CHAPTER V

QUATERNARY GEOLOGY

Quaternary Sedimentary Description

It is postulated that the climatic change since the Quaternary period has introduced construction of geomorphological landforms in worldwide area, especially in the tropical zones. In the area under investigation, the geomorphological landforms have been also formed during Quaternary period such as high terrace, middle terrace, low terrace and floodplain, already mentioned in the previous chapter. Detail of sedimentary characteristics, especially in floodplain and low terrace landforms, are described in this chapter. Most of sediments were extensively deposited by fluvial processes. On the basis of sedimentary structures and textures, the sediments comprising these landforms in the middle part of the area can be divided predominantly into eight lithofacies. Based on their unconsolidated condition together with the evidence of ages of wood fragments, tree remained, tektite, laterite formation and basalts, it can be indicated that the sediments were deposited extensively during Quaternary period.

1. Lithofacies of fluvial deposits

Fluvial successions of Quaternary period in the study area are described from exposures of paleochannel deposit situated in the middle part of the basin. Primary sedimentary structures displaying in dominant river terraces on both sides of the main paleochannel indicate the paleoenvironments of deposition which are composed mainly of braided, point bar and overbank deposits.

Based on lithofacies classified by Miall (1984), lithofacies of the channel deposits can be divided predominantly into 8 facies. Two gravelly facies are recognized as massive gravels (Gm) and foreset-bedded gravels (Gp). Sandy lithofacies are subdivided into trough and wedge-shaped cross-bedded sands (St), cross lamination sand (Sc), foreset laminated sands (Sp), planar stratified sand (Ss). Silty clay lithofacies consists of horizontal laminated silt (Sl), silt and mud (Sm).

a) Facies 1: Massive Gravels (Gm). Gravels are composed of subangular to subrounded quartzite pebbles, cobbles and boulders up to 20 cm in diameters, with mean size of about 10 cm. They are grain sandy matrix supported and locally show imbrication. Massive gravels formed laterally continuous beds with planar deposition. Horizontal strata within massive of gravels are not uncommon. Appearance of some weathered basalt gravels are also observed mixing with quartzite, chert and quartz gravels. (fig. 5.2)

Regarding to gemstone exploration, this facies is directly associated with gemstone placer deposit. It can be found in the sedimentary profiles of every gemstone minepit with varying thickness. Gemstone is observed in this facies. In Ban Chong Dan area, gemstone-bearing gravel bed (Gm facies) can generally be 1 to 3 m thick situated at the depth between 4 to 7 m. In Ban Bung Hua Waen area, this facies is about 5 m thick and 15 to 20 m deep.

b) Facies 2 : Foreset-bedded gravels (Gp). Gravels of quartzite, chert and quartz with subangular to subrounded are found with mean size of 7 cm. They formed with a large scale of foreset-bedded, mixed with sandy layer of median to coarse-grained. Gravel imbrication is present. The dip of megastratification about 25

degrees with estimate 2-3 m long and 60 cm thick was measured. Cross-stratified sand is commonly occurrred along the upper part of this megastratification. (fig.5.3)

c) Facies 3 : Trough and wedge-shaped cross bedded sands (St). Extensive medium to coarse-grained sand observed as up to 10 meters long and up to 4 meters thick with concave shape overlain the foreset bedded gravel. The major internal structure as trough cross bedded and wedge-shaped cross bedded are found. They overlain by sandy silt layer of overbank deposit. An upwards fining in grain size is common. Parallel lamination of medium to coarse-grained sand was occasionally found at the top of this facies. (fig. 5.4)

d) Facies 4 : Cross lamination sands (Sc). Normally, an extensive medium to coarse-grained sand occurs as a wide of 30 cm (sometime up to 50 cm) and average thick of 20 cm (may be up to 30 cm). The significant sedimentary structures such as cross lamination and low angle lamination were observed. An fining upward in grain size also occurred without gravel or pebble of stones. Some trees and wood fragments were collected. It overlain by sandy silt and silty clay of overbank on the top. The average dip angle of cross lamination is 25 to 30 degrees with east-west direction. They indicated that the flow direction of an old channel were dominantly traversed from north to south and represented the braided of paleochannel. (fig. 5.5)

e) Facies 5 : Foreset laminated sands (Sp). Medium and coarse-grained sand distributed extensively with dip angle of 10-20 degrees. They observed almost at the top of foreset cross bedded gravels. Locally, the foreset laminated sand indicates oxidizing period of deposition base on their colour of strata. The dip direction of all laminated sands with east-west are mentioned. These are a good

indicator of point bar and flow direction of the old channel. The bottomset of these facies is masked by thin layer of pebbles of quartzites and cherts.

f) Facies 6 : Planar stratified sand (Ss). This facies comprises fine to medium sand which formed with planar or horizontal stratification. It was occurred by overbank deposit of river action. The thickness of this facies is vary, ranging from 1 to 5 meters. Occasionally, fine sand with planar stratified layer overlying the massive gravel strata was observed. Thin layer of planar sand with average thickness of 10 cm. are not continuously deposited throughout in the basin. Thin parallel lamination is significant evidence to indicate the lastest period of flash-flood events which represented very low flow regime. (fig. 5.6-5.7)

g) Facies 7 : Horizontal laminated silt (Sl). Three type of silt layers are composed of thin horizontal laminated silt, thick silt layer and thin laminated of silt layer with low angle lamination. They are situated on the upper part of fining upwards sequence of channel deposits which deposited from suspension particles. Massive silts layer contains rootlet and some plant remains. Horizontal lamination silt has been attributed to upper flow- regime plane bed condition and was commonly deposited on the upper part of point bars.

h) Facies 8 : Silty and muds (Sm). This extensive facies comprises structureless clayey silt ranging in colour from yellowish brown to grayish brown. The facies occurs commonly as laminated strata. The upper surface of each unit is occasionally erosion and commonly shows mud crack structure. The fine to very fine-grained particles indicate quiet water deposition of point bar sequences. In the study area, this facies is extensively overlain by overbank silty clay deposit which also observed sharp contact boundaries. (fig. 5.8-5.9)

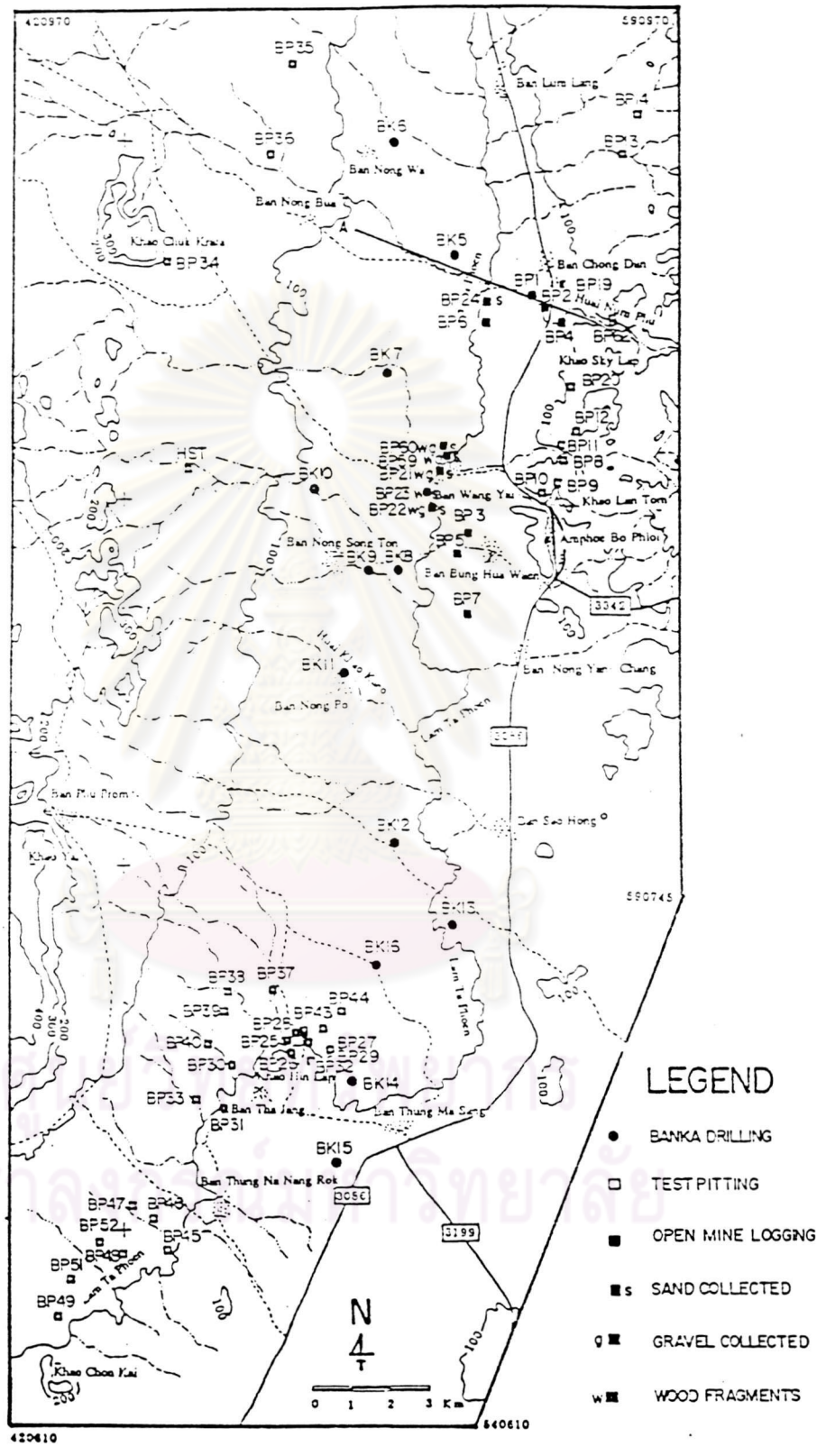


Figure 5.1 Locations of banka drills, test pits and mining-face log with positions of sands, gravels and woods sample.

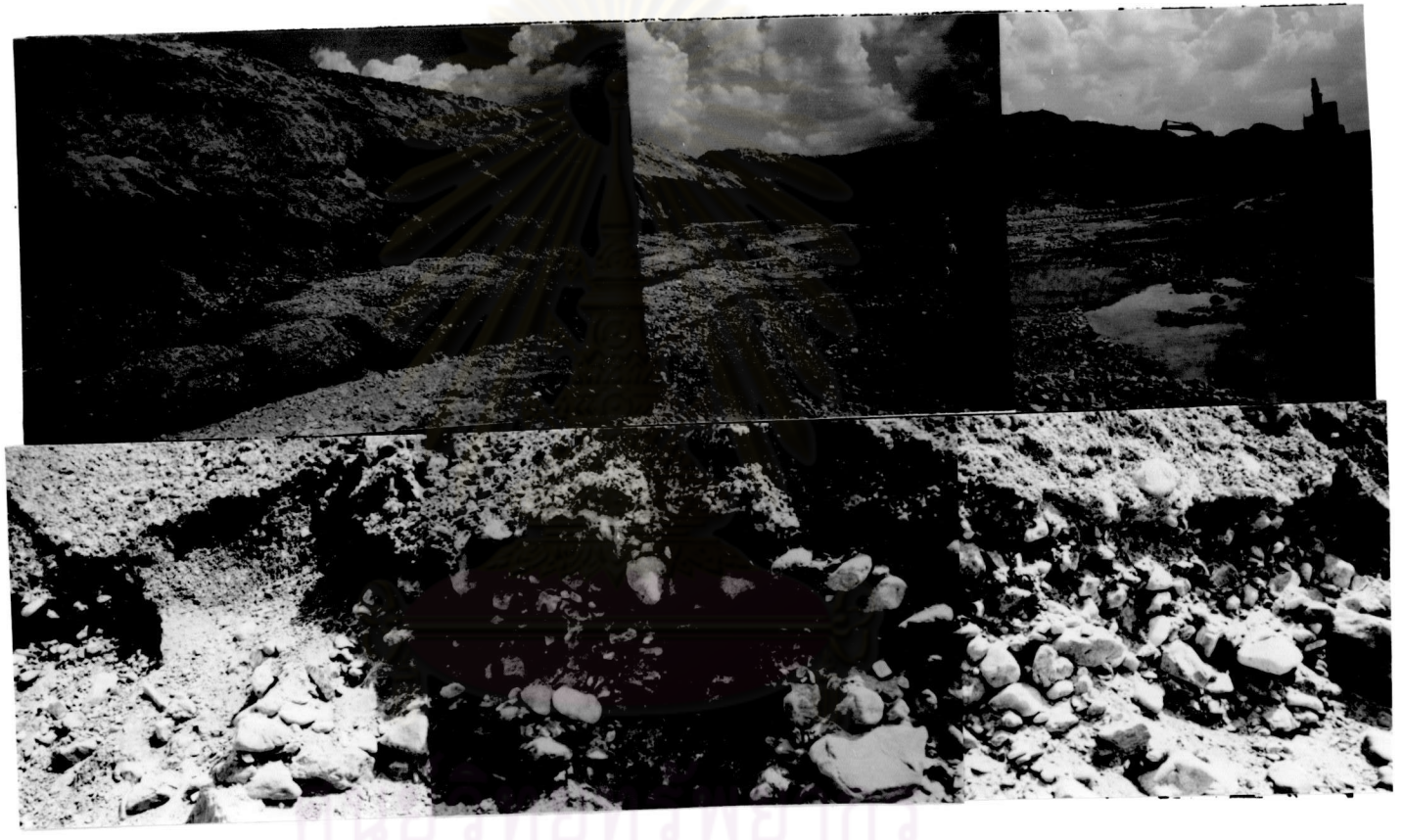


Figure 5.2 Massive gravels (Gm) facies in the middle part of the basin, characterized by grained -support matrix, Gravels are quartzite, chert and weathered basalt. Local word called " Krasa". Amphoe Bo Phloi, Changwat Kanchanaburi. (Grid references : 554899 (top), 532855(bottom))

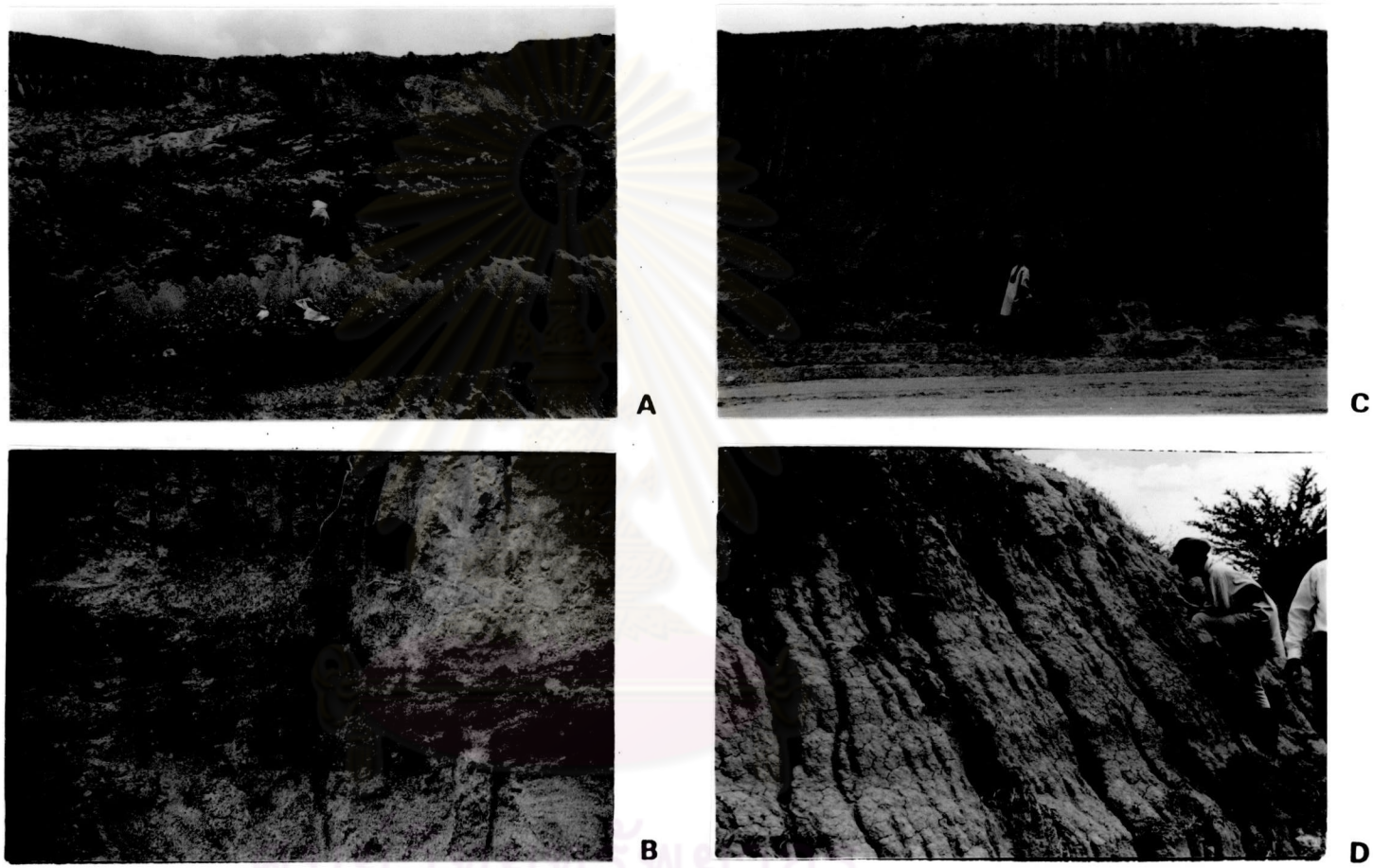


Figure 5.3 Lithofacies in low terrace and floodplain. A) foreset-bedded gravels facies,Gp, B) foreset laminated sand facies, Sp, C) horizontal laminated silt facies, Sl, and silt and mud facies,Sm.(Grid reference : 5295837)

