.995   0.107   0.107   1.198  92.816 10.748  0.00058 10.741  0.00058     1
               0.000340 11.522   0.107   0.107   1.197  94.013 11.259  0.00041 11.249  0.00041     0
               0.000240 12.025   0.053   0.053   0.599  94.612 11.773  0.00029 11.768  0.00029     0
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Done

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                                                                                       ****************************
                                                                                       ****                    ****
 P1++ 133A      0   0.0    0   0.C      0.                                             ***   MULTIMODAL SAMPLE  ***
                                                                                       ****                    ****
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               WET WT     DRY WT      SALT     ORGANIC    MOISTURE                 WEIGHT LOSS DUE TO HANDLING      0.0
            1000.0000     8.0200      0.0         0.0        0.0   (GRAMS)         GRAVEL CORRECTION FACTOR         1.000
              99.9999   100.0000      0.0         0.0        0.0   (PCT WET WT)    SIZES ELIMINATED (<0.01%)         NONE
                                                                                   TRASK SORTING COEFFECIENT        2.218
                                                                                   USING PROBABILITY EXTRAP.        2.210
                                                                                   MEAN CUBED DEVIATION            23.169
                                                                                   USING PROBABLITY EXTRAP.        19.762

 PERCENTAGE          TABLE OF STATISTICAL DATA IN PHI UNITS              PERCENTILES   LINEAR EXTRAP.          PROBABLILITY EXTRAP.
 COMPOSITION
                                  MEAN     STD DEV  SKEWNESS KURTOSIS                      MM.      PHI UNITS       MM.      PHI UNITS
 GRAVEL      0.0     MOMENT      4.50674   2.26962  1.98171  7.19375         5.0       0.17334   2.52634       0.16949   2.56071
 SAND       57.36    P-MOMENT    4.50765   2.18476  1.89509  6.63331        10.0       0.15953   2.64812       0.15105   2.72686
 SILT       35.16    FOLK        4.17936   1.85558  0.54769  1.22782        16.0       0.14440   2.79185       0.13791   2.85816
 CLAY        7.48    P-FOLK      4.20043   1.83270  0.56641  1.22675        25.0       0.12433   3.00775       0.12425   3.00890
 MUD        42.64    INMAN       4.41614   1.62429  0.43733  1.11991        50.0       0.07664   3.70579       0.07666   3.70542
 S/M         1.35    P-INMAN     4.44794   1.58978  0.46706  1.15424        75.0       0.02527   5.30647       0.02543   5.29722
                     KRUMBEIN              1.70276  0.45132  0.25473        84.0       0.01519   6.04043       0.01522   6.03772
                     P-KRUM.               1.69505  0.44764  0.25849        90.0       0.00699   7.16022       0.00703   7.15311
                     FOLK (TRANSFORMED)                      0.55113        95.0       0.00146   9.41503       0.00147   9.41025
                     P-FOLK (TRANSFORMED)                    0.55091


                              DATA FOR CONSTN OF BARGRAPHS AND CUM. CURVES

                      SIZE FRACTION       WT.(GMS)     WT.PCT. WT.PCT.  MID PHI(LINEAR)  MID PHI(PROB.)  MODE
                       MM        PHI    UNCOR    COR     COR    CUMUL.     PHI       MM     PHI      MM

                     0.250000  2.000    0.100    0.100   1.247   1.247  1.751  0.29707  1.915  0.26525     0
                     0.177000  2.498    0.200    0.200   2.494   3.741  2.249  0.21036  2.304  0.20248     0
                     0.125000  3.000    1.680    1.680  20.948  24.688  2.749  0.14875  2.823  0.14129     1*
                     0.088000  3.506    1.630    1.630  20.324  45.012  3.253  0.10488  3.267  0.10387     0
                     0.062500  4.000    0.990    0.990  12.344  57.357  3.753  0.07416  3.753  0.07419     0
                     0.044000  4.506    0.482    0.482   6.011  63.367  4.253  0.05244  4.251  0.05254     0
                     0.031000  5.012    0.576    0.576   7.178  70.546  4.759  0.03693  4.753  0.03707     0
                     0.022000  5.506    0.599    0.599   7.473  78.019  5.259  0.02612  5.250  0.02629     1
                     0.015600  6.002    0.458    0.458   5.715  83.734  5.754  0.01853  5.743  0.01867     0
                     0.011000  6.506    0.282    0.282   3.517  87.251  6.254  0.01310  6.244  0.01319     0
                     0.007800  7.002    0.176    0.176   2.198  89.449  6.754  0.00926  6.746  0.00932     0
                     0.005500  7.506    0.141    0.141   1.759  91.208  7.254  0.00655  7.246  0.00659     0
                     0.003900  8.002    0.106    0.106   1.319  92.526  7.754  0.00463  7.747  0.00466     0
                     0.002700  8.533    0.071    0.071   0.880  93.406  8.268  0.00325  8.261  0.00326     0
                     0.001900  9.040    0.070    0.070   0.879  94.285  8.786  0.00227  8.779  0.00228     0
                     0.001380  9.501    0.070    0.070   0.879  95.164  9.270  0.00162  9.263  0.00163     1
                     0.000980  9.995    0.035    0.035   0.440  95.603  9.748  0.00116  9.743  0.00117     0
                     0.000690 10.501    0.035    0.035   0.440  96.044 10.248  0.00082 10.243  0.00083     1
                     0.000490 10.995    0.035    0.035   0.440  96.483 10.748  0.00058 10.742  0.00058     0
                     0.000340 11.522    0.035    0.035   0.440  96.923 11.259  0.00041 11.251  0.00041     1
                     0.000240 12.025    0.035    0.035   0.440  97.362 11.773  0.00029 11.765  0.00029     1

                     0.000061 14.000    0.212    0.212   2.638 100.000 13.012  0.00012 12.337  0.00019     0
                    TOTALS              8.020    8.020 100.0
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P1++ 133B     0   0.0    0   0.0     0                                         ******************************
                                                                                ****                      ****
                                                                                ***   MULTIMODAL SAMPLE    ***
                                                                                ****                      ****
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            WET WT     DRY WT      SALT     ORGANIC   MOISTURE                   WEIGHT LOSS DUE TO HANDLING     0.0
          1000.0000    7.2800     0.0        0.0        0.0   (GRAMS)            GRAVEL CORRECTION FACTOR        1.000
           100.0000  100.0000     0.0        0.0        0.0   (PCT WET WT)       SIZES ELIMINATED (<0.01%)        NONE
                                                                                 TRASK SORTING COEFFECIENT       2.233
                                                                                 USING PROBABILITY EXTRAP.       2.219
                                                                                 MEAN CUBED DEVIATION           18.086
                                                                                 USING PROBABLITY EXTRAP.       13.994

 PERCENTAGE           TABLE OF STATISTICAL DATA IN PHI UNITS            PERCENTILES   LINEAR EXTRAP.        PROBABLILITY EXTRAP.
 COMPOSITION
                                 MEAN     STD DEV SKEWNESS KURTOSIS                     MM.      PHI UNITS      MM.      PHI UNITS
 GRAVEL     0.0      MOMENT     5.36330  2.28937  1.50729  5.40415        5.0       0.15023   2.73474     0.14143   2.82184
 SAND      28.85     P-MOMENT   5.34203  2.17512  1.35979  4.73275       10.0       0.12137   3.04249     0.12027   3.05562
 SILT      60.14     FOLK       5.08096  2.09200  0.24233  1.38692       16.0       0.10044   3.31555     0.09840   3.34524
 CLAY      11.01     P-FOLK     5.08928  2.06950  0.25390  1.38359       25.0       0.07277   3.78056     0.07219   3.79205
 MUD       71.15     INMAN      5.11865  1.80310  0.06270  1.17874       50.0       0.03113   5.00559     0.03113   5.00565
 S/M        0.41     P-INMAN    5.13109  1.78584  0.07024  1.17417       75.0       0.01459   6.09898     0.01466   6.09230
                     KRUMBEIN            1.71733 -0.06581  0.21779       84.0       0.00825   6.92175     0.00828   6.91693
                     P-KRUM.             1.70386 -0.06345  0.21686       90.0       0.00303   8.36513     0.00305   8.35907
                     FOLK (TRANSFORMED)                    0.58140       95.0       0.00065  10.59171     0.00065  10.58728
                     P-FOLK (TRANSFORMED)                  0.58047

                                DATA FOR CONSTN OF BARGRAPHS AND CUM. CURVES

                      SIZE FRACTION      WT.(GMS)      WT.PCT. WT.PCT.  MID PHI(LINEAR)  MID PHI(PROB.)  MODE
                       MM        PHI    UNCOR    COR     COR    CUMUL.    PHI      MM     PHI      MM

                     0.250000  2.000   0.030   0.030   0.412   0.412  1.751  0.29707  1.899  0.26818    0
                     0.177000  2.498   0.070   0.070   0.962   1.374  2.249  0.21036  2.312  0.20145    0
                     0.125000  3.000   0.560   0.560   7.692   9.066  2.749  0.14875  2.834  0.14025    0
                     0.088000  3.506   0.810   0.810  11.126  20.192  3.253  0.10488  3.287  0.10247    1
                     0.062500  4.000   0.630   0.630   8.654  28.846  3.753  0.07416  3.765  0.07356    0
                     0.044000  4.506   0.817   0.817  11.225  40.071  4.253  0.05244  4.261  0.05216    1
                     0.031000  5.012   0.731   0.731  10.047  50.119  4.759  0.03693  4.761  0.03688    0
                     0.022000  5.506   1.015   1.015  13.938  64.056  5.259  0.02612  5.255  0.02619    1*
                     0.015600  6.002   0.694   0.694   9.536  73.593  5.754  0.01853  5.746  0.01863    0
                     0.011000  6.506   0.534   0.534   7.335  80.928  6.254  0.01310  6.243  0.01321    0
                     0.007800  7.002   0.267   0.267   3.668  84.596  6.754  0.00926  6.746  0.00932    0
                     0.005500  7.506   0.214   0.214   2.934  87.530  7.254  0.00655  7.245  0.00659    0
                     0.003900  8.002   0.107   0.107   1.467  88.997  7.754  0.00463  7.749  0.00465    0
                     0.002700  8.533   0.107   0.107   1.467  90.464  8.268  0.00325  8.261  0.00326    0
                     0.001900  9.040   0.107   0.107   1.468  91.931  8.786  0.00227  8.778  0.00228    1
                     0.001380  9.501   0.053   0.053   0.734  92.665  9.270  0.00162  9.266  0.00162    0
                     0.000960  9.995   0.107   0.107   1.467  94.132  9.748  0.00116  9.737  0.00117    1
                     0.000690 10.501   0.053   0.053   0.734  94.865 10.248  0.00082 10.241  0.00083    0
                     0.000490 10.995   0.053   0.053   0.734  95.599 10.748  0.00058 10.740  0.00058    0
                     0.000340 11.522   0.053   0.053   0.734  96.332 11.259  0.00041 11.249  0.00041    1
                     0.000061 14.000   0.267   0.267   3.668 100.000 12.761  0.00014 11.905  0.00026    0

           TOTALS                      7.280   7.280 100.0
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 PITT136                          SIEVE, SH. PIP., SEDIGRAPH  SAMPLE WT.=  4.3900

   PHI  PCT. CUMPCT.
  3.00
        2.51              ***
  3.50          2.51
        5.24              *****
  4.00          7.74
        6.59              *******
  4.50         14.33
       14.12              **************
  5.00         28.46
       15.06              ***************
  5.50         43.52
       14.12              **************
  6.00         57.64
        9.41              *********
  6.50         67.05
        3.77              ****
  7.00         70.82
        2.82              ***
  7.50         73.64
        2.82              ***
  8.00         76.47
        1.88              **
  8.50         78.35
        1.88              **
  9.00         80.23
        2.82              ***
  9.50         83.06
        0.94              *
 10.00         84.00
        3.77              ****
 10.50         87.76
        1.88              **
 11.00         89.64
        1.88              **
 11.50         91.53
        0.94              *
 12.00         92.47
        2.82              ***
 12.50         95.29
        4.71              *****
 12.00        100.00
   MEAN   ST.DEV. SKEWNESS KURTOSIS
    6.33    2.23     0.58     0.46    KRUMBEIN+PETTIJOHN(1938) MOMENT MEASURES
                                      FOR SIZE RANGE  3.5 TO  12.5 PHI

    6.76    2.68     0.56     1.64    FOLK GRAPHIC STATISTICAL PARAMETERS
                                             FOLK AND WARD,1957

 PERCENTILES   MEDIAN  5.73      5TH  3.74      16TH  4.56      25TH  4.88

                                75TH  7.74      84TH 10.00      95TH 12.45


 PER CENT  GRAVEL   0.0   SAND   7.74  SILT  68.91 ( 68.72)  CLAY  23.35 ( 23.53)
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 P1++ 137       0   0.0     0   0.0      0                                    ****************************
                                                                              ****                    ****
                                                                              ***    MULTIMODAL SAMPLE   ***
                                                                              ****                    ****
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               WET WT      DRY WT      SALT      ORGANIC    MOISTURE                WEIGHT LOSS DUE TO HANDLING      0.0
            1000.0000      5.0000      0.0         0.0         0.0   (GRAMS)        GRAVEL CORRECTION FACTOR         1.000
             100.0000    100.0000      0.0         0.0         0.0   (PCT WET WT)   SIZES ELIMINATED (<0.01%)         NONE
                                                                                    TRASK SORTING COEFFECIENT        1.848
                                                                                    USING PROBABILITY EXTRAP.        1.831
                                                                                    MEAN CUBED DEVIATION             5.657
                                                                                    USING PROBABLITY FXTRAP.         4.544

  PERCENTAGE          TABLE OF STATISTICAL DATA IN PHI UNITS                      PERCENTILES   LINEAR EXTRAP.          PROBABLILITY EXTRAP.
  COMPOSITION
                                    MEAN     STD DEV SKEWNESS KURTOSIS                            MM.      PHI UNITS        MM.       PHI UNITS
  GRAVEL     0.0      MOMENT       5.00902  1.58568  1.41879  5.96666            5.0          0.11826    3.07994       0.11411     3.13147
  SAND      28.40     P-MOMENT     5.00873  1.52415  1.28336  5.01376           10.0          0.10139    3.30202       0.09727     3.36187
  SILT      65.63     FOLK         4.85852  1.46524  0.21125  1.21810           16.0          0.08500    3.55642       0.08438     3.56696
  CLAY       5.97     P-FOLK       4.85704  1.44877  0.21616  1.22105           25.0          0.06800    3.87836       0.06726     3.89416
  MUD       71.60     INMAN        4.89110  1.33469  0.07323  0.97281           50.0          0.03606    4.79336       0.03605     4.79391
  S/M        0.40     P-INMAN      4.88861  1.32165  0.07166  0.96741           75.0          0.01991    5.65018       0.02006     5.63965
                      KRUMBEIN              1.31246 -0.02909  0.24881           84.0          0.01336    6.22579       0.01351     6.21026
                      P-KRUM.               1.29296 -0.02701  0.25024           90.0          0.00859    6.86262       0.00867     6.84944
                      FOLK (TRANSFORMED)                      0.54916           95.0          0.00307    8.34609       0.00310     8.33193
                      P-FOLK (TRANSFORMED)                    0.54976

                                 DATA FOR CONSTN OF BARGRAPHS AND CUM. CURVES

                       SIZE FRACTION       WT.(GMS)     WT.PCT.  WT.PCT.   MID PHI(LINEAR)   MID PHI(PROB.)   MODE
                        MM        PHI    UNCOR     COR     COR     CUMUL.     PHI      MM       PHI      MM

                      0.250000   2.000   0.010    0.010    0.200    0.200   1.751  0.29707   1.883  0.27111      0
                      0.177000   2.498   0.010    0.010    0.200    0.400   2.249  0.21036   2.287  0.20486      0
                      0.125000   3.000   0.140    0.140    2.800    3.200   2.749  0.14875   2.846  0.13904      0
                      0.088000   3.506   0.570    0.570   11.400   14.600   3.253  0.10488   3.320  0.10011      0
                      0.062500   4.000   0.690    0.690   13.800   28.400   3.753  0.07416   3.777  0.07295      1
                      0.044000   4.506   0.588    0.588   11.750   40.150   4.253  0.05244   4.261  0.05214      0
                      0.031000   5.012   0.867    0.867   17.338   57.488   4.759  0.03693   4.760  0.03691      1*
                      0.022000   5.506   0.746    0.746   14.916   72.404   5.259  0.02612   5.249  0.02629      0
                      0.015600   6.002   0.447    0.447    8.950   81.354   5.754  0.01853   5.741  0.01870      0
                      0.011000   6.506   0.298    0.298    5.967   87.321   6.254  0.01310   6.238  0.01325      0
                      0.007800   7.002   0.186    0.186    3.729   91.050   6.754  0.00926   6.739  0.00936      0
                      0.005500   7.506   0.075    0.075    1.492   92.542   7.254  0.00655   7.246  0.00659      0
                      0.003900   8.002   0.075    0.075    1.491   94.033   7.754  0.00463   7.744  0.00467      0
                      0.002700   8.533   0.075    0.075    1.492   95.525   8.268  0.00325   8.252  0.00328      1
                      0.001900   9.040   0.037    0.037    0.746   96.271   8.786  0.00227   8.777  0.00228      0
                      0.001380   9.501   0.075    0.075    1.492   97.763   9.270  0.00162   9.246  0.00165      1
                      0.000980   9.995   0.075    0.075    1.491   99.254   9.748  0.00116   9.692  0.00121      0
                      0.000061  14.000   0.037    0.037    0.746  100.000  11.997  0.00024  10.733  0.00059      0
                    TOTALS               5.000    5.000  100.0
   0.250000       0.030000
   0.177000       0.030000
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  P1++ 138      0    0.0     0   0.0      0                                             ****                    ****
                                                                                        ***    MULTIMODAL SAMPLE  ***
                                                                                        ****                    ****
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              WET WT     DRY WT       SALT      ORGANIC     MOISTURE                 WEIGHT LOSS DUE TO HANDLING     0.0
            1000.0000     6.0300      0.0         0.0          0.0   (GRAMS)         GRAVEL CORRECTION FACTOR        1.000
             100.0000   100.0000      0.0         0.0          0.0   (PCT WET WT)    SIZES ELIMINATED (<0.01%)        NONE
                                                                                     TRASK SORTING COEFFECIENT       2.086
                                                                                     USING PROBABILITY EXTRAP.       2.086
                                                                                     MEAN CUBED DEVIATION           10.910
                                                                                     USING PROBABLITY EXTRAP.        5.812

 PERCENTAGE           TABLE OF STATISTICAL DATA IN PHI UNITS              PERCENTILES   LINEAR EXTRAP.           PROBABLILITY EXTRAP.
 COMPOSITION
                                     MEAN     STD DEV SKEWNESS KURTOSIS                   MM.      PHI UNITS       MM.      PHI UNITS
 GRAVEL     0.0       MOMENT        5.15899   1.93139  1.51435  5.76153         5.0     0.12198    3.03522      0.11994   3.05965
 SAND      31.84      P-MOMENT      5.11456   1.73799  1.10719  3.98882        10.0     0.10573    3.24153      0.10133   3.30279
 SILT      60.34      FOLK          5.01066   1.68515  0.29443  1.10890        16.0     0.08906    3.48909      0.08870   3.49494
 CLAY       7.82      P-FOLK        5.00971   1.67555  0.29644  1.11578        25.0     0.07274    3.78103      0.07168   3.80230
 MUD       68.16      INMAN         5.11993   1.63084  0.20100  0.75991        50.0     0.03609    4.79213      0.03608   4.79245
 S/M        0.47      P-INMAN       5.11834   1.62340  0.20074  0.75600        75.0     0.01672    5.90255      0.01679   5.89648
                      KRUMBEIN                1.57150  0.04966  0.24228        84.0     0.00929    6.75077      0.00934   6.74173
                      P-KRUM.                 1.55124  0.05694  0.24308        90.0     0.00508    7.61985      0.00512   7.61032
                      FOLK (TRANSFORMED)                        0.52582        95.0     0.00228    8.77547      0.00230   8.76103
                      P-FOLK (TRANSFORMED)                      0.52736

                                 DATA FOR CONSTN OF BARGRAPHS AND CUM. CURVES

                    SIZE FRACTION      WT.(GMS)     WT.PCT. WT.PCT.  MID PHI(LINEAR)  MID PHI(PROB.)  MODE
                     MM        PHI    UNCOR    COR     COR    CUMUL.   PHI       MM      PHI       MM

                  0.250000   2.000    0.030   0.030   0.498    0.498  1.751  0.29707  1.902  0.26757    1
                  0.177000   2.498    0.030   0.030   0.498    0.995  2.249  0.21036  2.286  0.20498    0
                  0.125000   3.000    0.190   0.190   3.151    4.146  2.749  0.14875  2.819  0.14169    0
                  0.088000   3.506    0.740   0.740  12.272   16.418  3.253  0.10488  3.313  0.10059    0
                  0.062500   4.000    0.930   0.930  15.423   31.841  3.753  0.07416  3.775  0.07303    1*
                  0.044000   4.506    0.625   0.625  10.370   42.211  4.253  0.05244  4.259  0.05223    0
                  0.031000   5.012    0.830   0.830  13.770   55.981  4.759  0.03693  4.759  0.03692    1
                  0.022000   5.506    0.771   0.771  12.779   68.760  5.259  0.02612  5.252  0.02624    0
                  0.015600   6.002    0.471   0.471   7.810   76.571  5.754  0.01853  5.745  0.01664    0
                  0.011000   6.506    0.342   0.342   5.680   82.250  6.254  0.01310  6.244  0.01319    0
                  0.007800   7.002    0.214   0.214   3.550   85.800  6.754  0.00926  6.745  0.00932    0
                  0.005500   7.506    0.214   0.214   3.550   89.350  7.254  0.00655  7.242  0.00661    1
                  0.003900   8.002    0.171   0.171   2.840   92.190  7.754  0.00463  7.740  0.00468    0
                  0.002700   8.533    0.128   0.128   2.130   94.320  8.268  0.00325  8.251  0.00328    0
                  0.001900   9.040    0.086   0.086   1.420   95.740  8.786  0.00227  8.772  0.00229    0
                  0.001380   9.501    0.043   0.043   0.710   96.450  9.270  0.00162  9.262  0.00163    0
                  0.000061  14.000    0.214   0.214   3.550  100.000 11.751  0.00029 10.197  0.00085    0
                TOTALS                6.030   6.030 100.0
    0.250000     0.030000
    0.177000     0.010000
    0.125000     0.180000
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                                                                                       ****                      ****
P1++ 139        0   0.0     0   0.0      0                                             ***    MULTIMODAL SAMPLE   ***
                                                                                       ****                      ****
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           WET WT     DRY WT      SALT      ORGANIC    MOISTURE                       WEIGHT LOSS DUE TO HANDLING      0.0
        1000.0000     5.3400      0.0         0.0        0.0   (GRAMS)                GRAVEL CORRECTION FACTOR         1.000
          99.9999   100.0000      0.0         0.0        0.0   (PCT WET WT)           SIZES ELIMINATED (<0.01%)        NONE
                                                                                      TRASK SORTING COEFFECIENT        1.976
                                                                                      USING PROBABILITY EXTRAP.        1.956
                                                                                      MEAN CUBED DEVIATION            11.992
                                                                                      USING PROBABLITY EXTRAP.         7.663

PERCENTAGE         TABLE OF STATISTICAL DATA IN PHI UNITS                PERCENTILES   LINEAR EXTRAP.            PROBABLILITY EXTRAP.
COMPOSITION
                                 MEAN     STD DEV SKEWNESS KURTOSIS                      MM.      PHI UNITS        MM.      PHI UNITS
GRAVEL    0.0      MOMENT       5.03403  1.90546  1.73337  6.56473         5.0        0.12217   3.03304        0.12009   3.05781
SAND     32.21     P-MOMENT     5.00610  1.75075  1.42794  5.00869        10.0        0.10726   3.22081        0.10252   3.28595
SILT     60.57     FOLK         4.81995  1.64918  0.33258  1.25922        16.0        0.09175   3.44614        0.09048   3.46624
CLAY      7.22     P-FOLK       4.82220  1.63724  0.33896  1.27266        25.0        0.07400   3.75632        0.07299   3.77604
MUD      67.79     INMAN        4.91501  1.46887  0.19414  1.05508        50.0        0.04039   4.62983        0.04044   4.62808
S/M       0.48     P-INMAN      4.91926  1.45302  0.20040  1.06839        75.0        0.01895   5.72127        0.01908   5.71172
                   KRUMBEIN              1.45552  0.10896  0.23731        84.0        0.01197   6.38388        0.01207   6.37226
                   P-KRUM.               1.43383  0.11580  0.23798        90.0        0.00608   7.36078        0.00612   7.35278
                   FOLK (TRANSFORMED)                      0.55737        95.0        0.00186   9.07033        0.00186   9.06863
                   P-FOLK (TRANSFORMED)                    0.55999


                              DATA FOR CONSTN OF BARGRAPHS AND CUM. CURVES

                  SIZE FRACTION        WT.(GMS)      WT.PCT.  WT.PCT.  MID PHI(LINEAR)  MID PHI(PROB.)  MODE
                   MM        PHI     UNCOR     COR     COR     CUMUL.    PHI       MM     PHI       MM

