

CHAPTER IV

GEOMORPHOLOGY

Introduction

Major and minor elements of aerial photographic patterns include landforms and rock types, the surface-drainage patterns, erosion features, gray tones and miscellaneous details (Lueder, 1959). A description of aerial photographic interpretation places great emphasis especially on photo analysis and detail evaluation. The origin of geomorphic landforms are observed based on the geographical features such as relief and orders of relief. Some surface-drainage patterns should be included too. Gray-tones of aerial photograph are major character assisting in demarcation the boundary of various landforms. Finally, miscellaneous elements such as vegetation, natural slopes, may facilitate for delineating subdued landforms.

Geomorphological Units and Their Characteristics

Various patterns of landforms can be obtained from aerial photograph. Landforms in the study area are associated with geological origins. The geomorphological unit can be classified mainly into three categories as denudational origin, fluvial-colluvial origin and fluvial origin. Detail of their characteristics will be described based on their distinctive physical features shown in Plate I.

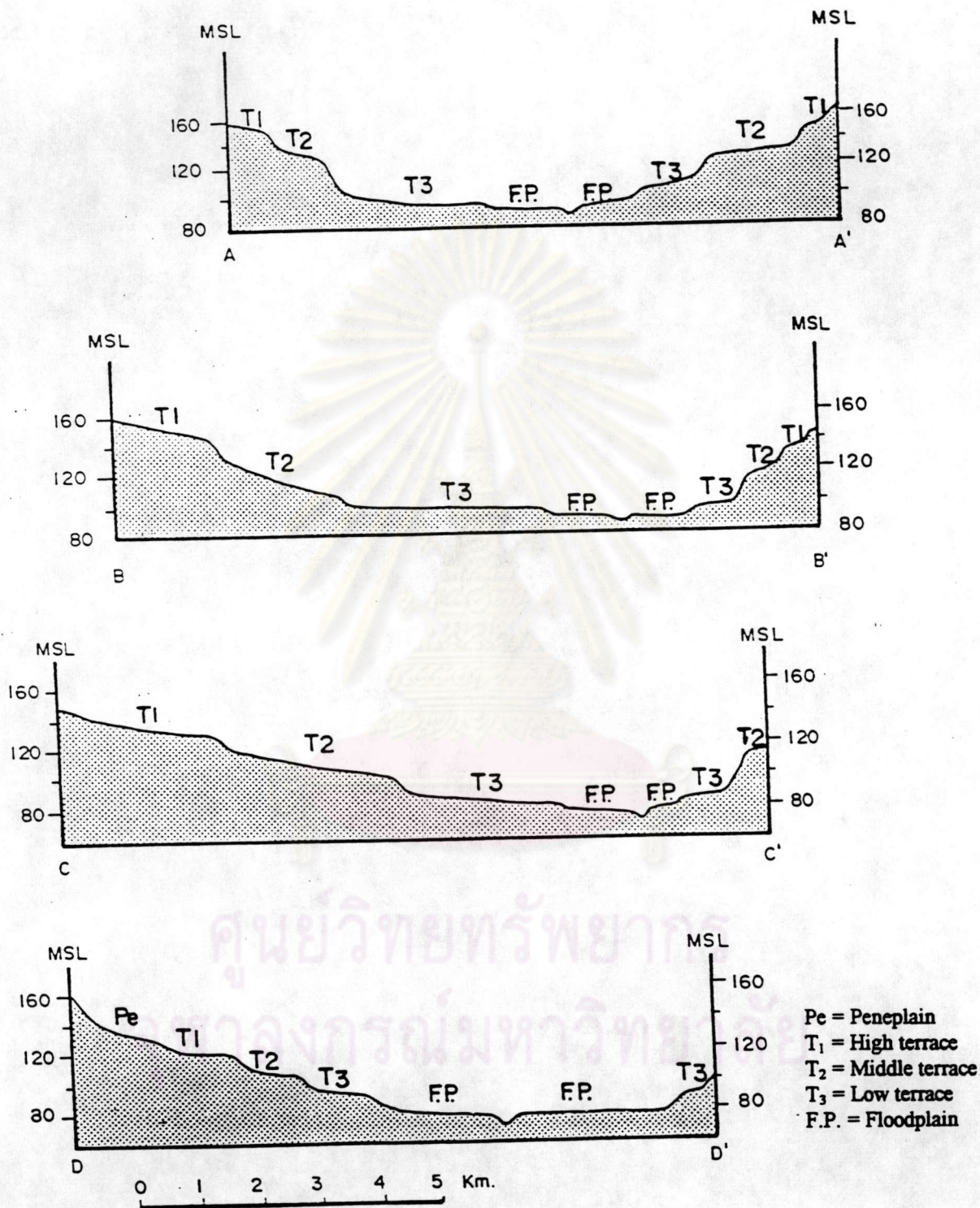


Figure 4.1 Topographic cross section illustrated terrace developed by meandering of river channel. Both of paired and unpaired terraces were found.