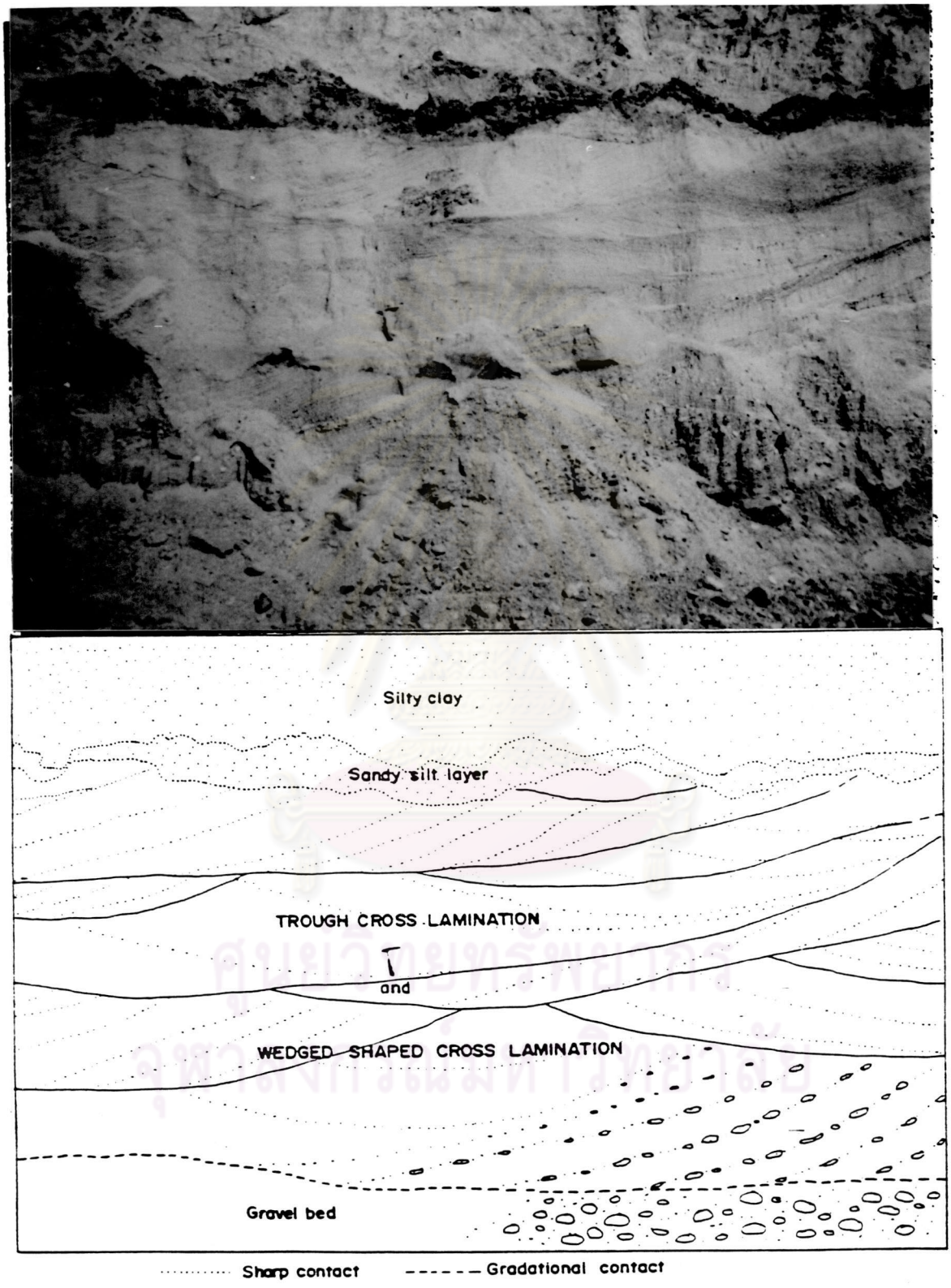


Figure 5.4 Trough and wedge-shaped cross bedded sands facies (St) observes in the middle part of Bo Phloi basin. Amphoe Bo Phloi, Changwat Kanchanaburi. (Grid reference : 532855)

Figure 5.5 Cross lamination sand facies (Sc) represents normal point bar deposit in the middle part of the basin. Amphoe Bo Phloi, Changwat Kanchanaburi (Grid reference : 530844)

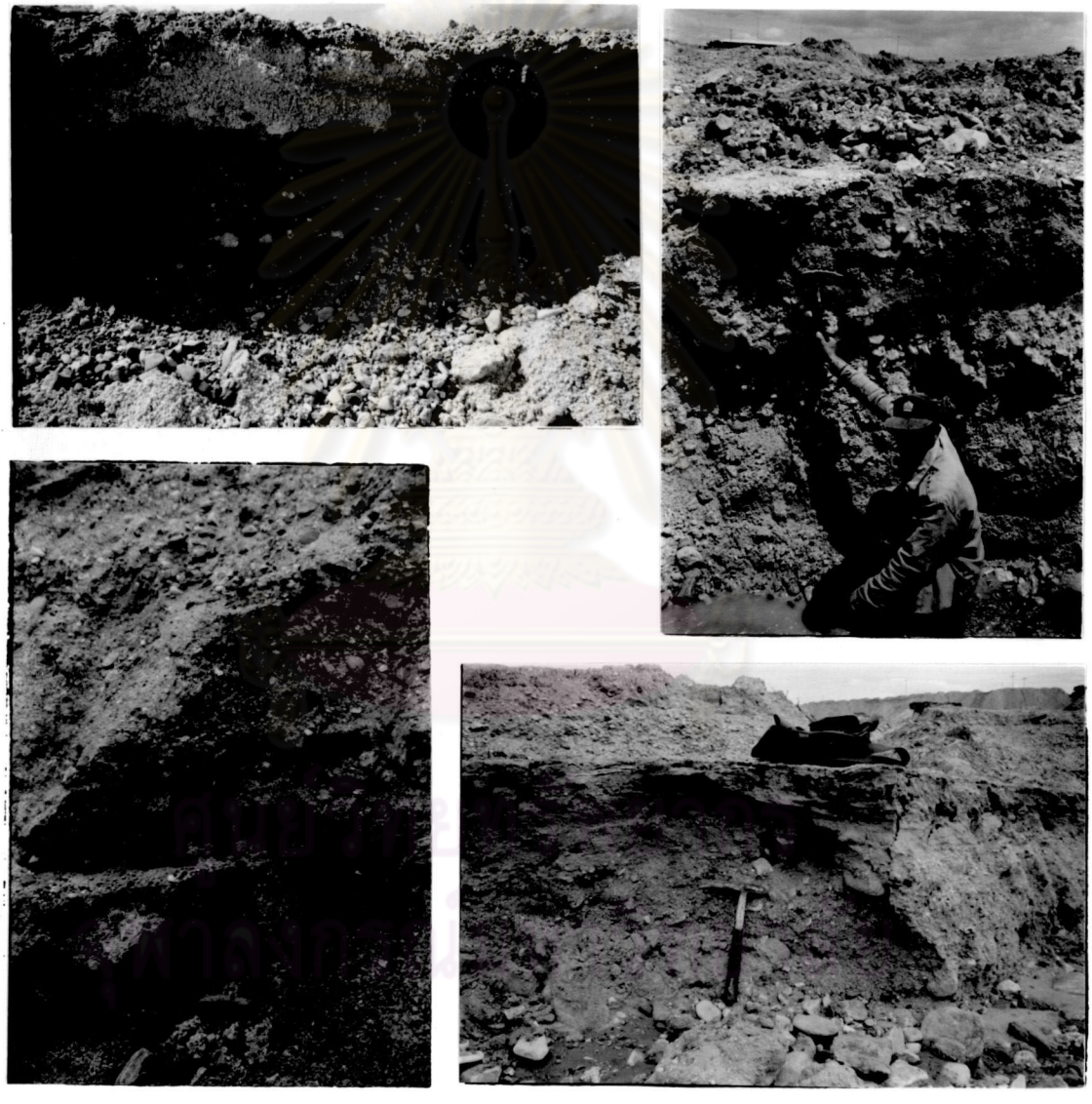


Figure 5.6 Planar stratified sands facies (Ss) overlies the massive gravel facies, occasionally observed in the middle part of Bo Phloi basin. Amphoe Bo Phloi, Changwat Kanchanaburi. (Grid reference : 5428535)

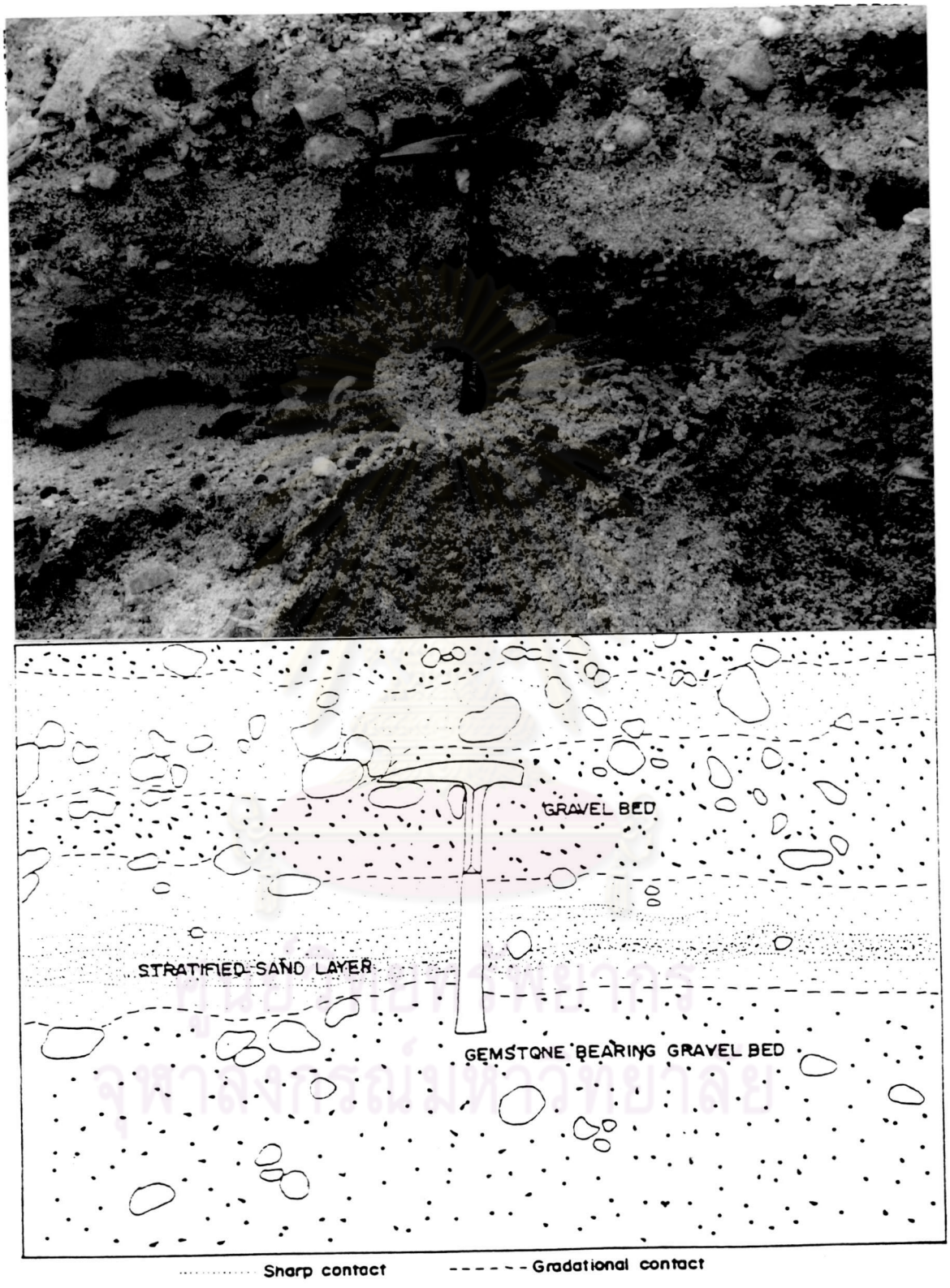
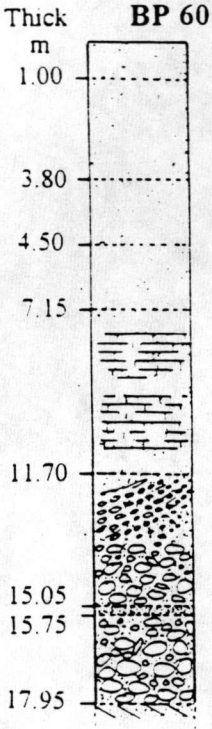


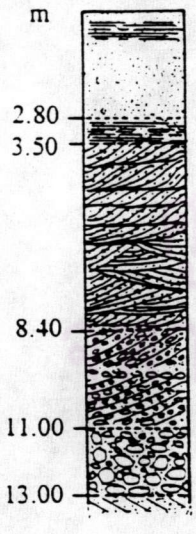
Figure 5.7 Planar stratified sand facies (Ss) characterized by silt to fine sand with stratification. Amphoe Bo Phloi, Changwat Kanchanaburi.

(Grid reference : 5428535)



BP 60 (Grid ref. 529841) sheet 4837 I

	Clayey silt, Pale yellowish brown (10YR 6/2)
	Silty clay, Grayish orange pink (5YR 7/2)
Sm	Clayey silt, Dusky brown (5YR 7/2)
	Silty clay, Grayish orange pink (5YR 7/2)
	Secondary limestones, Yellowish gray (5Y 8/1), sandy silt with some rock fragments.
Gp	Gravel bed, Yellowish gray (5Y 7/2), foreset-bedded structure.
Ss	Fine sand, Yellowish gray (5Y 7/2), planar stratified structure.
Gm	Massive gravel bed, Yellowish gray (5Y 7/2), gravels of quartzite, chert, quartz.

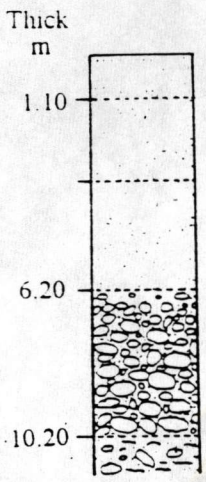


BP 21 (Grid ref. 532855) sheet 4937 IV

Sm	Clayey silt, Very pale orange (10YR 8/2), mud crack.
Sl	Silty sand, Very pale orange (10YR 8/2), horizontal stratified layers.
Sc	Medium to coarse sand, Very pale orange (10YR 8/2), cross-lamination.
St	Medium to coarse sand, Dark yellowish orange (10YR 6/6), wedge-shape cross-lamination.
Gp	Gravel bed, Light gray (N7), gravels of quartzite, quartz, chert and coarse sand matrix, foreset-bedded.
Gm	Massive gravels, Dark yellowish orange (10YR 6/6), gravels of quartzite, quartz, chert. Gemstone paystreak. Weathered bedrock of quartzite.

Figure 5.8 Generalized Quaternary sedimentary lithofacies observes in the middle part of the area that shows dominant Gp and Gm facies (Top) and sandy facies (Bottom).

BP 2 (Grid ref. 55908955)

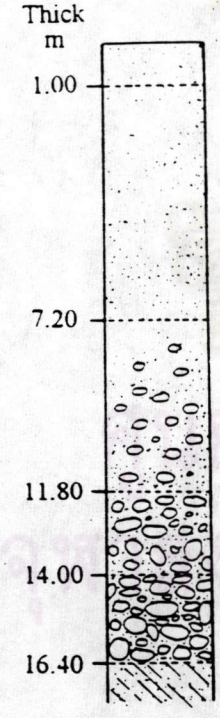


Sm Silty clay, Grayish orange pink (5YR 7/2)

Sl Silty sand, Grayish orange pink (5YR 7/2)

Gm Gravel bed, Dark yellowish orange (10YR 6/6) and Light greenish gray (5GY 8/1) with medium to coarse sand matrix, gravels of quartzite, quartz, chert. Gemstone paystreak.

