CHAPTER V

DISCUSSION

This chapter intends to discuss about paleoenvironments at the deposition of Paleo-Mun river sediments and geological ages of sediments by using, stratigraphical records, lithology and sedimentary structures. Moreover, ancient elephant fossils from the sand pit are determined.

In the present study, lithostratigraphical columnar section, lithology, sedimentary structure, and paleontological features of ancient elephant teeth were used to analysis the depositional microenvironments. The depositional environments can be reconstructed by dividing depositional layers into 4 units in ascending order units are as follows:

Unit A; This unit lies at the bottom of the stratigraphic section. It shows alternation of very fine sandstone and conglomeratic sandstone. These sediments were overlied by fine to coarse sandstone with planar cross-bedded. The characteristic of this unit is sub-angular and poorly sorted. These characteristics may suggests rapid, short distance transport and rapid deposition. Unlike the typical unimodal grain size distributions of river sediments deposited under normal flow regimes.

Stratigraphic succession in this unit is coarsening upward cycle and followed by fining upward. This can be interpreted as alluvial fan deposits. Coarsening upward isn't be occurred due to the periodic fault uplifting source rock or subsidence of basin while coarsening followed by fining was occurred due to spacing between fault movements which allows system to move toward equilibrium. (Rust and Koster, 1984).

Thick sandstones and sedimentary structure were represented for the channel deposits of small, shallow, heavily loaded stream. The structureless were indicated rapid deposition of a massive unit in a turbulent. This sedimentary succession was overlaid by planar cross-beds that showed lower flow regime and deposited in areas of lower velocity turbulence. This unit lies unconformably under the thin bed of conglomerate, clay supported which was expected to be debris flow. This is due to poorly sorted, sub-angular to sub-rounded and consisting of particles of a variable size ranges from clay to pebble. Debris flow can originate subaerially as well as subaqueously on rather gentle slopes, and flow over large distances without becoming appreciably sorted. (Chamley, 1990)

Unit B; This unit was overlaid unit A, Itshows sedimentary succession of fining upward and followed by coarsening upward cycle and fining upward of coarse to fine grain. This unit was overlaid by fine sandstone. The unit B lies unconformably underneath the conglomerate, clay supported which expected to be debris flow. The characteristic of the sediment in this unit similar to unit A that is loose, sub-angular to sub-rounded and moderately to poorly sorted. For the sedimentary structure succession can be assumed as fan deposits.

Unit C; This unit consists of 2 subunits that are subunit C1 and C2.

Subunit C1; is composed of coarsening upward cycle of fine to coarse grain. Debris flow was found in this unit. The characteristic of this unit are loose, sub-angular to sub-rounded and moderately to poorly sorted. For the sedimentary structure succession, the environment of deposition can be assumed as fan deposits.

It should be mentioned that, trough and planar cross-bedded were indicated water-laid deposits. Sheetflood and stream channel deposits can be considered of intergradational. Sheetflood deposits accumulated were found in shallow channels and bars. The nature of water-laid deposits was shown of the progressive change down fan, eroded from the valley. There is an increase in the abundance of cross-stratal sets, chiefly planar with transition from coarse gravel through clast supported fine-grained gravel, sand matrix- supported gravel to sand. These changes reflect gradual decrease in the particle size to water depth ratio as stream competence decrease down-fan (Rust and Koster, 1984).