                 0.250000  2.000    0.030    0.030    0.562    0.562  1.751  0.29707  1.904  0.26720     1
                 0.177000  2.498    0.010    0.010    0.187    0.749  2.249  0.21036  2.265  0.20807     0
                 0.125000  3.000    0.180    0.180    3.371    4.120  2.749  0.14875  2.831  0.14054     0
                 0.088000  3.506    0.720    0.720   13.483   17.603  3.253  0.10488  3.316  0.10042     0
                 0.062500  4.000    0.780    0.780   14.607   32.210  3.753  0.07416  3.773  0.07315     1
                 0.044000  4.506    0.709    0.709   13.280   45.490  4.253  0.05244  4.259  0.05221     0
                 0.031000  5.012    0.985    0.985   18.451   63.941  4.759  0.03693  4.755  0.03702     1*
                 0.022000  5.506    0.424    0.424    7.934   71.875  5.259  0.02612  5.253  0.02623     0
                 0.015600  6.002    0.385    0.385    7.212   79.086  5.754  0.01853  5.744  0.01865     0
                 0.011000  6.506    0.347    0.347    6.491   85.577  6.254  0.01310  6.240  0.01323     0
                 0.007800  7.002    0.154    0.154    2.885   88.462  6.754  0.00926  6.745  0.00932     0
                 0.005500  7.506    0.115    0.115    2.163   90.625  7.254  0.00655  7.245  0.00659     0
                 0.003900  8.002    0.116    0.116    2.164   92.788  7.754  0.00463  7.742  0.00467     1
                 0.002700  8.533    0.038    0.038    0.721   93.509  8.268  0.00325  8.262  0.00326     0
                 0.001900  9.040    0.077    0.077    1.443   94.952  8.786  0.00227  8.774  0.00228     1
                 0.001380  9.501    0.039    0.039    0.721   95.673  9.270  0.00162  9.263  0.00163     0
                 0.000980  9.995    0.077    0.077    1.442   97.115  9.748  0.00116  9.728  0.00118     0
                 0.000061 14.000    0.154    0.154    2.885  100.000 11.997  0.00024 10.624  0.00063     0
               TOTALS               5.340    5.340  100.0
     0.250000  0.030000
     0.177000  0.030000
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PI++ 140      0   0.0    0   0.0     0                                                                  ****************************
                                                                                                         ****                    ****
                                                                                                         ***    MULTIMODAL SAMPLE   ***
                                                                                                         ****                    ****
                                                                                                         ****************************

              WET WT     DRY WT      SALT     ORGANIC    MOISTURE                           WEIGHT LOSS DUE TO HANDLING      0.0
           1000.0000     6.0900      0.0        0.0        0.0    (GRAMS)                    GRAVEL CORRECTION FACTOR         1.000
            100.0000   100.0000      0.0        0.0        0.0    (PCT WET WT)               SIZES ELIMINATED (<0.01%)         NONE
                                                                                             TRASK SORTING COEFFECIENT        1.974
                                                                                             USING PROBABILITY EXTRAP.        1.970
                                                                                             MEAN CUBED DEVIATION             8.875
                                                                                             USING PROBABLITY EXTRAP.         4.459


PERCENTAGE         TABLE OF STATISTICAL DATA IN PHI UNITS                       PERCENTILES   LINEAR EXTRAP.             PROBABLILITY EXTRAP.
COMPOSITION
                                     MEAN     STD DEV  SKEWNESS KURTOSIS                         MM.        PHI UNITS        MM.        PHI UNITS
GRAVEL       0.0    MOMENT          5.21568  1.75895  1.63083  6.96997                 5.0     0.11604     3.10735       0.11181     3.16092
SAND        25.29   P-MOMENT        5.17539  1.57455  1.14219  4.78355                10.0     0.09520     3.39288       0.09289     3.42837
SILT        68.48   FOLK            5.01978  1.50134  0.18113  1.10958                16.0     0.07937     3.65528       0.07793     3.68165
CLAY         6.23   P-FOLK          5.02576  1.48261  0.18980  1.09930                25.0     0.06296     3.98932       0.06288     3.99126
MUD         74.71   INMAN           5.04806  1.39277  0.06092  0.90723                50.0     0.03206     4.96321       0.03203     4.96450
S/M          0.34   P-INMAN         5.05643  1.37477  0.06687  0.90886                75.0     0.01616     5.95163       0.01620     5.94798
                    KRUMBEIN                 1.45356  0.00726  0.27644                84.0     0.01151     6.44083       0.01159     6.43120
                    P-KRUM.                  1.44942  0.00512  0.27920                90.0     0.00813     6.94211       0.00819     6.93253
                    FOLK (TRANSFORMED)                         0.52597                95.0     0.00292     8.42004       0.00294     8.40941
                    P-FOLK (TRANSFORMED)                       0.52365


                                         DATA FOR CONSTN OF BARGRAPHS AND CUM. CURVES

                    SIZE FRACTION        WT.(GMS)       WT.PCT. WT.PCT.   MID PHI(LINEAR)    MID PHI(PROB.)   MODE
                     MM        PHI     UNCOR     COR      COR    CUMUL.     PHI       MM      PHI       MM

                   0.250000  2.000    0.030    0.030    0.493    0.493  1.751  0.29707  1.902  0.26760     0
                   0.177000  2.498    0.030    0.030    0.493    0.985  2.249  0.21036  2.286  0.20498     0
                   0.125000  3.000    0.130    0.130    2.135    3.120  2.749  0.14875  2.808  0.14283     0
                   0.088000  3.506    0.540    0.540    8.867   11.987  3.253  0.10488  3.315  0.10349     0
                   0.062500  4.000    0.810    0.810   13.300   25.287  3.753  0.07416  3.761  0.07272     1
                   0.044000  4.506    0.499    0.499    8.196   33.484  4.253  0.05244  4.261  0.05214     0
                   0.031000  5.012    1.112    1.112   18.264   51.748  4.759  0.03693  4.765  0.03679     1*
                   0.022000  5.506    0.948    0.948   15.566   67.314  5.259  0.02612  5.253  0.02623     0
                   0.015600  6.002    0.521    0.521    8.561   75.874  5.754  0.01853  5.745  0.01864     0
                   0.011000  6.506    0.569    0.569    9.339   85.213  6.254  0.01310  6.236  0.01327     1
                   0.007800  7.002    0.332    0.332    5.447   90.661  6.754  0.00926  6.734  0.00939     0
                   0.005500  7.506    0.095    0.095    1.557   92.218  7.254  0.00655  7.246  0.00659     0
                   0.003900  8.002    0.095    0.095    1.557   93.774  7.754  0.00463  7.744  0.00467     1
                   0.002700  8.533    0.095    0.095    1.557   95.331  8.268  0.00325  8.252  0.00328     1
                   0.001900  9.040    0.047    0.047    0.778   96.108  8.786  0.00227  8.777  0.00228     0
                   0.001380  9.501    0.047    0.047    0.778   96.887  9.270  0.00162  9.260  0.00163     0
                   0.000061 14.000    0.190    0.190    3.113  100.000 11.751  0.00029 10.204  0.00085     0
                 TOTALS               6.090    6.090  100.0
     0.250000     0.020000
     0.177000     0.030000
     0.125000     0.120000
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PITT 141        0   C.0    0   0.0      0                                            ***   MULTIMODAL SAMPLE   ***
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          WET WT     DRY WT       SALT     ORGANIC    MOISTURE                    WEIGHT LOSS DUE TO HANDLING      0.0
        1000.0000     5.4200      0.0        0.0        0.0   (GRAMS)             GRAVEL CORRECTION FACTOR         1.000
         100.0000   100.0000      0.0        0.0        0.0   (PCT WET WT)        SIZES ELIMINATED (<0.01%)        NONE
                                                                                  TRASK SORTING COEFFECIENT        2.007
                                                                                  USING PROBABILITY EXTRAP.        1.985
                                                                                  MEAN CUBED DEVIATION            13.132
                                                                                  USING PROBABLITY EXTRAP.         8.126

PERCENTAGE           TABLE OF STATISTICAL DATA IN PHI UNITS                  PERCENTILES   LINEAR EXTRAP.            PROBABLILITY EXTRAP.
COMPOSITION
                                          MEAN     STD DEV  SKEWNESS KURTOSIS                 MM.       PHI UNITS        MM.       PHI UNITS
GRAVEL     0.0       MOMENT             5.18648  2.00107  1.63888  5.94068           5.0    0.11865    3.07519       0.11436    3.12827
SAND      31.73      P-MOMENT           5.14942  1.82717  1.33206  4.52803          10.0    0.10316    3.27699       0.09849    3.34380
SILT      59.09      FOLK               4.97995  1.75111  0.32626  1.30637          16.0    0.08741    3.51610       0.08726    3.51851
CLAY       9.18      P-FOLK             4.97843  1.74035  0.33168  1.31603          25.0    0.07215    3.79288       0.07104    3.81516
MUD       68.27      INMAN              5.07701  1.56092  0.18656  1.05209          50.0    0.03625    4.78581       0.03624    4.78609
S/M        0.46      P-INMAN            5.07460  1.55609  0.18541  1.04076          75.0    0.01792    5.80266       0.01803    5.79305
                     KRUMBEIN                    1.48873  0.01196  0.22659          84.0    0.01004    6.63793       0.01009    6.63069
                     P-KRUM.                     1.46510  0.01801  0.22673          90.0    0.00477    7.71184       0.00479    7.70559
                     FOLK (TRANSFORMED)                            0.56642          95.0    0.00140    9.48149       0.00140    9.47949
                     P-FOLK (TRANSFORMED)                          0.56823

                                  DATA FOR CONSTN OF BARGRAPHS AND CUM. CURVES

                      SIZE FRACTION       WT.(GMS)     WT.PCT. WT.PCT.  MID PHI(LINEAR)  MID PHI(PROB.)  MODE
                        MM       PHI    UNCOR    COR     COR    CUMUL.     PHI     MM      PHI     MM

                     0.250000  2.000   0.020   0.020   0.369    0.369  1.751  0.29707  1.897  0.26657      0
                     0.177000  2.498   0.030   0.030   0.554    0.923  2.249  0.21036  2.298  0.20334      0
                     0.125000  3.000   0.120   0.120   2.214    3.137  2.749  0.14875  2.811  0.14250      0
                     0.088000  3.506   0.680   0.680  12.546   15.683  3.253  0.10488  3.323  0.09990      0
                     0.062500  4.000   0.870   0.870  16.052   31.734  3.753  0.07416  3.777  0.07295      1*
                     0.044000  4.506   0.571   0.571  10.530   42.265  4.253  0.05244  4.259  0.05223      0
                     0.031000  5.012   0.758   0.758  13.983   56.248  4.759  0.03693  4.759  0.03692      0
                     0.022000  5.506   0.765   0.765  14.113   70.362  5.259  0.02612  5.251  0.02626      1
                     0.015600  6.002   0.421   0.421   7.763   78.125  5.754  0.01853  5.745  0.01865      0
                     0.011000  6.506   0.268   0.268   4.939   83.064  6.254  0.01310  6.244  0.01319      0
                     0.007800  7.002   0.191   0.191   3.529   86.592  6.754  0.00926  6.745  0.00932      0
                     0.005500  7.506   0.153   0.153   2.823   89.415  7.254  0.00655  7.244  0.00660      0
                     0.003900  8.002   0.076   0.076   1.411   90.827  7.754  0.00463  7.748  0.00465      0
                     0.002700  8.533   0.076   0.076   1.411   92.238  8.268  0.00325  8.259  0.00326      1
                     0.001900  9.040   0.076   0.076   1.411   93.648  8.786  0.00227  8.777  0.00228      0
                     0.001380  9.501   0.076   0.076   1.411   95.060  9.270  0.00162  9.259  0.00163      0
                     0.000980  9.995   0.076   0.076   1.411   96.471  9.748  0.00116  9.731  0.00118      0
                     0.000061 14.000   0.191   0.191   3.529  100.000 11.997  0.00024 10.615  0.00064      0
                   TOTALS              5.420   5.420 100.0
      0.250000     0.020000
      0.177000     0.010000
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  P1++ 142       0  0.0     0  0.0      0                                               ***   MULTIMODAL SAMPLE   ***
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              WET WT     DRY WT      SALT     ORGANIC    MOISTURE                      WEIGHT LOSS DUE TO HANDLING      0.0
           1000.0000     5.8700      0.0        0.0         0.0   (GRAMS)              GRAVEL CORRECTION FACTOR         1.000
             99.9999   100.0000      0.0        0.0         0.0   (PCT WET WT)         SIZES ELIMINATED (<0.01%)         NONE
                                                                                       TRASK SORTING COEFFECIENT        1.952
                                                                                       USING PROBABILITY EXTRAP.        1.942
                                                                                       MEAN CUBED DEVIATION            15.290
                                                                                       USING PROBABLITY EXTRAP.        10.572

  PERCENTAGE          TABLE OF STATISTICAL DATA IN PHI UNITS                    PERCENTILES   LINEAR EXTRAP.          PROBABLILITY EXTRAP.
  COMPUSITION
                                        MEAN     STD DEV SKEWNESS KURTOSIS                    MM.        PHI UNITS      MM.        PHI UNITS
  GRAVEL      0.0     MCMENT          4.99812   2.02941  1.82941  6.55402           5.0      0.12008    3.05789     0.11536     3.11572
  SAND       38.33    P-MCMENT        4.97679   1.87859  1.59464  5.29855          10.0      0.10916    3.19549     0.10274     3.26295
  SILT       52.76    FCLK            4.76062   1.74673  0.40570  1.37532          16.0      0.09735    3.36062     0.09375     3.41510
  CLAY        8.91    P-FOLK          4.77681   1.72233  0.42320  1.37320          25.0      0.08169    3.61370     0.08096     3.62668
  MUD        61.67    INMAN           4.89146   1.53084  0.25641  1.11538          50.0      0.04423    4.49894     0.04422     4.49905
  S/M         0.62    P-INMAN         4.91569   1.50059  0.27765  1.13763          75.0      0.02144    5.54368     0.02147     5.54138
                      KRUMBEIN                  1.42962  0.07975  0.22042          84.0      0.01166    6.42230     0.01171     6.41628
                      P-KRUM.                   1.41830  0.08498  0.22328          90.0      0.00525    7.57343     0.00526     7.57065
                      FOLK (TRANSFORMED)                          0.57900          95.0      0.00135    9.53450     0.00135     9.53116
                      P-FOLK (TRANSFORMED)                        0.57863

                                 DATA FOR CONSTN OF BARGRAPHS AND CUM. CURVES

                       SIZE FRACTION        WT.(GMS)      WT.PCT.  WT.PCT.   MID PHI(LINEAR)   MID PHI(PROB.)   MODE
                         MM        PHI     UNCOR    COR     COR    CUMUL.      PHI      MM      PHI      MM

                      0.250000   2.000   0.020    0.020    0.341    0.341   1.751  0.29707  1.895  0.26886     1
                      0.177000   2.498   0.010    0.010    0.170    0.511   2.249  0.21036  2.272  0.20711     0
                      0.125000   3.000   0.140    0.140    2.385    2.896   2.749  0.14875  2.833  0.14029     0
                      0.088000   3.506   1.080    1.080   18.399   21.295   3.253  0.10488  3.334  0.09915     1*
                      0.062500   4.000   1.000    1.000   17.036   38.331   3.753  0.07416  3.770  0.07332     0
                      0.044000   4.506   0.695    0.695   11.842   50.173   4.253  0.05244  4.256  0.05234     0
                      0.031000   5.012   0.835    0.835   14.224   64.397   4.759  0.03693  4.755  0.03704     1
                      0.022000   5.506   0.597    0.597   10.172   74.569   5.259  0.02612  5.250  0.02628     0
                      0.015600   6.002   0.336    0.336    5.722   80.291   5.754  0.01853  5.745  0.01864     0
                      0.011000   6.506   0.261    0.261    4.451   84.742   6.254  0.01310  6.244  0.01319     0
                      0.007800   7.002   0.149    0.149    2.543   87.284   6.754  0.00926  6.747  0.00931     0
                      0.005500   7.506   0.149    0.149    2.543   89.828   7.254  0.00655  7.244  0.00660     1
                      0.003900   8.002   0.075    0.075    1.272   91.100   7.754  0.00463  7.748  0.00465     0
                      0.002700   8.533   0.112    0.112    1.907   93.007   8.268  0.00325  8.255  0.00327     1
                      0.001900   9.040   0.075    0.075    1.271   94.278   8.786  0.00227  8.776  0.00228     0
                      0.001360   9.501   0.037    0.037    0.636   94.914   9.270  0.00162  9.265  0.00163     0
                      0.000980   9.995   0.075    0.075    1.272   96.186   9.748  0.00116  9.734  0.00117     1
                      0.000690  10.501   0.037    0.037    0.635   96.821  10.248  0.00082 10.239  0.00083     0
                      0.000061  14.000   0.187    0.187    3.179  100.000  12.251  0.00021 11.047  0.00047     0
                    TOTALS                5.870    5.870  100.0
      0.250000      0.020000
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     P1++ 143        0   0.0     0   0.0      0                                       ***    MULTIMODAL SAMPLE    ***
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                  WET WT      DRY WT       SALT     ORGANIC    MOISTURE                     WEIGHT LOSS DUE TO HANDLING      0.0
               1000.0000      6.0600       0.0        0.0        0.0   (GRAMS)              GRAVEL CORRECTION FACTOR         1.000
                 99.9999    100.0000       0.0        0.0        0.0   (PCT WET WT)         SIZES ELIMINATED (<0.01%)         NONE
                                                                                            TRASK SORTING COEFFECIENT        2.395
                                                                                            USING PROBABILITY EXTRAP.        2.377
                                                                                            MEAN CUBED DEVIATION            13.554
                                                                                            USING PROBABLITY EXTRAP.        10.155

     PERCENTAGE          TABLE OF STATISTICAL DATA IN PHI UNITS                   PERCENTILES    LINEAR EXTRAP.           PROBABILITY EXTRAP.
     COMPOSITION
                                       ~~MEAN~~   STD DEV SKEWNESS KURTOSIS                       MM.       PHI UNITS        MM.       PHI UNITS
     GRAVEL       0.0    MOMENT          5.10492  2.16715  1.33174  4.55280           5.0      0.14618     2.77417       0.13693     2.86852
     SAND        40.59   P-MOMENT        5.09098  2.05574  1.16887  3.75398          10.0      0.12148     3.04118       0.11979     3.06146
     SILT        48.48   FOLK            4.97285  2.01769  0.35725  1.12432          16.0      0.10903     3.19721       0.10547     3.24513
     CLAY        10.92   P-FOLK          4.98754  1.98886  0.37466  1.11678          25.0      0.09270     3.43124       0.09151     3.44984
     MUD         59.41   INMAN           5.13790  1.94070  0.25514  0.78093          50.0      0.04003     4.64275       0.04004     4.64223
     S/M          0.68   P-INMAN         5.16020  1.91507  0.27047  0.77715          75.0      0.01616     5.95098       0.01620     5.94778
                         KRUMBEIN                 1.86647  0.04836  0.24104          84.0      0.00740     7.07860       0.00742     7.07527
                         P-KRUM.                  1.85033  0.05658  0.24029          90.0      0.00324     8.26802       0.00326     8.25920
                         FOLK (TRANSFORMED)                         0.52926          95.0      0.00121     9.68665       0.00122     9.67526
                         P-FOLK (TRANSFORMED)                       0.52758


                                        DATA FOR CONSTN OF BARGRAPHS AND CUM. CURVES

                          SIZE FRACTION        WT.(GMS)        WT.PCT. WT.PCT.  MID PHI(LINEAR)   MID PHI(PROB.)   MODE
                           MM         PHI     UNCOR     COR      COR    CUMUL.    PHI       MM      PHI       MM

                         0.250000   2.000    0.020    0.020    0.330    0.330  1.751  0.29707  1.894  0.26898      0
                         0.177000   2.498    0.030    0.030    0.495    0.825  2.249  0.21036  2.298  0.20332      0
                         0.125000   3.000    0.460    0.460    7.591    8.416  2.749  0.14875  2.850  0.13871      0
                         0.088000   3.506    1.180    1.180   19.472   27.888  3.253  0.10488  3.299  0.10157      1*
                         0.062500   4.000    0.770    0.770   12.706   40.594  3.753  0.07416  3.762  0.07371      0
                         0.044000   4.506    0.400    0.400    6.607   47.201  4.253  0.05244  4.255  0.05238      0
                         0.031000   5.012    0.628    0.628   10.366   57.567  4.759  0.03693  4.758  0.03696      0
                         0.022000   5.506    0.661    0.661   10.912   68.479  5.259  0.02612  5.253  0.02622      1
                         0.015600   6.002    0.441    0.441    7.274   75.752  5.754  0.01853  5.746  0.01863      0
                         0.011000   6.506    0.257    0.257    4.243   79.996  6.254  0.01310  6.247  0.01316      0
                         0.007800   7.002    0.220    0.220    3.637   83.633  6.754  0.00926  6.747  0.00931      0
                         0.005500   7.506    0.147    0.147    2.425   86.058  7.254  0.00655  7.248  0.00658      0
                         0.003900   8.002    0.184    0.184    3.031   89.089  7.754  0.00463  7.744  0.00467      1
                         0.002700   8.533    0.110    0.110    1.818   90.908  8.268  0.00325  8.259  0.00326      0
                         0.001900   9.040    0.110    0.110    1.818   92.726  8.786  0.00227  8.776  0.00228      1
                         0.001380   9.501    0.110    0.110    1.818   94.545  9.270  0.00162  9.258  0.00163      1
                         0.000980   9.995    0.073    0.073    1.212   95.757  9.748  0.00116  9.736  0.00117      0
                         0.000690  10.501    0.110    0.110    1.818   97.575 10.248  0.00082 10.219  0.00084      0
                         0.000061  14.000    0.147    0.147    2.425  100.000 12.251  0.00021 11.059  0.00047      0
                       TOTALS                6.060    6.060  100.0
        0.250000       0.030000
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PI++ 144      0   0.0    0   0.0     0                                              ***    MULTIMODAL SAMPLE   ***
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            WET WT     DRY.WT     SALT    ORGANIC   MOISTURE                     WEIGHT LOSS DUE TO HANDLING     0.0
          1000.0000    4.3400     0.0       0.0       0.0    (GRAMS)             GRAVEL CORRECTION FACTOR        1.000
           100.0000  100.0000     0.0       0.0       0.0    (PCT WET WT)        SIZES ELIMINATED (<0.01%)        NONE
                                                                                 TRASK SORTING COEFFECIENT       2.763
                                                                                 USING PROBABILITY EXTRAP.       2.745
                                                                                 MEAN CUBED DEVIATION           10.808
                                                                                 USING PROBABLITY EXTRAP.        9.226

PERCENTAGE        TABLE OF STATISTICAL DATA IN PHI UNITS               PERCENTILES   LINEAR EXTRAP.          PROBABLILITY EXTRAP.
COMPOSITION
                                MEAN    STD DEV SKEWNESS KURTOSIS                     MM.     PHI UNITS       MM.     PHI UNITS
GRAVEL     0.0    MOMENT       5.00430  2.17114  1.05601  3.44012         5.0      0.15634   2.67723      0.14589   2.77705
SAND      47.70   P-MOMENT     5.00754  2.10821  0.98461  3.03967        10.0      0.13170   2.92471      0.12862   2.95883
SILT      40.55   FOLK         4.89243  2.09724  0.52159  0.94091        16.0      0.11642   3.10252      0.11395   3.13347
CLAY      11.76   P-FOLK       4.90008  2.07148  0.53800  0.93911        25.0      0.10093   3.30854      0.09862   3.34155
MUD       52.30   INMAN        5.24207  2.13955  0.49026  0.58474        50.0      0.05467   4.19313      0.05467   4.19302
S/M        0.91   P-INMAN      5.25361  2.12014  0.50024  0.57426        75.0      0.01303   6.26229      0.01309   6.25517
                  KRUMBEIN              2.18796  0.59229  0.27229        84.0      0.00600   7.38163      0.00603   7.37376
                  P-KRUM.               2.15791  0.60555  0.27083        90.0      0.00307   8.34861      0.00309   8.33710
                  FOLK (TRANSFORMED)                      0.48478        95.0      0.00142   9.45849      0.00143   9.45236
                  P-FOLK (TRANSFORMED)                    0.48430

                          DATA FOR CONSTN OF BARGRAPHS AND CUM. CURVES

                   SIZE FRACTION      WT.(GMS)      WT.PCT. WT.PCT.  MID PHI(LINEAR)  MID PHI(PROB.)  MODE
                    MM      PHI     UNCOR    COR     COR    CUMUL.    PHI      MM      PHI      MM

                  0.250000  2.000   0.030   0.030   0.691   0.691   1.751  0.29707  1.907  0.26562    0
                  0.177000  2.498   0.030   0.030   0.691   1.382   2.249  0.21036  2.286  0.20503    0
                  0.125000  3.000   0.440   0.440  10.138  11.521   2.749  0.14875  2.841  0.13961    0
                  0.088000  3.506   0.960   0.960  22.120  33.641   3.253  0.10488  3.291  0.10217    1*
                  0.062500  4.000   0.610   0.610  14.055  47.696   3.753  0.07416  3.759  0.07389    0
                  0.044000  4.506   0.262   0.262   6.040  53.736   4.253  0.05244  4.253  0.05245    0
                  0.031000  5.012   0.224   0.224   5.168  58.904   4.759  0.03693  4.758  0.03697    0
                  0.022000  5.506   0.324   0.324   7.471  66.376   5.259  0.02612  5.255  0.02619    1
                  0.015600  6.002   0.255   0.255   5.871  72.247   5.754  0.01853  5.749  0.01859    0
                  0.011000  6.506   0.232   0.232   5.338  77.584   6.254  0.01310  6.247  0.01316    0
                  0.007800  7.002   0.139   0.139   3.202  80.786   6.754  0.00926  6.749  0.00930    0
                  0.005500  7.506   0.185   0.185   4.271  85.057   7.254  0.00655  7.244  0.00660    1
                  0.003900  8.002   0.139   0.139   3.202  88.258   7.754  0.00463  7.744  0.00466    0
                  0.002700  8.533   0.116   0.116   2.668  90.926   8.268  0.00325  8.255  0.00327    0
                  0.001900  9.040   0.093   0.093   2.136  93.062   8.786  0.00227  8.773  0.00229    0
                  0.001380  9.501   0.093   0.093   2.135  95.197   9.270  0.00162  9.254  0.00164    0
                  0.000980  9.995   0.093   0.093   2.135  97.332   9.748  0.00116  9.719  0.00119    0
                  0.000690 10.501   0.069   0.069   1.600  98.932  10.248  0.00082 10.200  0.00085    0
                  0.000061 14.000   0.046   0.046   1.068 100.000  12.251  0.00021 11.114  0.00045    0
                TOTALS              4.340   4.340 100.0
    0.250000    0.010000
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P1++ 145      0   0.0    0   0.0     0                                                            ***   MULTIMODAL SAMPLE   ***
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                WET WT     DRY WT      SALT     ORGANIC   MOISTURE                                WEIGHT LOSS DUE TO HANDLING     0.0
             1000.0000     5.5000      0.0        0.0       0.0    (GRAMS)                        GRAVEL CORRECTION FACTOR        1.000
              100.0000   100.0000      0.0        0.0       0.0    (PCT WET WT)                   SIZES ELIMINATED (<0.01%)        NONE
                                                                                                  TRASK SORTING COEFFECIENT       2.316
                                                                                                  USING PROBABILITY EXTRAP.       2.309
                                                                                                  MEAN CUBED DEVIATION           17.740
                                                                                                  USING PROBABLITY EXTRAP.       13.725