BP 18 (Grid ref. 5428595)



Sm Silty mud, Pale yellowish brown (10YR 6/2)

Sl Silty sand, Grayish orange (10YR 7/4), some iron concretions and thin layer of laterite.

Sp Fine to coarse sand, Very pale orange (10YR 8/2), foreset-laminated structure with some pebbles of quartzite, chert in the bottom.

Gp Gravel bed, Dark yellowish orange (10YR 6/6), coarse sand matrix, gravels of quartzite, chert, quartz, foreset-bedded structure.

Gm Gravel bed, gravels of quartzite, quartz, chert, subangular to subrounded. Gemstone paystreak. Weatered quartzite bedrock, Pale yellowish orange (10YR 8/6) and Light brown (5YR 5/6).

Figure 5.9 Generalized Gm facies which observed within the Bo Phloi Basin, Ban Chong Dan area (Top) and Ban Bung Hua Waen area (Bottom).

2. Laboratory Analysis

Samples from field collection, gravel and sand, are provided for laboratory analysis in order to making kinds and characteristics of sediment. Results from laboratory analysis are clearly of fundamental significance in understanding the depositional process of sedimentary formation. The previous chapter explained and mapped the various types of differential geomorphological units. Each units identified base on geography and some lithofacies in their landforms. This part considers the kinds and characteristics of each sediment from each landform, especially the deposit of gemstone in the middle part of the area which belonging to floodplain and low terrace.

Gravels using for morphometrical gravel analysis were collected totally 12 samples from opencasts consisting BP 22, BP 28, BP 60 and BP 63. Fifty gravels which collected from a one by one squaremeter was provided. Twelve sand samples using for sieve analysis were collected which represented each sedimentary layer in the opencast. In place, wood fragments and peats were noted within some layers. In addition, seven woods and peats samples were also collected for dating by using radiocarbon method. The result of each sample will be explained and illustrated as follows.

2.1. Morphometrical gravel analyses. Results from morphological gravel analyses of stones by using Cailleux method (1956) were described in chapter II. The average roundness of fluvial stones within the Bo Phloi Basin are subangular to subrounded which indicated short distance of transportation from sources. They are summarized in table below.

Table 5.1 Range of roundness of stones calculated by Cailleux method, Amphoe Bo Phloi, Changwat Kanchanaburi.

Number	A	SA	SR	R	WR	Location
1						BP22
2						BP28
3						BP59/1
4						BP59/2
5						BP59/3
6						BP59/4
7						BP60/2
8						BP60/4
9						BP60/5
10						BP62
11						BP63/1
12						BP63/3

Remark : Roundness Class
A = Angular
SA = Subangular
SR = Subrounded
R = Rounded
WR = Well rounded

All of morphometrical gravel analyses of stones and location of collected samples are summarized below and illustrated by histograms as follows.

Especially in the middle part of the study area, eight gravel samples were collected mostly within gravel bed of floodplain, comprising BP 22, BP 59 and BP 60. Samples were collected from high terrace such as number BP 62, and middle

terrace at Khao Hin Lap southern part of the area such as number BP 28. Furthermore, two samples were collected from the northern regions, such as numbers BP 63/1 and BP 63/2.

Sample No. BP 22 was collected at depth of 19.10 m from present surface in the middle part of the area (grid reference 530844). 50 stones are composed of quartzite and chert. The roundness is ranging from angular to subrounded (fig. 5.10).

Sample No. BP 59 is divided into 4 samples which collected from different depth (grid reference 5295837). BP 59/1, BP 59/2, BP 59/3 and BP 59/4 were collected respectively from 4.70, 5.25, 8.00 and 10.25 m depth. All of samples located within floodplain landforms. The roundness of all samples are subrounded to rounded, subangular to subrounded, subangular to subrounded and angular to subrounded, respectively. (fig. 5.11 to 5.15)

Sample No. BP 60 is divided into 3 samples which collected from different depth, composed of BP 60/2, BP 60/4 and BP 60/5 at depth of 15.00, 16.15 and 17.00 m. respectively (grid reference 529841). They are situated in floodplain landforms. The roundness is subangular to subrounded, angular to subrounded and subangular to subrounded, respectively (fig. 5.16 and 5.17 to 5.19).

Sample No. BP 62 was collected from remained high terrace at depth 1.5 m. at grid reference 572887 within lateritic gravel. The roundness is subangular to subrounded (fig. 5.20).

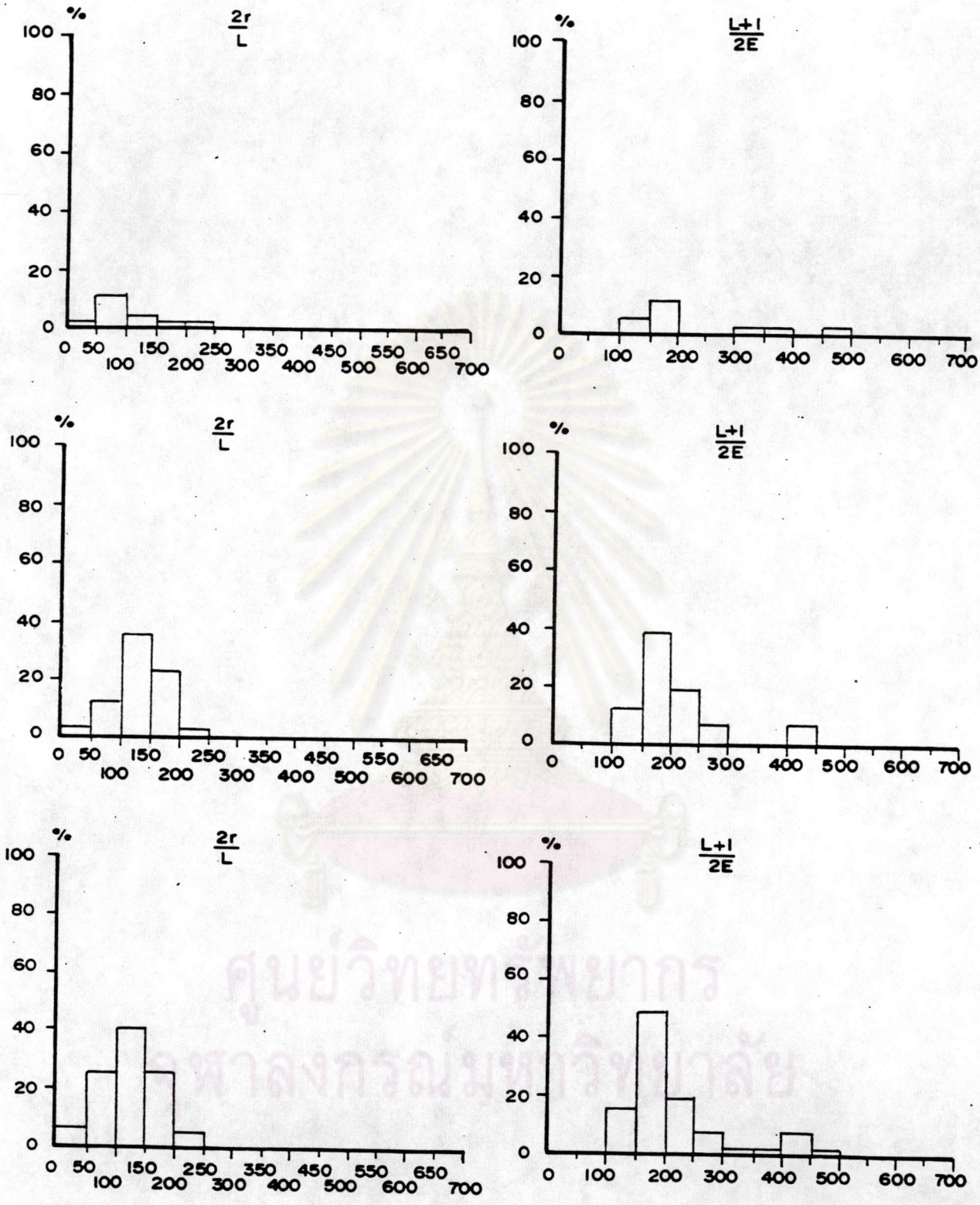
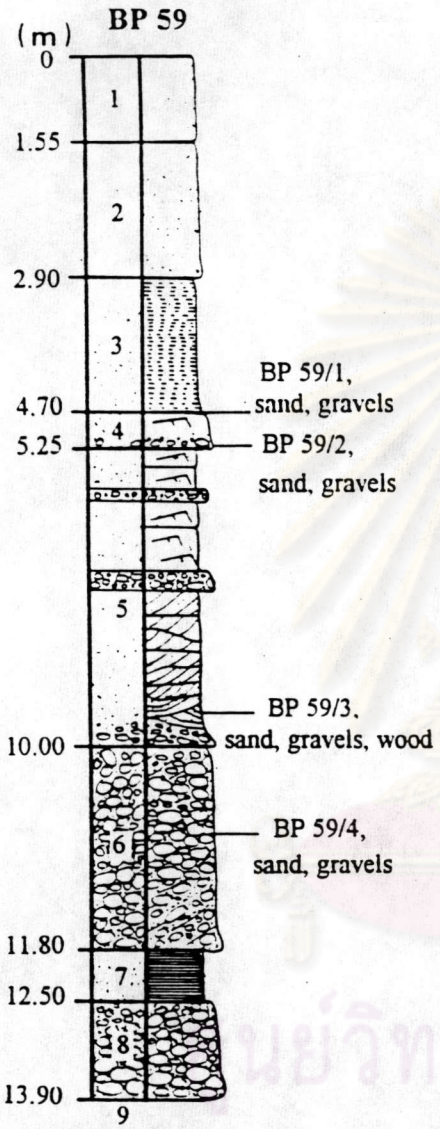


Figure 5.10 The roundness index of sample No. BP 22 shows angular to subrounded of chert (top), quartzite (middle) and total 50 stones (bottom).



1. Top soil, Pale brown (5YR 5/2), silty clay with root plants, gradual contact.
2. Clayey silt layer, Dark yellowish orange (10YR 6/6) and Pale yellowish brown (10YR 6/2), some mottle.
3. Fine sand, Grayish orange (10YR 7/4) and Very Pale orange (10YR 8/2), silty clay.
4. Fine to medium sand, Dusky orange (5Y 6/4) and Dark yellowish orange (10YR 8/2), some gravels of chert, quartzite in the bottom.

5/1. Medium to coarse sand, Grayish orange (10YR 7/4), cross-lamination, some gravel in the bottom.

5/2. Medium to coarse sand, Dark yellowish orange (10YR 6/6), cross-lamination, oxidized in some layer with Moderate brown (5YR 3/4).

5/3. Top gravel bed, Pale yellowish brown (10YR 6/2) and Dark yellowish brown (10YR 4/2), gravels are quartzite, quartz, jasper, cross-bedding and graided bedding, wood fragments.

6. Bottom gravel bed, Dark yellowish brown (10YR 4/2), gravels are quartzite, quartz, chert, high sphericity, sub-rounded to rounded roundness, spinel.
7. Fine sand, Dark yellowish brown (10YR 6/2)
8. Gravel bed, Dark yellowish brown (10YR 4/2), gravels are quartzite, quartz, chert with coarse sand matrix, gravel about 70%, spinel, sapphire.
9. Bedrock, Dark yellowish orange (10YR 6/6), clayey silt.

Figure 5.11 Depositional fluvial profiles in the middle part of the Bo Phloi Basin at BP 59 (grid reference 5295837) with depth of collected samples.

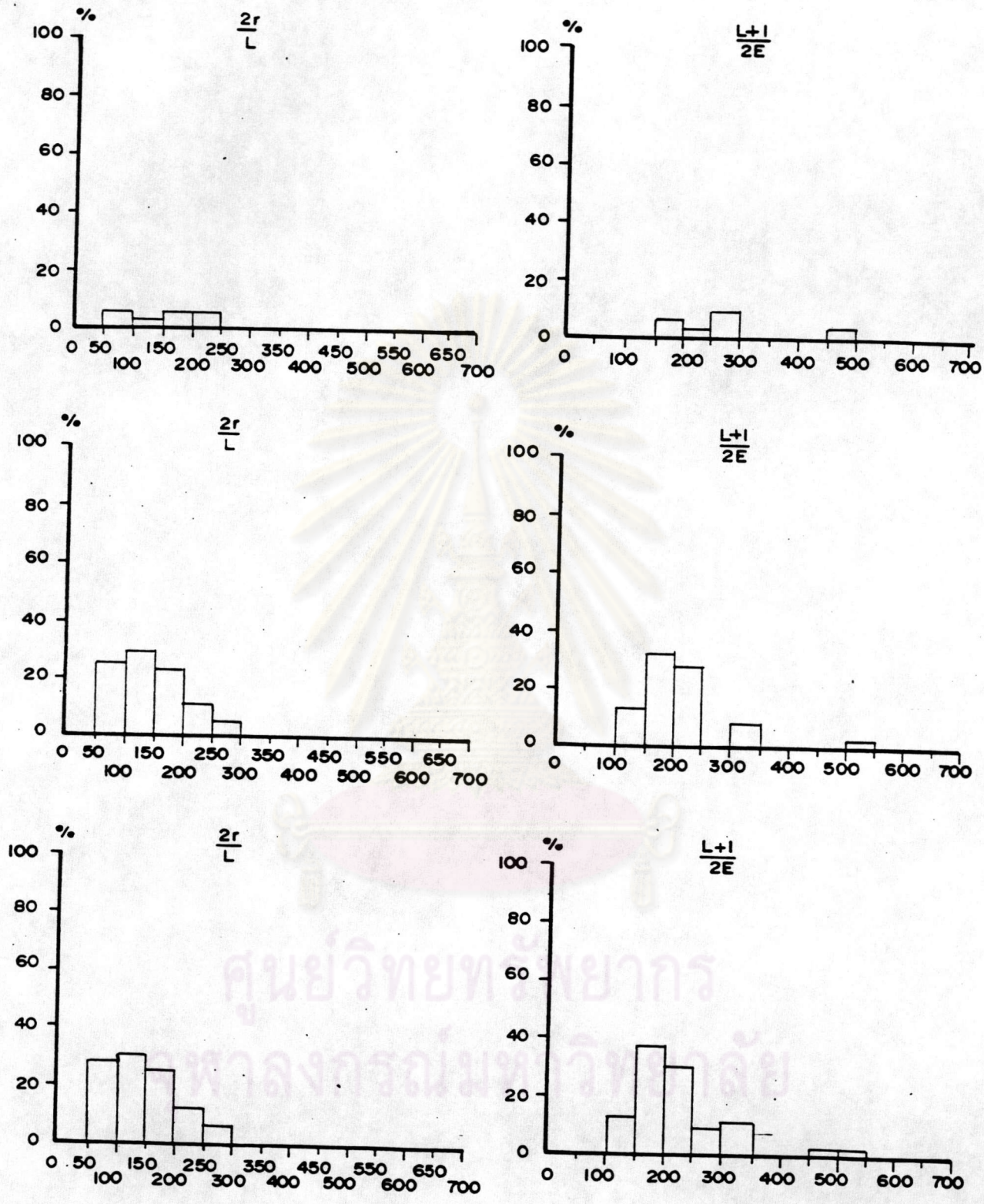


Figure 5.12 The roundness index of sample No. BP 59/1 at 4.70 m. depth shows subrounded to rounded of chert (top), quartzite (middle) and total 50 stones (bottom).

