ธรณีวิทยาควอเทอร์นารีบริเวณเขาพลอยแหวนและพื้นที่ใกล้เคียง อำเภอท่าใหม่ จังหวัดจันทบุรี

นางสาวรุ่งทิพย์ วิเตียรณี

วิทยานิพนธ์นี้เป็นส่วนหนึ่งของการศึกษาตามหลักสูตรปริญญาวิทยาศาสตรมหาบัณฑิต
สาขาวิชาธรณีวิทยา ภาควิชาธรณีวิทยา
คณะวิทยาศาสตร์ จุฬาลงกรณ์มหาวิทยาลัย
ปีการศึกษา 2543

ISBN 974-03-0008-1

QUATERNARY GEOLOGY OF KHAO PHLOI WAEN AND ITS VICINITY, AMPHOE THA MAI, CHANGWAT CHANTHABURI

Miss Rungthip Vitiaranee

A Thesis submitted in Partial Fulfillment of the Requirements
for the Degree of Master of Science in Geology
Department of Geology
Faculty of Science
Chulalongkorn University
Academic Year 2000

ISBN 974-03-0008-1

Thesis Title	QUATERNARY GEOLOGY OF KHAO PHLOI WAEN AND ITS VICINITY, AMPHOE THA MAI, CHANGWAT CHANTHABURI
By	Miss Rungthip Vitiaranee
Field of Study	Geology
Thesis Advisor	Associate Professor Thanawat Jarupongsakul, Ph.D.

Accepted by the Faculty of Science, Chulalongkorn University in Partial Fulfillment of the Requirements for the Master's Degree

..... Dean of Faculty of Science

(Associate Professor Wanchai Phothiphichitr, Ph.D.)

THESIS COMMITTEE

..... Chairman

(Assistant Professor Somchai Nakapadungrat, Ph.D.)

..... Thesis Advisor

(Associate Professor Thanawat Jarupongsakul, Ph.D.)

..... Member

(Associate Professor Narong Thiramongkol, Ph.D.)

..... Member

(Assistant Professor Sompop Vedchakanchana, M.Sc.)

..... Member

(Rak Hansawek, M.Sc.)

รุ่งทิพย์ วิเตียรณี : ธรณีวิทยาควอเทอร์นารีบริเวณเขาพลอยแหวนและพื้นที่ใกล้เคียง อำเภอท่าใหม่ จังหวัดจันทบุรี. (QUATERNARY GEOLOGY OF KHAO PHLOI WAEN AND ITS VICINITY, AMPHOE THA MAI, CHANGWAT CHANTHABURI) **อ. ที่ปรึกษา : รศ. ดร. ธนวัฒน์ จารุพงษ์สกุล, จำนวนหน้า** 213 **หน้า.** ISBN 974-03-0008-1.

พื้นที่ศึกษาบริเวณเขาพลอยแหวนและพื้นที่ใกล้เคียงตั้งอยู่ในเขตอำเภอท่าใหม่และอำเภอเมือง จังหวัดจันทบุรี ธรณีสัณฐานในพื้นที่สามารถแบ่งได้เป็น 4 **หน่วย คือ** 1) **ภูเขาและเนินเขาของหินท้องที่** 2) **ที่ราบเชิงเขา โดยการสะสมตัวของเศษหินเชิงเขาและตะกอนน้ำพา** 3) **ลานตะพักลำน้ำและที่ราบลุ่มน้ำพา และ** 4) **ที่ราบชายฝั่งทะเล ตะกอนพื้นผิวที่ปกคลุมในพื้นที่ประกอบด้วยบริเวณที่เกิดการผุพังอยู่กับที่ของหินท้องที่ และตะกอนชนิดต่าง ๆ แต่ข้อมูลจากหลุมเจาะพบว่าชั้นตะกอนน้ำพาบางส่วนสะสมตัวร่วมกับเศษหินเชิงเขาและส่วนใหญ่ถูกปิดทับด้วยตะกอนป่าเลนน้ำเค็มบริเวณที่ราบชายฝั่งทะเล ด้วยลักษณะตะกอนที่แตกต่างกันนี้ ชี้บ่งถึงสภาพแวดล้อมและขบวนการในการสะสมตัวที่เปลี่ยนแปลงจาการสะสมในน้ำจืดไปเป็นน้ำทะเล นอกจากนี้ข้อมูลจากหลุมเจาะยังพบชั้นหินบะซอลต์ผุ ซึ่งคาดว่าต่อเนื่องมาจากเขาพลอยแหวน ซึ่งถูกปิดทับด้วยชั้นตะกอนป่าชายเลน และจากการเทียบสัมพันธ์พบว่ามีชั้นตะกอนใต้ชั้นหินบะซอลต์ดังกล่าว ซึ่งคาดว่าอาจเป็นบริเวณที่เกิดการผุพังของหินท้องที่ หรือเป็นบริเวณที่มีการสะสมตัวของตะกอนน้ำพา**

นอกเหนือจากนี้ แหล่งพลอยคอรันดัมในพื้นที่ส่วนใหญ่มีการสะสมตัวในบริเวณที่เกิดการผุพังแบบอยู่กับที่ของหินบะซอลต์ร่วมกับเพื่อนแร่อื่น ๆ ได้แก่ ไพรอกซีน โกเมน เพทาย สปิเนล แมกนีไทต์ อิลเมไนต์ และโอลิวีน สำหรับพื้นที่ศักยภาพพลอยคอรันดัมพบการสะสมตัวใน 2 **ลักษณะ คือ การสะสมตัวแบบผุพังอยู่กับที่ของหินบะซอลต์ และการสะสมตัวแบบลานแร่ในชั้นกรวด โดยพบว่าพื้นที่ศักยภาพสูงของแหล่งพลอยคอรันดัมครอบคลุมพื้นที่** 21.58 **ตารางกิโลเมตร**

ภาควิชา ธรณีวิทยา	ลายมือชื่อนิสิต .....
สาขาวิชา ธรณีวิทยา	ลายมือชื่ออาจารย์ที่ปรึกษา .....
ปีการศึกษา 2000	ลายมือชื่ออาจารย์ที่ปรึกษาร่วม .....

4072364423 :MAJOR GEOLOGY
KEY WORD: QUATERNARY GEOLOGY / KHAO PHLOI WAEN / CORUNDUM / BASALTIC RESIDUAL DEPOSIT / PLACER DEPOSIT RUNGTHIP VITIARANEE: QUATERNARY GEOLOGY OF KHAO PHLOI WAEN AND ITS VICINITY, AMPHOE THA MAI, CHANGWAT CHANTHABURI. THESES ADVISOR: ASSOC. PROF. THANAWAT JARUPONGSAKUL, Ph.D. 213 pp. ISBN 974-03-0008-1.

The study area, Khao Phloi Waen and its vicinity, is located in Amphoe Tha Mai, and Amphoe Muang, Changwat Chanthaburi. Landforms in this area can be divided into 4 units; the mountainous and hilly area of the country rocks, the piedmont plain, terrace and floodplain, and tidal flat. The surficial deposit is composed of the residual deposit of the country rocks and sediments from various processes. By the banka drilling, alluvial deposit is deposited with colluvium and some is overlain by mangrove deposit. By the difference of sedimentary character, it indicates to the depositional environments and processes changed from fluvial to marine. Besides, it is found weathered basalt that underlies mangrove deposit. It might continue from Khao Phloi Waen. By the correlation, there is a sedimentary layer underlies this basaltic layer. It is expected to be the weathering zone of bedrocks or fluvial sediments.

In addition, corundum deposit in this area was mostly associated with basaltic residual weathering zone. Corundum was found with the associated minerals such as pyroxene, garnet, zircon, spinal, magnetite, ilmenite, and olivine. For the potential of corundum deposit, there are 2 types of deposit in the area; residual weathering of basaltic rock and placer deposit in the gravel bed. Lastly, the total area of potential corundum deposit in both types is about 21.58 square kilometers.

Department Geology Student's signature .....
Field of Study Geology Advisor's signature .....
Academic Year 2000 Co-advisor's signature .....

ACKNOWLEDGEMENTS

This thesis was completed with the assistance from many people and organizations. Associate Professor Dr. Thanawat Jarupongsakul, the thesis advisor, has spent his valuable time for guidance, suggestion, discussion, and encouragement. Assistant Professor Dr. Somchai Nakapadungrat, Associate Professor Dr. Narong Thiramongkol, Assistant Professor Sompop Vedchakanchana, and Mr. Rak Hansawek, the thesis committees are gratefully acknowledged for their valuable time and effort, during the examination. The Department of Geology has granted the numerous facilities.

Deeply sincere acknowledgement is extended to Gemstone Section, Economic Geology Division, Department of Mineral Resources for many data in field investigation. The geoscientist staffs from Gemstone Section are deeply for assistance, in various aspects and the great helpfulness in anyway.

The author would like express sincere gratitude to the author's family, and friends for love, care, encouragement as well as the financial support. Finally, the acknowledgements are also due to those who kindly assist the author, which are not mentioned here and the appreciation to the readers for commenting the manuscript.

CONTENTS

CHAPTER

LIST OF TABLES

LIST OF FIGURES

CHAPTER 1

INTRODUCTION

Background

Thailand has recently upgraded its studies of the Quaternary succession due to significant increase of the economically industrial minerals within them and other uses of these sediments. It also has become increasingly apparent from these studies that, within the framework of the Quaternary, there has been profound gemstone-placer exploration. It is clearly recognized that these lines of research have been progressed to the point where it is now possible to systemize at least the Quaternary geology of the study area.

A combination of geomorphology, sedimentology and banka drilling in Khao Phloi Waen and its vicinity i.e. Khao Wua have long been famous corundum deposits of Thailand for more than 100 years, which are related to gem-bearing basalt of the age about 0.44±0.11 Ma (Barr and Macdonald, 1981). It has been carried out aiming to provide unique insights into this area's recent history, which can be helpful for the corundum exploration.

Objectives

The purpose of this study is:

(1) To investigate Quaternary geological, sedimentological, and geomorphological characters of the study area.

(2) To compile the existing corundum exploration data and to arrange them in a manageable form.

(3) To establish the relation between Quaternary processes and relevant gem deposits within the study area.

The Study Area

This area is located in Amphoe Tha Mai, Amphoe Muang, and Amphoe Laem Sing, Changwat Chanthaburi. It is situated between UTM grid 175000-184000 m. E and 1388000-1400000 m. N in the 48 UTM zone (Figure 1.1). It approximately covers 120 square kilometers of are area in the topographic map sheet 5434 III (Changwat Chanthaburi) scale 1:50,000.

Changwat Chanthaburi is about 246 kilometers to the east of Bangkok. The route from Bangkok to Chanthaburi is comfortable. A journey from Bangkok to Changwat Chonburi can be done by driving along highway No. 34 for 81 kilometers, then changes to highway No. 344 (Ban Bung-Klaeng) in southeast direction for another 105 kilometers. From Amphoe Klaeng, following highway No. 3 (Sukhumwit) which for 60 kilometers run passing the northern part of the study area, and leads to Chanthaburi.

From Chanthaburi, There are 2 highways run directly to the study area. Firstly highway No. 3147 (Amphoe Muang-Amphoe Tha Mai) is 11.4 kilometers long and cut through the central area. Secondly highway No. 3146 (Amphoe Muang-Ban Tha Chalaep) is 11.6 kilometers long through the southeast. Besides, there are many roads, both in hard and light surfaces, run through the investigated area.

The northern and central part of the study area is covered by hilly terrains and narrow plain, while the southern part is covered by deltaic plain. The general slope of the area is from north to south about 5-10 degrees. The main waterway is the Chanthaburi River flowing in the southern area. Klong Lam Pan, Klong Bang Kacha, and Klong Nam Sai are its distributary streams. There are many gullies cut through the country rock, supplied water and sediments.

This area is mostly used for agriculture such as durian, pepper, and rubber. Many shrimp farms are located along the coastal area. The important industry is corundum mining and corundum related business.

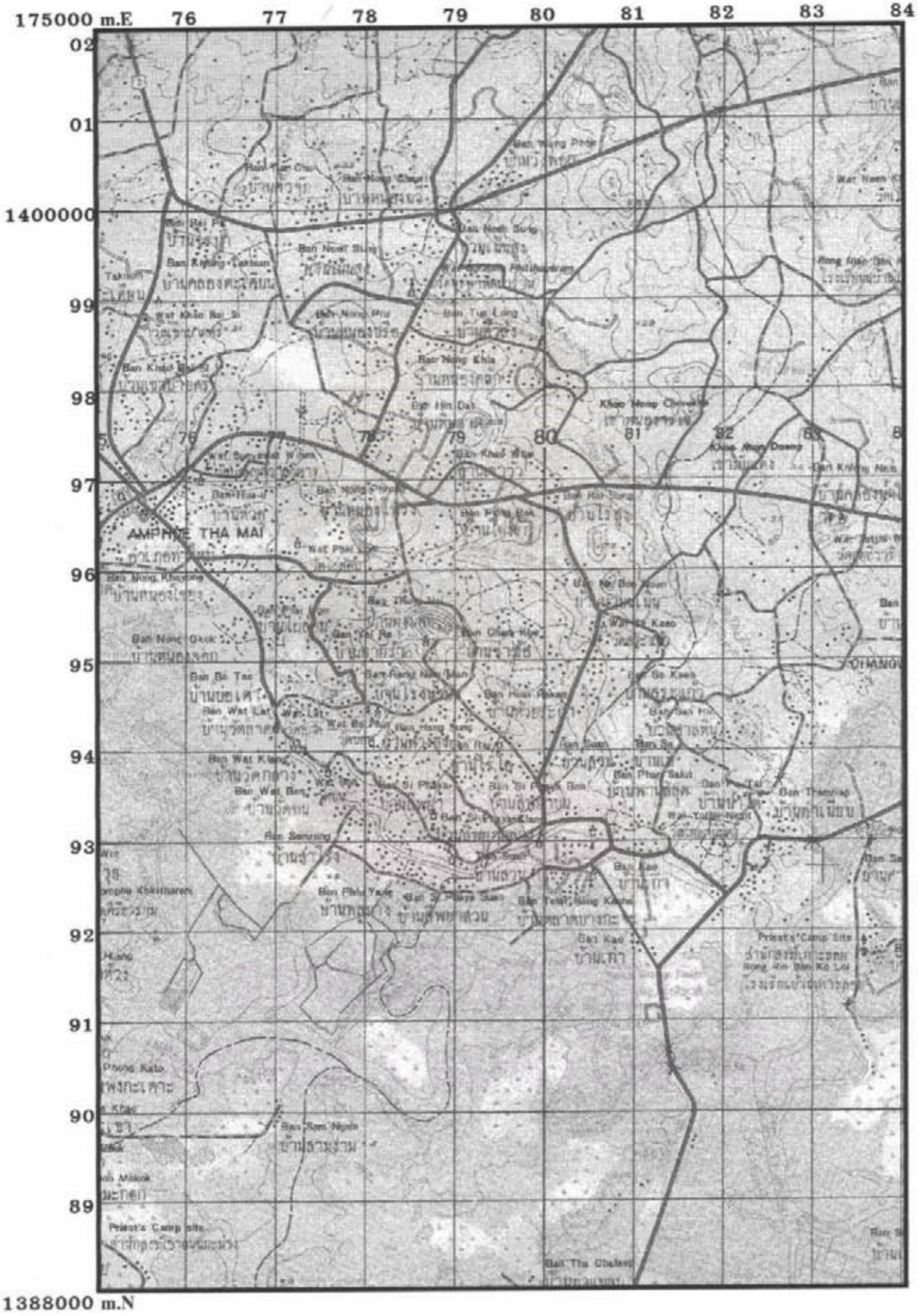


Figure 1.1 Topographic map of the study area (map sheet 5434 III, after Royal Thai Survey Department, 1981)

Methodology

The methodology of this study is conventionally started literature review. Numerous geological reports and relevant papers have been collected, including topographic maps and aerial photographs. To study geomorphology, aerial photographs have been interpreted. This step can assist to plan for the field exploration.

Field investigation consisted of geological survey, soil profile investigation, pitting, and banka drilling. It aims to delineate the surficial deposits, to reveal the characteristics of pre-quaternary rocks and their tectonic history that many indicate their geological processes, and to plan for follow-up pitting and banka drilling.

Some pittings have been carried out by 1x1 $m.^2$ pits at the footslope of the hills. It aims to prove the geological boundary, to establish pit-profiles and to verify gem occurrence and its distribution. It is generally digged through bedrocks, unless obstructed by the hardpan material or groundwater table.

Banka drilling is modified from tin exploration that the sidiments can be sampled deeper than pitting. It has usually been done in the alluvial plain and deltaic plain covered by the thick sediments. Sedimentary samples have been collected from every representative layers. Based on difference of color, particle size, and kind of particles.

Sedimentary samples from mine profile, pitting, and banka drilling have been described in the following properties, i.e. layer nomenclature, color (Japan Color Research Institute, 1957), sediment component, particle size, particle shape (sphericity and roundness), grain sorting, associated minerals, and layer contact.

In laboratory, samples have been investigated by sieve analysis, x-ray diffraction, and mineral identification under binocular. It aims to describe their size distribution, and mineral components.

Data interpretation and compilation has carefully done. Finally, it was accomplished by the presentation and thesis report. Flow chart of the present methodology is shown in figure 1.2.

Literature Review

Various relevant papers have been collected and reviewed for this study. They are related to geology, geomorphology, Quaternary geology, geochemistry, geophysics, mineral deposits, and palynology of the study area and its vicinity. They also include the hypothesis, which involved to this study as follows:

Hughes and Bateson (1967) explored the geology and mineral deposits in Changwat Chanthaburi. This area is covered by granite and sedimentary rocks that overlain by basalt, alluvial and colluvial deposits. Corundum is the most important mineral for mining at Khao Phloi Waen, Ban Ang Ed, Ban Bo Wen, and Ban Bo Na Wong. Usually, it has been recovered zone of residual weathered basalt and alluvial deposits.

Vichit (1975) proposed that corundum might be the phenocryst in alkali basalt originated from the partial melting of upper mantle at 30-70 kilometers depth. Corundum is associated with pyroxene and garnet that indicates its origin of high-pressure environment.

Barr and Macdonald (1978) studied geochemistry and the origin of Cenozoic alkali basalt in Thailand. He also reported the age of the basalt from western Chanthaburi ranging from 29.0±1.70 Ma to 23.6±1.2 Ma and clssified in nephelinite.

Vichit *et. al.* (1978) reported the distribution and characteristics of gem–bearing basalt. He also suggested that corundum deposits are invariably associated with the soil that weathered from basalt, which overlies bedrocks of Devonian-Carboniferous phyllite, quartzite, and schist. The age of basalt is Tertiary or younger. Major outcrop of basalt can be found only at Khao Phloi Waen, and Khao Wua that are assumed to be the volcanic plug (Taylor and Buravas, 1951).

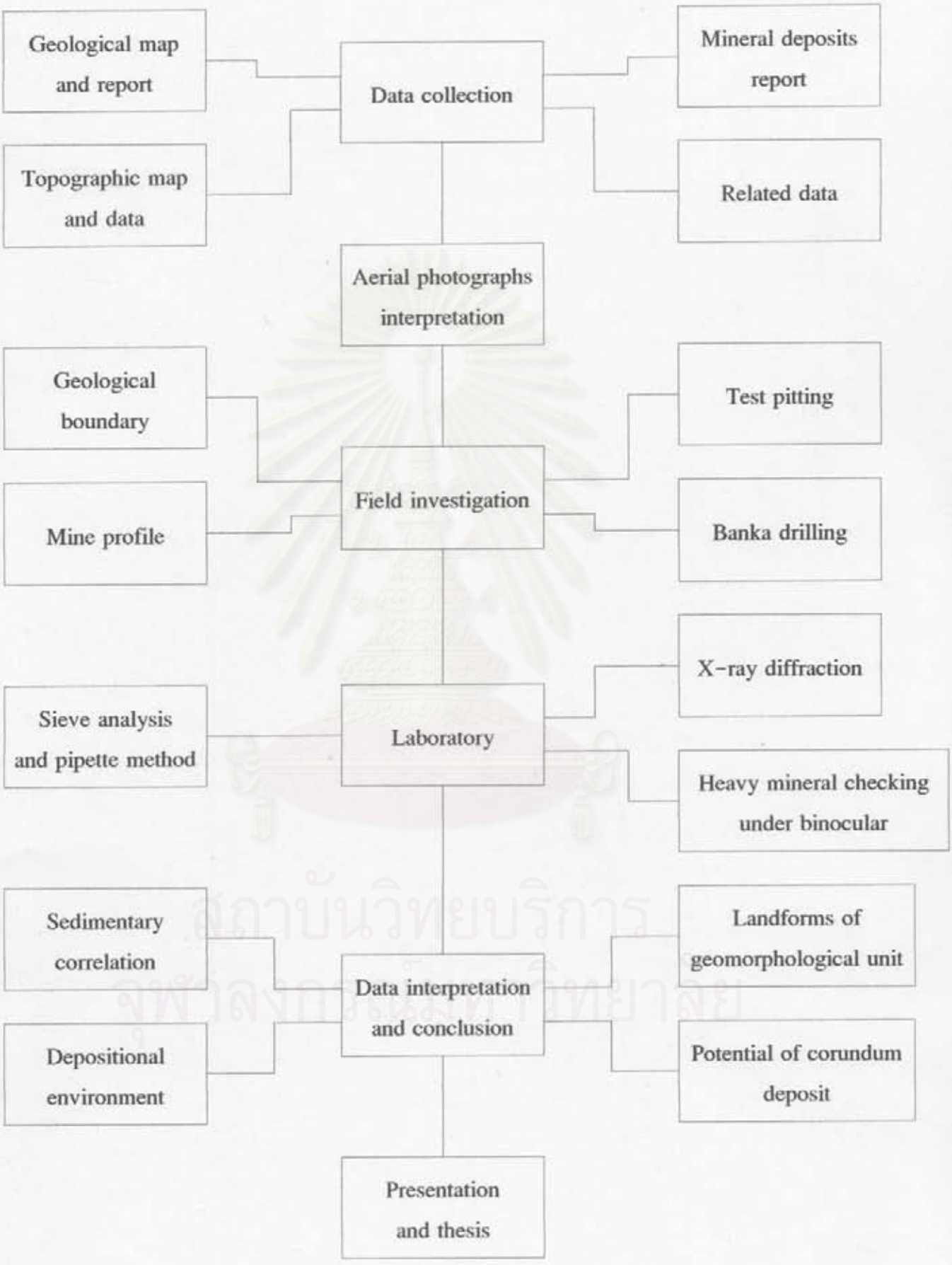


Figure 1.2 Flow chart of methodology in this study

Barr and Macdonald (1981) studied geochemistry and determind radiometric age of Southeast Asia Cenozoic basalt by the K-Ar method. The reported that the Khao Phloi Waen basalt was 0.44±0.11 Ma old.

Sirinawin (1981, in Thai) studied geochemistry and the origin of gem-bearing basalt at Ban Nong Bon, Amphoe Bo Rai, Changwat Trat. It is grouped in olivine nephelinite. He suggested that corundum is indirectly associated with basalt, because the latter was extruded by the magma that many have been generated within the crust at pressure of at least 20 kilobars.

Yaemniyom (1982) studied the chemical composition of gem-bearing basalt in Amphoe Bo Ploi, Changwat Kanchanaburi. Basalt contains corundum, pyroxene, and spinel phenocrysts. It many have been crystallized from primary magma under the pressure greater than 15-20 kilobars.

Dheeradilok *et. al.* (1983) studied geology, geomorphology, and Quaternary geology in eastern Thailand. This area is composed of mountain ranges, monadknocks in the east, and undulating plain in the west including floodplain and coastal plain. Chonburi-Chanthaburi-Trat is a part of the east mountain range that trends in N-S direction. It is covered by Precambrian metamorphic rocks, Paleozoic-Mesozoic sedimentary rocks that distribute from west to east. Besides, granite, ultramafic rock, and basalt are also found.

Hasting and Liengsakul (1983) summarized a chronology of Late Quaternary climatic changes. It is postulated that beginning with 60,000 years before oresent and ending with 30,000 years before present, the climate was cool and dry. A warm and wet period then prevailed until 20,000 years before present. The climate then returned to cool and dry until the Holocene, 11,000 years before present, when it again become warm and wet. This chronology is compared with

others from the Tropics. The result is that the timing and types of climate changes in the Tropics is roughly equivalent.

Pramojanee and Hastings (1983) studied geomorphology and palynology in coastal area of Amphoe Tha Mai. Geomorphologically its landforms are the results of fluvial and marine processes. Based on palynological data, it indicates that there are two sea level changes during Late Pleistocene to Holocene. Firstly, sea level fell during 16,200±1,320 years before present (last Late Pleistocene regression). Then, it rose during 8,400±1,300 years before present (Holocene transgression).

Tansathien *et. al.* (1985) reported geology of Changwat Chanthaburi and compiled geological map sheet ND48-13 (Changwat Chanthaburi), scale 1:250,000. The investigated area consists of Carboniferous-Permian sedimentary rocks, Triassic granite, olivine basalt, and Quaternary sediments.

Vichit (1988; in Thai) studied corundum deposits in Thailand. Corundum has mostly been found in residual basalt, that so-called “look ron”. It is round, quite sphere, in various sizes. Khao Phloi Waen area are the famous corundum deposit of Thailand for more than 100 years.

The Gulf of Thailand Mineral Exploration Project (1988, 1989, and 1994; in Thai) was an important undertaking for investigation of geology, mineral deposits, geophysics, and drilling in Laem Sing offshore area (1E). Some significantly magnetic anomalies may indicate basaltic bodies. They are expected to be volcanic plugs and related to corundum deposits, similar to Khao Phloi Waen. While the exploration drilling data reveal marine sediments, clay, sand, and laterite, which cover bedrocks such as siltstone, sandstone, and shale. Heavy minerals found in the sediments are mostly pyrite and magnetite, within minor pyroxene, garnet and epidote. This area might be a potential area for prospecting

of heavy minerals. Blue sapphire was also found which would be transported from the continent. It was suggested that the Gulf of Thailand was used to be the terrestrial environment during the last glacial maximum.

Kenting Earth Sciences International Limited (1989) carried out an airborne geophysical survey, and published the airborne geophysical interpretation map sheet ND48-13 (Changwat Chanthaburi), scale 1:250,000. Two magnetic anomalies were found in the west and the east of Chanthaburi.

Kengkoom (1990) reported to the Quaternary sea-level fluctuations in the coastal area eastern Thailand. The old beach barrier has been found at the water depth of about 20 meters or at a distance of approximately 10 kilometers offshore. It is thought to be parallel to the present shoreline and to have formed during the postglacial marine transgression period in the early Holocene (6,000-8,000 years before present) when sea level was about 20 meters lower than present. Some composite barriers have been located beyond a depth of 20 meters and are evidence for Pleistocene interstadials. These interstadials would have influenced marine erosion of the inferred gem-bearing basalts found in area 1-E.

Raksasakulwong and Prakobchat (1990; in Thai) explored and mapped geology in the areas of the map sheet 5434 III (Changwat Chanthaburi), 5433 IV (Amphoe Laem Sing), and 5334 II (Ban Khod Hoi). These areas are covered by Carboniferous-Permian sedimentary rocks, and Quaternary sediment, including granite and basalt.

Chaodumrong (1992; in Thai) compiled a geologic map eastern Thailand, scale 1:250,000. The study area is composed of the Noen Po formation, granite, basalt, and unconsolidated sediments.

Chotikasathien (1994) studied the lithofacies and applied for model reconstruction in the offshore area 1, Rayong-Chantaburi. This revealed several

possible models of the eastern coast and inner shelf. Some models are interested in the mineral deposits. Specifically, marine remarking of deeply weathered basalt is the most prespective models for gem deposits in the area 1-E near Chantaburi and sandy shoreface models of the offshore area 1-A, Rayong is expected for detrital heavy mineral deposits.

Levinson and Cook (1994) proposed a hypothesis indicating the relation between corundum and alkali basalt. They suggested that corundum and associated minerals might have been formed by the metamorphism of high alumina sedimentary rocks such as shale, laterite and bauxite in subduction zone at 24-28 kilometers depth. These minerals were brought upwards by alkali basalt that occurred at more than 50 kilometers depth.

Sutthirat *et. al.* (1994) dated Khao Wua basalt, which is 3.0±0.19 Ma, by Ar-Ar dating. Its characteristic is black to blackish gray, fine grained with spinel, and pyroxene phenocrysts.

Coenraads *et. al.* (1995) studied the xenocrysts in basalt. They consist of corundum, zircon, and magnetite. Corundum from Khao Wua, Khao Phloi Waen, and Ban Bang Kacha was found in the weathered soil from basalt and alluviam. Corundum is associated with spinel, pyroxene, garnet, zircon, and magnetite. Garnet is more abundant than zircon, similarly pyroxene is more than spinel. Phlogopite is occasionally found.

Choowong (1996) studied Quaternary Geology related to corundum deposit in Amphoe Bo Ploi, Changwat Kanchanaburi. Corundum deposit was classified in 3 types as follows: soil from weathered basalt, colluvial, and placer deposit. Peat from gravel bed is 35,600±4,200 years before present determined by Carbon-14 dating.

CHAPTER 2

GEOLOGY AND GEOMORPHOLOGY

Regional Geology

Raksasakulwong and Prakobchat (1990; in Thai) surveyed and mapped geology of scale 1:50,000 in the area map sheet 5434 III (Changwat Chanthaburi), 5433 IV (Amphoe Laem Sing) and 5334 II (Ban Khod Hoi) (Figure 2.1). It is described in the detail as follows:

Stratigraphy

This area is covered by both of sedimentary and igneous rocks. The oldest rock is the Noen Po formation, in the Chanthaburi Group, ages in Carboniferous-Permian. Then, it was overlain by the Noen Poo Yai Yua formation, and Pong Nam Ron formation in Triassic. It was followed by the Laem Sing formation deposited in Jurussic-Cretaceous. Finally, Quaternary sediment widely distributed in the low-lying areas.

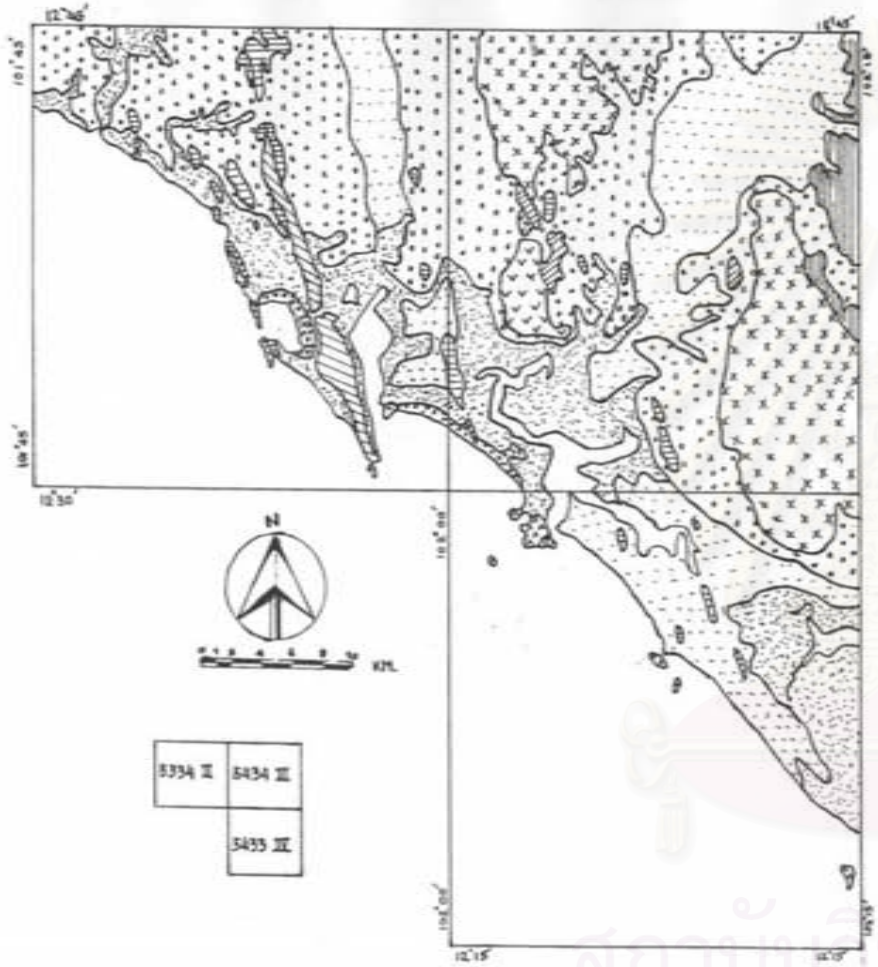
In addition, intrusion of Triassic granite was extensive following previous extrusion of rhyolite during Permo-Triassic, and uplifting of the depositional basin. The last extrusion, however, eruption of basalt occurred in Quaternary. All of these rock units can be described in more detail as follows:

Sedimentary Rocks

1. Noen Po formation

It is the upper lithological fomation of the Chanthaburi Group, which comprises sedimentary rocks and pyroclastic rocks overlying on the lower part i.e. the Bang Kachai formation comprising of black mudstone intercalated with

pyroclastic rock. The Noen Po formation is dominantly composed of massive chert. The section from top to bottom is as follows:



Legend

Sedimentary rocks

Alluvial and flood plain deposits; sand, silt, clay, and gravel

Colluvial deposits; laterite, lateritic soil, clay, and saprolite

Mangrove deposits; peaty clay, black, wood remains, fragments of shells

Beach and barrier deposit; silica sand, fragments of shells

Laem Sing Formation; conglomeratic sandstone, sandstone, reddish brown, light brown, medium to course grained, arkosic and lithic, well bedded, cross bedding, intercalated with mudstone and shale, reddish brown, maroon, with dessication cracks

Pong Nam Ron Formation; Greywacke, greenish gray, fine to medium grained interbedded with mudstone and shale, yellowish brown

Noen Poo Yai Yua Formation; black shale interbedded with siltstone and fine-grained sandstone, well bedded, graded bedding

Noen Po Formation; chert, well bedding, with radiolaria, intercalateed with tuffaceous siltstone, mudstone, and shale, brownish reddish gray

Igneous rocks

Olivine basalt, black, sapphire bearing;

Granite; equigranular and porphyritic texture, quartz, feldspar, biotite and hornblende, K-feldspar phenocrysts

Rhyolite, pinkish, greenish white

Figure 2.1 Geological map of Changwat Chanthaburi (5434 III), Ban Khod Hoi (5334 II), and Amphoe Laem Sing (5433 IV). (after Raksasakulwong, and Prakobchat, 1990)

- chert, thickly bedded
- siliceous mudstone, bedded, intercalated with chert in the upper part
- siltstone
- slate interbedded with shale in various colors
- tuffaceous mudstone, in various colors

Radiolaria sp of the Carboniferous-Permian was found in bedded chert. It is totally 300 meters thick. This formation has been slightly metamorphosed and cut by faults.

2. Noen Poo Yai Yua formation

It prominently consists of shale. It can be divided into 2 parts. The upper one is composed of siltstone interbedded with fine-grained, well-bedded sandstone and also shows graded bedding and load cast, while the lower part is black massive shale. This formation might be an outer fan deposited in deep sea during Triassic.

3. Pong Nam Ron formation

It comprises greenish gray graywacke. It is fine to medium grained and interbedded with yellowish brown mudstone and shale. Fossil has not yet been found in the investigated area but Daonella and Halobia are recorded in the other area. These rocks might be an inner fan deposited in deep sea during Triassic.

4. Laem Sing formation

It consists of conglomerate, fine to coarse-grained sandstone, reddish brown to white siltstone and mudstone. These rocks show well-bedding, well-lamination, cross-bedding, graded bedding, and mud crack. They also overlie unconformably on the Noen Po formation. It might be deposited in Jurassic-Cretaceous.

5. Unconsolidated sediments

They are extensively distributed during Quaternary. They can be distinctly divided into 4 types as follows:

- Alluvial and floodplain deposits: sand, silt, clay, and gravel in both of channel lag sediment and floodplain.
- Colluvial deposits: laterite, lateritic soil, clay and saprolite.
- Mangrove deposits: black clay with plant remains and shell fragments.
- Beach and barrier deposits: silica sand with shell fragments.

Igneous Rocks

1. Granite

Hornblende-biotite Late Triassic granite is widely exposed in 2 main plutons, Khao Sa Bap pluton and Khao Klad pluton. It is equigranular and porphyritic granite that is composed of quartz, K-feldspar, hornblende, and biotite. It is tin-tungsten-barren granite. Hughes and Bateson (1967) have been dated these granite by K-Ar method yielded 190±9 Ma.

2. Rhyolite

It exposes at Khao Proet and nearby-island in the southern part of Laem Sing map sheet. It is pink, green, and yellowish brown with porphyritic texture. Phenocryst is quartz, while groundmass is quartz, feldspar, glass, iron oxide, and mica. Tansathien *et. al.* (1985) reported that it is in Permo-Triassic age.

3. Basalt

It is dark gray to black, vesicular and porphyritic texture. Phenocryst is olivine and pyroxene, while groundmass is plagioclase, pyroxene, and iron oxide.

Barr and Macdonald (1981) dated basalt from Khao Phloi Waen by K-Ar dating yielded 0.44±0.11 Ma. Basalt in this area is gem corundum-bearing basalt.

Structural Geology

This area is a part of a suture zone caused by convergent plate tectonics (Shan-Thai and Indochina cratons) showing complex geological structures (Raksasakulwong and Prakobchat, 1990; in Thai) as follows:

Faults

The main fault trends in NW-SE direction and seems to indicate the suture zone. This causes to the displacement of the stratigraphy of sedimentary rocks at Khao Nong Chim, Khao Din So, and Khao Khod Hoi.

The minor faults trend in N-S and NE-SW direction appearing at Khao Cham Han and Khao Noi respectively.

Folds

There are both anticline and syncline with distinctive appearance in this area. A syncline of the Noen Poo Yai Yua formation can be clearly observed at Khao Nong Chorake. By the way, an anticline of the Noen Po formation apparently appears at Khao Noen Po.

Unconformity

Angular unconformity was found at Khao Nong Go Khon, and Khao Noi Nong Chim. It is remarkably indicated by the contact between the underlying chert bed with dip angle 70-85 degrees, and the overlying volcanic tuff with dip angle 16-20 degrees. Referring to the foregoing stratigraphic description, it is suggested that an angular unconformity occurs between the Pong Nam Ron formation and the Laem Sing formation.

Historical Geology

During Carboniferous-Permian, this area may be seem to be a deep sea with a lot of submarine volcanisms resulting to the deposition of volcanic sediments in the deep basins. While the volcanoes were in abeyance, blackish gray mud deposited instead. Then, the sediments varied to chert, mud and silt, whereas the volcanic sediment was still dominant. All of these sediments might have been deposited in the former subduction zone. As seawater might be very turbid and unsuitable for deposition of carbonate, there was no limestone in this area.

There seems to be active rhyolitic volcanism during Permian and Early Triassic. In addition, the sea might appear to be shallow in the northeast and become deeper in the southwest. The deposition of turbidite fan might have been taken place by turbidity current as the evidences of graywacke in the Pong Nam Ron formation as the inner and mid fan, and blackish gray mudstone interbedded with whitish gray siltstone of the Noen Poo Yai Yua formation as the outer fan.

During Late Triassic, the foregoing depositional basin might have been tectonically uplifted to shallow sea. Following the uplifting, there would be a pervasive intrusion of porphyritic, hornblended-biotite granite. These appear to be the source rocks for sandstone, mudstone, as the Laem Sing formation.

During Cretaceous to Tertiary, The whole area has become a terrestrial environment. Then, fluvial action caused to widespread erosion and deposition. Until 0.4 Ma., the volcanoes erupted at Khao Phloi Waen, as the evidences of gem-bearing basalt.

After the last ice age, the sea level transgressed to 8-10 meters above the present level. This caused to the distribution of marine mud on the margin of the continent.

Economic Geology

There is no record of any significant mineral deposits that associated with granite, except quartz at Khao Noi. Use of laterite is occassionally reported, while glass sand is still not exploited because of the environmental problems. Gem corundum is the only important economic mineral, but gradually depleted.

Gem deposits

Cenozoic basalt in this area, including eastern Chanthaburi and Trat, is related to gem deposit. Barr and Macdonald (1978) concluded that basalt in Thailand could be divided into 3 groups; basanitoid basalts, hawaiitic basalts, and tholeiitic basalts. Basanitoid basalts that include nephelinite, basanite, nepheline hawaiite, and nepheline mugearite, can found corundum, zircon, and the other megacrysts with ultramafic inclusions. These might relate to the magma of basanitoid basalts which results from the partial melting of mantle at 20-30 kilobars.

Corundum is indirectly related to olivine nephelinite, the derivative magma carried corundum from the depth that the pressure is at least 20 kilobars or higher (Sirinawin, 1981). It might be concluded that gem-barren basalt is come from the other magma, which in the depth that pressure is less than 20 kilobars. By the way, it might be vesicular basalt or basaltic tuff in the upper part of basalt that corundum was not found.

Vichit (1988; in Thai) reported that only blue, green, and yellow sapphires have been commonly found at Khao Phloi Waen, Khao Wua, and Ban Bang Kacha. In Amphoe Klung, eastern Chanthaburi, and Amphoe Khao Saming, Changwat Trat, gem corundum has been found in both of ruby and sapphire. By the way, Amphoe Bo Rai, Changwat Trat, only ruby has been commonly found.

Gem corundum is found in 0.3-1.0 meters thick and 3-8 meter deep of basaltic residual soil around Khao Phloi Waen and Khao Wua. It is also found in alluvial deposits at Ban Bang Kacha. Its associated minerals are garnet, pyroxene, phlogopite, zircon, and black spinel.

At present, mining activity in this area is decreasing. During the field investigation, there are only 4 active corundum mines around Khao Phloi Waen and one around Khao Wua. By the way, some local people still dig into the basaltic residual soil at the old mine profile during the dry season, in order to seek the gem corundum that is mostly abandont.

Geology of the study area

Geology of the study area (Figure 2.2) was modified from geological map, scale 1:50,000 sheet 5434 III (Changwat Chanthaburi) compiled by Raksasakulwong and Prakobchat (1990; in Thai) and the study of the geological continuance in eastern Thailand, scale 1:250,000 by Chaodumrong (1992; in Thai). It is briefly summarized as follows:

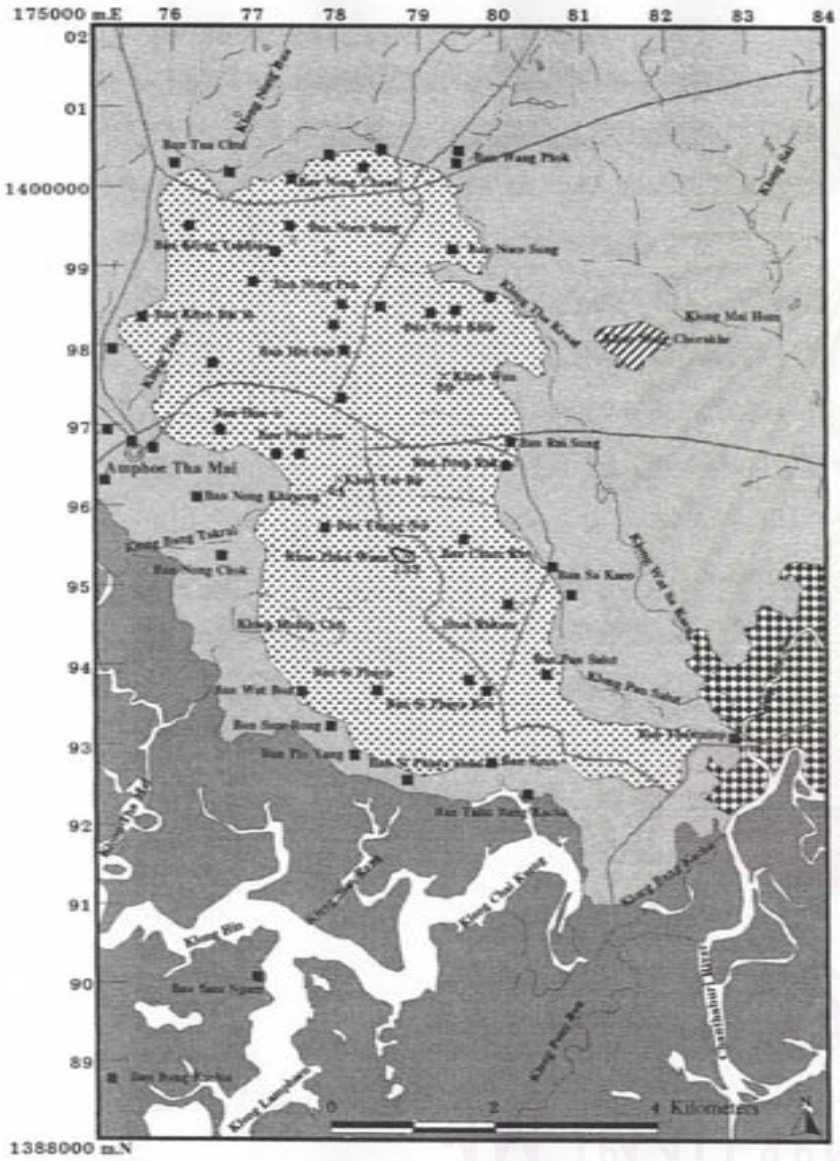
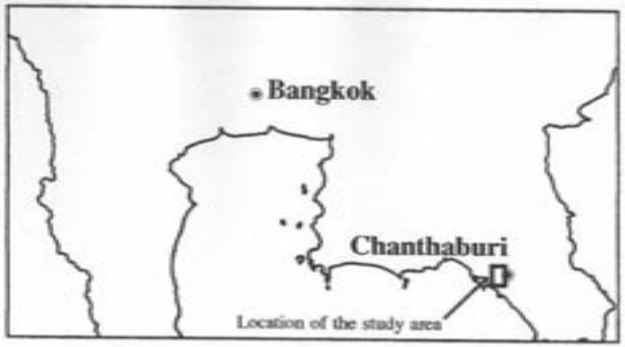


Figure 2.2 Geological map of the study area (modified from Raksasakulwong and Prakobchat, 1990)



EXPLANATION

Sedimentary Rock	Age
Alluvial deposit: sand, silt, clay, and gravel.	Quaternary
Colluvial deposit: laterite, lateritic soil, clay and saprolite.	Quaternary
Mangrove deposit: clay, mud, silt with plant remains and shell fragment.	Quaternary
Noen Po Formation: chert bedded, interbedded mudstone, shale, and tuffaceous sandstone, brown and reddish gray.	Carboniferous–Permian
Igneous Rock	
Basalt: olivine basalt, blackish gray, corundum-bearing, porphyritic and vesicular.	Quaternary

LEGEND

◎	Amphoe (district)	× 135	Spot elevation in meters
■	Ban (village)		100-meter contour
	Hard surface road, 2 lanes up		Stream
	Soft surface road, 1 lane up		River
			Pond

Sedimentary rocks cropped out in the study area are composed predominantly of the Noen Po formation and Quaternary sediments. The Noen Po formation consists mainly of brown and reddish gray, bedded, tuffaceous siltstone, mudstone, and interbedded shale, Carboniferous-Permian ages. It is only exposed at Khao Nong Chorake in the northeast.