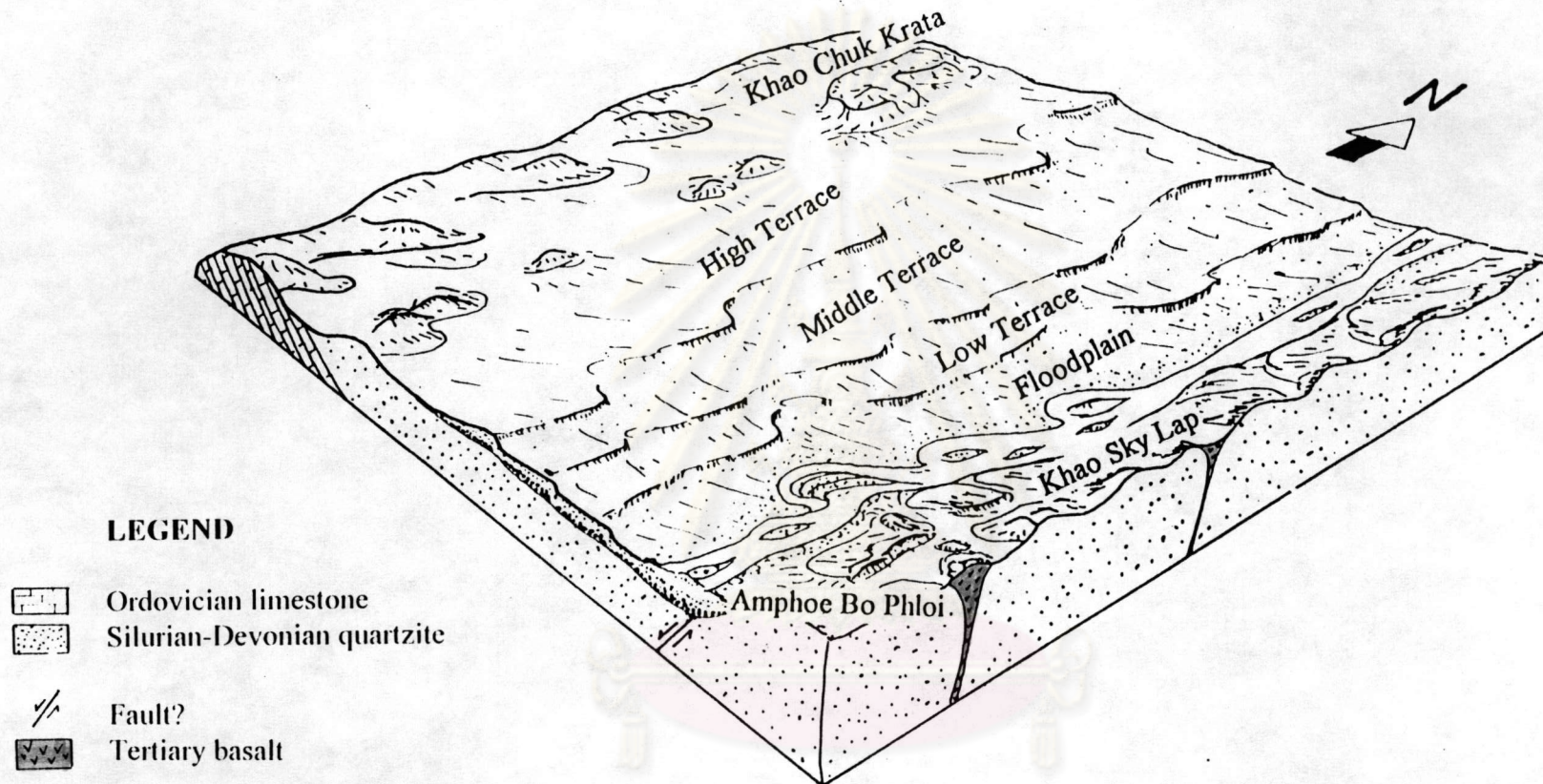


Figure 4.2 Idealized paleogeographic model illustrated geomorphological landforms and basaltic eruption occurring during Late Tertiary to Pleistocene. Amphoe Bo Phloi, Changwat Kanchanaburi.