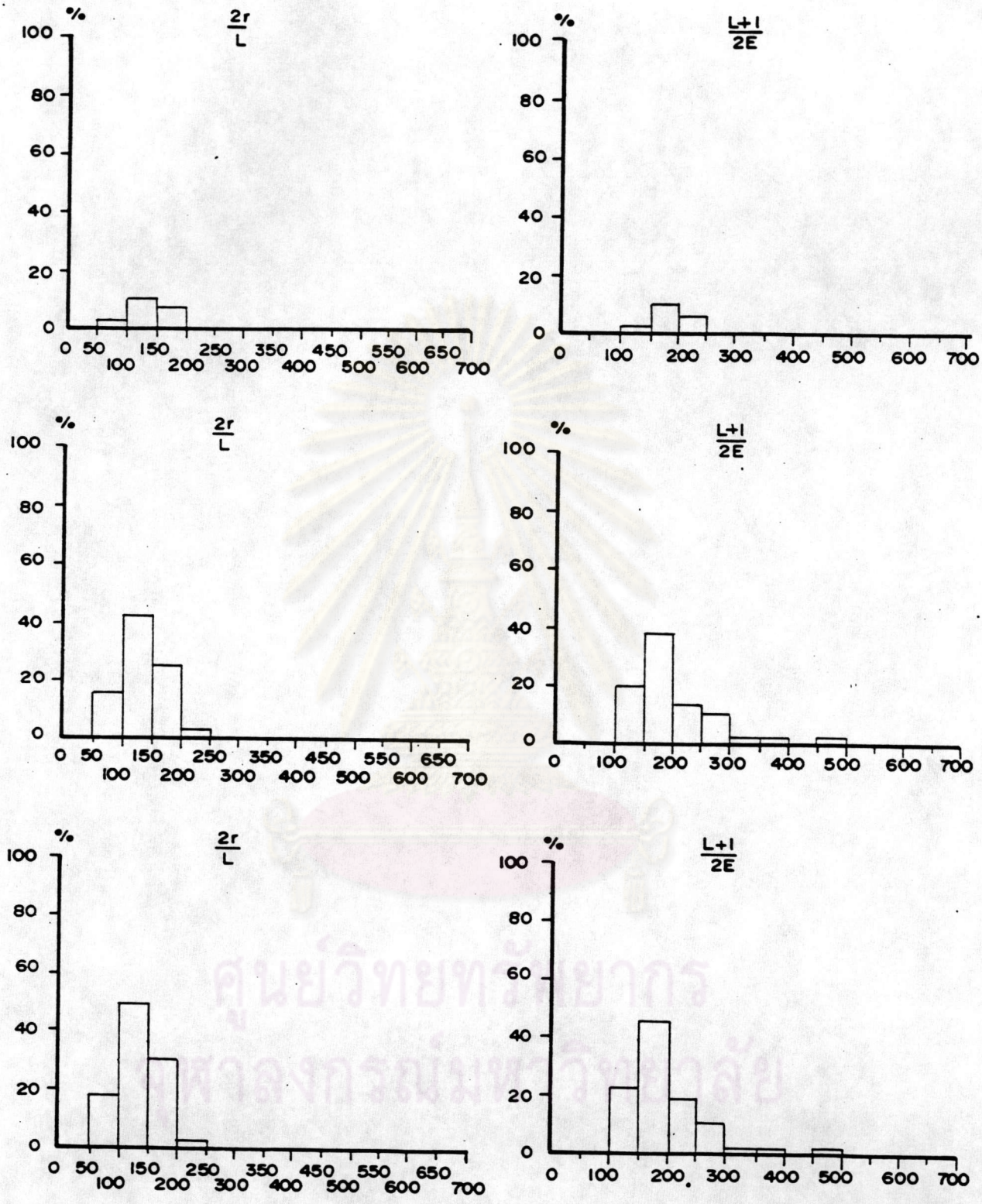


Figure 5.13 The roundness index of sample No. BP 59/2 at depth 5.25 m. shows subangular to subrounded of chert (top), quartzite (middle) and total 50 stones (bottom).

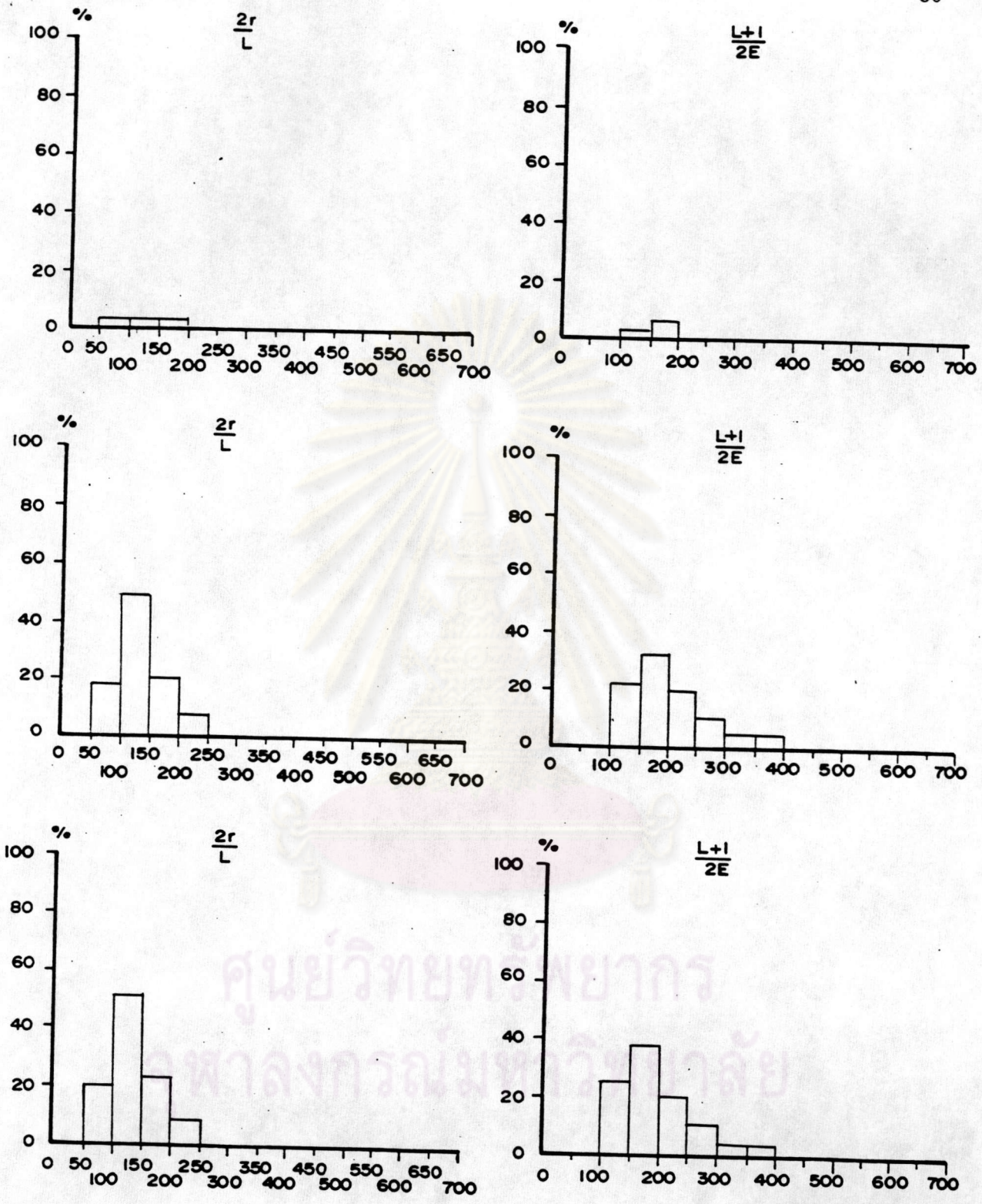


Figure 5.14 The roundness index of sample No. BP 59/3 at depth 8.00 m. shows subangular to subrounded of chert (top), quartzite (middle) and total 50 stones (bottom).

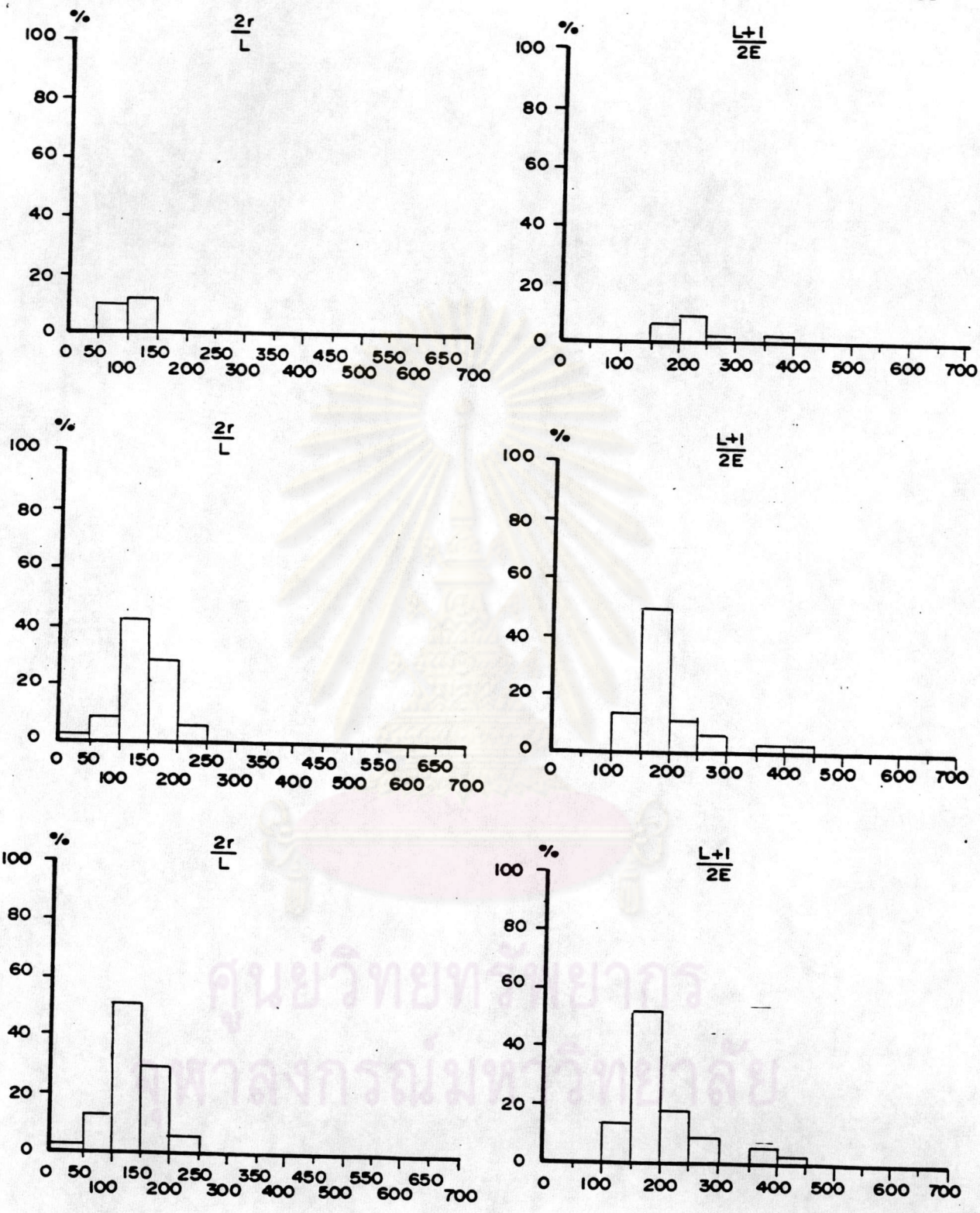


Figure 5.15 The roundness index of sample No. BP 59/4 at depth 10.25 m. shows angular to subrounded of chert (top), quartzite (middle) and total 50 stones (bottom).

1. Top soil, Pale yellowish brown (10YR 6/2), clayey silt, some archaeological finds
2. Silty clay, Grayish orange pink (5YR 7/2)
3. Clayey silt, Dusky brown (5YR 7/2).
4. Mottle layer, Grayish orange (10YR 7/4), clayey silt with mottle spots
5. Calcrete, Yellowish gray (5Y 8/1), sandy silt with calcium carbonate, some gravels with average 1-2 cm.
6. Top gravel bed, Yellowish gray (5Y 7/2), gravels are quartzite, quartz about 80% with coarse sand matrix, friable, cross-lamination, cross-bedding.

7/1. Fine sand, Yellowish gray (5Y 7/2).

7/2. Gravel bed, Yellowish gray (5Y 7/2), gravels are quartzite, quartz, chert and sandstone, low sphericity, subangular to subrounded roundness.

8. Grevel bed, Yellowish gray (5Y 7/2), gravels are quartzite, chert, wood fragment in mud boulders
9. Bedrock, Grayish brown (5YR 3/2), fine sand.

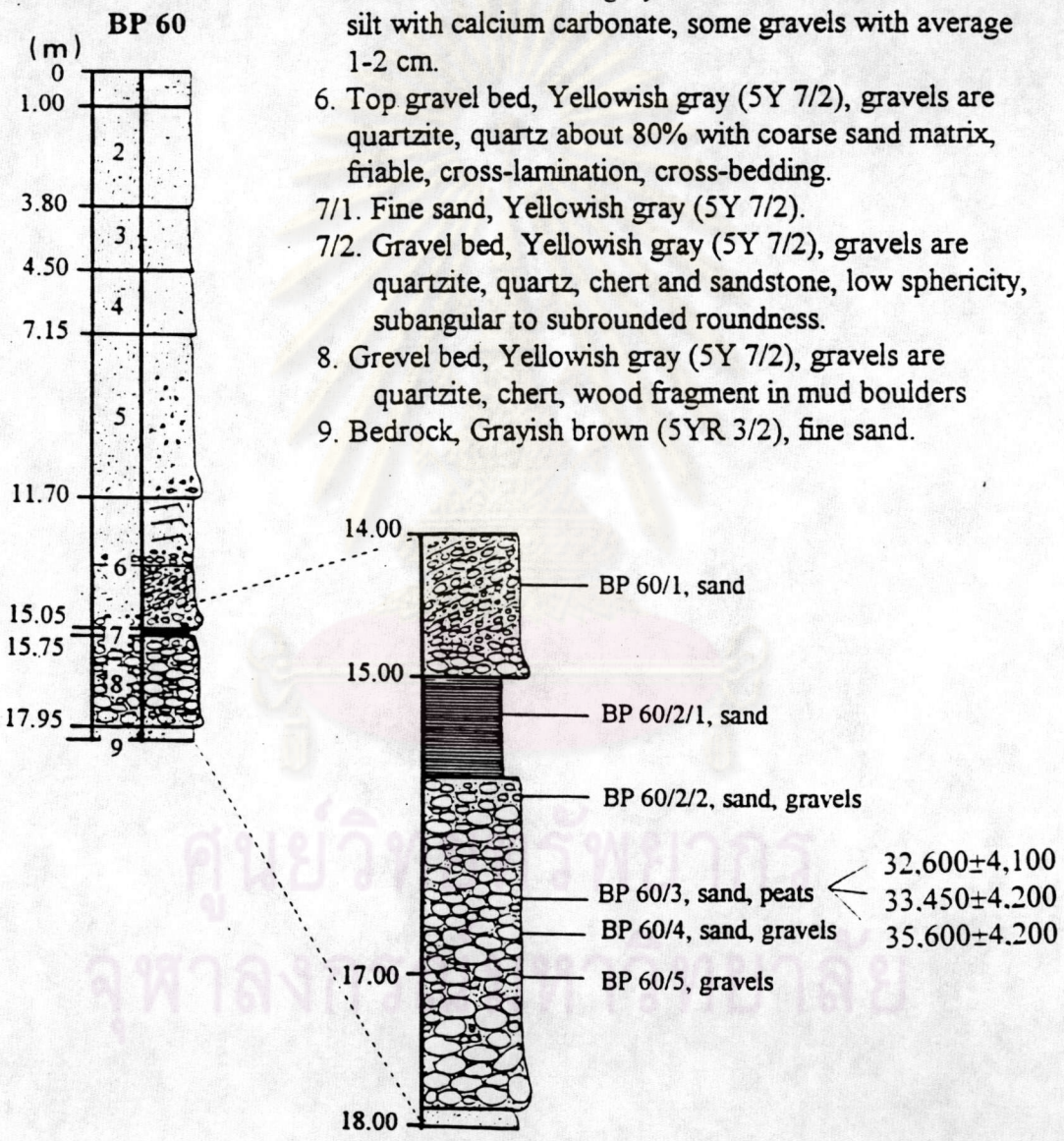


Figure 5.16 Depositional fluvial profiles with calcrete in the middle part of the Bo Phloi Basin at BP 60 (grid reference 529841) with depth of collected samples.