Quaternary sediments in this area can be classified into 3 main types.

Firstly, alluvial and floodplain deposits mostly comprise stratified sand, silt, and clay including minor gravel along the upper part of Chanthaburi River and its distributary streams in the central east.

Secondly, colluvial deposit is mainly composed of unstratified rock debris, laterite, clay and saprolite. It is widely distributed in the northern part as the result of the residual from weathering of country rocks.

Thirdly, mangrove deposit covers widely in the southern part and laterally appears to be continuing from the colluvial and alluvial deposits to the coastal area. It consisted of gray to blackish gray clay, mud, and silt, with plant remains and shell fragments. It is continually distributed from the coast to the gulf beneath the sea level at 20 meters (Offshore Mineral Exploration Project of the Gulf of Thailand, 1994; in Thai).

Basalt extensively covers in the north of the study area of about 28 square kilometers extending in N-S direction (Vichit, 1988; in Thai) and overlies on shale, sandstone, siltstone and granite. Olivine, clinopyroxene, and spinel are common phenocrysts. Its chemical composition appears to be high in alkali elements and titanium, but low in silica (Tritrangan, 1992; cited in Chaodumrong, 1992; in Thai).

The Khao Wua basalt is about 10 kilometers from the west-northwest of Chanthaburi. It is about 85 meters high. Its fresh surface still shows clear

vesicular texture, with iron oxide as its amygdules. Clusters of olivine and lherzolite seem to be xenoliths. Minor amount of spinel and phlogopite are also found. Based on Ar/Ar radiometric dating method, Sutthirat *et. al*. (1994) reported that the age of the basalt is 3.0±0.19 Ma.

The Khao Phloi Waen basalt is about 6 kilometers from Chanthaburi in the west. It is about 135 meters high. It might be a part of volcanic plug (Taylor and Buravas, 1926, in Vichit, 1973; in Thai). Its age is 0.44±0.11 Ma by K/Ar dating (Barr and Macdonald, 1981). The surface of basalt on top of the hill is highly weathered to reddish brown soil. Outcrops of the basalt are commonly found in the central of Khao Phloi Waen. The basalt remarkably shows vesicular texture and contains pyroxene megacrysts. It has been assumed that the basalt may have been extruded at least twice (Vichit, 1973; in Thai). According to drilled cutting data, the lower part of basalt is noticeably fine-grained, and overlies disconformably on granite.

Geomorphology of the study area

Geomorphological study has firstly been carried out by means of aerial photograph interpretation. Subsequently, it is followed up careful field investigations. This was extended the area widerly to 352 square kilometers. The total study area appears on 15 aerial photographs including Strip 45 No. 3264-3268, Strip 46 No. 3353-3357, and Strip 47 No. 3392-3396. They cover the area on the topographic map, scale 1:50,000 (sheet 5434 III, Changwat Chanthaburi) between the horizontal UTM grid 174000-190000 m. E and the vertical UTM grid 1384000-1406000 m. N in zone 48.

Based on the foregoing investigation, landforms of the study area are divided into 4 groups in accordance with their origins as shown in figure 2.3.

1. Unit of denudation origin

The landforms in this unit are caused by the denudation of the area. They are the mountainous and hilly areas of the sedimentary and igneous rocks in various ages. These can be divided into 4 types.

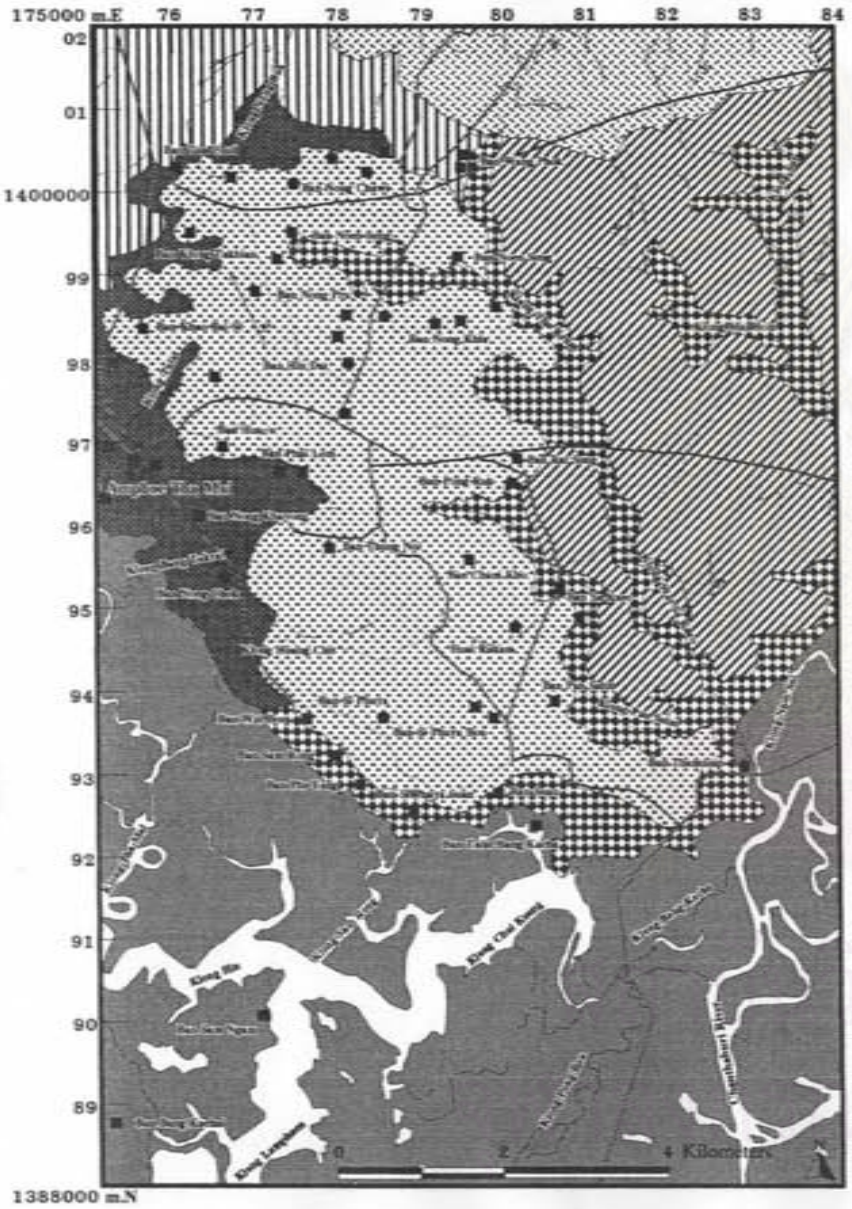
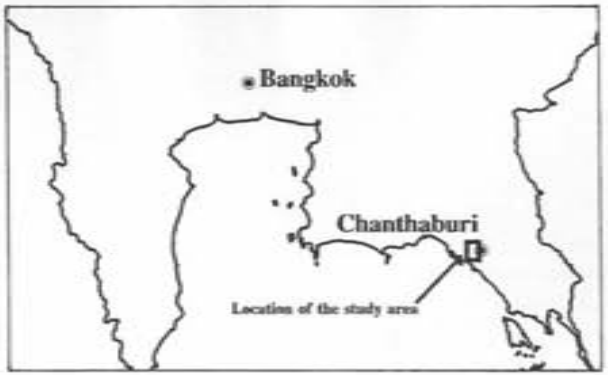


Figure 2.3 Geomorphological map of the study area



EXPLANATION

Unit of denudation origin
- Hilly area of Carboniferous–Permian sedimentary rock
- Hilly area of Triassic granite
- Hilly area of Cenozoic basalt

Unit of colluvial–alluvial origin
- Piedmont plain of colluvial–alluvial deposit

Unit of alluvial origin
- Terrace
- Floodplain

Unit of marine origin
- Tidal flat

LEGEND

- Amphoe (district)
- Ban (village)
- Hard surface road, 2 lanes up
- Soft surface road, 1 lane up
- Geomorphological boundary
- Stream
- River
- Pond
- Slope direction and slope angle

- Hilly area of Carboniferous-Permian sedimentary rocks, bedded chert with limestone lenses, shale interbedded with siltstone and sandstone. It trends in N-S direction with 5-10 degrees of slope. The elevation is from 10-80 meters above the mean sea level of Khao Nong Chorake, and Khao Din So (Figure 2.4 and 2.5).

- Hilly area of Triassic granite, it distributes in the northern part. It is 20-80 meters high with 5 degrees of slope from north to south. Hilly area that widely continues northward is more steep slope and shows distinctively of ridges and valleys (Figure 2.6 and 2.7).

- Hilly area of Cenozoic basalt is in the central west. Its elevation is from 10-136 meters above mean sea level. It exposes at Khao Wua and Khao Phloi Waen, which are assumed to be the volcanic plug. The slope trends from south to the north, while the southern rim is steep slope. This type is encompassed by the piedmont plain in the west and floodplain in the east (Figure 2.6).

2. Unit of colluvial-alluvial origin

The piedmont plain of colluvial and alluvial deposits is the landform that caused by gravitational and fluviatile works. It occurs along the foothill in the west of basaltic area. It is lower than 10 to 20 meters high with gentle slope and undulating character. This unit consists of the rock debris and the sediment in various sizes. Laterite can be found in the enclosing basaltic area.

3. Unit of fluvial origin

The landforms in this unit are caused by the fluvial effect. They can be divided into 2 types.

- Terrace covers in the northwestern area. The elevation is 20-80 meters above mean sea level with 5 degrees of slope. It is composed of the sediment in various size and laterite.

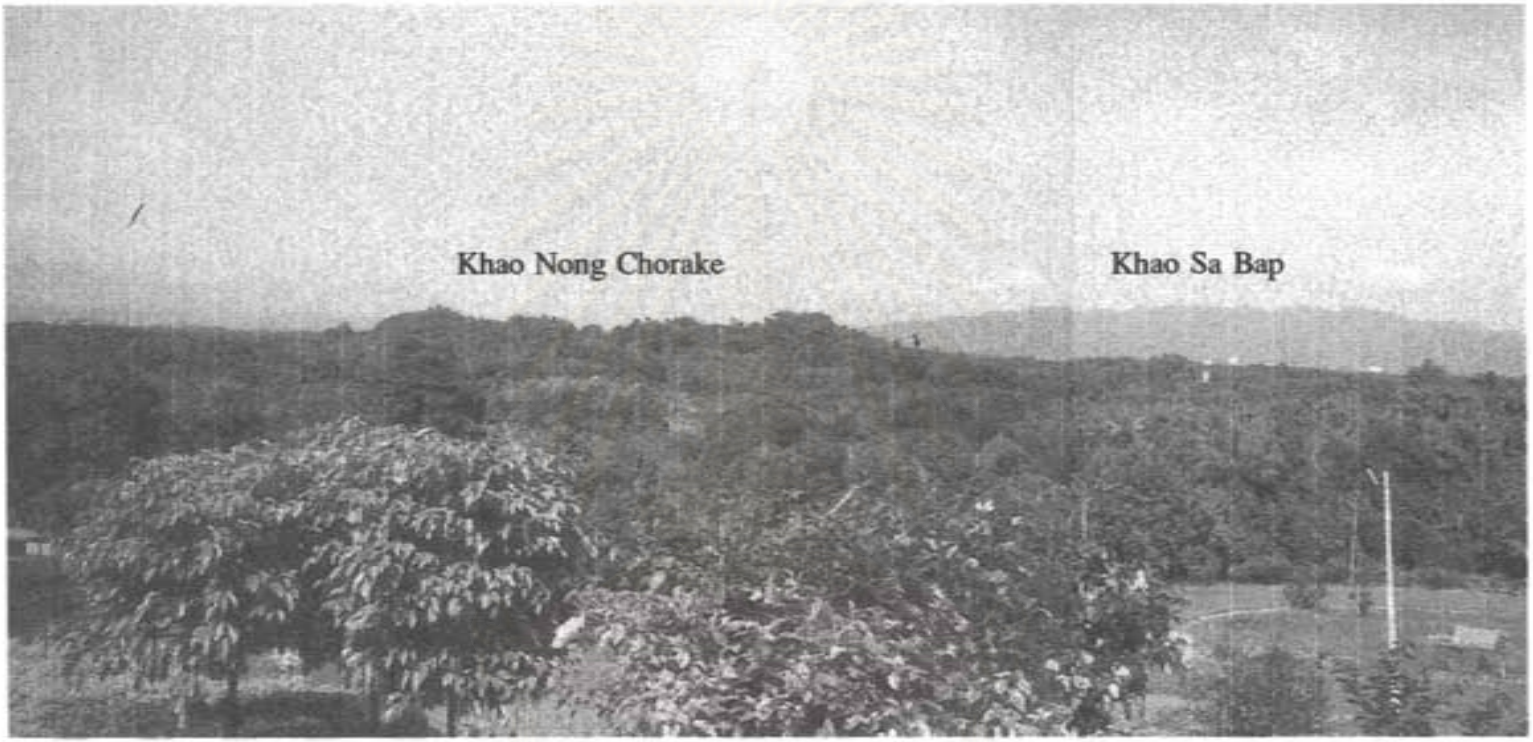


Figure 2.4 Hilly area of Carboniferous-Permian sedimentary rocks and mountainous area of Khao Sa Bap (UTM grid 179320 m.E 1397640 m.N, E-direction)

Figure 2.5 Hilly area of Carboniferous-Permian sedimentary rocks and tidal flat in the southwestern area (UTM grid 177620 m.E 1393780 m.N, SW-direction)

Figure 2.6 Mountainous area of Triassic granite, hilly area of Quaternary basalt, and floodplain in the study area (UTM grid 176926 m.E 1393380 m.N, NE-direction)

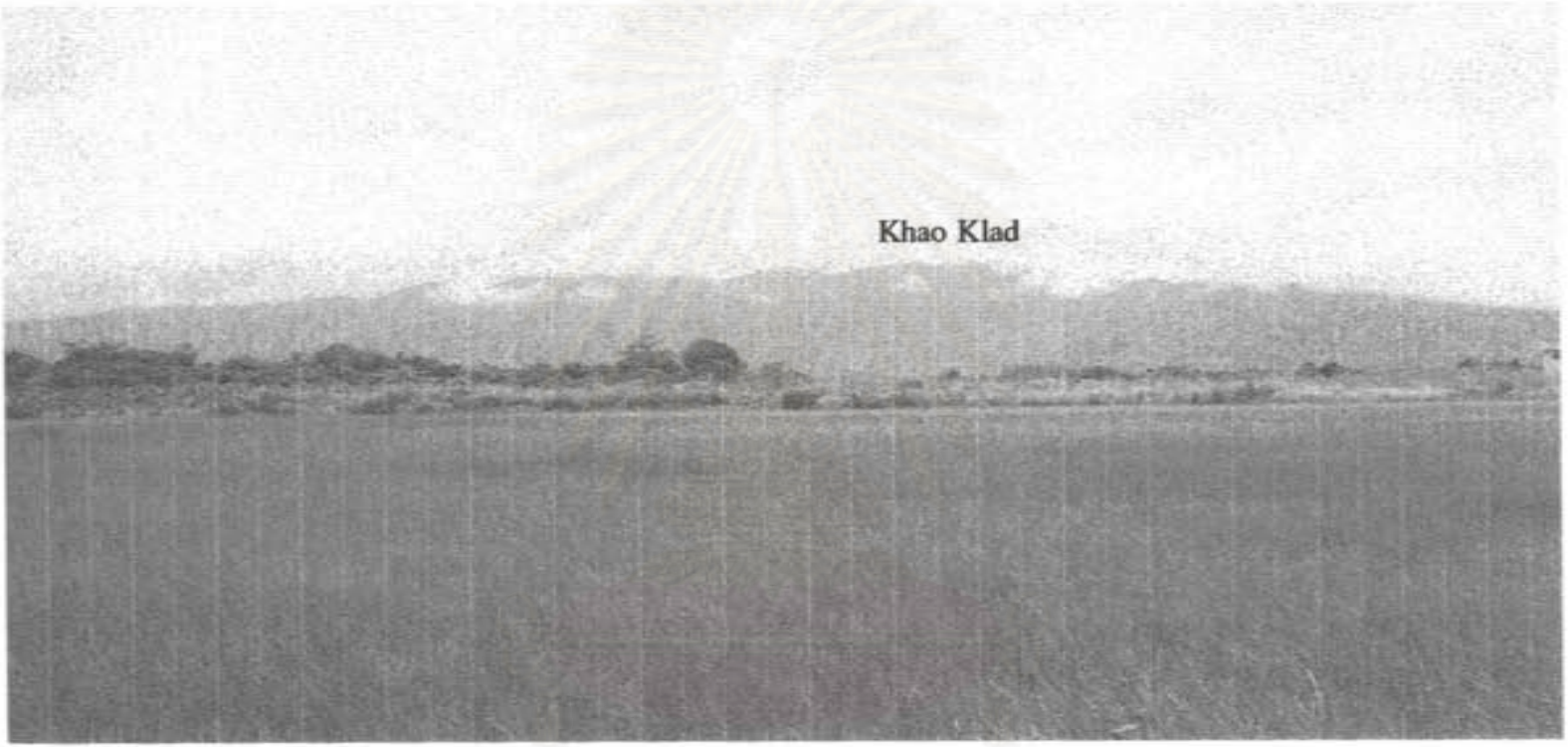


Figure 2.7 Floodplain in the southern area, and Khao Klad, the mountainous area of Triassic granite (UTM grid 181432 m.E 1392220 m.N, N-direction)

- Floodplain that covers widespread in the eastern part, is the narrow area along the banks of Klong Pan Salut, Klong Wat Sakaeo, Klong Chanthaburi, Chanthaburi River and the distributary streams, in the east. This part is narrow in the north and wider in the south. The elevation is lower than 10 meters with nearly flat slope. It comprises sand, silt and clay supplied from the country rocks (Figure 2.6 to 2.9).

4. Unit of marine origin

Tidal flat widely distributes in the southern area. It is effected by marine process. This type consists of marine clay with shell fragment. The elevation is lower than 10 meters with flat to nearly flat slope. The main waterway is Chanthaburi River, contained brackish water. Some gullies, Klong Nam Sai, Klong Bang Kacha, cut the flat area to the islets. The mangrove naturally grows in this area. Besides, the large area of tidal flat is transformed into the blocks of shrimp farm (Figure 2.5 and 2.10).

To continue to the southwest beach is the narrow area with low elevation to the sea level and covers along the coast of the gulf. It is composed of sand with shell fragments.

Figure 2.8 Klong Pan Salut, the recent stream and the river banks (UTM grid 182136 m.E 1394663 m.N, N-direction)

Figure 2.9 Klong Wat Sakaeo, Recent stream and the river banks (UTM grid 180712 m.E 1395399 m.N, SE-direction)

Figure 2.10 Klong Nam Sai runs through the tidal flat in the southwestern area (UTM grid 183100 m.E 1393029 m.N, N-direction)

CHAPTER 3

POTENTIAL OF CORUNDUM-BEARING DEPOSIT

Surficial geology of the study area

The aerial photograph interpretation can help to delineate the landforms on the earth crust. It can correlate and bound the unit of the surficial material to the geomorphological map. The field investigation is the complementary method to correct the boundary. For vertical correlation, banka drilling, pitting, and mine profile studying were done. These all data can correlate to interpret all surficial process in this area. The study area was covered by the residual weathering zone of country rocks and unconsolidated sediment in the various environments.

In field investigation, samples were collected from pitting, banka drilling, and mine profile sampling. They were described and logged in the field. All of them is sampled and treated in laboratory. Samples were separated into gravel, sand, silt, and clay sized by sieve analysis and pipette method. This lithological description below is based on the laboratory result.

1. Residual weathering zone of the source rocks

The surficial materials in the field study derived from the source rocks, which consisted of basalt, granite, shale, phyllite, quartzite, chert and tuffaceous sandstone. Outcrop of basalt, granite, shale, and phyllite only exposes with high weathering. The weathering profile of these rocks is similar and divided into 3 zones by the degree of weathering. They are soils, residual deposits, and weathered country rocks.

1.1 Materials derived from argillaceous rocks

Residual shale and phyllite was found in the central east and southwest. The weathering profiles of argillaceous rocks in this area like shale, slaty shale, and phyllite were studied at Khao Nong Chorake, and Khao Din So. These can be classified into 3 zones (Figure 3.1 a and b) as follows:

- Argillaceous soil (AS)

It is highly weathered from argillaceous rocks. It is bright reddish brown (5YR5/6) and pale reddish orange (2.5YR7/3) clay and silt. Gravel and plant remains were found on the surface to 0.5 meter depth. Rock fragments can found slightly. It is soft and friable.

- Arigillaceous residual deposit (ARD)

It is caused by the residual weathering of argillaceous rocks. It is mostly composed of is bright reddish brown (5YR5/6) and dark reddish brown (5YR3/4) clay and silt that vary in color. Sandy clay occasionally interbedded. Rock fragments are commonly found with the remained texture of argillaceous rocks.

- Weathered argillaceous rock (WA)

It is slightly to moderately weathered of argillaceous rocks like claystone and siltstone. The upper part is soft and firm with mottle color. The lower part is slightly weathered. It is grayish red (10R6/2), dark reddish brown (5YR3/4) and very dark reddish brown (5YR2/4) shale, slaty shale, and phyllite with lamination. Thin bedded siltstone, and sandstone, including quartz vein are found.

1.2 Materials derived from granitic rock

It exposed only in the northern area. The weathering profile was studied and similarly divided into 3 zones (Figure 3.2) as follows:

- Granitic soil (GS)

It is pale reddish orange (2.5YR7/3) soil. It is composed of silt to quartzitic fine sand with plant remains. Quartz gravel is rarely found. It is slightly compacted on the surface but loose in the lower part.

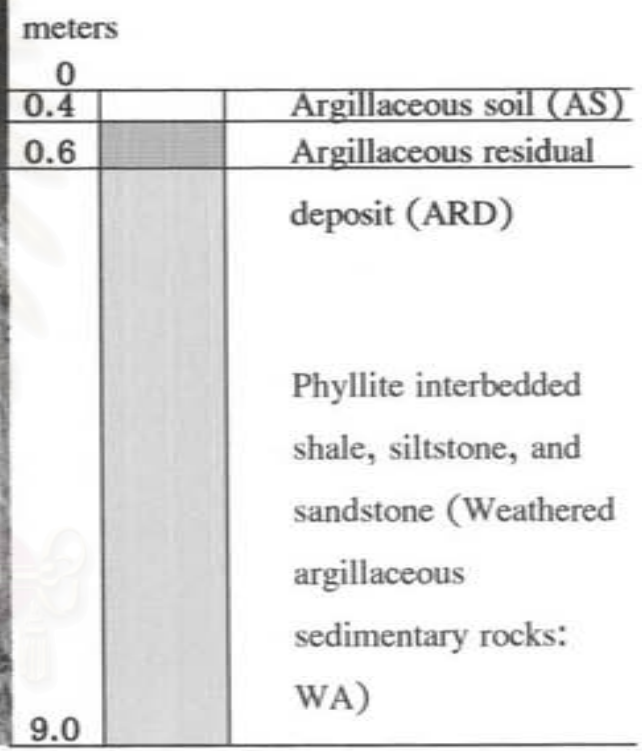


Figure 3.1a Weathering profile of argillaceous sedimentary rocks (UTM grid 181860 m.E 1399029 m.N, NW-direction)

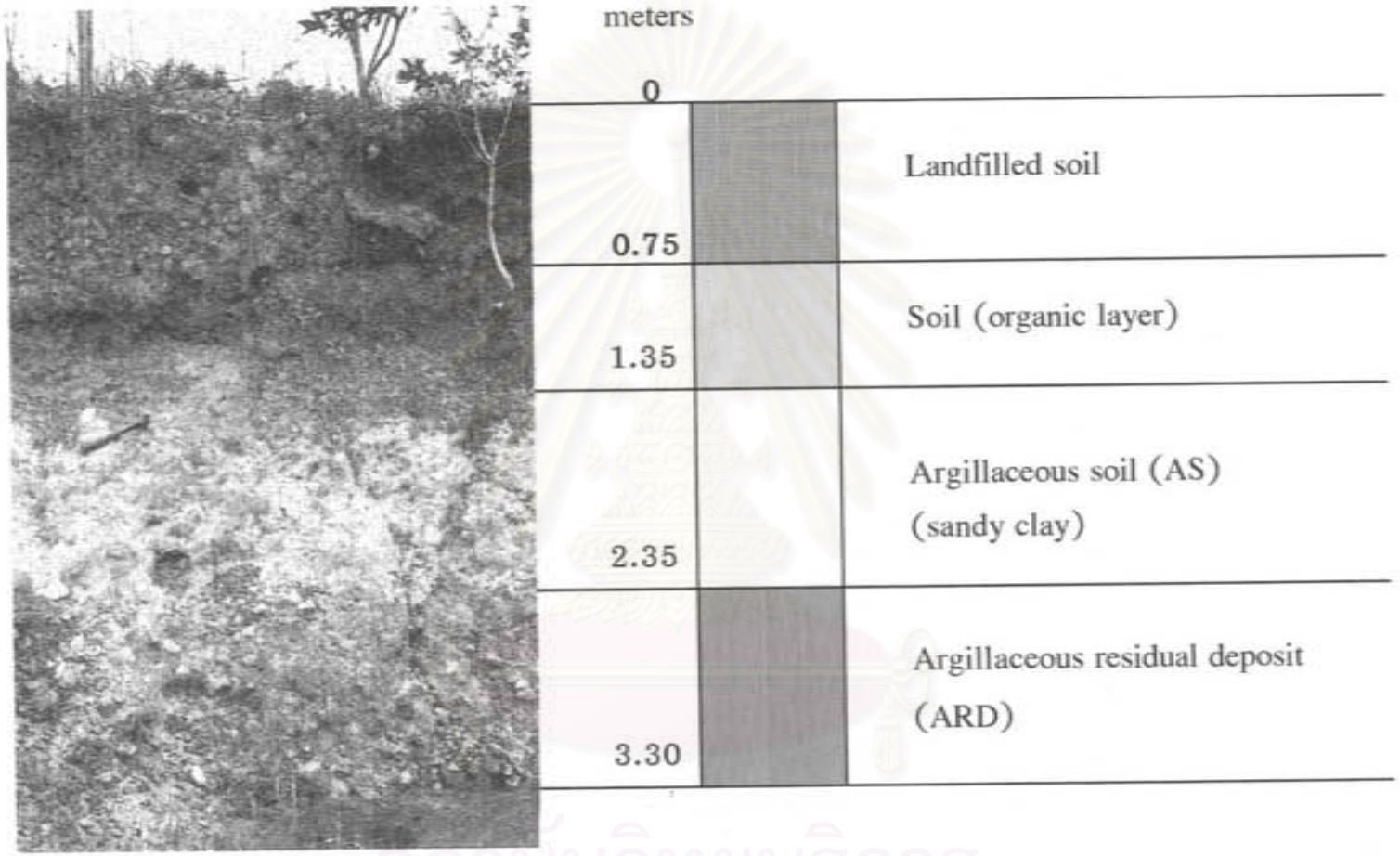


Figure 3.1b Weathering profile of argillaceous sedimentary rocks (UTM grid 181690 m.E 1398580 m.N, E-direction)

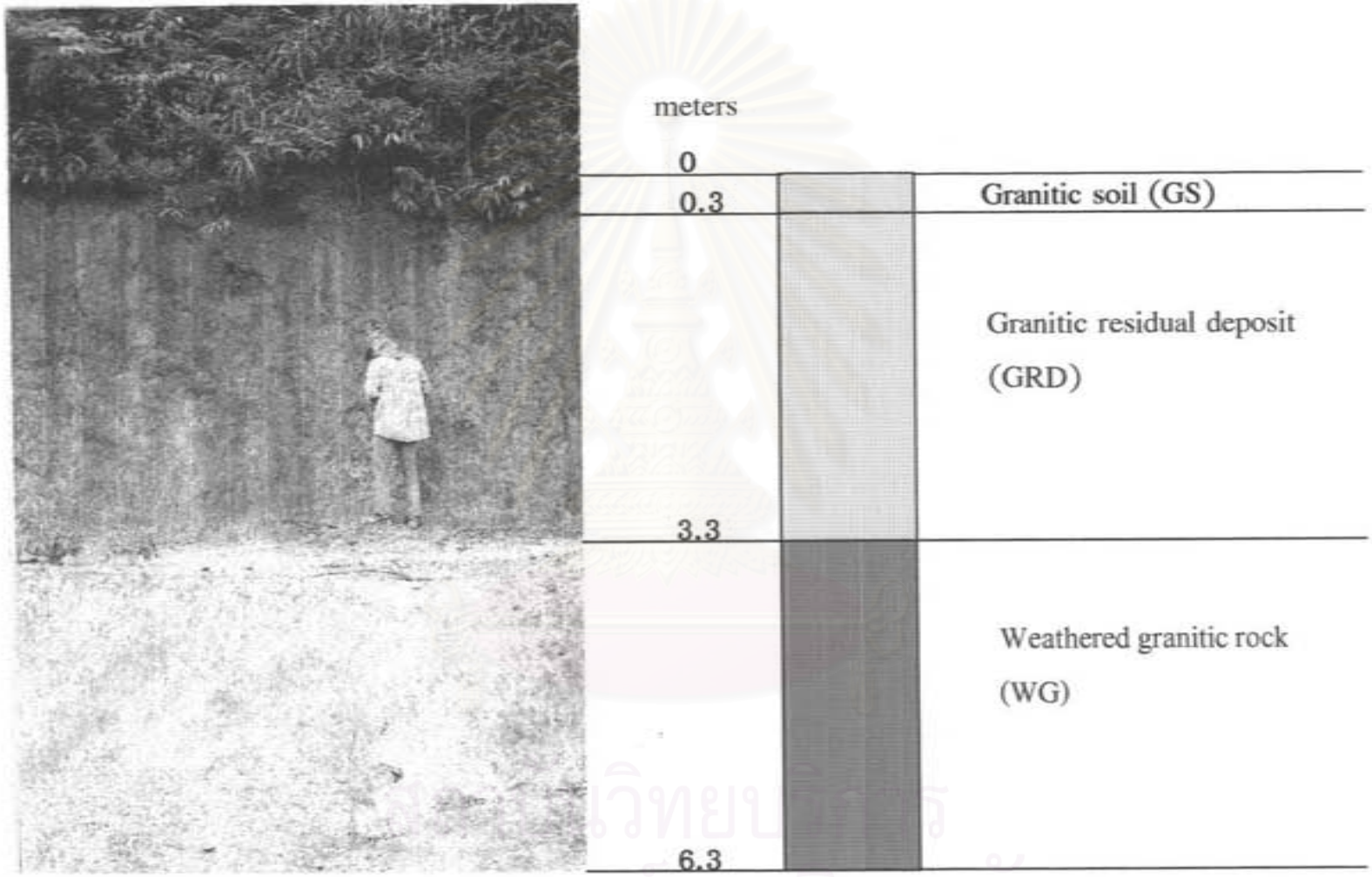


Figure 3.2 Weathering profile of granitic rock (UTM grid 182420 m.E 1401230 m.N, N-direction)

- Granitic residual deposit (GRD)

It is reddish brown (10R5/3) to red (7.5R4/6) with mottle color. It mainly comprises quartz gravel and silt, while quartzitic sand is scarcely found.

- Weathered granite (WG)

Quartzitic gravel, K-feldspar, dark minerals, and rock fragment with phaneritic texture are found. It is light gray (7.5YR8/1) to grayish red (10R6/2) with pale reddish orange (2.5YR7/3) mottled. It is loose in the upper part and firm in the lower part.

1.3 Materials derived from basaltic rocks

It widely distributes in the central area. Many basaltic weathering profiles were studied at the corundum mine profiles and the pitting. It is subdivided into 3 zones (Figure 3.3 to 3.6), like argillaceous and granitic rocks as follows:

- Basaltic soil (BS)

It is extremely weathered from basalt. The surficial soil was slightly moved to the foothill. It is dark red (10R3/6) silt, and fine sand, with some spheroidal weathering basaltic fragments, and pisolite. Ferromagnesian minerals such as pyroxene, magnetite, ilmenite were found. The thickness of basaltic soil is 0.6-6.0 meters at Khao Phloi Waen and 1-5 meters at Khao Wua.

- Basaltic residual deposit (BRD)

It occurred from weathered basalt that still has basaltic texture. It is dark red (10R3/6) silt and fine sand with more sphere basaltic fragments, pisolite, and ferromagnesian minerals, including corundum. Sphere basaltic fragment with iron oxide is locally called as “Look Lon” that is the indicator for corundum exploration. The lower part partially developed to hard pan laterite especially in the

southwestern area of Khao Phloi Waen, and the western area of Khao Wua. This zone is 0.15-10.0 meters thick at Khao Phloi Waen and 0.7-6.0 meters thick at Khao Wua.

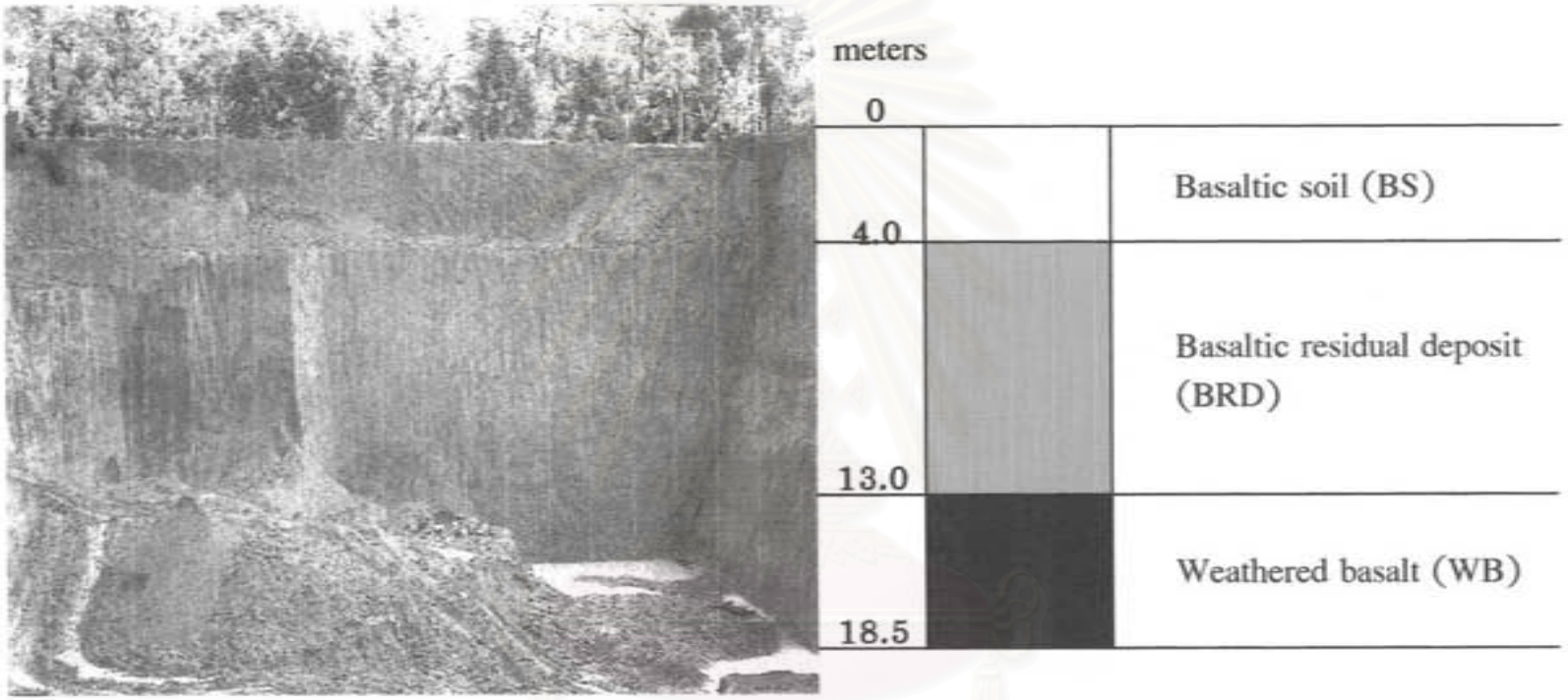


Figure 3.3 Weathering profile of basaltic rock at Khao Phloi Waen (UTM grid 179650 m.E 1397850 m.N, NW-direction)

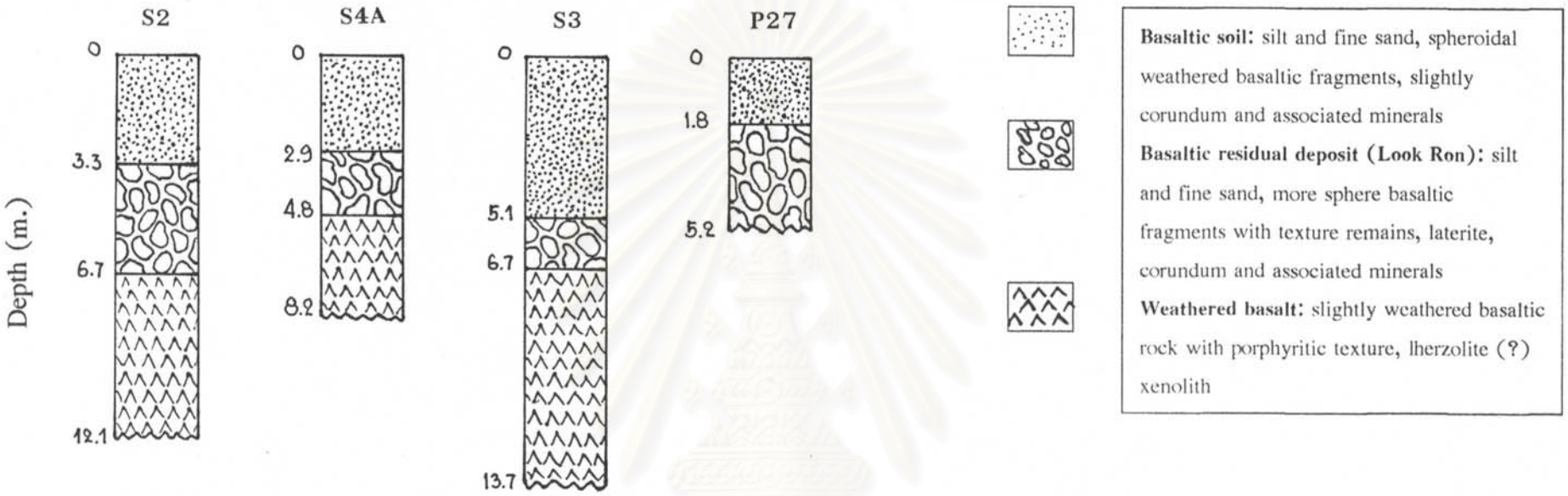


Figure 3.4 Quaternary succession at Khao Phloi Waen

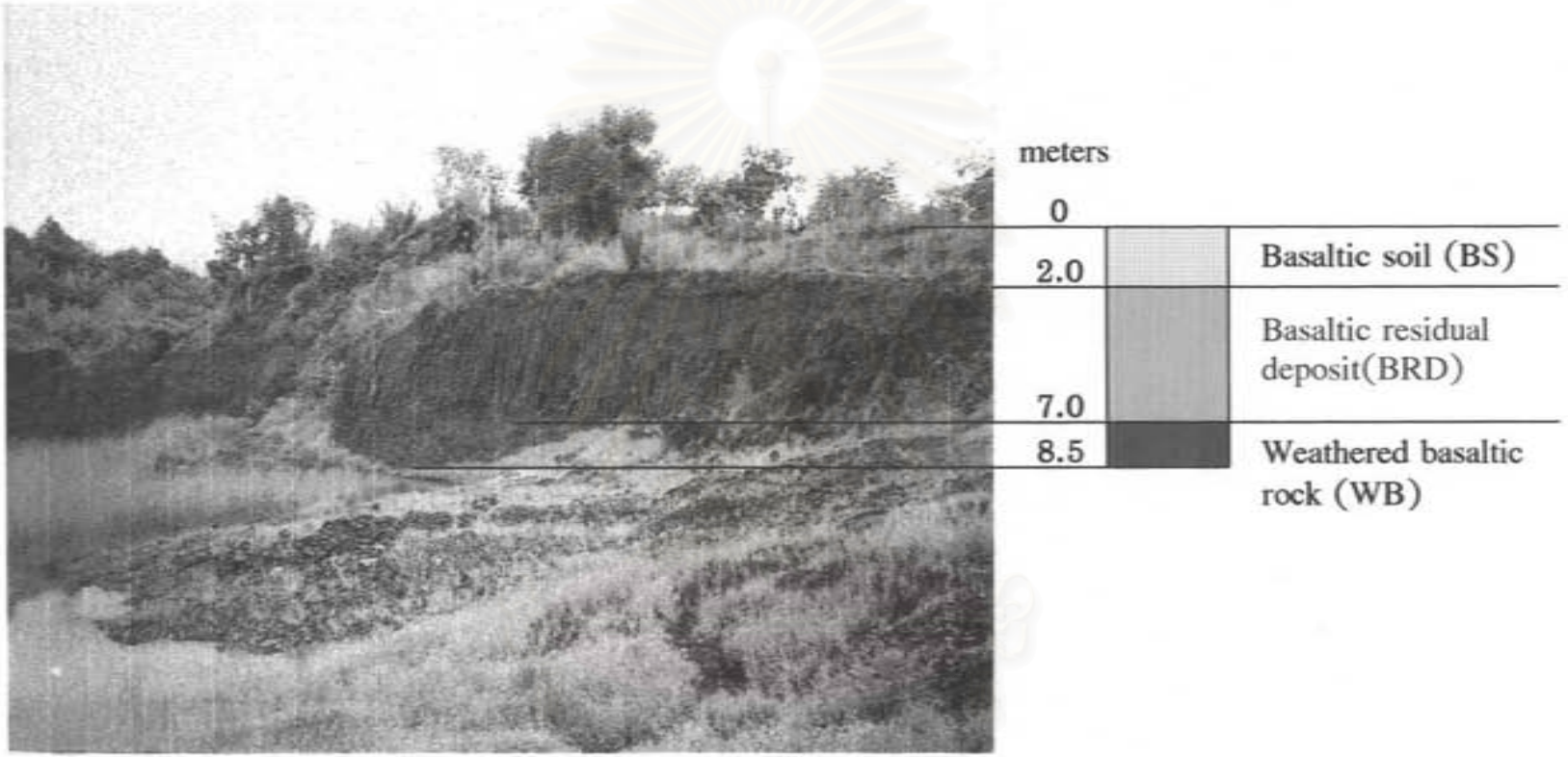


Figure 3.5 Weathering profile of basaltic rock at Khao Wua (UTM grid 178900 m.E 1398206 m.N, SW-direction)

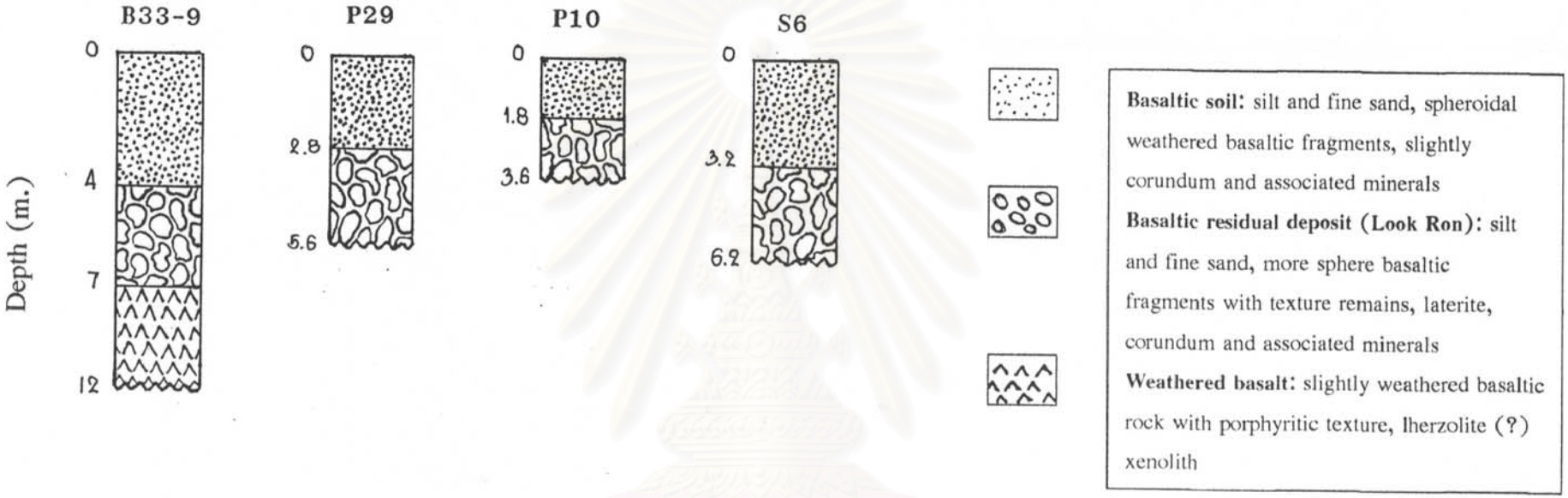


Figure 3.6 Quaternary succession at Khao Wua

- Weathered basalt (WB)

It is grayish white (N7/0) to gray (N5/0) with mottle texture. It is mainly composed of silt and rock fragments. Slightly weathered basalt in the lower part has porphyritic texture, with pyroxene, and olivine phenocryst. Lherzolite (?) also found as xenolith.