PEPCENTAGE          TABLE OF STATISTICAL DATA IN PHI UNITS                         PERCENTILES   LINEAR EXTRAP.             PROBABLILITY EXTRAP.
COMPOSITION
                                  MEAN     STD DEV SKEWNESS KURTOSIS                                MM.       PHI UNITS        MM.      PHI UNITS
GRAVEL     0.0      MOMENT       5.20633   2.28454  1.48787  4.78651                  5.0       0.12394    3.01228      0.12293    3.02411
SAND      40.73     P-MOMENT     5.19140   2.16681  1.34911  4.09239                 10.0       0.11285    3.14747      0.10765    3.21559
SILT      46.30     FOLK         5.02288   2.06127  0.45702  1.21977                 16.0       0.10085    3.30970      0.09693    3.36690
CLAY      12.97     P-FOLK       5.04026   2.04218  0.46790  1.21955                 25.0       0.08507    3.55519      0.08470    3.56155
MUD       59.27     INMAN        5.24717   1.93747  0.34729  0.86066                 50.0       0.04198    4.57430      0.04199    4.57370
S/M        0.69     P-INMAN      5.27354   1.90664  0.36705  0.88459                 75.0       0.01587    5.97796      0.01588    5.97660
                    KRUMBEIN               1.79465  0.19228  0.21290                 84.0       0.00687    7.18464      0.00690    7.18018
                    P-KRUM.                1.78892  0.19537  0.21510                 90.0       0.00219    8.83751      0.00220    8.82935
                    FOLK (TRANSFORMED)                       0.54950                 95.0       0.00084   10.22301      0.00084   10.21057
                    P-FOLK (TRANSFORMED)                     0.54946


                             DATA FOR CONSTN OF BARGRAPHS AND CUM. CURVES

                     SIZE FRACTION       WT.(GMS)     WT.PCT. WT.PCT.  MID PHI(LINEAR)  MID PHI(PROB.)  MODE
                       MM        PHI    UNCOR    COR    COR    CUMUL.    PHI       MM     PHI      MM

                    0.250000   2.000    0.010   0.010   0.182    0.182  1.751  0.29707  1.881  0.27157    0
                    0.177000   2.498    0.010   0.010   0.182    0.364  2.249  0.21036  2.287  0.20485    0
                    0.125000   3.000    0.230   0.230   4.182    4.545  2.749  0.14875  2.860  0.13774    0
                    0.088000   3.506    1.030   1.030  18.727   23.273  3.253  0.10488  3.319  0.10017    1*
                    0.062500   4.000    0.960   0.960  17.455   40.727  3.753  0.07416  3.768  0.07542    0
                    0.044000   4.506    0.426   0.426   7.739   48.466  4.253  0.05244  4.255  0.05238    0
                    0.031000   5.012    0.627   0.627  11.401   59.867  4.759  0.03693  4.757  0.03698    1
                    0.022000   5.506    0.509   0.509   9.262   69.129  5.259  0.02612  5.255  0.02622    0
                    0.015600   6.002    0.340   0.340   6.174   75.303  5.754  0.01853  5.748  0.01861    0
                    0.011000   6.506    0.272   0.272   4.940   80.243  6.254  0.01310  6.246  0.01317    0
                    0.007800   7.002    0.170   0.170   3.087   83.330  6.754  0.00926  6.748  0.00931    0
                    0.005500   7.506    0.102   0.102   1.852   85.182  7.254  0.00655  7.249  0.00657    0
                    0.003900   8.002    0.102   0.102   1.853   87.035  7.754  0.00463  7.749  0.00465    1
                    0.002700   8.533    0.102   0.102   1.852   88.886  8.268  0.00325  8.260  0.00326    0
                    0.001900   9.040    0.102   0.102   1.853   90.739  8.786  0.00227  8.778  0.00228    0
                    0.001380   9.501    0.136   0.136   2.469   93.208  9.270  0.00162  9.257  0.00163    1
                    0.000980   9.995    0.068   0.068   1.235   94.444  9.748  0.00116  9.738  0.00117    0
                    0.000690  10.501    0.068   0.068   1.235   95.678 10.248  0.00082 10.235  0.00083    0
                    0.000490  10.995    0.068   0.068   1.235   96.913 10.748  0.00058 10.731  0.00059    0
                    0.000061  14.000    0.170   0.170   3.087  100.000 12.497  0.00017 11.465  0.00035    0
                  TOTALS                5.500   5.500 100.0
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                                                                                   ***   MULTIMODAL SAMPLE   ***
PITT 146        0    0.0     0    0.0       0                                      ****                     ****
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                  WET WT    DRY WT      SALT     ORGANIC   MOISTURE               WEIGHT LOSS DUE TO HANDLING       0.0
               1000.0000    5.7550      0.0        0.0        0.0   (GRAMS)        GRAVEL CORRECTION FACTOR          1.000
                100.0000  100.0000      0.0        0.0        0.0   (PCT WET WT)   SIZES ELIMINATED (<0.01%)          NONE
                                                                                   TRASK SORTING COEFFECIENT          2.154
                                                                                   USING PROBABILITY EXTRAP.          2.134
                                                                                   MEAN CUBED DEVIATION              16.966
                                                                                   USING PROBABLITY EXTRAP.          12.464

PERCENTAGE          TABLE OF STATISTICAL DATA IN PHI UNITS                    PERCENTILES   LINEAR EXTRAP.          PROBABLILITY EXTRAP.
COMPOSITION
                                  MEAN    STD DEV  SKEWNESS KURTOSIS                          MM.      PHI UNITS       MM.      PHI UNITS
GRAVEL      0.0    MOMENT        5.32753  2.20175  1.58552  5.37505             5.0        0.11674    3.09860       0.11054    3.17740
SAND       33.71   P-MOMENT      5.30545  2.06618  1.41304  4.52068            10.0        0.10306    3.27848       0.09757    3.35737
SILT       54.79   FOLK          5.13246  1.98459  0.39571  1.32555            16.0        0.08874    3.49433       0.08841    3.49959
CLAY       11.50   P-FOLK        5.13281  1.96800  0.40402  1.32390            25.0        0.07419    3.75254       0.07299    3.77617
MUD        66.29   INMAN         5.29403  1.79969  0.26932  0.98904            50.0        0.03566    4.80933       0.03566    4.80969
S/M         0.51   P-INMAN       5.29437  1.79478  0.27005  0.96850            75.0        0.01600    5.96607       0.01602    5.96359
                   KRUMBEIN               1.63965  0.04998  0.21011            84.0        0.00732    7.09372       0.00734    7.08915
                   P-KRUM.                1.62031  0.06019  0.21083            90.0        0.00268    8.54607       0.00268    8.54498
                   FOLK (TRANSFORMED)                       0.56999            95.0        0.00082   10.25792       0.00082   10.24344
                   P-FOLK (TRANSFORMED)                     0.56969

                        DATA FOR CONSTN OF BARGRAPHS AND CUM. CURVES

            SIZE FRACTION      WT.(GMS)     WT.PCT. WT.PCT.  MID PHI(LINEAR)   MID PHI(PROB.)   MODE
            MM        PHI    UNCOR    COR     COR    CUMUL.    PHI      MM      PHI      MM

         0.250000   2.000   0.010   0.010   0.174    0.174   1.751  0.29707   1.879  0.27180     0
         0.177000   2.498   0.010   0.010   0.174    0.348   2.249  0.21036   2.287  0.20485     0
         0.125000   3.000   0.110   0.110   1.911    2.259   2.749  0.14875   2.840  0.13968     0
         0.088000   3.506   0.810   0.810  14.075   16.334   3.253  0.10488   3.337  0.09896     0
         0.062500   4.000   1.000   1.000  17.376   33.710   3.753  0.07416   3.777  0.07296     1*
         0.044000   4.506   0.528   0.528   9.182   42.891   4.253  0.05244   4.258  0.05228     0
         0.031000   5.012   0.682   0.682  11.853   54.745   4.759  0.03693   4.760  0.03692     0
         0.022000   5.506   0.744   0.744  12.931   67.675   5.259  0.02612   5.253  0.02622     1
         0.015600   6.002   0.455   0.455   7.902   75.577   5.754  0.01853   5.746  0.01863     0
         0.011000   6.506   0.289   0.289   5.028   80.605   6.254  0.01310   6.246  0.01318     0
         0.007800   7.002   0.165   0.165   2.874   83.479   6.754  0.00926   6.748  0.00930     0
         0.005500   7.506   0.165   0.165   2.873   86.352   7.254  0.00655   7.246  0.00659     0
         0.003900   8.002   0.124   0.124   2.155   88.507   7.754  0.00463   7.747  0.00466     0
         0.002700   8.533   0.083   0.083   1.437   89.944   8.268  0.00325   8.261  0.00326     0
         0.001900   9.040   0.124   0.124   2.155   92.098   8.786  0.00227   8.775  0.00228     1
         0.001380   9.501   0.083   0.083   1.437   93.535   9.270  0.00162   9.262  0.00163     0
         0.000980   9.995   0.041   0.041   0.719   94.254   9.748  0.00116   9.742  0.00117     0
         0.000690  10.501   0.083   0.083   1.436   95.690  10.248  0.00082  10.234  0.00083     1
         0.000490  10.995   0.041   0.041   0.719   96.408  10.748  0.00058  10.739  0.00059     0
         0.000061  14.000   0.207   0.207   3.592  100.000  12.497  0.00017  11.459  0.00036     0
        TOTALS              5.755   5.755 100.0
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  P1++ 147         0  0.0     0  0.0      0                                      ***    MULTIMODAL SAMPLE   ***
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              WET WT      DRY WT     SALT     ORGANIC   MOISTURE                WEIGHT LOSS DUE TO HANDLING     0.0
           1000.0000      5.6300     0.0        0.0        0.0    (GRAMS)       GRAVEL CORRECTION FACTOR        1.000
            100.0000    100.0000     0.0        0.0        0.0    (PCT WET WT)  SIZES ELIMINATED (<0.01%)        NONE
                                                                                TRASK SORTING COEFFECIENT        1.843
                                                                                USING PROBABILITY EXTRAP.        1.834
                                                                                MEAN CUBED DEVIATION            12.172
                                                                                USING PROBABLITY EXTRAP.         6.762


  PERCENTAGE          TABLE OF STATISTICAL DATA IN PHI UNITS              PERCENTILES   LINEAR EXTRAP.          PROBABLILITY EXTRAP.
  COMPOSITION
                                   MEAN    STD DEV  SKEWNESS KURTOSIS                    MM.      PHI UNITS      MM.      PHI UNITS
  GRAVEL       0.0    MOMENT      5.46444  1.91212  1.74112  6.55292           5.0     0.10131    3.30311     0.09595    3.38157
  SAND        19.89   P-MOMENT    5.41673  1.70805  1.35702  4.87894          10.0     0.08238    3.60149     0.08068    3.63162
  SILT        71.75   FOLK        5.24436  1.67551  0.28160  1.44044          16.0     0.06968    3.84316     0.06820    3.87411
  CLAY         8.36   P-FOLK      5.25066  1.65326  0.29613  1.43409          25.0     0.05291    4.24027     0.05238    4.25474
  MUD         80.11   INMAN       5.31488  1.47172  0.14376  1.10694          50.0     0.02909    5.10331     0.02912    5.10159
  S/M          0.25   P-INMAN     5.32520  1.45109  0.15409  1.10978          75.0     0.01557    6.00477     0.01558    6.00457
                      KRUMBEIN             1.30704  0.01921  0.21662          84.0     0.00906    6.78660     0.00912    6.77628
                      P-KRUM.              1.29617  0.02806  0.21698          90.0     0.00490    7.67434     0.00493    7.66391
                      FOLK (TRANSFORMED)                     0.59024          95.0     0.00138    9.50477     0.00138    9.50452
                      P-FOLK (TRANSFORMED)                   0.58917


                                 DATA FOR CONSTN OF BARGRAPHS AND CUM. CURVES

                       SIZE FRACTION      WT.(GMS)      WT.PCT. WT.PCT.  MID PHI(LINEAR)  MID PHI(PROB.)  MODE
                         MM       PHI    UNCOR    COR     COR    CUMUL.    PHI      MM      PHI      MM

                      0.250000  2.000   0.010   0.010    0.178    0.178  1.751  0.29707  1.880  0.27169    1
                      0.177000  2.498   0.010   0.010    0.178    0.355  2.249  0.21036  2.287  0.20485    0
                      0.125000  3.000   0.040   0.040    0.710    1.066  2.749  0.14875  2.807  0.14286    0
                      0.088000  3.506   0.370   0.370    6.572    7.638  3.253  0.10498  3.343  0.09555    0
                      0.062500  4.000   0.690   0.690   12.256   19.893  3.753  0.07416  3.793  0.07216    1
                      0.044000  4.506   0.606   0.606   10.761   30.655  4.253  0.05244  4.268  0.05192    0
                      0.031000  5.012   0.897   0.897   15.941   46.596  4.759  0.03693  4.767  0.03673    0
                      0.022000  5.506   1.034   1.034   18.358   64.954  5.259  0.02612  5.255  0.02619    1*
                      0.015600  6.002   0.564   0.564   10.013   74.967  5.754  0.01853  5.745  0.01865    0
                      0.011000  6.506   0.376   0.376    6.675   81.642  6.254  0.01310  6.243  0.01320    0
                      0.007800  7.002   0.235   0.235    4.172   85.814  6.754  0.00926  6.744  0.00933    0
                      0.005500  7.506   0.188   0.188    3.337   89.152  7.254  0.00655  7.243  0.00660    0
                      0.003900  8.002   0.141   0.141    2.504   91.655  7.754  0.00463  7.742  0.00467    0
                      0.002700  8.533   0.094   0.094    1.669   93.324  8.268  0.00325  8.256  0.00327    0
                      0.001900  9.040   0.047   0.047    0.835   94.159  8.766  0.00227  8.780  0.00228    0
                      0.001380  9.501   0.047   0.047    0.835   94.994  9.270  0.00162  9.263  0.00163    1
                      0.000980  9.995   0.047   0.047    0.834   95.828  9.748  0.00116  9.739  0.00117    0
                      0.000061 14.000   0.235   0.235    4.172  100.000 11.997  0.00024 10.608  0.00064    0
                     TOTALS             5.630   5.630  100.0
          0.250000    0.010000
          0.177000    0.010000
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  PI++ 148       0   0.0    0   0.0      0                                       ***    MULTIMODAL SAMPLE   ***
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              WET WT     DRY WT      SALT    ORGANIC    MOISTURE                WEIGHT LOSS DUE TO HANDLING     0.0
            1000.0000    5.4700      0.0       0.0        0.0    (GRAMS)        GRAVEL CORRECTION FACTOR        1.000
             100.0000  100.0000      0.0       0.0        0.0    (PCT WET WT)   SIZES ELIMINATED (<0.01%)        NONE
                                                                                TRASK SORTING COEFFECIENT       1.655
                                                                                USING PROBABILITY EXTRAP.       1.646
                                                                                MEAN CUBED DEVIATION           10.783
                                                                                USING PROBABLITY EXTRAP.        4.900

 .PERCENTAGE          TABLE OF STATISTICAL DATA IN PHI UNITS             PERCENTILES   LINEAR EXTRAP.          PROBABLILITY EXTRAP.
  COMPOSITION
                                      MEAN     STD DEV SKEWNESS KURTOSIS                   MM.      PHI UNITS      MM.      PHI UNITS
  GRAVEL    0.0     MOMENT          5.03805  1.70734  2.16667  8.70359        5.0      0.10674    3.22784     0.10045    3.31549
  SAND     25.96    P-MOMENT        4.98277  1.45327  1.59656  5.93573       10.0      0.08678    3.52641     0.08626    3.53519
  SILT     68.63    FOLK            4.79833  1.32911  0.24844  1.42264       16.0      0.07671    3.70445     0.07460    3.74468
  CLAY      5.41    P-FOLK          4.80992  1.30334  0.26977  1.41143       25.0      0.06375    3.97150     0.06345    3.97516
  MUD      74.04    INMAN           4.83283  1.12838  0.09172  1.23706       50.0      0.03770    4.72934     0.03772    4.72867
  S/M       0.35    P-INMAN         4.85054  1.10586  0.11020  1.23930       75.0      0.02326    5.42588     0.02342    5.41628
                    KRUMBEIN                 1.07732 -0.03064  0.22499       84.0      0.01605    5.96121     0.01610    5.95640
                    P-KRUM.                  1.06527 -0.03145  0.22406       90.0      0.00924    6.75849     0.00933    6.74447
                    FOLK (TRANSFORMED)                         0.58723       95.0      0.00323    8.27635     0.00324    8.26821
                    P-FOLK (TRANSFORMED)                       0.58531

                                 DATA FOR CONSTN OF BARGRAPHS AND CUM. CURVES

                     SIZE FRACTION        WT.(GMS)      WT.PCT.  WT.PCT.  MID PHI(LINEAR)   MID PHI(PROB.)   MODE
                      MM        PHI     UNCOR     COR     COR     CUMUL.     PHI      MM      PHI      MM

                    0.250000   2.000    0.010    0.010    0.183    0.183   1.751  0.29707   1.881  0.27154    0
                    0.177000   2.498    0.010    0.010    0.183    0.366   2.249  0.21036   2.287  0.20485    0
                    0.125000   3.000    0.060    0.060    1.097    1.463   2.749  0.14875   2.820  0.14158    0
                    0.088000   3.506    0.430    0.430    7.861    9.324   3.253  0.10488   3.337  0.09894    0
                    0.062500   4.000    0.910    0.910   16.636   25.960   3.753  0.07416   3.792  0.07217    1
                    0.044000   4.506    0.821    0.821   15.003   40.963   4.253  0.05244   4.265  0.05203    0
                    0.031000   5.012    1.120    1.120   20.475   61.438   4.759  0.03693   4.758  0.03696    1*
                    0.022000   5.506    0.886    0.886   16.196   77.633   5.259  0.02612   5.244  0.02639    0
                    0.015600   6.002    0.380    0.380    6.942   84.575   5.754  0.01853   5.740  0.01871    0
                    0.011000   6.506    0.211    0.211    3.856   88.431   6.254  0.01310   6.242  0.01321    0
                    0.007800   7.002    0.169    0.169    3.085   91.516   6.754  0.00926   6.740  0.00935    0
                    0.005500   7.506    0.084    0.084    1.542   93.058   7.254  0.00655   7.245  0.00659    0
                    0.003900   8.002    0.084    0.084    1.543   94.601   7.754  0.00463   7.742  0.00467    1
                    0.002700   8.533    0.042    0.042    0.771   95.373   8.268  0.00325   8.259  0.00326    0
                    0.001900   9.040    0.042    0.042    0.771   96.143   8.786  0.00227   8.777  0.00228    0
                    0.000061  14.000    0.211    0.211    3.856  100.000  11.520  0.00034   9.803  0.00112    0
                  TOTALS                5.470    5.470  100.0
     0.177000     0.010000
     0.125000     0.120000
     0.088000     0.550000
     0.062500     0.470000
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 P1++ 149      0   0.0     0   0.0      0                                            ***   MULTIMODAL SAMPLE    ***
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            WET WT     DRY WT      SALT     ORGANIC   MOISTURE                 WEIGHT LOSS DUE TO HANDLING     0.0
         1000.0000     4.9900      0.0        0.0        0.0   (GRAMS)         GRAVEL CORRECTION FACTOR        1.000
          100.0000   100.0000      0.0        0.0        0.0   (PCT WET WT)    SIZES ELIMINATED (<0.01%)        NONE
                                                                               TRASK SORTING COEFFECIENT       2.035
                                                                               USING PROBABILITY EXTRAP.       2.024
                                                                               MEAN CUBED DEVIATION           12.142
                                                                               USING PROBABLITY EXTRAP.        8.304

 PERCENTAGE         TABLE OF STATISTICAL DATA IN PHI UNITS              PERCENTILES   LINEAR EXTRAP.        PROBABLILITY EXTRAP.
 COMPOSITION
                                     MEAN   STD DEV  SKEWNESS KURTOSIS                 MM.      PHI UNITS        MM.      PHI UNITS
 GRAVEL    0.0      MOMENT        5.51209  2.04103  1.42804  5.19853       5.0      0.11582    3.11000       0.11047    3.17820
 SAND     23.05     P-MOMENT      5.48541  1.90448  1.20210  4.17091      10.0      0.09877    3.33970       0.09500    3.39589
 SILT     65.95     FOLK          5.28287  1.89196  0.26506  1.35783      16.0      0.08073    3.63069       0.07981    3.64729
 CLAY     11.00     P-FOLK        5.28646  1.87502  0.27454  1.35322      25.0      0.05716    4.12673       0.05687    4.13606
 MUD      76.95     INMAN         5.35579  1.72510  0.12682  0.96920      50.0      0.02842    5.13702       0.02844    5.13567
 S/M       0.30     P-INMAN       5.36186  1.71457  0.13192  0.95881      75.0      0.01380    6.17942       0.01388    6.17039
                    KRUMBEIN               1.51903  0.01705  0.20515      84.0      0.00739    7.08090       0.00741    7.07643
                    P-KRUM.                1.50691  0.01755  0.20612      90.0      0.00309    8.33778       0.00311    8.33078
                    FOLK (TRANSFORMED)                       0.57588      95.0      0.00104    9.90414       0.00105    9.89524
                    P-FOLK (TRANSFORMED)                     0.57505

                               DATA FOR CONSTN OF BARGRAPHS AND CUM. CURVES

                     SIZE FRACTION     WT.(GMS)     WT.PCT. WT.PCT.  MID PHI(LINEAR)   MID PHI(PROB.)  MODE
                      MM       PHI   UNCOR    COR     COR    CUMUL.    PHI      MM      PHI      MM

                   0.177000  2.498   0.010   0.010   0.200    0.200  2.249  0.21036   2.381  0.19195    0
                   0.125000  3.000   0.120   0.120   2.405    2.605  2.749  0.14875   2.864  0.13740    0
                   0.088000  3.506   0.550   0.550  11.022   13.627  3.253  0.10488   3.327  0.09968    1
                   0.062500  4.000   0.470   0.470   9.419   23.046  3.753  0.07416   3.773  0.07314    0
                   0.044000  4.506   0.383   0.383   7.684   30.730  4.253  0.05244   4.262  0.05211    0
                   0.031000  5.012   0.753   0.753  15.088   45.819  4.759  0.03693   4.767  0.03674    0
                   0.022000  5.506   0.823   0.823  16.490   62.309  5.259  0.02612   5.256  0.02616    1*
                   0.015600  6.002   0.509   0.509  10.207   72.516  5.754  0.01853   5.746  0.01863    0
                   0.011000  6.506   0.353   0.353   7.068   79.584  6.254  0.01310   6.244  0.01319    0
                   0.007800  7.002   0.196   0.196   3.926   83.510  6.754  0.00926   6.746  0.00932    0
                   0.005500  7.506   0.157   0.157   3.141   86.651  7.254  0.00655   7.245  0.00655    0
                   0.003900  8.002   0.118   0.118   2.356   89.007  7.754  0.00463   7.746  0.00466    0
                   0.002700  8.523   0.078   0.078   1.570   90.577  8.268  0.00325   8.260  0.00326    0
                   0.001900  9.040   0.078   0.078   1.570   92.147  8.786  0.00227   8.778  0.00228    0
                   0.001380  9.501   0.078   0.078   1.571   93.718  9.270  0.00162   9.261  0.00163    1
                   0.000980  9.995   0.078   0.078   1.570   95.289  9.748  0.00116   9.734  0.00117    0
                   0.000690 10.501   0.078   0.078   1.570   96.859 10.248  0.00082  10.227  0.00083    0
                   0.000061 14.000   0.157   0.157   3.141  100.000 12.251  0.00021  11.047  0.00047    0
                  TOTALS             4.990   4.990 100.0
      0.250000    0.010000
      0.177000    0.020000
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 P1++ 150      0   0.0     0   0.0     0                                            ****************************
                                                                                    ****                    ****
                                                                                    ***    MULTIMODAL SAMPLE ***
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           WET WT     DRY WT       SALT     ORGANIC   MOISTURE                      WEIGHT LOSS DUE TO HANDLING     0.0
        1000.0000     5.4700       0.0        0.0        0.0    (GRAMS)             GRAVEL CORRECTION FACTOR        1.000
         100.0000   100.0000       0.0        0.0        0.0    (PCT WET WT)        SIZES ELIMINATED (<0.01%)        NONE
                                                                                    TRASK SORTING COEFFECIENT       2.370
                                                                                    USING PROBABILITY EXTRAP.       2.346
                                                                                    MEAN CUBED DEVIATION           14.377
                                                                                    USING PROBABLITY EXTRAP.       10.943

 PERCENTAGE           TABLE OF STATISTICAL DATA IN PHI UNITS                 PERCENTILES   LINEAR EXTRAP.          PROBABLILITY EXTRAP.
 COMPOSITION
                                      ~~MEAN~~   STD DEV SKEWNESS KURTOSIS                     MM.      PHI UNITS        MM.     PHI UNITS
 GRAVEL        0.0    MOMENT          5.44971  2.18289  1.38225  4.77423          5.0      0.11760     3.08606        0.11246    3.15245
 SAND         30.90   P-MOMENT        5.43285  2.07281  1.22872  4.05169         10.0      0.10273     3.28311        0.09782    3.35368
 SILT         57.57   FOLK            5.26484  2.02850  0.34035  1.18109         16.0      0.08745     3.51538        0.08732    3.51752
 CLAY         11.53   P-FOLK          5.26258  2.01373  0.34578  1.18190         25.0      0.07139     3.80617        0.07037    3.82897
 MUD          69.10   INMAN           5.39857  1.88319  0.21302  0.90463         50.0      0.03131     4.99740        0.03130    4.99760
 S/M           0.45   P-INMAN         5.39508  1.87756  0.21170  0.88934         75.0      0.01271     6.29739        0.01279    6.28912
                      KRUMBEIN                 1.84387  0.05538  0.23585         84.0      0.00643     7.28176        0.00647    7.27264
                      P-KRUM.                  1.82233  0.06145  0.23632         90.0      0.00265     8.56014        0.00265    8.55871
                      FOLK (TRANSFORMED)                         0.54151         95.0      0.00081    10.26163        0.00082   10.24714
                      P-FOLK (TRANSFORMED)                       0.54168