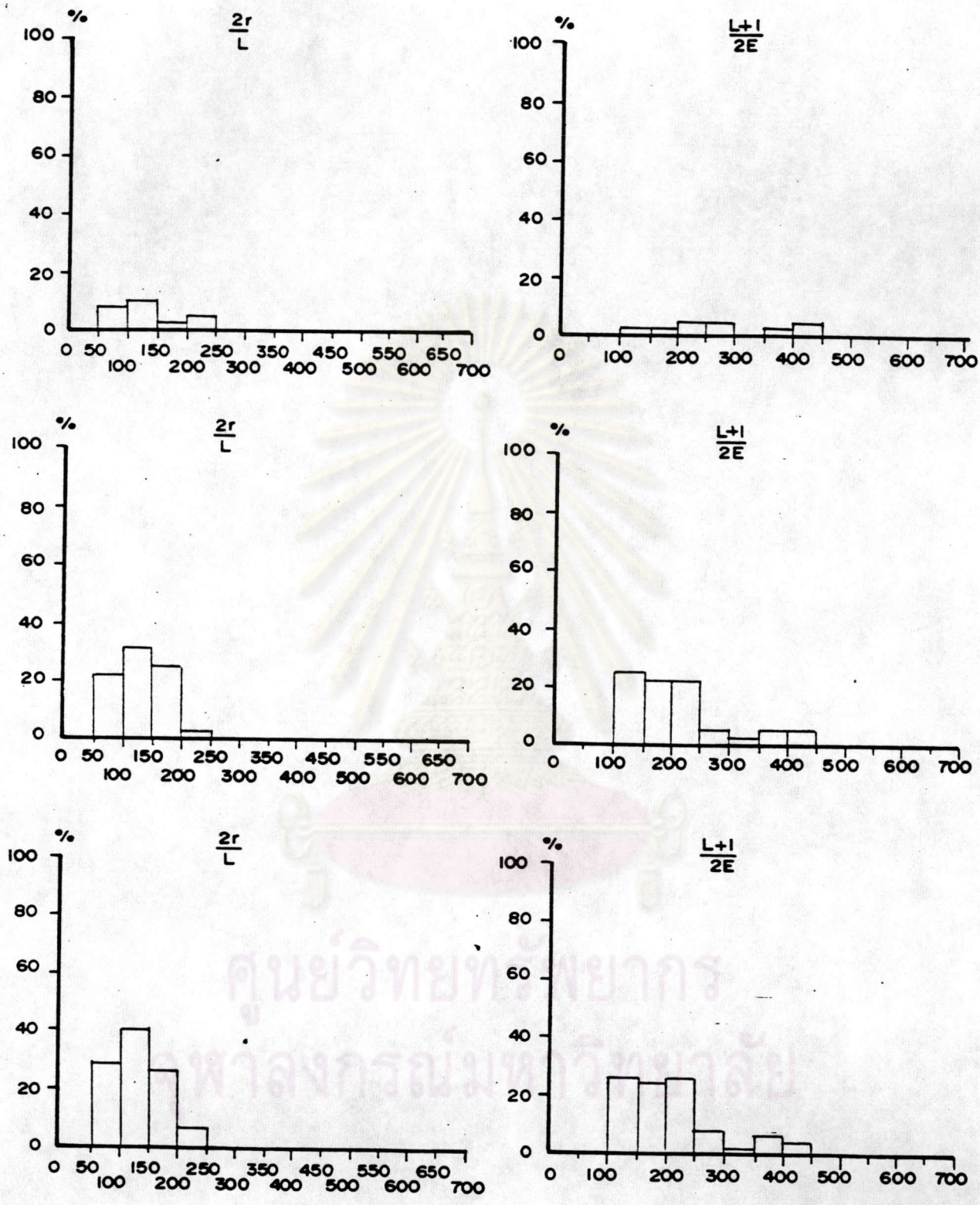


Figure 5.17 The roundness index of sample No. BP 60/2 at depth 15.00 m. shows subangular to subrounded of chert (top), quartzite (middle) and total 50 stones (bottom).

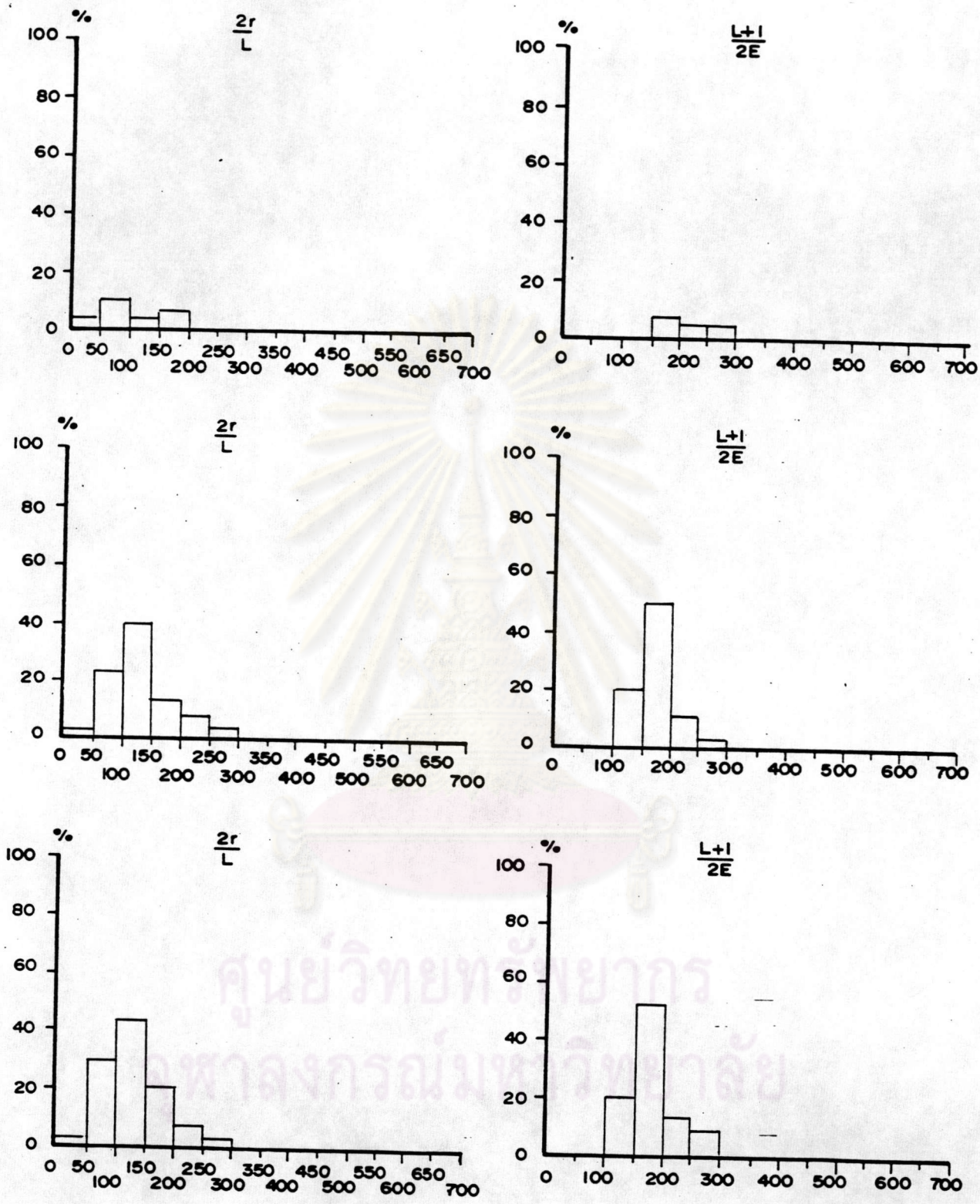


Figure 5.18 The roundness index of sample No. BP 60/4 at depth 16.15 m. shows angular to subrounded of chert (top), quartzite (middle) and total 50 stones (bottom).

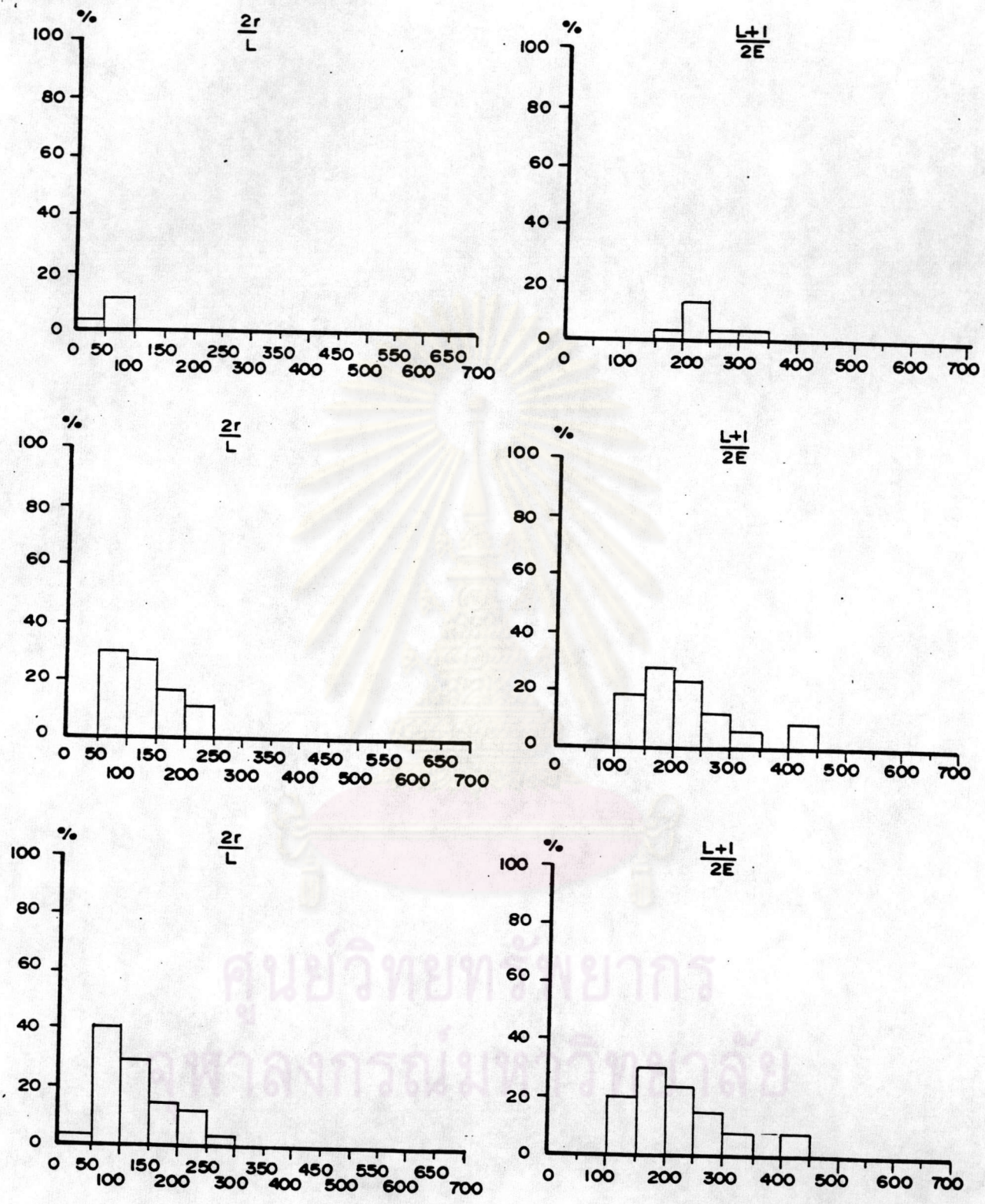


Figure 5.19 The roundness index of sample No. BP 60/5 at depth 17.00 m. shows subangular to subrounded of chert (top), quartzite (bottom) and total 50 stones (bottom).

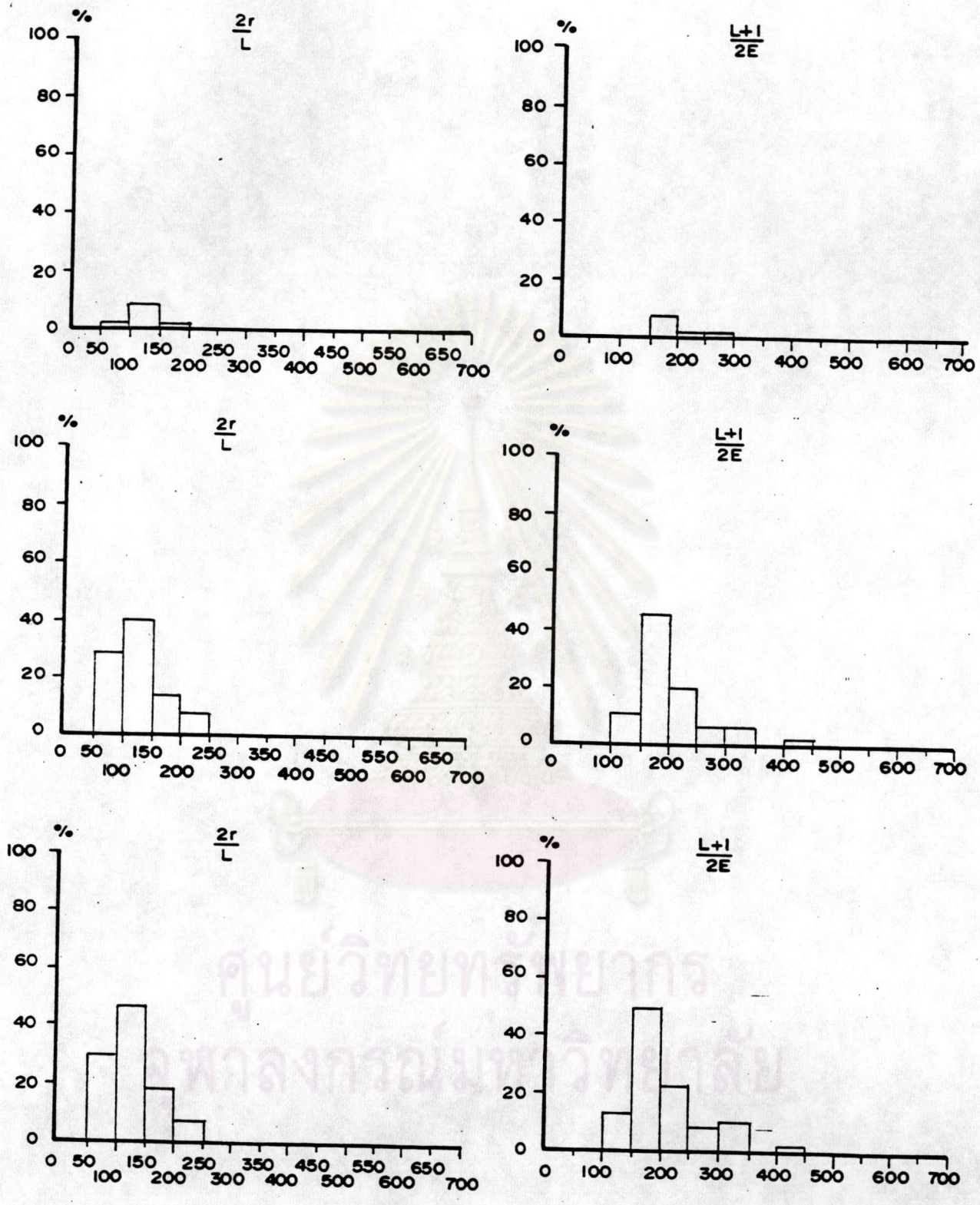


Figure 5.20 The roundness index of sample No.BP 62 at depth 1.50 m. shows subangular to subrounded of chert (top), quartzite (middle) and total 50 stones (bottom).

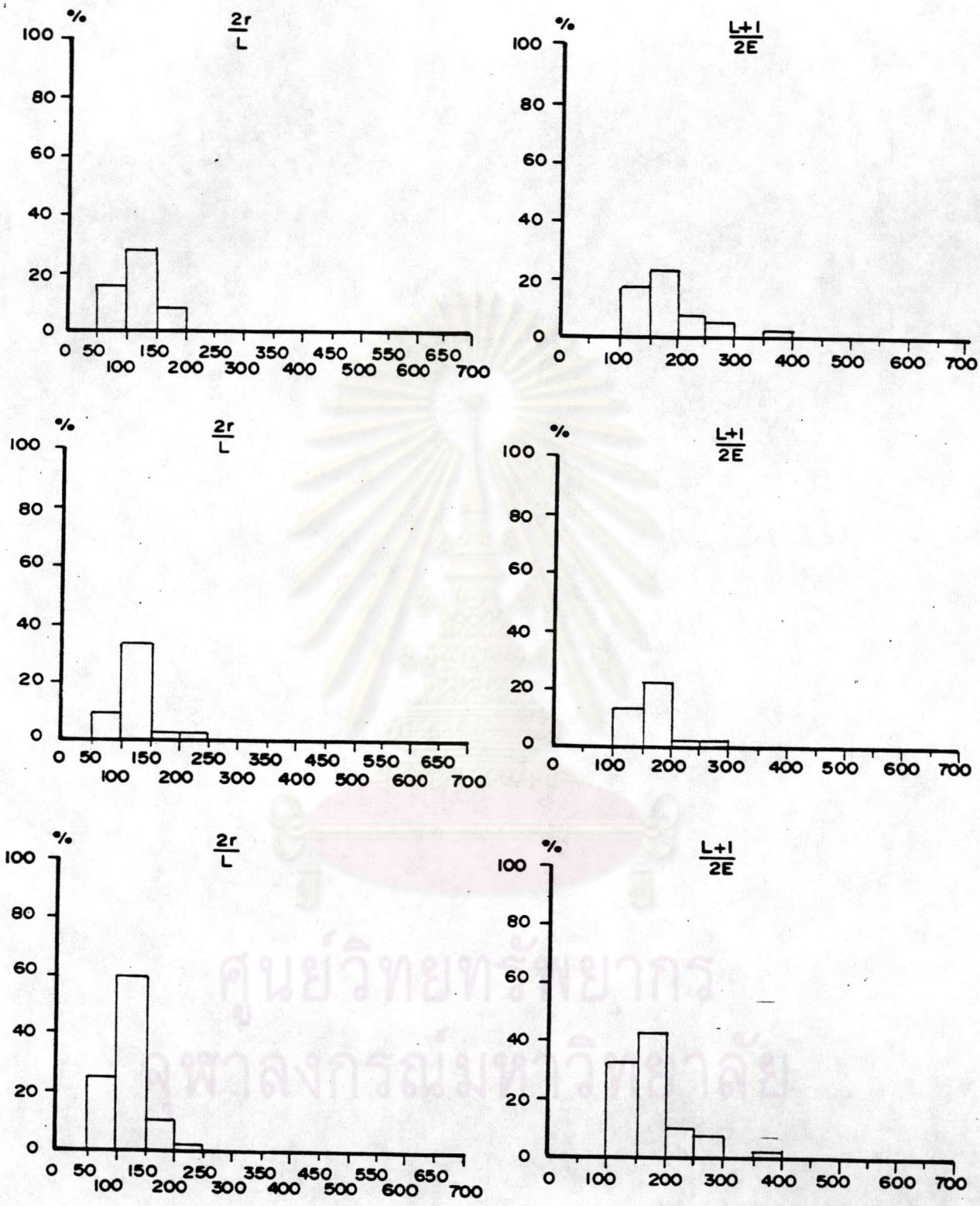


Figure 5.21 The roundness index of sample No. BP 28 at depth 0.50 m shows subangular to subrounded of quartz (top), quartzite (middle) and total 50 stones (bottom).