1. Units of Denudational Origin

Various rock units in the area were reported by Bunopas and Bunjitradulya (1975). In the study area, five rock units have been obtained comprising predominantly granite intrusion in the western part of the region, basalt in the middle part of the region, hard metamorphic rocks (Thabsila Gneiss), Cambro-Ordovician to Ordovician limestone and marble in southwest of the basin and the quartzite and chert of Bo Phloi Formation. Some parts of granite boundaries which were reported by Bunopas and Bunjitradulya are changed by the author because from aerial photograph study shows the different in the lineation of bedding traces and clearly different in drainage pattern.

Seven different types of denudational origin have been distinguished. Denudational area of mountains are above 300 meters from mean sea level whereas elevation of denudational area of hills are less than 300 meters from mean sea level.

1.1) Denudational mountains of Precambrian gneiss and schist occupy large areas of Khao Chong Insi. The highest elevation of this unit is 582 metres mean sea level.

1.2) Denudational mountains of karst area of Cambro-Ordovician limestone and marble (mainly Thung Song Group). They occur mainly in the west, north and small area in the southern part of the study area and is characterized by sinkhole. The highest elevation is 529 metres from mean sea level.

1.3) Denudational mountain of Silurian-Devonian quartzite , chert, siltstone and shale cover area in the central part and eastern part of the area with highest elevation 404 meters from mean sea level.

1.4) Denudational hills of metamorphic and sedimentary rock (Silurian-Devonian quartzite, chert, siltstone and chert) cover area in the north and eastern of Lam Ta Phoen. The highest elevation is 404 meters from mean sea level.

1.5) Denudational mountains of Triassic granite covers area in the northwestern part and also in southern part of the area in Khao Chon Kai. The highest elevation is 363 metres from mean sea level.

1.6) Denudational hill of Tertiary basalt covers seven hills so-called Khao Lan Tom in the middle part of the area. The highest elevation is 120 meters from mean sea level.

1.7) Denudational area of peneplain. Peneplain is a low, nearly featureless, and gently undulating or almost-plane surface area which presumably has been developed by the processes of long-continued, subaerial erosion (primarily mass-wasting of and sheetwash on interstream area of a mature landscape, assisted by stream erosion). A peneplain may be characterized by gently graded and broadly convex interfluves sloping down to broad valley floors, by truncation of strata of varying resistance (monadnocks) rising above it (Gray and others, 1977).

In tropical climates with alternating dry and wet seasons, duricrusts are characteristics of peneplain surfaces (Fairbridge, 1968). In the study area, peneplain is characterized by two features. The first one is laterite with about 3 m thick overlying Silurian-Devonian arenaceous bedrocks. The other is calcareous travertine on lime rich