                                DATA FOR CONSTN OF BARGRAPHS AND CUM. CURVES

                        SIZE FRACTION       WT.(GMS)     WT.PCT. WT.PCT.  MID PHI(LINEAR)  MID PHI(PROB.)   MODE
                          MM       PHI    UNCOR     COR     COR    CUMUL.     PHI      MM     PHI      MM

                      0.250000  2.000    0.010    0.010    0.183    0.183  1.751  0.29707  1.881  0.27154     0
                      0.177000  2.498    0.020    0.020    0.366    0.548  2.249  0.21036  2.308  0.20196     0
                      0.125000  3.000    0.120    0.120    2.194    2.742  2.749  0.14875  2.828  0.14078     0
                      0.088000  3.506    0.710    0.710   12.980   15.722  3.253  0.10488  3.329  0.09953     0
                      0.062500  4.000    0.830    0.830   15.174   30.896  3.753  0.07416  3.776  0.07299     1*
                      0.044000  4.506    0.416    0.416    7.599   38.495  4.253  0.05244  4.258  0.05225     0
                      0.031000  5.012    0.648    0.648   11.837   50.332  4.759  0.03693  4.762  0.03686     0
                      0.022000  5.506    0.709    0.709   12.957   63.289  5.259  0.02612  5.255  0.02618     1
                      0.015600  6.002    0.433    0.433    7.918   71.207  5.754  0.01853  5.748  0.01860     0
                      0.011000  6.506    0.354    0.354    6.479   77.686  6.254  0.01310  6.246  0.01318     0
                      0.007800  7.002    0.236    0.236    4.319   82.005  6.754  0.00926  6.746  0.00931     0
                      0.005500  7.506    0.197    0.197    3.599   85.603  7.254  0.00655  7.245  0.00659     0
                      0.003900  8.002    0.157    0.157    2.879   88.483  7.754  0.00463  7.745  0.00466     0
                      0.002700  8.533    0.079    0.079    1.440   89.922  8.268  0.00325  8.261  0.00326     0
                      0.001900  9.040    0.079    0.079    1.440   91.362  8.786  0.00227  8.779  0.00228     1
                      0.001380  9.501    0.079    0.079    1.440   92.802  9.270  0.00162  9.262  0.00163     1
                      0.000980  9.995    0.079    0.079    1.440   94.241  9.748  0.00116  9.737  0.00117     1
                      0.000690 10.501    0.079    0.079    1.440   95.681 10.248  0.00082 10.234  0.00083     0
                      0.000490 10.995    0.079    0.079    1.440   97.121 10.748  0.00058 10.728  0.00059     0
                      0.000061 14.000    0.157    0.157    2.879  100.000 12.497  0.00017 11.467  0.00035     0
                    TOTALS               5.470    5.470  100.0
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 P1++ 151        0   0.0     0   0.0      0                               ***   MULTIMODAL SAMPLE    ***
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              WET WT     DRY WT       SALT      ORGANIC   MOISTURE            WEIGHT LOSS DUE TO HANDLING      0.0
           1000.0000     5.7600       0.0         0.0       0.0   (GRAMS)     GRAVEL CORRECTION FACTOR         1.000
            100.0000   100.0000       0.0         0.0       0.0   (PCT WET WT) SIZES ELIMINATED (<0.01%)        NONE
                                                                              TRASK SORTING COEFFECIENT        1.778
                                                                              USING PROBABILITY EXTRAP.        1.764
                                                                              MEAN CUBED DEVIATION            11.121
                                                                              USING PROBABLITY EXTRAP.         5.477

 PERCENTAGE          TABLE OF STATISTICAL DATA IN PHI UNITS                PERCENTILES   LINEAR EXTRAP.          PROBABLILITY EXTRAP.
 COMPOSITION
                                  MEAN     STD DEV SKEWNESS KURTOSIS                     MM.      PHI UNITS       MM.      PHI UNITS
 GRAVEL      0.0     MOMENT      5.43441   1.86476  1.71505  6.50260          5.0     0.09753   3.35805       0.09429   3.40670
 SAND       17.36    P-MOMENT    5.37623   1.63602  1.25075  4.58288         10.0     0.07869   3.66775       0.07645   3.70936
 SILT       74.02    FOLK        5.23949   1.57604  0.31919  1.42436         16.0     0.06522   3.93655       0.06454   3.95364
 CLAY        8.62    P-FOLK      5.24065   1.56139  0.32708  1.43004         25.0     0.05094   4.29507       0.05030   4.31334
 MUD        82.64    INMAN       5.34212   1.40357  0.21937  1.05549         50.0     0.03052   5.03422       0.03053   5.03359
 S/M         0.21    P-INMAN     5.34418   1.39054  0.22336  1.05545         75.0     0.01612   5.95532       0.01616   5.95160
                     KRUMBEIN              1.22981  0.09098  0.21103         84.0     0.00932   6.74570       0.00939   6.73472
                     P-KRUM.               1.21353  0.09888  0.21074         90.0     0.00515   7.60135       0.00517   7.59637
                     FOLK (TRANSFORMED)                      0.58752         95.0     0.00179   9.12811       0.00179   9.12307
                     P-FOLK (TRANSFORMED)                    0.58848

                                DATA FOR CONSTN OF BARGRAPHS AND CUM. CURVES

                     SIZE FRACTION        WT.(GMS)     WT.PCT.  WT.PCT.  MID PHI(LINEAR)  MID PHI(PROB.)  MODE
                      MM        PHI     UNCOR    COR     COR    CUMUL.     PHI      MM      PHI      MM

                    0.250000   2.000    0.030   0.030   0.521    0.521   1.751  0.29707   1.903  0.26743    1
                    0.177000   2.498    0.020   0.020   0.347    0.868   2.249  0.21036   2.277  0.20634    0
                    0.125000   3.000    0.040   0.040   0.694    1.563   2.749  0.14875   2.781  0.14553    0
                    0.088000   3.506    0.280   0.280   4.861    6.424   3.253  0.10488   3.321  0.10503    0
                    0.062500   4.000    0.630   0.630  10.938   17.361   3.753  0.07416   3.795  0.07202    0
                    0.044000   4.506    0.755   0.755  13.108   30.469   4.253  0.05244   4.273  0.05174    0
                    0.031000   5.012    1.080   1.080  18.743   49.212   4.759  0.03693   4.767  0.03673    1*
                    0.022000   5.506    0.992   0.992  17.216   66.428   5.259  0.02612   5.253  0.02621    0
                    0.015600   6.002    0.545   0.545   9.469   75.897   5.754  0.01853   5.745  0.01865    0
                    0.011000   6.506    0.347   0.347   6.026   81.923   6.254  0.01310   6.244  0.01320    0
                    0.007800   7.002    0.248   0.248   4.304   86.227   6.754  0.00926   6.743  0.00933    0
                    0.005500   7.506    0.198   0.198   3.444   89.670   7.254  0.00655   7.242  0.00661    0
                    0.003900   8.002    0.099   0.099   1.721   91.392   7.754  0.00463   7.746  0.00466    0
                    0.002700   8.533    0.099   0.099   1.722   93.114   8.268  0.00325   8.256  0.00327    1
                    0.001900   9.040    0.099   0.099   1.721   94.835   8.786  0.00227   8.772  0.00229    0
                    0.001380   9.501    0.050   0.050   0.861   95.696   9.270  0.00162   9.262  0.00163    0
                    0.000061  14.000    0.248   0.248   4.304  100.000  11.751  0.00029  10.188  0.00086    0
                  TOTALS                5.760   5.760 100.0
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P1++ 152        0   0.0     0   0.0      0                                          ***    MULTIMODAL SAMPLE   ***
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             WET WT     DRY WT      SALT     ORGANIC   MOISTURE                WEIGHT LOSS DUE TO HANDLING      0.0
          1000.0000     5.5700      0.0        0.0        0.0    (GRAMS)       GRAVEL CORRECTION FACTOR         1.000
           100.0000   100.0000      0.0        0.0        0.0    (PCT WET WT)  SIZES ELIMINATED (<0.01%)         NONE
                                                                               TRASK SORTING COEFFECIENT        1.968
                                                                               USING PROBABILITY EXTRAP.        1.958
                                                                               MEAN CUBED DEVIATION            11.302
                                                                               USING PROBABLITY EXTRAP.         7.097


PERCENTAGE          TABLE OF STATISTICAL DATA IN PHI UNITS                PERCENTILES   LINEAR EXTRAP.          PROBABLILITY EXTRAP.
COMPOSITION
                                 MEAN    STD DEV SKEWNESS KURTOSIS                      MM.      PHI UNITS        MM.      PHI UNITS
GRAVEL     0.0      MOMENT      5.26645  1.94584  1.53409  5.76524          5.0       0.12524   2.99720        0.12509   2.99896
SAND      26.21     P-MOMENT    5.23540  1.78898  1.23956  4.37945         10.0       0.10571   3.24181        0.10206   3.29244
SILT      64.56     FOLK        5.03978  1.74802  0.24740  1.34007         16.0       0.08645   3.53201        0.08618   3.53652
CLAY       9.23     P-FOLK      5.03944  1.74338  0.24638  1.34723         25.0       0.06495   3.94445        0.06465   3.95118
MUD       73.79     INMAN       5.09250  1.56050  0.10136  1.04655         50.0       0.03270   4.93434        0.03268   4.93548
S/M        0.36     P-INMAN     5.09142  1.55490  0.10029  1.05001         75.0       0.01677   5.89788        0.01685   5.89053
                    KRUMBEIN             1.44699 -0.01317  0.21657         84.0       0.00994   6.65300        0.00998   6.64633
                    P-KRUM.              1.43656 -0.01463  0.21779         90.0       0.00464   7.75168        0.00466   7.74470
                    FOLK (TRANSFORMED)                     0.57266         95.0       0.00150   9.38446        0.00151   9.37410
                    P-FOLK (TRANSFORMED)                   0.57397


                              DATA FOR CONSTN OF BARGRAPHS AND CUM. CURVES

                     SIZE FRACTION        WT.(GMS)     WT.PCT. WT.PCT.  MID PHI(LINEAR)   MID PHI(PROB.)    MODE
                      MM       PHI     UNCOR     COR     COR    CUMUL.     PHI       MM      PHI       MM

                    0.177000  2.498    0.010    0.010    0.180    0.180   2.249  0.21036   2.378  0.19233     0
                    0.125000  3.000    0.270    0.270    4.847    5.027   2.749  0.14875   2.881  0.13572     0
                    0.088000  3.506    0.580    0.580   10.413   15.440   3.253  0.10488   3.303  0.10131     0
                    0.062500  4.000    0.600    0.600   10.772   26.212   3.753  0.07416   3.772  0.07318     0
                    0.044000  4.506    0.601    0.601   10.789   37.001   4.253  0.05244   4.262  0.05210     0
                    0.031000  5.012    0.855    0.855   15.345   52.346   4.759  0.03693   4.762  0.03685     0
                    0.022000  5.506    0.856    0.856   15.373   67.718   5.259  0.02612   5.253  0.02623     1*
                    0.015600  6.002    0.514    0.514    9.224   76.942   5.754  0.01853   5.744  0.01866     0
                    0.011000  6.506    0.342    0.342    6.149   83.091   6.254  0.01310   6.243  0.01321     0
                    0.007800  7.002    0.171    0.171    3.075   86.165   6.754  0.00926   6.746  0.00932     0
                    0.005500  7.506    0.171    0.171    3.075   89.240   7.254  0.00655   7.243  0.00660     0
                    0.003900  8.002    0.086    0.086    1.537   90.777   7.754  0.00463   7.747  0.00465     0
                    0.002700  8.533    0.086    0.086    1.538   92.314   8.268  0.00325   8.258  0.00327     1
                    0.001900  9.040    0.086    0.086    1.537   93.851   8.786  0.00227   8.775  0.00228     0
                    0.001380  9.501    0.086    0.086    1.538   95.389   9.270  0.00162   9.257  0.00163     1
                    0.000980  9.995    0.086    0.086    1.537   96.925   9.748  0.00116   9.728  0.00116     0
                    0.000061 14.000    0.171    0.171    3.075  100.000  11.997  0.00024  10.621  0.00063     0
                  TOTALS               5.570    5.570  100.0
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    P1++ 153        0   0.0     0   0.0      0                                       ***   MULTIMODAL SAMPLE    ***
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                WET WT      DRY WT       SALT      ORGANIC    MOISTURE                 WEIGHT LOSS DUE TO HANDLING     0.0
              1000.0000      6.1000      0.0         0.0         0.0    (GRAMS)        GRAVEL CORRECTION FACTOR        1.000
                99.9999    100.0000      0.0         0.0         0.0    (PCT WET WT)   SIZES ELIMINATED (<0.01%)        NONE
                                                                                       TRASK SORTING COEFFECIENT       2.015
                                                                                       USING PROBABILITY EXTRAP.       1.993
                                                                                       MEAN CUBED DEVIATION           11.024
                                                                                       USING PROBABLITY EXTRAP.        5.956


    PERCENTAGE          TABLE OF STATISTICAL DATA IN PHI UNITS                 PERCENTILES   LINEAR EXTRAP.            PROBABLILITY EXTRAP.
    COMPOSITION
                                      MEAN     STD DEV SKEWNESS KURTOSIS                        MM.       PHI UNITS        MM.       PHI UNITS
    GRAVEL      0.0     MOMENT       5.13866  1.90420  1.59666  6.06504              5.0     0.11735    3.09113       0.11232     3.15430
    SAND       32.30    P-MOMENT     5.09649  1.70939  1.19241  4.24382             10.0     0.10174    3.29704       0.09717     3.36330
    SILT       60.02    FOLK         4.97766  1.64163  0.29789  1.16576             16.0     0.08641    3.53266       0.08600     3.53945
    CLAY        7.69    P-FOLK       4.97790  1.62580  0.30509  1.16774             25.0     0.07225    3.79077       0.07106     3.81488
    MUD        67.70    INMAN        5.07290  1.54024  0.18551  0.86725             50.0     0.03622    4.78717       0.03621     4.78738
    S/M         0.48    P-INMAN      5.07317  1.53372  0.18633  0.84812             75.0     0.01779    5.81295       0.01789     5.80450
                        KRUMBEIN              1.49791  0.01469  0.24210             84.0     0.01022    6.61314       0.01026     6.60688
                        P-KRUM.               1.47379  0.02231  0.24226             90.0     0.00563    7.47341       0.00564     7.46976
                        FOLK (TRANSFORMED)                      0.53827             95.0     0.00218    8.84313       0.00221     8.82329
                        P-FOLK (TRANSFORMED)                    0.53869



                                  DATA FOR CONSTN OF BARGRAPHS AND CUM. CURVES

                         SIZE FRACTICN        WT.(GMS)     WT.PCT.  WT.PCT.  MID PHI(LINEAR)  MID PHI(PROB.)  MODE
                          MM       PHI     UNCOR     COR     COR     CUMUL.     PHI      MM      PHI      MM

                       0.250000  2.000    0.040    0.040    0.656    0.656  1.751  0.29707  1.906  0.26676      1
                       0.177000  2.498    0.020    0.020    0.328    0.984  2.249  0.21036  2.271  0.20717      0
                       0.125000  3.000    0.110    0.110    1.803    2.787  2.749  0.14875  2.803  0.14333      0
                       0.088000  3.506    0.750    0.750   12.295   15.082  3.253  0.10488  3.327  0.09966      0
                       0.062500  4.000    1.050    1.050   17.213   32.295  3.753  0.07416  3.779  0.07285      1*
                       0.044000  4.506    0.673    0.673   11.036   43.331  4.253  0.05244  4.259  0.05223      0
                       0.031000  5.012    0.732    0.732   11.998   55.329  4.759  0.03693  4.759  0.03692      0
                       0.022000  5.506    0.937    0.937   15.356   70.684  5.259  0.02612  5.250  0.02627      1
                       0.015600  6.002    0.426    0.426    6.980   77.665  5.754  0.01853  5.746  0.01864      0
                       0.011000  6.506    0.341    0.341    5.584   83.248  6.254  0.01310  6.243  0.01320      0
                       0.007800  7.002    0.213    0.213    3.490   86.739  6.754  0.00926  6.745  0.00933      0
                       0.005500  7.506    0.213    0.213    3.489   90.228  7.254  0.00655  7.241  0.00661      0
                       0.003900  8.002    0.128    0.128    2.094   92.322  7.754  0.00463  7.743  0.00467      0
                       0.002700  8.533    0.085    0.085    1.396   93.718  8.268  0.00325  8.257  0.00327      0
                       0.001900  9.040    0.128    0.128    2.094   95.612  8.786  0.00227  8.766  0.00230      1
                       0.001360  9.501    0.043    0.043    0.698   96.510  9.270  0.00162  9.262  0.00163      0
                       0.000061 14.000    0.213    0.213    3.490  100.000 11.751  0.00029 10.198  0.00085      0
                     TOTALS               6.100    6.100  100.0
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PI++ 154      0   0.0    0   0.0     0                                          ******************************
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                                                                                ***    MULTIMODAL SAMPLE   ***
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           WET WT     DRY WT      SALT     ORGANIC   MOISTURE                WEIGHT LOSS DUE TO HANDLING     0.0
         1000.0000     5.7400     0.0        0.0        0.0   (GRAMS)        GRAVEL CORRECTION FACTOR        1.000
          100.0000   100.0000     0.0        0.0        0.0   (PCT WET WT)   SIZES ELIMINATED (<0.01%)        NONE
                                                                             TRASK SORTING COEFFECIENT       3.030
                                                                             USING PROBABILITY EXTRAP.       2.992
                                                                             MEAN CUBED DEVIATION           43.722
                                                                             USING PROBABLITY EXTRAP.       34.586

PERCENTAGE         TABLE OF STATISTICAL DATA IN PHI UNITS              PERCENTILES   LINEAR EXTRAP.          PROBABLILITY EXTRAP.
COMPOSITION
                                  MEAN    STD DEV SKEWNESS KURTOSIS                  MM.      PHI UNITS        MM.      PHI UNITS
GRAVEL     0.0     MOMENT        5.57607  3.21677  1.31351  3.49902        5.0     0.15790    2.66293      0.14778    2.75849
SAND      47.74    P-MOMENT      5.52139  3.03305  1.23952  3.25897       10.0     0.13370    2.90297      0.12987    2.94480
SILT      33.25    FOLK          5.44258  3.05257  0.64995  1.33420       16.0     0.11763    3.08760      0.11541    3.11516
CLAY      19.01    P-FOLK        5.45127  2.93594  0.65216  1.25567       25.0     0.10254    3.28577      0.10010    3.32048
MUD       52.26    INMAN         6.03773  2.95013  0.60521  0.76459       50.0     0.05247    4.25228      0.05247    4.25228
S/M        0.91    P-INMAN       6.05078  2.93562  0.61265  0.65037       75.0     0.01117    6.48396      0.01118    6.48307
                   KRUMBEIN               2.36903  0.63259  0.17330       84.0     0.00197    8.98786      0.00197    8.98640
                   P-KRUM.                2.34266  0.64950  0.17352       90.0     0.00022   12.13009      0.00023   12.05611
                   FOLK (TRANSFORMED)                       0.57159       95.0     0.00012   13.07446      0.00018   12.44819
                   P-FOLK (TRANSFORMED)                     0.55667

                          DATA FOR CONSTN OF BARGRAPHS AND CUM. CURVES

                   SIZE FRACTION        WT.(GMS)     WT.PCT. WT.PCT.  MID PHI(LINEAR)   MID PHI(PROB.)   MODE
                     MM       PHI    UNCOR     COR     COR   CUMUL.    PHI      MM      PHI      MM

                   0.250000  2.000   0.050    0.050    0.871   0.871  1.751  0.29707  1.910  0.26603     1
                   0.177000  2.498   0.040    0.040    0.697   1.568  2.249  0.21036  2.280  0.20584     0
                   0.125000  3.000   0.600    0.600   10.453  12.021  2.749  0.14875  2.837  0.13993     0
                   0.088000  3.506   1.320    1.320   22.997  35.017  3.253  0.10488  3.290  0.10223     1*
                   0.062500  4.000   0.730    0.730   12.718  47.735  3.753  0.07416  3.756  0.07394     0
                   0.044000  4.506   0.261    0.261    4.545  52.281  4.253  0.05244  4.253  0.05244     0
                   0.031000  5.012   0.345    0.345    6.013  58.294  4.759  0.03693  4.758  0.03697     0
                   0.022000  5.506   0.545    0.545    9.503  67.796  5.259  0.02612  5.254  0.02621     1
                   0.015600  6.002   0.182    0.182    3.168  70.964  5.754  0.01853  5.751  0.01856     0
                   0.011000  6.506   0.242    0.242    4.223  75.187  6.254  0.01310  6.249  0.01315     1
                   0.007800  7.002   0.121    0.121    2.112  77.299  6.754  0.00926  6.751  0.00928     0
                   0.005500  7.506   0.121    0.121    2.112  79.411  7.254  0.00655  7.251  0.00657     1
                   0.003900  8.002   0.091    0.091    1.584  80.995  7.754  0.00463  7.751  0.00464     0
                   0.002700  8.533   0.091    0.091    1.584  82.578  8.268  0.00325  8.264  0.00325     1
                   0.001900  9.040   0.091    0.091    1.584  84.162  8.786  0.00227  8.782  0.00227     1
                   0.001380  9.501   0.061    0.061    1.056  85.218  9.270  0.00162  9.268  0.00162     0
                   0.000980  9.995   0.061    0.061    1.056  86.274  9.748  0.00116  9.745  0.00117     0
                   0.000690 10.501   0.061    0.061    1.057  87.330 10.248  0.00082 10.244  0.00082     1
                   0.000490 10.995   0.061    0.061    1.056  88.386 10.748  0.00058 10.744  0.00058     0
                   0.000340 11.522   0.030    0.030    0.528  88.914 11.259  0.00041 11.256  0.00041     0
                   0.000240 12.025   0.030    0.030    0.528  89.442 11.773  0.00029 11.771  0.00029     1

                   0.000061 14.000   0.606    0.606   10.558  99.900 13.012  0.00012 12.319  0.00020     0
                 TOTALS              5.740    5.740  100.0
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 P1** 155        0   0.0     0   0.0      0                                 ***    MULTIMODAL SAMPLE   ***
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            WET WT    DRY WT      SALT     ORGANIC   MOISTURE                  WEIGHT LOSS DUE TO HANDLING    0.0
          1000.0000    5.6400     0.0        0.0        0.0    (GRAMS)         GRAVEL CORRECTION FACTOR       1.000
           100.0000  100.0000     0.0        0.0        0.0    (PCT WET WT)    SIZES ELIMINATED (<0.01%)      NONE
                                                                               TRASK SORTING COEFFECIENT      2.027
                                                                               USING PROBABILITY EXTRAP.      2.020
                                                                               MEAN CUBED DEVIATION          23.820
                                                                               USING PROBABLITY EXTRAP.      19.565

 PERCENTAGE           TABLE OF STATISTICAL DATA IN PHI UNITS                 PERCENTILES   LINEAR EXTRAP.           PROBABLILITY EXTRAP.
.COMPOSITION
                                     MEAN    STD DEV SKEWNESS KURTOSIS                        MM.      PHI UNITS      MM.      PHI UNITS
 GRAVEL     0.0       MOMENT        5.46484  2.42218  1.67616  5.53946           5.0        0.13401    2.89962      0.13001    2.94332
 SAND      26.60      P-MOMENT      5.44548  2.31465  1.57774  5.06670          10.0        0.10988    3.18592      0.10646    3.23163
 SILT      60.79      FOLK          5.16888  2.25461  0.40149  1.75939          16.0        0.09044    3.46682      0.08980    3.47716
 CLAY      12.61      P-FOLK        5.17060  2.24275  0.40552  1.75839          25.0        0.06610    3.91920      0.06573    3.92724
 MUD       73.40      INMAN         5.32406  1.85723  0.25066  1.35608          50.0        0.03447    4.85853      0.03442    4.86048
 S/M        0.36      P-INMAN       5.32566  1.84849  0.25165  1.35384          75.0        0.01609    5.95781      0.01611    5.95548
                      KRUMBEIN               1.51008  0.07998  0.17788          84.0        0.00689    7.18129      0.00692    7.17415
                      P-KRUM.                1.50240  0.08088  0.17855          90.0        0.00207    8.91634      0.00208    8.91136
                      FOLK (TRANSFORMED)                       0.63760          95.0        0.00031   11.65119      0.00031   11.64542
                      P-FOLK (TRANSFORMED)                     0.63747


                                   DATA FOR CONSTN OF BARGRAPHS AND CUM. CURVES

                      SIZE FRACTION       WT.(GMS)      WT.PCT. WT.PCT.  MID PHI(LINEAR)   MID PHI(PROB.)  MODE
                       MM        PHI    UNCOR     COR     COR    CUMUL.    PHI      MM      PHI      MM

                      0.177000  2.498   0.050    0.050    0.887    0.887  2.249  0.21036  2.409  0.18833     0
                      0.125000  3.000   0.290    0.290    5.142    6.028  2.749  0.14875  2.838  0.13990     0
                      0.088000  3.506   0.610    0.610   10.816   16.844  3.253  0.10488  3.298  0.10165     1
                      0.062500  4.000   0.550    0.550    9.752   26.596  3.753  0.07416  3.769  0.07333     0
                      0.044000  4.506   0.508    0.508    9.011   35.606  4.253  0.05244  4.261  0.05215     0
                      0.031000  5.012   1.165    1.165   20.648   56.254  4.759  0.03693  4.762  0.03684     1*
                      0.022000  5.506   0.753    0.753   13.346   69.600  5.259  0.02612  5.252  0.02625     0
                      0.015600  6.002   0.335    0.335    5.932   75.532  5.754  0.01853  5.748  0.01861     0
                      0.011000  6.506   0.251    0.251    4.449   79.981  6.254  0.01310  6.247  0.01317     0
                      0.007800  7.002   0.167    0.167    2.966   82.947  6.754  0.00926  6.748  0.00930     0
                      0.005500  7.506   0.167    0.167    2.965   85.912  7.254  0.00655  7.246  0.00659     0
                      0.003900  8.002   0.084    0.084    1.483   87.395  7.754  0.00463  7.750  0.00465     0
                      0.002700  8.533   0.084    0.084    1.483   88.879  8.268  0.00325  8.262  0.00326     0
                      0.001900  9.040   0.084    0.084    1.482   90.361  8.786  0.00227  8.780  0.00228     0
                      0.001380  9.501   0.084    0.084    1.483   91.844  9.270  0.00162  9.263  0.00163     1
                      0.000980  9.995   0.042    0.042    0.741   92.585  9.748  0.00116  9.744  0.00117     0
                      0.000690 10.501   0.042    0.042    0.742   93.327 10.248  0.00082 10.243  0.00083     1
                      0.000490 10.995   0.042    0.042    0.741   94.068 10.748  0.00058 10.742  0.00058     0
                      0.000340 11.522   0.042    0.042    0.741   94.809 11.259  0.00041 11.252  0.00041     0
                      0.000240 12.025   0.042    0.042    0.742   95.551 11.773  0.00029 11.766  0.00029     0
                      0.000061 14.000   0.251    0.251    4.449  100.000 13.012  0.00012 12.326  0.00019     0