Subunit C2; This unit presents fining-upward succession of very fine sand to medium sand with trough and planar cross-bedding overlying on the conglomerate coarse sand, black and white color with granule to pebble (grain support). This set is similar to the sequence of point bar of meandering river which show fining-upward sequence, with sands on top of channel lags (Einsele, 1992). They showed the lower flow regime that were deposited in areas of lower velocity turbulence. Besides, increasing in abundance down-fan always show minor deposits of horizon laminated sand and laminated or massive mud (Rust and Koster, 1984). This unit can be interpreted as fluvial deposits of meandering river that is composed of point bar, levee and backswamp deposits. Unit C lies unconformably underneath the thickly bedded of fine sand, reddish yellow

Unit D; This unit shows of fine sand, sandy clay and clay. It can be indicated as abandoned channel and floodplain deposits of meandering river which mean that post-depositional alteration to form soils. Internal structure succession was presented as structureless, bioturbation and rootlets. This shows that it was occurred during a flood from intense precipitation on the floodplain or from increased discharge in a through flowing river. After inundation, suspended sediment was deposited on the plain and vegetation starts to grow and soil forming process take place.

According to the results of stratigraphy and sedimentology analysis described above, it can be assumed that in the past, landscape in this area differ from the present. The stratigraphic record shows the vertical changes in facies type. It can be interpreted as alluvial fan deposit. Model of alluvial fan can see in Figure 5.1, 5.2 and 5.3, respectively. The lower part unit of the sandpit showed upward increasing in grain size. It can be expected to midal-distal facies accumulate migrate down fan. Repetitive sequences succession of grain size and bed thickness in Unit A- subunit C1 indicated coarsening upward and thinning upward sequence. It can be expected that sedimentary responses to tectonism, or subsidence of basin. It can occur when there is a sudden and violent change in the environment such as floods. Debris flow may indicate amount of sedimentsdecreases rapidly and continuous range of sediment gravity flows. Unit C1 is dominated of water laid deposits. Sheetflood and stream channel deposits can be considered to be inter-gradational. It is composed of shallow channels and bars.

In Subunit C2 presents fining upward and overly on debris flows which may indicate rejuvenation and forming of point bar of meandering river. This shows little or no contrast between the slopes of the two valley sides of a meander curve. So it can be expected that the terraces that found near the Mun River may be the tops of the valley.

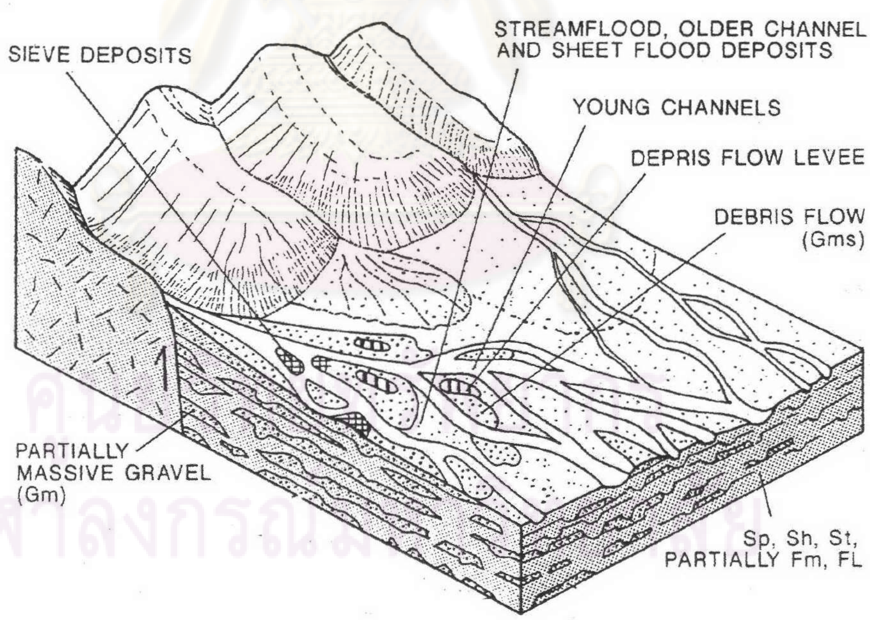

Figure 5.1 Simplified facies models of alluvial fan (proximal to mid fan region) (Einsele, 1992).