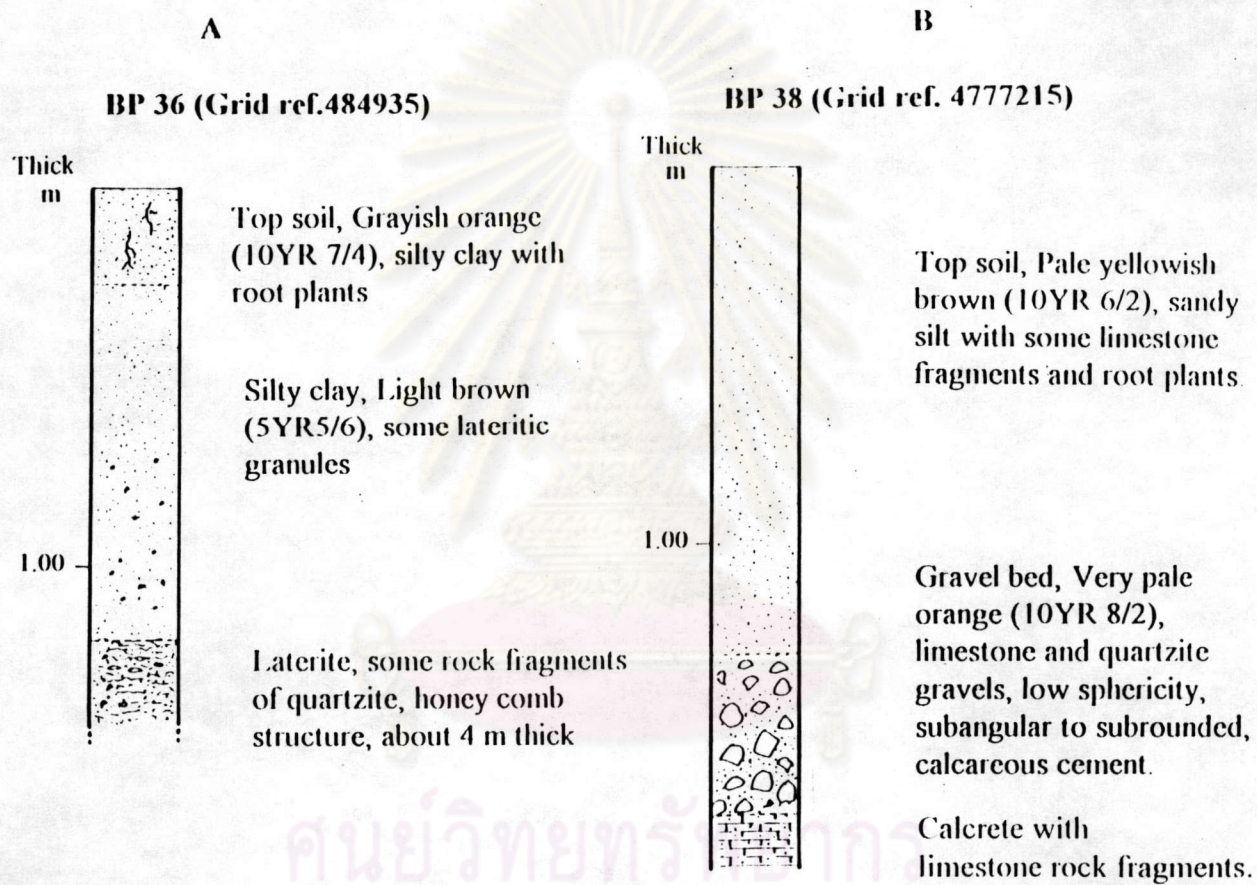


Figure 4.3 Typical peneplain profiles in the study area characterized by (A) laterite and (B) calcrete.

rocks or calcrete with thickness ranging from 0.3 to 4 meters. Both features display undulating surfaces. The eastern margin of the central part of the Bo Phloi Basin, from Khao Chong Insi to Huai Nam Pu in Ban Chong Dan area, is a hardly undulating surface and unchannelled drainage surfaces. The elevation is between 140 to 200 meters above mean sea level. The thickness of laterite which comprises honey comb structure on the top is generally 4 meters.

The age of the peneplain is still uncertain because evidence related its age is not available. In other place, such as Narmada Valley in India, the age of the thick laterite based on palaeontological data and the stratigraphy of those area, is Pliocene-Early Pleistocene (established by De Terra and P. Teilhard de Chardin, 1936, in Thiramongkol, 1983). Thiramongkol (1983) suggested that the peneplain of the Central Plain of Thailand is older than Pleistocene based on degree of weathering of the granitic rocks, and the formation of very thick laterite.

On the basis of lithological characteristics of laterite correlated with thick laterite formation in Central Plain of Thailand, the author believes that the age of Bo Phloi peneplain is range from Late Tertiary to Early Pleistocene. Furthermore, it may indicate that the development of the Bo Phloi basin has possibly started from Pliocene.

2. Units of Fluvial-Colluvial Origin

In place, some geomorphological landforms can not be separated from each other, e.g. piedmont plain is a general term for the plain occurs along the foot of mountain and hill. Two types in this unit can be divided based on the deposits. First, it is a piedmont plain, alluvial-colluvial deposits and the other is a piedmont plain, alluvial-colluvial and calcareous deposits.

2.1) Piedmont plain is a broad, continuous alluvial slope or gently inclined detrital surface extending along and from the base of a mountain ranges out into and around an inland basin, formed by the lateral coalescence of a series of separate but confluent alluvial fans, and having an undulating character due to the convexities of the component fans (Gary and others, 1977).