               TOTALS                   5.640    5.640  100.0
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P1++ 156          0   0.0     0   0.0      0                                         ***************************
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                                                                                       ***   MULTIMODAL SAMPLE   ***
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             WET WT     DRY WT      SALT      ORGANIC   MOISTURE                  WEIGHT LOSS DUE TO HANDLING      0.0
          1000.0000     6.2200      0.0         0.0        0.0   (GRAMS)          GRAVEL CORRECTION FACTOR         1.000
           100.0000   100.0000      0.0         0.0        0.0   (PCT WET WT)     SIZES ELIMINATED (<0.01%)         NONE
                                                                                  TRASK SORTING COEFFECIENT        2.187
                                                                                  USING PROBABILITY EXTRAP.        2.163
                                                                                  MEAN CUBED DEVIATION            13.772
                                                                                  USING PROBABLITY EXTRAP.        11.320


PERCENTAGE          TABLE OF STATISTICAL DATA IN PHI UNITS                 PERCENTILES   LINEAR EXTRAP.            PROBABLILITY EXTRAP.
COMPOSITION
                                  MEAN    STD DEV SKEWNESS KURTOSIS                      MM.      PHI UNITS        MM.      PHI UNITS
GRAVEL      0.0     MOMENT       4.87330  2.08486  1.51969  5.41443           5.0      0.15388   2.70015         0.14726   2.70359
SAND       45.02    P-MOMENT     4.86979  2.00543  1.40357  4.72923          10.0      0.12259   3.02803         0.12136   3.04264
SILT       46.47    FOLK         4.67655  1.88953  0.44497  1.24212          16.0      0.11084   3.17339         0.10730   3.22020
CLAY        8.51    P-FOLK       4.69289  1.86666  0.46103  1.24821          25.0      0.09530   3.39143         0.09355   3.41809
MUD        54.98    INMAN        4.87820  1.70480  0.35132  1.00758          50.0      0.05150   4.27926         0.05150   4.27937
S/M         0.82    P-INMAN      4.89964  1.67944  0.36933  1.01788          75.0      0.01992   5.64996         0.02000   5.64351
                    KRUMBEIN              1.67298  0.24144  0.24302          84.0      0.01043   6.58300         0.01046   6.57908
                    P-KRUM.               1.64846  0.25143  0.24071          90.0      0.00489   7.67474         0.00493   7.66531
                    FOLK (TRANSFORMED)                      0.55399          95.0      0.00134   9.54521         0.00134   9.54139
                    P-FOLK (TRANSFORMED)                    0.55520


                                 DATA FOR CONSTN OF BARGRAPHS AND CUM. CURVES

                   SIZE FRACTION      WT.(GMS)      WT.PCT. WT.PCT.  MID PHI(LINEAR)   MID PHI(PROB.)   MODE
                    MM        PHI    UNCOR    COR     COR    CUMUL.    PHI       MM     PHI       MM

                 0.250000   2.000    0.090   0.090   1.447    1.447   1.751  0.29707   1.916  0.26497      1
                 0.177000   2.498    0.060   0.060   0.965    2.412   2.249  0.21036   2.276  0.20649      0
                 0.125000   3.000    0.400   0.400   6.431    8.842   2.749  0.14875   2.810  0.14258      0
                 0.088000   3.506    1.300   1.300  20.900   29.743   3.253  0.10488   3.299  0.10161      1
                 0.062500   4.000    0.950   0.950  15.273   45.016   3.753  0.07416   3.761  0.07374      0
                 0.044000   4.506    0.562   0.562   9.036   54.052   4.253  0.05244   4.253  0.05243      0
                 0.031000   5.012    0.531   0.531   8.536   62.588   4.759  0.03693   4.756  0.03701      0
                 0.022000   5.506    0.670   0.670  10.770   73.359   5.259  0.02612   5.250  0.02628      1
                 0.015600   6.002    0.353   0.353   5.668   79.027   5.754  0.01853   5.746  0.01863      0
                 0.011000   6.506    0.282   0.282   4.535   83.562   6.254  0.01310   6.245  0.01319      0
                 0.007800   7.002    0.176   0.176   2.834   86.396   6.754  0.00926   6.746  0.00931      0
                 0.005500   7.506    0.176   0.176   2.834   89.230   7.254  0.00655   7.244  0.00660      1
                 0.003900   8.002    0.141   0.141   2.268   91.498   7.754  0.00463   7.744  0.00467      0
                 0.002700   8.533    0.070   0.070   1.133   92.631   8.268  0.00325   8.260  0.00326      0
                 0.001900   9.040    0.106   0.106   1.700   94.331   8.786  0.00227   8.773  0.00229      1
                 0.001380   9.501    0.035   0.035   0.568   94.899   9.270  0.00162   9.266  0.00162      0
                 0.000980   9.995    0.070   0.070   1.133   96.032   9.748  0.00116   9.736  0.00117      1
                 0.000690  10.501    0.070   0.070   1.133   97.166  10.248  0.00082  10.231  0.00083      0
                 0.000490  10.995    0.071   0.071   1.134   98.300  10.748  0.00058  10.722  0.00059      0
                 0.000061  14.000    0.106   0.106   1.700  100.000  12.497  0.00017  11.492  0.00035      0
               TOTALS                6.220   6.220 100.0
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 P1++ 157        0   0.0     0   0.0      0                                   ***   MULTIMODAL SAMPLE    ***
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            WET WT    DRY WT     SALT     ORGANIC   MOISTURE                WEIGHT LOSS DUE TO HANDLING      0.0
          1000.0000   6.1400     0.0        0.0       0.0   (GRAMS)         GRAVEL CORRECTION FACTOR         1.000
           100.0000 100.0000     0.0        0.0       0.0   (PCT WET WT)    SIZES ELIMINATED (<0.01%)         NONE
                                                                            TRASK SORTING COEFFECIENT        2.126
                                                                            USING PROBABILITY EXTRAP.        2.108
                                                                            MEAN CUBED DEVIATION             8.923
                                                                            USING PROBABLITY EXTRAP.         6.388

 PERCENTAGE         TABLE OF STATISTICAL DATA IN PHI UNITS                PERCENTILES   LINEAR EXTRAP.          PROBABLILITY EXTRAP.
 COMPOSITION
                                  MEAN    STD DEV SKEWNESS KURTOSIS                      MM.      PHI UNITS        MM.      PHI UNITS
 GRAVEL     0.0     MOMENT       4.34413  1.80627  1.51416  5.84721            5.0     0.17600   2.50637        0.17511    2.51367
 SAND      56.03    P-MOMENT     4.33869  1.70746  1.28327  4.42558           10.0     0.15882   2.65450        0.15190    2.71883
 SILT      39.03    FOLK         4.18926  1.61348  0.47229  1.03073           16.0     0.14041   2.83226        0.13575    2.88096
 CLAY       4.94    P-FOLK       4.20466  1.59920  0.48400  1.04055           25.0     0.11842   3.07803        0.11745    3.08962
 MUD       43.97    INMAN        4.40098  1.56872  0.40489  0.74416           50.0     0.07351   3.76582        0.07351    3.76592
 S/M        1.27    P-INMAN      4.42403  1.54307  0.42649  0.77003           75.0     0.02621   5.25388        0.02644    5.24133
                    KRUMBEIN              1.61174  0.40014  0.26690           84.0     0.01596   5.96970        0.01599    5.96711
                    P-KRUM.               1.59372  0.39965  0.26897           90.0     0.00942   6.73067        0.00950    6.71846
                    FOLK (TRANSFORMED)                      0.50757           95.0     0.00396   7.97856        0.00397    7.97626
                    P-FOLK (TRANSFORMED)                    0.50994


                               DATA FOR CONSTN OF BARGRAPHS AND CUM. CURVES

                     SIZE FRACTION       WT.(GMS)     WT.PCT. WT.PCT.  MID PHI(LINEAR)   MID PHI(PROB.)  MODE
                      MM        PHI    UNCOR    COR     COR    CUMUL.    PHI      MM      PHI      MM

                    0.250000  2.000   0.120    0.120   1.954   1.954  1.751  0.29707  1.919  0.26446      0
                    0.177000  2.498   0.170    0.170   2.769   4.723  2.249  0.21036  2.293  0.20403      0
                    0.125000  3.000   1.040    1.040  16.938  21.661  2.749  0.14875  2.812  0.14244      0
                    0.088000  3.506   1.330    1.330  21.661  43.323  3.253  0.10488  3.271  0.10358      1
                    0.062500  4.000   0.780    0.780  12.704  56.026  3.753  0.07416  3.753  0.07415      0
                    0.044000  4.506   0.450    0.450   7.336  63.362  4.253  0.05244  4.250  0.05255      0
                    0.031000  5.012   0.431    0.431   7.024  70.385  4.759  0.03693  4.754  0.03707      0
                    0.022000  5.506   0.579    0.579   9.423  79.808  5.259  0.02612  5.246  0.02634      1
                    0.015600  6.002   0.276    0.276   4.487  84.295  5.754  0.01853  5.745  0.01865      0
                    0.011000  6.506   0.275    0.275   4.487  88.782  6.254  0.01310  6.240  0.01323      0
                    0.007800  7.002   0.165    0.165   2.693  91.475  6.754  0.00926  6.742  0.00934      0
                    0.005500  7.506   0.138    0.138   2.243  93.718  7.254  0.00655  7.240  0.00662      0
                    0.003900  8.002   0.083    0.083   1.346  95.064  7.754  0.00463  7.743  0.00467      0
                    0.002700  8.533   0.083    0.083   1.346  96.410  8.268  0.00325  8.251  0.00328      1
                    0.001900  9.040   0.083    0.083   1.346  97.757  8.786  0.00227  8.762  0.00230      0
                    0.001380  9.501   0.055    0.055   0.897  98.654  9.270  0.00162  9.246  0.00165      0
                    0.000061 14.000   0.083    0.083   1.346 100.000 11.751  0.00029 10.266  0.00081      0
                  TOTALS              6.140    6.140 100.0
    0.250000     0.030000
    0.177000     C.030000
    0.125000     0.400000
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P1++ 158     0   C.0    0   0.0    0

            WET WT      DRY WT      SALT      ORGANIC    MOISTURE                          WEIGHT LOSS DUE TO HANDLING      0.0
          1000.0000     6.1500      0.0         0.0         0.0    (GRAMS)                 GRAVEL CORRECTION FACTOR         1.000
           100.0000   100.0000      0.0         0.0         0.0    (PCT WET WT)            SIZES ELIMINATED (<0.01%)         NONE
                                                                                           TRASK SORTING COEFFECIENT        1.756
                                                                                           USING PROBABILITY EXTRAP.        1.738
                                                                                           MEAN CUBED DEVIATION            10.778
                                                                                           USING PROBABLITY EXTRAP.         5.998

PERCENTAGE          TABLE OF STATISTICAL DATA IN PHI UNITS                           PERCENTILES   LINEAR EXTRAP.               PROBABLILITY EXTRAP.
COMPOSITION
                                    MEAN     STD DEV  SKEWNESS KURTOSIS                            MM.       PHI UNITS          MM.       PHI UNITS
GRAVEL      0.0     MOMENT         4.46696   1.69660  2.20701  9.01030                  5.0     0.14273     2.80867         0.13531     2.88562
SAND       51.22    P-MOMENT       4.44097   1.50717  1.75197  6.31393                 10.0     0.12017     3.05686         0.11758     3.08828
SILT       43.64    FOLK           4.22197   1.37490  0.44155  1.32762                 16.0     0.10940     3.19225         0.10531     3.24729
CLAY        5.14    P-FOLK         4.24047   1.34852  0.46822  1.33162                 25.0     0.09504     3.39534         0.09314     3.42450
MUD        48.78    INMAN          4.34709   1.15484  0.32504  1.27882                 50.0     0.06374     3.97172         0.06368     3.97290
S/M         1.05    P-INMAN        4.37426   1.12697  0.35614  1.29874                 75.0     0.03082     5.02014         0.03084     5.01915
                    KRUMBEIN                 1.20355  0.23602  0.25387                 84.0     0.02207     5.50193         0.02208     5.50123
                    P-KRUM.                  1.18122  0.24892  0.25258                 90.0     0.01308     6.25685         0.01318     6.24500
                    FOLK (TRANSFORMED)                         0.57038                 95.0     0.00372     8.07201         0.00373     8.06685
                    P-FOLK (TRANSFORMED)                       0.57111

                                      DATA FOR CONSTN OF BARGRAPHS AND CUM. CURVES

                        SIZE FRACTION          WT.(GMS)       WT.PCT. WT.PCT.   MID PHI(LINEAR)    MID PHI(PROB.)   MODE
                         MM        PHI      UNCOR     COR      COR     CUMUL.     PHI       MM       PHI      MM

                      0.250000   2.000     0.030     0.030    0.488    0.488   1.751  0.29707   1.902  0.26763     0
                      0.177000   2.498     0.030     0.030    0.488    0.976   2.249  0.21036   2.286  0.20498     0
                      0.125000   3.000     0.400     0.400    6.504    7.480   2.749  0.14875   2.841  0.13959     0
                      0.088000   3.506     1.380     1.380   22.439   29.919   3.253  0.10488   3.306  0.10113     1*
                      0.062500   4.000     1.310     1.310   21.301   51.220   3.753  0.07416   3.762  0.07373     0
                      0.044000   4.506     0.784     0.784   12.743   63.963   4.253  0.05244   4.249  0.05259     0
                      0.031000   5.012     0.669     0.669   10.877   74.840   4.759  0.03693   4.749  0.03719     0
                      0.022000   5.506     0.568     0.568    9.242   84.082   5.259  0.02612   5.242  0.02642     0
                      0.015600   6.002     0.284     0.284    4.621   88.703   5.754  0.01853   5.740  0.01871     0
                      0.011000   6.506     0.158     0.158    2.567   91.271   6.254  0.01310   6.242  0.01321     0
                      0.007800   7.002     0.126     0.126    2.054   93.324   6.754  0.00926   6.742  0.00934     0
                      0.005500   7.506     0.063     0.063    1.028   94.352   7.254  0.00655   7.246  0.00659     0
                      0.003900   8.002     0.032     0.032    0.513   94.865   7.754  0.00463   7.750  0.00465     0
                      0.002700   8.533     0.063     0.063    1.027   95.892   8.268  0.00325   8.256  0.00327     0
                      0.001900   9.040     0.095     0.095    1.541   97.433   8.786  0.00227   8.762  0.00230     0
                      0.000061  14.000     0.158     0.158    2.567  100.000  11.520  0.00034   9.827  0.00110     0
                     TOTALS                6.150     6.150  100.0
     0.250000        0.030000
     0.177000        0.030000
     0.125000        1.730000
     0.088000        2.170000
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  P1++ 159      0  0.0    0   0.0     0                                                      ****                    ****
                                                                                             ***   MULTIMODAL SAMPLE   ***
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              WET WT     DRY WT      SALT     ORGANIC   MOISTURE                           WEIGHT LOSS DUE TO HANDLING      0.0
           1000.0000     6.5100      0.0        0.0        0.0   (GRAMS)                   GRAVEL CORRECTION FACTOR         1.000
            100.0000   100.0000      0.0        0.0        0.0   (PCT WET WT)              SIZES ELIMINATED (<0.01%)         NONE
                                                                                           TRASK SORTING COEFFECIENT        1.504
                                                                                           USING PROBABILITY EXTRAP.        1.487
                                                                                           MEAN CUBED DEVIATION             8.791
                                                                                           USING PROBABLITY EXTRAP.         5.486

  PERCENTAGE            TABLE OF STATISTICAL DATA IN PHI UNITS                   PERCENTILES   LINEAR EXTRAP.           PROBABLILITY EXTRAP.
  COMPOSITION
                                          MEAN    STD DEV  SKEWNESS KURTOSIS                     MM.       PHI UNITS       MM.       PHI UNITS
  GRAVEL      0.0       MOMENT          3.81337  1.47543   2.73693  12.71195           5.0     0.16780    2.57518       0.15376    2.70128
  SAND       73.27      P-MOMENT        3.81987  1.33264   2.31810   9.15342          10.0     0.15717    2.66960       0.14310    2.80493
  SILT       24.45      FOLK            3.66023  1.14048   0.54370   1.42959          16.0     0.14530    2.78290       0.13520    2.86684
  CLAY        2.28      P-FOLK          3.69246  1.09073   0.60231   1.42148          25.0     0.12915    2.95285       0.12691    2.97813
  MUD        26.73      INMAN           3.81943  1.03653   0.46077   0.98095          50.0     0.09863    3.34183       0.09829    3.34686
  S/M         2.74      P-INMAN         3.86527  0.97843   0.52984   1.02879          75.0     0.05711    4.13014       0.05740    4.12276
                        KRUMBEIN                 0.87207   0.19966   0.21223          84.0     0.03453    4.85596       0.03483    4.84369
                        P-KRUM.                  0.84787   0.20358   0.21767          90.0     0.02298    5.44320       0.02313    5.43426
                        FOLK (TRANSFORMED)                           0.58841          95.0     0.00974    6.68180       0.00981    6.67133
                        P-FOLK (TRANSFORMED)                         0.58703

                                        DATA FOR CONSTN OF BARGRAPHS AND CUM. CURVES

                         SIZE FRACTION       WT.(GMS)      WT.PCT.  WT.PCT.   MID PHI(LINEAR)    MID PHI(PROB.)   MODE
                          MM       PHI     UNCOR     COR     COR     CUMUL.     PHI       MM      PHI       MM

                        0.250000  2.000    0.030    0.030    0.461    0.461   1.751   0.29707   1.901   0.26781     1
                        0.177000  2.498    0.030    0.030    0.461    0.922   2.249   0.21036   2.287   0.20497     0
                        0.125000  3.000    1.730    1.730   26.575   27.496   2.749   0.14875   2.865   0.13726     0
                        0.088000  3.506    2.170    2.170   33.333   60.830   3.253   0.10488   3.262   0.10427     1*
                        0.062500  4.000    0.810    0.810   12.442   73.272   3.753   0.07416   3.744   0.07465     0
                        0.044000  4.506    0.438    0.438    6.723   79.995   4.253   0.05244   4.243   0.05281     0
                        0.031000  5.012    0.377    0.377    5.788   85.783   4.759   0.03693   4.745   0.03729     0
                        0.022000  5.506    0.315    0.315    4.834   90.617   5.259   0.02612   5.241   0.02645     0
                        0.015600  6.002    0.167    0.167    2.559   93.176   5.754   0.01853   5.739   0.01872     0
                        0.011000  6.506    0.093    0.093    1.422   94.598   6.254   0.01310   6.243   0.01320     0
                        0.007800  7.002    0.074    0.074    1.137   95.735   6.754   0.00926   6.743   0.00934     0
                        0.005500  7.506    0.074    0.074    1.137   96.872   7.254   0.00655   7.238   0.00662     1
                        0.003900  8.002    0.055    0.055    0.853   97.725   7.754   0.00463   7.738   0.00468     0
                        0.002700  8.533    0.037    0.037    0.569   98.294   8.268   0.00325   8.251   0.00328     0
                        0.001900  9.040    0.019    0.019    0.284   98.578   8.786   0.00227   8.776   0.00228     0
                        0.000061 14.000    0.093    0.093    1.422  100.000  11.520   0.00034   9.877   0.00106     0
                      TOTALS               6.510    6.510  100.0
          0.250000     0.010000
          0.177000     0.020000
          0.125000     0.040000
          0.088000     0.220000
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 P1++ 160      0   0.0    0   0.0     0                    ****************************
                                                           ****                    ****
                                                           ***   MULTIMODAL SAMPLE   ***
                                                           ****                    ****
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             WET WT     DRY WT     SALT    ORGANIC   MOISTURE           WEIGHT LOSS DUE TO HANDLING    0.0
          1000.0000     4.6900     0.0       0.0        0.0   (GRAMS)    GRAVEL CORRECTION FACTOR       1.000
           100.0000   100.0000     0.0       0.0        0.0   (PCT WET WT)  SIZES ELIMINATED (<0.01%)      NONE
                                                                        TRASK SORTING COEFFECIENT      1.921
                                                                        USING PROBABILITY EXTRAP.      1.913
                                                                        MEAN CUBED DEVIATION           5.198
                                                                        USING PROBABLITY EXTRAP.       3.117

 PERCENTAGE        TABLE OF STATISTICAL DATA IN PHI UNITS                PERCENTILES   LINEAR EXTRAP.          PROBABLILITY EXTRAP.
 COMPOSITION
                                  MEAN    STD DEV SKEWNESS KURTOSIS                     MM.      PHI UNITS        MM.      PHI UNITS
 GRAVEL     0.0    MOMENT       5.64269  1.69771  1.06232  4.65365         5.0       0.09615   3.37860       0.09329   3.42204
 SAND      14.50   P-MOMENT     5.62261  1.59289  0.77105  3.36558        10.0       0.07521   3.73291       0.07326   3.77091
 SILT      75.02   FOLK         5.54653  1.62107  0.26070  1.20444        16.0       0.05840   4.05775       0.05794   4.10928
 CLAY      10.48   P-FOLK       5.54612  1.60540  0.26483  1.19893        25.0       0.04167   4.58494       0.04138   4.59495
 MUD       85.50   INMAN        5.66181  1.56405  0.22111  0.77029        50.0       0.02510   5.31598       0.02509   5.31678
 S/M        0.17   P-INMAN      5.66079  1.55151  0.22172  0.76462        75.0       0.01129   6.46924       0.01131   6.46674
                   KRUMBEIN              1.39578  0.21111  0.21705        64.0       0.00668   7.22586       0.00674   7.21230
                   P-KRUM.               1.38649  0.21408  0.21794        90.0       0.00371   8.07359       0.00373   8.06507
                   FOLK (TRANSFORMED)                      0.54637        95.0       0.00207   8.91625       0.00210   8.89765
                   P-FOLK (TRANSFORMED)                    0.54523

                              DATA FOR CONSTN OF BARGRAPHS AND CUM. CURVES

                   SIZE FRACTION      WT.(GMS)      WT.PCT. WT.PCT.  MID PHI(LINEAR)   MID PHI(PROB.)  MODE
                     MM       PHI    UNCOR    COR     COR    CUMUL.    PHI      MM      PHI      MM

                   0.250000  2.000   0.010   0.010   0.213   0.213  1.751  0.29707  1.885  0.27081    0
                   0.177000  2.498   0.020   0.020   0.426   0.640  2.249  0.21036  2.308  0.20199    0
                   0.125000  3.000   0.040   0.040   0.853   1.493  2.749  0.14875  2.794  0.14417    0
                   0.088000  3.506   0.220   0.220   4.691   6.183  3.253  0.10488  3.322  0.09999    0
                   0.062500  4.000   0.390   0.390   8.316  14.499  3.753  0.07416  3.791  0.07226    1
                   0.044000  4.506   0.365   0.365   7.774  22.273  4.253  0.05244  4.270  0.05183    0
                   0.031000  5.012   0.822   0.822  17.528  39.801  4.759  0.03693  4.775  0.03653    1*
                   0.022000  5.506   0.777   0.777  16.577  56.377  5.259  0.02612  5.260  0.02609    0
                   0.015600  6.002   0.536   0.536  11.426  67.804  5.754  0.01853  5.749  0.01860    0
                   0.011000  6.506   0.364   0.364   7.768  75.571  6.254  0.01310  6.248  0.01318    0
                   0.007800  7.002   0.286   0.286   6.107  81.678  6.754  0.00926  6.744  0.00933    0
                   0.005500  7.506   0.245   0.245   5.235  86.913  7.254  0.00655  7.240  0.00661    0
                   0.003900  8.002   0.123   0.123   2.618  89.531  7.754  0.00463  7.745  0.00466    0
                   0.002700  8.533   0.164   0.164   3.489  93.020  8.268  0.00325  8.248  0.00329    1
                   0.001900  9.040   0.123   0.123   2.617  95.636  8.786  0.00227  8.763  0.00230    1
                   0.001380  9.501   0.123   0.123   2.617  98.255  9.270  0.00162  9.228  0.00167    1
                   0.000061 14.000   0.082   0.082   1.745 100.000 11.751  0.00029 10.243  0.00083    0
                TOTALS               4.690   4.690 100.0
   0.250000     0.040000
   0.177000     0.020000
   0.125000     0.060000
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   P1++ 161       0   0.0    0   0.0     0                                                    ***   MULTIMODAL SAMPLE   ***
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                WET WT     DRY WT      SALT      ORGANIC    MOISTURE                           WEIGHT LOSS DUE TO HANDLING     0.0
             1000.0000     4.5300      0.0         0.0         0.0    (GRAMS)                  GRAVEL CORRECTION FACTOR        1.000
              100.0000   100.0000      0.0         0.0         0.0    (PCT WET WT)             SIZES ELIMINATED (<0.01%)        NONE
                                                                                               TRASK SORTING COEFFECIENT       1.981
                                                                                               USING PROBABILITY EXTRAP.       1.964
                                                                                               MEAN CUBED DEVIATION            7.409
                                                                                               USING PROBABLITY EXTRAP.        3.205