2. Unconsolidated sediment

It extensively superimposes in the study area. It is effected from both fluvial and marine processes that can be divided into 3 types by the surficial appearance.

2.1 Colluvial-alluvial deposit

It consists of gravel, sand, silt, and clay with laterite. It is in the piedmont plain at Ban Hua-u and its vicinity. Granite, basalt is the source of the sediment transported along this stream. According to banka drilling and test pitting data, the section was classified into 3 layers (Figure 3.7).

(a) Clay and gravel

It is grayish red (7.5R6/2) to dark red (10R3/6). It is composed of clay in 60-80 percents, and gravel in 20-40 percents. Gravel is 2-3 millimeters in size of diameter. It is subround and high sphericity of basaltic gravel, angular to subangular, low sphericity of lateritic, and quartzitic gravel. The sediment is poor sorting, and quite stiff. It is 1-2 meters thick. Corundum, and pyroxene, garnet, and zircon were found.

(b) Clay, sand and gravel

It is dull reddish orange (10R6/4) to bright brown (2.5YR5/8). It consists of clay in 70-80 percents, sand and gravel in 20-30 percents. Gravel is subangular

to round, low sphericity of lateritic gravel and quartz. It is 2-3 millimeters in size of diameter. The sediment is poorly sorted and cemented with iron oxide. This layer is 1-8 meters thick. Laterite is slightly developed. Corundum, pyroxene and garnet were found.

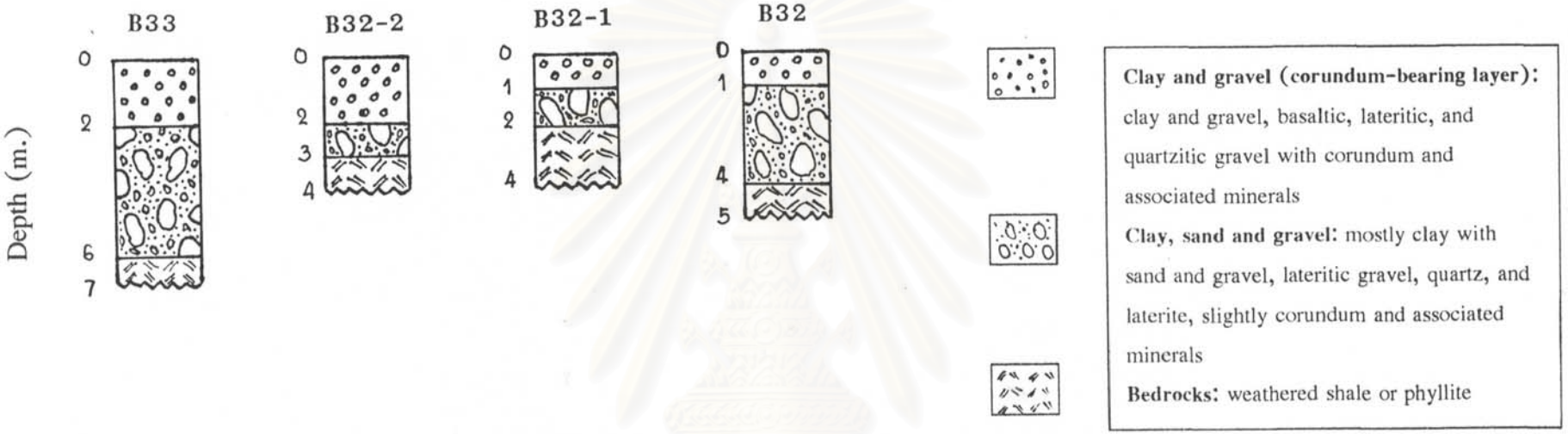


Figure 3.7 Quaternary succession at Ban Hua-u

Both of these sedimentary layers are quite similar with little difference. The criteria is based on color, content of clay to gravel, type of the gravel (sources of the sediment).

(c) Bedrock

It is highly weathered shale or phyllite with light yellowish orange (7.5YR8/4) in color.

2.2 Alluvial deposit

It covers in the floodplain of 2 streams, Klong Pan Salut and Klong Wat Sakae, in the east of basaltic area. They join together at Ban Tham Niab and run through Chanthaburi River in the south. Granite, basalt, and shale are the sources of sediment. The sediment from both streams is slightly different as follows:

Klong Pan Salut

It is the boundary of basalt and argillaceous rocks. Sediment is from the south of Khao Wua, the north and east of Khao Phloi Waen, and the west of argillaceous area. It can be divided into 3 layers (Figure 3.8).

(a) Sandy gravel

It is gray (N4/0) to reddish gray (5R5/1). It is various in size, which comprises gravel more than 35 percents, sand less than 35 percents, and silt less than 25 percents and clay. Gravel is iron concretion, and lateritic gravel, chert and shale fragments. It is angular to subangular, low sphericity. The sediment is poor sorting, and stiff. This layer is generally 2.5-8.0 meters thick. Corundum and associated minerals were found.

(b) Silty gravel

It is light gray (7.5YR8/1) to dull orange (5YR3/4). It is composed of silt less than 25 percents, gravel more than 40 percents with sand and clay. Gravel is iron concretion, pisolite, basaltic and lateritic gravel, including granite, chert and shale fragments. It is angular to subround. The sediment is poor sorting, and

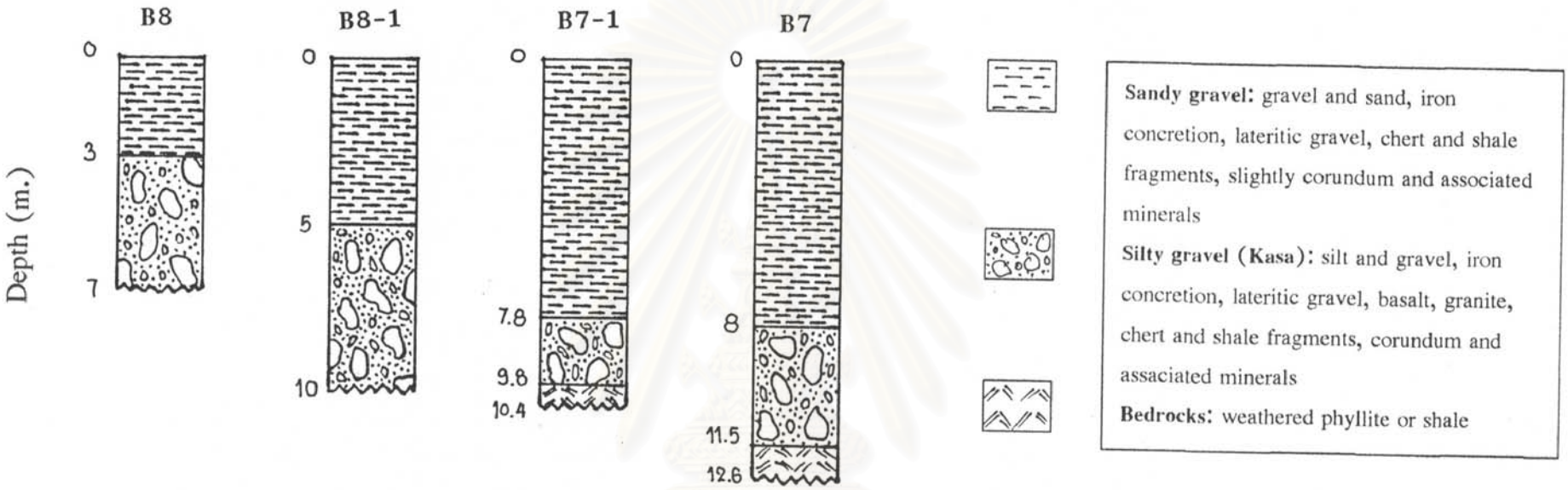


Figure 3.8 Quaternary succession at Klong Pan Salut

quite stiff. This layer is 2-5 meters thick. Lateritic gravel, corundum and associated minerals were found more densely than the upper layer.

(c) Bedrock

The extremely weathered phyllite or shale is light gray (7.5YR8/1) to dull orange (5YR3/4) clay with layered rock fragments.

Klong Wat Sakaeo

The source of sediment is basalt from Khao Wua and the argillaceous rocks in the west, including granite from the north. The sediment profile is classified into 3 layers (Figure 3.9)

(a) Clay with sand and gravel

It mostly consists of dull reddish orange (10R6/4) to dark red (10R3/6) clay with less than 10 percents of fine sand, and/or gravel in 5-25 percents. It is more gravel in the upper stream. It is resemble and can be correlated to the first layer from Klong Pan Salut. Gravel is lateritic gravel, iron concretion, chert, and siltstone fragments, including quartz. It is subangular to round, low sphericity. This layer is 1-5 meters thick. Corundum and associated minerals were rarely found.

(b) Sand and gravel/Sand, gravel with clay

It is light gray (7.5YR8/1) to dull orange (5YR3/4) sand gravel, with slightly clay. Gravel is iron concretion, basaltic and lateritic gravel, quartz, chert and shale fragments. It is angular to subround with low sphericity and poor sorting. It can be correlated with the second layer of Klong Pan Salut profile. Their characteristics are the same. It is 5.0-7.5 meters thick. There are some corundum and associated minerals that deposited densely in the lowermost of this layer.

(c) Bedrock

It is the phyllite, shale, and tuffaccous sandstone, which is highly weathered to clay and rock fragments.

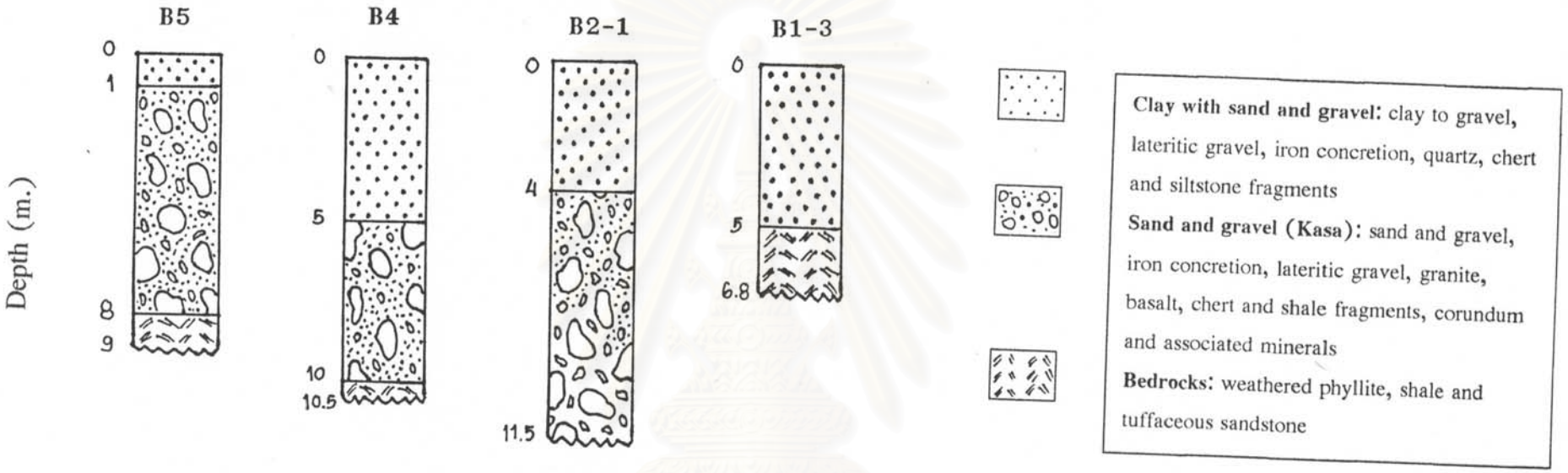


Figure 3.9 Quaternary succession at Klong Wat Sakaeo

2.3 Mangrove deposit

Mangrove deposit widely distributes in the tidal flat area from the central west to the south of this area, and continues to the coast. This area is effected by marine and fluvial work. It resulted to the contamination of marine and fluvial sediments. The surface sediment is dark clay and mud of marine environment that suit for mangrove plants, and used for shrimp farm. From banka drilling, mangrove deposit overlain alluvial deposit. The depositional environment changed from fluvial to marine environment. It indicates to the transgression of sea level. Mangrove deposit is divided into 2 subareas.

1) Ban Nong Khayong-Ban Wat Klang

It is in the middle west of the study area or the south of Amphoe Tha Mai. Sediment profile is classified into 4 layers (Figure 3.10) as follows:

(a) Mangrove deposit

It mostly consists of dark purplish gray (5RP3/1) to black (N1.5/0) and gray (7.5Y4/1) silt, and clay, with little fine sand. Plant remains and shell fragments were commonly found. Gravel was scarcely found as like as corundum and associated minerals. This layer is 0.5-4.0 meters thick.

(b) Underlain basalt

It supposed to continue from Khao Phloi Waen basalt. It approximately distributed in 2 square kilometers. It is extremely weathered to bright brown (2.5YR5/8) to grayish white (N7/0) basalt fragments, silt, sand and laterite. Corundum, zircon and pyroxene were found densely. This layer is 0.7-6.5 meters thick.

(c) Silty sand

It is bright brown (2.5YR5/8) mottled in red (10R4/8) sand more than 45 percents. The rest is silt and gravel in the same proportion. Gravel is quartz, lateritic gravel and shale fragment with angular to subround shape, low sphericity

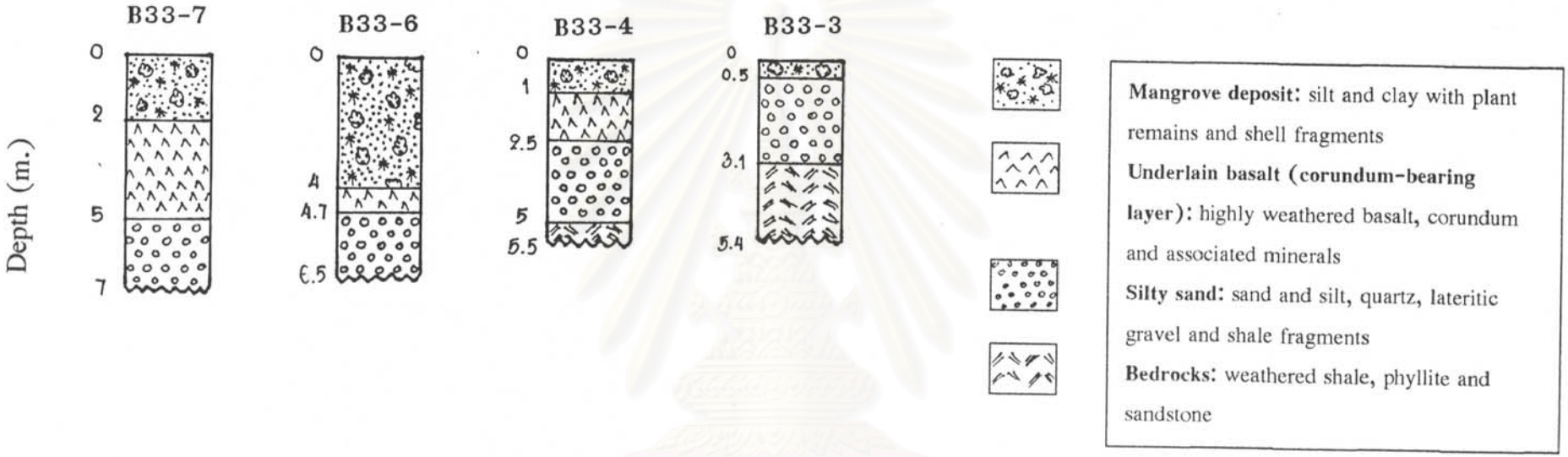


Figure 3.10 Quaternary succession at Ban Nong Khayong

and poorly sorting. Laterite was regularly found. This layer is 1.8-6.0 meters thick. This layer lies beneath basaltic layer so corundum and the associated minerals have not been found. It might be the sediment by fluvial process before the volcanic eruption of Khao Phloi Waen or the weathered surface of the country rocks.

(d) Bedrock

It is weathered shale, phyllite and sandstone.

2) Ban Wat Klang-Ban Bang Kacha

It widely covers in the southern area of Khao Phloi Waen basalt to the Chanthaburi estuary. The profile is ordered in 5 layers (Figure 3.11).

(a) Mangrove deposit

It is dark purplish gray (5RP3/1) to black (N2/0) and dark greenish gray (7.5GY4/1) to gray (7.5Y4/1) silt, clay and sand. Plant remains and shell fragments were commonly found, while gravel is rarely. This layer is 2-8 meters thick.

(b) Sandy gravel

Due to banka drilled samples, this layer can be found in the eastern part of tidal flat area. It consists of sand and gravel. Gravel is iron concretion, laterite gravel and shale fragments. It is slightly developed to laterite. It is correlated to the sandy gravel layer of the first layer in Klong Pan Salut and Klong Wat Sakaeo areas. Corundum and associated minerals were not found.

(c) Silty sand

It is mostly composed of sand and silt with few gravel of quartz, basaltic and lateritic gravel, iron concretion. It is slightly developed to laterite. This layer can be correlated to the second layer of Klong Pan Salut and Klong Wat Sakaeo,

although gravel is more scarcely found in this layer. Corundum and associated minerals are also found. It is 1-7 meters thick.

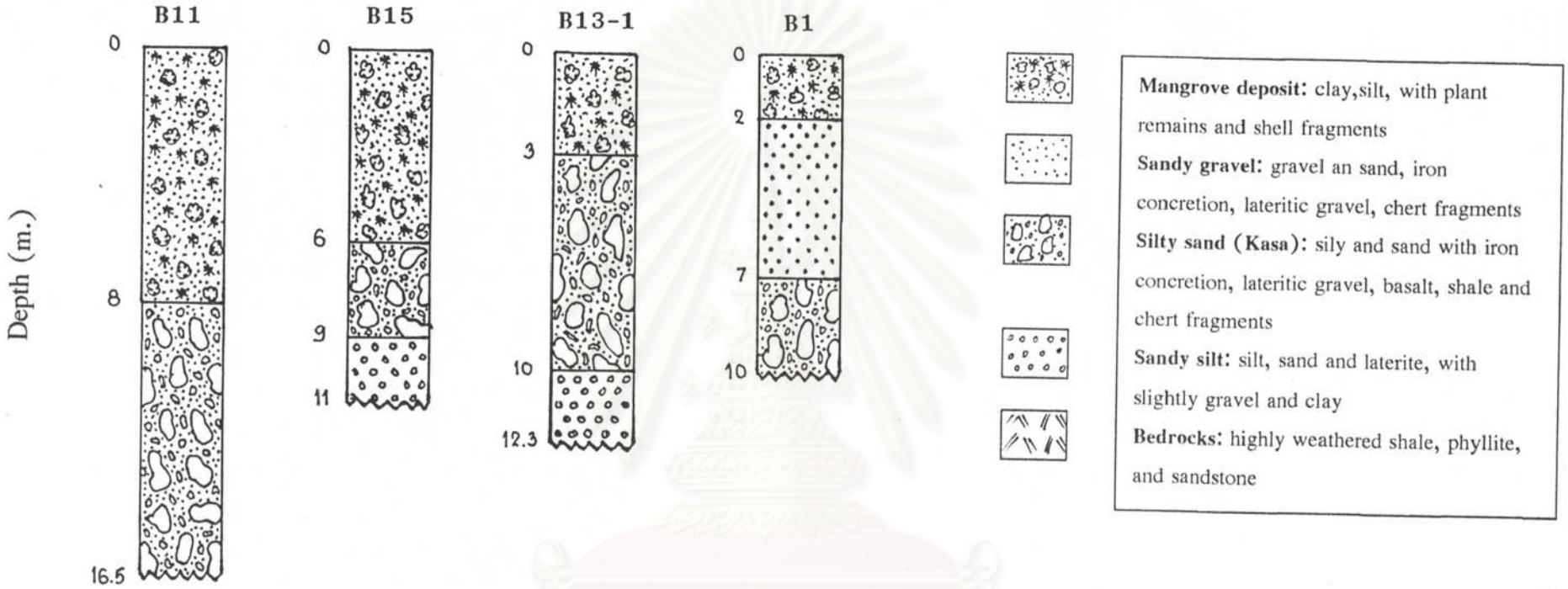


Figure 3.11 Quaternary succession at Ban Bang Kacha

(d) Sandy silt

It variably comprises bright brown (2.5YR5/8) silt more than 40 percents, sand more than 35 percents and gravel in 10-15 percents and clay. Laterite is usually found. This layer is 1-8.5 meters thick, and thicker southward. Corundum and associated minerals were not found. This layer can be correlated to the silty sand layer (the third layer) of Ban Nong Khayong that might be the fluvial sediment before the volcanic eruption, or the weathered surface of the country rocks.

(e) Bedrock

It is highly weathered shale, phyllite, and sandstone.

Corundum Deposit

The famous corundum deposit of Thailand is Khoa Phloi Waen, in the study area. Corundum mostly found around the foothill, which densely deposited in the basaltic residual deposit (BRD). Some were transported and deposited with the associated minerals such as pyroxene, zircon, garnet, etc. They were deposited in the gravel bed along the stream not far from the hill.

By field investigation, 75 banka drilled holes, 21 test pitted holes, and 7 mine profiles were done (Figure 3.12) that the sediment samples were collected and proved. Corundum and associated minerals were separated from the samples in order to calculate the quantity. By the sedimentary correlation, corundum was deposited in both of residual deposit and placer deposit.

Corundum residual deposit

Khao Phloi Waen basalt is corundum-bearing basalt, which is the easily weathered rocks, moreover weathering rate in Chanthaburi is high that caused by

the climate (Hughes and Bateson, 1967). That why the weathering zone of basalt in this area very thick. Due to mine profile, basaltic weathering profile can be classified in to 3 zones, basaltic soil (BS), basaltic residual deposit (BRD) and weathered basalt (WB). Basaltic soil is highly weather from basalt and slightly moved, while

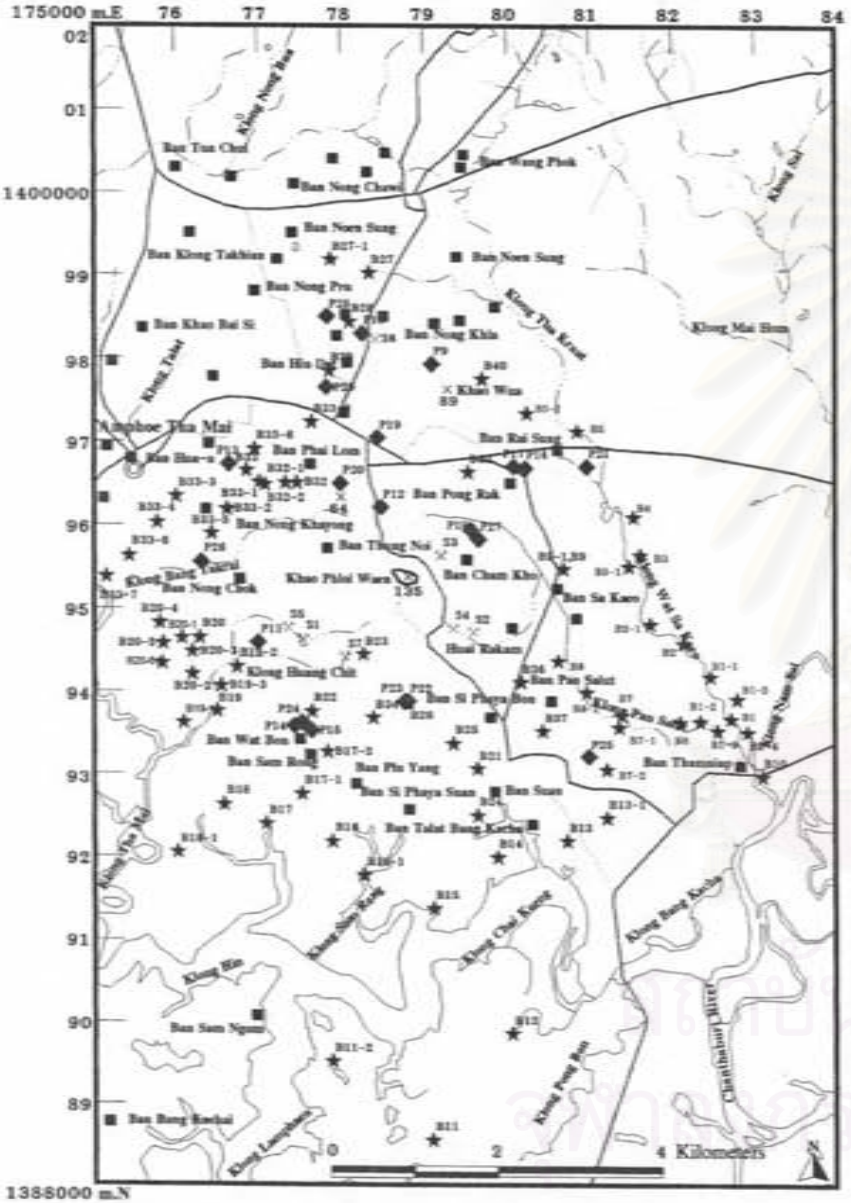
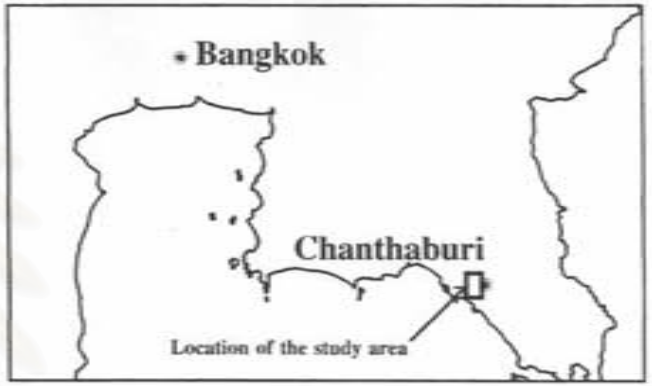


Figure 3.12 The position of Banka drilling, test pitting and mine profile in the study area



LEGEND

◎	Amphoe (district)	135	Spot elevation in meters
■	Ban (village)		100-meter contour
——	Hard surface soad, 2 lanes up	~~~	Stream
	Soft surface road, 1 lane up	~~~	River
◆	Test pitting position		Pond
★	Banka drilling position		Mined section position

basaltic residual deposit is the highly residual weathered basalt to be soil with basalt fragments and iron concretion that locally call “Look Ron” (Vichit, 1992).

Generally, corundum mining in this area was mostly done in basaltic residual deposit. Although, corundum was found with the associated mineral were deposited in all 3 zones but more densely in basaltic residual deposit (BRD). This layer might be the leaching zone of iron (Fe) from the upper zone. Due to the iron illuviation, and the erosion and transportation of soil in the upper zone, it effects to lose the soil volume. Corundum and the associated minerals are loose in basaltic soil, and the infilltration might carry the minerals to depth. These result to settle easily downward to basaltic residual deposit by their gravity. Corundum that still remained in basaltic soil (BS) is quite small. While weathered basalt (WB) is still hard and corundum was not isolated from basalt. Therefore, corundum and associated minerals were deposited scarcely in these 2 zones.

Basaltic residual deposit (BRD) is thick around the foothill of Khao Phloi Waen and Khao Wua. It is thinner when it is far from the hill. By mine profile, this layer is 0.15-10.0 meters thick around Khao Phloi Waen and 0.7-6.0 meters thick around Khao Wua. It also might be developed to laterite, which is hard, compacted and firm. By banka drilling, corundum and the associated mineral were found in basaltic residual deposit (BRD) at more than 10 meters deep. The correlated profile of Khao Phloi Waen is shown in figure 3.13 and Khoa Wua in figure 3.14.

Corundum placer deposit

Although corundum was deposited in basaltic residual deposit, there is corundum placer deposit in the study area. Corundum and the associated minerals were transported and deposited with the alluvial sediments.

Generally, corundum and the other heavy minerals were deposited together with basaltic gravel (locally call “Hin Ka Bok”) and the fragments of the other country rocks. The mineral-bearing gravel bed that overlain bedrock, generally is called “Kasa”. Besides, these minerals is bigger in the upstream and smaller than in the downstream. The quantity of these minerals also decreases to the downstream.

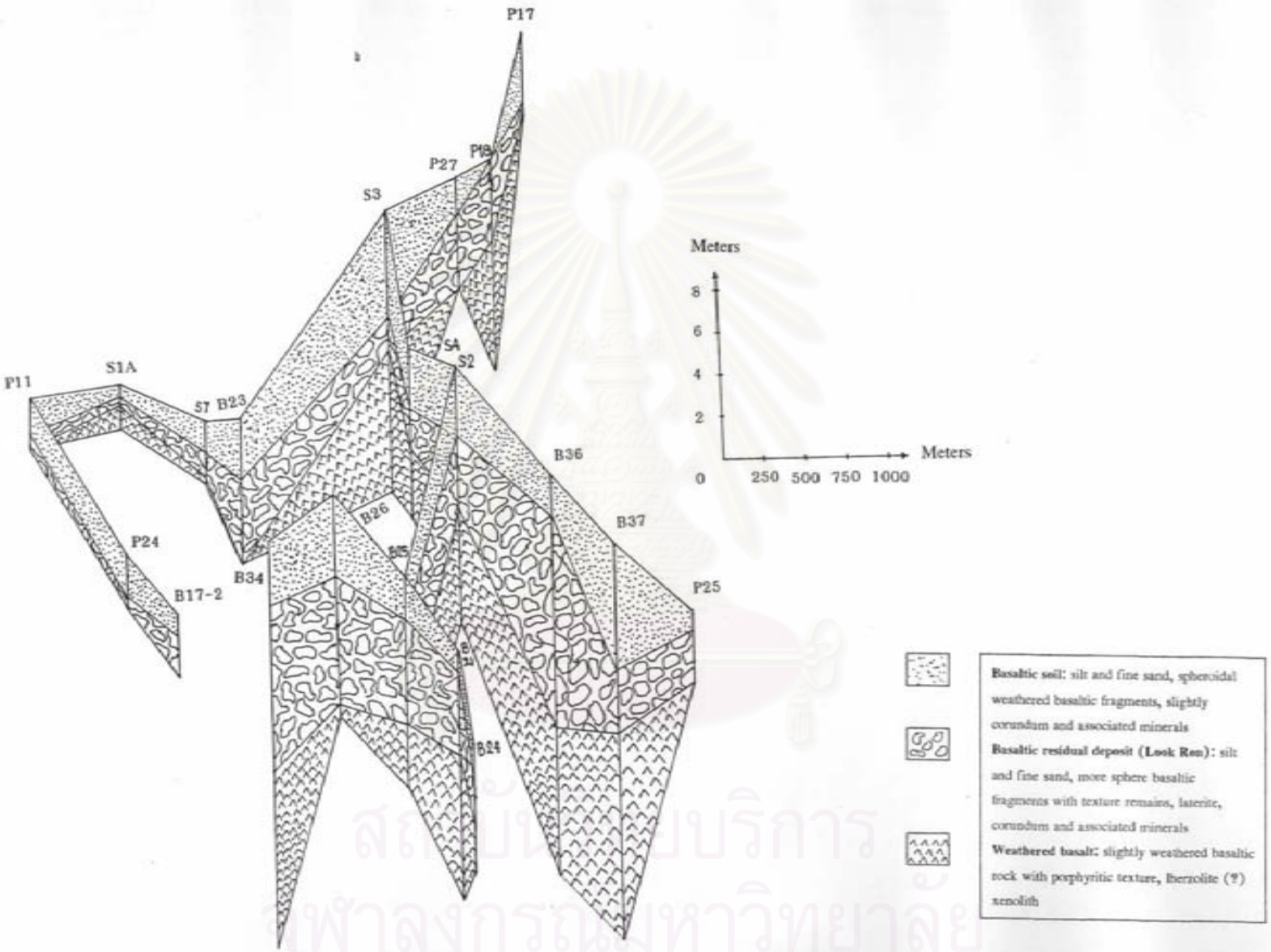


Figure 3.13 Fence diagram of the stratigraphic section at Khao Phloi Waen

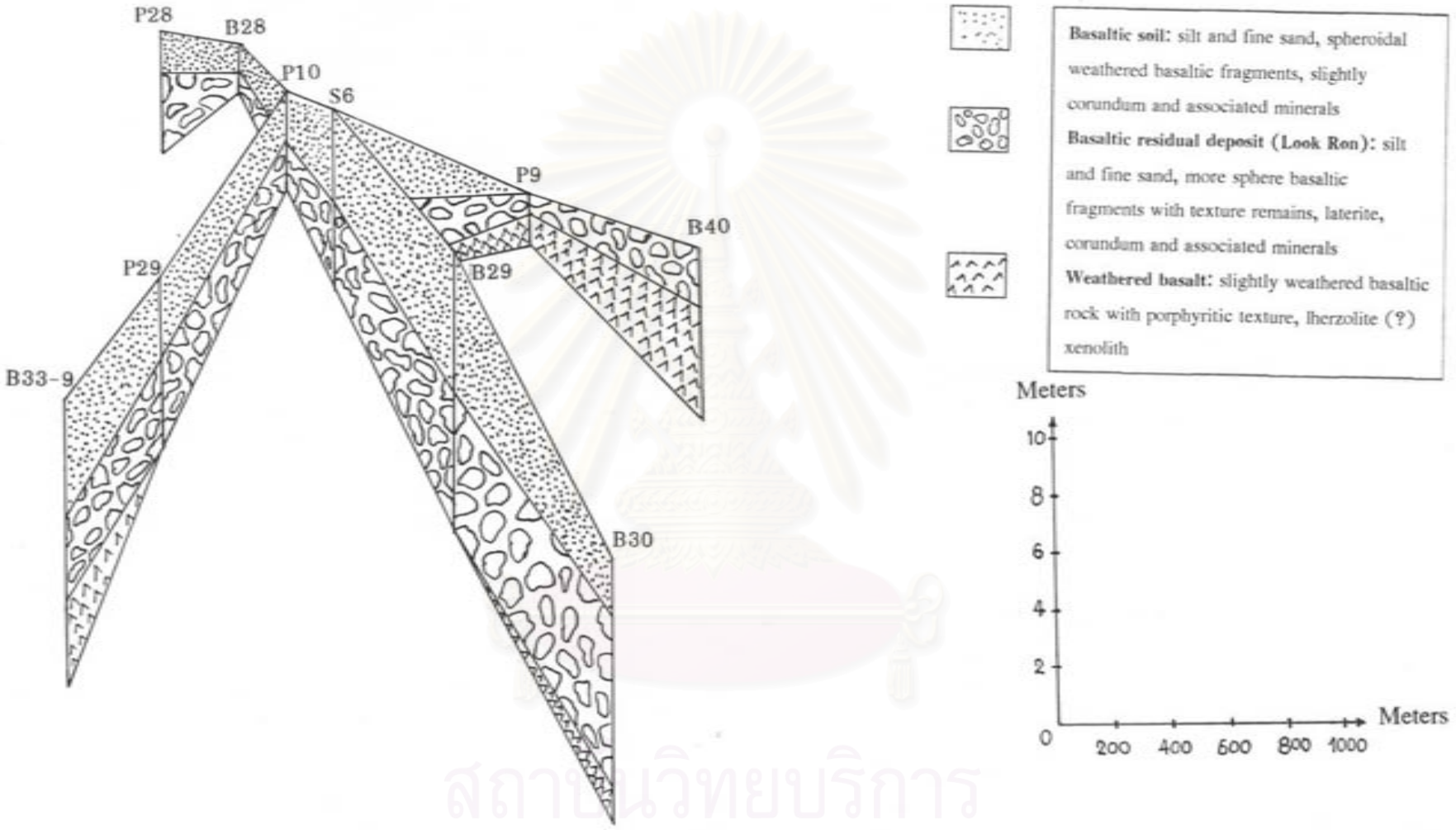


Figure 3.14 Fence diagram of the stratigraphic section at Khao Wua

By field investigation, corundum and the associated mineral were rarely found in the downstream at Klong Pan Salut, and Klong Wat Sakaeo. They were not found from the Chanthaburi estuary.

According to the lithological description of surficial sediment, the corundum placer deposit can be divided into 5 subareas. Gem-bearing layer (Kasa) is described in the detail as follows:

Ban Hua-u area

Although corundum and the associated minerals were found in both of the top and buttom layers at Ban Hua-u. They were found densely in the top layer and their size is bigger than from the bottom layer. Consequently, Kasa is the top layer that mostly consisted of clay and gravel. Gravel is quartz, basaltic and lateritic gravel, and shale or phyllite fragments in various sizes. It is 1-2 meters thick. This layer result from colluvial-alluvial deposit. The sediment is greater provided by basaltic source. The sedimentary correlated profile is shown in figure 3.15.

Klong Pan Salut and Klong Wat Sakaeo

Corundum and the associated minerals deposited in both subareas can be found in the top and bottom layer. However, they were deposited densely in the gravel bed that lies over the bedrock. The corundum-bearing layer of these 2 streams is similar. It is gravelly sand bed, which mostly consisted of sand, while gravel is basalt fragments, iron concretion, quartz, lateritic gravel, granite and sandstone fragments in various sizes. This layer in Klong Pan Salut is 2.5-5.0 meters thick, while Klong Wat Sakaeo is 5-7.5 meters thick. The sedimentary correlated profile is shown in figure 3.16.

Ban Nong Khayong

This subarea is covered by mangrove deposit. The corundum-bearing layer is the weathered basalt that underlain mangrove deposit. It is 0.7-6.5 meters thick.

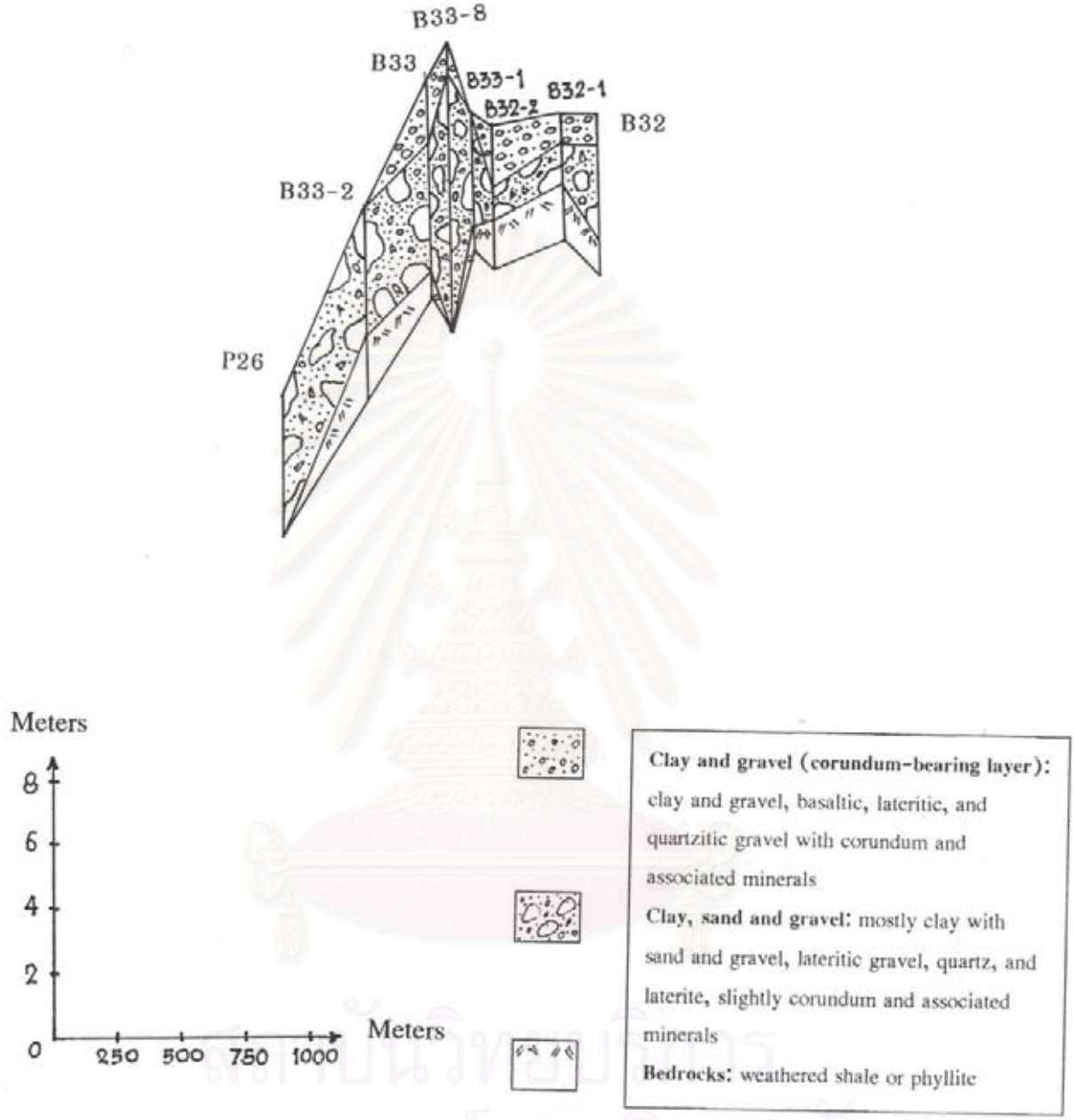


Figure 3.15 Fence diagram of the stratigraphic section at Ban Hua-u

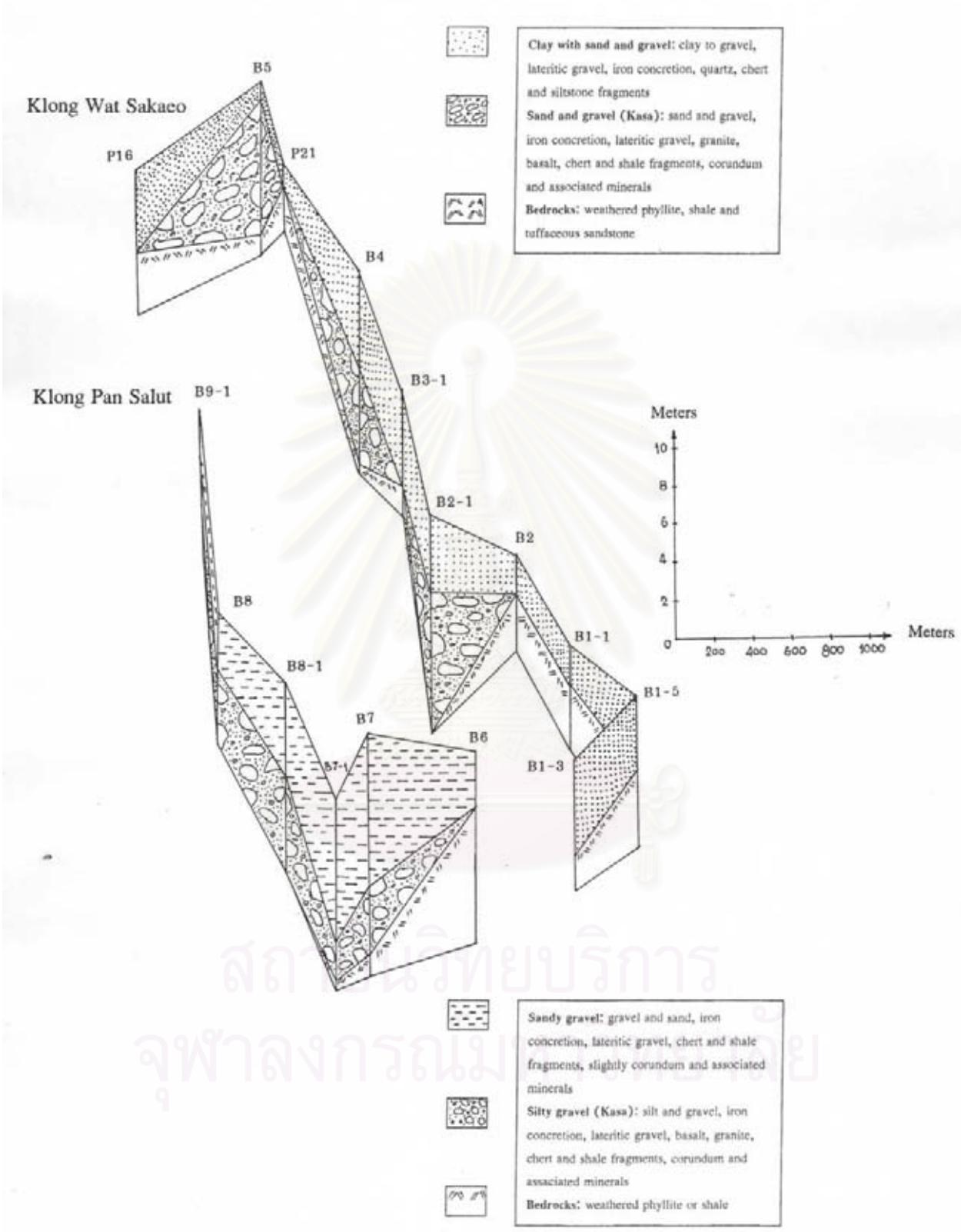


Figure 3.16 Fence diagram of the stratigraphic section at Klong Pan Salut and Klong Wat Sakaeo

It is highly weathered to clay and slightly developed to laterite. The sedimentary correlated profile is shown in figure 3.17.

