CHAPTER II

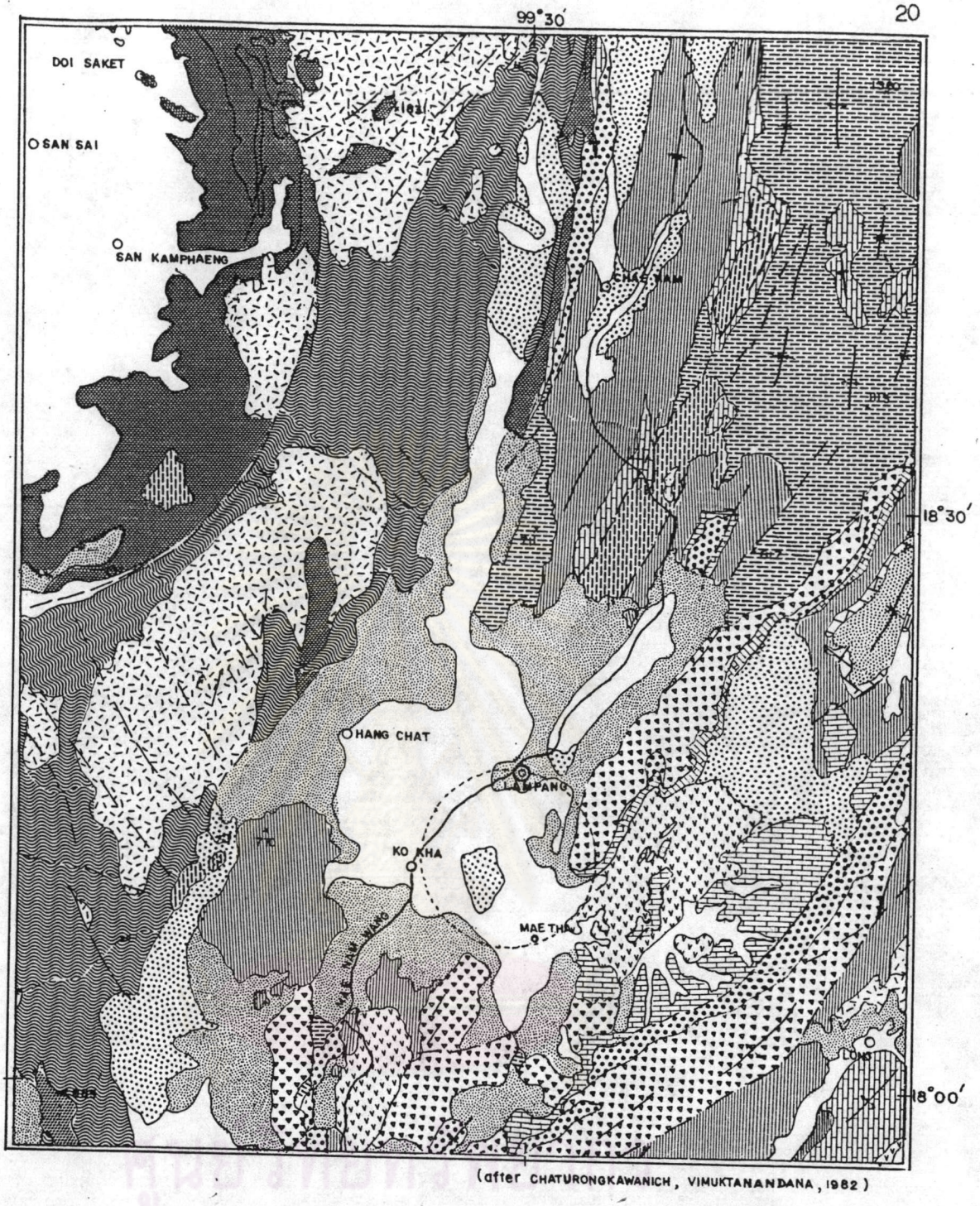
GEOLOGY

.2.1 Geology Surround Lampang Basin

Lampang Basin is a large intermontane Tertiary basin in Changwat Lampang, northern Thailand. The basin covers an area of approximatly 1,000 km^2. The upper easthern part of Lampang is bounded mainly by the Permo-Triassic volcanic rocks of Doi Ton and Doi Farang oriented in the NNE/SSW direction parallel with regional structure. The volcanic rocks included rhyolite, associated with rhyolitic tuff or agglomerate, with some andesite. The lower easthern part of the basin is bounded by Pleistocene vesicular basalt, limestone of Doi Chang Formation, Permo-Triassic volcanic rocks, and clastic sediments of Phra That Formation (Chonglakmani, 1983). The westhern part of the basin is essentially bounded by the Khun Tan mountain range oriented in the NNE/SSW parallel to the regional structure. This