   PERCENTAGE             TABLE OF STATISTICAL DATA IN PHI UNITS                       PERCENTILES   LINEAR EXTRAP.           PROBABLILITY EXTRAP.
   COMPOSITION
                                       MEAN      STD DEV SKEWNESS KURTOSIS                              MM.      PHI UNITS         MM.      PHI UNITS
   GRAVEL       0.0       MOMENT       5.44229   1.79035  1.29109  5.47933                5.0      0.10826    3.20739        0.10406    3.26445
   SAND        19.43      P-MOMENT     5.39263   1.59692  0.76686  3.53277               10.0      0.08371    3.57841        0.08248    3.59975
   SILT        72.25      FOLK         5.29670   1.57300  0.22001  1.10615               16.0      0.06950    3.84676        0.06821    3.87382
   CLAY         8.32      P-FOLK       5.30254   1.55546  0.23168  1.10833               25.0      0.05157    4.27729        0.05107    4.29128
   MUD         80.57      INMAN        5.37980   1.53304  0.16262  0.73601               50.0      0.02855    5.13049        0.02857    5.12910
   S/M          0.24      P-INMAN      5.38926   1.51544  0.17168  0.73715               75.0      0.01314    6.24941        0.01325    6.23818
                          KRUMBEIN               1.46083  0.13286  0.23640               84.0      0.00830    6.91284        0.00835    6.90470
                          P-KRUM.                1.44215  0.13563  0.23544               90.0      0.00465    7.74952        0.00470    7.73436
                          FOLK (TRANSFORMED)                       0.52520               95.0      0.00270    8.53015        0.00271    8.52953
                          P-FOLK (TRANSFORMED)                     0.52569


                                          DATA FOR CONSTN OF BARGRAPHS AND CUM. CURVES

                           SIZE FRACTION       WT.(GMS)      WT.PCT. WT.PCT.  MID PHI(LINEAR)   MID PHI(PROB.)   MODE
                            MM        PHI    UNCOR     COR     COR    CUMUL.     PHI      MM      PHI      MM

                          0.250000  2.000   0.040   0.040    0.883    0.883  1.751  0.29707  1.911  0.26600      1
                          0.177000  2.498   0.020   0.020    0.442    1.325  2.249  0.21036  2.271  0.20720      0
                          0.125000  3.000   0.060   0.060    1.325    2.649  2.749  0.14875  2.785  0.14505      0
                          0.088000  3.506   0.260   0.260    5.740    8.389  3.253  0.10488  3.309  0.10093      0
                          0.062500  4.000   0.500   0.500   11.038   19.426  3.753  0.07416  3.788  0.07240      1
                          0.044000  4.506   0.461   0.461   10.178   29.604  4.253  0.05244  4.267  0.05192      0
                          0.031000  5.012   0.743   0.743   16.403   46.007  4.759  0.03693  4.768  0.03671      0
                          0.022000  5.506   0.753   0.753   16.614   62.620  5.259  0.02612  5.256  0.02617      1*
                          0.015600  6.002   0.376   0.376    8.307   70.927  5.754  0.01853  5.748  0.01861      0
                          0.011000  6.506   0.376   0.376    8.307   79.234  6.254  0.01310  6.243  0.01320      1
                          0.007800  7.002   0.263   0.263    5.815   85.049  6.754  0.00926  6.742  0.00935      0
                          0.005500  7.506   0.150   0.150    3.322   88.371  7.254  0.00655  7.243  0.00660      0
                          0.003900  8.002   0.150   0.150    3.322   91.693  7.754  0.00463  7.739  0.00468      0
                          0.002700  8.533   0.151   0.151    3.323   95.017  8.268  0.00325  8.242  0.00330      1
                          0.001900  9.040   0.075   0.075    1.661   96.678  8.786  0.00227  8.766  0.00230      0
                          0.000061 14.000   0.150   0.150    3.322  100.000 11.520  0.00034  9.811  0.00111      0
                        TOTALS              4.530   4.530  100.0
          0.250000      0.040000
          0.177000      0.040000
          0.125000      1.470000
          0.088000      2.360000
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P1++ 162        0   0.0      0   0.0      0                                                        ***   MULTIMODAL SAMPLE   ***
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                 WET WT    DRY WT     SALT     ORGANIC   MOISTURE                           WEIGHT LOSS DUE TO HANDLING      0.0
               1000.0000    6.2000    0.0        0.0       0.0    (GRAMS)                   GRAVEL CORRECTION FACTOR         1.000
                100.0000  100.0000    0.0        0.0       0.0    (PCT WET WT)              SIZES ELIMINATED (<0.01%)        NONE
                                                                                            TRASK SORTING COEFFECIENT        1.353
                                                                                            USING PROBABILITY EXTRAP.        1.346
                                                                                            MEAN CUBED DEVIATION            14.441
                                                                                            USING PROBABLITY EXTRAP.        12.703


PERCENTAGE           TABLE OF STATISTICAL DATA IN PHI UNITS                   PERCENTILES   LINEAR EXTRAP.             PROBABLILITY EXTRAP.
COMPOSITION
                                 MEAN    STD DEV  SKEWNESS KURTOSIS                         MM.       PHI UNITS        MM.       PHI UNITS
GRAVEL    0.0        MOMENT      3.78522 1.61962  3.39904 16.87296              5.0       0.16762    2.57668        0.15531    2.66676
SAND     79.19       P-MOMENT    3.80379 1.55964  3.34828 16.07440             10.0       0.15577    2.68251        0.14319    2.80403
SILT     17.77       FOLK        3.51730 1.02450  0.48976  1.93770             16.0       0.14264    2.80950        0.13428    2.89670
CLAY      3.04       P-FOLK      3.54549 0.98225  0.54314  1.91265             25.0       0.12500    2.99999        0.12500    2.99999
MUD      20.81       INMAN       3.60967 0.80017  0.34633  1.57516             50.0       0.09927    3.33255        0.09884    3.33879
S/M       3.81       P-INMAN     3.64884 0.75214  0.41223  1.65959             75.0       0.06832    3.87163        0.06900    3.85725
                     KRUMBEIN            0.64567  0.10326  0.16354             84.0       0.04704    4.40984        0.04733    4.40098
                     P-KRUM.             0.63501  0.08983  0.16941             90.0       0.02456    5.34742        0.02479    5.33412
                     FOLK (TRANSFORMED)                    0.65960             95.0       0.00963    6.69782        0.00970    6.68752
                     P-FOLK (TRANSFORMED)                  0.65667


                                DATA FOR CONSTN OF BARGRAPHS AND CUM. CURVES

                       SIZE FRACTION      WT.(GMS)      WT.PCT. WT.PCT.  MID PHI(LINEAR)   MID PHI(PROB.)   MODE
                        MM       PHI     UNCOR    COR     COR   CUMUL.    PHI      MM      PHI      MM

                     0.250000  2.000    0.040    0.040   0.645    0.645  1.751  0.29707  1.906  0.26680       0
                     0.177000  2.498    0.040    0.040   0.645    1.290  2.249  0.21036  2.286  0.20502       0
                     0.125000  3.000    1.470    1.470  23.710   25.000  2.749  0.14875  2.856  0.13809       0
                     0.088000  3.506    2.360    2.360  38.065   63.065  3.253  0.10488  3.263  0.10414       1
                     0.062500  4.000    1.000    1.000  16.129   79.194  3.753  0.07416  3.736  0.07503       0
                     0.044000  4.506    0.368    0.368   5.938   85.132  4.253  0.05244  4.240  0.05293       0
                     0.031000  5.012    0.156    0.156   2.515   87.646  4.759  0.03693  4.751  0.03714       0
                     0.022000  5.506    0.215    0.215   3.468   91.114  5.259  0.02612  5.244  0.02638       1
                     0.015600  6.002    0.148    0.148   2.385   93.498  5.754  0.01853  5.740  0.01872       0
                     0.011000  6.506    0.067    0.067   1.083   94.581  6.254  0.01310  6.245  0.01318       0
                     0.007800  7.002    0.067    0.067   1.084   95.665  6.754  0.00926  6.743  0.00933       1
                     0.005500  7.506    0.040    0.040   0.650   96.315  7.254  0.00655  7.246  0.00659       0
                     0.003900  8.002    0.040    0.040   0.651   96.966  7.754  0.00463  7.744  0.00466       1
                     0.002700  8.533    0.013    0.013   0.216   97.182  8.268  0.00325  8.263  0.00325       0
                     0.001900  9.040    0.027    0.027   0.434   97.616  8.786  0.00227  8.777  0.00228       1
                     0.001380  9.501    0.013    0.013   0.217   97.833  9.270  0.00162  9.266  0.00162       0
                     0.000980  9.995    0.013    0.013   0.216   98.049  9.748  0.00116  9.742  0.00117       0
                     0.000690 10.501    0.013    0.013   0.217   98.266 10.248  0.00082 10.242  0.00083       0
                     0.000490 10.995    0.013    0.013   0.217   98.483 10.748  0.00058 10.741  0.00058       1
                     0.000340 11.522    0.013    0.013   0.217   98.700 11.259  0.00041 11.250  0.00041       0
                     0.000240 12.025    0.013    0.013   0.216   98.916 11.773  0.00029 11.763  0.00029       0



                     0.000061 14.000    0.067    0.067   1.084  100.000 13.012  0.00012 12.370  0.00019       0
                   TOTALS               6.200    6.200 100.0
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 P1++ 163       0  0.0    0  0.0      0                               ***   MULTIMODAL SAMPLE   ***
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         WET WT     DRY WT      SALT     ORGANIC   MOISTURE                  WEIGHT LOSS DUE TO HANDLING      0.0
       1000.0000    6.5600      0.0        0.0        0.0    (GRAMS)          GRAVEL CORRECTION FACTOR         1.000
         99.9999  100.0000      0.0        0.0        0.0    (PCT WET WT)     SIZES ELIMINATED (<0.01%)         NONE
                                                                              TRASK SORTING COEFFECIENT        2.016
                                                                              USING PROBABILITY EXTRAP.        2.015
                                                                              MEAN CUBED DEVIATION            12.881
                                                                              USING PROBABLITY EXTRAP.         9.079

 PERCENTAGE        TABLE OF STATISTICAL DATA IN PHI UNITS               PERCENTILES   LINEAR EXTRAP.            PROBABLILITY EXTRAP.
 COMPOSITION
                                     MEAN    STD DEV SKEWNESS KURTOSIS                   MM.      PHI UNITS      MM.      PHI UNITS
 GRAVEL     0.0    MOMENT          4.23774  1.87659  1.94917  7.45318         5.0      0.17006    2.55591      0.16208    2.62520
 SAND      63.11   P-MOMENT        4.23330  1.75045  1.69277  5.79397        10.0      0.15727    2.66865      0.14692    2.76693
 SILT      31.84   FOLK            4.02134  1.56895  0.59523  1.10744        16.0      0.14320    2.80393      0.13594    2.87892
 CLAY       5.05   P-FOLK          4.04235  1.53620  0.62432  1.09428        25.0      0.12449    3.00594      0.12440    3.00695
 MUD       36.89   INMAN           4.28479  1.48086  0.53372  0.84631        50.0      0.08873    3.49442      0.08868    3.49527
 S/M        1.71   P-INMAN         4.31589  1.43697  0.57108  0.87788        75.0      0.03061    5.02962      0.03064    5.02824
                   KRUMBEIN                 1.49902  0.52336  0.25676        84.0      0.01838    5.76565      0.01854    5.75287
                   P-KRUM.                  1.49725  0.52233  0.26351        90.0      0.01024    6.60951      0.01029    6.60226
                   FOLK (TRANSFORMED)                         0.52549        95.0      0.00384    8.02416      0.00385    8.02212
                   P-FOLK (TRANSFORMED)                       0.52251

                              DATA FOR CONSTN OF BARGRAPHS AND CUM. CURVES

                 SIZE FRACTION       WT.(GMS)      WT.PCT. WT.PCT.  MID PHI(LINEAR)  MID PHI(PROB.)  MODE
                 MM         PHI    UNCOR    COR      COR    CUMUL.    PHI      MM      PHI      MM

              0.250000   2.000   0.050   0.050    0.762    0.762   1.751  0.29707   1.909  0.26636    0
              0.177000   2.498   0.110   0.110    1.677    2.439   2.249  0.21036   2.308  0.20189    0
              0.125000   3.000   1.460   1.460   22.256   24.695   2.749  0.14875   2.838  0.13988    0
              0.088000   3.506   1.700   1.700   25.915   50.610   3.253  0.10488   3.267  0.10385    1*
              0.062500   4.000   0.820   0.820   12.500   63.110   3.753  0.07416   3.750  0.07434    0
              0.044000   4.506   0.254   0.254    3.869   66.979   4.253  0.05244   4.251  0.05253    0
              0.031000   5.012   0.510   0.510    7.780   74.759   4.759  0.03693   4.751  0.03714    1
              0.022000   5.506   0.433   0.433    6.601   81.361   5.259  0.02612   5.248  0.02631    0
              0.015600   6.002   0.331   0.331    5.048   86.409   5.754  0.01853   5.742  0.01869    0
              0.011000   6.506   0.204   0.204    3.107   89.515   6.254  0.01310   6.243  0.01320    0
              0.007800   7.002   0.153   0.153    2.330   91.845   6.754  0.00926   6.743  0.00934    0
              0.005500   7.506   0.127   0.127    1.941   93.787   7.254  0.00655   7.241  0.00661    0
              0.003900   8.002   0.076   0.076    1.165   94.952   7.754  0.00463   7.744  0.00466    0
              0.002700   8.533   0.076   0.076    1.165   96.117   8.268  0.00325   8.254  0.00328    0
              0.001900   9.040   0.051   0.051    0.777   96.893   8.786  0.00227   8.775  0.00228    0
              0.001380   9.501   0.051   0.051    0.777   97.670   9.270  0.00162   9.257  0.00163    0
              0.000980   9.995   0.025   0.025    0.389   98.059   9.748  0.00116   9.738  0.00117    0
              0.000061  14.000   0.127   0.127    1.941  100.000  11.997  0.00024  10.648  0.00062    0
                     TOTALS      6.560   6.560  100.0
      0.250000   0.030000
      0.177000   0.030000
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   P1++ 164        0   0.0      0   0.0       0                                           ***    MULTIMODAL SAMPLE    ***
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                 WET WT      DRY WT      SALT     ORGANIC    MOISTURE                    WEIGHT LOSS DUE TO HANDLING      0.0
               1000.0000     6.2700      0.0        0.0        0.0     (GRAMS)           GRAVEL CORRECTION FACTOR        1.000
                100.0000   100.0000      0.0        0.0        0.0     (PCT WET WT)      SIZES ELIMINATED (<0.01%)        NONE
                                                                                         TRASK SORTING COEFFECIENT       1.875
                                                                                         USING PROBABILITY EXTRAP.       1.859
                                                                                         MEAN CUBED DEVIATION           12.299
                                                                                         USING PROBABLITY EXTRAP.        7.157

   PERCENTAGE         TABLE OF STATISTICAL DATA IN PHI UNITS                     PERCENTILES   LINEAR EXTRAP.          PROBABLILITY EXTRAP.
   COMPOSITION
                                        MEAN    STD DEV SKEWNESS KURTOSIS                      MM.      PHI UNITS        MM.      PHI UNITS
   GRAVEL      0.0    MOMENT          4.70128  1.84726  1.95120  7.58669             5.0      0.14486   2.78728       0.13656    2.87236
   SAND       42.74   P-MOMENT        4.66852  1.66081  1.56224  5.51932            10.0      0.12033   3.05495       0.11818    3.08099
   SILT       51.22   FOLK            4.47437  1.53345  0.33852  1.28100            16.0      0.10749   3.21776       0.10390    3.26667
   CLAY        6.03   P-FOLK          4.48833  1.50556  0.35934  1.27743            25.0      0.09075   3.46198       0.09002    3.47361
   MUD        57.26   INMAN           4.56740  1.34964  0.20679  1.09941            50.0      0.05118   4.28831       0.05117    4.28861
   S/M         0.75   P-INMAN         4.58820  1.32153  0.22670  1.10954            75.0      0.02583   5.27503       0.02605    5.26243
                      KRUMBEIN                 1.34300  0.08019  0.24174            84.0      0.01655   5.91705       0.01663    5.90972
                      P-KRUM.                  1.32505  0.07941  0.24085            90.0      0.00894   6.80492       0.00901    6.79456
                      FOLK (TRANSFORMED)                         0.56159            95.0      0.00285   8.45420       0.00286    8.44799
                      P-FOLK (TRANSFORMED)                       0.56091

                                   DATA FOR CONSTN OF BARGRAPHS AND CUM. CURVES

                       SIZE FRACTION       WT.(GMS)      WT.PCT. WT.PCT.  MID PHI(LINEAR)  MID PHI(PROB.)  MODE
                        MM        PHI    UNCOR    CCP     COR    CUMUL.     PHI      MM      PHI      MM

                      0.250000  2.000   0.030   0.030    0.478    0.478  1.751  0.29707  1.901  0.26769      0
                      0.177000  2.498   0.030   0.030    0.478    0.957  2.249  0.21036  2.286  0.20497      0
                      0.125000  3.000   0.440   0.440    7.018    7.974  2.749  0.14875  2.843  0.13934      0
                      0.088000  3.506   1.170   1.170   18.660   26.635  3.253  0.10488  3.300  0.10150      1*
                      0.062500  4.000   1.010   1.010   16.108   42.743  3.753  0.07416  3.764  0.07361      0
                      0.044000  4.506   0.799   0.799   12.744   55.487  4.253  0.05244  4.254  0.05242      0
                      0.031000  5.012   0.902   0.902   14.378   69.865  4.759  0.03693  4.751  0.03714      1
                      0.022000  5.506   0.605   0.605    9.643   79.508  5.259  0.02612  5.246  0.02634      0
                      0.015600  6.002   0.340   0.340    5.424   84.932  5.754  0.01853  5.742  0.01868      0
                      0.011000  6.506   0.227   0.227    3.616   88.549  6.254  0.01310  6.242  0.01321      0
                      0.007800  7.002   0.151   0.151    2.411   90.959  6.754  0.00926  6.744  0.00933      0
                      0.005500  7.506   0.113   0.113    1.809   92.768  7.254  0.00655  7.244  0.00660      0
                      0.003900  8.002   0.076   0.076    1.205   93.973  7.754  0.00463  7.746  0.00466      0
                      0.002700  8.533   0.076   0.076    1.206   95.179  8.268  0.00325  6.256  0.00327      1
                      0.001900  9.040   0.038   0.038    0.602   95.781  8.766  0.00227  8.779  0.00228      0
                      0.001380  9.501   0.076   0.076    1.206   96.986  9.270  0.00162  9.255  0.00164      0
                      0.000061 14.000   0.189   0.189    3.014  100.000 11.751  0.00029 10.206  0.00085      0
                    TOTALS              6.270   6.270  100.0
    0.250000      0.060000
    0.177000      0.130000
    0.125000      1.120000
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  P1++ 165        0   0.0     0   0.0     0                                       ***    MULTIMODAL SAMPLE  ***
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               WET WT      DRY WT       SALT      ORGANIC    MOISTURE                  WEIGHT LOSS DUE TO HANDLING    0.0
            1000.0000      5.8500       0.0         0.0        0.0   (GRAMS)           GRAVEL CORRECTION FACTOR       1.000
             100.0000    100.0000       0.0         0.0        0.0   (PCT WET WT)      SIZES ELIMINATED (<0.01%)       NONE
                                                                                       TRASK SORTING COEFFECIENT      1.907
                                                                                       USING PROBABILITY EXTRAP.      1.898
                                                                                       MEAN CUBED DEVIATION           8.782
                                                                                       USING PROBABLITY EXTRAP.       5.639


  PERCENTAGE             TABLE OF STATISTICAL DATA IN PHI UNITS               PERCENTILES   LINEAR EXTRAP.          PROBABLILITY EXTRAP.
  COMPOSITION
                                     MEAN      STD DEV SKEWNESS KURTOSIS                     MM.       PHI UNITS       MM.      PHI UNITS
  GRAVEL      0.0        MOMENT     4.14152  1.66488  1.90298  7.73452             5.0     0.17145    2.54409      0.16599    2.59086
  SAND       62.91       P-MOMENT   4.13388  1.53808  1.54970  5.39615            10.0     0.15657    2.67515      0.14776    2.75864
  SILT       33.65       FOLK       3.97067  1.40557  0.51545  1.06776            16.0     0.14040    2.83241      0.13479    2.89123
  CLAY        3.45       P-FOLK     3.98974  1.38173  0.53937  1.06271            25.0     0.12065    3.05112      0.11991    3.05991
  MUD        37.09       INMAN      4.17270  1.34028  0.45221  0.81076            50.0     0.08440    3.56661      0.08445    3.56568
  S/M         1.70       P-INMAN    4.20177  1.31053  0.48536  0.82928            75.0     0.03317    4.91417      0.03328    4.90898
                         KRUMBEIN            1.38003  0.41604  0.26095            84.0     0.02190    5.51293      0.02191    5.51230
                         P-KRUM.             1.36969  0.41876  0.26026            90.0     0.01319    6.24487      0.01332    6.23069
                         FOLK (TRANSFORMED)                    0.51638            95.0     0.00593    7.39794      0.00598    7.38552
                         P-FOLK (TRANSFORMED)                  0.51520


                                     DATA FOR CONSTN OF BARGRAPHS AND CUM. CURVES

                        SIZE FRACTION       WT.(GMS)      WT.PCT.  WT.PCT.   MID PHI(LINEAR)    MID PHI(PROB.)   MODE
                         MM        PHI     UNCOR    COR      COR     CUMUL.     PHI       MM      PHI       MM

                      0.250000   2.000    0.060    0.060    1.026    1.026   1.751  0.29707   1.912  0.26566     0
                      0.177000   2.498    0.130    0.130    2.222    3.248   2.249  0.21036   2.307  0.20206     0
                      0.125000   3.000    1.120    1.120   19.145   22.393   2.749  0.14875   2.826  0.14399     0
                      0.088000   3.506    1.510    1.510   25.812   48.205   3.253  0.10488   3.271  0.10361     1*
                      0.062500   4.000    0.860    0.860   14.701   62.906   3.753  0.07416   3.750  0.07433     0
                      0.044000   4.506    0.391    0.391    6.690   69.596   4.253  0.05244   4.248  0.05262     0
                      0.031000   5.012    0.392    0.392    6.695   76.291   4.759  0.03693   4.751  0.03713     0
                      0.022000   5.506    0.447    0.447    7.648   83.938   5.259  0.02612   5.244  0.02638     1
                      0.015600   6.002    0.268    0.268    4.589   88.527   5.754  0.01853   5.740  0.01571     0
                      0.011000   6.506    0.179    0.179    3.060   91.587   6.254  0.01310   6.240  0.01323     0
                      0.007800   7.002    0.112    0.112    1.912   93.499   6.754  0.00926   6.742  0.00934     0
                      0.005500   7.506    0.112    0.112    1.912   95.411   7.254  0.00655   7.237  0.00663     1
                      0.003900   8.002    0.067    0.067    1.147   96.558   7.754  0.00463   7.740  0.00468     0
                      0.002700   8.533    0.067    0.067    1.147   97.705   8.268  0.00325   8.245  0.00330     1
                      0.001900   9.040    0.045    0.045    0.765   98.470   8.786  0.00227   8.765  0.00230     0
                      0.000061  14.000    0.089    0.089    1.530  100.000  11.520  0.00034   9.870  0.00107     0
                      TOTALS              5.850    5.850  100.0
     0.250000         0.030000
     0.177000         0.070000
     0.125000         0.960000
     0.088000         1.470000
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     P1++ 166        0   0.0     0   0.0       0                                    ***    MULTIMODAL SAMPLE   ***
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                 WET WT     DRY WT      SALT     ORGANIC    MOISTURE                  WEIGHT LOSS DUE TO HANDLING      0.0
              1000.0000     6.7700      0.0        0.0        0.0    (GRAMS)          GRAVEL CORRECTION FACTOR         1.000
                99.9999   100.0000      0.0        0.0        0.0    (PCT WET WT)     SIZES ELIMINATED (<0.01%)        NONE
                                                                                      TRASK SORTING COEFFECIENT        2.442
                                                                                      USING PROBABILITY EXTRAP.        2.411
                                                                                      MEAN CUBED DEVIATION            25.499
                                                                                      USING PROBABLITY EXTRAP.        21.496

     PERCENTAGE          TABLE OF STATISTICAL DATA IN PHI UNITS            PERCENTILES   LINEAR EXTRAP.        PROBABLILITY EXTRAP.
     COMPOSITION
                                          MEAN    STD DEV SKEWNESS KURTOSIS                  MM.      PHI UNITS       MM.      PHI UNITS
     GRAVEL      0.0     MOMENT         4.98936  2.50767  1.61701  5.22733        5.0      0.16141    2.63115      0.15029    2.73415
     SAND       49.78    P-MOMENT       4.98315  2.41172  1.53244  4.77880       10.0      0.14162    2.81989      0.13439    2.89550
     SILT       38.43    FOLK           4.67698  2.19946  0.57616  1.27119       16.0      0.12254    3.02864      0.12180    3.03745
     CLAY       11.80    P-FOLK         4.67954  2.18082  0.58851  1.27215       25.0      0.10595    3.23852      0.10376    3.26865
     MUD        50.22    INMAN          5.00629  1.97764  0.49955  1.02013       50.0      0.06171    4.01835      0.06171    4.01829
     S/M         0.99    P-INMAN        5.01017  1.97272  0.50280  0.99812       75.0      0.01777    5.81459      0.01784    5.80838
                         KRUMBEIN                1.90820  0.50820  0.22069       84.0      0.00790    6.98393      0.00791    6.98289
                         P-KRUM.                 1.88128  0.52022  0.22057       90.0      0.00248    8.65624      0.00248    8.65269
                         FOLK (TRANSFORMED)                        0.55970       95.0      0.00063   10.62136      0.00064   10.61759
                         P-FOLK (TRANSFORMED)                      0.55989

                                     DATA FOR CONSTN OF BARGRAPHS AND CUM. CURVES

                          SIZE FRACTION      WT.(GMS)     WT.PCT.  WT.PCT.  MID PHI(LINEAR)   MID PHI(PROB.)   MODE
                           MM        PHI    UNCOR    COR    COR     CUMUL.     PHI      MM     PHI      MM