Ban Bang Kacha

Kasa in this subarea is similarly in both Klong Pan Salut and Klong Wat Sakaeo. It consists of clay to gravel, quartz, iron concretion, and lateritic gravel. It is 1-7 meters thick. The sedimentary correlated profile is shown in figure 3.18.

Although, the gem-bearing layer (or Kasa) generally is the gravel bed that overlain the bedrock and the minerals were densely deposited in the lowermost of this layer. In the study area, this layer is mostly the gravelly silt bed that overlain the bedrock. Corundum and the associated minerals did not only concentrate in the lowermost of this layer, but also can be found along this thick layer. Beside, they are also deposited in the top sedimentary layer. It might be caused by the high rate of weathering and erosion in the area that effected to high transportation, and deposition. Corundum was so abundant that it can be transported and deposited continually in the past more than present.

Potential of Corundum Deposit

In the past, corundum mining in this area was mostly done around the foothill of Khao Phloi Waen and Khao Wua that is corundum residual deposit. Some was done in the piedmont plain and floodplain in the south of Khao Phloi Waen. At present, corundum mining is rarely done because the corundum produce is decreasing.

By mine profile, test pitting, and banka drilling, soil and sediment were described in the detail of sediment component, particle size, shape, sorting, and color. Mine profile was divided into 3 zone; basaltic soil, basaltic residual deposit, and weathered basalt. These samples were collected along their thickness at

least 20 lits by volume. The soil or sediment from pitted holes was sampled similarly, while from banka drilling were slightly different. Samples from banka drilling were

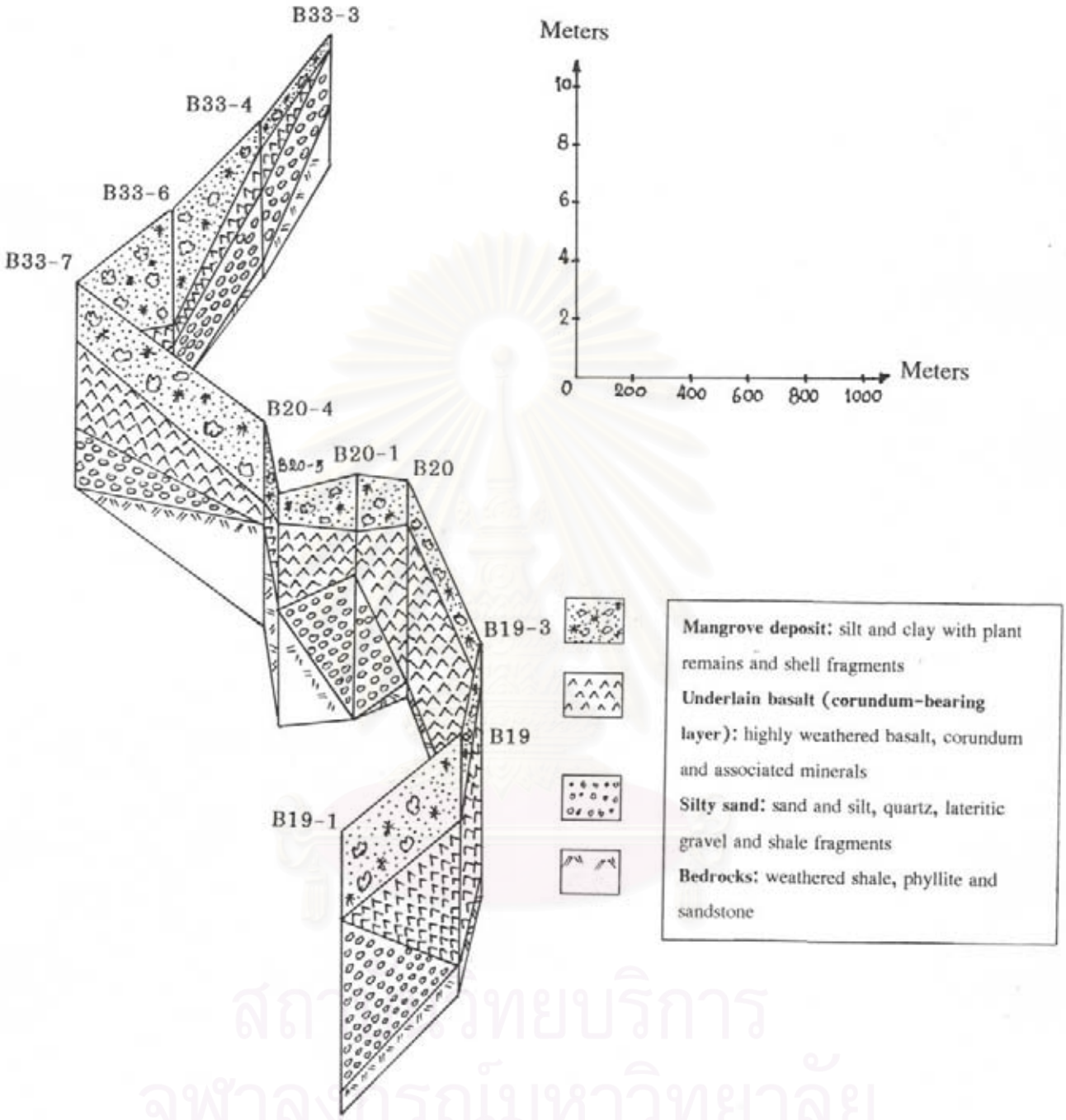


Figure 3.17 Fence diagram of the stratigraphic section at Ban Nong Khayong

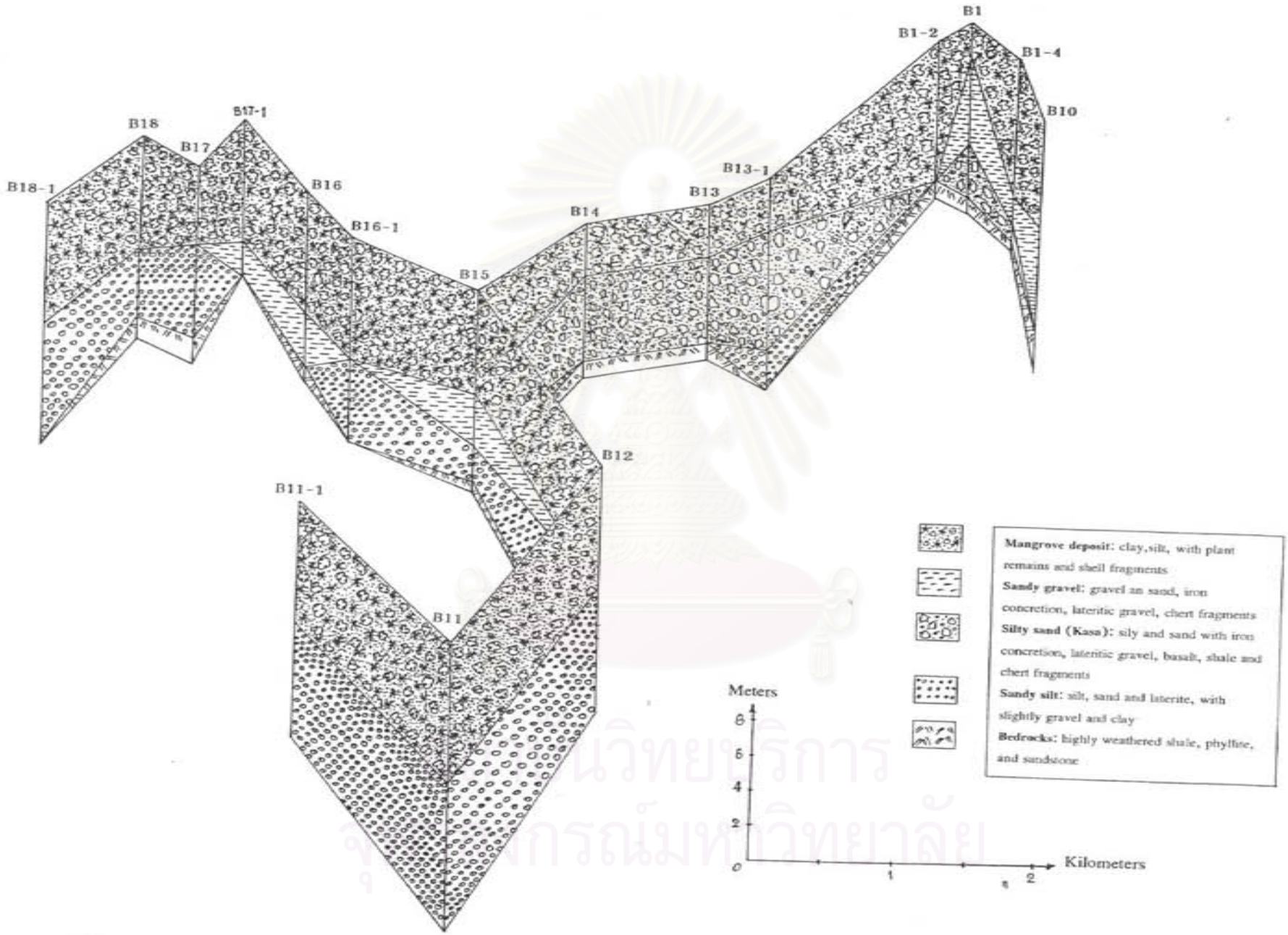


Figure 3.18 Fence diagram of the stratigraphic section at Ban Bang Kacha

collected from meter-to-meter for 10 lits by volume. The sediment volume might be less if the sedimentary layer is thinner than 1 meter. All of these samples were washed, sieved in diameter 2 millimeters, and panned for separation the heavy minerals. Corundum and the associated minerals were separated in their groups. They were described in size, shape, color, and weighted in carat. The unit of mineral weight (carat) and sediment volume (lit) were transform to gram and cubicmeter orderly (1 carat = 0.2 gram and 1 lit = 0.001 $m^{3)}$ In fieldwork, samples from banka drilling, test pitting, and mine profile were sieved and panned. Afterthat, the minerals were separated from the sediments. The weight of these minerals is calculated for the average of the mineral abundance value. This is the criterion to evaluate the corundum high potential area.

The average of the mineral abundance value is calculate by sum of the mineral weight (w) divided by the sediment volume (v) that multiplied by the thickness (t) of the sedimentary layer or weathering zone, divided by sum of the thickness of the same sedimentary layer or weathering zone.

$$MAV = \sum(w/v \times t)/\sum t$$

When MAV = the average of the mineral abundance value (g/m^3)

w = the mineral weight (g)

v = the sediment volume (m^3)

t = the thickness of the gem-bearing layer

The mineral abundance value is separated to corundum, pyroxene-spinel, zircon, magnetite-ilmenite, and garnet that calculated by the weight of these minerals in size more than 1 millimeter. To delineate the high potential area, the minimum of the average of the mineral abundance value in basaltic residual deposit (or “Look Ron”) from mine profile is the criteria in the area of corundum residual deposit. By the way, the minimum of the average of the mineral

abundance value in the lowermost of gravel bed (or “Kasa”) is the criteria in the area of corundum placer deposit. These minimum of the average of the mineral abundance value are shown in table 3.1.

Table 3.1 The minimum of minerals abundance average value in the basaltic residual deposit (BRD) and the lowermost gravel bed (Kasa) in the study area (Modified after Saraphanchotwittaya *et. al.*, unpublished).

Minerals	The minimum of mineral abundance average value (g/m^3)			
	Basaltic residual deposit (BRD)		Lowermost gravel bed (Kasa)	
	Ø 1-2 mm.	Ø >2 mm.	Ø 1-2 mm.	Ø > 2 mm.
Corundum (sapphire)	0.046	1.107	0.059	0.556
Pyroxene-spinel	0.083	40.021	0.556	0.789
Zircon	0.133	3.542	0.022	-
Magnetite-ilmenite	0.045	-	-	-
Garnet	0.138	1.417	-	1.537

Although, these average value is non-economic cut-off grade, and without any safety factor of the gem quality and quantity. In residual weathering, they might be implied to the base level that corundum mine is acceptable. In placer deposit, due to the most concentration in Kasa overlies the bedrocks, they might be implied to the base that they could be deposited. It might be henceforth the advantage for the detail exploration in this area in the future.

The potential area is the area that was found corundum associated with the other minerals at least 1 kind. The high potential area is the area that the average

of the mineral abundance value is higher than the minimum of the average value in the table 3.1. The potential area is shown in figure 3.19. It totally covers 11.11 square

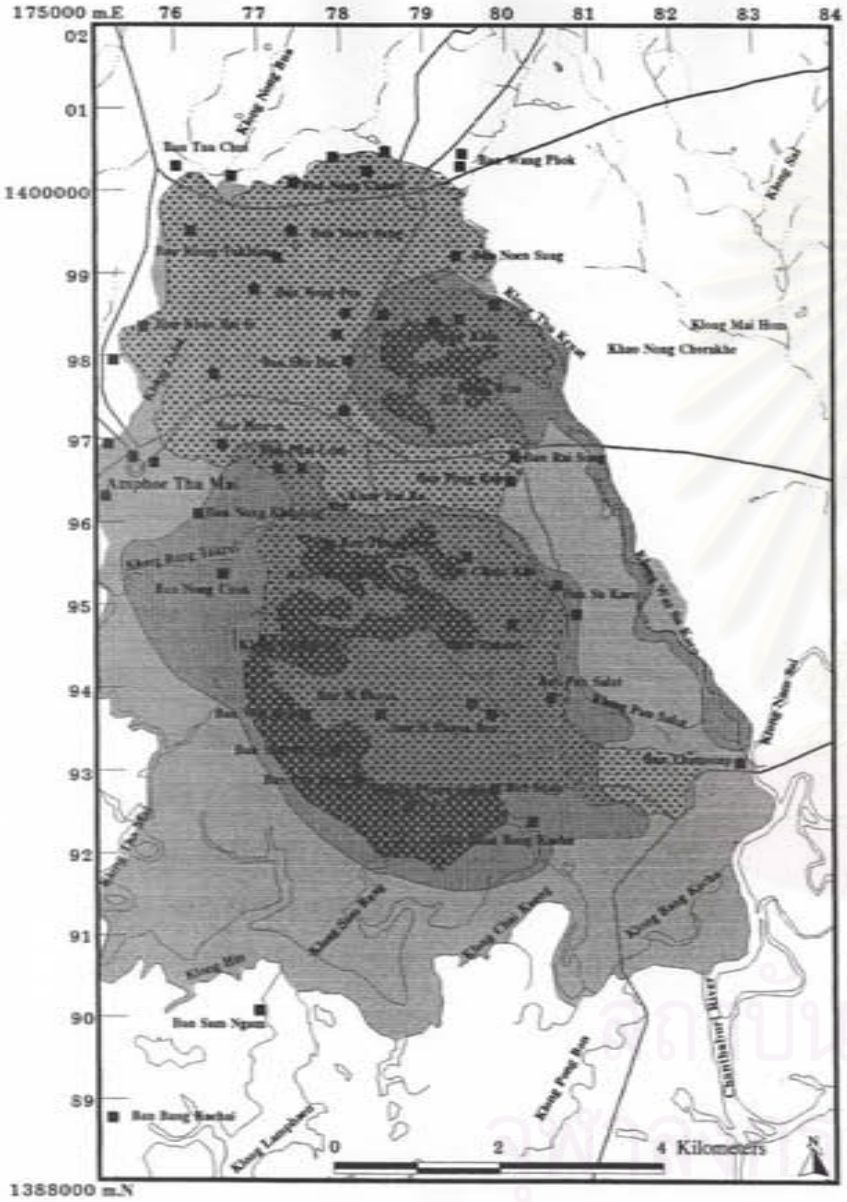
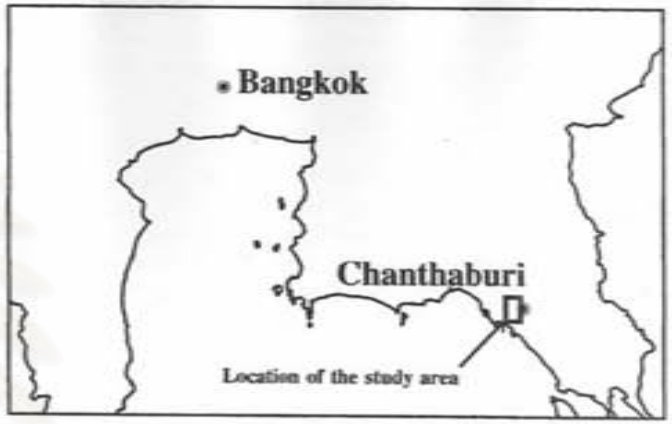
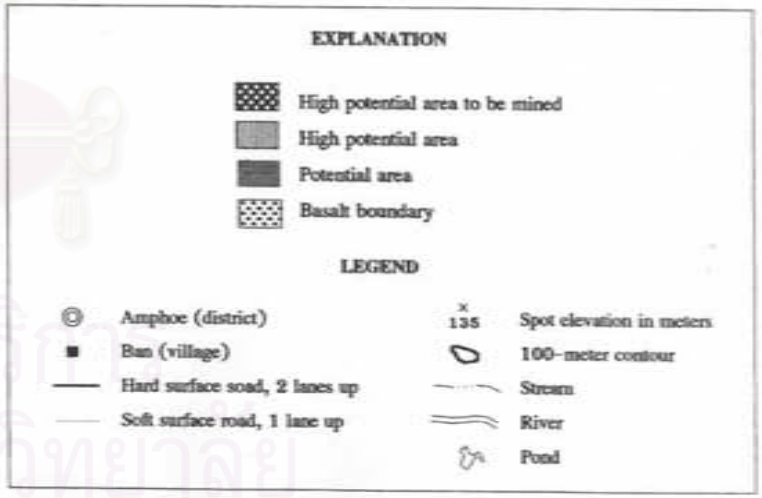


Figure 3.19 Corundum potential area in the study area (modified from Saraphanchotwittaya et. al., unpublished)





kilometers for residual deposit and 10.47 square kilometers for placer deposit. This is shown the detail in table 3.2.

Table 3.2 High potential area of corundum in the study area (Modified after Saraphanchotwittaya *et. al.*, unpublished).

Type of deposit and the subarea	High potential area (sq.km.)
1. Residual deposit (saprolite)	
- Khao Phloi Waen	3.02
- Khao Wua	8.09
	Total 11.11
2. Placer deposit (Kasa)	
- Ban Hua-u	1.50
- Klong Pan Salut	0.84
- Klong Wat Sakaeo	0.63
- Ban Nong Khayong	1.69
- Ban Bang Kacha	4.81
	Total 10.47

CHAPTER 4

CONCLUSION

This study assumed that during the volcanic eruption, gem-bearing basaltic lava flew continually from Khao Phloi Waen to the south, which is covered by the recent sediments. That might be the potential area of corundum. It also aims to study Quaternary geology, geomorphology, and sedimentology that related to corundum deposit in this area.

By the drilled samples, there is no any basalt lava that flew to the south. However, there is the evidence of basaltic flow at Ban Nong Khayong in the west that is overlain by Recent mangrove sediment. It approximately covered 2 square kilometers.

Landforms in the study area consist of the denudation hill of the argillaceous, granitic and basaltic rocks, piedmont plain of colluvial-alluvial deposit, terrace and floodplain from alluvial origin, as well as tidal flat by marine action.

By field investigation, the surficial appearance in the study area is divided into 2 types. Firstly, weathering profile of the source rocks is classified into 3 zones: soils, residual deposits, and weathered rocks.

Secondly, when the country rocks were weathered and eroded. The unconsolidated sediments were transported and deposited in the piedmont plain and floodplain by colluvial and alluvial work, and also in the tidal flat by marine action. Due to the difference of sedimentary character, the dark gray mud with shell fragments in the top layer changed to the alluvial sediments in various sizes with laterite. It indicates to the difference of the depositional environment that changed from fluvial to marine environment. By the sedimentary profile of Ban

Nong Khayong area, there is a silty sand layer beneath basaltic layer, which might be the fluvial sediments before the volcanic eruption, or the weathered surface of country rocks. It can be correlated to the sandy silt layer lies over the bedrock in Bang Kacha area. All of the geomorphological processes occurred in the study area are concluded in table 4.1 below.

Table 4.1 Geomorphological processes in the study area

Parent Material	Processes	Type of rocks and sediments	Age
Basltic lava	Volcanic eruption	basaltic rock	Late to Middle Pleistocene (0.44±0.11 Ma)
Quaternary basaltic rock	Weathering	basaltic residual deposit	Quaternary
Triassic granitic rock		granitic residual deposit	Quaternary
Carboniferous-Permian argillaceous rocks		argillaceous residual deposit	Quaternary
basaltic residual deposit	Erosion and transportation	basaltic soil	Late Pleistocene to Recent
granitic residual deposit		granitic soil	Late Pleistocene to Recent
argillaceous residual deposit		argillaceous soil	Late Pleistocene to Recent
residual deposits and soils	Fluvial process	gravel bed (gem-barren layer)	Lower Pleistocene
		gravel bed (gem-bearing layer)	Late Pleistocene to Recent
		river channel	Late Pleistocene to Recent
terrigenous sediments	Coastal and marine processes	tidal flat	Not before 8,000 years to Recent (Holocene transgression)
		beach	Not before 8,000 years to Recent (Holocene transgression)

In addition, there are 7 subareas of the corundum deposits in this area. By the basaltic residual weathering of Khao Phloi Waen and Khao Wua, corundum and associated minerals such as pyroxene, zircon, magnetite, are deposited densely in basaltic residual deposit (BRD) with iron concretion and basaltic fragments. By placer deposit, the minerals are deposited within the gravel bed lying over the bedrocks in the floodplin of Klong Pan Salut and Klong Wat Sakaeo. At Ban Hau-u, corundum and the other minerals are deposited in piedmont plain of Recent colluvial-alluvial deposit. In tidal flat, by the way, the corundum-bearing layer at Ban Nong Khayong is the weathered basalt lying under the mangrove deposit. While it is the silty sand layer by the fluvial prcess at Ban Bang Kacha.

Furthermore, the average of the mineral abundance value is calculated by the mineral weight, the sediment volume, and the thickness of gem-bearing layer, in order to delineate the high potential area of corundum deposit. Although the averages of the mineral abundance values are non-economic grade, they might be the advantage for corundum exploration in this area in the future. Finally, the high potential area of corundum deposit in 7 subareas totally covers for 21.58 square kilometers.

REFERENCES

Barr, S. M., and Macdonald, A. S. 1978. Geochemistry and petrogenesis of late Cenozoic alkaline basalts of Thailand. Geological Society of Malaysia Bulletin. 10: 25-52.

Barr, S. M., and Macdonald, A. S. 1981. Geochemistry and geochronology of late Cenozoic basalts of Southeast Asia. The Geological Society of America Bulletin. 92: 1066-1142.

Chaodumrong, P. 1992. Geological Extension of Eastern Thailand (Report No. 0187). Geological Survey Division, Department of Mineral Resources. (in Thai).

Choowong, M. 1996. Quaternary Geology related to Gemstone Deposit in Bo Ploi Basin, Amphoe Bo Ploi, Changwat Kanchanaburi. Master's thesis, Department of Geology, Graduate School, Chulalongkorn University.

Chotikasathien, W. 1994. Application of Lithofacies Concept for Offshore Mineral Exploration in Area1: Rayong-Chantaburi-Trat Provinces. Economic Geology Report, No.7/1994, Bangkok: Offshore Mineral Exploration and Remote Sensing Section, and Economic Geology Service Section, Economic Geology Division, Department of Mineral Resources.

Coenraads, R. R.; Vichit, P.; and Sutherland, F. L. 1995. An unusual sapphire-zircon-magnetite xenolith from the Chanthaburi gem province, Thailand. Mineralogical Magazine. 59: 465-479.

Dheeradilok, P.; Thiramongkol, N.; Vijarnsorn, P.; and Sinsakul, S. 1983. Quaternary geology and geomorphology of the central plain and eastern

Thailand. Proceedings of the First Symposium on Geomorphology and Quaternary Geology of Thailand. (published as part of the tour guide).

Friedman, G. M., and Johnson, K. G. 1982. Exercises in Sedimentology. New York: John Wiley & Sons.

Hastings, P., and Liengsakul, M. 1983. Chronology of the late Quaternary climatic changes in Thailand. Proceedings of the First Symposium on Geomorphology and Quaternary Geology of Thailand (October): 24-34.

Hughes, I. G., and Bateson, J. H. 1967. Reconnaissance Geological and Mineral Survey of the Chantaburi Area of the Southeast Thailand (Report No. 7). London: Institute of Geological Science, Oversea Division, Prince Gate.

Japan Color Research Institute. 1957. Revised Standard Soil Color Charts. The Research Council of the Agriculture, Forestry, and Fisheries.

Kengkoom, S. 1990. Quaternary Sea-Level Fluctuations in the Coastal Area Eastern Thailand: A Synoptic View in Relation to Mineral Resource exploration. Economic Geology Report, No.10/1990. Bangkok: offshore Mineral Exploration and Remote Sensing Section, and Economic Geology Service Section, Economic Geology Division, Department of Mineral Resources.

Kenting Earth Science International Limited. 1989. Interpretation Report for Airborne Geophysical Survey of the Mineral Resources Development Project (ND48-13). Vol. 36. Ottawa.

Levinson, A. A., and Cook, F. A. 1994. Gem corundum in alkaline basalt: origin and occurrence. Gem and Gemology. 30 (No. 4): 253-262.

Pramojanee, P., and Hastings, P. 1983. Geomorphological and palynological investigation of sea level changes in Chantaburi, SE Thailand.

Proceedings of the First Symposium on Geomorphology and Quaternary Geology of Thailand (October): 35-51.

Raksasakulwong, L., and Prakobchat, T. 1990. Geological Report Map Sheet 5434 III (Changwat Chanthaburi), 5433 IV (Amphoe Laem Sing), and 5334 II (Ban Khod Hoi) (Report No. 0158). Geological Survey Division, Department of Mineral Resources, Bangkok. (in Thai).

Royal Thai Survey Department. 1981. Topographic Map of Changwat Chanthaburi, 1:50,000, sheet 5434 III. Royal Thai Survey Department.

Saraphanchotwittaya, P.; Vitiaranee, R.; and Tungpong, P. 1998. Gemstone Deposit in Amphoe Tha Mai, Amphoe Muang, and Amphoe Laem Sing, Changwat Chanthaburi. Bangkok: Gemstone Section, Economic Geology Division, Department of Mineral Resources. (in Thai). (Unpublished Manuscript).

Sirinawin, T. 1981. Geochemistry and gem-bearing basalt occurrence in Changwat Chanthaburi-Trat. Independent Study submitted Master's Degree. Department of Geology, Graduate School, Chieng Mai University. (in Thai).

Suthirat, C.; Charusiri, P.; Farrar, E.; and Clark, A. H. 1994. New $^{40}Ar/^{39}Ar$ geochronology and characteristics of some Cenozoic basalts in Thailand. Proceedings of International Symposium on Stratigraphic Correlation of Southeast Asia (DMR. and IGCP 306): 306-321.

Tansathien, W.; Polprasit, C.; and Paijitprapaporn, V. 1985. Geological Map of Changwat Chanthaburi, 1:250,000, Sheet ND48-13. Geological Survey Division, Department of Mineral Resources.

The Gulf of Thailand Mineral Exploration Project. 1988. Offshore Mineral Exploration in Area 1-E, Changwat Chanthaburi. Economic Geology Report, No. 28/1988. Bangkok: Economic Geology Division, Department of Mineral Resources. (in Thai).

The Gulf of Thailand Mineral Exploration Project. 1989. Detailed Offshore Geophysical Exploration in Area 1-E Changwat Chanthavuri. Economic Geology Report, No.29/1989. Bangkok: Economic Geology Division, Department of Mineral Resources. (in Thai).

The Gulf of Thailand Mineral Exploration Project. 1994. Exploration Drilling for Mineral Deposits in The Gulf of Thailand, Offshore Area 1A, 1C, 1D, and 1E, Changwat Rayong and Chanthaburi, Offshore Area 2, 3B, and3D, Changwat Prachaup Khiri Khan, Surat Thani, and Nakorn Si Thammarat. Economic Geology Report, No. 9/1994. Bangkok: Economic Geology Division, Department of Mineral Resources. (in Thai).

Vichit, P. 1975. Origin of Corundum in Basalt. Independent study submitted Master's Degree. New Mexico Institute of Mining and Technology, USA.

Vichit, P. 1988. Corundum (ruby-sapphire) Deposit in Thailand. 1st ed. Bangkok: Department of Mineral Resources. (in Thai).

Vichit, P. 1992. Gemstone in Thailand. Proceedings of the National Conference on Geologic Resources of Thailand: Potential for Future development. (November): 124-150.

Vichit, P.; Vudhichatvanich, S.; and Hansawek, R. 1978. The distribution and some characteristics of corundum-bearing basalts in Thailand. Journal of the Geological Society of Thailand. 3: M4/1–M4/38.

Yaemniyom, N. 1982. The Petrochemical Study of Corundum-bearing Basalts at Bo Ploi District, Kanchanaburi Province. Master's Thesis. Department of Geology, Graduate School, Chulalongkorn University.

APPENDIX A

Quaternary Stratigraphic Description

By Mine Profile

Quaternary Stratigraphic Pattern of
Amphoe Tha Mai-Amphoe Muang, Changwat Chanthaburi

Log No. S1-A **Grid ref.** 177552 E 1394641 N **Total depth** 2.10 **m.**

0-0.6 m.; dark red (10R3/6) basaltic soil with basalt fragment, iron concretion, magnetite, ilmenite, and spinel.

0.6-0.8 m.; dark red (10R3/6) basaltic residual soil with basalt fragment, laterite, iron concretion, magnetite, spinel, and zircon.

0.8-2.1 m.; dull orange (5YR6/4) and light gray (7.5Y7/1) highly weathered basalt with magnetite, ilmenite, and spinel.

Log No. S1-B **Grid ref.** 177552 E 1394641 N **Total depth** 1.10 **m.**

0-0.6 m.; dark red (10R3/6) basaltic soil with basalt fragment, iron concretion, pisolite, and pyroxene.

0.6-1.0 m.; dark red (10R3/6) basaltic residual soil with basalt fragment, and laterite.

1.0-1.1 m.; dark red (10R3/6) and light yellowish orange (7.5YR8/4) highly weathered basalt, developed to laterite.

Quaternary Stratigraphic Pattern of
Amphoe Tha Mai-Amphoe Muang, Changwat Chanthaburi

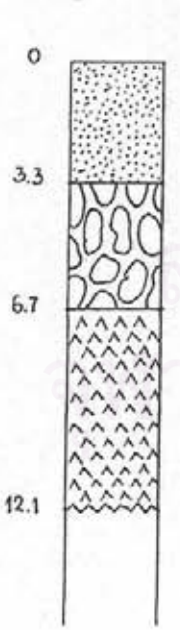
Log No. S1-C **Grid ref.** 177552 E 1394641 N **Total depth** 1.80 m.

0-1.2 m.; dark red (10R3/6) basaltic soil with fragment, pisolite and corundum.

1.2-1.4 m.; dark red (10R3/6) basaltic residual soil with basalt fragment, corundum, pyroxene, and spinel.

1.4-1.8 m.; light yellowish orange (7.5YR8/4) highly weathered basalt.

Log No. S2 **Grid ref.** 177830 E 1397650 N **Total depth** 12.10 m.



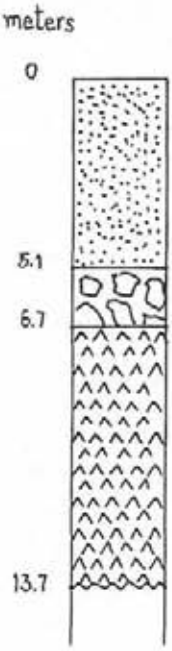
0-3.3 m.; bright brown (2.5YR5/8) basaltic soil with pyroxene, soft.

3.3-6.7 m.; bright brown (2.5YR5/8) basaltic residual soil with laterite, iron concretion, corundum, garnet, pyroxene, magnetite, ilmenite, spinel, and zircon.

6.7-12.1 m.; grayish white (N7/0) to gray (N6/0) weathered basalt, vesicular.

Quaternary Stratigraphic Pattern of
Amphoe Tha Mai-Amphoe Muang, Changwat Chanthaburi

Log No. S3 **Grid ref.** 179211 E 1395649 N **Total depth** 13.70 m.

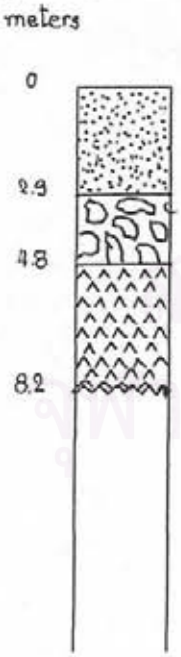


0-5.1 m.; bright brown (2.5YR5/8) basaltic soil with pisolite, pyroxene, corundum, zircon, spinel, magnetite, and ilmenite.

5.1-6.7 m.; dark red (10R3/6) basaltic residual soil with iron concretion, corundum, zircon, spinel, magnetite, and ilmenite.

6.7-13.7 m.; gray (N4/0-N6/0) and black (N2/0) weathered basalt, vary in degree of weathering, pyroxene, magnetite, ilmenite, spinel, and corundum.

Log No. S4-A **Grid ref.** 179355 E 1394709 N **Total depth** 8.20 m.



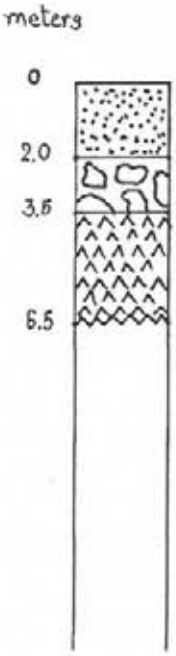
0-2.9 m.; bright brown (2.5YR5/8) basaltic soil with slightly fragment.

2.9-4.8 m.; bright brown (2.5YR5/8) and dull orange (5YR6/4) basaltic residual soil with basaltic fragment, iron concretion, pisolite, pyroxene, magnetite, ilmenite, spinel, and garnet.

4.8-8.2 m.; grayish white (N7/0) highly weathered basalt with corundum, pyroxene, ilmenite, magnetite, and spinel.

Quaternary Stratigraphic Pattern of
Amphoe Tha Mai-Amphoe Muang, Changwat Chanthaburi

Log No. S4-B **Grid ref.** 179355 E 1394765 N **Total depth** 6.50 m.

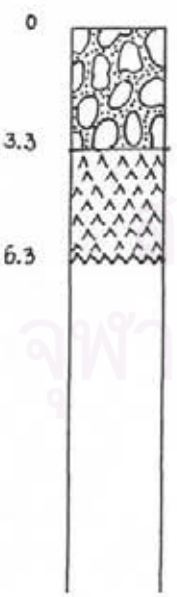


0-2.0 m.; bright brown (2.5YR5/8) basaltic soiil with slightly fragment, friable.

2.0-3.5 m.; dark red (10R3/6) basaltic residual soil with basalt fragment, iron concretion, corundum, pyroxene, spinel, zircon, magnetite, and ilmenite.

3.5-6.5 m.; gray (N6/0-N4/0) weathered basalt with lherzolite xenolith.

Log No. S5 **Grid ref.** 179366 E 1395718 N **Total depth** 6.30 m.

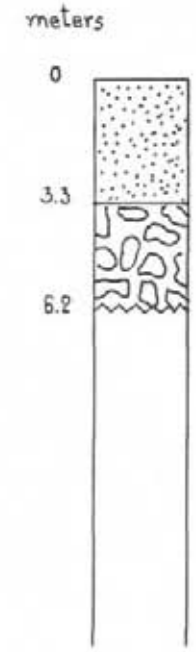


0-3.3 m.; bright brown (2.5YR5/8) contaminated basaltic soil.

3.3-6.3 m.; various color weathered basalt with garnet, and pyroxene.

Quaternary Stratigraphic Pattern of
Amphoe Tha Mai-Amphoe Muang, Changwat Chanthaburi

Log No. S6 **Grid ref.** 178426 E 1398232 N **Total depth** 6.20 m.



0-3.3 m.; bright brown (2.5YR5/8) basaltic soil with slightly fragment, iron concretion, zircon, garnet, pyroxene, and ilmenite.

3.3-6.2 m.; grayish red (10R6/2) laterite with basalt fragment, iron concretion, garnet, pyroxene, zircon, magnetite, and ilmenite.

Log No. S7 **Grid ref.** 178061 E 1394427 N **Total depth** 3.00 m.

0-1.55 m.; dark red (10R3/6) basaltic soil with iron concretion, pisolite, corundum, and pyroxene.

1.55-2.7 m.; dark red (10R3/6) basaltic residual soil with slightly fragment, developed to laterite, corundum, pyroxene, zircon, garnet, and mica.

2.7-3.0 m.; light gray (7.5YR8/1) and light yellowish orange (7.5YR8/4) laterite with corundum, pyroxene, zircon, garnet, and magnetite.

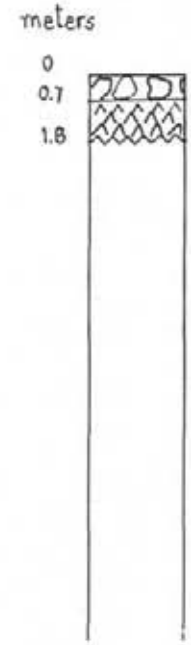
APPENDIX B

Quaternary Stratigraphic Description

By Test Pitting

Quaternary Stratigraphic Pattern of
Amphoe Tha Mai-Amphoe Muang, Changwat Chanthaburi

Log No. P9 **Grid ref.** 179100 E 1397930 N **Total depth** 1.80 m.



0-0.7 m.; dark red (10R3/6) basaltic soil with fragment, iron concretion, pisolite, zircon, pyroxene, spinel, magnetite, and ilmenite.

0.7-1.8 m.; light gray (7.5YR8/1) weathered basalt, mottle and vesicular, pyroxene, zircon, magnetite, and ilmenite.

Log No. P10 **Grid ref.** 178264 E 1398294 N **Total depth** 3.50 m.

0-1.04 m.; dark reddish brown (5YR3/4) clay to gravel, iron concretion, pisolite, and quartz, subangular to subround, poorly sorted.

1.04-1.82 m.; dark reddish brown (5YR3/4) clay to gravel, iron concretion, and pisolite, subangular to subround, poor sphericity, poorly sorted.

1.82-3.45 m.; grayish red (7.5R6/2) laterite with iron concretion.

Quaternary Stratigraphic Description of
Amphoe Tha Mai-Amphoe Muang, Changwat Chanthaburi

Log No. P11 **Grid ref.** 177010 E 1394594 N **Total depth** 2.45 m.

0-1.82 m.; red (10R5/6) and grayish red (10R6/2) basaltic soil with lateritic gravel.

1.82-2.45 m.; red (10R5/6) and grayish red (10R6/2) laterite, firm and compacted.

Log No. P14 **Grid ref.** 177448 E 1393585 N **Total depth** 4.65 m.

0-2.0 m.; dark red (10R3/4) basaltic soil, firm and compacted.

2.0-2.15 m.; dark red (10R3/4) basaltic gravel, low sphericity, subangular to subround, cobble-sized, moderately sorted.

2.15-4.65 m.; grayish white (N8/0) and pale reddish orange (2.5YR7/3) weathered granite, aquifer.

Quaternary Stratigraphic Pattern of
Amphoe Tha Mai–Amphoe Muang, Changwat Chanthaburi

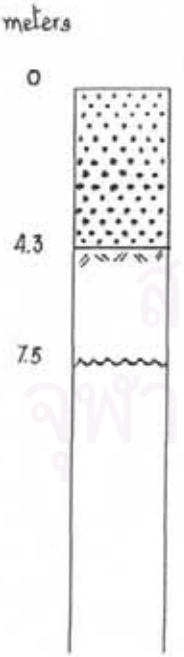
Log No. P15 **Grid ref.** 177650 E 1393530 N **Total depth** 1.70 **m.**

0–1.3 m.; reddish gray (5R6/1) and bright reddish brown (5YR5/6) sand to, clay, poorly sorted, loose and friable.

1.5–1.7 m.; gray (7.5Y6/1–7.5Y4/1) basaltic gravel with corundum, subangular to subround, low sphericity, well sorted.

1.7 m.; dull reddish orange (10R6/4) weathered granite.

Log No. P16 **Grid ref.** 180220 E 1396690 N **Total depth** 7.50 **m.**



0–4.3 m.; dull reddish orange (10R6/4) clay with silt to gravel, moderately sorted.

4.3–7.5 m.; grayish white (N8/0) phyllite.

Quaternary Stratigraphic Pattern of
Amphoe Tha Mai-Amphoe Muang, Changwat Chanthaburi

Log No. P17 **Grid ref.** 180080 E 1396710 N **Total depth** 3.70 m.

0-3.5 m.; dark red (7.5R3/4) clay, firm and compact.

3.5-3.7 m.; dark red (7.5R3/4) clay with lateritic gravel and corundum, angular, low sphericity, poorly sorted, slightly compacted.

3.7 m.; black (N2/0) weathered phyllite.

Log No. P18 **Grid ref.** 179870 E 1395950 N **Total depth** 10.0 m.

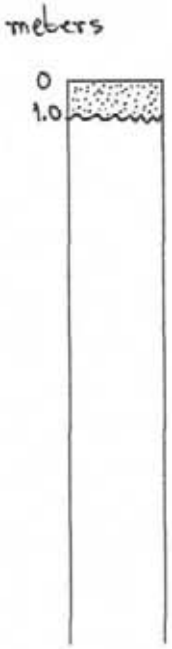
0-3.8 m.; dark red (10R3/6) clay with lateritic gravel, low sphericity, angular, firm and compacted.

3.8-10.0 m.; grayish white (N7/0) and olive gray (5GY5/1) weathered basalt.

10.0 m.; weathered granite, aquifer.

Quaternary Stratigraphic Description of
Amphoe Tha Mai-Amphoe Muang, Changwat Chanthaburi

Log No. P20 **Grid ref.** 178000 E 1396500 N **Total depth** 1.00 m.



0-1.0 m.; dark red (10R3/6) basaltic soil, with fragment, loose and friable.

Log No. P21 **Grid ref.** 180976 E 1396710 N **Total depth** 3.55 m.

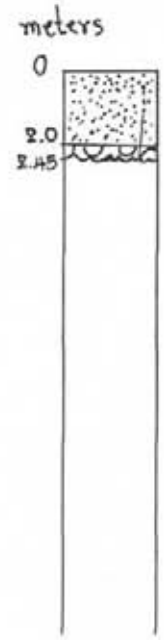
0-0.8 m.; reddish orange (10R6/8) clay with lateritic gravel, and slightly quartz, angular to subround, low sphericity, poorly sorted.