The Piedmont plain is the area aggrading along foot of the mountains. It is widely distributed in the eastern marginal zones of the western mountain range. It occurs extensively in the western part of Khao Chong Insi, traverses with north-south trending from the upper to lower part along eastern mountain ranges. In the western part, residual deposits of Silurian-Devonian quartzite is observed. Calcrete is also mentioned together in this landform. The slope angle in southeast direction of this landform along the western mountain range is not exceed 15 degrees. In Khao Chong Insi mountain ranges, the slope in southwest to west direction with average 10 degrees of slope angle is extensively observed. The low angle areas without channel or less channel drainage development on the surface of piedmont plain is prominently observed. Only in the western mountain zones, small area of colluvium and talus deposits were investigated base on airphotos interpretation and field observation.

3. Units of Fluvial Origin

Fluvial action is the major process responsible for sculpturing shape of the earth's surface features. The process of fluvial action consists of two major processes. The first is erosion trending to create landforms that are predominantly as the result of degradational sculpturing. In the studied area, almost of the landforms related to erosion process distributed along the denudated mountain area. The other is

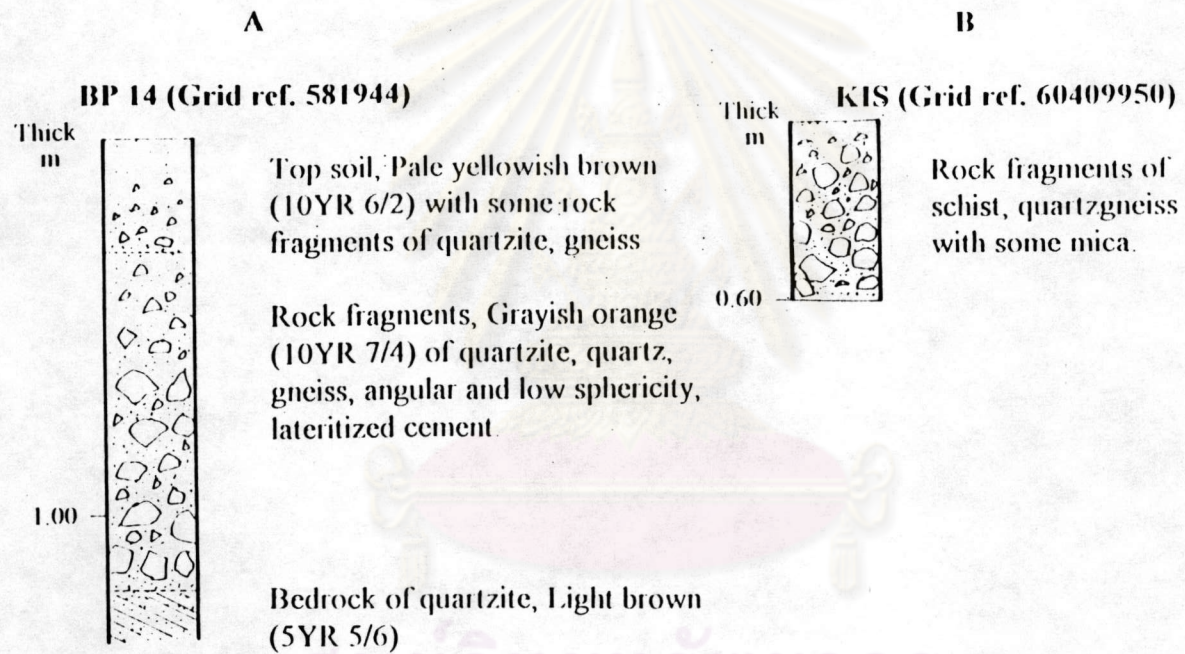


Figure 4.4 Local piedmont deposit along the foot of the mountains in the study area showing aggradational textures of parent rocks.

**A**

Grid reference : 571892

**B**

Grid reference : 442910

Figure 4.5 A) Peneplain in the eastern part of the basin which characterized by laterite with 3 meters thick. B) cliff, Khao Chuk Krata western part of the basin.