                         0.250000  2.000    0.030   0.030   0.443    0.443   1.751  0.29707  1.900  0.26794     0
                         0.177000  2.498    0.070   0.070   1.034    1.477   2.249  0.21036  2.311  0.20147     0
                         0.125000  3.000    0.900   0.900  13.294   14.771   2.749  0.14875  2.844  0.13924     0
                         0.088000  3.506    1.470   1.470  21.713   36.484   3.253  0.10488  3.283  0.10275     1*
                         0.062500  4.000    0.900   0.900  13.294   49.778   3.753  0.07416  3.757  0.07398     0
                         0.044000  4.506    0.413   0.413   6.107   55.886   4.253  0.05244  4.252  0.05247     0
                         0.031000  5.012    0.419   0.419   6.192   62.078   4.759  0.03693  4.757  0.03699     0
                         0.022000  5.506    0.659   0.659   9.737   71.815   5.259  0.02612  5.252  0.02625     1
                         0.015600  6.002    0.347   0.347   5.125   76.939   5.754  0.01853  5.748  0.01861     0
                         0.011000  6.506    0.278   0.278   4.100   81.039   6.254  0.01310  6.247  0.01317     0
                         0.007800  7.002    0.208   0.208   3.075   84.114   6.754  0.00926  6.747  0.00931     0
                         0.005500  7.506    0.139   0.139   2.049   86.163   7.254  0.00655  7.248  0.00658     0
                         0.003900  8.002    0.139   0.139   2.050   88.213   7.754  0.00463  7.747  0.00465     1
                         0.002700  8.533    0.104   0.104   1.537   89.750   8.268  0.00325  8.261  0.00326     0
                         0.001900  9.040    0.069   0.069   1.025   90.775   8.786  0.00227  8.781  0.00227     1
                         0.001380  9.501    0.104   0.104   1.538   92.313   9.270  0.00162  9.263  0.00163     1
                         0.000980  9.995    0.104   0.104   1.537   93.850   9.748  0.00116  9.737  0.00117     0
                         0.000690 10.501    0.069   0.069   1.025   94.875  10.248  0.00082 10.239  0.00083     0
                         0.000490 10.995    0.035   0.035   0.513   95.388  10.748  0.00058 10.743  0.00058     0
                         0.000340 11.522    0.035   0.035   0.513   95.900  11.259  0.00041 11.252  0.00041     0
                         0.000240 12.025    0.035   0.035   0.513   96.413  11.773  0.00029 11.767  0.00029     1

                         0.000061 14.000    0.243   0.243   3.587  100.000  13.012  0.00012 12.330  0.00019     0
                       TOTALS               6.770   6.770 100.0
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                                                                                      ****                    ****
  P1++ 167       0   0.0     0   0.0     0                                            ***   MULTIMODAL SAMPLE   ***
                                                                                      ****                    ****
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                WET WT     DRY WT      SALT    ORGANIC   MOISTURE                    WEIGHT LOSS DUE TO HANDLING    0.0
             1000.0000     6.1100      0.0       0.0        0.0    (GRAMS)           GRAVEL CORRECTION FACTOR       1.000
              100.0000   100.0000      0.0       0.0        0.0    (PCT WET WT)      SIZES ELIMINATED (<0.01%)       NONE
                                                                                     TRASK SORTING COEFFECIENT      1.710
                                                                                     USING PROBABILITY EXTRAP.      1.689
                                                                                     MEAN CUBED DEVIATION           8.818
                                                                                     USING PROBABLITY EXTRAP.       6.608

    PERCENTAGE         TABLE OF STATISTICAL DATA IN PHI UNITS            PERCENTILES    LINEAR EXTRAP.         PROBABLILITY EXTRAP.
    COMPOSITION
                                   MEAN    STD DEV SKEWNESS KURTOSIS                      MM.       PHI UNITS       MM.      PHI UNITS
    GRAVEL     0.0     MOMENT     4.86212  1.68540  1.84179  7.19225           5.0     0.11875    3.07402     0.11441    3.12776
    SAND      32.24    P-MOMENT   4.85513  1.59327  1.63390  5.80864          10.0     0.10368    3.26983     0.09884    3.33871
    SILT      60.84    FOLK       4.64672  1.46327  0.33542  1.49699          16.0     0.08809    3.50480     0.08806    3.50540
    CLAY       6.92    P-FOLK     4.64483  1.45134  0.34101  1.51448          25.0     0.07283    3.77934     0.07170    3.80179
    MUD       67.76    INMAN      4.71817  1.21337  0.17665  1.32964          50.0     0.04408    4.50383     0.04407    4.50391
    S/M        0.48    P-INMAN    4.71529  1.20989  0.17471  1.30857          75.0     0.02491    5.32710     0.02515    5.31349
                       KRUMBEIN            1.14649  0.04939  0.21168          84.0     0.01638    5.93155     0.01646    5.92517
                       P-KRUM.             1.11978  0.05373  0.21099          90.0     0.00822    6.92575     0.00825    6.92102
                       FOLK (TRANSFORMED)                     0.59952          95.0     0.00236    8.72747     0.00238    8.71399
                       P-FOLK (TRANSFORMED)                   0.60230


                                   DATA FOR CONSTN OF BARGRAPHS AND CUM. CURVES

                        SIZE FRACTION       WT.(GMS)      WT.PCT.  WT.PCT.   MID PHI(LINEAR)   MID PHI(PROB.)   MODE
                         MM        PHI     UNCOR    COR     COR    CUMUL.      PHI       MM      PHI       MM

                       0.250000   2.000    0.020   0.020    0.327    0.327   1.751  0.29707   1.894  0.26901      0
                       0.177000   2.498    0.020   0.020    0.327    0.655   2.249  0.21036   2.287  0.20492      0
                       0.125000   3.000    0.150   0.150    2.455    3.110   2.749  0.14875   2.826  0.14103      0
                       0.088000   3.506    0.790   0.790   12.930   16.039   3.253  0.10488   3.324  0.09583      0
                       0.062500   4.000    0.990   0.990   16.203   32.242   3.753  0.07416   3.776  0.07297      0
                       0.044000   4.506    1.090   1.090   17.846   50.088   4.253  0.05244   4.260  0.05220      1*
                       0.031000   5.012    1.064   1.064   17.416   67.504   4.759  0.03693   4.753  0.03710      0
                       0.022000   5.506    0.718   0.718   11.754   79.258   5.259  0.02612   5.245  0.02637      0
                       0.015600   6.002    0.338   0.338    5.531   84.769   5.754  0.01853   5.742  0.01868      0
                       0.011000   6.506    0.211   0.211    3.457   88.246   6.254  0.01310   6.243  0.01320      0
                       0.007800   7.002    0.127   0.127    2.074   90.320   6.754  0.00926   6.746  0.00932      0
                       0.005500   7.506    0.085   0.085    1.383   91.703   7.254  0.00655   7.247  0.00658      0
                       0.003900   8.002    0.085   0.085    1.383   93.086   7.754  0.00463   7.746  0.00466      1
                       0.002700   8.533    0.085   0.085    1.383   94.469   8.268  0.00325   8.256  0.00327      1
                       0.001900   9.040    0.085   0.085    1.383   95.852   8.786  0.00227   8.772  0.00229      1
                       0.001380   9.501    0.084   0.084    1.382   97.234   9.270  0.00162   9.251  0.00164      0
                       0.000980   9.995    0.084   0.084    1.383   98.617   9.748  0.00116   9.712  0.00119      0
                       0.000061  14.000    0.084   0.084    1.383  100.000  11.997  0.00024  10.674  0.00061      0
                     TOTALS                6.110   6.110  100.0
          0.250000   0.050000
          0.177000   0.040000
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PITT168                          SIEVE, SH. PIP., SEDIGRAPH  SAMPLE WT.=  5.3700

  PHI   PCT. CUMPCT.

 3.50
         2.61              ***
 4.00           2.61
         3.98              ****
 4.50           6.58
        16.88              *****************
 5.00          25.47
        24.84              *************************
 5.50          50.31
        16.89              *****************
 6.00          67.21
         9.94              **********
 6.50          77.14
         5.96              ******
 7.00          83.11
         1.99              **
 7.50          85.09
         1.99              **
 8.00          87.08
         1.99              **
 8.50          89.07
         0.99              *
 9.00          90.06
         1.99              **
 9.50          92.05
         0.99              *
10.00          93.04
         0.99              *
10.50          94.04
         0.99              *
11.00          95.03
         4.97              *****
12.00         100.00

  MEAN  ST.DEV. SKEWNESS KURTOSIS

   5.79    1.34     0.81     2.83     KRUMBEIN+PETTIJOHN(1938) MONENT MEASURES
                                      FOR SIZE RANGE  4.0 TO  11.0 PHI

   5.82    1.63     0.52     1.74     FOLK GRAPHIC STATISTICAL PARAMETERS
                                          FOLK AND WARD,1957

PERCENTILES   MEDIAN  5.49     5TH  4.30      16TH  4.75      25TH  4.99

                                75TH  6.39      84TH  7.22      95TH 10.98

PER CENT  GRAVEL   0.0   SAND   2.61  SILT  84.34 ( 84.47)  CLAY  13.05 ( 12.92)

GRAVEL + SAND   2.61   SILT/(SILT+CLAY)  86.73PCT  GRAV+SAND/SILT+CLAY     0.03

LABELS SHEPAFD -SILT       FOLK(GMS)-MUD                   (SCS)-SILT
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PITT169        .              SIEVE, SH. PIP., SEDIGRAPH  SAMPLE WT.=  3.6900

  PHI  PCT. CUMPCT.

 2.50
        0.81               *
 3.00         0.81
        1.35               *
 3.50         2.17
        2.44               **
 4.00         4.60
        1.91               **
 4.50         6.51
       14.31               **************
 5.00        20.82
       19.08               *******************
 5.50        39.90
       10.49               **********
 6.00        50.39
        9.54               **********
 6.50        59.93
        7.63               ********
 7.00        67.56
        5.72               ******
 7.50        73.29
        3.82               ****
 8.00        77.10
        2.86               ***
 8.50        79.97
        3.82               ****
 9.00        83.78
        3.82               ****
 9.50        87.60
        2.86               ***
10.00        90.46
        2.86               ***
10.50        93.32
        0.95               *
11.00        94.28
        1.91               **
11.50        96.18
        3.82               ****
12.00       100.09

  MEAN  ST.DEV. SKEWNESS KURTOSIS

   6.40    1.65     0.40    -0.02     KRUMBEIN+PETTIJOHN(1938) MONENT MEASURES
                                      FOR SIZE RANGE  3.0 TO  11.5 PHI

   6.61    2.12     0.46     1.40     FOLK GRAPHIC STATISTICAL PARAMETERS
                                          FOLK AND WARD,1957

PERCENTILES   MEDIAN  5.98     5TH  4.10      16TH  4.83      25TH  5.11
                                 75TH  7.72      84TH  9.03      95TH 11.19


PER CENT  GRAVEL    0.0    SAND    4.60   SILT  72.40 ( 72.50)  CLAY  23.00 ( 22.90)
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     PITT170                          SIEVE, SH. PIP., SEDIGRAPH  SAMPLE WT.=  3.3000

       PHI  PCT. CUMPCT.

      2.50
             3.03               ***
      3.00         3.03
             6.06               ******
      3.50         9.09
             9.09               *********
      4.00        18.18
             9.28               *********
      4.50        27.46
            16.03               ****************
      5.00        43.49
            17.71               ******************
      5.50        61.20
            10.12               **********
      6.00        71.32
            10.97               ***********
      6.50        82.29
             4.22               ****
      7.00        86.50
             5.06               *****
      7.50        91.57
             2.53               ***
      8.00        94.10
             1.69               **
      8.50        95.78
             1.69               **
      9.00        97.47
             2.53               ***
     12.00       100.00

       MEAN   ST.DEV. SKEWNESS KURTOSIS

        5.24      1.33     0.20    -0.10     KRUMBEIN+PETTIJOHN(1938) MONENT MEASURES
                                             FOR SIZE RANGE  3.0 TO   9.0 PHI

        5.26      1.48     0.14     1.20     FOLK GRAPHIC STATISTICAL PARAMETERS
                                                 FOLK AND WARD,1957

     PERCENTILES    MEDIAN  5.18      5TH  3.16      16TH  3.88      25TH  4.37

                                      75TH  6.17      84TH  6.70      95TH  8.27

     PER CENT  GRAVEL   0.0   SAND  18.18  SILT  76.52 ( 75.91)  CLAY   5.30 (  5.90)

     GRAVEL + SAND  18.18    SILT/(SILT+CLAY)  92.78PCT  GRAV+SAND/SILT+CLAY     0.22

     LABELS SHEPARD -SILT        FOLK(GMS)-SANDY MUD           (SCS)-SANDY SILT
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   PITT171                      SIEVE, SH. PIP., SEDIGRAPH  SAMPLE WT.=  5.1600

    PHI   PCT. CUMPCT.
   3.50
          2.13             **
   4.00          2.13
          1.98             **
   4.50          4.11
         15.82             ****************
   5.00         19.93
         27.68             ****************************
   5.50         47.61
         17.79             ******************
   6.00         65.40
         10.87             ***********
   6.50         76.27
          4.94             *****
   7.00         81.22
          3.95             ****
   7.50         85.17
          3.95             ****
   8.00         89.13
          4.94             *****
   8.50         94.07
          3.95             ****
   9.00         98.02
          1.98             **
  12.00        100.00

    MEAN  ST.DEV. SKEWNESS KURTOSIS

    5.87     1.17     0.47     0.23    KRUMBEIN+PETTIJOHN(1938) MOMENT MEASURES
                                       FOR SIZE RANGE  4.0 TO    9.0 PHI

    5.93     1.24     0.47     1.08    FOLK GRAPHIC STATISTICAL PARAMETERS
                                           FOLK AND WARD,1957

  PERCENTILES   MEDIAN  5.57     5TH  4.53     16TH  4.88      25TH  5.09

                                75TH  6.44     84TH  7.35      95TH  8.62

  PER CENT  GRAVEL   0.0   SAND   2.13  SILT  87.21 ( 86.99)  CLAY  10.66 ( 10.87)

  GRAVEL + SAND   2.13   SILT/(SILT+CLAY)  88.89PCT  GRAV+SAND/SILT+CLAY     0.02
  LABELS SHEPARD -SILT        FOLK(GMS)-MUD                 (SCS)-SILT
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  PI++ 172         0   0.0     0   0.0      0

                                                                  *****************************
                                                                  ****                     ****
                                                                  ***    MULTIMODAL SAMPLE  ***
                                                                  ****                     ****
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              WET WT     DRY WT      SALT     ORGANIC    MOISTURE
           1000.0000     6.2000      0.0        0.0         0.0    (GRAMS)           WEIGHT LOSS DUE TO HANDLING       C.0
            100.0000   100.0000      0.0        0.0         0.0    (PCT WET WT)      GRAVEL CORRECTION FACTOR          1.000
                                                                                     SIZES ELIMINATED (<0.01%)          NONE
                                                                                     TRASK SORTING COEFFECIENT         1.769
                                                                                     USING PROBABILITY EXTRAP.         1.742
                                                                                     MEAN CUBED DEVIATION             10.025
                                                                                     USING PROBABLITY EXTRAP.          6.001

  PERCENTAGE          TABLE OF STATISTICAL DATA IN PHI UNITS                      PERCENTILES    LINEAR EXTRAP.              PROBABLILITY EXTRAP.
  COMPOSITION
                                     MEAN-    STD DEV  SKEWNESS  KURTOSIS                        MM.      PHI UNITS          MM.      PHI UNITS
  GRAVEL      0.0     MOMENT        4.24545   1.67467   2.13458   8.68077            5.0       0.15915    2.65150          0.14834    2.75303
  SAND       61.45    P-MOMENT      4.23052   1.51648   1.72089   5.99570           10.0       0.13702    2.86756          0.13166    2.92507
  SILT       34.93    FOLK          4.07644   1.33846   0.51821   1.19969           16.0       0.12076    3.04980          0.11915    3.06908
  CLAY        3.62    P-FOLK        4.08157   1.31659   0.54101   1.20514           25.0       0.10863    3.20253          0.10580    3.24062
  MUD        38.55    INMAN         4.26705   1.21725   0.46978   0.97858           50.0       0.07720    3.69521          0.07726    3.69419
  S/M         1.59    P-INMAN       4.27525   1.20617   0.48174   0.95210           75.0       0.03472    4.84806          0.03486    4.84206
                      KRUMBEIN                1.21892   0.33008   0.23808           84.0       0.02234    5.48431          0.02238    5.48142
                      P-KRUM.                 1.18625   0.34714   0.23656           90.0       0.01249    6.32338          0.01260    6.30995
                      FOLK (TRANSFORMED)                          0.54539           95.0       0.00565    7.46837          0.00567    7.46215
                      P-FOLK (TRANSFORMED)                        0.54651

                                        DATA FOR CCNSTN OF BARGRAPHS AND CUM. CURVES

                      SIZE FRACTION        WT.(GMS)       WT.PCT.  WT.PCT.  MID PHI(LINEAR)    MID PHI(PROB.)   MODE
                       MM        PHI     UNCOR     COR      COR     CUMUL.    PHI       MM        PHI       MM

                     0.250000   2.000    0.050    0.050    0.806    0.806   1.751   0.29707   1.909   0.26622     I
                     0.177000   2.498    0.040    0.040    0.645    1.452   2.249   0.21036   2.280   0.20583     0
                     0.125000   3.000    0.720    0.720   11.613   13.065   2.749   0.14875   2.842   0.13946     0
                     0.088000   3.506    1.850    1.850   29.839   42.903   3.253   0.10488   3.289   0.10227     I*
                     0.062500   4.000    1.150    1.150   18.548   61.452   3.753   0.07416   3.752   0.07425     0
                     0.044000   4.506    0.618    0.618    9.973   71.425   4.253   0.05244   4.246   0.05271     0
                     0.031000   5.012    0.328    0.328    5.285   76.710   4.759   0.03693   4.752   0.03710     0
                     0.022000   5.506    0.473    0.473    7.629   84.340   5.259   0.02612   5.244   0.02639     I
                     0.015600   6.002    0.224    0.224    3.614   87.953   5.754   0.01853   5.743   0.01867     0
                     0.011000   6.500    0.199    0.199    3.213   91.166   6.254   0.01310   6.240   0.01323     0
                     0.007800   7.002    0.100    0.100    1.606   92.772   6.754   0.00926   6.745   0.00932     0
                     0.005500   7.500    0.149    0.149    2.410   95.181   7.254   0.00655   7.234   0.00664     I
                     0.003900   8.002    0.075    0.075    1.205   96.386   7.754   0.00463   7.740   0.00468     0
                     0.002700   8.533    0.050    0.050    0.803   97.189   8.268   0.00325   8.254   0.00328     0
                     0.001900   9.040    0.050    0.050    0.802   97.992   8.786   0.00227   8.768   0.00229     0
                     0.000061  14.000    0.124    0.124    2.008  100.000  11.520   0.00034   9.846   0.00109     0
                   TOTALS                6.200    6.200  100.0
   0.250000        0.040000
   0.177000        0.040000
   0.125000        0.530000
   0.088000        1.080000
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                                                                                  ****                    ****
   P1++ 173        0   0.0     0   0.0      0                                     ***   MULTIMODAL SAMPLE   ***
                                                                                  ****                    ****
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             WET WT     DRY WT     SALT     ORGANIC   MOISTURE                    WEIGHT LOSS DUE TO HANDLING      0.0
          1000.0000     6.6100     0.0        0.0        0.0    (GRAMS)           GRAVEL CORRECTION FACTOR         1.000
           100.0000   100.0000     0.0        0.0        0.0    (PCT WET WT)      SIZES ELIMINATED (<0.01%)         NONE
                                                                                  TRASK SORTING COEFFECIENT        1.946
                                                                                  USING PROBABILITY EXTRAP.        1.936
                                                                                  MEAN CUBED DEVIATION            13.436
                                                                                  USING PROBABLITY EXTRAP.         8.226

   PERCENTAGE        TABLE OF STATISTICAL DATA IN PHI UNITS                 PERCENTILES   LINEAR EXTRAP.          PROBABLILITY EXTRAP.
   COMPOSITION
                                     MEAN    STD DEV SKEWNESS KURTOSIS                   MM.     PHI UNITS        MM.     PHI UNITS
   GRAVEL      0.0   MOMENT        4.80247  1.92296  1.88953  7.41521          5.0    0.15017   2.73535      0.14084   2.82783
   SAND      39.64   P-MOMENT      4.77049  1.74700  1.54282  5.64280         10.0    0.12295   3.02390      0.12207   3.03419
   SILT      53.94   FOLK          4.55618  1.59466  0.26698  1.26038         16.0    0.10808   3.20984      0.10503   3.25114
   CLAY       6.43   P-FOLK        4.56994  1.56951  0.26601  1.24847         25.0    0.08908   3.48876      0.08882   3.49293
   MUD       60.36   INMAN         4.60957  1.39973  0.11444  1.10956         50.0    0.04577   4.44939      0.04575   4.44996
   S/M        0.66   P-INMAN       4.62993  1.37879  0.13053  1.10647         75.0    0.02353   5.40908      0.02369   5.39977
                     KRUMBEIN               1.42247 -0.00047  0.25119         84.0    0.01552   6.00931      0.01553   6.00872
                     P-KRUM.                1.41248 -0.00361  0.25091         90.0    0.00869   6.84631      0.00876   6.83409
                     FOLK (TRANSFORMED)                       0.55760         95.0    0.00250   8.64101      0.00251   8.63659
                     P-FOLK (TRANSFORMED)                     0.55525


                            DATA FOR CONSTN OF BARGRAPHS AND CUM. CURVES

                SIZE FRACTION      WT.(GMS)      WT.PCT.  WT.PCT.  MID PHI(LINEAR)  MID PHI(PROB.)   MODE
                  MM      PHI    UNCOR    COR      COR    CUMUL.    PHI      MM      PHI      MM

                0.250000  2.000  0.040   0.040    0.605    0.605  1.751  0.29707  1.905  0.26698    0
                0.177000  2.498  0.040   0.040    0.605    1.210  2.249  0.21036  2.286  0.20501    0
                0.125000  3.000  0.530   0.530    8.018    9.228  2.749  0.14875  2.839  0.13974    0
                0.088000  3.506  1.080   1.080   16.339   25.567  3.253  0.10488  3.293  0.10200    1*
                0.062500  4.000  0.930   0.930   14.070   39.637  3.753  0.07416  3.764  0.07360    0
                0.044000  4.506  0.772   0.772   11.676   51.313  4.253  0.05244  4.255  0.05236    0
                0.031000  5.012  0.884   0.884   13.368   64.682  4.759  0.03693  4.755  0.03705    1
                0.022000  5.506  0.849   0.849   12.843   77.524  5.259  0.02612  5.246  0.02535    0
                0.015600  6.002  0.424   0.424    6.422   83.946  5.754  0.01853  5.742  0.01869    0
                0.011000  6.506  0.255   0.255    3.852   87.799  6.254  0.01310  6.243  0.01321    0
                0.007800  7.002  0.212   0.212    3.211   91.010  6.754  0.00926  6.741  0.00935    0
                0.005500  7.506  0.085   0.085    1.284   92.294  7.254  0.00655  7.247  0.00658    0
                0.003900  8.002  0.085   0.085    1.284   93.579  7.754  0.00463  7.746  0.00466    0
                0.002700  8.533  0.085   0.085    1.284   94.863  8.268  0.00325  8.256  0.00327    1
                0.001900  9.040  0.042   0.042    0.641   95.505  8.786  0.00227  8.780  0.00228    0
                0.001380  9.501  0.042   0.042    0.642   96.147  9.270  0.00162  9.263  0.00163    1
                0.000980  9.995  0.042   0.042    0.642   96.789  9.748  0.00116  9.739  0.00117    0
                0.000061 14.000  0.212   0.212    3.211  100.000 11.997  0.00024 10.619  0.00064    0
              TOTALS             6.610   6.610  100.0
     0.250000   0.030000
     0.177000   0.040000
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  PITT174                          SIEVE, SH. PIP., SEDIGRAPH  SAMPLE WT.=  4.6800

    PHI   PCT. CUMPCT.
    3.00
          1.92              **
    3.50          1.92
          4.06              ****
    4.00          5.98
          4.75              *****
    4.50         10.73
          5.70              ******
    5.00         16.43
         14.25              **************
    5.50         30.67
          4.75              *****
    6.00         35.42
         21.84              **********************
    6.50         57.26
          8.55              *********
    7.00         65.81
          6.65              *******
    7.50         72.46
          3.80              ****
    8.00         76.26
          3.80              ****
    8.50         80.06
          2.85              ***
    9.00         82.91
          2.85              ***
    9.50         85.76
          2.85              ***
   10.00         88.60
          2.85              ***
   10.50         91.45
          1.90              **
   11.00         93.35
          1.90              **
   11.50         95.25
          4.75              *****
   12.00        100.00

     MEAN  ST.DEV. SKEWNESS KURTOSIS

     6.55     1.84     0.34     0.02     KRUMBEIN+PETTIJOHN(1938) MOMENT MEASURES
                                         FOR SIZE RANGE  3.5 TO  11.5 PHI

     6.83     2.20     0.35     1.52     FOLK GRAPHIC STATISTICAL PARAMETERS
                                             FOLK AND WARD,1957

   PERCENTILES   MEDIAN  6.33      5TH  3.88      16TH  4.96      25TH  5.30

                                  75TH  7.83      84TH  9.19      95TH 11.43

   PER CENT   GRAVEL    0.0    SAND    5.98  SILT   70.51 ( 70.28)  CLAY  23.50 ( 23.74)

   GRAVEL + SAND    5.98    SILT/(SILT+CLAY)   74.75PCT  GRAV+SAND/SILT+CLAY     0.06
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  PITT175                        SIEVE, SH. PIP., SEDIGRAPH  SAMPLE WT.=  4.4800

    PHI  PCT. CLMPCT.