mountain range consists of green schist facies of Don Chai Group, Triassic Khun Tan granite, and sediments including volcanic rock of Mae Tha Group. The northern of the basin is bordered by the high mountain range of Doi Pae Luang which is consisting of clastics and carbonate sediments of Hong Hoi Formation, Kiu Lom Formation, Pha Huat Formation, Huai Tak Formation, Phra That Formation and Doi Chang Formation. The southern part of basin is bounded by clastic sediments of Hong Hoi Formation, Permo-Triassic volcanic rocks, and Pleistocene basalt (Fig. 2.1.1, 2.1.2)

Other neighbouring intermontane Tertiary basins of Lampang Basin are Mae Moh Basin on the east, Changmai Basin in the northeast, and Chae Hom, Mae Pan and Wang Nua Basins in the north and Serm Ngam Basin in the southwest (Fig. 2.1.3).

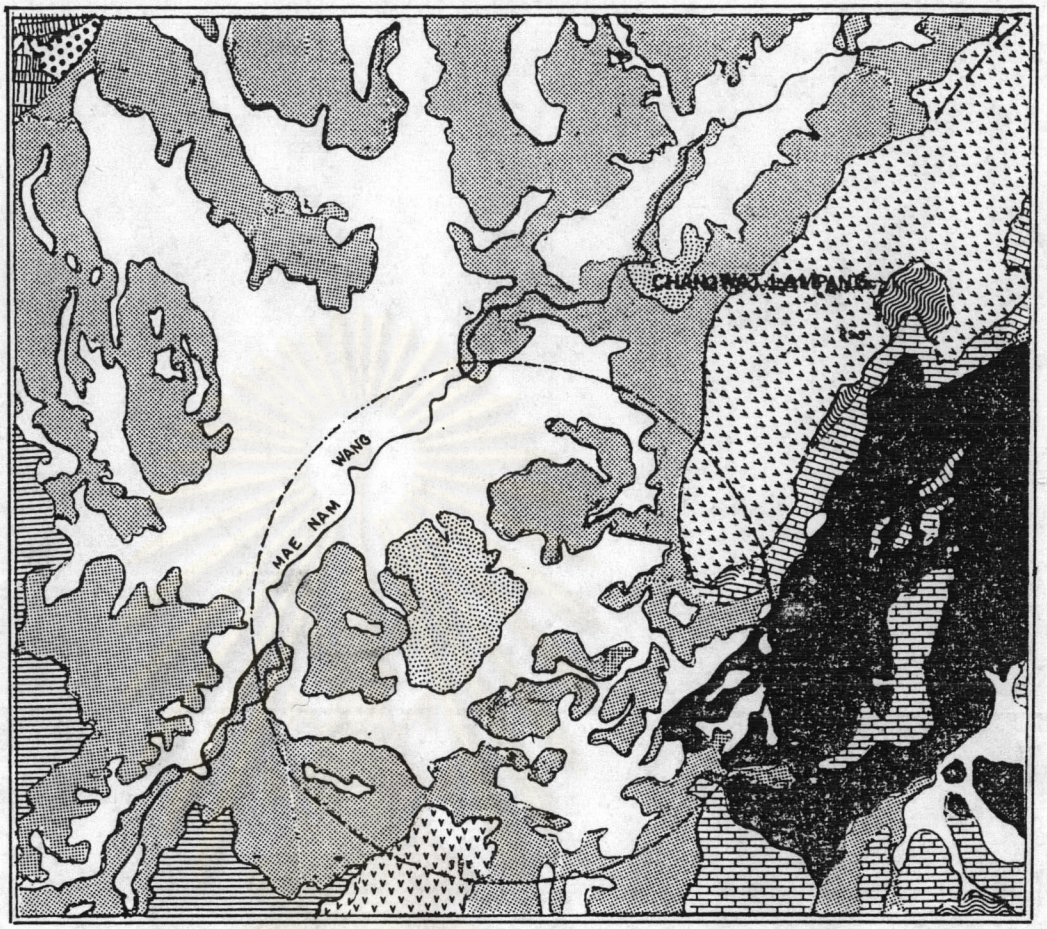
GEOLOGICAL MAP OF LAMPANG BASIN AND ADJACENT AREA