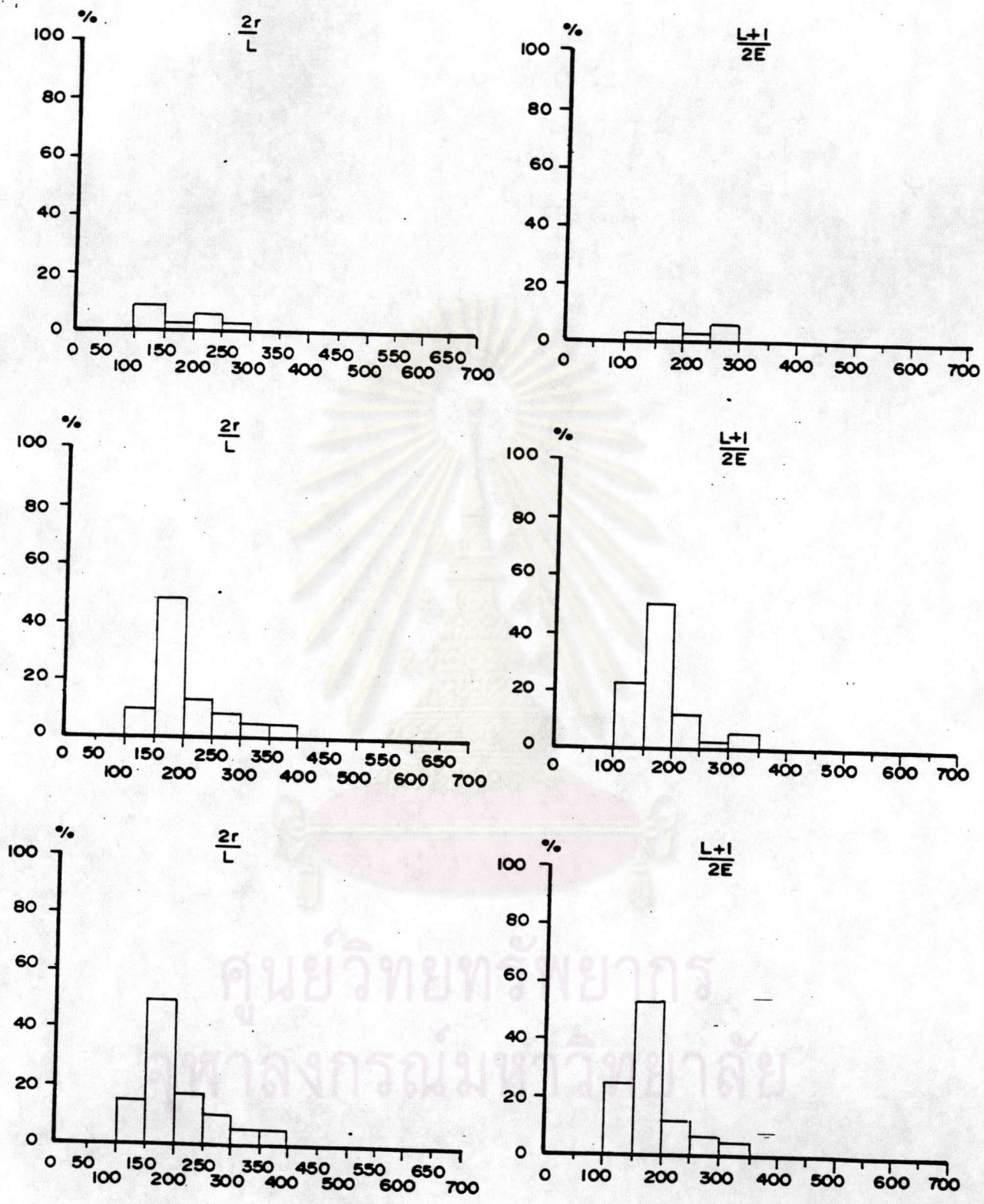


Figure 5.22 The roundness index of sample No.BP 63/1 shows subrounded to well rounded of chert (top), quartzite (middle) and total 50 stones (bottom).

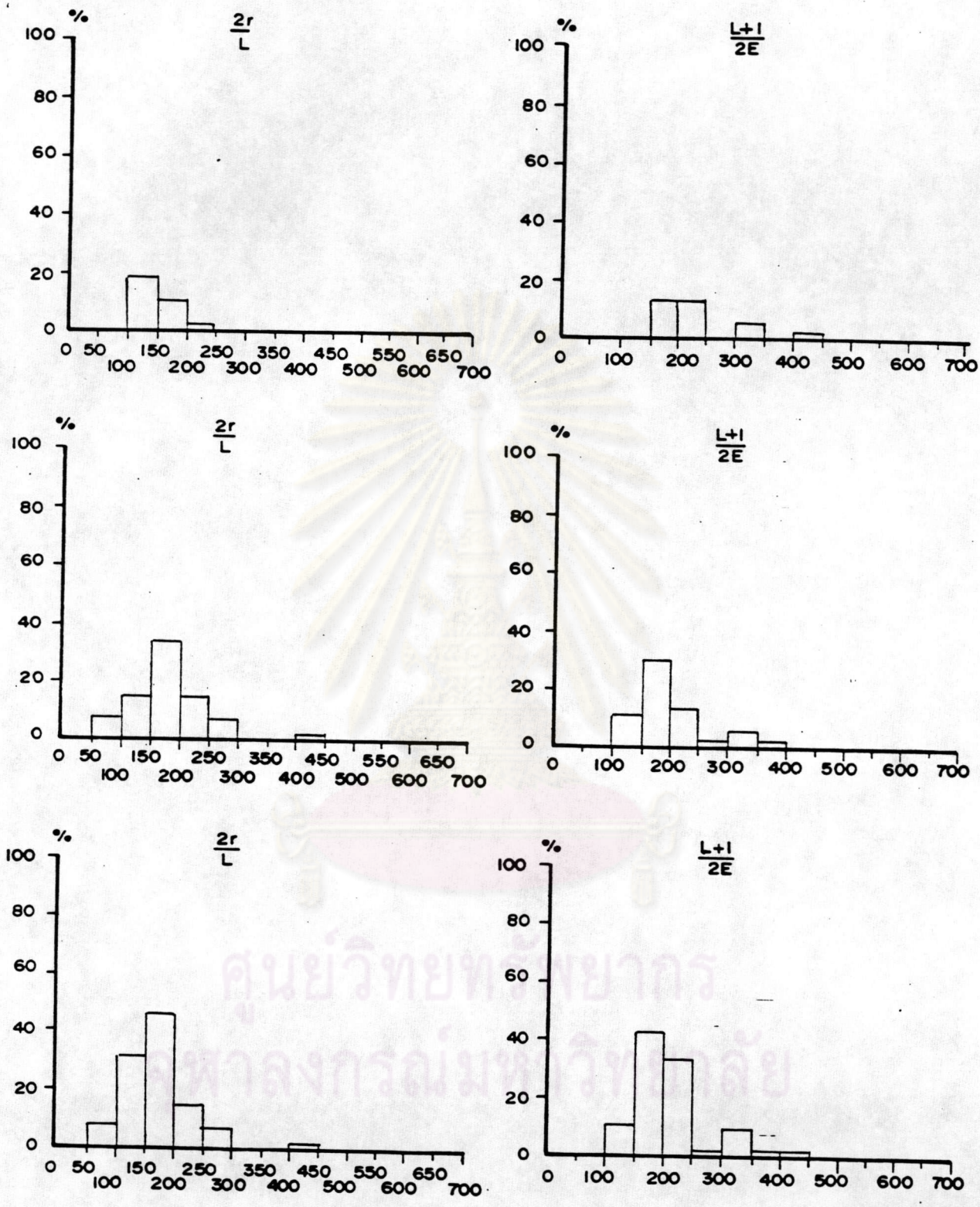


Figure 5.23 The roundness index of sample No. BP 63/2 shows subangular to well rounded of chert (top), quartzite (middle) and total 50 stones (bottom).

Sample No. BP 28 was collected from middle terrace by test pit at depth 0.5 m of lateral profile (grid reference 495712). The roundness is subangular to subrounded (fig. 5.21).

Sample No. BP 63 is divided into 2 samples which collected from different depth, consist of BP 63/1 (top) and BP 63/2 (bottom). These samples located in northern part of the study area at grid reference 532143. The roundness is subrounded to well rounded, and subangular to well rounded with some ventrifact gravels (fig. 5.22 and 5.23).

2.2. Particle size analyses. Result for particle size analyses by sieving test was illustrated in the form of histograms, the various kinds of relative graph and statistic parameters. Naturally, the channel deposit is affected on the basis of velocity of flow, the amount and character of the material, mixing of the material deposited from suspension with that producted by lateral erosion, mixing of suspended and bed loads, scouring of fine-grained sediments, burying of coarse-grained sediments by the finer-grained ones which drop onto the coarse underlying sediment, arrangement of larger particles by the effects of currents (Kukal, 1971). In the area under investigation, the major source of river sand is granite in the west mountain ranges which supplied the large amount of quartz sand and some mica. 19 representative samples were collected from the middle part of this basin in order to confirm the paleoenvironment of their deposition. The range of sand size from various localities are fine to very coarse-grained (-0.90 to 2.33 in phi scale). All of sample was collected from matrix of Gm facies, matrix of Gp facies, St facies, Sc facies, Sp facies and Ss facies.

The range of size distribution for matrix of Gm facies (BP 60/1 to BP 60/4) is fine to very coarse-grained sand at depth of 14.50 to 16.70 meters from surface. The range of sorting class of this matrix sand is moderately well sorted to poorly sorted on phi standard deviation values, very positively skewed to negatively skewed of skewness degree, and very leptokurtic to mesokurtic of kurtosis class. (fig. 5.26)

The range of size distribution from matrix of St facies (BP 59/1 to BP 59/4) is medium to very coarse sand in phi mean at depth between 4.70 to 9.00 meters. The most of sorting class is moderately sorted on standard deviation values, negatively skewed to positively skewed of skewness class and platykurtic to leptokurtic of kurtosis class. (fig. 5.27)

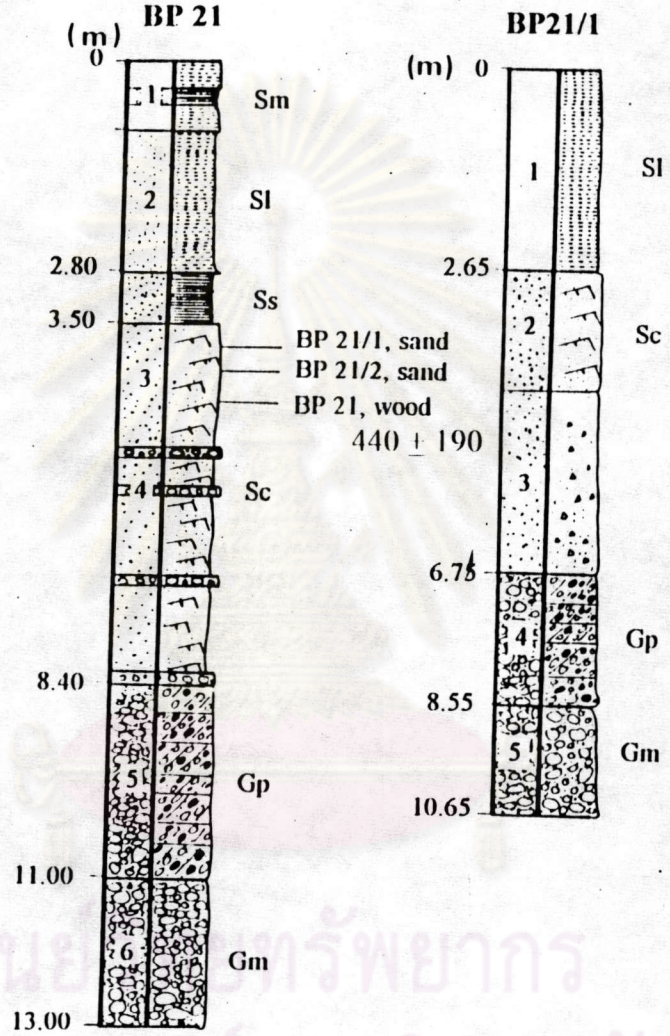
The range of size distribution from Gp facies (BP 23B to BP 23E) is coarse to very coarse sand in phi mean at depth between 15.50 to 17.00 meters. The range of sorting class is moderately to poorly sorted on standard deviation values, symmetrical skewness and very leptokurtic to mesokurtic skewness. (fig. 5.28)

The range of size distribution from Sc facies (BP 24) is coarse-grained sand in phi mean at depth of 5.50 meters. The range of sorting degree is moderately sorted, very positively skewed of skewness, and leptokurtic kurtosis. (fig. 5.29)

The range of size distribution from Sp facies (BP 21/1 to BP 21/3) is medium to very coarse-grained sand on phi mean at depth of 4.50 meters. The range of sorting class is moderately sorted to moderately well sorted, very positively skewed to symmetrical skewness and mesokurtic to leptokurtic kurtosis. (fig. 5.29)

The range of size distribution from Ss facies (BP22/1 to BP22/2) is medium to coarse sand on phi mean at depth 19.10 meters. The range of sorting class is moderately well sorted to very poorly sorted, symmetrical skewness, and mesokurtic kurtosis. (fig. 5.29)

1. Clayey silt, Very pale orange (10YR 8/2) alternated with sandy clay, mud crack.
2. Silty sand, Very pale orange (10YR 8/2), horizontal lamination.
3. Fine sand, Very pale orange (10YR 8/2), planar stratified.
4. Medium to coarse sand, Very pale orange (10YR 8/2), cross-lamination, wood fragments.
5. Foreset-bedded gravels, Dark yellowish orange (10YR 6/6), gravels of quartzite, quartz, chert, subangular to subrounded with coarse sand matrix.
6. Massive gravels, Dark yellowish orange (10YR 6/6), gravels of quartzite, quartz, chert, flint, subangular to subrounded with coarse sand matrix. Gemstone paystreak.



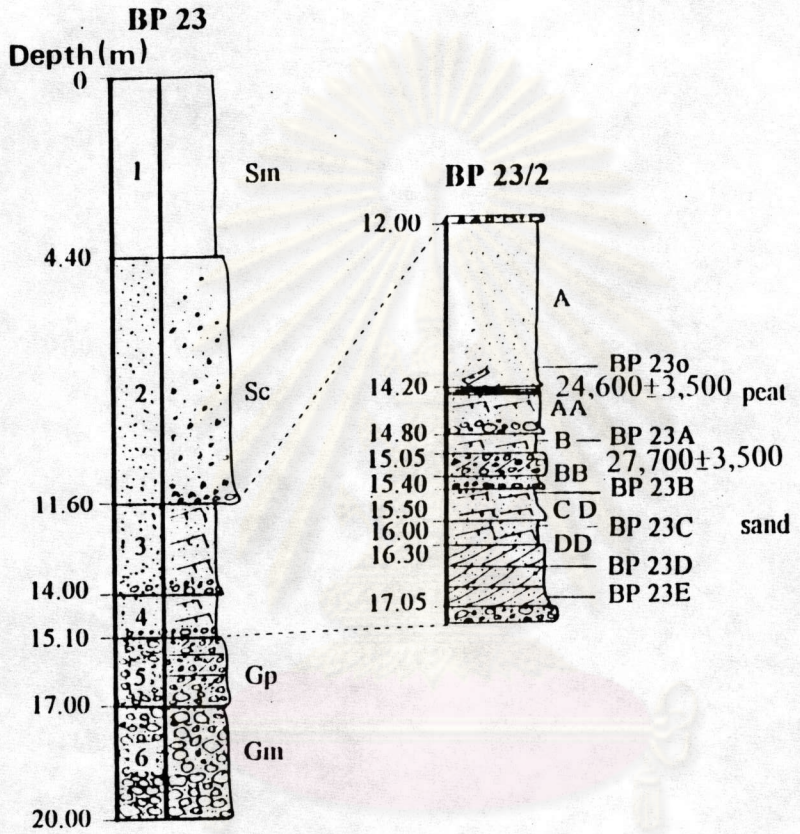
1. Clayey silt, Greenish pink (5R 8/2), alternated with silty sand.