   3.50
          0.67             *
   4.00          0.67
          0.99             *
   4.50          1.66
          7.95             ********
   5.00          9.61
         20.86             *********************
   5.50         30.47
         19.87             ********************
   6.00         50.33
         12.91             *************
   6.50         63.25
          6.95             *******
   7.00         70.20
          5.96             ******
   7.50         76.16
          3.97             ****
   8.00         80.13
          2.98             ***
   8.50         83.11
          2.98             ***
   9.00         86.09
          3.97             ****
   9.50         90.07
          1.99             **
  10.00         92.05
          1.99             **
  10.50         94.04
          1.99             **
  11.00         96.03
          3.97             ****
  12.00        100.00

    MEAN  ST.DEV. SKEWNESS KURTOSIS

     6.44     1.54      0.56      0.50     KRUMBEIN+PETTIJOHN(1938) MONENT MEASURES
                                           FOR SIZE RANGE  4.0 TO  11.0 PHI

     6.60     1.79      0.55      1.35     FOLK GRAPHIC STATISTICAL PARAMETERS
                                               FOLK AND WARD,1957

  PERCENTILES   MEDIAN  5.99      5TH  4.71      16TH  5.15      25TH  5.37

                                  75TH  7.40      84TH  8.65      95TH 10.74

  PER CENT  GRAVEL    0.0   SAND    0.67  SILT  79.24 ( 79.46)  CLAY  20.09 ( 19.87)

  GRAVEL + SAND   0.67   SILT/(SILT+CLAY)  80.00PCT  GRAV+SAND/SILT+CLAY     0.01

  LABELS SHEPARD -SILT        FOLK(GMS)-MUD               (SCS)-SILT
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                                                                                          ******************************
                                                                                          ****                      ****
P1++ 176       0   0.0     0   0.0       0                                                ***   MULTIMODAL SAMPLE    ***
                                                                                          ****                      ****
                                                                                          ******************************

          WET WT     DRY WT      SALT     ORGANIC   MOISTURE                          WEIGHT LOSS DUE TO HANDLING    0.0
       1000.0000     7.3200      0.0        0.0        0.0     (GRAMS)                GRAVEL CORRECTION FACTOR       1.000
         99.9999   100.0000      0.0        0.0        0.0     (PCT WET WT)           SIZES ELIMINATED (<0.01%)       NONE
                                                                                      TRASK SORTING COEFFECIENT      1.866
                                                                                      USING PROBABILITY EXTRAP.      1.846
                                                                                      MEAN CUBED DEVIATION          10.177
                                                                                      USING PROBABLITY EXTRAP.       5.902

PERCENTAGE        TABLE OF STATISTICAL DATA IN PHI UNITS                 PERCENTILES    LINEAR EXTRAP.           PROBABLILITY EXTRAP.
COMPOSITION
                                  MEAN    STD DEV SKEWNESS KURTOSIS                      MM.       PHI UNITS       MM.       PHI UNITS
GRAVEL      0.0   MOMENT        4.99725  1.78832  1.77948  6.98255            5.0      0.11697    3.09581      0.11153    3.16451
SAND      32.65   P-MOMENT      4.96645  1.61852  1.39202  5.00257           10.0      0.10188    3.29508      0.09710    3.36442
SILT      60.40   FOLK          4.77966  1.51455  0.30092  1.28397           16.0      0.08679    3.52624      0.08648    3.53142
CLAY       6.95   P-FOLK        4.77785  1.49833  0.30926  1.28760           25.0      0.07268    3.78231      0.07147    3.80658
MUD       67.35   INMAN         4.84641  1.32017  0.15167  1.13589           50.0      0.03994    4.64618      0.03996    4.64531
S/M        0.48   P-INMAN       4.84412  1.31270  0.15145  1.11666           75.0      0.02087    5.58240      0.02097    5.57537
                  KRUMBEIN               1.33340  0.03618  0.23638           84.0      0.01392    6.16658      0.01402    6.15682
                  P-KRUM.                1.31021  0.04567  0.23698           90.0      0.00728    7.10263      0.00731    7.09628
                  FOLK (TRANSFORMED)                       0.56217           95.0      0.00235    8.73529      0.00237    8.72159
                  P-FOLK (TRANSFORMED)                     0.56286

                                  DATA FOR CONSTN OF BARGRAPHS AND CUM. CURVES

                   SIZE FRACTION       WT.(GMS)      WT.PCT. WT.PCT.  MID PHI(LINEAR)  MID PHI(PROB.)  MODE
                    MM       PHI     UNCOR    COR      COR    CUMUL.     PHI       MM      PHI       MM

                  0.250000  2.000   0.030    0.030    0.410    0.410   1.751  0.29707   1.899  0.26320     0
                  0.177000  2.498   0.040    0.040    0.546    0.956   2.249  0.21036   2.294  0.20384     0
                  0.125000  3.000   0.120    0.120    1.639    2.596   2.749  0.14875   2.801  0.14352     0
                  0.088000  3.506   0.930    0.930   12.705   15.301   3.253  0.10488   3.330  0.09944     0
                  0.062500  4.000   1.270    1.270   17.350   32.650   3.753  0.07416   3.779  0.07287     1*
                  0.044000  4.506   0.997    0.997   13.626   46.277   4.253  0.05244   4.259  0.05222     0
                  0.031000  5.012   0.985    0.985   13.452   59.729   4.759  0.03693   4.757  0.03697     0
                  0.022000  5.506   1.016    1.016   13.887   73.615   5.259  0.02612   5.249  0.02630     1
                  0.015600  6.002   0.661    0.661    9.027   82.642   5.754  0.01853   5.739  0.01872     0
                  0.011000  6.506   0.305    0.305    4.166   86.808   6.254  0.01310   6.243  0.01320     0
                  0.007800  7.002   0.203    0.203    2.777   89.585   6.754  0.00926   6.744  0.00933     0
                  0.005500  7.506   0.152    0.152    2.083   91.668   7.254  0.00655   7.244  0.00660     0
                  0.003900  8.002   0.102    0.102    1.389   93.057   7.754  0.00463   7.746  0.00466     0
                  0.002700  8.533   0.102    0.102    1.389   94.445   8.268  0.00325   8.256  0.00327     0
                  0.001900  9.040   0.102    0.102    1.389   95.834   8.766  0.00227   8.772  0.00229     1
                  0.001380  9.501   0.102    0.102    1.389   97.223   9.270  0.00162   9.251  0.00164     1
                  0.000061 14.000   0.203    0.203    2.777  100.000  11.751  0.00029  10.210  0.00084     0
                        TOTALS      7.320    7.320  100.0
    0.250000       0.020000
    0.177000       0.010000
    0.125000       0.060000
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                                                                                   ****                      ****
   PI++ 177       0    0.0     0    0.0      0                                     ***    MULTIMODAL SAMPLE   ***
                                                                                   ****                      ****
                                                                                   ******************************

                    WET WT      DRY WT      SALT     ORGANIC    MOISTURE          WEIGHT LOSS DUE TO HANDLING     0.0
                 1000.0000      7.4100      0.0        0.0        0.0    (GRAMS)       GRAVEL CORRECTION FACTOR        1.000
                  100.0000    100.0000      0.0        0.0        0.0    (PCT WET WT)  SIZES ELIMINATED (<0.01%)        NONE
                                                                                   TRASK SORTING COEFFECIENT       1.728
                                                                                   USING PROBABILITY EXTRAP.       1.719
                                                                                   MEAN CUBED DEVIATION            8.771
                                                                                   USING PROBABLITY EXTRAP.        4.094

     PERCENTAGE            TABLE OF STATISTICAL DATA IN PHI UNITS                 PERCENTILES    LINEAR EXTRAP.            PROBABLILITY EXTRAP.
     COMPOSITION
                                          MEAN     STD DEV  SKEWNESS KURTOSIS                   MM.       PHI UNITS        MM.       PHI UNITS
     GRAVEL      0.0       MOMENT       5.12973   1.65875   1.92175  7.92382        5.0       0.10417    3.26301       0.09811    3.34945
     SAND       23.48      P-MOMENT     5.08611   1.44530   1.35623  5.14613       10.0       0.08504    3.55570       0.08390    3.57519
     SILT       70.93      FOLK         4.95122   1.38019   0.26585  1.28064       16.0       0.07415    3.75343       0.07211    3.79356
     CLAY        5.59      P-FOLK       4.96038   1.35111   0.28323  1.26615       25.0       0.06000    4.05884       0.05975    4.06488
     MUD        76.52      INMAN        5.01921   1.26579   0.16114  0.94825       50.0       0.03552    4.81524       0.03548    4.81666
     S/M         0.31      P-INMAN      5.03225   1.23869   0.17404  0.94951       75.0       0.02010    5.63699       0.02022    5.62817
                           KRUMBEIN               1.16900   0.03267  0.23260       84.0       0.01282    6.28500       0.01295    6.27093
                           P-KRUM.                1.15800   0.02986  0.23219       90.0       0.00810    6.94812       0.00814    6.94160
                           FOLK (TRANSFORMED)                        0.56157       95.0       0.00341    8.19514       0.00345    8.17912
                           P-FOLK (TRANSFORMED)                      0.55872

                              DATA FOR CONSTN OF BARGRAPHS AND CUM. CURVES

                        SIZE FRACTION       WT.(GMS)       WT.PCT. WT.PCT.   MID PHI(LINEAR)   MID PHI(PROB.)   MODE
                         MM       PHI     UNCOR    COR       COR   CUMUL.     PHI      MM       PHI      MM

                      0.250000  2.000    0.020    0.020     0.270   0.270  1.751  0.29707  1.890  0.26978     1
                      0.177000  2.498    0.010    0.010     0.135   0.405  2.249  0.21036  2.272  0.20710     0      1.2
                      0.125000  3.000    0.060    0.060     0.810   1.215  2.749  0.14875  2.807  0.14288     0
                      0.088000  3.506    0.540    0.540     7.287   8.502  3.253  0.10488  3.341  0.09866     0
                      0.062500  4.000    1.110    1.110    14.980  23.482  3.753  0.07416  3.793  0.07213     1
                      0.044000  4.506    0.968    0.968    13.061  36.542  4.253  0.05244  4.266  0.05198     0      57.
                      0.031000  5.012    1.631    1.631    22.010  58.553  4.759  0.03693  4.761  0.03688     1*
                      0.022000  5.506    1.063    1.063    14.348  72.900  5.259  0.02612  5.249  0.02630     0
                      0.015600  6.002    0.591    0.591     7.970  80.870  5.754  0.01853  5.742  0.01868     0      26
                      0.011000  6.506    0.413    0.413     5.580  86.450  6.254  0.01310  6.240  0.01323     0
                      0.007800  7.002    0.295    0.295     3.985  90.435  6.754  0.00926  6.739  0.00936     0
                      0.005500  7.506    0.177    0.177     2.391  92.827  7.254  0.00655  7.241  0.00661     0
                      0.003900  8.002    0.118    0.118     1.594  94.420  7.754  0.00463  7.742  0.00467     0
                      0.002700  8.533    0.118    0.118     1.594  96.015  8.268  0.00325  8.250  0.00329     1      9.5
                      0.001900  9.040    0.059    0.059     0.797  96.812  8.786  0.00227  8.775  0.00228     0
                      0.000061 14.000    0.236    0.236     3.188 100.000 11.520  0.00034  9.813  0.00111     0
                    TOTALS               7.410    7.410   100.0
     0.250000         0.070000
     0.177000         0.030000
     0.125000         0.290000
     0.088000         0.810000
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PITT178                    SIEVE, SH. PIP., SEDIGRAPH  SAMPLE WT.=  4.6300

 PHI  PCT. CUMPCT.
3.50
      2.16                **
4.00         2.16
      1.96                **
4.50         4.12
      8.21                *********
5.00        12.92
     18.59                *******************
5.50        31.51
     17.61                ******************
6.00        49.12
     12.72                *************
6.50        61.84
      7.83                ********
7.00        69.67
      5.87                ******
7.50        75.54
      3.91                ****
8.00        79.45
      1.96                **
8.50        81.41
      1.96                **
9.00        83.37
      2.94                ***
9.50        86.30
      2.94                ***
10.00       89.24
      1.96                **
10.50       91.19
      1.96                **
11.00       93.15
      1.96                **
11.50       95.11
      4.89                *****
12.00      100.00
  MEAN  ST.DEV. SKEWNESS KURTOSIS
  6.46    1.71     0.57     0.65   KRUMBEIN+PETTIJOHN(1938) MONENT MEASURES
                                   FOR SIZE RANGE  4.0 TO  11.5 PHI

  6.74    2.06     0.55     1.52   FOLK GRAPHIC STATISTICAL PARAMETERS
                                       FOLK AND WARD,1957


PERCENTILES   MEDIAN  6.03     5TH  4.55     16TH  5.08      25TH  5.32
                               75TH  7.45     84TH  9.11      95TH 11.47

PER CENT  GRAVEL   0.0   SAND   2.16  SILT  77.30 ( 77.29)  CLAY  20.54 ( 20.55)

GRAVEL + SAND   2.16   SILT/(SILT+CLAY)  79.00PCT  GRAV+SAND/SILT+CLAY     0.02
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PITT179                          SIEVE, SH. PIP., SEDIGRAPH  SAMPLE WT.=  4.8900

  PHI  PCT. CUMPCT.
 2.00
        1.02              *
 2.50          1.02
        1.64              **
 3.00          2.66
        2.86              ***
 3.50          5.52
        5.52              ******
 4.00         11.04
        6.23              ******
 4.50         17.27
       19.57              ********************
 5.00         36.84
       17.79              ******************
 5.50         54.63
       12.45              ************
 6.00         67.09
        8.01              ********
 6.50         75.09
        6.23              ******
 7.00         81.32
        4.45              ****
 7.50         85.77
        1.78              **
 8.00         87.55
        1.78              **
 8.50         89.33
        1.78              **
 9.00         91.10
        1.78              **
 9.50         92.88
        2.67              ***
10.00         95.55
        1.78              **
10.50         97.33
        2.67              ***
12.00        100.00

  MEAN  ST.DEV. SKEWNESS KURTOSIS

   5.65    1.63    0.45    0.85    KRUMBEIN+PETTIJOHN(1938) MONENT MEASURES
                                   FOR SIZE RANGE  2.5 TO  10.5 PHI

   5.69    1.71    0.36    1.53    FOLK GRAPHIC STATISTICAL PARAMETERS
                                       FOLK AND WARD,1957


PERCENTILES   MEDIAN  5.37     5TH  3.41      16TH  4.40      25TH  4.70

                               75TH  6.49      84TH  7.30      95TH  9.90

PER CENT  GRAVEL   0.0   SAND  11.04  SILT  76.69 ( 76.50)  CLAY  12.27 ( 12.45)


GRAVEL + SAND  11.04   SILT/(SILT+CLAY)  86.00PCT  GRAV+SAND/SILT+CLAY     0.12
LABELS SHEPARD -SILT        FOLK(GMS)-SANDY MUD           (SCS)-SANDY SILT
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                                                                          ****                    ****
 P1++ 180      0   0.0    0   0.0    0                                    ***   MULTIMODAL SAMPLE  ***
                                                                          ****                    ****
                                                                          ****************************

          WET WT     DRY WT      SALT     ORGANIC   MOISTURE                  WEIGHT LOSS DUE TO HANDLING     0.0
       1000.0000     5.4700      0.0        0.0       0.0    (GRAMS)          GRAVEL CORRECTION FACTOR        1.000
         99.9999   100.0000      0.0        0.0       0.0    (PCT WET WT)     SIZES ELIMINATED (<0.01%)       NONE
                                                                              TRASK SORTING COEFFECIENT       2.434
                                                                              USING PROBABILITY EXTRAP.       2.417
                                                                              MEAN CUBED DEVIATION           11.139
                                                                              USING PROBABLITY EXTRAP.        7.508

 PERCENTAGE          TABLE OF STATISTICAL DATA IN PHI UNITS             PERCENTILES   LINEAR EXTRAP.         PROBABLILITY EXTRAP.
 COMPOSITION
                                   MEAN   STD DEV SKEWNESS KURTOSIS                      MM.      PHI UNITS       MM.      PHI UNITS
 GRAVEL     0.0     MOMENT      5.21162  2.07127  1.25358  4.91588            5.0      0.14375    2.79839       0.13808    2.85640
 SAND      34.00    P-MOMENT    5.18968  1.94761  1.01628  3.83822           10.0      0.11678    3.09813       0.11382    3.13511
 SILT      57.22    FOLK        5.07272  1.89660  0.24646  1.01803           16.0      0.10130    3.30330       0.09840    3.34521
 CLAY       8.77    P-FOLK      5.08626  1.87532  0.25827  1.01488           25.0      0.08068    3.63162       0.08008    3.64246
 MUD       66.00    INMAN       5.16497  1.86167  0.14865  0.71192           50.0      0.03377    4.88822       0.03376    4.88863
 S/M        0.52    P-INMAN     5.18507  1.83986  0.16112  0.71361           75.0      0.01362    6.19769       0.01371    6.18884
                    KRUMBEIN             1.90079  0.02643  0.27004           84.0      0.00767    7.02664       0.00768    7.02493
                    P-KRUM.              1.88621  0.02702  0.27093           90.0      0.00434    7.84945       0.00438    7.83436
                    FOLK (TRANSFORMED)                     0.50447           95.0      0.00173    9.17247       0.00175    9.16200
                    P-FOLK (TRANSFORMED)                   0.50369


                                 DATA FOR CONSTN OF BARGRAPHS AND CUM. CURVES

                    SIZE FRACTION      WT.(GMS)     WT.PCT. WT.PCT.  MID PHI(LINEAR)  MID PHI(PROB.)  MODE
                      MM      PHI    UNCOR    COR     COR    CUMUL.    PHI      MM      PHI     MM

                   0.250000  2.000   0.070   0.070   1.280    1.280  1.751  0.29707  1.915  0.26520    1
                   0.177000  2.498   0.030   0.030   0.548    1.828  2.249  0.21036  2.268  0.20761    0
                   0.125000  3.000   0.290   0.290   5.302    7.130  2.749  0.14875  2.814  0.14220    0
                   0.088000  3.506   0.810   0.810  14.808   21.938  3.253  0.10488  3.300  0.10155    1*
                   0.062500  4.000   0.660   0.660  12.066   34.004  3.753  0.07416  3.766  0.07349    0
                   0.044000  4.506   0.505   0.505   9.227   43.230  4.253  0.05244  4.258  0.05228    0
                   0.031000  5.012   0.490   0.490   8.956   52.186  4.759  0.03693  4.760  0.03691    0
                   0.022000  5.506   0.626   0.626  11.448   63.634  5.259  0.02612  5.255  0.02618    1
                   0.015600  6.002   0.479   0.479   8.755   72.389  5.754  0.01853  5.747  0.01862    0
                   0.011000  6.506   0.368   0.368   6.734   79.123  6.254  0.01310  6.245  0.01519    0
                   0.007800  7.002   0.258   0.258   4.714   83.837  6.754  0.00926  6.744  0.00933    0
                   0.005500  7.506   0.184   0.184   3.367   87.205  7.254  0.00655  7.244  0.00660    0
                   0.003900  8.002   0.221   0.221   4.040   91.245  7.754  0.00463  7.737  0.00469    1
                   0.002700  8.533   0.111   0.111   2.021   93.266  8.268  0.00325  8.254  0.00327    0
                   0.001900  9.040   0.074   0.074   1.346   94.612  8.786  0.00227  8.775  0.00228    0
                   0.001380  9.501   0.074   0.074   1.347   95.960  9.270  0.00162  9.257  0.00163    1
                   0.000690 10.501   0.074   0.074   1.346   97.306 10.001  0.00098  9.960  0.00100    0
                   0.000061 14.000   0.147   0.147   2.694  100.000 12.251  0.00021 11.054  0.00047    0
                 TOTALS              5.470   5.470 100.0
 EXECUTION TERMINATED
```

APPENDIX 4 BEDLOAD CALCULATIONS

A simplified form of Einsteins (1950) equation was used (Graf, 1971).

Method

$\Phi = f(\Psi)$

$$\Psi = \frac{\rho_s - \rho}{\rho} \; \frac{d}{s\, R_h'} \qquad \text{use } d = d_{35} \qquad R_h \cong R_h'$$

Knowing Ψ, go to Figure and determine Φ

$$\Phi = \frac{g_s}{\gamma_s} \sqrt{\frac{\rho}{\rho - \rho} \; \frac{1}{g\, d^3}}$$

$$\therefore\; g_s = \frac{\Phi \quad \gamma_s}{\sqrt{\frac{\rho}{\rho_s - \rho} \; \frac{1}{g\, d^3}}}$$

$Gs = B\, g_s$ (in kilograms per hour)

Ψ	intensity of shear of particles
Φ	intensity of bedload transport
ρ_s	density of grain
ρ	density of water
d	grain diameter
s	slope
R_h	hydraulic radius
g_s	bedload rate (unit time and width)
G_s	bedload rate per uit time
B	width

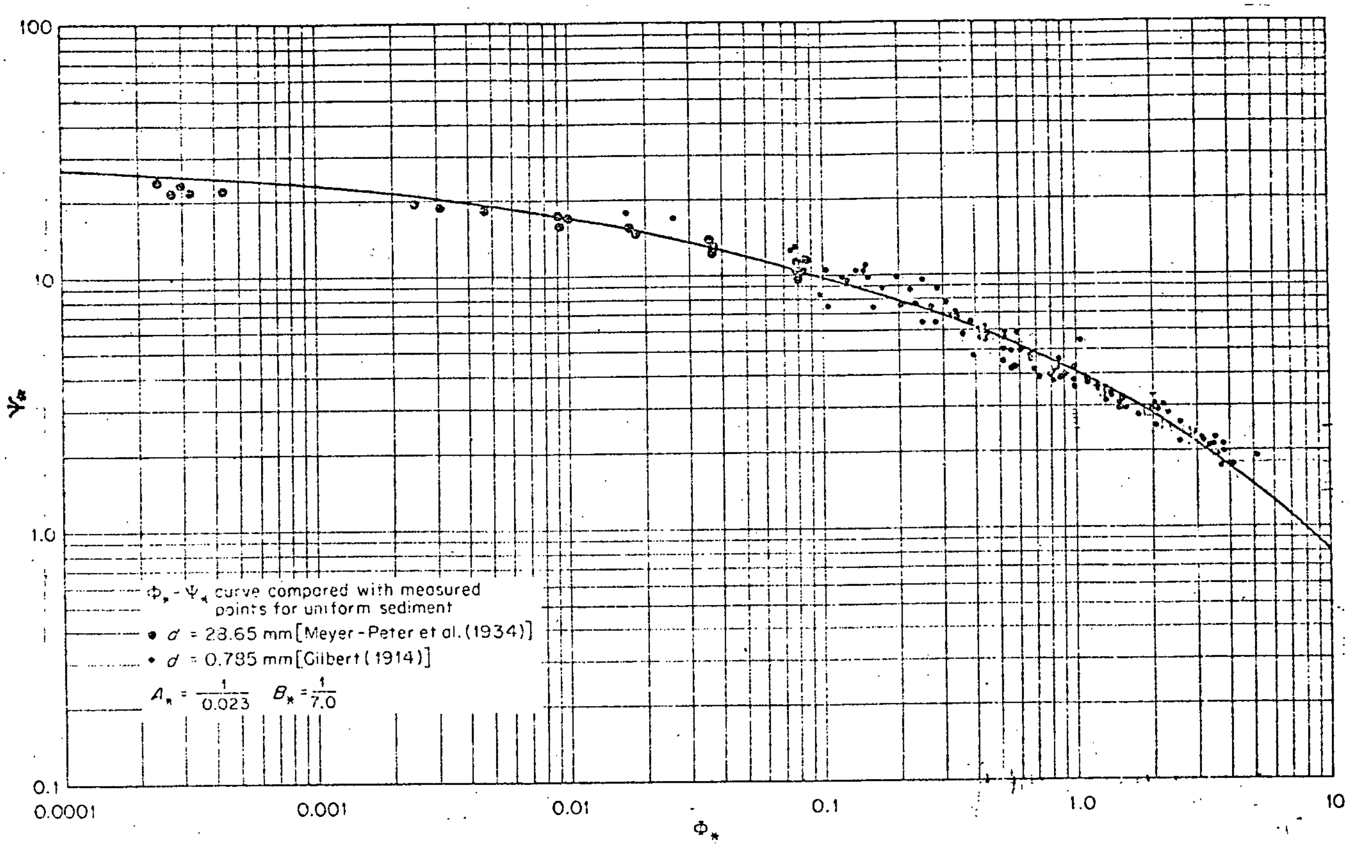

Fig. 7.13 Plot of Einstein's functions; Φ_* vs. Ψ_*. [*After* EINSTEIN (*1950*).]

Graf, W. H., 1971, Hydraulics of sediment transport: McGraw Hill, Inc., New York.

An example: Pitt-Fraser confluence; Freshet flood.

$B = 601$ m
$s = .000018$
$\rho_s = 2.65$
$\rho = 1.00$
$R_h = 5.06$ m
$d_{35} = .0003$ m

$$\Psi = \frac{2.65 - 1}{1} \times \frac{.0003}{.000018 \times 5.06}$$

$$= \frac{.0003}{.0000919} = 3.3 \quad \text{(from fig. } \Phi = 1.6\text{)}$$

$$g_s = \frac{1.6\ (2650)}{\frac{1}{2.65-1} \times \frac{1}{9.8(.0003)^3}}$$

$$= \frac{4240}{4785.91}$$

$$= .088593$$

$$G_s = .088593\ (601)$$

$$= 53.24 \text{ kg/sec}$$

$$= 191{,}664 \text{ kg/hr}$$

Summary of calculations of three cross sections of the river. (1) near Fraser-Pitt confluence (2) mid-river (3) near lake entrance. Values are in kg/hr.
+ movement in flood direction
- movement in ebb direction

	(1) Near Pitt-Fraser confluence	(2) Mid-river	(3) Near Lake entrance	
Winter Flood	+407,320	+239,680	+320,250	
Winter Ebb	-251,156	-164,352	-202,825	Average
	+156,164	+75,328	+117,425	+116,305
Freshet Flood	+191,664	+68,480	+117,425	
Freshet Ebb	-149,750	-49,990	-90,737	Average
	+41,914	+18,490	+26,688	+26,688

Calculations for net sediment movement were based on values determined at (1) near Fraser Pitt confluence.

WINTER TRANSPORT(8 months)

Flood = 44% of total time, 5856 hours
Ebb = 56% of total time, 5856 hours

For time under flood, 55% is above critical velocity
For time under ebb, 60% is above critical velocity

Thus, FLOOD = (44%)(55%)(5856)=1417 hours/year
EBB = (56%)(60%)(5856)=1968 hours/year

FLOOD
G_s = 407,319 kg/hr

total flood transport = 407,319kg/hr X 1417 hours
total flood=+577,717,023 kg.

EBB

G_s = 251,156 kg/hr

total ebb transport = 251,156 kg/hr X 1968 hours
total ebb=-494,275,008 kg.

FRESHET TRANSPORT (4 months)

Flood =44% of total time, 2904 hours
Ebb =56% of total time, 2904 hours

For time under flood, 55% isabove critical velocity
For time under ebb, 60% is above critical velocity

Thus, FLOOD = (44%)(55%)(2904)=702 hours
EBB = (56$)(60%)(2904)=976 hours

FLOOD
G_s = 191,664 kg/hr

total flood transport = 191,664 kg/hr X 702 hours
total flood =+134,548,699 kg.

EBB
G_s= 149,751 kg/hr
total ebb transport = 149,751 kg/hr X 976 hours
total ebb =-146,156,976 kg.

Winter flood - Winter Ebb = +82,896 tonnes
Freshet flood-freshet Ebb = -11,608 tonnes
71,288 tones

Net transport + 71, 288 tonnes

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