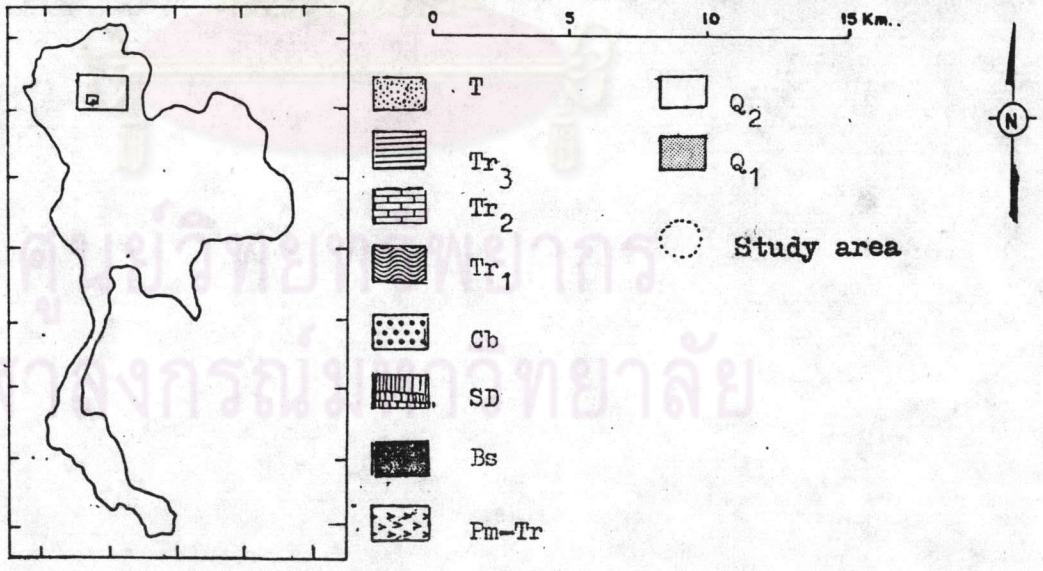


(after CHATURONGKAWANICH, VIMUKTANANDANA, 1982)

FIG.2.1.1 GEOLOGICAL MAP OF LAMPANG BASIN AND ADJACENT AREAS

○ Study area





(After Piyasin, 1971)

GEOLOGICAL MAP OF STUDY AREA	PONGSAK SRIPONGPHUN GEOLOGY DEPARTMENT GRADUATE SCHOOL CHULALONGKORN UNIVERSITY 1985
Lithostratigraphy and Depositional Environment of Diatomite Deposits in the Southeastern Part of Lampang Basin, Changwat Lampang	FIG.2.1.2