0.8-1.2 m.; reddish orange (10R6/8) gravel bed, rock fragment and quartz, angular to subangular, low sphericity, poorly sorted.

1.2-3.55 m.; light gray (7.5YR8/1) and red (10R4/8) weathered phyllite, mottled.

Quaternary Stratigraphic Description of
Amphoe Tha Mai-Amphoe Muang, Changwat Chanthaburi

Log No. P24 **Grid ref.** 177535 E 1393638 N **Total depth** 2.45 **m.**



0-2.0 m.; dark red (10R3/6) and grayish red (7.5R6/2) basaltic soil with slightly fragment.

2.0-2.45 m.; gray (N5/0) basaltic gravel with corundum and associated minerals, vary in size, subround to angular, low sphericity, poosly sorted.

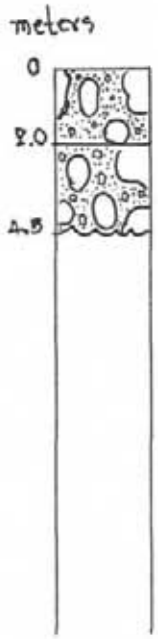
Log No. P25 **Grid ref.** 181000 E 1393220 N **Total depth** 3.40 **m.**

0-1.0 m.; bright brown (2.5YR5/8) basaltic soil with slightly fragments, loose and friable.

1.0-3.4 m.; bright reddish brown (5YR5/6), dull orange (5YR6/4), and dark reddish brown (7.5R3/3) laterite, firm and compacted.

Quaternary Stratigraphic Description of
Amphoe Tha Mai-Amphoe Muang, Changwat Chanthaburi

Log No. P26 **Grid ref.** 176330 E 1395560 N **Total depth** 4.50 m.



0-2.0 m.; dark purplish gray (5RP3/1) clay to gravel, lateritic gravel, quartz, plant remains, and slightly shale fragments, angular to subround, poorly sorted.

2.0-4.5 m.; dull orange (5YR6/4) and grayish red (10R6/2) laterite compacted.

Log No. P27 **Grid ref.** 179660 E 1395840 N **Total depth** 5.20 m.

0-1.8 m.; red (10R4/8) basaltic soil, loose and friable.

1.8-5.2 m.; dark red (7.5R3/6), and bright reddish brown (5YR5/6) basaltic residual soil with lateritic gravel, iron concretion, and pisolite, firm and compacted.

Quaternary Stratigraphic Description of
Amphoe Tha Mai-Amphoe Muang, Changwat Chanthaburi

Log No. P28 **Grid ref.** 177840 E 1398500 N **Total depth** 4.35 m.

0-1.5 m.; dark red (10R /6) basaltic soil with fragment, loose and friable.

1.5-4.35 m.; dark red (7.5R3/6), and pale reddish orange (2.5YR7/3) laterite, firm and compacted.

Log No. P29 **Grid ref.** 177830 E 1397650 N **Total depth** 5.80 m.

0-2.8 m.; dark red (7.5R3/6) basaltic soil and fragment, with lateritic gravel, loose and friable.

2.8-5.8 m.; dark red (7.5R3/6) basaltic soil and fragment, loose and friable.

APPENDIX C

Sedimentary Description from

Banka Drilling

Sedimentary Description from Banka Drilling of

Amphoe Tha Mai-Amphoe Muang, Changwat Chanthaburi

Banka No. B1 Grid ref. 182580 E 1393830 N Total depth 11.00 m.

Depth (m.)		Description	Sediment Volume (lits)		
From	To		Total	Clay-Sand	Gravel
0	2	black (N1.5/0) clay with plant remains and gravel, quartz and feldspar, angular to suubround, low sphericity, poorly sorted.	17.5	16.75	0.75
2	7	gray (7.5Y4/1) clay with sand and gravel, quartz, feldspar, peat, subangular to subround, low sphericity, poorly sorted.	36.5	34.25	2.25
7	10	dark gray (N3/0) sand and gravel, quartz, organic matter, angular, low sphericity, moderately sorted, olivine, spinel, zircon, magnetite and pyroxene.	26	19.5	6.5
10	11	light greenish gray (7.5GY8/1) and grayish orange (2.5YR7/3) weathered shale.			

Sedimentary Description from Banka Drilling of

Amphoe Tha Mai-Amphoe Muang, Changwat Chanthaburi

Banka No. B1-1 Grid ref. 182442 E 1394117 N Total depth 5.40 m.

Depth (m.)		Description	Sediment Volume (lits)		
From	To		Total	Clay-Sand	Gravel
0	1.5	grayish red (7.5R6/2) fine to coarse sand and gravel, quartz, feldspar, subangular, low sphericity, moderately sorted.	10	4.5	5.5
1.5	2	dark red (7.5R3/6) lateritic gravel, and laterite.	9	8	1
2	5.4	bright brown (2.5YR5/8) weathered phyllite.	34	31.5	2.5

Banka No. B1-2 Grid ref. 182342 E 1393655 N Total depth 9.00 m.

Depth (m.)		Description	Sediment Volume (lits)		
From	To		Total	Clay-Sand	Gravel
0	8	dark red (7.5R3/6), dark reddish brown (5YR3/4) and dark greenish gray (7.5GY4/1) clay with lateritic gravel, shell fragments and quartz, subangular, low sphericity.	73.5	66	7.5
8	9	grayish red (10R6/2) weathered phyllite.	8.5	5.5	3

Sedimentary Description from Banka Drilling of

Amphoe Tha Mai-Amphoe Muang, Changwat Chanthaburi

Banka No. B1-3 Grid ref. 182460 E 1393580 N Total depth 6.80 m.

Depth (m.)		Description	Sediment Volume (lits)		
From	To		Total	Sand	Gravel
0	5	dark red (7.5R3/6) to red (101R4/8) mostly clay with sand and gravel, quartz, laterite, iron concretion, angular to subround, low sphericity, poorly sorted, olivine, spinel and pyroxene.	44	37	7
5	6.8	dull reddish orange (10R6/4) with light gray (7.5YR8/1) to pale reddish orange (2.5YR7/3) highly weathered phyllite.	16.5	15.75	0.75

Banka No. B1-4 Grid ref. 182921 E 1393527 N Total depth 11.00 m.

Depth (m.)		Description	Sediment Volume (lits)		
From	To		Total	Sand	Gravel
0	8	very dark reddish brown (5YR2/4) to dark gray (N3/0) clay with plant remains, and basalt fragments.	66.5	64.5	2
8	9.5	red (10R4/8) with light reddish gray (10R7/1) and dark gray (N3/0) clay with basalt fragments.	7	6.25	0.75
9.5	10.5	dull reddish orange (10R6/4) clay, fine sand and gravel, quartz, phyllite fragments, blue sapphire and pyroxene.	8	7.25	0.75
10.5	11	gray (N6/0) and dull orange (5YR6/4) highly weathered phyllite.	8.5	5.5	3

Sedimentary Description from Banka Drilling of

Amphoe Tha Mai-Amphoe Muang, Changwat Chanthaburi

Banka No. B1-5 Grid ref. 182793 E 1393925 N Total depth 8.00 m.

Depth (m.)		Description	Sediment Volume (lits)		
From	To		Total	Sand	Gravel
0	4	bright brown (2.5YR5/8) and reddish orange (10R6/8) clay, fine sand, lateritic gravel, quartz, angular to subangular, low sphericity, poorly sorted, pyroxene.	34	29	5
4	8	light gray (7.5YR8/1) with dull reddish orange (10R6/4) and dull orange (5YR6/4) weathered phyllite.	32	30	2

Banka No. B2 Grid ref. 182170 E 1394660 N Total depth 5.00 m.

Depth (m.)		Description	Sediment Volume (lits)		
From	To		Total	Sand	Gravel
0	2	Dull orange (5YR6/4) sand and quartz gravel with phyllite fragments.	19	7.5	11.5
2	5	Light gray (7.5YR8/1) with reddish orange (10R6/8) and pale reddish orange (2.5YR7/3) highly weathered phyllite.	20	16.75	3.25

Sedimentary Description from Banka Drilling of

Amphoe Tha Mai-Amphoe Muang, Changwat Chanthaburi

Banka No. B2-1 Grid ref. 181726 E 1394856 N Total depth 11.50 m.

Depth (m.)		Description	Sediment Volume (lits)		
From	To		Total	Sand	Gravel
0	4	grayish red (10R6/2) with dull orange (5YR6/4) clay to gravel, quartz and lateritic gravel, shale and siltstone fragments,subangular, low sphericity, poorly sorted.	35.5	27	8.5
4	11.5	grayish red (10R6/2) with dull orange (5YR6/4) to gray (N4/0) fine to coarse sand, quartz gravel, shale and siltstone fragmentswith laterite, pyroxene, olivine, spinel and blue sapphire.	61.5	48	13.5
11.5	++	greenish black (8.5GY2/1) weathered tuffaceous siltstone.			

Banka No. B3 Grid ref. 181658 E 1395711 N Total depth 7.50 m.

Depth (m.)		Description	Sediment Volume (lits)		
From	To		Total	Sand	Gravel
0	7	dull orange (5YR6/4) to light reddish gray (7.5R7/1) with dull orange (5YR6/4) clay to gravel, quartz and shale fragments, low sphericity, angular to subangular, poorly sorted.	56	49	7
7	7.5	black (N2/0) weathered shale with fissility.	5	4.75	0.25

Sedimentary Description from Banka Drilling of

Amphoe Tha Mai-Amphoe Muang, Changwat Chanthaburi

Banka No. B3-1 Grid ref. 181580 E 1395520 N Total depth 6.70 m.

Depth (m.)		Description	Sediment Volume (lits)		
From	To		Total	Sand	Gravel
0	3	grayish red (10R6/2) to bright reddish brown (5YR5/6) clay to gravel, quartz with low sphericity, subangular to subrounded, poorly sorted.	28	22	6
3	5	black (N2/0) clay to gravel, quartz, basalt fragments and laterite.	15.5	13	2.5
5	6.7	light gray (7.5YR8/1) with dull orange (5YR6/4) weathered phyllite.	14.5	12.25	2.25

Banka No. B4 Grid ref. 181360 E 1396140 N Total depth 10.50 m.

Depth (m.)		Description	Sediment Volume (lits)		
From	To		Total	Sand	Gravel
0	5	bright reddish brown (5YR5/6) and grayish red (10R6/2) sand and quartz gravel, very angular to subangular, low sphericity, poorly sorted.	47	36.75	10.25
5	10	dull orange (5YR6/4), grayish red (10R6/2) with gray (N4/0) and bright reddish brown (5YR5/6) sand with quartz gravel clay, olivine, pyroxene, green sapphire zircon.	42	33.75	8.25
10	10.5	greenish gray (10G6/1) weathered shale with fissility.	5	2.5	2.5

Sedimentary Description from Banka Drilling of

Amphoe Tha Mai-Amphoe Muang, Changwat Chanthaburi

Banka No. B5 Grid ref. 180860 E 1397137 N Total depth 9.00 m.

Depth (m.)		Description	Sediment Volume (lits)		
From	To		Total	Sand	Gravel
0	1	dull orange (5YR6/4) silt and gravel, quartz, chert and shale fragments, subangular to angular, low sphericity, poorly sorted.	10	9	1
1	7	grayish red (10R6/2) to bright reddish brown (5YR5/6) and red (10R4/8) clay to gravel, quartz, chert and shale fragments, angular to subangular, poorly sorted.	52.5	46.25	6.25
7	8	grayish red (10R6/2) and red (10R4/8) clay to gravel, quartz and shale fragments, subrounded to subangular, low sphericity, poorly sorted, zircon.	9	8.25	0.75
8	9	grayish red (10R6/2) to grayish red (7.5R6/2) weathered shale.	9	8.25	0.75

Banka No. B5-1 Grid ref. 180238 E 1397351 N Total depth 0.30 m.

Depth (m.)		Description	Sediment Volume (lits)		
From	To		Total	Sand	Gravel
0	0.3	dark red (7.5R3/6) laterite, firm and compacted.	5	4	1

Sedimentary Description from Banka Drilling of

Amphoe Tha Mai-Amphoe Muang, Changwat Chanthaburi

Banka No. B6 Grid ref. 181950 E 1393630 N Total depth 10.00 m.

Depth (m.)		Description	Sediment Volume (lits)		
From	To		Total	Sand	Gravel
0	3	bright brown (2.5YR5/8) to red (10R4/8) and pale reddish orange (2.5YR7/3) clay to gravel, lateritic gravel, quartz, iron concretion, angular to subangular, low sphericity, poorly sorted.	27	19.25	7.75
3	10	dull reddish orange (10R6/4) with light gray (7.5YR8/1) to dull orange (5YR6/4) and light yellowish orange (7.5YR8/4) highly weathered shale.	60.5	57	3.5

Sedimentary Description from Banka Drilling of

Amphoe Tha Mai-Amphoe Muang, Changwat Chanthaburi

Banka No. B7 Grid ref. 181403 E 1393731 N Total depth 12.60 m.

Depth (m.)		Description	Sediment Volume (lits)		
From	To		Total	Sand	Gravel
0	2	dark red (10R3/6) and very dark reddish brown (5YR2/4) clay to fine sand, quartz, zircon.	19	18	1
2	8	gray (N4/0-N5/0) with red (10R4/8) clay to gravel with plant remains, quartz, angular to subangular, low sphericity, poorly sorted.	48	40	8
8	11.5	light gray (7.5YR8/1) and dull orange (5YR6/4) clayey sand with quartz gravel, iron concretion, granite fragments.	26.5	19	7.5
11.5	12.6	black (N2/0) - dark gray (N3/0) with reddish gray (7.5R5/1) and brown (10YR4/4) to dull orange (5YR6/4) weathered shale with fissility.	14	8.5	5.5

Sedimentary Description from Banka Drilling of

Amphoe Tha Mai-Amphoe Muang, Changwat Chanthaburi

Banka No. B7-1 Grid ref. 181230 E 1393580 N Total depth 12.00 m.

Depth (m.)		Description	Sediment Volume (lits)		
From	To		Total	Clay-Sand	Gravel
0	2	land-filled soil.	17.5	13.75	3.75
2	5.5	dark reddish brown (5YR3/4) gravel to clay, quartz, very angular to subangular, low sphericity, poorly sorted.	26.5	23.25	3.25
5.5	9.5	Dull reddish orange (10R6/4) to pale reddish orange (2.5YR7/3) and bright reddish brown (5YR5/6), soft clay with fine sand.	38.5	37.25	1.25
9.5	11.5	Grayish red (10R6/2) clay to gravel, quartz, laterite, angular to rounded, low sphericity, poorly sorted, zircon and spinel.	27.5	24	3.5
11.5	12	Gray (N6/0) with gray (7.5Y5/1) weathered phyllite.			

Sedimentary Description from Banka Drilling of

Amphoe Tha Mai-Amphoe Muang, Changwat Chanthaburi

Banka No. B7-2 Grid ref. 181221 E 1393069 N Total depth 8.30 m.

Depth (m.)		Description	Sediment Volume (lits)		
From	To		Total	Clay-Sand	Gravel
0	2	Grayish red (10R6/2) and dull reddish orange clay with lateritic gravel, iron concretion and quartz, round to angular, low sphericity, poorly sorted.	17	13	4
2	7	Dull reddish orange (10R6/4) to pale reddish orange (2.5YR7/3) and dull orange (5YR6/4) clay to gravel, quartz, lateritc, angular to subround, low sphericity, poorly sorted.	41	37.5	3.5
7	8.3	Dull orange (5YR6/4) weathered granite.	11.5	10.25	1.25

Sedimentary Description from Banka Drilling of

Amphoe Tha Mai-Amphoe Muang, Changwat Chanthaburi

Banka No. B8 Grid ref. 180624 E 1394379 N Total depth 7.00 m.

Depth (m.)		Description	Sediment Volume (lits)		
From	To		Total	Clay-Sand	Gravel
0	1.5	Dark red (10R3/6) to very dark reddish brown (7.5R2/3) clay with sand and gravel, quartz, iron concretion, basalt fragments, angular, low sphericity, moderately sorted.	10	9.5	0.5
1.5	3	Black (N2/0) clay with sand and gravel, quartz, shale fragments, plant remains, angular, low sphericity, poorly sorted, garnet.	15	14.5	0.5
3	7	Pale reddish orange (2.5 YR7/3) to dull orange (5YR6/4) and light gray (7.5YR2/1) weathered shale.	30.5	28.5	2

Sedimentary Description from Banka Drilling of

Amphoe Tha Mai-Amphoe Muang, Changwat Chanthaburi

Banka No. B8-1 Grid ref. 180972 E 1394002 N Total depth 10.00 m.

Depth (m.)		Description	Sediment Volume (lits)		
From	To		Total	Clay-Sand	Gravel
0	5	Reddish gray(5R5/1)to gray (N4/0)clay with lateritic gravel, basalt and sandstone fragments, angular, low sphericity, poorly sorted, laterite, olivine and pyroxene.	40.5	38	2.5
5	10	Gray (N4/0) to dull orange (5YR6/4) sand to gravel, quartz, sandstone and basalt fragments, subangular to round, low sphericity, moderately sorted, pyroxene, zircon, sapphire.	38	32.25	5.75

Banka No. B9 Grid ref. 180688 E 1395493 N Total depth 2.30 m.

Depth (m.)		Description	Sediment Volume (lits)		
From	To		Total	Clay-Sand	Gravel
0	2.3	Pale reddish orange (2.5YR7/3) to bright reddish brown (5YR5/6) and dark reddish brown (5YR3/4) clay to gravel, laterite, iron concretion, basalt fragments, qrartz, angular to subround, low sphericity, poorly sorted.	22	19	3

Sedimentary Description from Banka Drilling of

Amphoe Tha Mai-Amphoe Muang, Changwat Chanthaburi

Banka No. B9-1 Grid ref. 180540 E 1395450 N Total depth 7.50 m.

Depth (m.)		Description	Sediment Volume (lits)		
From	To		Total	Clay-Sand	Gravel
0	2.5	Dark red (7.5R3/6) to dark reddish brown (7.5R3/3) clay and gravel with plant remains, lateritic gravel, iron concretion.	18	17.5	0.5
2.5	5	Bright reddish brown (5YR5/6) clay to gravel, quartz, iron concretion, lateritic gravel, basalt fragments, angular to subangular, low sphericity, pyroxene, zircon, sapphire and garnet.	25.5	22.5	3
5	7.5	Dull orange (5YR6/4) to pale orange (0.5YR7/3) weathered shale with fissility	15	11.75	3.25

Sedimentary Description from Banka Drilling of

Amphoe Tha Mai-Amphoe Muang, Changwat Chanthaburi

Banka No. B10 Grid ref. 183106 E 1392987 N Total depth 14.50 m.

Depth (m.)		Description	Sediment Volume (lits)		
From	To		Total	Clay-Sand	Gravel
0	6	Brownish gray (5R5/1) to brownish black (5RP3/1) clay with organic matter, sand and gravel, and laterite	45	3.5	10
6	11	Gray (N4/0) clay with fine to coarse sand moderately sorted, friable, and soft.	42	40.05	1.5
11	12	Gray (N4/0) clay with fine to coarse sand, gravel, quartz, poorly sorted, friable, and soft.	8.5	7	1.5
12	14.5	Grayish white (N7/0) weathered phyllite.	18.5	17.5	1

Sedimentary Description from Banka Drilling of

Amphoe Tha Mai-Amphoe Muang, Changwat Chanthaburi

Banka No. B11 Grid ref. 179000 E 1388680 N Total depth 18.50 m.

Depth (m.)		Description	Sediment Volume (lits)		
From	To		Total	Clay-Sand	Gravel
0	2	Bright reddish brown (5YR5/6) land-filled soil with lateritic gravel, quartz, and phyllite fragments.	16.5	16	0.5
2	10	Gray (7.5Y4/6) and dark greenish gray (7.5GY4/1) clay with shell fragments, gravel, lateritic gravel, basalt fragments, angular to subround, and poorly sorted.	69.5	67.5	2
10	18.5	Hight gray (7.5Y7/1) to dull orange (5YR6/4) clay to gravel, quartz, laterite, iron concretion, and phyllite fragments.	82	77	5

Sedimentary Description from Banka Drilling of

Amphoe Tha Mai-Amphoe Muang, Changwat Chanthaburi

Banka No. B11-1 Grid ref. 177896 E 1389528 N Total depth 13.50 m.

Depth (m.)		Description	Sediment Volume (lits)		
From	To		Total	Clay-Sand	Gravel
0	4	Very dark reddish brown (7.5R2/3) to dark reddish brown (5YR3/4) clay with plant remains.	35	34	1
4	7	Dark reddish brown (5YR3/4) clay with shell fragments.	24	23.25	0.75
7	8	Grayish white (N7/0) with bright brown (2.5YR5/8) clay with lateritic fragment.	10	9.25	0.75
8	13.5	Grayish white (N8/0) with dull reddish orange (10R6/4) clay with fine to coarse sand, gravel, angular to subangular, low sphericity, and poorly sorted.	57	55.25	1.75
13.5	++	Grayish white (N8/0) weathered phyllite.			

Sedimentary Description from Banka Drilling of

Amphoe Tha Mai-Amphoe Muang, Changwat Chanthaburi

Banka No. B12 Grid ref. 180049 E 1389878 N Total depth 14.00 m.

Depth (m.)		Description	Sediment Volume (lits)		
From	To		Total	Clay-Sand	Gravel
0	2.5	Dark purplish gray (5RP3/1) to black (N2/0) clay with plant remains, quartz gravel, peat, subangular, low sphererecity, and poorly sorted	17	15.75	1.25
2.5	7	Gray (7.5Y4/1) to dark greenish gray (7.5Gy4/1) clay with shell fragment, gravel, subround to subangular, low sphericity, and poorly sorted.	47	44.25	2.75
7	14	Various colored with mottle clay with lateritic gravel, quartz, angular, to subround, poorly sorted, low sphericity, and compacted.	68	62	6
14	++	Dull orange (5YR6/4) and light gray (7.5YR8/1) highly weathered phyllite.			

Sedimentary Description from Banka Drilling of

Amphoe Tha Mai-Amphoe Muang, Changwat Chanthaburi

Banka No. B13 Grid ref. 180731 E 1392203 N Total depth 9.00 m.

Depth (m.)		Description	Sediment Volume (lits)		
From	To		Total	Clay-Sand	Gravel
0	3	Grayish olive(5Y4/2) to dark greenish gray (7.5GY4/1) clay with slightly sand, shell fragments, lateritio gravel, very angular-angular, low sphericity, and poorly sorted.	26.5	25	1.5
3	8	Dull reddish orange (10R6/4) to pale reddish orange (2.5YR7/3) clay with sand and gravel, quartz, lateritio, angular to subround, low sphericity, and poorly sorted.	40	32.75	7.25
8	9	Pale reddish orange (2.5YR7/3) with mottle color highly weathered shale, and fissility remained.	10	7.5	2.5

Sedimentary Description from Banka Drilling of

Amphoe Tha Mai-Amphoe Muang, Changwat Chanthaburi

Banka No. B13-1 Grid ref. 181174 E 1392437 N Total depth 12.30 m.

Depth (m.)		Description	Sediment Volume (lits)		
From	To		Total	Clay-Sand	Gravel
0	3	Gray (5Y6/1) with dull orange (5YR6/4) clay with quartz and lateritic gravel.	27	26.25	0.75
3	10	Gray (N6/0) mottle with bright brown (2.5YR5/8) and dull orange (5YR6/4) fine to coarse sand with gravel and clay, laterite, quartz with subangular, low sphericity, slightly compacted, green sapphire, pyorxene, and zircon.	56.5	51	5.5
10	12.3	Bright brown (2.5YR5/8) and dull orange (5Y6/4) clay, gravel and sand, lateritic gravel, quartz, angular to subangular, low sphericity, compacted, and firm.	24.5	23	15
12.3	++	Gray (N6/0) highly weathered shale to clay with fissility and fragments remain			

Sedimentary Description from Banka Drilling of

Amphoe Tha Mai-Amphoe Muang, Changwat Chanthaburi

Banka No. B14 Grid ref. 179883 E 1392003 N Total depth 9.00 m.

Depth (m.)		Description	Sediment Volume (lits)		
From	To		Total	Clay-Sand	Gravel
0	3	Dark reddish brown (7.5R3/3) to dark gray (N3/0) clay and fine sand with shell fragments and basalt.	25.5	24.75	0.75
3	8	Dull reddish orange (10R6/4) with red (10R4/8) and reddish orange (10R6/8) clay with sand, lateritic gravel, iron concretion, quartz, pisolite, angular to subangular, low sphericity, poorly sorted, pyroxene.	41.5	36.75	4.75
8	9	Pale reddish orange (2.5YR7/3) with dull reddish orange (10R6/4) and light gray (7.5YR8/1) highly weathered shale to clay and rock fragments	9	8.25	0.75

Sedimentary Description from Banka Drilling of

Amphoe Tha Mai-Amphoe Muang, Changwat Chanthaburi

Banka No. B15 Grid ref. 179116 E 1391392 N Total depth 11.60 m.

Depth (m.)		Description	Sediment Volume (lits)		
From	To		Total	Clay-Sand	Gravel
0	6	Dark greenish gray (7.5GY4/1) clay with quartz gravel and sillstone fragments, subangular, low sphericity, poorly sorted, shell fragments.	51	49.5	1.5
6	9	Dark reddish brown (5YR3/4) to bright brown (2.5YR5/8) clay, fine to coarse sand, quartz gravel, chert fragment and laterite, subangular, low sphericity, poorly sorted.	26	22.25	3.75
9	11	Dull orange (5YR6/4) clay, fine to coarse sand, quartz, laterite and chert fragments, low shpericity, subangular to round, firm and soft.	15.5	13.5	2
11	11.6	Dull orange (5YR6/4) highly weathered phyllite.	6.5	5.75	0.75

Sedimentary Description from Banka Drilling of

Amphoe Tha Mai-Amphoe Muang, Changwat Chanthaburi

Banka No. B16 Grid ref. 177900 E 1392193 N Total depth 11.00 m.

Depth (m.)		Description	Sediment Volume (lits)		
From	To		Total	Clay-Sand	Gravel
0	1	Grayish red (10R6/2) clay and fine sand with plant remains.	10	9.75	0.25
1	7	Gray (7.5Y4/1) to dark greenish gray (7.5GY4/1) clay with shell fragments.	51.5	50	1.5
7	10	Reddish orange (10R6/8) clay, fine sand, lateritic gravel, quartz, iron concretion, pyroxene.	30	28.75	1.25
10	11	Light gray (7.5YR8/1) to dull orange (5YR6/4) highly weathered phyllite to clay with fragments.	6.5	6.25	0.25

Banka No. B16-1 Grid ref. 178220 E 1391820 N Total depth 11.80 m.

Depth (m.)		Description	Sediment Volume (lits)		
From	To		Total	Clay-Sand	Gravel
0	7	Gray (7.5Y4/1) to dark greenish gray (7.5GY4/1) clay with plant remains and shell fragments, slightly lateritic gravel and basalt fragments.	65.5	63.75	1.75
7	11.8	Dull orange (5YR6/4) with bright brown (2.5YR5/8) clay, fine to coarse sand and gravel, laterite, quartz, angular to subangular, low sphericity, poorly sorted.	44.5	42.25	2.25
11.8	++	Dull orange (5YR6/4) with light gray (7.5Y7/1) weathered shale.			

Sedimentary Description from Banka Drilling of

Amphoe Tha Mai-Amphoe Muang, Changwat Chanthaburi

Banka No. B16-1 Grid ref. 178220 E 1391820 N Total depth 11.80 m.

Depth (m.)		Description	Sediment Volume (lits)		
From	To		Total	Clay-Sand	Gravel
0	7	Gray (7.5Y4/1) to dark greenish gray (7.5GY4/1) clay with plant remains and shell fragments, slightly lateritic gravel and basalt fragments.	65.5	63.75	1.75
7	11.8	Dull orange (5YR6/4) with bright brown (2.5YR5/8) clay, fine to coarse sand and gravel, laterite, quartz, angular to subangular, low sphericity, poorly sorted.	44.5	42.25	2.25
11.8	++	Dull orange (5YR6/4) with light gray (7.5Y7/1) weathered shale.			

Sedimentary Description from Banka Drilling of

Amphoe Tha Mai-Amphoe Muang, Changwat Chanthaburi

Banka No. B17 Grid ref. 177107 E 1392409 N Total depth 11.50 m.

Depth (m.)		Description	Sediment Volume (lits)		
From	To		Total	Clay-Sand	Gravel
0	1	Black (N2/0) mostly clay and fine sand with plant remains.	10	9.75	0.25
1	4.5	Greenish black (7.5GY2/1) to dark bluish gray (5BG4/1) clay with shell fragments.	27	26.25	0.75
4.5	10	Light gray (7.5Y7/1) dull reddish orange (10R6/4) with light gray (7.5YR8/1) and bright brown (2.5YR5/8) clay and lateritic gravel, angular to subround, low sphericity, poorly sorted.	51	45.25	5.75
10	11.5	Light gray (7.5YR8/1) with light yellowish orange (7.5YR8/4) to dull orange (5YR6/4) hgihly weathered phyllite.	15.5	15	0.5

Sedimentary Description from Banka Drilling of

Amphoe Tha Mai-Amphoe Muang, Changwat Chanthaburi

Banka No. B17-1 Grid ref. 177440 E 1392830 N Total depth 9.00 m.

Depth (m.)		Description	Sediment Volume (lits)		
From	To		Total	Clay-Sand	Gravel
0	2	Grayish red (10R6/2) clay and fine sand with plant remains.	18.5	18	0.5
2	7	Gray (7.5Y4/1) to gray (N4/0) clay with fine sand and shell fragments.	44.5	43.25	1.25
7	9	Dull orange (5YR6/4) with gray (N6/0) and light gray (7.5YR8/1) clay, fine sand, lateritic gravel, quartz, angular to subround, low sphericity, poorly sorted, zircon and pyroxene.	20	19	1

Banka No. B17-2 Grid ref. 177840 E 1393255 N Total depth 8.50 m.

Depth (m.)		Description	Sediment Volume (lits)		
From	To		Total	Clay-Sand	Gravel
0	3	Dark reddish brown (5YR3/4) and grayish olive (5Y4/2) weathered basalt with zircon, olivine and pyroxene.	27.5	25	2.5
3	7	Dull orange (5YR6/4) with grayish white (N8/0) and dull reddish orange (10R6/4) clay, fine to coarse sand, quartz, laterite.	38.5	32.25	6.25
7	8.5	Dark red (10R3/6) with dull orange (5YR6/4) weathered shale with fissility.	7	6.75	0.25

Sedimentary Description from Banka Drilling of

Amphoe Tha Mai-Amphoe Muang, Changwat Chanthaburi

Banka No. B18 Grid ref. 176690 E 1392640 N Total depth 11.70 m.

Depth (m.)		Description	Sediment Volume (lits)		
From	To		Total	Clay-Sand	Gravel
0	1.5	Grayish red(7.5R6/2) clay and fine sand with plant remains.	10	9.75	0.25
1.5	6.5	Dark bluish gray (5BG4/1) to (5BG3/1) clay with shell fragments	42	40.75	1.25
6.5	10.5	Light gray (7.5Y7/1) to dull reddish orange (10R6/4) and bright brown (2.5YR5/8) clay with fine sand, laterite and quartz, very angular to subround, low sphericity, poorly sorted.	32	26.25	5.75
10.5	11.7	Light gray (7.5YR8/1) with light yellowish orange (7.5YR8/4) and bright brown weathered phyllite.	17	14	3

Banka No. B18-1 Grid ref. 176042 E 1392059 N Total depth 14.00 m.

Depth (m.)		Description	Sediment Volume (lits)		
From	To		Total	Clay-Sand	Gravel
0	2	Dark purplish gray (5RP3/1) clay and fine sand, with plant remains.	18	7.5	0.5
2	7	Dark bluish gray (5BG3/1) – (5BG4/1) clay with shell fragments.	41.5	40.25	1.25
7	14	Gray (N6/0) with dull reddish orange (10R6/4) clay and sand, laterite, quartz, angular to subround, low sphericity, poorly sorted.	60	55	5

Sedimentary Description from Banka Drilling of

Amphoe Tha Mai-Amphoe Muang, Changwat Chanthaburi

Banka No. B19 Grid ref. 176518 E 1393775 N Total depth 9.00 m.

Depth (m.)		Description	Sediment Volume (lits)		
From	To		Total	Clay-Sand	Gravel
0	3	Dark purplish gray (5RP3/1) clay with lateritic gravel, subangular, low sphericity, poorly sorted.	26.5	25	1.5
3	8.5	Bright brown (2.5YR5/8) with dull orange (5YR6/4) lateritic gravel, subangular, low sphericity.	39.5	34.25	5.25
8.5	9	Dull orange (5YR6/4) weathered phyllite.	8.5	8.25	0.25

Banka No. B19-1 Grid ref. 176110 E 1393440 N Total depth 9.80 m.

Depth (m.)		Description	Sediment Volume (lits)		
From	To		Total	Clay-Sand	Gravel
0	3	Gray (7.5Y4/1) with black (7.5Y2/1) clay with shell fragments, well sorted.	25.5	24.75	0.75
3	6	Bright brown (2.5YR5/8) clay with sand and lateritic gravel, quartz subangular, low sphericity, poorly sorted.	50.5	40.75	9.75
9	9.8	Dull orange (5YR6/4)	7.5	7.25	0.25

Sedimentary Description from Banka Drilling of

Amphoe Tha Mai-Amphoe Muang, Changwat Chanthaburi

Banka No. B19-2 Grid ref. 176756 E 1394304 N Total depth 7.00 m.

Depth (m.)		Description	Sediment Volume (lits)		
From	To		Total	Clay-Sand	Gravel
0	3	Grayish red (10R6/2) laterite, lateritic gravel and clay, slightly compacted, green sapphire and zircon.	28.5	24.5	4
3	7	Dull orange (5YR6/4) laterite, lateritic gravel and quartz, slightly compacted.	33.5	31.75	3.5
7	++	Light gray (7.5YR8/1) with pale reddish orange (2.5YR7/3) weathered shale.			

Banka No. B19-3 Grid ref. 176569 E 1394073 N Total depth 8.60 m.

Depth (m.)		Description	Sediment Volume (lits)		
From	To		Total	Clay-Sand	Gravel
0	1.5	Black (N1.5/0) clay with silt and organic matter.	10	9.5	0.5
1.5	8	Black (N1.5/0) to dull reddish orange (10R6/4) and dull orange (5YR6/4) laterite.	60.5	47.5	13
8	8.6	Dull orange (5YR6/4) weathered phyllite.	7	6.75	0.25

Sedimentary Description from Banka Drilling of

Amphoe Tha Mai-Amphoe Muang, Changwat Chanthaburi

Banka No. B20 Grid ref. 176308 E 1394661 N Total depth 7.40 m.

Depth (m.)		Description	Sediment Volume (lits)		
From	To		Total	Clay-Sand	Gravel
0	1.5	Black (N2/0) clay with plant remains, green sapphire and zircon.	9	8.75	0.25
1.5	7	Grayish red (7.5R6/2) to dark red (10R3/6) clay with lateritic gravel and quartz, laterite, loose to moderately compacted, zircon.	53.5	44.75	8.75
7	7.4	Dull orange (5YR6/4) weathered phyllite.	6	5.75	0.25

Sedimentary Description from Banka Drilling of

Amphoe Tha Mai-Amphoe Muang, Changwat Chanthaburi

Banka No. B20-1 Grid ref. 176140 E 1394670 N Total depth 8.50 m.

Depth (m.)		Description	Sediment Volume (lits)		
From	To		Total	Clay-Sand	Gravel
0	2	Black (N1.5/0) clay with plant remains, quartz gravel, basalt fragments, laterite, zircon.	16	14.5	1.5
2	3.5	Dark red (7.5R3/6) with dark reddish brown (5YR3/4) weathered basalt with laterite, zircon and pyroxene.	8.5	7	1.5
3.5	5	Grayish red (10R6/2) gravel to clay, quartz, laterite and basalt fragments.	19	14.25	4.75
5	8.5	Bright brown (2.5YR5/8) with dull orange (5YR6/4) clay, sand, laterite and quartz gravel.	23.5	21.25	2.25
8.5	++	Dull orange (5YR6/4) weathered phyllite.	6	5.75	0.25

Sedimentary Description from Banka Drilling of

Amphoe Tha Mai-Amphoe Muang, Changwat Chanthaburi

Banka No. B20-2 Grid ref. 176226 E 1394219 N Total depth 8.00 m.

Depth (m.)		Description	Sediment Volume (lits)		
From	To		Total	Clay-Sand	Gravel
0	2	Black (N1.5/0) clay with plant remains, and lateritic gravel.	18.5	18	0.5
2	6	Dull orange (5YR6/4) and bright brown (2.5YR5/8) lateritic gravel with basalt fragment, green sapphire and pyroxene.	31	26	5
6	8	Dull orange (5YR6/4) weathered phyllite.	14.5	14	0.5

Banka No. B20-3 Grid ref. 176224 E 1394419 N Total depth 7.60 m.

Depth (m.)		Description	Sediment Volume (lits)		
From	To		Total	Clay-Sand	Gravel
0	1.5	Black (N1.5/0) clay with plant remains.	9.5	9.25	0.25
1.5	4	Bright brown (2.5YR5/8) to dull orange (5YR6/4) Aand grayish white (N7/0) basalt fragments, laterite and lateritic gravel	28	21.5	6.5
4	7.6	Bright brown (2.5YR5/8) to dull orange (5YR6/4) clay to gravel, quartz and lateritic gravel.	26	23.75	2.25
7.6	++	Dull orange (5YR6/4) weathered phyllite.	9	8	1

Sedimentary Description from Banka Drilling of

Amphoe Tha Mai-Amphoe Muang, Changwat Chanthaburi

Banka No. B20-4 Grid ref. 175824 E 1394838 N Total depth 7.00 m.

Depth (m.)		Description	Sediment Volume (lits)		
From	To		Total	Clay-Sand	Gravel
0	2.7	Dark purplish gray (5RP3/1) soft clay with plant remains, olivine, ziron and pyroxene.	17	16.25	0.75
2.7	3.5	Reddish brown (10R5/3) and red (7.5R4/6) weathered basalt with hardpan laterite.	7.5	7.25	0.25
3.5	7	Grayish white (N8/0), bright brown (2.5YR5/8) to dull orange (5YR6/4) weathered shale.	38	33	5

Banka No. B20-5 Grid ref. 175868 E 1394586 N Total depth 8.00 m.

Depth (m.)		Description	Sediment Volume (lits)		
From	To		Total	Clay-Sand	Gravel
0	1	Dark reddish brown 95YR3/4) soft clay with plant remains, pyroxene.	9	8.75	0.25
1	4	Gray (7.5Y4/1) weathered basalt with developed laterite, pyroxene and zircon.	23.5	19.25	4.25
4	8	Bright brown (2.5YR5/8) to dull orange (5YR6/4) clay with laterite, pyroxene.	34	28.25	5.75
8	++	Dull orange (5YR6/4) weathered phyllite.			

Sedimentary Description from Banka Drilling of

Amphoe Tha Mai-Amphoe Muang, Changwat Chanthaburi

Banka No. B20-6 Grid ref. 175859 E 1394343 N Total depth 9.00 m.

Depth (m.)		Description	Sediment Volume (lits)		
From	To		Total	Clay-Sand	Gravel
0	2	Land-filled soil.	18.5	17.75	0.75
2	3	Dark reddish brown (5YR3/4) clay with plant remains.	7.5	7.25	0.25
3	5	Gray (7.5Y4/1) weathered basalt with laterite.	16.5	13.5	3
5	8	Clay with laterite and quartz gravel.	27	22.5	4.5
8	9	Dull orange (5YR6/4) weathered phyllite.	10	8.5	1.5

Banka No. B21 Grid ref. 179530 E 1393020 N Total depth 15.00 m.

Depth (m.)		Description	Sediment Volume (lits)		
From	To		Total	Clay-Sand	Gravel
0	12	Bright brown (2.5YR5/8) with dull orange (5YR6/4) and dark reddish brown (7.5R3/3) basaltic residual soil with basalt fragments, green sapphire.	104.5	84.5	20
12	15	Weathered fine-grained sandstone.	24	22	2

Sedimentary Description from Banka Drilling of

Amphoe Tha Mai-Amphoe Muang, Changwat Chanthaburi

Banka No. B22 Grid ref. 177658 E 1393767 N Total depth 19.20 m.

Depth (m.)		Description	Sediment Volume (lits)		
From	To		Total	Clay-Sand	Gravel
0	5	Dark red (7.5R3/6) basaltic soil with basalt fragments, iron concretion, pisolite, zircon, light blue sapphire, pyroxene, and magnetite/ilmenite.	41.5	40	1.5
5	12	Dark red (7.5R3/6) to bright reddish brown (5YR5/6) with grayish red (10R6/2) and bright reddish brown (5YR5/6) lateritic soil with basalt fragments, laterite, iron concretion and pisolite.	56.5	53.5	2.5
12	19.2	Gray (N6/0) weathered basalt with porphyritic texture.	70.5	68.5	2

Banka No. B23 Grid ref. 178280 E 1394460 N Total depth 7.00 m.

Depth (m.)		Description	Sediment Volume (lits)		
From	To		Total	Clay-Sand	Gravel
0	7	Dark red (10R3/6) to black (N2/0) weathered basalt with resicular texture, green and yellow sapphire, magnetite, olivine and garnet.	58	50.75	7.25

Sedimentary Description from Banka Drilling of

Amphoe Tha Mai-Amphoe Muang, Changwat Chanthaburi

Banka No. B24 Grid ref. 179610 E 1392450 N Total depth 6.00 m.

Depth (m.)		Description	Sediment Volume (lits)		
From	To		Total	Clay-Sand	Gravel
0	6	Bright reddish brown (5YR5/6) to dark greenish gray (7.5GY4/1) and dark red (10R3/6) weathered basalt and laterite, pyroxene, magnetite, zircon, and spinel.	48	28	20

Banka No. B25 Grid ref. 179240 E 1393460 N Total depth 10.00 m.

Depth (m.)		Description	Sediment Volume (lits)		
From	To		Total	Clay-Sand	Gravel
0	10	Grayish red (7.5R6/8) to pale reddish orange (2.5YR7/3) with light gray (7.5YR8/1) to dark red (10R3/6) to dark reddish brown (7.5R3/3) and dark gray (N3/0) weathered basalt and laterite, pyroxene, zircon, mica and green sapphire.	86.5	70.75	15.75

Sedimentary Description from Banka Drilling of

Amphoe Tha Mai-Amphoe Muang, Changwat Chanthaburi

Banka No. B26 Grid ref. 178820 E 1393980 N Total depth 10.60 m.

Depth (m.)		Description	Sediment Volume (lits)		
From	To		Total	Clay-Sand	Gravel
0	10.6	Dark red (10R3/6) to dark red (10R3/6) and dark reddish brown (5YR3/4) weathered basalt and laterite, green sapphire and pyroxene.	91.5	82.5	9

Banka No. B27 Grid ref. 178349 E 1399030 N Total depth 3.70 m.

Depth (m.)		Description	Sediment Volume (lits)		
From	To		Total	Clay-Sand	Gravel
0	2	Pale reddish orange (2.5YR7/3) clay to sand with phyllite fragments.	19	15.75	3.25
2	3	Grayish white (N7/0) with dull orange (5YR6/4) clay and gravel quartz, laterite, phyllite fragments, angular to subangular, low sphericity, poorly sorted.	8.5	8	0.5
3	3.7	Dull reddish brown (7.5R4/3) weathered phyllite.			

Sedimentary Description from Banka Drilling of

Amphoe Tha Mai-Amphoe Muang, Changwat Chanthaburi

Banka No. B27-1 Grid ref. 177750 E 1399120 N Total depth 6.80 m.

Depth (m.)		Description	Sediment Volume (lits)		
From	To		Total	Clay-Sand	Gravel
0	3	Grayish red (10r6/2) to dull orange (5YR6/4) and bright brown (2.5YR5/8) clay to fine sand and gravel, quartz, phyllite fragments and lateritic gravel, angular to subround, low sphericity, poorly sorted.	28	22.75	5.25
3	6.8	Reddish orange (10R6/8) to dull reddish brown (7.5R4/3) with light reddish gray (10R7/1) weathered phyllite.	34	30	4

Banka No. B28 Grid ref. 178111 E 1398448 N Total depth 1.70 m.

Depth (m.)		Description	Sediment Volume (lits)		
From	To		Total	Clay-Sand	Gravel
0	1	Dark red (10R3/6) basaltic soil with basalt fragments, iron concretion, and pisolite.	9.5	7	2.5
1	1.7	Dark red with black (N1.5/0) laterite, cpmpacted and firm.	10	9.25	0.75

Sedimentary Description from Banka Drilling of

Amphoe Tha Mai-Amphoe Muang, Changwat Chanthaburi

Banka No. B29 Grid ref. 177830 E 1397720 N Total depth 9.70 m.