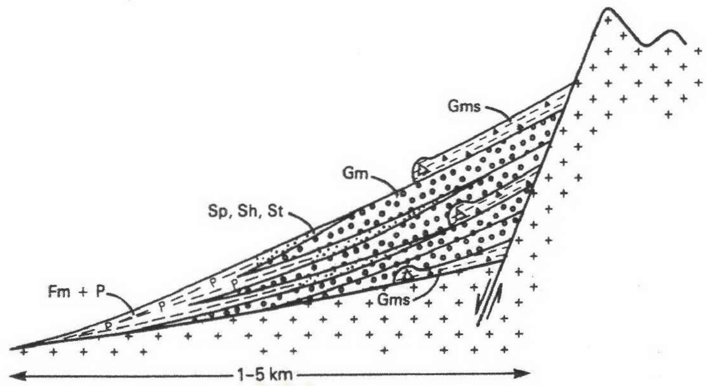

Figure 5.2 Diagrammatic cross-section of an alluvial fan, showing proximal-distal facies variation. (Rust and Koster, 1984).

Gm: Clast-supported, commonly imbricate gravel with poorly defined subhorizontal bedding.

Gms: Muddy matrix-supported gravel without imbrication or internal stratification

Sp: Planar cross-stratified sand

St: Trough cross-stratified sand

Sh: Horizintally stratified sand

Fm: Massive fine sandy mud or mud

P: Pedogenic concretionary carbonate

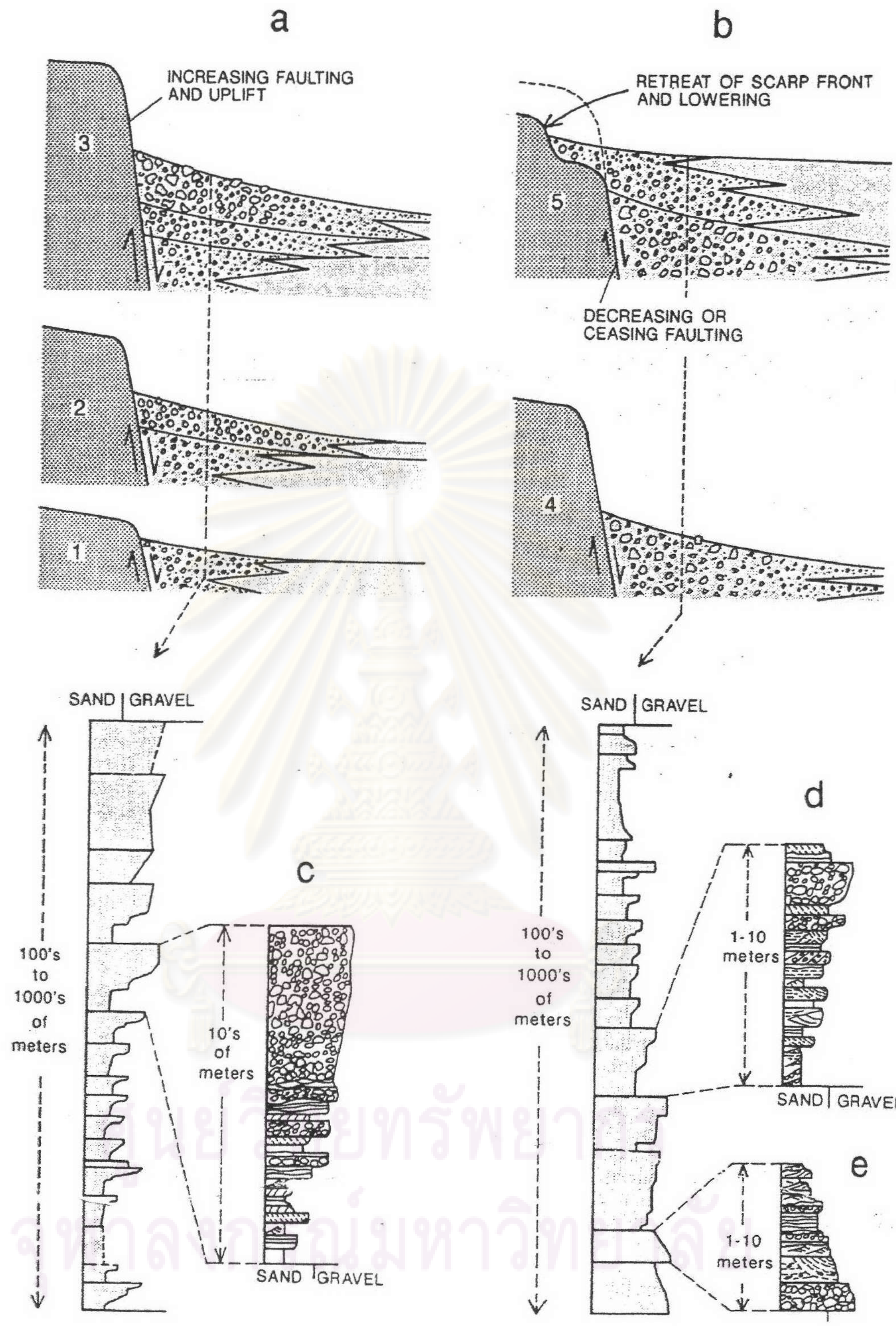

Figure 5.3 Idealized vertical succession in alluvial fan deposits and their possible cause. a. Large-scale coarsening-upward succession due to continuous faulting and fan pro-gradation (Stages 1 through 3). B. Large-scale fining-upward sequence caused by retreat of scarp front and lower-ring of relief in source area (Stages 4 and 5). c and d Small scale coarsening-upward cycles due to the prograding of individual fan lobes. e. Small-scale fining-upward cycle with Inchannelized base generated by bar processes or filling of braided channel. (Einsele, 1992).

Unit D represents the fining upward succession in the lower part and fine grain unit of clay in the upper part as well as numerous of archaeological remains. This unit showed clearly geological process as overbank floodplain deposits.

Multicyclic evolution of landscapes is more common than the monocyclic development. Mature or old-age topography is likely to have superimposed upon it youthful features as a result of rejuvenation. Rejuvenation of a region is suggested a topographic unconformity or discordance. By this mean, it reveals a lack of conformity between the topographic forms of the upper parts of valleys. The upland and upper valley forms are those of maturity or old age, whereas the lower valley forms are those of the youth (Thornbury, 1954).