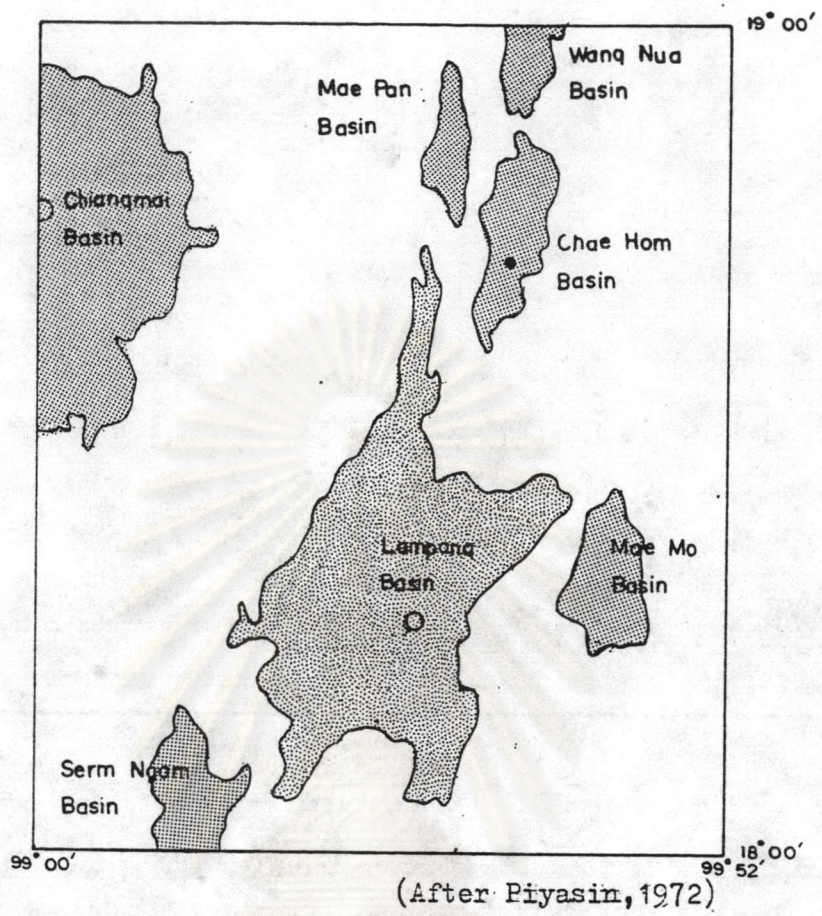
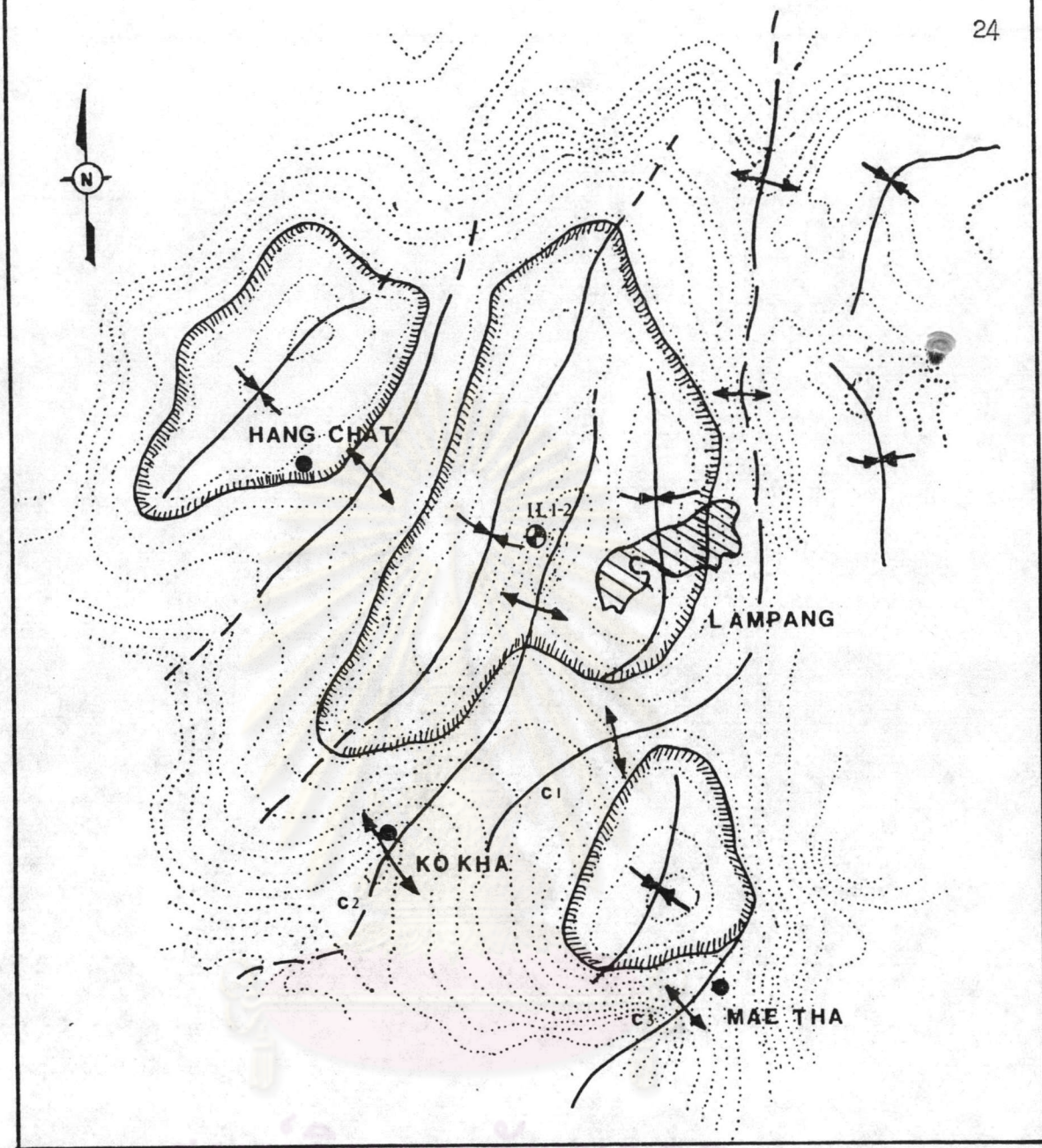