Depth (m.)		Description	Sediment Volume (lits)		
From	To		Total	Clay-Sand	Gravel
0	9.7	Dark red (7.5R3/6) to dark red (10R3/6) weathered basalt.	80.5	76	4.5

Banka No. B30 Grid ref. 179370 E 1396648 N Total depth 9.20 m.

Depth (m.)		Description	Sediment Volume (lits)		
From	To		Total	Clay-Sand	Gravel
0	9.2	Dark red (7.5R3/6) weathered basalt with iron concretion, pisolite and basalt fragments.	80.5	78.5	2.75

Sedimentary Description from Banka Drilling of

Amphoe Tha Mai-Amphoe Muang, Changwat Chanthaburi

Banka No. B32 Grid ref. 177475 E 1396516 N Total depth 5.00 m.

Depth (m.)		Description	Sediment Volume (lits)		
From	To		Total	Clay-Sand	Gravel
0	1	Light gray (10YR8/1) and dull orange (5YR6/4) weathered basalt and laterite, green sapphire.	10	9.25	0.75
1	3	Light gray (10YR8/1) with dull orange (5YR6/4) clay to gravel, quartz, iron concretion, angular to subround, low sphericity, poorly sorted.	20	16	4
3	4	Light reddish gray (10R7/1) with reddish orange (10R6/8) clay to gravel, laterite, quartz, phyllite fragments, angular to subangular, low sphericity, poorly sorted.	9.5	8.75	0.75
4	5	Light gray (7.5YR8/1) with light yellowish orange (7.5YR8/4) and grayish red (10R6/2) weathered phyllite.	8.5	8	0.5

Sedimentary Description from Banka Drilling of

Amphoe Tha Mai-Amphoe Muang, Changwat Chanthaburi

Banka No. B32-1 Grid ref. 177343 E 1396517 N Total depth 4.00 m.

Depth (m.)		Description	Sediment Volume (lits)		
From	To		Total	Clay-Sand	Gravel
0	1	Bright reddish brown (5YR5/6) clay with lateritic gravel, subround to round, low sphericity, firm and compacted, zircon, garnet and pyroxene	10	8.75	1.25
1	2	Bright reddish brown (5YR5/6) with grayish red (10R6/2) clay with lateritic gravel, quartz, subangular to round, low sphericity, poorly sorted	10	8	2
2	2.2	Bright reddish brown (5YR5/6) clay with laterite and quartz gravel, angular, low sphericity, poorly sorted	9.5	9.25	0.25
2.2	4	Grayish white (N8/0) weathered phyllite	19.5	19.25	0.25

Sedimentary Description from Banka Drilling of

Amphoe Tha Mai-Amphoe Muang, Changwat Chanthaburi

Banka No. B32-2 Grid ref. 177093 E 1396494 N Total depth 4.50 m.

Depth (m.)		Description	Sediment Volume (lits)		
From	To		Total	Clay-Sand	Gravel
0	2	Bright reddish brown (5YR5/6) with gray (N6/0) clay with lateritic gravel and quartz, angular to subangular, low sphericity, poorly sorted	20	18	2
2	3	Bright brown (2.5YR5/8) clay to gravel, laterite, quartz, angular, low sphericity, poorly sorted, green sapphire	9.5	8.75	0.75
3	4.5	Dull reddish orange (10R6/4) to light gray (7.5YR8/1) weathered phyllite	14	13.25	0.75

Sedimentary Description from Banka Drilling of

Amphoe Tha Mai-Amphoe Muang, Changwat Chanthaburi

Banka No. B33 Grid ref. 176873 E 1396661 N Total depth 6.80 m.

Depth (m.)		Description	Sediment Volume (lits)		
From	To		Total	Clay-Sand	Gravel
0	2	Grayish red (10R6/2) with pale reddish orange (2.5YR7/3) clay to gravel, laterite, quartz, iron concretion, angular, low sphericity, poorly sorted, blue, green and star sapphire, pyroxene	20	16.25	3.75
2	4	Grayish red (10R6/2) and dull orange (5YR6/4) clay to gravel, quartz, lateritic gravel, angular to subangular, low sphericity, and poorly sorted, pyroxene	18.5	17.75	0.75
4	6	Dull orange (5YR6/4) to pale reddish orange (2.5YR7/3) clay to gravel, quartz, lateritic gravel, phyllite fragments, angular to subangular, low sphericity, poorly sorted, pyroxene and garnet	18	15	3
6	6.8	Dull yellow (2.5Y6/3) weathered phyllite			

Sedimentary Description from Banka Drilling of

Amphoe Tha Mai-Amphoe Muang, Changwat Chanthaburi

Banka No. B33-1 Grid ref. 177030 E 1396520 N Total depth 4.30 m.

Depth (m.)		Description	Sediment Volume (lits)		
From	To		Total	Clay-Sand	Gravel
0	3.5	Dark reddish brown (5YR3/4) to bright reddish brown (5YR5/6) and dull orange (5YR6/4) clay to gravel, lateritic gravel, quartz, angular to subround, low sphericity, poorly sorted, green sapphire and pyroxene	29	27	2
3.5	4.3	Light yellowish orange (7.5YR8/4) - light gray (7.5YR8/1) and dull yellow (2.5Y6/3) with gray (7.5Y5/1) weathered phyllite	15	14.25	0.75

Sedimentary Description from Banka Drilling of

Amphoe Tha Mai-Amphoe Muang, Changwat Chanthaburi

Banka No. B33-2 Grid ref. 176638 E 1396204 N Total depth 6.00 m.

Depth (m.)		Description	Sediment Volume (lits)		
From	To		Total	Clay-Sand	Gravel
0	2	Bright reddish brown (5YR5/6) and dull reddish orange (10R6/4) sand to clay with gravel, quartz, angular to subround, low sphericity, poorly sorted, pyroxene	19	14.5	4.5
2	4	Dull reddish orange (10R6/4) with light gray (7.5YR8/1) clay to gravel, lateritic gravel and quartz, angular to subround, low sphericity, poorly sorted	17	13.5	3.5
4	6	Light yellowish orange (7.5YR8/4) to light gray (7.5YR8/1) and reddish orange (10R6/8) weathered phyllite	18	16.75	1.25

Sedimentary Description from Banka Drilling of

Amphoe Tha Mai-Amphoe Muang, Changwat Chanthaburi

Banka No. B33-3 Grid ref. 176032 E 1396353 N Total depth 6.00 m.

Depth (m.)		Description	Sediment Volume (lits)		
From	To		Total	Clay-Sand	Gravel
0	1.5	Bright brown (2.5YR5/8) and dull orange (5YR6/4) clay with phyllite and sandstone fragments	9	5.5	3.5
1.5	2	Dark purplish gray (5RP3/1) clay with plant remains	8.5	7.75	0.75
2	4	Grayish white (N7/0) to dull orange (5YR6/4) and bright brown (2.5YR5/8) clay to sand and gravel, lateritic gravel, angular to subround, low sphericity, poorly sorted	18	16.5	1.5
4	4.1	Dull orange (5YR6/4) with bright brown (2.5YR5/8) gravel, laterite, quartz, sandstone fragments, subangular, low sphericity, poorly sorted	10	9.25	0.75
4.1	6	Light gray (7.5YR8/1) and pale reddish orange (7.5YR8/4) weathered shale	18.5	17.75	0.75

Sedimentary Description from Banka Drilling of

Amphoe Tha Mai-Amphoe Muang, Changwat Chanthaburi

Banka No. B33-4 Grid ref. 175802 E 1395994 N Total depth 6.50 m.

Depth (m.)		Description	Sediment Volume (lits)		
From	To		Total	Clay-Sand	Gravel
0	1	Land-filled soil	9	6	3
1	2	Dark purplish gray (5RP3/1) clay with plant remains, sand and gravel, sandstone and shale fragments, quartz, angular, low sphericity, poorly sorted	8.5	7	1.5
2	3.5	Greenish gray (7.5GY6/1) clay with lateritic gravel	7.5	6.75	0.75
3.5	5	Grayish white (N7/0) with dull orange (5YR6/4) and bright brown (2.5YR5/8) clay to gravel, phyllite fragments, laterite, subangular, low sphericity, poorly sorted	19.5	18	1.5
5	6	Greenish gray (7.5GY6/1) sand and gravel, quartz, laterite, phyllite fragments, subangular, low sphericity	10	9.25	0.75
6	6.5	Greenish gray (7.5GY6/1) weathered phyllite	7.5	7.25	0.25

Banka No. B33-5 Grid ref. 176451 E 1395912 N Total depth 1.30 m.

Depth (m.)		Description	Sediment Volume (lits)		
From	To		Total	Clay-Sand	Gravel
0	1	Land-filled soil	9	8	1
1	1.3	Dark reddish brown (5YR3/4) with drak red (7.5R3/6) hardpan laterite, compacted and firm	7	6	1.5

Sedimentary Description from Banka Drilling of

Amphoe Tha Mai-Amphoe Muang, Changwat Chanthaburi

Banka No. B33-6 Grid ref. 175499 E 1395604 N Total depth 6.50 m.

Depth (m.)		Description	Sediment Volume (lits)		
From	To		Total	Clay-Sand	Gravel
0	4	Dark purplish gray (5RP3/1) clay with plant remains, zircon and pyroxene	32.5	30.75	1.75
4	4.7	Dark red (10R3/6) to dark reddish brown (5YR3/4) and gray (7.5Y4/1) weathered basalt, developed to laterite, green sapphire, pyroxene	7.5	6.75	0.75
4.7	6.5	Dull orange (5YR6/4) quartz gravel and laterite	16	14.5	1.5
6.5	++	Grayish white (N8/0) weathered phyllite	6	5.5	0.5

Banka No. B33-7 Grid ref. 175166 E 1395324 N Total depth 7.00 m.

Depth (m.)		Description	Sediment Volume (lits)		
From	To		Total	Clay-Sand	Gravel
0	2	Very dark reddish brown (7.5R2/3) soft clay with plant remains	16	16	-
2	5	Dark gray (N3/0) to gray (N6/0) weathered basalt and laterite	24.5	21.5	3
5	7	Bright brown (2.5YR5/8) clay to gravel, laterite and quartz, angular, low sphericity, poorly sorted	18	16	2
7	++	Light grayish gray (10GY8/1) weathered phyllite			

Sedimentary Description from Banka Drilling of

Amphoe Tha Mai-Amphoe Muang, Changwat Chanthaburi

Banka No. B33-8 Grid ref. 176967 E 1396885 N Total depth 9.00 m.

Depth (m.)		Description	Sediment Volume (lits)		
From	To		Total	Clay-Sand	Gravel
0	1	Dark red (7.5R3/6) basaltic soil with iron concretion	10	9.75	0.25
1	9	Dull reddish orange (10R6/4) – grayish white (N7/0), light yellowish orange (7.5YR8/4) and grayish white (N8/0) clay to gravel, laterite, quartz, iron concretion, angular to subround, low sphericity, poorly sorted, pyroxene	72	63.75	8.25

Banka No. B33-9 Grid ref. 177480 E 1397220 N Total depth 10.00 m.

Depth (m.)		Description	Sediment Volume (lits)		
From	To		Total	Clay-Sand	Gravel
0	10	Dark red (10R3/6) and very dark reddish brown (7.5R2/3) weathered basalt	83	80.75	2.25

Sedimentary Description from Banka Drilling of

Amphoe Tha Mai-Amphoe Muang, Changwat Chanthaburi

Banka No. B34 Grid ref. 178397 E 1393697 N Total depth 19.50 m.

Depth (m.)		Description	Sediment Volume (lits)		
From	To		Total	Clay-Sand	Gravel
0	19.5	Dark red (10R3/6) to gray (7.5Y4/1) weathered basalt with basaltic soil and fragments	171	165.25	5.75

Banka No. B36 Grid ref. 180166 E 1394126 N Total depth 19.10 m.

Depth (m.)		Description	Sediment Volume (lits)		
From	To		Total	Clay-Sand	Gravel
0	19.1	Dark red (7.5R3/6) – bright brown (2.5YR5/8) to bright reddish brown (5YR5/6) and gray (7.5Y5/1) weathered basalt with basaltic soil and fragments in vary size, pyroxene, magnetite and ilmenite	172	163	9

Sedimentary Description from Banka Drilling of

Amphoe Tha Mai-Amphoe Muang, Changwat Chanthaburi

Banka No. B37 Grid ref. 180540 E 1393640 N Total depth 19.00 m.

Depth (m.)		Description	Sediment Volume (lits)		
From	To		Total	Clay-Sand	Gravel
0	19	Dark red (7.5R3/6) to bright reddish brown (5YR5/6) and dark reddish brown (5YR3/4) weathered basalt with basaltic soil and fragments, pyroxene	157.5	149.75	7.75

Banka No. B40 Grid ref. 179693 E 1397744 N Total depth 6.00 m.

Depth (m.)		Description	Sediment Volume (lits)		
From	To		Total	Clay-Sand	Gravel
0	6	Grayish white (N8/0) with pale reddish orange (2.5YR7/3) weathered basalt with pyroxene, zircon and green sapphire	56.5	49.25	7.25

APPENDIX D

The Average Abundance Value of the Mineral Samples by Mine Profile, Test Pitting, and Banka Drilling in the Study Area

Appendix D

Remarks Depth is ranged from the surface by the upper level to the lower level (unit in meters)

Mineral Weight (w) 1 carat = 0.200 gram

Sediment volume (v) 1 lit = 0.001 m^3

Mineral Abundance Value (mav) = $\frac{\text{Mineral Weight (w)}}{\text{Sediment volume (v)}}$ g/m^3

The mineral abundance value = $(w/v)*t$ g/m^3

Sum of the mineral abundance value = $\sum\{(w/v)*t\}$ g/m^3

Thickness by depth (t) is the lower level of the depth – the upper level of the depth (unit in meters)

Thickness of mineral-bearing layer (T) is sum of the thickness by depth ($\sum t$) within the same layer (unit in meters)

The average of mineral abundance value in the mineral-bearing layer (MAV) = $\frac{\sum\{(w/v)*t\}}{\sum t}$ g/m^3

*The values shown in the bold font are the values calculated from the mineral-bearing layers (basaltic residual deposit (look Ron)/gravel bed (Kasa))

The average abundance value of corundum (sapphire), size <1 mm. at Khao Phloi Waen												
Hole No.	Depth (m.)	Mineral Weight		Sediment Volume		mav (g/m^3)	t (m.)	mav*t (g/m^3)	Sum (mav*t) (g/m^3)	t (m.)	T (m.)	MAV (g/m^3)
		(carats)	(grams)	(lits)	(m^3)							
B25	0.0-1.0	0.0000	0.0000	9	0.0090	0.0000	1	0.0000	1.1111	1	10	0.1111
	1.0-2.0	0.0000	0.0000	10	0.0100	0.0000	1	0.0000		1		
	2.0-3.0	0.0000	0.0000	9	0.0090	0.0000	1	0.0000		1		
	3.0-4.0	0.0000	0.0000	8.5	0.0085	0.0000	1	0.0000		1		
	4.0-5.0	0.0500	0.0100	9	0.0090	1.1111	1	1.1111		1		
	5.0-6.0	0.0000	0.0000	7.5	0.0075	0.0000	1	0.0000		1		
	6.0-7.0	0.0000	0.0000	8	0.0080	0.0000	1	0.0000		1		
	7.0-8.0	0.0000	0.0000	8	0.0080	0.0000	1	0.0000		1		
	8.0-9.0	0.0000	0.0000	8.5	0.0085	0.0000	1	0.0000		1		
	9.0-10.0	0.0000	0.0000	9	0.0090	0.0000	1	0.0000		1		

The average abundance value of corundum (sapphire), size 1-2 mm. at Khao Phloi Waen												
Hole No.	Depth (m.)	Mineral Weight		Sediment Volume		mav	t	mav*t	Sum (mav*t)	t	T	MAV
		(carats)	(grams)	(lits)	(m^3)	(g/m^3)	(m.)	(g/m^3)	(g/m^3)	(m.)	(m.)	(g/m^3)
B21	0.0-1.0	0.0000	0.0000	10	0.0100	0.0000	1	0.0000	2.0000	1	12	0.1667
	1.0-2.0	0.0000	0.0000	10	0.0100	0.0000	1	0.0000		1		
	2.0-3.0	0.0000	0.0000	9.5	0.0095	0.0000	1	0.0000		1		
	3.0-4.0	0.0000	0.0000	8	0.0080	0.0000	1	0.0000		1		
	4.0-5.0	0.0000	0.0000	9	0.0090	0.0000	1	0.0000		1		
	5.0-6.0	0.0000	0.0000	8	0.0080	0.0000	1	0.0000		1		
	6.0-7.0	0.0000	0.0000	8.5	0.0085	0.0000	1	0.0000		1		
	7.0-8.0	0.0000	0.0000	8	0.0080	0.0000	1	0.0000		1		
	8.0-9.0	0.0000	0.0000	7.5	0.0075	0.0000	1	0.0000		1		
	9.0-10.0	0.0000	0.0000	8.5	0.0085	0.0000	1	0.0000		1		
	10.0-11.9	0.0000	0.0000	9	0.0090	0.0000	1	0.0000		1.9		
	11.9-12.0	0.0850	0.0170	8.5	0.0085	2.0000	1	2.0000		0.1		
B23	0.0-1.0	0.0000	0.0000	10	0.0100	0.0000	1	0.0000	0.0000	1	5	0.0000
	1.0-2.0	0.0000	0.0000	9	0.0090	0.0000	1	0.0000		1		
	2.0-3.0	0.0000	0.0000	8	0.0080	0.0000	1	0.0000		1		
	3.0-4.0	0.0000	0.0000	7.5	0.0075	0.0000	1	0.0000		1		

	4.0-5.0	0.0000	0.0000	8	0.0080	0.0000	1	0.0000		1		
	5.0-6.0	0.0070	0.0014	10	0.0100	0.1400	1	0.1400	0.1400	1	1	0.1400

The average abundance value of corundum (sapphire), size 1-2 mm. at Khao Phloi Waen												
Hole No.	Depth (m.)	Mineral Weight		Sediment Volume		mav (g/m^3)	t (m.)	mav*t (g/m^3)	Sum (mav*t) (g/m^3)	t (m.)	T (m.)	MAV (g/m^3)
		(carats)	(grams)	(lits)	(m^3)							
B25	0.0-1.0	0.0000	0.0000	9	0.0090	0.0000	1	0.0000	2.8765	1	10	0.2876
	1.0-2.0	0.0000	0.0000	10	0.0100	0.0000	1	0.0000		1		
	2.0-3.0	0.0000	0.0000	9	0.0090	0.0000	1	0.0000		1		
	3.0-4.0	0.0000	0.0000	8.5	0.0085	0.0000	1	0.0000		1		
	4.0-5.0	0.0000	0.0000	9	0.0090	0.0000	1	0.0000		1		
	5.0-6.0	0.0000	0.0000	7.5	0.0075	0.0000	1	0.0000		1		
	6.0-7.0	0.0000	0.0000	8	0.0080	0.0000	1	0.0000		1		
	7.0-8.0	0.1000	0.0200	8	0.0080	2.5000	1	2.5000		1		
	8.0-9.0	0.0160	0.0032	8.5	0.0085	0.3765	1	0.3765		1		
	9.0-10.0	0.0000	0.0000	9	0.0090	0.0000	1	0.0000		1		
S1B	0.0-0.6	0.0500	0.0100	15	0.0150	0.6667	0.6	0.4000	0.4000	0.6	0.6	0.6667
S3	0.0-5.1	0.0500	0.0100	27	0.0270	0.3704	5.1	1.8889	1.8889	5.1	5.1	0.3704
	5.1-6.7	0.0500	0.0100	24	0.0240	0.4167	1.6	0.6667	0.6667	1.6	1.6	0.4167
	6.7-8.7	0.0000	0.0000	21	0.0210	0.0000	2	0.0000	1.4286	2	7	0.2041
	8.7-10.7	0.0000	0.0000	21	0.0210	0.0000	2	0.0000		2		
	10.7-13.7	0.0500	0.0100	21	0.0210	0.4762	3	1.4286		3		

The average abundance value of corundum (sapphire), size 1-2 mm. at Khao Phloi Waen												
Hole No.	Depth (m.)	Mineral Weight		Sediment Volume		mav (g/m^3)	t (m.)	mav*t (g/m^3)	Sum (mav*t) (g/m^3)	t (m.)	T (m.)	MAV (g/m^3)
		(carats)	(grams)	(lits)	(m^3)							
S4A	4.8-6.8	0.0500	0.0100	17	0.0170	0.5882	2	1.1765	1.1765	2	3.4	0.3460
	6.8-8.2	0.0000	0.0000	12	0.0120	0.0000	1.4	0.0000		1.4		
S4B	**2.0-3.5**	**0.0350**	**0.0070**	**23**	**0.0230**	**0.3043**	**1.5**	**0.4565**	**0.4565**	**1.5**	**1.5**	**0.3043**
S7	0.0-1.55	0.1000	0.0200	80	0.0800	0.2500	1.55	0.3875	0.3875	1.55	1.55	0.2500
	1.55-2.7	**0.0000**	**0.0000**	**395**	**0.3950**	**0.0000**	**1.15**	**0.0000**	***0.0462***	**1.15**	***1.45***	**0.0318**
	2.7-3.0	**0.0500**	**0.0100**	**65**	**0.0650**	**0.1538**	**0.3**	**0.0462**		**0.3**		

The average abundance value of corundum (sapphire), size >2 mm. at Khao Phloi Waen												
Hole No.	Depth (m.)	Mineral Weight		Sediment Volume		mav	t	mav*t	Sum (mav*t)	t	T	MAV
		(carats)	(grams)	(lits)	(m^3)	(g/m^3)	(m.)	(g/m^3)	(g/m^3)	(m.)	(m.)	(g/m^3)
B21	0.0-1.0	0.0000	0.0000	10	0.0100	0.0000	1	0.0000	0.8235	1	12	0.0686
	1.0-2.0	0.0000	0.0000	10	0.0100	0.0000	1	0.0000		1		
	2.0-3.0	0.0000	0.0000	9.5	0.0095	0.0000	1	0.0000		1		
	3.0-4.0	0.0000	0.0000	8	0.0080	0.0000	1	0.0000		1		
	4.0-5.0	0.0000	0.0000	9	0.0090	0.0000	1	0.0000		1		
	5.0-6.0	0.0000	0.0000	8	0.0080	0.0000	1	0.0000		1		
	6.0-7.0	0.0000	0.0000	8.5	0.0085	0.0000	1	0.0000		1		
	7.0-8.0	0.0000	0.0000	8	0.0080	0.0000	1	0.0000		1		
	8.0-9.0	0.0000	0.0000	7.5	0.0075	0.0000	1	0.0000		1		
	9.0-10.0	0.0000	0.0000	8.5	0.0085	0.0000	1	0.0000		1		
	10.0-11.9	0.0000	0.0000	9	0.0090	0.0000	1	0.0000		1.9		
	11.9-12.0	0.0350	0.0070	8.5	0.0085	0.8235	1	0.8235		0.1		
B22	0.0-1.0	0.0000	0.0000	9	0.0090	0.0000	1	0.0000	7.9750	1	5	1.5950
	1.0-2.0	0.0000	0.0000	8	0.0080	0.0000	1	0.0000		1		
	2.0-3.0	0.0000	0.0000	8	0.0080	0.0000	1	0.0000		1		
	3.0-4.0	0.0000	0.0000	8.5	0.0085	0.0000	1	0.0000		1		

	4.0-5.0	0.3190	0.0638	8	0.0080	7.9750	1	7.9750		1		

The average abundance value of corundum (sapphire), size >2 mm. at Khao Phloi Waen												
Hole No.	Depth (m.)	Mineral Weight		Sediment Volume		mav (g/m^3)	t (m.)	mav*t (g/m^3)	Sum (mav*t) (g/m^3)	t (m.)	T (m.)	MAV (g/m^3)
		(carats)	(grams)	(lits)	(m^3)							
B25	0.0-1.0	0.0000	0.0000	9	0.0090	0.0000	1	0.0000	6.8889	1	10	0.6889
	1.0-2.0	0.0000	0.0000	10	0.0100	0.0000	1	0.0000		1		
	2.0-3.0	0.0000	0.0000	9	0.0090	0.0000	1	0.0000		1		
	3.0-4.0	0.0000	0.0000	8.5	0.0085	0.0000	1	0.0000		1		
	4.0-5.0	0.0000	0.0000	9	0.0090	0.0000	1	0.0000		1		
	5.0-6.0	0.0000	0.0000	7.5	0.0075	0.0000	1	0.0000		1		
	6.0-7.0	0.0000	0.0000	8	0.0080	0.0000	1	0.0000		1		
	7.0-8.0	0.0000	0.0000	8	0.0080	0.0000	1	0.0000		1		
	8.0-9.0	0.0000	0.0000	8.5	0.0085	0.0000	1	0.0000		1		
	9.0-10.0	0.3100	0.0620	9	0.0090	6.8889	1	6.8889		1		
S1C	0.0-1.2	22.3500	4.4700	10	0.0100	447.0000	1.2	536.4000	536.4000	1.2	1.2	447.0000
	1.2-1.4	**4.3720**	**0.8744**	**12**	**0.0120**	**72.8667**	**0.2**	**14.5733**	***14.5733***	**0.2**	**0.2**	**72.8667**
S2	**3.3-6.7**	**0.9000**	**0.1800**	**96**	**0.0960**	**1.8750**	**3.4**	**6.3750**	***6.3750***	**3.4**	**3.4**	**1.8750**
S3	**5.1-6.7**	**0.0830**	**0.0166**	**24**	**0.0240**	**0.6917**	**1.6**	**1.1067**	***1.1067***	**1.6**	**1.6**	**0.6917**

The average abundance value of corundum (sapphire), size >2 mm. at Khao Phloi Waen												
Hole No.	Depth (m.)	Mineral Weight		Sediment Volume		mav (g/m^3)	t (m.)	mav*t (g/m^3)	Sum (mav*t) (g/m^3)	t (m.)	T (m.)	MAV (g/m^3)
		(carats)	(grams)	(lits)	(m^3)							
S7	0.0-1.55	6.0000	1.2000	80	0.0800	15.0000	1.55	23.2500	23.2500	1.55	1.55	15.0000
	1.55-2.7	**18.139**	**3.6278**	**395**	**0.3950**	**0.0790**	**1.15**	**0.0909**	**1.9832**	**1.15**	**1.45**	**1.7245**
	2.7-3.0	**2.0500**	**0.4100**	**65**	**0.0650**	**6.3077**	**0.3**	**1.8923**		**0.3**		

The average abundance value of pyroxene-spinel, size <1 mm. at Khao Phloi Waen												
Hole No.	Depth (m.)	Mineral Weight		Sediment Volume		mav (g/m^3)	t (m.)	mav*t (g/m^3)	Sum (mav*t) (g/m^3)	t (m.)	T (m.)	MAV (g/m^3)
		(carats)	(grams)	(lits)	(m^3)							
B25	0.0-1.0	0.0000	0.0000	9	0.0090	0.0000	1	0.0000	9.2500	1	10	0.9250
	1.0-2.0	0.0000	0.0000	10	0.0100	0.0000	1	0.0000		1		
	2.0-3.0	0.0000	0.0000	9	0.0090	0.0000	1	0.0000		1		
	3.0-4.0	0.0000	0.0000	8.5	0.0085	0.0000	1	0.0000		1		
	4.0-5.0	0.0500	0.0100	9	0.0090	1.1111	1	1.1111		1		
	5.0-6.0	0.0000	0.0000	7.5	0.0075	0.0000	1	0.0000		1		
	6.0-7.0	0.0000	0.0000	8	0.0080	0.0000	1	0.0000		1		
	7.0-8.0	0.0500	0.0100	8	0.0080	1.2500	1	1.2500		1		
	8.0-9.0	0.0000	0.0000	8.5	0.0085	0.0000	1	0.0000		1		
	9.0-10.0	0.3100	0.0620	9	0.0090	6.8889	1	6.8889		1		

The average abundance value of pyroxene-spinel, size 1-2 mm. at Khao Phloi Waen												
Hole No.	Depth (m.)	Mineral Weight		Sediment Volume		mav (g/m^3)	t (m.)	mav*t (g/m^3)	Sum (mav*t) (g/m^3)	t (m.)	T (m.)	MAV (g/m^3)
		(carats)	(grams)	(lits)	(m^3)							
B17-2	0.0-1.0	0.0000	0.0000	10	0.0100	0.0000	1	0.0000	1.5000	1	3	0.5000
	1.0-2.0	0.0000	0.0000	7.5	0.0075	0.0000	1	0.0000		1		
	2.0-3.0	0.0750	0.0150	10	0.0100	1.5000	1	1.5000		1		
B22	0.0-1.0	0.0000	0.0000	9	0.0090	0.0000	1	0.0000	6.4250	1	5	1.2850
	1.0-2.0	0.0000	0.0000	8	0.0080	0.0000	1	0.0000		1		
	2.0-3.0	0.0000	0.0000	8	0.0080	0.0000	1	0.0000		1		
	3.0-4.0	0.0000	0.0000	8.5	0.0085	0.0000	1	0.0000		1		
	4.0-5.0	0.2570	0.0514	8	0.0080	6.4250	1	6.4250		1		
B24	0.0-1.0	0.0000	0.0000	8	0.0080	0.0000	1	0.0000	23.7554	1	4	5.9388
	1.0-2.0	0.2550	0.0510	8	0.0080	6.3750	1	6.3750		1		
	2.0-3.0	0.2060	0.0412	8.5	0.0085	4.8471	1	4.8471		1		
	3.0-4.0	0.4700	0.0940	7.5	0.0075	12.5333	1	12.5333		1		
B25	0.0-1.0	0.0000	0.0000	9	0.0090	0.0000	1	0.0000	10.6667	1	10	1.0667
	1.0-2.0	0.0000	0.0000	10	0.0100	0.0000	1	0.0000		1		

	2.0-3.0	0.0000	0.0000	9	0.0090	0.0000	1	0.0000		1		
	3.0-4.0	0.0000	0.0000	8.5	0.0085	0.0000	1	0.0000		1		
	4.0-5.0	0.3000	0.0600	9	0.0090	6.6667	1	6.6667		1		

The average abundance value of pyroxene-spinel, size 1-2 mm. at Khao Phloi Waen												
Hole No.	Depth (m.)	Mineral Weight		Sediment Volume		mav (g/m^3)	t (m.)	mav*t (g/m^3)	Sum (mav*t) (g/m^3)	t (m.)	T (m.)	MAV (g/m^3)
		(carats)	(grams)	(lits)	(m^3)							
B25	5.0-6.0	0.1500	0.0300	7.5	0.0075	4.0000	1	4.0000		1		
(ต่อ)	6.0-7.0	0.0000	0.0000	8	0.0080	0.0000	1	0.0000		1		
	7.0-8.0	0.0000	0.0000	8	0.0080	0.0000	1	0.0000		1		
	8.0-9.0	0.0000	0.0000	8.5	0.0085	0.0000	1	0.0000		1		
	9.0-10.0	0.0000	0.0000	9	0.0090	0.0000	1	0.0000		1		
B26	0.0-1.0	0.0000	0.0000	10	0.0100	0.0000	1	0.0000	7.7750	1	10	0.7775
	1.0-2.0	0.0000	0.0000	10	0.0100	0.0000	1	0.0000		1		
	2.0-3.0	0.0000	0.0000	7.5	0.0075	0.0000	1	0.0000		1		
	3.0-4.0	0.0000	0.0000	8	0.0080	0.0000	1	0.0000		1		
	4.0-5.0	0.0000	0.0000	8.5	0.0085	0.0000	1	0.0000		1		
	5.0-6.0	0.0000	0.0000	8	0.0080	0.0000	1	0.0000		1		
	6.0-7.0	0.0000	0.0000	7.5	0.0075	0.0000	1	0.0000		1		
	7.0-8.0	0.0000	0.0000	8.5	0.0085	0.0000	1	0.0000		1		
	8.0-9.0	0.0000	0.0000	8	0.0080	0.0000	1	0.0000		1		
	9.0-10.0	0.3110	0.0622	8	0.0080	7.7750	1	7.7750		1		

The average abundance value of pyroxene-spinel, size 1-2 mm. at Khao Phloi Waen												
Hole No.	Depth (m.)	Mineral Weight		Sediment Volume		mav (g/m^3)	t (m.)	mav*t (g/m^3)	Sum (mav*t) (g/m^3)	t (m.)	T (m.)	MAV (g/m^3)
		(carats)	(grams)	(lits)	(m^3)							
B36	0.0-1.0	0.0000	0.0000	10	0.0100	0.0000	1	0.0000	7.9750	1	10	0.7975
	1.0-2.0	0.0000	0.0000	8.5	0.0085	0.0000	1	0.0000		1		
	2.0-3.0	0.0000	0.0000	7	0.0070	0.0000	1	0.0000		1		
	3.0-4.0	0.0000	0.0000	10	0.0100	0.0000	1	0.0000		1		
	4.0-5.0	0.0000	0.0000	9	0.0090	0.0000	1	0.0000		1		
	5.0-6.0	0.0000	0.0000	9	0.0090	0.0000	1	0.0000		1		
	6.0-7.0	0.0000	0.0000	8.5	0.0085	0.0000	1	0.0000		1		
	7.0-8.0	0.3190	0.0638	8	0.0080	7.9750	1	7.9750		1		
	8.0-9.0	0.0000	0.0000	9	0.0090	0.0000	1	0.0000		1		
	9.0-10.0	0.0000	0.0000	8.5	0.0085	0.0000	1	0.0000		1		
B37	0.0-1.0	0.0000	0.0000	9	0.0090	0.0000	1	0.0000	5.7800	1	2	2.8900
	1.0-2.0	0.2890	0.0578	10	0.0100	5.7800	1	5.7800		1		
S1A	0.0-0.6	0.3500	0.0700	15	0.0150	4.6667	0.6	2.8000	2.8000	0.6	0.6	4.6667
	0.6-0.8	**0.1500**	**0.0300**	**15**	**0.0150**	**2.0000**	**0.2**	**0.4000**	**0.4000**	**0.2**	**0.2**	**2.0000**
	0.8-2.1	0.0190	0.0038	12	0.0120	0.3167	1.3	0.4117	0.4117	1.3	1.3	0.3167

S1B	0.0-0.6	0.1500	0.0300	15	0.0150	2.0000	0.6	1.2000	1.2000	0.6	0.6	2.0000

The average abundance value of pyroxene-spinel, size 1-2 mm. at Khao Phloi Waen												
Hole No.	Depth (m.)	Mineral Weight		Sediment Volume		mav (g/m^3)	t (m.)	mav*t (g/m^3)	Sum (mav*t) (g/m^3)	t (m.)	T (m.)	MAV (g/m^3)
		(carats)	(grams)	(lits)	(m^3)							
S1C	**1.2-1.4**	**0.0250**	**0.0050**	**12**	**0.0120**	**0.4167**	**0.2**	**0.0833**	**0.0833**	**0.2**	**0.2**	**0.4167**
S2	0.0-3.3	0.2500	0.0500	18	0.0180	2.7778	3.3	9.1667	9.1667	3.3	3.3	2.7778
	3.3-6.7	**0.2500**	**0.0500**	**96**	**0.0960**	**0.5208**	**3.4**	**1.7708**	**1.7708**	**3.4**	**3.4**	**0.5208**
	6.7-12.10	0.4500	0.0900	8	0.0080	11.2500	5.4	60.7500	60.7500	5.4	5.4	11.2500
S3	0.0-5.1	0.3400	0.0680	27	0.0270	2.5185	5.1	12.8444	12.8444	5.1	5.1	2.5185
	5.1-6.7	**2.1000**	**0.4200**	**24**	**0.0240**	**17.5000**	**1.6**	**28.0000**	**28.0000**	**1.6**	**1.6**	**17.5000**
	6.7-8.7	0.2500	0.0500	21	0.0210	2.3810	2	4.7619	29.1905	2	7	4.1701
	8.7-10.7	0.4500	0.0900	21	0.0210	4.2857	2	8.5714		2		
	10.7-13.7	0.5550	0.1110	21	0.0210	5.2857	3	15.8571		3		
S4A	**2.9-4.8**	**0.5500**	**0.1100**	**28**	**0.0280**	**3.9286**	**1.9**	**7.4643**	**7.4643**	**1.9**	**1.9**	**3.9286**
	4.8-6.8	0.5500	0.1100	17	0.0170	6.4706	2	12.9412	23.4412	2	3.4	6.8945
	6.8-8.2	0.4500	0.0900	12	0.0120	7.5000	1.4	10.5000		1.4		
S4B	**2.0-3.5**	**1.4500**	**0.2900**	**23**	**0.0230**	**12.6087**	**1.5**	**18.9130**	**18.9130**	**1.5**	**1.5**	**12.6087**

The average abundance value of pyroxene-spinel, size 1-2 mm. at Khao Phloi Waen												
Hole No.	Depth (m.)	Mineral Weight		Sediment Volume		mav (g/m^3)	t (m.)	mav*t (g/m^3)	Sum (mav*t) (g/m^3)	t (m.)	T (m.)	MAV (g/m^3)
		(carats)	(grams)	(lits)	(m^3)							
S7	0.0-1.55	0.0500	0.0100	80	0.0800	0.1250	1.55	0.1938	0.1938	1.55	1.55	0.1250
	1.55-2.7	**0.0000**	**0.0000**	**395**	**0.3950**	**0.0000**	**1.15**	**0.0000**	**1.2923**	**1.15**	**1.45**	**0.8912**
	2.7-3.0	**1.4000**	**0.2800**	**65**	**0.0650**	**4.3077**	**0.3**	**1.2923**		**0.3**		

The average abundance value of pyroxene-spinel, size >2 mm. at Khao Phloi Waen												
Hole No.	Depth (m.)	Mineral Weight		Sediment Volume		mav (g/m^3)	t (m.)	mav*t (g/m^3)	Sum (mav*t) (g/m^3)	t (m.)	T (m.)	MAV (g/m^3)
		(carats)	(grams)	(lits)	(m^3)							
B17-2	0.0-1.0	0.0000	0.0000	10	0.0100	0.0000	1	0.0000	1.2400	1	3	0.4133
	1.0-2.0	0.0000	0.0000	7.5	0.0075	0.0000	1	0.0000		1		
	2.0-3.0	0.0620	0.0124	10	0.0100	1.2400	1	1.2400		1		
B22	0.0-1.0	0.0000	0.0000	9	0.0090	0.0000	1	0.0000	14.5250	1	5	2.9050
	1.0-2.0	0.0000	0.0000	8	0.0080	0.0000	1	0.0000		1		
	2.0-3.0	0.0000	0.0000	8	0.0080	0.0000	1	0.0000		1		
	3.0-4.0	0.0000	0.0000	8.5	0.0085	0.0000	1	0.0000		1		
	4.0-5.0	0.5810	0.1162	8	0.0080	14.5250	1	14.5250		1		
B24	0.0-1.0	0.3560	0.0712	8	0.0080	8.9000	1	8.9000	241.9034	1	4	60.4759
	1.0-2.0	0.5650	0.1130	8	0.0080	14.1250	1	14.1250		1		
	2.0-3.0	2.2190	0.4438	8.5	0.0085	52.2118	1	52.2118		1		
	3.0-4.0	6.2500	1.2500	7.5	0.0075	166.6667	1	166.6667		1		
	4.0-5.0	1.1500	0.2300	7	0.0070	32.8571	1	32.8571	32.8571	1	1	32.8571

The average abundance value of pyroxene-spinel, size >2 mm. at Khao Phloi Waen												
Hole No.	Depth (m.)	Mineral Weight (carats)	Mineral Weight (grams)	Sediment Volume (lits)	Sediment Volume (m^3)	mav (g/m^3)	t (m.)	mav*t (g/m^3)	Sum (mav*t) (g/m^3)	t (m.)	T (m.)	MAV (g/m^3)
B25	0.0-1.0	0.0000	0.0000	9	0.0090	0.0000	1	0.0000	76.5516	1	10	7.6552
	1.0-2.0	0.0000	0.0000	10	0.0100	0.0000	1	0.0000		1		
	2.0-3.0	0.0000	0.0000	9	0.0090	0.0000	1	0.0000		1		
	3.0-4.0	0.0000	0.0000	8.5	0.0085	0.0000	1	0.0000		1		
	4.0-5.0	0.0000	0.0000	9	0.0090	0.0000	1	0.0000		1		
	5.0-6.0	0.0000	0.0000	7.5	0.0075	0.0000	1	0.0000		1		
	6.0-7.0	0.0000	0.0000	8	0.0080	0.0000	1	0.0000		1		
	7.0-8.0	0.0000	0.0000	8	0.0080	0.0000	1	0.0000		1		
	8.0-9.0	1.0000	0.2000	8.5	0.0085	23.5294	1	23.5294		1		
	9.0-10.0	2.3860	0.4772	9	0.0090	53.0222	1	53.0222		1		
S1B	0.0-0.6	5.3000	1.0600	15	0.0150	70.6667	0.6	42.4000	42.4000	0.6	0.6	70.6667
S1C	**1.2-1.4**	**180.552**	**36.1104**	**12**	**0.0120**	**3009.2000**	**0.2**	**601.840**	**601.840**	**0.2**	**0.2**	**3009.20**
S2	**3.3-6.7**	**5.6500**	**1.1300**	**96**	**0.0960**	**11.7708**	**3.4**	**40.0208**	**40.0208**	**3.4**	**3.4**	**11.7708**

The average abundance value of pyroxene-spinel, size >2 mm. at Khao Phloi Waen												
Hole No.	Depth (m.)	Mineral Weight		Sediment Volume		mav (g/m^3)	t (m.)	mav*t (g/m^3)	Sum (mav*t) (g/m^3)	t (m.)	T (m.)	MAV (g/m^3)
		(carats)	(grams)	(lits)	(m^3)							
S3	0.0-5.1	2.6000	0.5200	27	0.0270	19.2593	5.1	98.2222	98.2222	5.1	5.1	19.2593
	5.1-6.7	**5.1750**	**1.0350**	**24**	**0.0240**	**43.1250**	**1.6**	**69.0000**	**69.0000**	**1.6**	**1.6**	**43.1250**
	6.7-8.7	1.0500	0.2100	21	0.0210	10.0000	2	20.0000	136.6667	2	7	19.5238
	8.7-10.7	2.3000	0.4600	21	0.0210	21.9048	2	43.8095		2		
	10.7-13.7	2.5500	0.5100	21	0.0210	24.2857	3	72.8571		3		
S4A	**2.9-4.8**	**0.3820**	**0.0764**	**28**	**0.0280**	**2.7286**	**1.9**	**5.1843**	**5.1843**	**1.9**	**1.9**	**2.7286**
S4B	**2.0-3.5**	**8.5660**	**1.7132**	**23**	**0.0230**	**74.4870**	**1.5**	**111.7304**	**111.7304**	**1.5**	**1.5**	**74.4870**
S5	3.3-6.3	13.9800	2.7960	42	0.0420	66.5714	3	199.7143	199.7143	3	3	66.5714
S7	0.0-1.55	71.4000	14.2800	80	0.0800	178.5000	1.55	276.6750	276.6750	1.55	1.55	178.5000
	1.55-2.7	**6127.52**	**1225.504**	**395**	**0.3950**	**3102.5418**	**1.15**	**3567.923**	**3575.2153**	**1.15**	**1.45**	**2465.6658**
	2.7-3.0	**7.9000**	**1.5800**	**65**	**0.0650**	**24.3077**	**0.3**	**7.2923**		**0.3**		

The average abundance value of green pyroxene, size <1 mm. at Khao Phloi Waen												
Hole No.	Depth (m.)	Mineral Weight		Sediment Volume		mav (g/m^3)	t (m.)	mav*t (g/m^3)	Sum (mav*t) (g/m^3)	t (m.)	T (m.)	MAV (g/m^3)
		(carats)	(grams)	(lits)	(m^3)							
B24	0.0-1.0	0.0000	0.0000	8	0.0080	0.0000	1	0.0000	0.2250	1	4	0.0563
	1.0-2.0	0.0090	0.0018	8	0.0080	0.2250	1	0.2250		1		
	2.0-3.0	0.0000	0.0000	8.5	0.0085	0.0000	1	0.0000		1		
	3.0-4.0	0.0000	0.0000	7.5	0.0075	0.0000	1	0.0000		1		