Rapidly continuous decreasing of sediment and slope of alluvial fan were reflected to expand and fill on plain and river. This is followed by sedimentation in the basin leading to filling up of the valleys and the formation of the extensive plain which can be seen in the stratigraphy of subunit C2 to Unit D.

Geomorphological change of this area is related to theanalysis of McGowan International Team (1982) reporting about the paleoenvironment of the Khorat Plateau during the Quaternary Period. They recognized that there are at least two major periods of erosion and incision. The Tertiary period was characterized by deep weathering of the bedrock and gently undulating landscape and the remnants are preserved beneath the shallow alluvial sediments of the northern Tung Kula Ronghai plain. Low, flattop plateau remnants with deep weathering profiles (high terrace) along the margin of the Mun and Chi River basin may also be remnants of this period. During the early Quaternary period, a lowering of base level caused this landscape to be dissected and the main valleys were deepened up to about 150 m below the present levels. This was followed by a major period of sedimentation in the basins leading to filling up of the valleys and the formation of the extensive plains, and related to climatic changes, associated with the world wide cooling and warming during the Pleistocene. This cooling was associated with drier conditions probably resulting from the greatly extended land area during the glacial low sea level stage. These drier environments resulted in reducing vegetative cover in the catchments areas and increasing supply of sandy sediments into the rivers causing braided floodplain conditions. This led to widespread accumulation of sand in the lower lying, low energy basins. Eolian activity was also associated with these processes and sandy material was blown out of the braided stream beds and deposited as sand sheets and sand mantles in the vicinity of the stream beds (Loeffler *et al.*, 1983).