West of Khao Chong Insi (looking north)

A



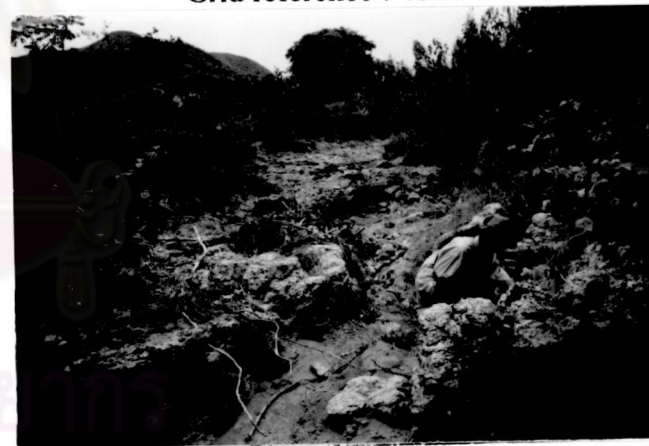
Grid reference : 460690

C



Grid reference : 460690

B



Grid reference : 580880

D

Figure 4.6 A) piedmont along marginal area of east and west mountain ranges are characterized by nearly flat slope angle, B, C) calcrete and D) laterite.

constructive trending to create landforms that are predominantly as the result of aggradational deposition.

The dominant features of fluvial origin which consist of terraces and floodplain that occurs extensively on both sides of Lam Ta Phoen. The floodplain is flat with numerous tributaries of Lam Ta Phoen developing. From field information, floodplain deposits comprise of gravel beds in the bottom and stratified sand-silty clay layers on the top.

3.1) High Terraces : High terraces occur as undulating surface bordering the eastern side of the central part of the Bo Phloi Basin and formed the high-flat plain along the western mountain ranges. They occur widely in the eastern side of Khao Chuk Krata and the western side of Khao Chong Insi. They are also found locally in the west of the basin such as around Huai Sink To. The high terrace is occurred along north-south trend and situated at elevations between 140 to 160 meters above mean sea level with relief amplitude of about 20 meters. Terraces in the western region of the basin have slope ranging from 5 to 10 degrees. It is characterized by thick laterite, lateritic gravel with silty layers on the top. The laterite is normally 2-3 meters thick with honeycomb-structured.

The high terraces occurring in the eastern part of the basin are situated in elevation between 140-160 meters above mean sea level with slopes about 10 degrees. They are composed of harden lateritic gravel, and form the undulating terrain especially in the western side of Khao Chong Insi. In places, the appearance of laterite more than 2 meters thick alone, can not separate high terraces from peneplain landforms.



Figure 4.7 High terrace, along west and east part of the basin, masked by lateritic gravel with average 1-2 meters thick.
(grid reference : 561720)

The age of high terrace in the Bo Phloi Basin is still uncertain but it may be ranges from Late Pliocene to Early Pleistocene based on the correlation with middle terraces and peneplain.

3.2) Middle terraces : The middle terraces are clearly seen in the eastern part of the basin. It lies at elevation between 100 to 120 meters above mean sea level. The middle terrace forms gentle slope with low relief amplitudes.

The middle terrace comprises clayey, silty and sandy and lateritic gravel from top to bottom respectively. The lateritic gravel layer with 0.5-1.0 meters thickness with honeycomb-structured and botryoidal feature. The most significant evidence in the middle terrace is the appearance of tektite in the lateritic gravel bed. (S, Pluto, person. comm., 1994). The author found tektite existing in gemstone-bearing gravel bed at the southern part of the basin. Historically, based on his research on tektite deposit in Thailand, Udomchoke (1983) reported that it has the age of 0.7 Ma. It indicates that the age of the middle terraces is probably not older than Middle Pleistocene.

3.3) Low terraces : Low terraces can not observed on the surface of the Bo Phloi Basin because they are covered by overbank deposits. But they can be observed from the gemstone open pits. It is characterized by thin laterite layer and pisolithic concretions. The elevation which can be seen the low terrace is ranging from 80 to 100 meters above mean sea level. The age of low terrace is Late Pleistocene based on the result of radiocarbon dating of wood fragments within the deposits.

3.4) Floodplain : Floodplain in the area covers up to 2.5 kilometers wide along Lam both sides of Ta Phoen in the central part of the basin and forms a narrow area in the southern part of this channel along Khao Hin Lap to Khao Chon Kai. The