The average abundance value of green pyroxene, size 1-2 mm. at Khao Phloi Waen												
Hole No.	Depth (m.)	Mineral Weight		Sediment Volume		mav	t	mav*t	Sum (mav*t)	t	T	MAV
		(carats)	(grams)	(lits)	(m^3)	(g/m^3)	(m.)	(g/m^3)	(g/m^3)	(m.)	(m.)	(g/m^3)
B23	0.0-1.0	0.0000	0.0000	10	0.0100	0.0000	1	0.0000	1.6750	1	5	0.3350
	1.0-2.0	0.0000	0.0000	9	0.0090	0.0000	1	0.0000		1		
	2.0-3.0	0.0000	0.0000	8	0.0080	0.0000	1	0.0000		1		
	3.0-4.0	0.0000	0.0000	7.5	0.0075	0.0000	1	0.0000		1		
	4.0-5.0	0.0670	0.0134	8	0.0080	1.6750	1	1.6750		1		
	5.0-6.0	0.0410	0.0082	10	0.0100	0.8200	1	0.8200	0.8200	1	1	0.8200
B24	0.0-1.0	0.2370	0.0474	8	0.0080	5.9250	1	5.9250	26.8250	1	4	6.7063
	1.0-2.0	0.8360	0.1672	8	0.0080	20.9000	1	20.9000		1		
	2.0-3.0	0.0000	0.0000	8.5	0.0085	0.0000	1	0.0000		1		
	3.0-4.0	0.0000	0.0000	7.5	0.0075	0.0000	1	0.0000		1		

The average abundance value of green pyroxene, size >2 mm. at Khao Phloi Waen												
Hole No.	Depth (m.)	Mineral Weight		Sediment Volume		mav (g/m^3)	t (m.)	mav*t (g/m^3)	Sum (mav*t) (g/m^3)	t (m.)	T (m.)	MAV (g/m^3)
		(carats)	(grams)	(lits)	(m^3)							
B22	0.0-1.0	0.0000	0.0000	9	0.0090	0.0000	1	0.0000	2.4750	1	5	0.4950
	1.0-2.0	0.0000	0.0000	8	0.0080	0.0000	1	0.0000		1		
	2.0-3.0	0.0000	0.0000	8	0.0080	0.0000	1	0.0000		1		
	3.0-4.0	0.0000	0.0000	8.5	0.0085	0.0000	1	0.0000		1		
	4.0-5.0	0.0990	0.0198	8	0.0080	2.4750	1	2.4750		1		
B23	0.0-1.0	0.0000	0.0000	10	0.0100	0.0000	1	0.0000	1.6500	1	5	0.3300
	1.0-2.0	0.0000	0.0000	9	0.0090	0.0000	1	0.0000		1		
	2.0-3.0	0.0000	0.0000	8	0.0080	0.0000	1	0.0000		1		
	3.0-4.0	0.0000	0.0000	7.5	0.0075	0.0000	1	0.0000		1		
	4.0-5.0	0.0660	0.0132	8	0.0080	1.6500	1	1.6500		1		
B24	0.0-1.0	0.0000	0.0000	8	0.0080	0.0000	1	0.0000	118.2681	1	4	29.5670
	1.0-2.0	0.8970	0.1794	8	0.0080	22.4250	1	22.4250		1		
	2.0-3.0	2.6000	0.5200	8.5	0.0085	61.1765	1	61.1765		1		
	3.0-4.0	1.3000	0.2600	7.5	0.0075	34.6667	1	34.6667		1		

The average abundance value of zircon, size <1 mm. at Khao Phloi Waen												
Hole No.	Depth (m.)	Mineral Weight		Sediment Volume		mav (g/m^3)	t (m.)	mav*t (g/m^3)	Sum (mav*t) (g/m^3)	t (m.)	T (m.)	MAV (g/m^3)
		(carats)	(grams)	(lits)	(m^3)							
B25	0.0-1.0	0.0000	0.0000	9	0.0090	0.0000	1	0.0000	0.9459	1	10	0.0946
	1.0-2.0	0.0000	0.0000	10	0.0100	0.0000	1	0.0000		1		
	2.0-3.0	0.0000	0.0000	9	0.0090	0.0000	1	0.0000		1		
	3.0-4.0	0.0000	0.0000	8.5	0.0085	0.0000	1	0.0000		1		
	4.0-5.0	0.0000	0.0000	9	0.0090	0.0000	1	0.0000		1		
	5.0-6.0	0.0090	0.0018	7.5	0.0075	0.2400	1	0.2400		1		
	6.0-7.0	0.0000	0.0000	8	0.0080	0.0000	1	0.0000		1		
	7.0-8.0	0.0000	0.0000	8	0.0080	0.0000	1	0.0000		1		
	8.0-9.0	0.0300	0.0060	8.5	0.0085	0.7059	1	0.7059		1		
	9.0-10.0	0.0000	0.0000	9	0.0090	0.0000	1	0.0000		1		
S7	0.0-1.55	0.0500	0.0100	80	0.0800	0.1250	1.55	0.1938	0.1938	1.55	1.55	0.1250
	1.55-2.7	**1.1950**	**0.2390**	**395**	**0.3950**	**0.6051**	**1.15**	**0.6958**	**0.6958**	**1.15**	**1.45**	**0.4799**
	2.7-3.0	**0.0000**	**0.0000**	**65**	**0.0650**	**0.0000**	**0.3**	**0.0000**		**0.3**		

The average abundance value of zircon, size 1-2 mm. at Khao Phloi Waen												
Hole No.	Depth (m.)	Mineral Weight		Sediment Volume		mav (g/m^3)	t (m.)	mav*t (g/m^3)	Sum (mav*t) (g/m^3)	t (m.)	T (m.)	MAV (g/m^3)
		(carats)	(grams)	(lits)	(m^3)							
B17-2	0.0-1.0	0.0000	0.0000	10	0.0100	0.0000	1	0.0000	0.7200	1	3	0.2400
	1.0-2.0	0.0270	0.0054	7.5	0.0075	0.7200	1	0.7200		1		
	2.0-3.0	0.0000	0.0000	10	0.0100	0.0000	1	0.0000		1		
B22	0.0-1.0	0.0000	0.0000	9	0.0090	0.0000	1	0.0000	1.3718	1	5	0.2744
	1.0-2.0	0.0270	0.0054	8	0.0080	0.6750	1	0.6750		1		
	2.0-3.0	0.0000	0.0000	8	0.0080	0.0000	1	0.0000		1		
	3.0-4.0	0.0000	0.0000	8.5	0.0085	0.0000	1	0.0000		1		
	4.0-5.0	0.0540	0.0108	15.5	0.0155	0.6968	1	0.6968		1		
B23	0.0-1.0	0.0000	0.0000	10	0.0100	0.0000	1	0.0000	0.2250	1	5	0.0450
	1.0-2.0	0.0000	0.0000	9	0.0090	0.0000	1	0.0000		1		
	2.0-3.0	0.0000	0.0000	8	0.0080	0.0000	1	0.0000		1		
	3.0-4.0	0.0000	0.0000	7.5	0.0075	0.0000	1	0.0000		1		
	4.0-5.0	0.0090	0.0018	8	0.0080	0.2250	1	0.2250		1		

The average abundance value of zircon, size 1-2 mm. at Khao Phloi Waen												
Hole No.	Depth (m.)	Mineral Weight		Sediment Volume		mav (g/m^3)	t (m.)	mav*t (g/m^3)	Sum (mav*t) (g/m^3)	t (m.)	T (m.)	MAV (g/m^3)
		(carats)	(grams)	(lits)	(m^3)							
B24	0.0-1.0	0.0200	0.0040	8	0.0080	0.5000	1	0.5000	1.1750	1	4	0.2938
	1.0-2.0	0.0270	0.0054	8	0.0080	0.6750	1	0.6750		1		
	2.0-3.0	0.0000	0.0000	8.5	0.0085	0.0000	1	0.0000		1		
	3.0-4.0	0.0000	0.0000	7.5	0.0075	0.0000	1	0.0000		1		
B25	0.0-1.0	0.0000	0.0000	9	0.0090	0.0000	1	0.0000	1.3333	1	10	0.1333
	1.0-2.0	0.0000	0.0000	10	0.0100	0.0000	1	0.0000		1		
	2.0-3.0	0.0000	0.0000	9	0.0090	0.0000	1	0.0000		1		
	3.0-4.0	0.0000	0.0000	8.5	0.0085	0.0000	1	0.0000		1		
	4.0-5.0	0.0000	0.0000	9	0.0090	0.0000	1	0.0000		1		
	5.0-6.0	0.0000	0.0000	7.5	0.0075	0.0000	1	0.0000		1		
	6.0-7.0	0.0000	0.0000	8	0.0080	0.0000	1	0.0000		1		
	7.0-8.0	0.0000	0.0000	8	0.0080	0.0000	1	0.0000		1		
	8.0-9.0	0.0000	0.0000	8.5	0.0085	0.0000	1	0.0000		1		
	9.0-10.0	0.0600	0.0120	9	0.0090	1.3333	1	1.3333		1		

The average abundance value of zircon, size 1-2 mm. at Khao Phloi Waen												
Hole No.	Depth (m.)	Mineral Weight (carats)	Mineral Weight (grams)	Sediment Volume (lits)	Sediment Volume (m^3)	mav (g/m^3)	t (m.)	mav*t (g/m^3)	Sum (mav*t) (g/m^3)	t (m.)	T (m.)	MAV (g/m^3)
B34	0.0-1.0	0.0000	0.0000	9	0.0090	0.0000	1	0.0000	0.4889	1	4	0.1222
	1.0-2.0	0.0000	0.0000	10	0.0100	0.0000	1	0.0000		1		
	2.0-3.0	0.0000	0.0000	9	0.0090	0.0000	1	0.0000		1		
	3.0-4.0	0.0220	0.0044	9	0.0090	0.4889	1	0.4889		1		
S1A	**0.6-0.8**	**0.0500**	**0.0100**	**15**	**0.0150**	**0.6667**	**0.2**	**0.1333**	**0.1333**	**0.2**	**0.2**	**0.6667**
S1B	0.0-0.6	0.0300	0.0060	15	0.0150	0.4000	0.6	0.2400	0.2400	0.6	0.6	0.4000
S2	**3.3-6.7**	**0.0510**	**0.0102**	**96**	**0.0960**	**0.1063**	**3.4**	**0.3613**	**0.3613**	**3.4**	**3.4**	**0.1063**
S3	0.0-5.1	0.0500	0.0100	27	0.0270	0.3704	5.1	1.8889	1.8889	5.1	5.1	0.3704
	5.1-6.7	**0.0500**	**0.0100**	**24**	**0.0240**	**0.4167**	**1.6**	**0.6667**	**0.6667**	**1.6**	**1.6**	**0.4167**
S4B	**2.0-3.5**	**0.1100**	**0.0220**	**23**	**0.0230**	**0.9565**	**1.5**	**1.4348**	**1.4348**	**1.5**	**1.5**	**0.9565**
S7	0.0-1.55	0.1000	0.0200	80	0.0800	0.2500	1.55	0.3875	0.3875	1.55	1.55	0.2500

	1.55-2.7	2.0100	0.4020	395	0.3950	1.0177	1.15	1.1704	1.4473	1.15	1.45	1.2585
	2.7-3.0	0.3000	0.0600	65	0.0650	0.9231	0.3	0.2769		0.3		

The average abundance value of zircon, size >2 mm. at Khao Phloi Waen												
Hole No.	Depth (m.)	Mineral Weight		Sediment Volume		mav (g/m^3)	t (m.)	mav*t (g/m^3)	Sum (mav*t) (g/m^3)	t (m.)	T (m.)	MAV (g/m^3)
		(carats)	(grams)	(lits)	(m^3)							
S2	**3.3-6.7**	**0.5000**	**0.1000**	**96**	**0.0960**	**1.0417**	**3.4**	**3.5417**	**3.5417**	**3.4**	**3.4**	**1.0417**
S7	**1.55-2.7**	**6.0850**	**1.2170**	**395**	**0.3950**	**3.0810**	**1.15**	**3.5432**	**3.5432**	**1.15**	**1.45**	**3.0810**
	2.7-3.0	**0.0000**	**0.0000**	**65**	**0.0650**	**0.0000**	**0.3**	**0.0000**		**0.3**		

The average abundance value of garnet, size 1-2 mm. at Khao Phloi Waen												
Hole No.	Depth (m.)	Mineral Weight		Sediment Volume		mav (g/m^3)	t (m.)	mav*t (g/m^3)	Sum (mav*t) (g/m^3)	t (m.)	T (m.)	MAV (g/m^3)
		(carats)	(grams)	(lits)	(m^3)							
B24	0.0-1.0	0.0000	0.0000	8	0.0080	0.0000	1	0.0000	1.8133	1	4	0.4533
	1.0-2.0	0.0000	0.0000	8	0.0080	0.0000	1	0.0000		1		
	2.0-3.0	0.0000	0.0000	8.5	0.0085	0.0000	1	0.0000		1		
	3.0-4.0	0.0680	0.0136	7.5	0.0075	1.8133	1	1.8133		1		
S4A	**2.9-4.8**	**0.0500**	**0.0100**	**28**	**0.0280**	**0.3571**	**1.9**	**0.6786**	**0.6786**	**1.9**	**1.9**	**0.3571**
S7	**1.55-2.7**	**0.0000**	**0.0000**	**395**	**0.3950**	**0.0000**	**1.15**	**0.0000**	**0.1385**	**1.15**	**1.45**	**0.1204**
	2.7-3.0	**0.1500**	**0.0300**	**65**	**0.0650**	**0.4615**	**0.3**	**0.1385**		**0.3**		

The average abundance value of garnet, size >2 mm. at Khao Phloi Waen												
Hole No.	Depth (m.)	Mineral Weight		Sediment Volume		mav (g/m^3)	t (m.)	mav*t (g/m^3)	Sum (mav*t) (g/m^3)	t (m.)	T (m.)	MAV (g/m^3)
		(carats)	(grams)	(lits)	(m^3)							
S2	**3.3-6.7**	**0.2000**	**0.0400**	**96**	**0.0960**	**0.4167**	**3.4**	**1.4167**	**1.4167**	**3.4**	**3.4**	**0.4167**
S5	3.3-6.3	0.0800	0.0160	42	0.0420	0.3810	3	1.1429	1.1429	3	3	0.3810
S7	**1.55-2.7**	**11.840**	**2.3680**	**395**	**0.3950**	**5.9949**	**1.15**	**6.8942**	**7.1249**	**1.15**	**1.45**	**6.1956**
	2.7-3.0	**0.2500**	**0.0500**	**65**	**0.0650**	**0.7692**	**0.3**	**0.2308**		**0.3**		

The average abundance value of magnetite-ilmenite, size 1-2 mm. at Khao Phloi Waen												
Hole No.	Depth (m.)	Mineral Weight		Sediment Volume		mav (g/m^3)	t (m.)	mav*t (g/m^3)	Sum (mav*t) (g/m^3)	t (m.)	T (m.)	MAV (g/m^3)
		(carats)	(grams)	(lits)	(m^3)							
B22	0.0-1.0	0.0000	0.0000	9	0.0090	0.0000	1	0.0000	3.0500	1	5	0.6100
	1.0-2.0	0.0270	0.0054	8	0.0080	0.6750	1	0.6750		1		
	2.0-3.0	0.0000	0.0000	8	0.0080	0.0000	1	0.0000		1		
	3.0-4.0	0.0000	0.0000	8.5	0.0085	0.0000	1	0.0000		1		
	4.0-5.0	0.0950	0.0190	8	0.0080	2.3750	1	2.3750		1		
B23	0.0-1.0	0.0000	0.0000	10	0.0100	0.0000	1	0.0000	0.7500	1	5	0.1500
	1.0-2.0	0.0000	0.0000	9	0.0090	0.0000	1	0.0000		1		
	2.0-3.0	0.0000	0.0000	8	0.0080	0.0000	1	0.0000		1		
	3.0-4.0	0.0000	0.0000	7.5	0.0075	0.0000	1	0.0000		1		
	4.0-5.0	0.0300	0.0060	8	0.0080	0.7500	1	0.7500		1		
B24	0.0-1.0	0.2410	0.0482	8	0.0080	6.0250	1	6.0250	9.1983	1	4	2.2996
	1.0-2.0	0.0000	0.0000	8	0.0080	0.0000	1	0.0000		1		
	2.0-3.0	0.0000	0.0000	8.5	0.0085	0.0000	1	0.0000		1		
	3.0-4.0	0.1190	0.0238	7.5	0.0075	3.1733	1	3.1733		1		

The average abundance value of magnetite-ilmenite, size 1-2 mm. at Khao Phloi Waen												
Hole No.	Depth (m.)	Mineral Weight		Sediment Volume		mav (g/m^3)	t (m.)	mav*t (g/m^3)	Sum (mav*t) (g/m^3)	t (m.)	T (m.)	MAV (g/m^3)
		(carats)	(grams)	(lits)	(m^3)							
B36	0.0-1.0	0.0000	0.0000	10	0.0100	0.0000	1	0.0000	19.3412	1	10	1.9341
	1.0-2.0	0.0000	0.0000	8.5	0.0085	0.0000	1	0.0000		1		
	2.0-3.0	0.0000	0.0000	7	0.0070	0.0000	1	0.0000		1		
	3.0-4.0	0.0000	0.0000	10	0.0100	0.0000	1	0.0000		1		
	4.0-5.0	0.0000	0.0000	9	0.0090	0.0000	1	0.0000		1		
	5.0-6.0	0.0000	0.0000	9	0.0090	0.0000	1	0.0000		1		
	6.0-7.0	0.0000	0.0000	8.5	0.0085	0.0000	1	0.0000		1		
	7.0-8.0	0.4160	0.0832	8	0.0080	10.4000	1	10.4000		1		
	8.0-9.0	0.0000	0.0000	9	0.0090	0.0000	1	0.0000		1		
	9.0-10.0	0.3800	0.0760	8.5	0.0085	8.9412	1	8.9412		1		
S1A	0.0-0.6	0.0560	0.0112	15	0.0150	0.7467	0.6	0.4480	0.4480	0.6	0.6	0.7467
	0.6-0.8	**0.0170**	**0.0034**	**15**	**0.0150**	**0.2267**	**0.2**	**0.0453**	**0.0453**	**0.2**	**0.2**	**0.2267**
	0.8-2.1	0.0630	0.0126	12	0.0120	1.0500	1.3	1.3650	1.3650	1.3	1.3	1.0500
S1B	**0.0-0.6**	**0.3000**	**0.0600**	**15**	**0.0150**	**4.0000**	**0.6**	**2.4000**	**2.4000**	**0.6**	**0.6**	**4.0000**

S2	**3.3-6.7**	**0.0500**	**0.0100**	**96**	**0.0960**	**0.1042**	**3.4**	**0.3542**	**0.3542**	**3.4**	**3.4**	**0.1042**
	6.7-12.1	0.0500	0.0100	8	0.0080	1.2500	5.4	6.7500	6.7500	5.4	5.4	1.2500

The average abundance value of magnetite-ilmenite, size 1-2 mm. at Khao Phloi Waen												
Hole No.	Depth (m.)	Mineral Weight		Sediment Volume		mav (g/m^3)	t (m.)	mav*t (g/m^3)	Sum (mav*t) (g/m^3)	t (m.)	T (m.)	MAV (g/m^3)
		(carats)	(grams)	(lits)	(m^3)							
S3	0.0-5.1	0.2500	0.0500	27	0.0270	1.8519	5.1	9.4444	9.4444	5.1	5.1	1.8519
	5.1-6.7	**3.6000**	**0.7200**	**24**	**0.0240**	**30.0000**	**1.6**	**48.0000**	**48.0000**	**1.6**	**1.6**	**30.0000**
	6.7-8.7	0.7500	0.1500	21	0.0210	7.1429	2	14.2857	60.0000	2	7	8.5714
	8.7-10.7	0.9000	0.1800	21	0.0210	8.5714	2	17.1429		2		
	10.7-13.7	1.0000	0.2000	21	0.0210	9.5238	3	28.5714		3		
S4A	**2.9-4.8**	**3.3000**	**0.6600**	**28**	**0.0280**	**23.5714**	**1.9**	**44.7857**	**44.7857**	**1.9**	**1.9**	**23.5714**
	4.8-6.8	3.3000	0.6600	17	0.0170	38.8235	2	77.6471	82.3137	2	3.4	24.2099
	6.8-8.2	0.2000	0.0400	12	0.0120	3.3333	1.4	4.6667		1.4		
S4B	**2.0-3.5**	**0.3000**	**0.0600**	**23**	**0.0230**	**2.6087**	**1.5**	**3.9130**	**3.9130**	**1.5**	**1.5**	**2.6087**
S7	**1.55-2.7**	**0.0000**	**0.0000**	**395**	**0.3950**	**0.0000**	**1.15**	**0.0000**	**0.2308**	**1.15**	**1.45**	**0.2007**
	2.7-3.0	**0.2500**	**0.0500**	**65**	**0.0650**	**0.7692**	**0.3**	**0.2308**		**0.3**		

The average abundance value of olivine, size >2 mm. at Khao Phloi Waen												
Hole No.	Depth (m.)	Mineral Weight		Sediment Volume		mav (g/m^3)	t (m.)	mav*t (g/m^3)	Sum (mav*t) (g/m^3)	t (m.)	T (m.)	MAV (g/m^3)
		(carats)	(grams)	(lits)	(m^3)							
B17-2	0.0-1.0	0.0000	0.0000	10	0.0100	0.0000	1	0.0000	1.9000	1	3	0.6333
	1.0-2.0	0.0000	0.0000	7.5	0.0075	0.0000	1	0.0000		1		
	2.0-3.0	0.0950	0.0190	10	0.0100	1.9000	1	1.9000		1		
B23	0.0-1.0	0.0000	0.0000	10	0.0100	0.0000	1	0.0000	0.0000	1	5	0.0000
	1.0-2.0	0.0000	0.0000	9	0.0090	0.0000	1	0.0000		1		
	2.0-3.0	0.0000	0.0000	8	0.0080	0.0000	1	0.0000		1		
	3.0-4.0	0.0000	0.0000	7.5	0.0075	0.0000	1	0.0000		1		
	4.0-5.0	0.0000	0.0000	8	0.0080	0.0000	1	0.0000		1		
	5.0-6.0	0.2670	0.0534	10	0.0100	5.3400	1	5.3400	5.3400	1	1	5.3400

The average abundance value of mica, size >2 mm. at Khao Phloi Waen												
Hole No.	Depth (m.)	Mineral Weight		Sediment Volume		mav (g/m^3)	t (m.)	mav*t (g/m^3)	Sum (mav*t) (g/m^3)	t (m.)	T (m.)	MAV (g/m^3)
		(carats)	(grams)	(lits)	(m^3)							
B25	0.0-1.0	0.0000	0.0000	9	0.0090	0.0000	1	0.0000	25.9056	1	10	2.5906
	1.0-2.0	0.0000	0.0000	10	0.0100	0.0000	1	0.0000		1		
	2.0-3.0	0.0000	0.0000	9	0.0090	0.0000	1	0.0000		1		
	3.0-4.0	0.0000	0.0000	8.5	0.0085	0.0000	1	0.0000		1		
	4.0-5.0	0.0000	0.0000	9	0.0090	0.0000	1	0.0000		1		
	5.0-6.0	0.0000	0.0000	7.5	0.0075	0.0000	1	0.0000		1		
	6.0-7.0	0.7500	0.1500	8	0.0080	18.7500	1	18.7500		1		
	7.0-8.0	0.0000	0.0000	8	0.0080	0.0000	1	0.0000		1		
	8.0-9.0	0.0000	0.0000	8.5	0.0085	0.0000	1	0.0000		1		
	9.0-10.0	0.3220	0.0644	9	0.0090	7.1556	1	7.1556		1		
S7	**1.55-2.7**	**3.7850**	**0.7570**	**395**	**0.3950**	**1.9165**	**1.15**	**2.2039**	**2.2039**	**1.15**	**1.45**	**1.9165**
	2.7-3.0	**0.0000**	**0.0000**	**65**	**0.0650**	**0.0000**	**0.3**	**0.0000**		**0.3**		

The average abundance value of corundum (sapphire), size 1-2 mm. at Khao Wua												
Hole No.	Depth (m.)	Mineral Weight		Sediment Volume		mav (g/m^3)	t (m.)	mav*t (g/m^3)	Sum (mav*t) (g/m^3)	t (m.)	T (m.)	MAV (g/m^3)
		(carats)	(grams)	(lits)	(m^3)							
B40	0.0-1.0	0.0790	0.0158	10	0.0100	1.5800	1	1.5800	1.8537	1	3	0.6179
	1.0-2.0	0.0000	0.0000	10	0.0100	0.0000	1	0.0000		1		
	2.0-3.0	0.0130	0.0026	9.5	0.0095	0.2737	1	0.2737		1		

The average abundance value of corundum (sapphire), size >2 mm. at Khao Wua												
Hole No.	Depth (m.)	Mineral Weight		Sediment Volume		mav (g/m^3)	t (m.)	mav*t (g/m^3)	Sum (mav*t) (g/m^3)	t (m.)	T (m.)	MAV (g/m^3)
		(carats)	(grams)	(lits)	(m^3)							
B40	0.0-1.0	0.0000	0.0000	10	0.0100	0.0000	1	0.0000	2.4211	1	3	0.8070
	1.0-2.0	0.0000	0.0000	10	0.0100	0.0000	1	0.0000		1		
	2.0-3.0	0.1150	0.0230	9.5	0.0095	2.4211	1	2.4211		1		

The average abundance value of pyroxene-spinel, size 1-2 mm. at Khao Wua												
Hole No.	Depth (m.)	Mineral Weight (carats)	Mineral Weight (grams)	Sediment Volume (lits)	Sediment Volume (m^3)	mav (g/m^3)	t (m.)	mav*t (g/m^3)	Sum (mav*t) (g/m^3)	t (m.)	T (m.)	MAV (g/m^3)
P9	**0.0-0.7**	**1.5500**	**0.3100**	**32**	**0.0320**	**9.6875**	**0.7**	**6.7813**	**6.7813**	**0.7**	**0.7**	**9.6875**
	0.7-1.8	8.8500	1.7700	15	0.0150	118.0000	1.1	129.8000	129.8000	1.1	1.1	118.0000
S6	0.0-3.3	0.0500	0.0100	13	0.0130	0.7692	3	2.3077	2.3077	3	3	0.7692
	3.3-6.2	**0.7500**	**0.1500**	**28**	**0.0280**	**5.3571**	**2.9**	**15.5357**	**15.5357**	**2.9**	**2.9**	**5.3571**
The average abundance value of pyroxene-spinel, size >2 mm. at Khao Wua												
Hole No.	Depth (m.)	Mineral Weight (carats)	Mineral Weight (grams)	Sediment Volume (lits)	Sediment Volume (m^3)	mav (g/m^3)	t (m.)	mav*t (g/m^3)	Sum (mav*t) (g/m^3)	t (m.)	T (m.)	MAV (g/m^3)
P9	**0.0-0.7**	**4.1220**	**0.8244**	**32**	**0.0320**	**25.7625**	**0.7**	**18.0338**	**18.0338**	**0.7**	**0.7**	**25.7625**
	0.7-1.8	57.2500	11.4500	15	0.0150	763.3333	1.1	839.6667	839.6667	1.1	1.1	763.3333
S6	0.0-3.3	2.5200	0.5040	13	0.0130	38.7692	3.3	127.9385	127.9385	3.3	3.3	38.7692
	3.3-6.2	**0.5600**	**0.1120**	**28**	**0.0280**	**4.0000**	**2.9**	**11.6000**	**11.6000**	**2.9**	**2.9**	**4.0000**

The average abundance value of zircon, size 1-2 mm. at Khao Wua												
Hole No.	Depth (m.)	Mineral Weight		Sediment Volume		mav (g/m^3)	t (m.)	mav*t (g/m^3)	Sum (mav*t) (g/m^3)	t (m.)	T (m.)	MAV (g/m^3)
		(carats)	(grams)	(lits)	(m^3)							
B40	0.0-1.0	0.0000	0.0000	10	0.0100	0.0000	1	0.0000	0.1800	1	3	0.0600
	1.0-2.0	0.0090	0.0018	10	0.0100	0.1800	1	0.1800		1		
	2.0-3.0	0.0000	0.0000	9.5	0.0095	0.0000	1	0.0000		1		
P9	**0.0-0.7**	**0.1700**	**0.0340**	**32**	**0.0320**	**1.0625**	**0.7**	**0.7438**	**0.7438**	**0.7**	**0.7**	**1.0625**
	0.7-1.8	0.2200	0.0440	15	0.0150	2.9333	1.1	3.2267	3.2267	1.1	1.1	2.9333
S6	0.0-3.3	0.0140	0.0028	13	0.0130	0.2154	3	0.6462	0.6462	3	3	0.2154
	3.3-6.2	**0.0500**	**0.0100**	**28**	**0.0280**	**0.3571**	**2.9**	**1.0357**	**1.0357**	**2.9**	**2.9**	**0.3571**

The average abundance value of zircon, size >2 mm. at Khao Wua												
Hole No.	Depth (m.)	Mineral Weight		Sediment Volume		mav (g/m^3)	t (m.)	mav*t (g/m^3)	Sum (mav*t) (g/m^3)	t (m.)	T (m.)	MAV (g/m^3)
		(carats)	(grams)	(lits)	(m^3)							
B40	0.0-1.0	0.0000	0.0000	10	0.0100	0.0000	1	0.0000	2.3400	1	3	0.7800
	1.0-2.0	0.1170	0.0234	10	0.0100	2.3400	1	2.3400		1		
	2.0-3.0	0.0000	0.0000	9.5	0.0095	0.0000	1	0.0000		1		

The average abundance value of garnet, size 1-2 mm. at Khao Wua												
Hole No.	Depth (m.)	Mineral Weight (carats)	Mineral Weight (grams)	Sediment Volume (lits)	Sediment Volume (m^3)	mav (g/m^3)	t (m.)	mav*t (g/m^3)	Sum (mav*t) (g/m^3)	t (m.)	T (m.)	MAV (g/m^3)
S6	**3.3-6.2**	**0.0100**	**0.0020**	**28**	**0.0280**	**0.0714**	**2.9**	**0.2071**	**0.2071**	**2.9**	**2.9**	**0.0714**
The average abundance value of garnet, size >2 mm. at Khao Wua												
Hole No.	Depth (m.)	Mineral Weight (carats)	Mineral Weight (grams)	Sediment Volume (lits)	Sediment Volume (m^3)	mav (g/m^3)	t (m.)	mav*t (g/m^3)	Sum (mav*t) (g/m^3)	t (m.)	T (m.)	MAV (g/m^3)
S6	**3.3-6.2**	**1.2500**	**0.2500**	**28**	**0.0280**	**8.9286**	**2.9**	**25.8929**	**25.8929**	**2.9**	**2.9**	**8.9286**

The average abundance value of magnetite-ilmenite, size 1-2 mm. at Khao Wua												
Hole No.	Depth (m.)	Mineral Weight (carats)	Mineral Weight (grams)	Sediment Volume (lits)	Sediment Volume (m^3)	mav (g/m^3)	t (m.)	mav*t (g/m^3)	Sum (mav*t) (g/m^3)	t (m.)	T (m.)	MAV (g/m^3)
P9	**0.0-0.7**	**2.2500**	**0.4500**	**32**	**0.0320**	**14.0625**	**0.7**	**9.8438**	**9.8438**	**0.7**	**0.7**	**14.0625**
	0.7-1.8	0.8500	0.1700	15	0.0150	11.3333	1.1	12.4667	12.4667	1.1	1.1	11.3333
S6	0.0-3.3	0.0500	0.0100	13	0.0130	0.7692	3	2.3077	2.3077	3	3	0.7692
	3.3-6.2	**0.2500**	**0.0500**	**28**	**0.0280**	**1.7857**	**2.9**	**5.1786**	**5.1786**	**2.9**	**2.9**	**1.7857**
The average abundance value of magnetite-ilmenite, size >2 mm. at Khao Wua												
Hole No.	Depth (m.)	Mineral Weight (carats)	Mineral Weight (grams)	Sediment Volume (lits)	Sediment Volume (m^3)	mav (g/m^3)	t (m.)	mav*t (g/m^3)	Sum (mav*t) (g/m^3)	t (m.)	T (m.)	MAV (g/m^3)
P9	**0.0-0.7**	**0.1220**	**0.0244**	**32**	**0.0320**	**0.7625**	**0.7**	**0.5338**	**0.5338**	**0.7**	**0.7**	**0.7625**

The average abundance value of corundum (sapphire), size <1 mm. at Ban Hua-u												
Hole No.	Depth (m.)	Mineral Weight (carats)	Mineral Weight (grams)	Sediment Volume (lits)	Sediment Volume (m^3)	mav (g/m^3)	t (m.)	mav*t (g/m^3)	Sum (mav*t) (g/m^3)	t (m.)	T (m.)	MAV (g/m^3)
B19-2	0.0-1.0	0.0060	0.0012	10	0.0100	0.1200	1	0.1200	0.1200	1	1	0.1200
The average abundance value of corundum (sapphire), size 1-2 mm. at Ban Hua-u												
Hole No.	Depth (m.)	Mineral Weight (carats)	Mineral Weight (grams)	Sediment Volume (lits)	Sediment Volume (m^3)	mav (g/m^3)	t (m.)	mav*t (g/m^3)	Sum (mav*t) (g/m^3)	t (m.)	T (m.)	MAV (g/m^3)
B33	0.0-1.0	0.0910	0.0182	10	0.0100	1.8200	1.00	1.8200	2.4000	1	2	1.2000
	1.0-2.0	0.0290	0.0058	10	0.0100	0.5800	1.00	0.5800		1		
The average abundance value of corundum (sapphire), size >2 mm. at Ban Hua-u												
Hole No.	Depth (m.)	Mineral Weight (carats)	Mineral Weight (grams)	Sediment Volume (lits)	Sediment Volume (m^3)	mav (g/m^3)	t (m.)	mav*t (g/m^3)	Sum (mav*t) (g/m^3)	t (m.)	T (m.)	MAV (g/m^3)
B32	0.0-1.0	0.0520	0.0104	10	0.0100	1.0400	1	1.0400	1.0400	1	1	1.0400
B33	0.0-1.0	0.0000	0.0000	10.0	0.0100	0.0000	1.00	0.0000	13.7200	1	2	6.8600
	1.0-2.0	0.6860	0.1372	10.0	0.0100	13.7200	1.00	13.7200		1		

The average abundance value of pyroxene-spinel, size <1 mm. at Ban Hua-u												
Hole No.	Depth (m.)	Mineral Weight (carats)	Mineral Weight (grams)	Sediment Volume (lits)	Sediment Volume (m^3)	mav (g/m^3)	t (m.)	mav*t (g/m^3)	Sum (mav*t) (g/m^3)	t (m.)	T (m.)	MAV (g/m^3)
B32	0.0-1.0	0.0520	0.0104	10	0.0100	1.0400	1	1.0400	1.0400	1	1	1.0400
B33-2	**0.0-1.0**	**0.0200**	**0.0040**	**10**	**0.0100**	**0.4000**	**1**	**0.4000**	**0.4000**	**1**	**2**	**0.2000**
	1.0-2.0	**0.0000**	**0.0000**	**9**	**0.0090**	**0.0000**	**1**	**0.0000**		**1**		
The average abundance value of pyroxene-spinel, size >2 mm. at Ban Hua-u												
Hole No.	Depth (m.)	Mineral Weight (carats)	Mineral Weight (grams)	Sediment Volume (lits)	Sediment Volume (m^3)	mav (g/m^3)	t (m.)	mav*t (g/m^3)	Sum (mav*t) (g/m^3)	t (m.)	T (m.)	MAV (g/m^3)
B33	0.0-1.0	0.0740	0.0148	10	0.0100	1.4800	1	1.4800	100.0600	1	2	50.0300
	1.0-2.0	4.9290	0.9858	10	0.0100	98.5800	1	98.5800		1		
B33-1	0.0-1.0	0.5300	0.1060	10	0.0100	10.6000	1	10.6000	10.6000	1	1	10.6000
B33-2	**0.0-1.0**	**0.2200**	**0.0440**	**10**	**0.0100**	**4.4000**	**1**	**4.4000**	**4.4000**	**1**	**2**	**2.2000**
	1.0-2.0	**0.0000**	**0.0000**	**9**	**0.0090**	**0.0000**	**1**	**0.0000**		**1**		

The average abundance value of pyroxene-spinel, size 1-2 mm. at Ban Hua-u												
Hole No.	Depth (m.)	Mineral Weight		Sediment Volume		mav (g/m^3)	t (m.)	mav*t (g/m^3)	Sum (mav*t) (g/m^3)	t (m.)	T (m.)	MAV (g/m^3)
		(carats)	(grams)	(lits)	(m^3)							
B32-1	0.0-1.0	0.1720	0.0344	10	0.0100	3.4400	1	3.4400	3.4400	1	1	3.4400
B33	0.0-1.0	0.2440	0.0488	10	0.0100	4.8800	1	4.8800	17.2200	1	2	8.6100
	1.0-2.0	0.6170	0.1234	10	0.0100	12.3400	1	12.3400		1		
	2.0-3.0	**0.1160**	**0.0232**	**10**	**0.0100**	**2.3200**	**1**	**2.3200**	**8.8141**	**1**	**4**	**2.2035**
	3.0-4.0	**0.1600**	**0.0320**	**8.5**	**0.0085**	**3.7647**	**1**	**3.7647**		**1**		
	4.0-5.0	**0.1160**	**0.0232**	**8.5**	**0.0085**	**2.7294**	**1**	**2.7294**		**1**		
	5.0-6.0	**0.0000**	**0.0000**	**9.5**	**0.0095**	**0.0000**	**1**	**0.0000**		**1**		
B33-1	**0.0-1.0**	**0.2200**	**0.0440**	**10**	**0.0100**	**4.4000**	**1**	**4.4000**	**4.4000**	**1**	**1**	**4.4000**
B33-8	0.0-1.0	0.0410	0.0082	10	0.0100	0.8200	1	0.8200	0.8200	1	1	0.8200
	1.0-2.0	**0.1560**	**0.0312**	**9**	**0.0090**	**3.4667**	**1**	**3.4667**	**10.3373**	**1**	**3**	**3.4458**
	2.0-3.0	**0.1390**	**0.0278**	**8.5**	**0.0085**	**3.2706**	**1**	**3.2706**		**1**		
	3.0-4.0	**0.1440**	**0.0288**	**8**	**0.0080**	**3.6000**	**1**	**3.6000**		**1**		

The average abundance value of zircon, size <1 mm. at Ban Hua-u												
Hole No.	Depth (m.)	Mineral Weight (carats)	Mineral Weight (grams)	Sediment Volume (lits)	Sediment Volume (m^3)	mav (g/m^3)	t (m.)	mav*t (g/m^3)	Sum (mav*t) (g/m^3)	t (m.)	T (m.)	MAV (g/m^3)
B33	0.0-1.0	0.0090	0.0018	10	0.0100	0.1800	1	0.1800	0.1800	1	2	0.0900
	1.0-2.0	0.0000	0.0000	10	0.0100	0.0000	1	0.0000		1		
The average abundance value of zircon, size 1-2 mm. at Ban Hua-u												
Hole No.	Depth (m.)	Mineral Weight (carats)	Mineral Weight (grams)	Sediment Volume (lits)	Sediment Volume (m^3)	mav (g/m^3)	t (m.)	mav*t (g/m^3)	Sum (mav*t) (g/m^3)	t (m.)	T (m.)	MAV (g/m^3)
B19-2	0.0-1.0	0.0260	0.0052	10	0.0100	0.5200	1	0.5200	0.5200	1	1	0.5200
B32-1	0.0-1.0	0.0610	0.0122	10	0.0100	1.2200	1	1.2200	1.2200	1	1	1.2200

The average abundance value of garnet, size <1 mm. at Ban Hua-u												
Hole No.	Depth (m.)	Mineral Weight (carats)	Mineral Weight (grams)	Sediment Volume (lits)	Sediment Volume (m^3)	mav (g/m^3)	t (m.)	mav*t (g/m^3)	Sum (mav*t) (g/m^3)	t (m.)	T (m.)	MAV (g/m^3)
B32-1	0.0-1.0	0.0100	0.0020	10	0.0100	0.2000	1	0.2000	0.2000	1	1	0.2000
The average abundance value of garnet, size >2 mm. at Ban Hua-u												
Hole No.	Depth (m.)	Mineral Weight (carats)	Mineral Weight (grams)	Sediment Volume (lits)	Sediment Volume (m^3)	mav (g/m^3)	t (m.)	mav*t (g/m^3)	Sum (mav*t) (g/m^3)	t (m.)	T (m.)	MAV (g/m^3)
B33	**2.0-3.0**	**0.0000**	**0.0000**	**10**	**0.0100**	**0.0000**	**1**	**0.0000**	**1.5368**	**1**	**4**	**0.3842**
	3.0-4.0	**0.0000**	**0.0000**	**8.5**	**0.0085**	**0.0000**	**1**	**0.0000**		**1**		
	4.0-5.0	**0.0000**	**0.0000**	**8.5**	**0.0085**	**0.0000**	**1**	**0.0000**		**1**		
	5.0-6.0	**0.0730**	**0.0146**	**9.5**	**0.0095**	**1.5368**	**1**	**1.5368**		**1**		

The average abundance value of corundum (sapphire), size 1-2 mm. at Klong Pan Salut

Hole No.	Depth (m.)	Mineral Weight (carats)	Mineral Weight (grams)	Sediment Volume (lits)	Sediment Volume (m^3)	mav (g/m^3)	t (m.)	mav*t (g/m^3)	Sum (mav*t) (g/m^3)	t (m.)	T (m.)	MAV (g/m^3)
B8-1	5.0-6.0	0.0000	0.0000	7	0.0070	0.0000	1	0.0000	1.0250	1	5	0.2050
	6.0-7.0	0.0000	0.0000	7	0.0070	0.0000	1	0.0000		1		
	7.0-8.0	0.0410	0.0082	8	0.0080	1.0250	1	1.0250		1		
	8.0-9.0	0.0000	0.0000	7.5	0.0075	0.0000	1	0.0000		1		
	9.0-10.0	0.0000	0.0000	8.5	0.0085	0.0000	1	0.0000		1		
B9-1	3.0-4.0	0.0000	0.0000	8	0.0080	0.0000	1	0.0000	0.4000	0	1	0.4000
	4.0-4.5	0.0360	0.0072	9	0.0090	0.8000	0.5	0.4000		0.5		
	4.5-5.0	0.0000	0.0000	6	0.0060	0.0000	1	0.0000		0.5		

The average abundance value of corundum (sapphire), size >2 mm. at Klong Pan Salut

Hole No.	Depth (m.)	Mineral Weight (carats)	Mineral Weight (grams)	Sediment Volume (lits)	Sediment Volume (m^3)	mav (g/m^3)	t (m.)	mav*t (g/m^3)	Sum (mav*t) (g/m^3)	t (m.)	T (m.)	MAV (g/m^3)
B9-1	3.0-4.0	0.0000	0.0000	8	0.0080	0.0000	1	0.0000	0.5556	1	2	0.2778
	4.0-4.5	0.0500	0.0100	9	0.0090	1.1111	0.50	0.5556		0.5		
	4.5-5.0	0.0000	0.0000	6	0.0060	0.0000	1	0.0000		0.5		

The average abundance value of pyroxene-spinel, size 1-2 mm. at Klong Pan Salut												
Hole No.	Depth (m.)	Mineral Weight		Sediment Volume		mav (g/m^3)	t (m.)	mav*t (g/m^3)	Sum (mav*t) (g/m^3)	t (m.)	T (m.)	MAV (g/m^3)
		(carats)	(grams)	(lits)	(m^3)							
B7-1	**11.0-11.5**	**0.0250**	**0.0050**	**9**	**0.0090**	**0.5556**	**1**	**0.5556**	**0.5556**	**0.5**	**0.5**	**1.1111**
B8-1	0.0-1.0	0.1080	0.0216	10	0.0100	2.1600	1	2.1600	8.0564	1	5	1.6113
	1.0-2.0	0.0000	0.0000	7.5	0.0075	0.0000	1	0.0000		1		
	2.0-3.0	0.0780	0.0156	8	0.0080	1.9500	1	1.9500		1		
	3.0-4.0	0.0970	0.0194	7	0.0070	2.7714	1	2.7714		1		
	4.0-5.0	0.0470	0.0094	8	0.0080	1.1750	1	1.1750		1		
	5.0-6.0	**0.3800**	**0.0760**	**7**	**0.0070**	**10.8571**	**1**	**10.8571**	**48.7848**	**1**	**5**	**9.7570**
	6.0-7.0	**0.5380**	**0.1076**	**7**	**0.0070**	**15.3714**	**1**	**15.3714**		**1**		
	7.0-8.0	**0.2620**	**0.0524**	**8**	**0.0080**	**6.5500**	**1**	**6.5500**		**1**		
	8.0-9.0	**0.3170**	**0.0634**	**7.5**	**0.0075**	**8.4533**	**1**	**8.4533**		**1**		
	9.0-10.0	**0.3210**	**0.0642**	**8.5**	**0.0085**	**7.5529**	**1**	**7.5529**		**1**		