But this research is differed from the above report due to the fact that by increased supply of sandy sediments into the rivers cause meandering floodplain not braided floodplain conditions. Sedimentary sequence and sedimentary structure succession were indicated as channel sub-facies of meandering channel (Unit D). These were originated as a lag deposit on the channel floor and are overlain by a sequence of sands with a general vertical decrease in grain size. Trough cross-bedded sands were graded up into tabular planar cross-bedded sands of diminishing set height. These in turn pass up into micro-crosslaminated and flat-bedded fine sands which graded into silts of the floodplain sub-facies (Selley, 1985).

In field study, fossils were found in the sandpit such as bivalve, bone and teeth of proboscidean fossils and antle of deer. Elephant fossils teeth can be classified to 4 genera as *Sinomastodon* sp., *Stegolophodon* sp., *Stegodon* sp., and *Elephas* sp. All of them except *Elephas* sp. were found in the layer of very coarse sand with granule to pebble with structureless of Unit A. *Elephas* sp. was found in the layer of clay in Unit D. The preservation of ancient teeth is not good but can be identified, except *Sinomastodon* tooth is rather well preserved but this fossil is soak. So it was easily broken when it was moved. Almost of bones are scattered in the beds and are deposited parallel to bedding plane. Vertebrate bones also are not articulated, but all the processes are nearly preserved. The conditions of erosion on the surface of these fossils, lithology and sedimentary structure were suggested that they were not transported for long distances but they were transported by a turbulence water current and rapidly deposited along the slope. For some fossils that can not be identified, they might be reworked fossils which transported from the older sediment.

The evidence of fossils can be expected that the age of Unit A is Miocene-Period. The well preserved skull of *Merycopotamus*, *Stegolophodon, Stegodon,* and mastodon molars were found in situ in the sandpit (Sato, 2002: Hunta *et al.*, 2005). It showed that paleoenvironment of this place was the forest or swamp.

Sinomastodon and *Stegodon* were found between upper unit A and lower unit B, so the age of unit B was presumed as Pliocene - Pleistocene age. The paleoenvironment was expected that it might be forested areas close to water sources.

The Unit C was presumed as Pleistocene Period. This unit contained no fossils, but Tektite was found in this horizon.(Sato, 2002)

Unit D which is the last unit was expected to be Holocene - Recent age by an evidence of archeological evidences such as fragments of ceramic and fossils of *Elephas maximus* and cattle. It can be assumed as paleoenvironment of this place might be grasslands.

Elephant fossils from the Northeastern Research Center for Petrified wood and Natural Resources Museum can be identified into seven generaas *Gomphotherium* sp., *Tetralophodon* gomphothere, *Prodeinotherium* sp., *Protanancus* sp., *Stegolophodon* sp., *Stegodon* sp. and *Elephas* sp. There are two new species that were reported as *Sinomastodon* sp. *A* and *B* by Thasod (2005). These specimens were recovered from Tha Chang sand pit. The preservation of all ancient elephant teeth is excellent and their dental lamellas are never detached. All of fossils at this museum did not mention the position and location However, erosion on the surface of these fossils may suggest that they were not transported for a long distance.

It can be concluded that this area showed the evolutionary trends of the proboscideans in eastern Eurasia since Miocene to Holocene before they extinct or migrate for survival in better environments somewhere. In the cause of investigation of relation between stratigraphy, sedimentology, sedimentary structure and elephant fossils found in the sand pit, can be assumed that the dominance of depositional environment in this site is the fluviatile environment. This environment is composed of fan deposits and fluvial deposits of meandering river system. It also showed that this area has been adjusted the level of paleo-landscape as alluvial fan from high slope to low which reflect to expanding and filling the sediment on the plain and the river. Besides, evolution of paleoenvironment in the Mun River area was developed from forest to grassland area.