FIG. 2.1.3 Location map of Lampang Basin and adjacent basins

2.2 Geology of Lampang Basinal Basement.

The pre-Tertiary basement of Lampang Basin is consisting of various types of rocks of different age. In the westhern part of the basin, the basement is characterized by biotite-hornblende granite of Khun Tan mountain range and metamorphic rock of Don Chai Group. These metamorphic rocks are in the green-schist facies composing of phyllite, quartize, quartz-schist, schist, quartzo-feldspathic schist.The southern part of Lampang Basin in the vicinity of Amphoe Ko Kha , the basement is believed to be rocks of Lampang Group. In the easthern part of the basin, the basement is characterized by Permo-Triassic volcanic rocks of rhyolitic and andesitic compositions. In the northern and central parts of the basin, the basinal basement are composed of shale and limestone of Lampang and Ratburi Groups.

Evidences from the gravity survey in Lampang Basin reveal that there are at least 3 main sub-basins namely, Lampang Sub-basin, Hang Chat Sub-basin, and Mae Tha Sub-basin (Fig. 2.2.1) Lampang Sub-basin,the largest sub-Basin, is elongated in the NE/SW direction extending from Lampang City center westwardly to Ban Thung Khoo Dai. The basement is characterized by folded pre-Tertiary shale and limestone having fold axes oriented in the NE/SW to N/S directions. Lampang Sub-basin is separated from the Hang Chat Sub-basin in the northwest by NE/SW anticline. Hang Chat Sub-basin is also elongated in the NE/SW direction having the syncline oriented along the sub-basin axis. To the southwest of Lampang Sub-basin, there is a smallest Mae Tha Sub-basin separated from Lampang Sub-basin by the NEE/SWW anticline. Mae Tha Sub-basin is elongated along the NNE/SSW direction with the syncline oriented along the sub-basinal axis



(After Piyasin, 1978)

SCALE 1:250,000

0 5 10 15 20 KM.

BOUGUER ANORMALY CONTOURS

ANTICLINE (DOME)

SYNCLINE (BASIN)

OUTLINE OF DEPRESSION

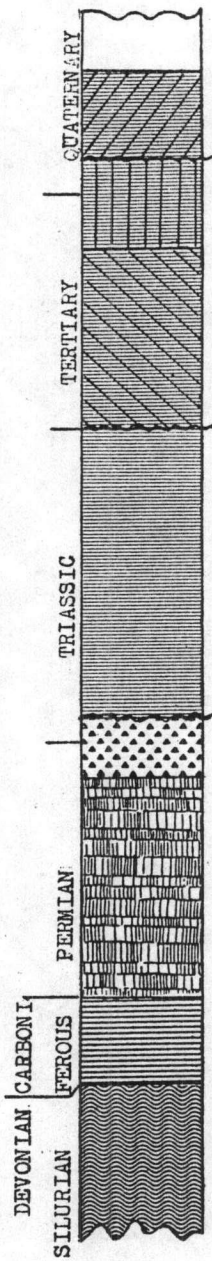
FIG2.2.1 BOUGUER ANORMALY CONTOUR MAP OF LAMPANG BASIN
Lithostratigraphy and Depositional Environment of Diatomite Deposits in the Southeastern Part of Lampang Basin, Changwat Lampang

PONGSAK SRIPONGPHUN GEOLOGY DEPARTMENT, GRADUATE SCHOOL CHULALONGKORN UNIVERSITY 1985

2.3 Sediments of Lampang Basin.

Lampang Basin, the second largest inland Tertiary basin in northern Thailand, is mainly covered by Quaternary deposits (Brown et al., 1951; Piyasin, 1972; Snansieng et al., 1982). The Quaternary deposits can be further subdivided into six different kinds, namely, recent alluvial, low terrace deposits, recent fan deposits, fan-colluvial deposits, high terrace deposits, and Pliocene (?) plain (Hattori 1970; Takaya 1971b.). Recent alluvial and low terrace deposits occur along the river bank and the deposits are characterized by sand and silt. Recent fan deposits consist of Holocene (?) sand and gravel. Fan-colluvial deposits are composed mainly of coarser sediment. High terrace deposits are usually capped by thick gravel bed and occasionally lateritic. Pliocene (?) plain consists of varying geological body ranging from lacustrine clay to angular gravelly alluvium. The lithostratigraphy of Quaternary deposits in Lampang Basin was first established and classified into two formations, namely, alluvium, and Mae Taeng Formation. The uppermost formation, alluvium, is consisting mainly of gravelly sand and river-borne sandy clay of mainly reddish brown color with thickness varying from 0 to 10 m. The lower formation, Mae Taeng Formation, is characterized by the unconsolidated cobble and gravel beds with sand and clay matrix (Piyasin 1972, 1977). The thickness of Mae Taeng Formation is between 5 to 610 m.