The average abundance value of pyroxene-spinel, size >2 mm. at Klong Pan Salut												
Hole No.	Depth (m.)	Mineral Weight		Sediment Volume		mav	t	mav*t	Sum (mav*t)	t	T	MAV
		(carats)	(grams)	(lits)	(m^3)	(g/m^3)	(m.)	(g/m^3)	(g/m^3)	(m.)	(m.)	(g/m^3)
B8-1	0.0-1.0	0.0000	0.0000	10	0.0100	0.0000	1	0.0000	109.4357	1	5	21.8871
	1.0-2.0	0.0000	0.0000	7.5	0.0075	0.0000	1	0.0000		1		
	2.0-3.0	0.0000	0.0000	8	0.0080	0.0000	1	0.0000		1		
	3.0-4.0	1.4310	0.2862	7	0.0070	40.8857	1	40.8857		1		
	4.0-5.0	2.7420	0.5484	8	0.0080	68.5500	1	68.5500		1		
	5.0-6.0	**2.2940**	**0.4588**	**7**	**0.0070**	**65.5429**	**1**	**65.5429**	**853.5625**	**1**	**5**	**170.7125**
	6.0-7.0	**12.182**	**2.4364**	**7**	**0.0070**	**348.0571**	**1**	**348.0571**		**1**		
	7.0-8.0	**3.4710**	**0.6942**	**8**	**0.0080**	**86.7750**	**1**	**86.7750**		**1**		
	8.0-9.0	**6.0260**	**1.2052**	**7.5**	**0.0075**	**160.6933**	**1**	**160.6933**		**1**		
	9.0-10.0	**8.1810**	**1.6362**	**8.5**	**0.0085**	**192.4941**	**1**	**192.4941**		**1**		
B9-1	**3.0-4.0**	**1.1910**	**0.2382**	**8**	**0.0080**	**29.7750**	**1**	**29.7750**	**79.5639**	**1**	**2**	**39.7819**
	4.0-4.5	**1.1570**	**0.2314**	**9**	**0.0090**	**25.7111**	**0.5**	**12.8556**		**0.5**		
	4.5-5.0	**1.1080**	**0.2216**	**6**	**0.0060**	**36.9333**	**1**	**36.9333**		**0.5**		

The average abundance value of green pyroxene, size 1-2 mm. at Klong Pan Salut												
Hole No.	Depth (m.)	Mineral Weight		Sediment Volume		mav (g/m^3)	t (m.)	mav*t (g/m^3)	Sum (mav*t) (g/m^3)	t (m.)	T (m.)	MAV (g/m^3)
		(carats)	(grams)	(lits)	(m^3)							
B8-1	0.0-1.0	0.0760	0.0152	10	0.0100	1.5200	1	1.5200	18.3593	1	5	3.6719
	1.0-2.0	0.0000	0.0000	7.5	0.0075	0.0000	1	0.0000		1		
	2.0-3.0	0.0000	0.0000	8	0.0080	0.0000	1	0.0000		1		
	3.0-4.0	0.1860	0.0372	7	0.0070	5.3143	1	5.3143		1		
	4.0-5.0	0.4610	0.0922	8	0.0080	11.5250	1	11.5250		1		
	5.0-60	**0.4210**	**0.0842**	**7**	**0.0070**	**12.0286**	**1**	**12.0286**	**29.7164**	**1**	**5**	**5.9433**
	6.0-7.0	**0.2220**	**0.0444**	**7**	**0.0070**	**6.3429**	**1**	**6.3429**		**1**		
	7.0-8.0	**0.0250**	**0.0050**	**8**	**0.0080**	**0.6250**	**1**	**0.6250**		**1**		
	8.0-9.0	**0.4020**	**0.0804**	**7.5**	**0.0075**	**10.7200**	**1**	**10.7200**		**1**		
	9.0-10.0	**0.0000**	**0.0000**	**8.5**	**0.0085**	**0.0000**	**1**	**0.0000**		**1**		

The average abundance value of green pyroxene, size >2 mm. at Klong Pan Salut												
Hole No.	Depth (m.)	Mineral Weight		Sediment Volume		mav	t	mav*t	Sum (mav*t)	t	T	MAV
		(carats)	(grams)	(lits)	(m^3)	(g/m^3)	(m.)	(g/m^3)	(g/m^3)	(m.)	(m.)	(g/m^3)
B8-1	0.0-1.0	0.0000	0.0000	10	0.0100	0.0000	1	0.0000	33.4571	1	5	6.6914
	1.0-2.0	0.0000	0.0000	7.5	0.0075	0.0000	1	0.0000		1		
	2.0-3.0	0.0000	0.0000	8	0.0080	0.0000	1	0.0000		1		
	3.0-4.0	0.9260	0.1852	7	0.0070	26.4571	1	26.4571		1		
	4.0-5.0	0.2800	0.0560	8	0.0080	7.0000	1	7.0000		1		
	5.0-60	**1.1410**	**0.2282**	**7**	**0.0070**	**32.6000**	**1**	**32.6000**	**1311.2038**	**1**	**5**	**262.2408**
	6.0-7.0	**18.5230**	**3.7046**	**7**	**0.0070**	**529.2286**	**1**	**529.2286**		**1**		
	7.0-8.0	**8.1650**	**1.6330**	**8**	**0.0080**	**204.1250**	**1**	**204.1250**		**1**		
	8.0-9.0	**9.4660**	**1.8932**	**7.5**	**0.0075**	**252.4267**	**1**	**252.4267**		**1**		
	9.0-10.0	**12.4450**	**2.4890**	**8.5**	**0.0085**	**292.8235**	**1**	**292.8235**		**1**		
B9-1	**3.0-4.0**	**0.3820**	**0.0764**	**8**	**0.0080**	**9.5500**	**1**	**9.5500**	**15.6833**	**1**	**2**	**7.8417**
	4.0-4.5	**0.5520**	**0.1104**	**9**	**0.0090**	**12.2667**	**0.5**	**6.1333**		**0.5**		
	4.5-5.0	**0.0000**	**0.0000**	**6**	**0.0060**	**0.0000**	**1**	**0.0000**		**0.5**		

The average abundance value of zircon, size 1-2 mm. at Klong Pan Salut												
Hole No.	Depth (m.)	Mineral Weight (carats)	Mineral Weight (grams)	Sediment Volume (lits)	Sediment Volume (m^3)	mav (g/m^3)	t (m.)	mav*t (g/m^3)	Sum (mav*t) (g/m^3)	t (m.)	T (m.)	MAV (g/m^3)
B7	0.0-1.0	0.0120	0.0024	10	0.0100	0.2400	1	0.2400	0.2400	1	1	0.2400
B7-1	**11.0-11.5**	**0.0150**	**0.0030**	**9**	**0.0090**	**0.3333**	**1**	**0.3333**	**0.3333**	**0.5**	**0.5**	**0.6667**
B8	2.0-3.0	0.0210	0.0042	8.5	0.0085	0.4941	1	0.4941	0.4941	1	1	0.4941
B8-1	**5.0-60**	**0.0420**	**0.0084**	**7**	**0.0070**	**1.2000**	**1**	**1.2000**	**9.5179**	**1**	**5**	**1.9036**
	6.0-7.0	**0.1450**	**0.0290**	**7**	**0.0070**	**4.1429**	**1**	**4.1429**		**1**		
	7.0-8.0	**0.1350**	**0.0270**	**8**	**0.0080**	**3.3750**	**1**	**3.3750**		**1**		
	8.0-9.0	**0.0000**	**0.0000**	**7.5**	**0.0075**	**0.0000**	**1**	**0.0000**		**1**		
	9.0-10.0	**0.0340**	**0.0068**	**8.5**	**0.0085**	**0.8000**	**1**	**0.8000**		**1**		
B9-1	**3.0-4.0**	**0.0070**	**0.0014**	**8**	**0.0080**	**0.1750**	**1**	**0.1750**	**2.5861**	**1**	**2**	**1.2931**
	4.0-4.5	**0.0940**	**0.0188**	**9**	**0.0090**	**2.0889**	**0.5**	**1.0444**		**0.5**		
	4.5-5.0	**0.0410**	**0.0082**	**6**	**0.0060**	**1.3667**	**1**	**1.3667**		**0.5**		

The average abundance value of garnet, size >2 mm. at Klong Pan Salut												
Hole No.	Depth (m.)	Mineral Weight		Sediment Volume		mav (g/m^3)	t (m.)	mav*t (g/m^3)	Sum (mav*t) (g/m^3)	t (m.)	T (m.)	MAV (g/m^3)
		(carats)	(grams)	(lits)	(m^3)							
B8-1	5.0-6.0	0.0000	0.0000	7	0.0070	0.0000	1	0.0000	4.7294	1	5	0.9459
	6.0-7.0	0.0000	0.0000	7	0.0070	0.0000	1	0.0000		1		
	7.0-8.0	0.0000	0.0000	8	0.0080	0.0000	1	0.0000		1		
	8.0-9.0	0.0000	0.0000	7.5	0.0075	0.0000	1	0.0000		1		
	9.0-10.0	0.2010	0.0402	8.5	0.0085	4.7294	1	4.7294		1		
B9-1	3.0-4.0	0.0000	0.0000	8	0.0080	0.0000	1	0.0000	1.4889	1	2	0.7444
	4.0-4.5	0.1340	0.0268	9	0.0090	2.9778	0.5	1.4889		0.5		
	4.5-5.0	0.0000	0.0000	6	0.0060	0.0000	0.5	0.0000		0.5		

The average abundance value of olivine, size 1-2 mm. at Klong Pan Salut												
Hole No.	Depth (m.)	Mineral Weight		Sediment Volume		mav (g/m^3)	t (m.)	mav*t (g/m^3)	Sum (mav*t) (g/m^3)	t (m.)	T (m.)	MAV (g/m^3)
		(carats)	(grams)	(lits)	(m^3)							
B8-1	0.0-1.0	0.0310	0.0062	10	0.0100	0.6200	1	0.6200	2.7700	1	5	0.5540
	1.0-2.0	0.0000	0.0000	7.5	0.0075	0.0000	1	0.0000		1		
	2.0-3.0	0.0000	0.0000	8	0.0080	0.0000	1	0.0000		1		
	3.0-4.0	0.0000	0.0000	7	0.0070	0.0000	1	0.0000		1		
	4.0-5.0	0.0860	0.0172	8	0.0080	2.1500	1	2.1500		1		

The average abundance value of corundum (sapphire), size 1-2 mm. at Klong Wat Sakaeo												
Hole No.	Depth (m.)	Mineral Weight		Sediment Volume		mav (g/m^3)	t (m.)	mav*t (g/m^3)	Sum (mav*t) (g/m^3)	t (m.)	T (m.)	MAV (g/m^3)
		(carats)	(grams)	(lits)	(m^3)							
B2-1	4.0-5.0	0.0000	0.0000	8	0.0080	0.0000	1	0.0000	0.8182	1	7.5	0.1091
	5.0-6.0	0.0000	0.0000	7.5	0.0075	0.0000	1	0.0000		1		
	6.0-7.0	0.0000	0.0000	8.5	0.0085	0.0000	1	0.0000		1		
	7.0-8.0	0.0000	0.0000	8	0.0080	0.0000	1	0.0000		1		
	8.0-9.0	0.0000	0.0000	8.5	0.0085	0.0000	1	0.0000		1		
	9.0-10.0	0.0000	0.0000	8.5	0.0085	0.0000	1	0.0000		1		
	10.0-11.0	0.0000	0.0000	7	0.0070	0.0000	1	0.0000		1		
	11.0-11.5	0.0450	0.0090	5.5	0.0055	1.6364	0.5	0.8182		0.5		
B4	5.0-6.0	0.0000	0.0000	8	0.0080	0.0000	1	0.0000	0.6381	1	5	0.1276
	6.0-7.0	0.0060	0.0012	7	0.0070	0.1714	1	0.1714		1		
	7.0-8.0	0.0000	0.0000	10	0.0100	0.0000	1	0.0000		1		
	8.0-9.0	0.0000	0.0000	8	0.0080	0.0000	1	0.0000		1		
	9.0-10.0	0.0210	0.0042	9	0.0090	0.4667	1	0.4667		1		

The average abundance value of pyroxene-spinel, size 1-2 mm. at Klong Wat Sakaeo												
Hole No.	Depth (m.)	Mineral Weight		Sediment Volume		mav (g/m^3)	t (m.)	mav*t (g/m^3)	Sum (mav*t) (g/m^3)	t (m.)	T (m.)	MAV (g/m^3)
		(carats)	(grams)	(lits)	(m^3)							
B1-3	0.0-1.0	0.0540	0.0108	10	0.0100	1.0800	1	1.0800	2.4550	1	2	1.2275
	1.0-2.0	0.0550	0.0110	8	0.0080	1.3750	1	1.3750		1		
B1-5	0.0-1.0	0.1110	0.0222	10	0.0100	2.2200	1	2.2200	2.2200	1	1	2.2200
B2-1	4.0-5.0	0.0000	0.0000	8	0.0080	0.0000	1	0.0000	11.9541	1	7.5	1.5939
	5.0-6.0	0.0210	0.0042	7.5	0.0075	0.5600	1	0.5600		1		
	6.0-7.0	0.0080	0.0016	8.5	0.0085	0.1882	1	0.1882		1		
	7.0-8.0	0.1960	0.0392	8	0.0080	4.9000	1	4.9000		1		
	8.0-9.0	0.0000	0.0000	8.5	0.0085	0.0000	1	0.0000		1		
	9.0-10.0	0.0640	0.0128	8.5	0.0085	1.5059	1	1.5059		1		
	10.0-11.0	0.1330	0.0266	7	0.0070	3.8000	1	3.8000		1		
	11.0-11.5	0.0550	0.0110	5.5	0.0055	2.0000	0.5	1.0000		0.5		
B4	5.0-6.0	0.0000	0.0000	8	0.0080	0.0000	1	0.0000	1.0500	1	5	0.2100
	6.0-7.0	0.0000	0.0000	7	0.0070	0.0000	1	0.0000		1		
	7.0-8.0	0.0000	0.0000	10	0.0100	0.0000	1	0.0000		1		

	8.0-9.0	0.0420	0.0084	8	0.0080	1.0500	1	1.0500		1		
	9.0-10.0	0.0000	0.0000	9	0.0090	0.0000	1	0.0000		1		

The average abundance value of pyroxene-spinel, size >2 mm. at Klong Wat Sakaeo												
Hole No.	Depth (m.)	Mineral Weight		Sediment Volume		mav (g/m^3)	t (m.)	mav*t (g/m^3)	Sum (mav*t) (g/m^3)	t (m.)	T (m.)	MAV (g/m^3)
		(carats)	(grams)	(lits)	(m^3)							
B2-1	4.0-5.0	0.1260	0.0252	8	0.0080	3.1500	1	3.1500	206.5813	1	7.5	27.5442
	5.0-6.0	0.0000	0.0000	7.5	0.0075	0.0000	1	0.0000		1		
	6.0-7.0	0.0000	0.0000	8.5	0.0085	0.0000	1	0.0000		1		
	7.0-8.0	0.3310	0.0662	8	0.0080	8.2750	1	8.2750		1		
	8.0-9.0	0.0550	0.0110	8.5	0.0085	1.2941	1	1.2941		1		
	9.0-10.0	7.4110	1.4822	8.5	0.0085	174.3765	1	174.3765		1		
	10.0-11.0	0.6820	0.1364	7	0.0070	19.4857	1	19.4857		1		
	11.0-11.5	0.0000	0.0000	5.5	0.0055	0.0000	0.5	0.0000		0.5		
B4	5.0-6.0	0.0380	0.0076	8	0.0080	0.9500	1	0.9500	229.6556	1	5	45.9311
	6.0-7.0	0.0000	0.0000	7	0.0070	0.0000	1	0.0000		1		
	7.0-8.0	0.0000	0.0000	10	0.0100	0.0000	1	0.0000		1		
	8.0-9.0	6.8940	1.3788	8	0.0080	172.3500	1	172.3500		1		
	9.0-10.0	2.5360	0.5072	9	0.0090	56.3556	1	56.3556		1		

The average abundance value of green pyroxene, size 1-2 mm. at Klong Wat Sakaeo												
Hole No.	Depth (m.)	Mineral Weight		Sediment Volume		mav (g/m^3)	t (m.)	mav*t (g/m^3)	Sum (mav*t) (g/m^3)	t (m.)	T (m.)	MAV (g/m^3)
		(carats)	(grams)	(lits)	(m^3)							
B2-1	4.0-5.0	0.0000	0.0000	8	0.0080	0.0000	1	0.0000	2.8286	1	7.5	0.3771
	5.0-6.0	0.0000	0.0000	7.5	0.0075	0.0000	1	0.0000		1		
	6.0-7.0	0.0000	0.0000	8.5	0.0085	0.0000	1	0.0000		1		
	7.0-8.0	0.0000	0.0000	8	0.0080	0.0000	1	0.0000		1		
	8.0-9.0	0.0850	0.0170	8.5	0.0085	2.0000	1	2.0000		1		
	9.0-10.0	0.0000	0.0000	8.5	0.0085	0.0000	1	0.0000		1		
	10.0-11.0	0.0290	0.0058	7	0.0070	0.8286	1	0.8286		1		
	11.0-11.5	0.0000	0.0000	5.5	0.0055	0.0000	0.5	0.0000		0.5		
B4	5.0-6.0	0.0000	0.0000	8	0.0080	0.0000	1	0.0000	1.7750	1	5	0.3550
	6.0-7.0	0.0000	0.0000	7	0.0070	0.0000	1	0.0000		1		
	7.0-8.0	0.0000	0.0000	10	0.0100	0.0000	1	0.0000		1		
	8.0-9.0	0.0710	0.0142	8	0.0080	1.7750	1	1.7750		1		
	9.0-10.0	0.0000	0.0000	9	0.0090	0.0000	1	0.0000		1		

The average abundance value of green pyroxene, size >2 mm. at Klong Wat Sakaeo												
Hole No.	Depth (m.)	Mineral Weight		Sediment Volume		mav (g/m^3)	t (m.)	mav*t (g/m^3)	Sum (mav*t) (g/m^3)	t (m.)	T (m.)	MAV (g/m^3)
		(carats)	(grams)	(lits)	(m^3)							
B4	5.0-6.0	0.0000	0.0000	8	0.0080	0.0000	1	0.0000	7.0500	1	5	1.4100
	6.0-7.0	0.0000	0.0000	7	0.0070	0.0000	1	0.0000		1		
	7.0-8.0	0.0000	0.0000	10	0.0100	0.0000	1	0.0000		1		
	8.0-9.0	0.2820	0.0564	8	0.0080	7.0500	1	7.0500		1		
	9.0-10.0	0.0000	0.0000	9	0.0090	0.0000	1	0.0000		1		

The average abundance value of zircon, size 1-2 mm. at Klong Wat Sakaeo												
Hole No.	Depth (m.)	Mineral Weight		Sediment Volume		mav (g/m^3)	t (m.)	mav*t (g/m^3)	Sum (mav*t) (g/m^3)	t (m.)	T (m.)	MAV (g/m^3)
		(carats)	(grams)	(lits)	(m^3)							
B4	5.0-6.0	0.0000	0.0000	8	0.0080	0.0000	1	0.0000	3.3564	1	5	0.6713
	6.0-7.0	0.0130	0.0026	7	0.0070	0.3714	1	0.3714		1		
	7.0-8.0	0.0080	0.0016	10	0.0100	0.1600	1	0.1600		1		
	8.0-9.0	0.1130	0.0226	8	0.0080	2.8250	1	2.8250		1		
	9.0-10.0	0.0000	0.0000	9	0.0090	0.0000	1	0.0000		1		

The average abundance value of magnetite-ilmenite, size 1-2 mm. at Klong Wat Sakaeo												
Hole No.	Depth (m.)	Mineral Weight		Sediment Volume		mav (g/m^3)	t (m.)	mav*t (g/m^3)	Sum (mav*t) (g/m^3)	t (m.)	T (m.)	MAV (g/m^3)
		(carats)	(grams)	(lits)	(m^3)							
B2-1	4.0-5.0	0.0000	0.0000	8	0.0080	0.0000	1	0.0000	2.5429	1	7.5	0.3390
	5.0-6.0	0.0000	0.0000	7.5	0.0075	0.0000	1	0.0000		1		
	6.0-7.0	0.0000	0.0000	8.5	0.0085	0.0000	1	0.0000		1		
	7.0-8.0	0.0000	0.0000	8	0.0080	0.0000	1	0.0000		1		
	8.0-9.0	0.0000	0.0000	8.5	0.0085	0.0000	1	0.0000		1		
	9.0-10.0	0.0000	0.0000	8.5	0.0085	0.0000	1	0.0000		1		
	10.0-11.0	0.0890	0.0178	7	0.0070	2.5429	1	2.5429		1		
	11.0-11.5	0.0000	0.0000	5.5	0.0055	0.0000	0.5	0.0000		0.5		

The average abundance value of magnetite-ilmenite, size >2 mm. at Klong Wat Sakaeo												
Hole No.	Depth (m.)	Mineral Weight		Sediment Volume		mav (g/m^3)	t (m.)	mav*t (g/m^3)	Sum (mav*t) (g/m^3)	t (m.)	T (m.)	MAV (g/m^3)
		(carats)	(grams)	(lits)	(m^3)							
B2-1	4.0-5.0	0.0000	0.0000	8	0.0080	0.0000	1	0.0000	3.6286	1	7.5	0.4838
	5.0-6.0	0.0000	0.0000	7.5	0.0075	0.0000	1	0.0000		1		
	6.0-7.0	0.0000	0.0000	8.5	0.0085	0.0000	1	0.0000		1		
	7.0-8.0	0.0000	0.0000	8	0.0080	0.0000	1	0.0000		1		
	8.0-9.0	0.0000	0.0000	8.5	0.0085	0.0000	1	0.0000		1		
	9.0-10.0	0.0000	0.0000	8.5	0.0085	0.0000	1	0.0000		1		
	10.0-11.0	0.1270	0.0254	7	0.0070	3.6286	1	3.6286		1		
	11.0-11.5	0.0000	0.0000	5.5	0.0055	0.0000	0.5	0.0000		0.5		

The average abundance value of olivine, size 1-2 mm. at Klong Wat Sakaeo												
Hole No.	Depth (m.)	Mineral Weight		Sediment Volume		mav (g/m^3)	t (m.)	mav*t (g/m^3)	Sum (mav*t) (g/m^3)	t (m.)	T (m.)	MAV (g/m^3)
		(carats)	(grams)	(lits)	(m^3)							
B1-3	0.0-1.0	0.0020	0.0004	10	0.0100	0.0400	1	0.0400	0.0400	1	2	0.0200
	1.0-2.0	0.0000	0.0000	8	0.0080	0.0000	1	0.0000		1		
B2-1	4.0-5.0	0.0000	0.0000	8	0.0080	0.0000	1	0.0000	4.1162	1	7.5	0.5488
	5.0-6.0	0.0000	0.0000	7.5	0.0075	0.0000	1	0.0000		1		
	6.0-7.0	0.0240	0.0048	8.5	0.0085	0.5647	1	0.5647		1		
	7.0-8.0	0.0790	0.0158	8	0.0080	1.9750	1	1.9750		1		
	8.0-9.0	0.0670	0.0134	8.5	0.0085	1.5765	1	1.5765		1		
	9.0-10.0	0.0000	0.0000	8.5	0.0085	0.0000	1	0.0000		1		
	10.0-11.0	0.0000	0.0000	7	0.0070	0.0000	1	0.0000		1		
	11.0-11.5	0.0000	0.0000	5.5	0.0055	0.0000	0.5	0.0000		0.5		
B4	5.0-6.0	0.0170	0.0034	8	0.0080	0.4250	1	0.4250	3.8993	1	5	0.7799
	6.0-7.0	0.0880	0.0176	7	0.0070	2.5143	1	2.5143		1		
	7.0-8.0	0.0380	0.0076	10	0.0100	0.7600	1	0.7600		1		
	8.0-9.0	0.0080	0.0016	8	0.0080	0.2000	1	0.2000		1		
	9.0-10.0	0.0000	0.0000	9	0.0090	0.0000	1	0.0000		1		

The average abundance value of olivine, size >2 mm. at Klong Wat Sakaeo												
Hole No.	Depth (m.)	Mineral Weight		Sediment Volume		mav (g/m^3)	t (m.)	mav*t (g/m^3)	Sum (mav*t) (g/m^3)	t (m.)	T (m.)	MAV (g/m^3)
		(carats)	(grams)	(lits)	(m^3)							
B2-1	4.0-5.0	0.0000	0.0000	8	0.0080	0.0000	1	0.0000	4.3818	1	7.5	0.5842
	5.0-6.0	0.0000	0.0000	7.5	0.0075	0.0000	1	0.0000		1		
	6.0-7.0	0.0000	0.0000	8.5	0.0085	0.0000	1	0.0000		1		
	7.0-8.0	0.0000	0.0000	8	0.0080	0.0000	1	0.0000		1		
	8.0-9.0	0.0680	0.0136	8.5	0.0085	1.6000	1	1.6000		1		
	9.0-10.0	0.0000	0.0000	8.5	0.0085	0.0000	1	0.0000		1		
	10.0-11.0	0.0000	0.0000	7	0.0070	0.0000	1	0.0000		1		
	11.0-11.5	0.1530	0.0306	5.5	0.0055	5.5636	0.5	2.7818		0.5		
B4	5.0-6.0	0.0000	0.0000	8	0.0080	0.0000	1	0.0000	2.6000	1	5	0.5200
	6.0-7.0	0.0910	0.0182	7	0.0070	2.6000	1	2.6000		1		
	7.0-8.0	0.0000	0.0000	10	0.0100	0.0000	1	0.0000		1		
	8.0-9.0	0.0000	0.0000	8	0.0080	0.0000	1	0.0000		1		
	9.0-10.0	0.0000	0.0000	9	0.0090	0.0000	1	0.0000		1		

The average abundance value of corundum (sapphire), size 1-2 mm. at Ban Nong Khayong												
Hole No.	Depth (m.)	Mineral Weight (carats)	Mineral Weight (grams)	Sediment Volume (lits)	Sediment Volume (m^3)	mav (g/m^3)	t (m.)	mav*t (g/m^3)	Sum (mav*t) (g/m^3)	t (m.)	T (m.)	MAV (g/m^3)
B20-2	**2.0-3.0**	**0.0270**	**0.0054**	**7.5**	**0.0075**	**0.7200**	**1**	**0.7200**	**0.7200**	**1**	**1**	**0.7200**
B33-6	**4.0-4.7**	**0.0190**	**0.0038**	**7.5**	**0.0075**	**0.5067**	**1**	**0.5067**	**0.5067**	**0.7**	**0.7**	**0.7238**

The average abundance value of green pyroxene, size 1-2 mm. at Ban Nong Khayong												
Hole No.	Depth (m.)	Mineral Weight (carats)	Mineral Weight (grams)	Sediment Volume (lits)	Sediment Volume (m^3)	mav (g/m^3)	t (m.)	mav*t (g/m^3)	Sum (mav*t) (g/m^3)	t (m.)	T (m.)	MAV (g/m^3)
B20-4	0.0-1.0	0.0000	0.0000	9	0.0090	0.0000	1	0.0000	0.1250	1	2	0.0625
	1.0-2.0	0.0050	0.0010	8	0.0080	0.1250	1	0.1250		1		
B20-5	0.0-1.0	0.0140	0.0028	9	0.0090	0.3111	1	0.3111	0.3111	1	1	0.3111

The average abundance value of pyroxene-spinel, size 1-2 mm. at Ban Nong Khayong												
Hole No.	Depth (m.)	Mineral Weight (carats)	Mineral Weight (grams)	Sediment Volume (lits)	Sediment Volume (m^3)	mav (g/m^3)	t (m.)	mav*t (g/m^3)	Sum (mav*t) (g/m^3)	t (m.)	T (m.)	MAV (g/m^3)
B20-2	**2.0-3.0**	**0.0090**	**0.0018**	**7.5**	**0.0075**	**0.2400**	**1**	**0.2400**	**0.2400**	**1**	**1**	**0.2400**
B20-4	0.0-1.0	0.0160	0.0032	9	0.0090	0.3556	1	0.3556	0.8306	1	2	0.4153
	1.0-2.0	0.0190	0.0038	8	0.0080	0.4750	1	0.4750		1		
B20-5	0.0-1.0	0.0140	0.0028	9	0.0090	0.3111	1	0.3111	0.3111	1	1	0.3111
B33-6	0.0-1.0	0.0000	0.0000	8	0.0080	0.0000	1	0.0000	0.9783	1	4	0.2446
	1.0-2.0	0.0170	0.0034	7.5	0.0075	0.4533	1	0.4533		1		
	2.0-3.0	0.0000	0.0000	9	0.0090	0.0000	1	0.0000		1		
	3.0-4.0	0.0210	0.0042	8	0.0080	0.5250	1	0.5250		1		
	4.0-4.7	**0.0280**	**0.0056**	**7.5**	**0.0075**	**0.7467**	**1**	**0.7467**	**0.7467**	**0.7**	**0.7**	**1.0667**

The average abundance value of pyroxene-spinel, size >2 mm. at Ban Nong Khayong												
Hole No.	Depth (m.)	Mineral Weight (carats)	Mineral Weight (grams)	Sediment Volume (lits)	Sediment Volume (m^3)	mav (g/m^3)	t (m.)	mav*t (g/m^3)	Sum (mav*t) (g/m^3)	t (m.)	T (m.)	MAV (g/m^3)
B20-1	**2.0-3.0**	**0.1980**	**0.0396**	**8.5**	**0.0085**	**4.6588**	**1**	**4.6588**	**4.6588**	**1**	**1**	**1.6588**

B33-6	**4.0-4.7**	**0.1050**	**0.0210**	**7.5**	**0.0075**	**2.8000**	**1**	**2.8000**	**2.8000**	**0.7**	**0.7**	**4.0000**

The average abundance value of olivine, size 1-2 mm. at Ban Nong Khayong												
Hole No.	Depth (m.)	Mineral Weight		Sediment Volume		mav (g/m^3)	t (m.)	mav*t (g/m^3)	Sum (mav*t) (g/m^3)	t (m.)	T (m.)	MAV (g/m^3)
		(carats)	(grams)	(lits)	(m^3)							
B20-4	0.0-1.0	0.0160	0.0032	9	0.0090	0.3556	1	0.3556	0.3556	1	2	0.1778
	1.0-2.0	0.0000	0.0000	8	0.0080	0.0000	1	0.0000		1		

The average abundance value of zircon, size <1 mm. at Ban Nong Khayong												
Hole No.	Depth (m.)	Mineral Weight		Sediment Volume		mav (g/m^3)	t (m.)	mav*t (g/m^3)	Sum (mav*t) (g/m^3)	t (m.)	T (m.)	MAV (g/m^3)
		(carats)	(grams)	(lits)	(m^3)							
B20	0.0-1.0	0.0060	0.0012	9	0.0090	0.1333	1	0.1333	0.1333	1	1	0.1333
	2.0-3.0	**0.0030**	**0.0012**	**9**	**0.0090**	**0.1333**	**1**	**0.1333**	**0.1333**	**1**	**1**	**0.1333**

The average abundance value of zircon, size 1-2 mm. at Ban Nong Khayong												
Hole No.	Depth (m.)	Mineral Weight		Sediment Volume		mav (g/m^3)	t (m.)	mav*t (g/m^3)	Sum (mav*t) (g/m^3)	t (m.)	T (m.)	MAV (g/m^3)
		(carats)	(grams)	(lits)	(m^3)							
B20	2.0-3.0	0.0080	0.0016	8	0.0080	0.2000	1	0.2000	0.2000	1	1	0.2000
B20-1	0.0-1.0	0.0100	0.0020	9	0.0090	0.2222	1	0.2222	0.6794	1	2	0.3397
	1.0-2.0	0.0160	0.0032	7	0.0070	0.4571	1	0.4571		1		
	2.0-3.0	**0.0140**	**0.0028**	**8.5**	**0.0085**	**0.3294**	**1**	**0.3294**	**0.3294**	**1**	**1**	**0.3294**
B20-4	0.0-1.0	0.0060	0.0012	9	0.0090	0.1333	1	0.1333	0.5583	1	2	0.2792
	1.0-2.0	0.0170	0.0034	8	0.0080	0.4250	1	0.4250		1		
B20-5	**1.0-2.0**	**0.0000**	**0.0000**	**8.5**	**0.0085**	**0.0000**	**1**	**0.0000**	**0.1818**	**1**	**3**	**0.0606**
	2.0-3.0	**0.0000**	**0.0000**	**7.5**	**0.0075**	**0.0000**	**1**	**0.0000**		**1**		
	3.0-4.0	**0.0150**	**0.0030**	**16.5**	**0.0165**	**0.1818**	**1**	**0.1818**		**1**		
B33-6	0.0-1.0	0.0150	0.0030	8	0.0080	0.3750	1	0.3750	0.3750	1	4	0.0938
	1.0-2.0	0.0000	0.0000	7.5	0.0075	0.0000	1	0.0000		1		
	2.0-3.0	0.0000	0.0000	9	0.0090	0.0000	1	0.0000		1		
	3.0-4.0	0.0000	0.0000	8	0.0080	0.0000	1	0.0000		1		

The average abundance value of corundum (sapphire), size 1-2 mm. at Ban Bang Kacha												
Hole No.	Depth (m.)	Mineral Weight		Sediment Volume		mav (g/m^3)	t (m.)	mav*t (g/m^3)	Sum (mav*t) (g/m^3)	t (m.)	T (m.)	MAV (g/m^3)
		(carats)	(grams)	(lits)	(m^3)							
B1-4	9.5-10.5	0.0060	0.0012	10	0.0100	0.1200	1	0.1200	0.1200	1	1	0.1200
B13-1	3.0-4.0	0.0000	0.0000	7.5	0.0075	0.0000	1	0.0000	0.3556	1	7	0.0508
	4.0-5.0	0.0000	0.0000	7	0.0070	0.0000	1	0.0000		1		
	5.0-6.0	0.0000	0.0000	8.5	0.0085	0.0000	1	0.0000		1		
	6.0-7.0	0.0000	0.0000	7.5	0.0075	0.0000	1	0.0000		1		
	7.0-8.0	0.0000	0.0000	8	0.0080	0.0000	1	0.0000		1		
	8.0-9.0	0.0000	0.0000	9.5	0.0095	0.0000	1	0.0000		1		
	9.0-10.0	0.0320	0.0064	18	0.0180	0.3556	1	0.3556		1		

The average abundance value of corundum (sapphire), size >2 mm. at Ban Bang Kacha												
Hole No.	Depth (m.)	Mineral Weight		Sediment Volume		mav (g/m^3)	t (m.)	mav*t (g/m^3)	Sum (mav*t) (g/m^3)	t (m.)	T (m.)	MAV (g/m^3)
		(carats)	(grams)	(lits)	(m^3)							
B13-1	3.0-4.0	0.0000	0.0000	7.5	0.0075	0.0000	1	0.0000	2.3714	1	7	0.3388
	4.0-5.0	0.0830	0.0166	7	0.0070	2.3714	1	2.3714		1		
	5.0-6.0	0.0000	0.0000	8.5	0.0085	0.0000	1	0.0000		1		
	6.0-7.0	0.0000	0.0000	7.5	0.0075	0.0000	1	0.0000		1		
	7.0-8.0	0.0000	0.0000	8	0.0080	0.0000	1	0.0000		1		
	8.0-9.0	0.0000	0.0000	9.5	0.0095	0.0000	1	0.0000		1		
	9.0-10.0	0.0000	0.0000	18	0.0180	0.0000	1	0.0000		1		

The average abundance value of pyroxene-spinel, size <1 mm. at Ban Bang Kacha												
Hole No.	Depth (m.)	Mineral Weight		Sediment Volume		mav (g/m^3)	t (m.)	mav*t (g/m^3)	Sum (mav*t) (g/m^3)	t (m.)	T (m.)	MAV (g/m^3)
		(carats)	(grams)	(lits)	(m^3)							
B1-4	9.5-10.5	0.0190	0.0038	8	0.0080	0.4750	1	0.4750	0.4750	1	1	0.4750
The average abundance value of pyroxene-spinel, size 1-2 mm. at Ban Bang Kacha												
Hole No.	Depth (m.)	Mineral Weight		Sediment Volume		mav (g/m^3)	t (m.)	mav*t (g/m^3)	Sum (mav*t) (g/m^3)	t (m.)	T (m.)	MAV (g/m^3)
		(carats)	(grams)	(lits)	(m^3)							
B1	7.0-8.0	0.0000	0.0000	7	0.0070	0.0000	1	0.0000	0.6667	1	3	0.2222
	8.0-9.0	0.0000	0.0000	10	0.0100	0.0000	1	0.0000		1		
	9.0-10.0	0.0600	0.0120	18	0.0180	0.6667	1	0.6667		1		
B13-1	3.0-4.0	0.0000	0.0000	7.5	0.0075	0.0000	1	0.0000	5.9810	1	7	0.8544
	4.0-5.0	0.1370	0.0274	7	0.0070	3.9143	1	3.9143		1		
	5.0-6.0	0.0000	0.0000	8.5	0.0085	0.0000	1	0.0000		1		
	6.0-7.0	0.0000	0.0000	7.5	0.0075	0.0000	1	0.0000		1		
	7.0-8.0	0.0000	0.0000	8	0.0080	0.0000	1	0.0000		1		
	8.0-9.0	0.0000	0.0000	9.5	0.0095	0.0000	1	0.0000		1		
	9.0-10.0	0.1860	0.0372	18	0.0180	2.0667	1	2.0667		1		

The average abundance value of pyroxene-spinel, size 1-2 mm. at Ban Bang Kacha												
Hole No.	Depth (m.)	Mineral Weight		Sediment Volume		mav (g/m^3)	t (m.)	mav*t (g/m^3)	Sum (mav*t) (g/m^3)	t (m.)	T (m.)	MAV (g/m^3)
		(carats)	(grams)	(lits)	(m^3)							
B14	3.0-4.0	0.0000	0.0000	7	0.0070	0.0000	1	0.0000	0.7200	1	2	0.3600
	4.0-5.0	0.0360	0.0072	10	0.0100	0.7200	1	0.7200		1		
B16	7.0-8.0	0.0000	0.0000	10	0.0100	0.0000	1	0.0000	1.2000	1	2	0.6000
	8.0-9.0	0.0600	0.0120	10	0.0100	1.2000	1	1.2000		1		
B17-1	7.0-8.0	0.0610	0.0122	10	0.0100	1.2200	1	1.2200	1.2200	1	2	0.6100
	8.0-9.0	0.0000	0.0000	10	0.0100	0.0000	1	0.0000		1		

The average abundance value of pyroxene-spinel, size >2 mm. at Ban Bang Kacha												
Hole No.	Depth (m.)	Mineral Weight		Sediment Volume		mav (g/m^3)	t (m.)	mav*t (g/m^3)	Sum (mav*t) (g/m^3)	t (m.)	T (m.)	MAV (g/m^3)
		(carats)	(grams)	(lits)	(m^3)							
B1	7.0-8.0	0.0000	0.0000	7	0.0070	0.0000	1	0.0000	11.1444	1	3	3.7148
	8.0-9.0	0.0000	0.0000	10	0.0100	0.0000	1	0.0000		1		
	9.0-10.0	1.0030	0.2006	18	0.0180	11.1444	1	11.1444		1		
B13-1	3.0-4.0	0.0000	0.0000	7.5	0.0075	0.0000	1	0.0000	5.7984	1	7	0.8283
	4.0-5.0	0.0750	0.0150	7	0.0070	2.1429	1	2.1429		1		
	5.0-6.0	0.0000	0.0000	8.5	0.0085	0.0000	1	0.0000		1		
	6.0-7.0	0.0000	0.0000	7.5	0.0075	0.0000	1	0.0000		1		
	7.0-8.0	0.0000	0.0000	8	0.0080	0.0000	1	0.0000		1		
	8.0-9.0	0.0000	0.0000	9.5	0.0095	0.0000	1	0.0000		1		
	9.0-10.0	0.3290	0.0658	18	0.0180	3.6556	1	3.6556		1		
B14	3.0-4.0	0.0000	0.0000	7	0.0070	0.0000	1	0.0000	1.2000	1	2	0.6000
	4.0-5.0	0.0600	0.0120	10	0.0100	1.2000	1	1.2000		1		
B16	7.0-8.0	0.0000	0.0000	10	0.0100	0.0000	1	0.0000	18.6000	1	2	9.3000
	8.0-9.0	0.9300	0.1860	10	0.0100	18.6000	1	18.6000		1		

The average abundance value of green pyroxene, size 1-2 mm. at Ban Bang Kacha												
Hole No.	Depth (m.)	Mineral Weight		Sediment Volume		mav (g/m^3)	t (m.)	mav*t (g/m^3)	Sum (mav*t) (g/m^3)	t (m.)	T (m.)	MAV (g/m^3)
		(carats)	(grams)	(lits)	(m^3)							
B1	**7.0-8.0**	**0.0000**	**0.0000**	**7**	**0.0070**	**0.0000**	**1**	**0.0000**	**0.3111**	**1**	**3**	**0.1037**
	8.0-9.0	**0.0000**	**0.0000**	**10**	**0.0100**	**0.0000**	**1**	**0.0000**		**1**		
	9.0-10.0	**0.0280**	**0.0056**	**18**	**0.0180**	**0.3111**	**1**	**0.3111**		**1**		

The average abundance value of magnetite-ilmenite, size 1-2 mm. at Ban Bang Kacha												
Hole No.	Depth (m.)	Mineral Weight		Sediment Volume		mav (g/m^3)	t (m.)	mav*t (g/m^3)	Sum (mav*t) (g/m^3)	t (m.)	T (m.)	MAV (g/m^3)
		(carats)	(grams)	(lits)	(m^3)							
B1	**7.0-8.0**	**0.0000**	**0.0000**	**7**	**0.0070**	**0.0000**	**1**	**0.0000**	**0.3222**	**1**	**3**	**0.1074**
	8.0-9.0	**0.0000**	**0.0000**	**10**	**0.0100**	**0.0000**	**1**	**0.0000**		**1**		
	9.0-10.0	**0.0290**	**0.0058**	**18**	**0.0180**	**0.3222**	**1**	**0.3222**		**1**		

The average abundance value of zircon, size 1-2 mm. at Ban Bang Kacha												
Hole No.	Depth (m.)	Mineral Weight		Sediment Volume		mav (g/m^3)	t (m.)	mav*t (g/m^3)	Sum (mav*t) (g/m^3)	t (m.)	T (m.)	MAV (g/m^3)
		(carats)	(grams)	(lits)	(m^3)							
B1	7.0-8.0	0.0000	0.0000	7	0.0070	0.0000	1	0.0000	0.0056	1	3	0.0019
	8.0-9.0	0.0000	0.0000	10	0.0100	0.0000	1	0.0000		1		
	9.0-10.0	0.0005	0.0001	18	0.0180	0.0056	1	0.0056		1		
B13-1	3.0-4.0	0.0000	0.0000	7.5	0.0075	0.0000	1	0.0000	0.4444	1	7	0.0635
	4.0-5.0	0.0000	0.0000	7	0.0070	0.0000	1	0.0000		1		
	5.0-6.0	0.0000	0.0000	8.5	0.0085	0.0000	1	0.0000		1		
	6.0-7.0	0.0000	0.0000	7.5	0.0075	0.0000	1	0.0000		1		
	7.0-8.0	0.0000	0.0000	8	0.0080	0.0000	1	0.0000		1		
	8.0-9.0	0.0000	0.0000	9.5	0.0095	0.0000	1	0.0000		1		
	9.0-10.0	0.0400	0.0080	18	0.0180	0.4444	1	0.4444		1		
B17-1	7.0-8.0	0.0130	0.0026	10	0.0100	0.2600	1	0.2600	0.9800	1	2	0.4900
	8.0-9.0	0.0360	0.0072	10	0.0100	0.7200	1	0.7200		1		

The average abundance value of olivine, size <1 mm. at Ban Bang Kacha												
Hole No.	Depth (m.)	Mineral Weight		Sediment Volume		mav (g/m^3)	t (m.)	mav*t (g/m^3)	Sum (mav*t) (g/m^3)	t (m.)	T (m.)	MAV (g/m^3)
		(carats)	(grams)	(lits)	(m^3)							
B1	7.0-8.0	0.0000	0.0000	7	0.0070	0.0000	1	0.0000	0.9556	1	3	0.3185
	8.0-9.0	0.0000	0.0000	10	0.0100	0.0000	1	0.0000		1		
	9.0-10.0	0.0860	0.0172	18	0.0180	0.9556	1	0.9556		1		
The average abundance value of olivine, size 1-2 mm. at Ban Bang Kacha												
Hole No.	Depth (m.)	Mineral Weight		Sediment Volume		mav (g/m^3)	t (m.)	mav*t (g/m^3)	Sum (mav*t) (g/m^3)	t (m.)	T (m.)	MAV (g/m^3)
		(carats)	(grams)	(lits)	(m^3)							
B1	7.0-8.0	0.0000	0.0000	7	0.0070	0.0000	1	0.0000	0.8356	1	3	0.2785
	8.0-9.0	0.0090	0.0018	10	0.0100	0.1800	1	0.1800		1		
	9.0-10.9	0.0590	0.0118	18	0.0180	0.6556	1	0.6556		1		

BIOGRAPHY

The author, Rungthip Vitiaranee, was born on October 1, 1974 in Banngkok. She graduated in Bachelor degree of Science (Geology), Faculty of Science, Chulalongkorn University in 1997. Then, she continued her study for the Master degree of Science in Geology. At present, she is working at Gemstone Section, Economic Geology Division, Department of Mineral Resources.