   Gradual contact

2. Coarse sand, Very pale orange (10YR 8/2), wood fragments, cross-lamination.
3. Calcrete with rock fragments, Dark yellowish orange (10YR 6/6).
4. Foreset-bedded gravels, Dark yellowish orange (10YR 6/6) and Light brown (N7), gravels of quartzite, quartz, chert with coarse sand matrix.
5. Massive gravels, Dark yellowish orange (10YR 6/6), gravels of quartzite, chert, flint with coarse sand matrix.

Figure 5.24 Detailed log description of BP 21 and BP 21/1 (50 m. north of BP 21) represent depositional profiles and depth of collected samples at grid reference 532855, Amphoe Bo Phloi, Changwat Kanchanaburi.

1. Silty clay, Dark yellowish brown (10YR 6/2)
2. Calcrete, Dark yellowish orange (10YR 6/6) with rock fragments of chert, quartz and limestone.
3. Fine to coarse sand, Grayish orange (10YR 7/4), cross-lamination, gravels of quart, quartzite, chert in the bottom.
4. Coarse sand with gravels, Very pale orange (10YR 8/2), some pebbles of quartzite, chert, cross-lamination.
5. Foreset-bedded gravels, Dark yellowish orange (10YR 6/6), pebbles and boulders of quartz, quartzite, chert with coarse sand matrix.
6. Massive gravels, Light brown (5YR 6/6), gravels of quartzite, chert, low sphericity, subangular to subrounded. Gemstone paystreak.



A. Clayey silt, Dark gray (N3) with peat.
AA. Gravels lag deposits, Medium dark gray (N4) with peat.
B. Secondary limestone
BB. Gravel layers with sand matrix, foreset-bedded.
C. Gravel with sand.
D. Sand, cross-lamination
DD. Sand, cross-lamination.

Figure 5.25 Detailed log description express depositional sediments within the Bo Phloi Basin at BP 23 (grid reference 5288485) and BP 23/2 (70 m. SW of BP 23) and position of collected sands and peats samples.

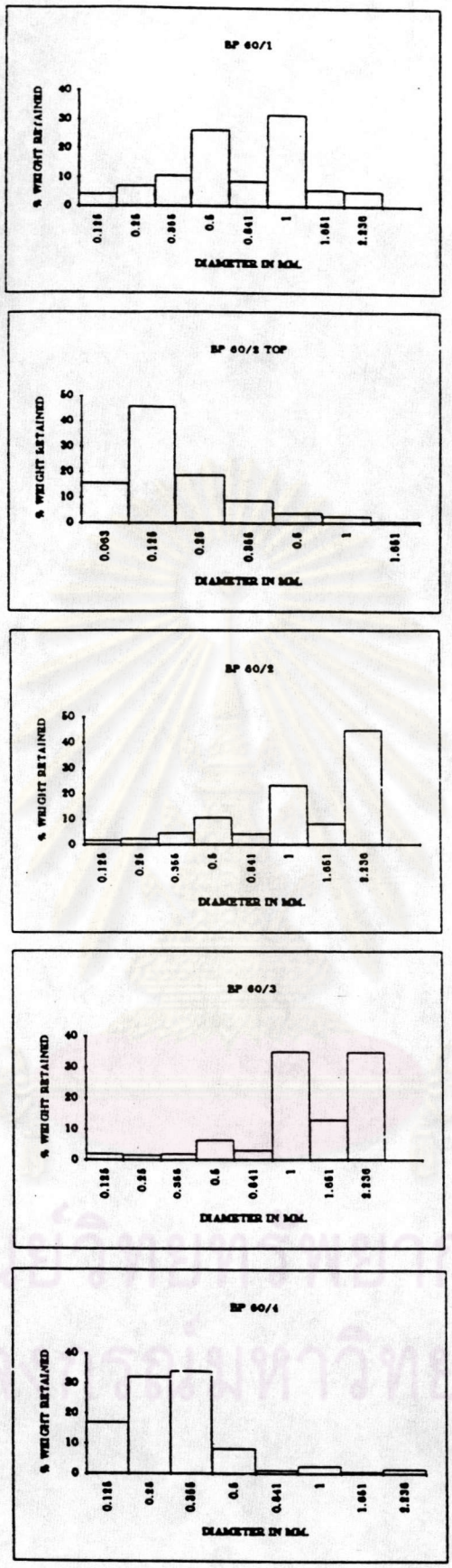
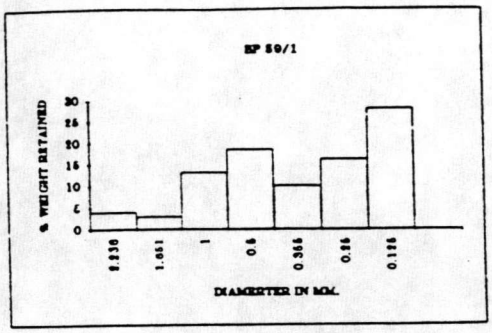
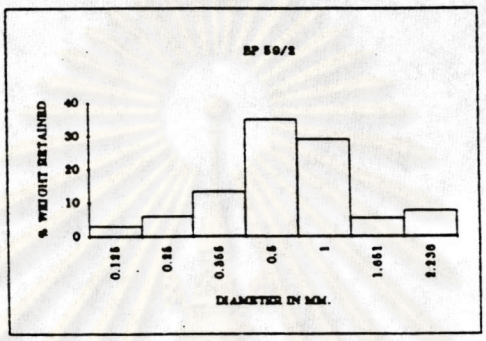
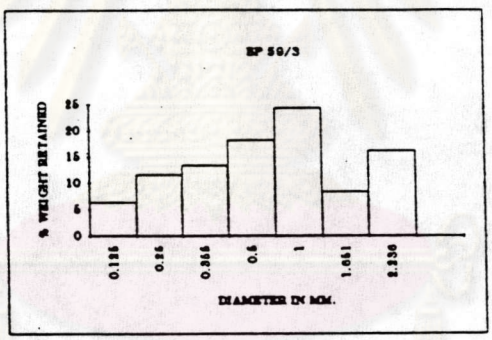


Figure 5.26 Histogram of size distribution from matrix of Gm facies shows fine to very coarse-grained sand.







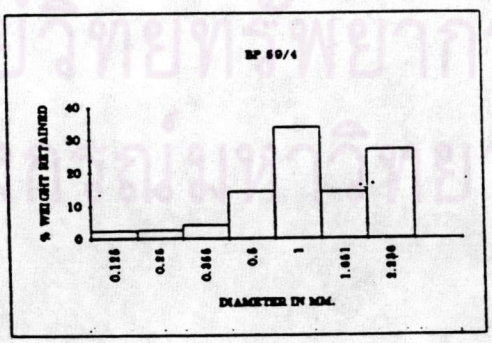


Figure 5.27 Histogram of size distribution from St facies shows medium to very coarse-grained sand.

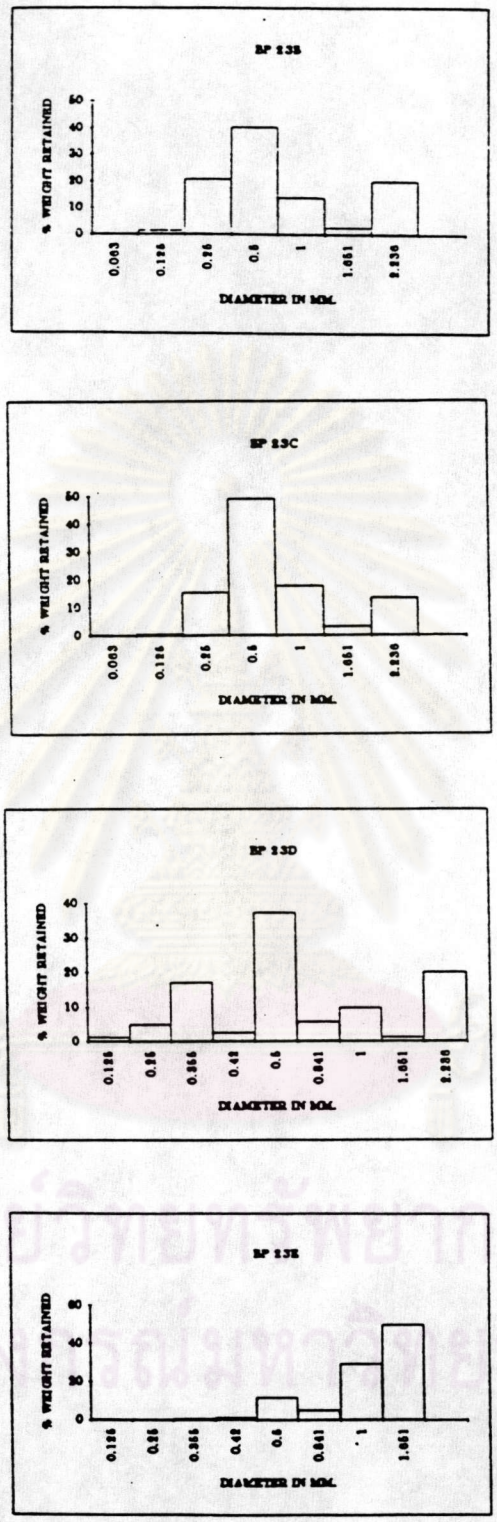


Figure 5.28 Histogram of size distribution from Gp facies represents coarse to very coarse-grained sand.

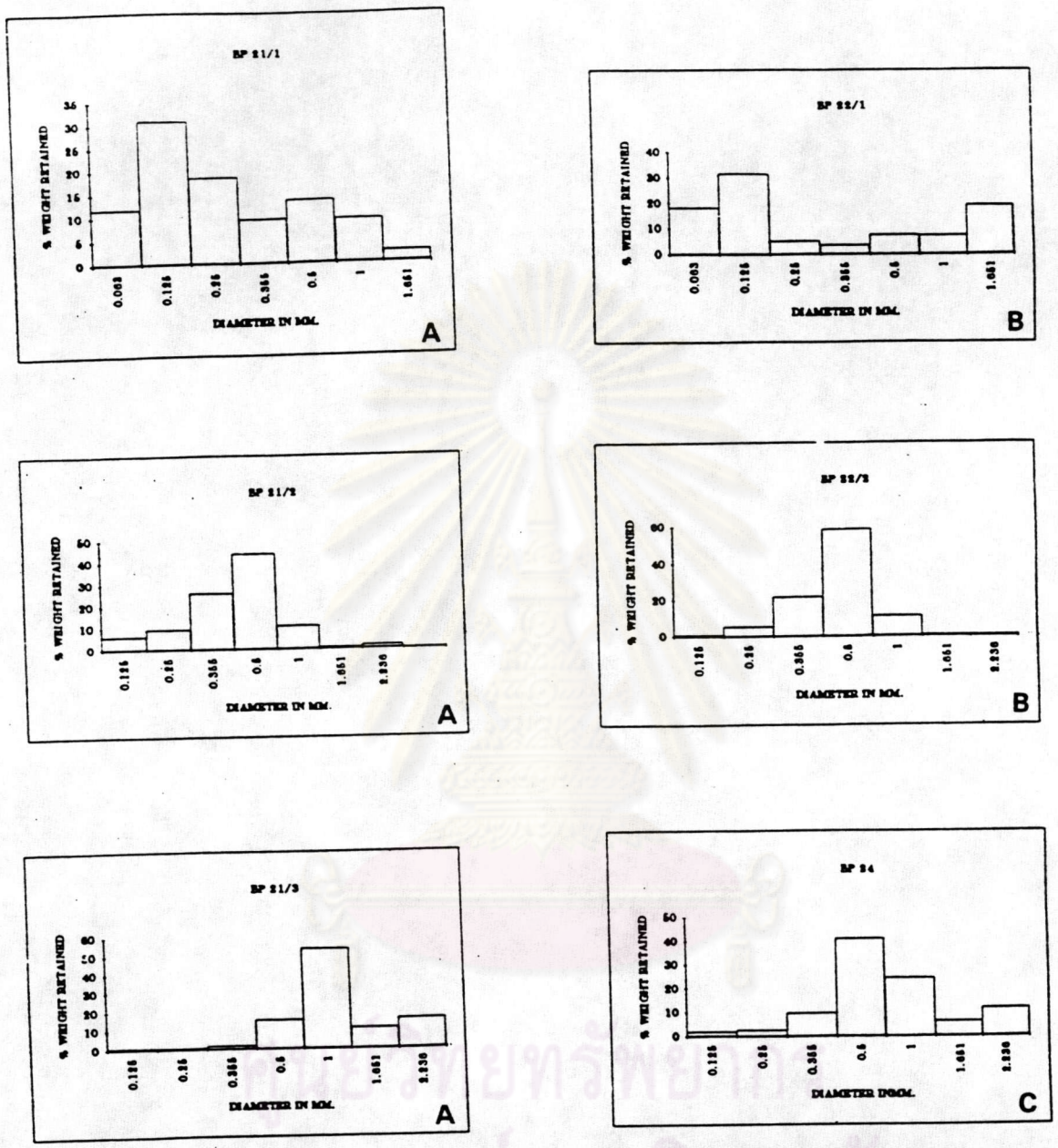


Figure 5.29 Histogram of size distribution from Sp facies (A) shows medium to very coarse sand, Ss facies (B) show medium to coarse sand and Sc facies (C) represents coarse sand.

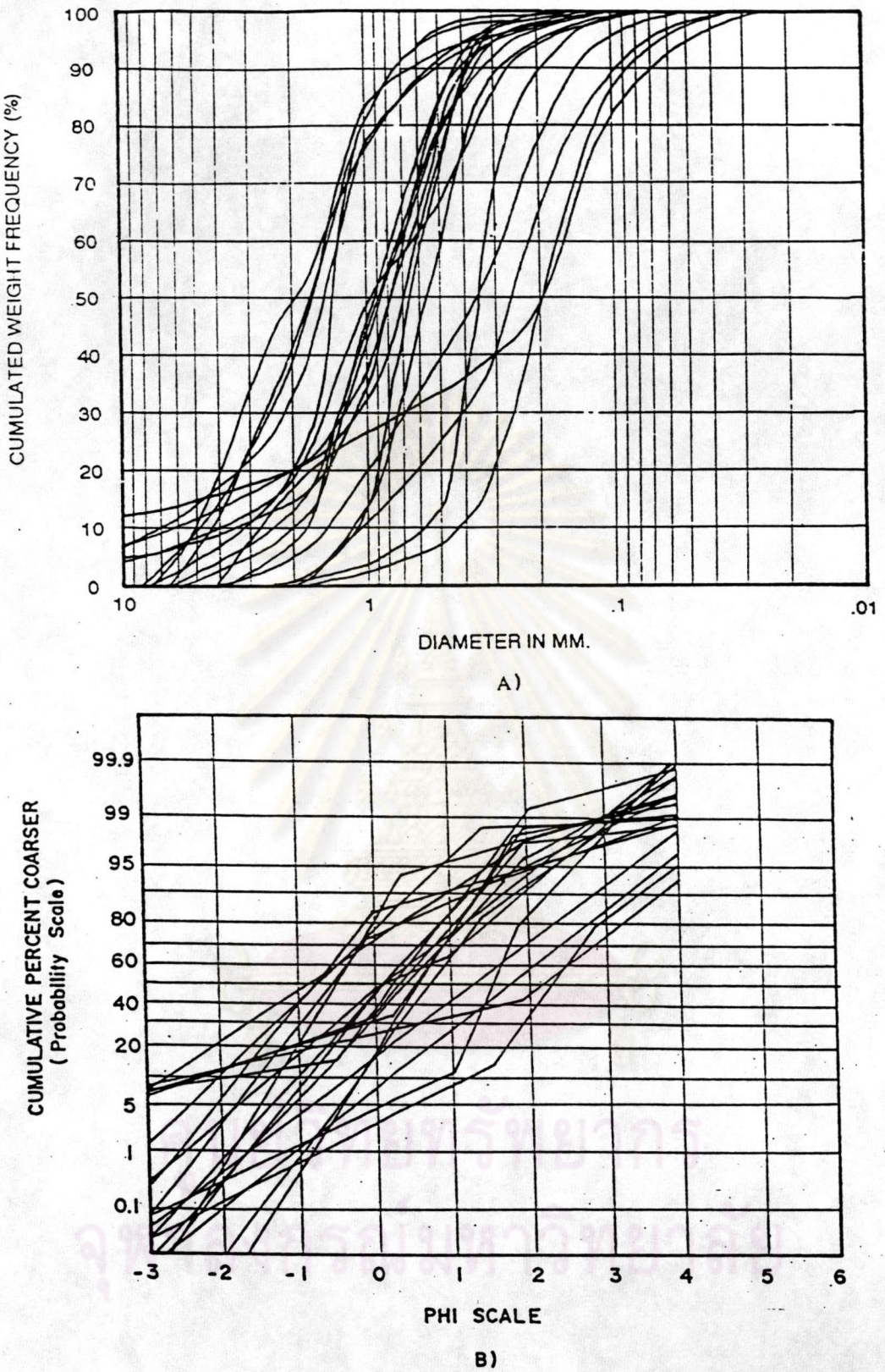
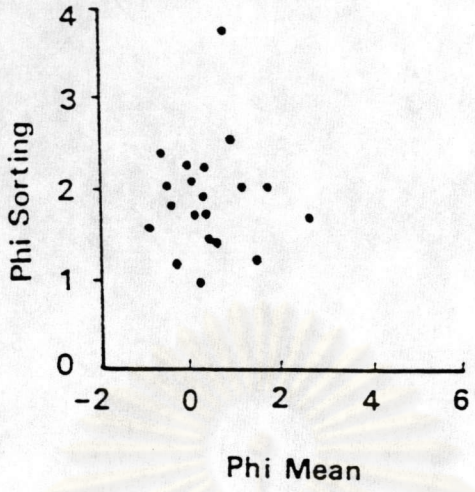
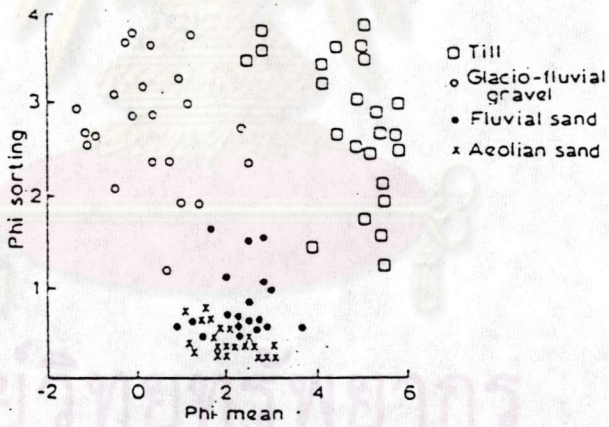


Figure 5.30 Two types of compilation plots of all sand samples. A) S-curve when using log-scale cumulative againsts log-scale of diameters and B) most of curves when plot by using probability cumulative againsts diameters in phi scale.