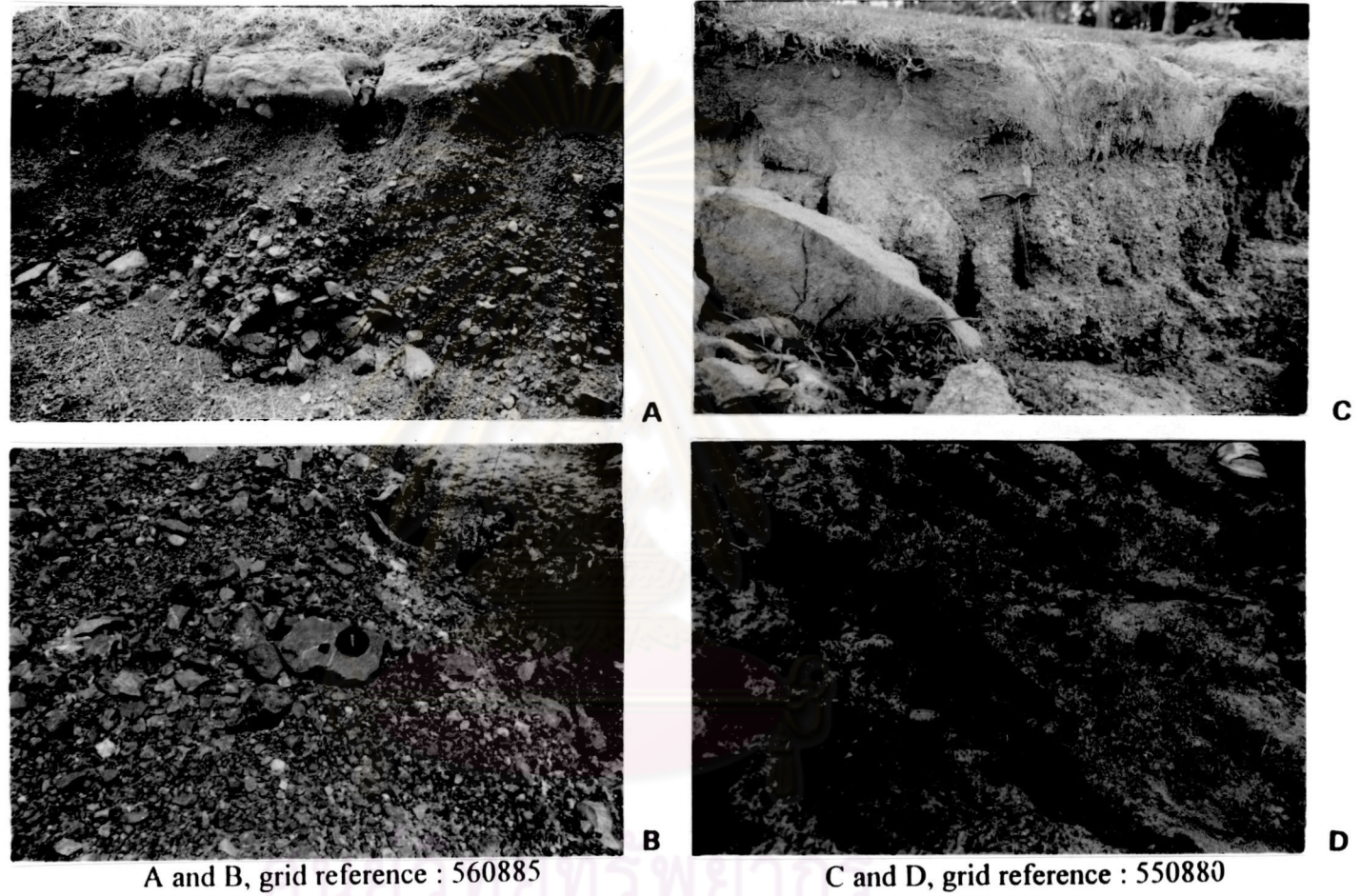


Figure 4.8 Middle terrace occurring in the eastern part of the basin are characterized by lateritic gravel with 0.5-1.0 meter thick (A,B), C) low terrace in the northern part of the area, and D) floodplain pisolitic soil in the middle part of the basin.

floodplain is composed of small natural levees which observed along both sides of Lam Ta Phoen. In the area under investigation, floodplain deposits covered on the old channel of point bar deposit. The point bar deposit is characterized by cross-lamination, cross-bedding and trough cross-lamination of medium to coarse sand and gravel bed of bedload deposit. Moreover, the sediments are sandy silt in natural levees and silty clay layers in floodplain.

In the southern region, Khao Hin Lap to Khao Chon Kai, it can be seen the floodplain along both sides of Lam Ta Phoen. It consists of silty clay with average 1 meter thick. The relative age of floodplain is ranging from late Pleistocene to Holocene.



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