(A)



(B)

Figure 5.31 Relationship of phi sorting and phi mean of Bo Phloi sand (A) compared with standard plot of various source of sand by Briggs(1977) (B).

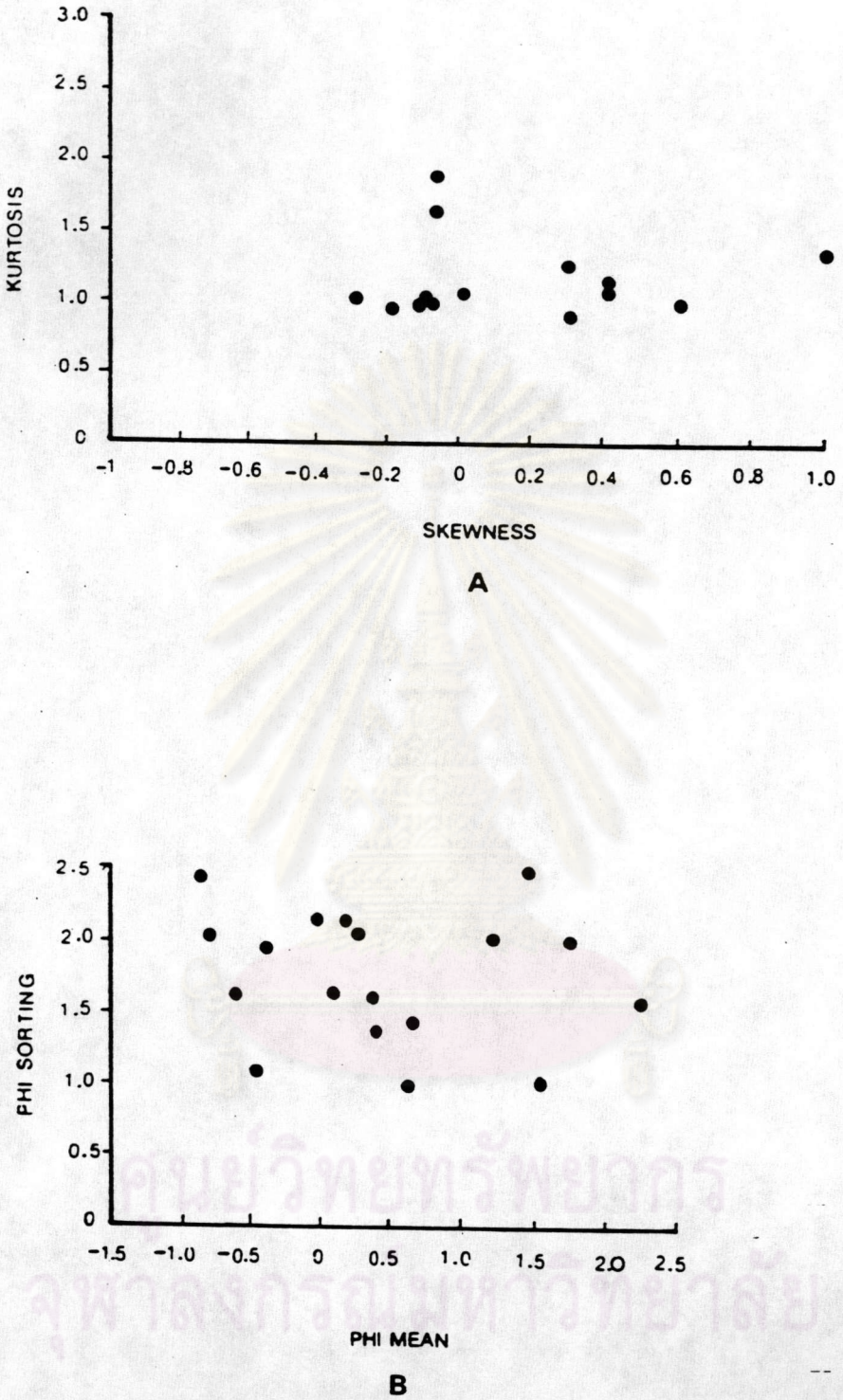


Figure 5.32 Scattergram plots showing relationship between statistic parameter of sand size from Bo Phloi area. A) kurtosis and skewness and B) phi sorting and phi mean.

Table 5.2 Size distribution of sand samples from Bo Phloi area compared with standard size class of sediment. (compared with standard phi mean from Friedman and Sanders, 1978)

Sample	Values of Mean (on phi scale)	Size
BP60/1	0.37	coarse sand
BP60/2T	2.33	fine sand
BP60/2	-0.90	very coarse sand
BP60/3	-0.80	very coarse sand
BP60/4	1.53	medium sand
BP24	0.13	coarse sand
BP21/1	1.70	medium sand
BP21/2	0.73	coarse sand
BP21/3	-0.50	very coarse sand
BP22/1	1.30	medium sand
BP22/2	0.60	coarse sand
BP59/1	1.23	medium sand
BP59/2	0.37	medium sand
BP59/3	0.27	medium sand
BP59/4	-0.40	very coarse sand
BP23B	0	coarse sand
BP23C	0.27	coarse sand
BP23D	0.10	coarse sand
BP23E	-0.73	very coarse sand

Table 5.3 Classification of sand samples into sorting class based on standard deviations, compared by using phi scale with standard sorting class from Friedman (1978).

Sample	Values of standard deviation (on phi scale)	Sorting class
BP60/1	1.05	moderately sorted
BP60/2T	0.96	moderately sorted
BP60/2	1.52	poorly sorted
BP60/3	1.04	moderately sorted
BP60/4	0.56	moderately well sorted
BP24	0.97	moderately sorted
BP21/1	1.26	moderately sorted
BP21/2	0.80	moderately sorted
BP21/3	0.70	moderately well sorted
BP22/1	2.42	very poorly sorted
BP22/2	0.59	moderately well sorted
BP59/1	1.31	moderately sorted
BP59/2	0.92	moderately sorted
BP59/3	1.27	moderately sorted
BP59/4	1.13	moderately sorted
BP23B	1.46	poorly sorted
BP23C	1.14	moderately sorted
BP23C	1.45	poorly sorted
BP23D	0.95	moderately sorted

Table 5.4 Comparision of sand samples from Bo Phloi area based on sorting values, compared with standard sorting term of Briggs (1977).

Sample	Values of sorting (on phi scale)	Sorting class
BP60/1	1.70	poorly sorted
BP60/2T	1.75	poorly sorted
BP60/2	2.45	very poorly sorted
BP60/3	2.00	very poorly sorted
BP60/4	1.15	poorly sorted
BP24	1.70	poorly sorted
BP21/1	2.00	very poorly sorted
BP21/2	1.40	poorly sorted
BP21/3	1.15	poorly sorted
BP22/1	3.85	very poorly sorted
BP22/2	0.95	moderately sorted
BP59/1	2.00	very poorly sorted
BP59/2	1.45	poorly sorted
BP59/3	2.05	very poorly sorted
BP59/4	1.90	poorly sorted
BP23B	2.25	very poorly sorted
BP23C	2.25	very poorly sorted
BP23D	2.55	very poorly sorted
BP23E	1.65	poorly sorted

Table 5.5 Classification of skewness values described based on standard term by Briggs (1977).

Sample	Value of skewness (on phi scale)	Skewness class
BP60/1	0.60	very positively skewed
BP60/2T	-0.10	symmetrical
BP60/2	-0.30	negatively skewed
BP60/3	1.40	-
BP60/4	-0.10	symmetrical
BP24	0.40	very positively skewed
BP21/1	0	symmetrical
BP21/2	0.40	very positively skewed
BP21/3	0.30	positively skewed
BP22/1	3.90	-
BP22/2	-0.10	symmetrical
BP59/1	-0.20	negatively skewed
BP59/2	-0.10	symmetrical
BP59/3	0.30	positively skewed
BP59/4	1.00	positively skewed
BP23B	-2.40	-
BP23C	-1.40	-
BP23D	-3.10	-
BP23E	-0.10	symmetrical

Table 5.6 Classification of sand samples into kurtosis description term based on phi scale and compared with standard class of Briggs (1977).

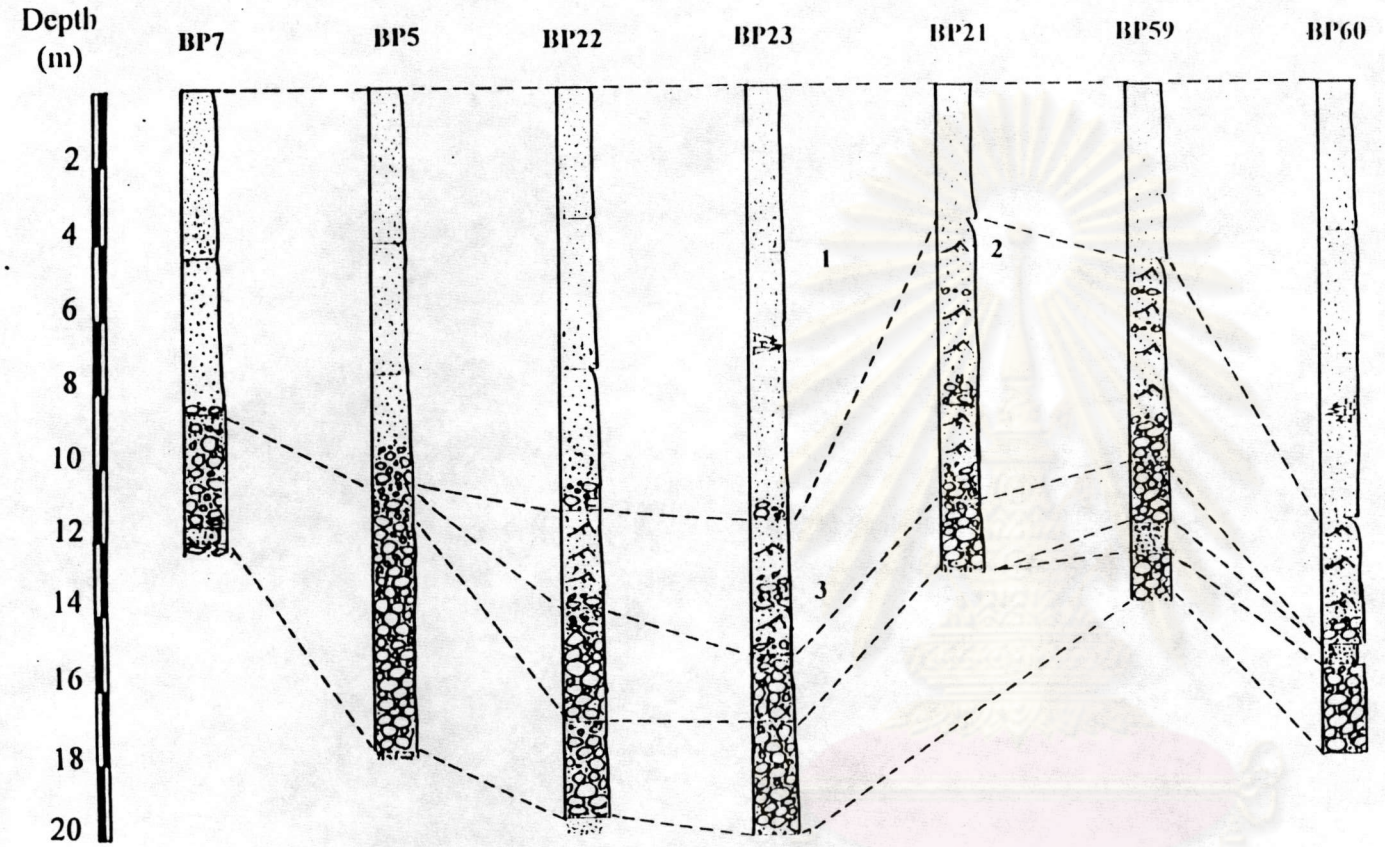
Sample	Values of kurtosis (on phi scale)	Kurtosis class
BP60/1	1.00	mesokurtic
BP60/2	1.60	very leptokurtic
BP60/2	1.06	mesokurtic
BP60/3	1.64	very leptokurtic
BP60/4	1.89	very leptokurtic
BP24	1.26	leptokurtic
BP21/1	1.10	mesokurtic
BP21/2	1.04	mesokurtic
BP21/3	1.35	leptokurtic
BP22/1	1.05	mesokurtic
BP22/2	0.97	mesokurtic
BP59/1	0.91	mesokurtic
BP59/2	0.99	mesokurtic
BP59/3	0.84	platykurtic
BP59/4	1.42	leptokurtic
BP23B	1.37	leptokurtic
BP23C	1.87	very leptokurtic
BP23D	1.31	leptokurtic
BP23E	0.97	mesokurtic

2.3 Carbon 14 Dating : Wood fragments and peats could be observed extensively the middle part of the study area. Stratigraphically, the generalized Quaternary profile represented fining upward sequences of fluvial deposition. Wood fragments found generally between 3 to 5 meters depth, whereas peats also recorded in the bottom, respectively. In this study, seven samples of woods and peats were dated by radiocarbon method. The result dating of woods and peats will be confirmed the certain age of the deposits. It can be helpful for paleoenvironment interpretation. The illustration of stratigraphic correlation together with its age can be summarized in fig. 5.34. The depth, types of specimens and absolute age of each samples can be concluded as follow table :

Table 5.7 Radiocarbon dating results of woods and peats sample which collected from Bo Phloi mining-face section, Amphoe Bo Phloi, Changwat Kanchanaburi.

Sample no.	Grid reference	Depth of sample (m)	Types of Sample	Radiocarbon Date (yrs in BP)
BP21	532855	4.50	Wood	440±190
BP23O	5288485	14.00	Wood	24,600±3,500
BP23A	5288485	15.00	Peat	26,200±3,200
BP59/3	5295837	9.00	Wood	27,700±3,500
BP60/3	529841	15.60	Wood	32,600±4,100
BP60/5	529841	15.80	Peat	35,600±4,200
BP60/6	529841	15.80	Peat	33,450±4,200

Figure 5.33 Present gemstone mining-face showing woods using for radiocarbon dating. (Grid reference : 532855)



LEGEND

Lithofacies

- Clayey silt to silty sand (Sm), silty sand (Sl) with calcareous deposits, cross-lamination sands (Sc) with gravel in the bottom
- Foreset-laminated sands (Sp), trough-wedge-shaped cross-lamination sands (St)
- Foreset-bedded gravels (Gp)
- Stratified sand (Ss)
- Massive gravels (Gm)

Lithofacies	Depositional Environment	Age
Sm, Sl, Sc, St	Fluvial deposits	Holocene
Gp, Ss, Gp	Old alluvial deposits	Late Pleistocene

C-14 Dating	
Sample	Yrs in BP
1. BP 21	440 ± 190
2. BP 59/3	27,700 ± 3,500
3. BP 23o	24,600 ± 3,500
BP 23A	26,200 ± 3,200
4. BP 60/3	32,600 ± 4,200
BP 60/6	33,450 ± 4,200
BP 60/5	35,600 ± 4,200

Figure 5.34 Stratigraphic correlation related to lithofacies, depositional environment and age dating, Amphoe Bo Phloi, Changwat Kanchanaburi.