Underlying the Mae Taeng Formation is the Ko Kha Formation of upper Tertiary Period. The formation is consisting of diatomaceous clay with wood remains. The thickness of this formation is approximately 15-30 m. Below the Ko Kha Formation is the Mae Sot Formation. The lowest Tertiary rock Formation of Lampang Basin is Mae Sot Formation which consists mainly of greenish gray shale, mudstone, and claystone with coal and oilshale interbedded. There are siltstone and sandstone in some intervals. Besides, there are evidences of reserve fossils, coal fragments and high amount of organic matter in the sequence of this formation. The thickness of Mae Sot Formation is approximately 152-250 m. (Fig. 2.3.1)



"Top Soil" fm	Gravel sand, river-borne sandy clay
"Q" group Mae Taeng fm	Unconsolidated cobble, gravel with sand and clay metrix
Ko Kha fm	Clay, diatomaceous clay
Mae Moh group Mae Sot fm	Claystone, mudstone, oilshale, coal and fossils
Lampang Group	Shale, sandstone and conglomerate Limestone, limestone conglomerate Shale and thin-bedded fine grained sandstone Limestone, massive Tuff, agglomerate, shale, sandstone
Volcanic Group	Rhyolite, andesite, tuff andagglomerate, with shale and tuffaceous sandstone intercalation
Ratburi Group	Shale, sandstone Mainly limestone with intercalation of thin-bedded tuff Clastic and pyroclastic sediments with intercalation of thin-bedded limestone
Mae Tha Group	Quartzitic sandstone, feldspathic sandstone, shale, andesitic and rhyolitic tuff
Dom Chai Group	Phyllite, quartzite, schist (green-schist facies)

Fig 2.3.1 Stratigraphic summary of Lampang Basin

2.4 Geological Evolution of Cenozoic Sedimentary Basin.

The marine Triassic sediments in Thailand were deposited in an elongate trough known as the Burmese-Malayan Geosyncline, which is considered to be the southeastward extension of the Tethys from the European Alps and Himalayas. The collision of Indochina and Shan-Thai subplates, Indosinian Orogeny, terminated marine deposition on Thailand almost permanently which was completed by late Triassic time. The boundary of these microplates is marked by an ophiolite belt well-exposed in the Nan and Uttaradit areas oriented approximately in the NE/SW direction with Sukhothai Fold -Belt on the westhern side of ophiolite belt or easthern part of Shan-Thai craton and Leoi Fold-Belt on the easthern side of ophiolite belt or westhern part of Indochina craton. (Javanaphet, 1969, Baum et al., 1970, and Bunopas & Vella, 1978). The map of Paleozoic to Triassic fold-belts is presented in Fig. 2.4.1.

Towards the end of Cretaceous to Early Tertiary, there was a tectonic uplifting in this area as a result of Himalayan Orogeny. The major geological structures developed are a tensional regime with a system of N/S trending normal faults.

In the upper North Thailand, Cenozoic deposits of considerable thickness were deposited in the graben or half-graben controlled basins which were partly influenced by the geological structures of the NE/SW Sukhothai Fold Belt and partly influecced by the N/S trending fault of the Himalayan Orogeny. These basins, namely, Changmai,Lampang,Phayao-Changrai, Phrae,Mae Moh, Fang, Chae Hom, Nan, Na Noi, Ngao, Mae Tip, Li and Mae Sariang, are geomorphologically expressed as intermontane basins. Tertiary deposits cropout extensively in some small basin but are mostly covered by thick Quaternary deposits in large basins. The deposits are generally fine-grained, though often with fine conglomerate or conglomeratic sandstone interbedded with fine-to medium-grained sandstone for a few tens of meters at the base. Limnic sediments are common, including fresh-water limestone, diatomites, carbonaceous shale, oil shales and coals.

According to Baum et al. (1970), late Tertiary or Pleistocene

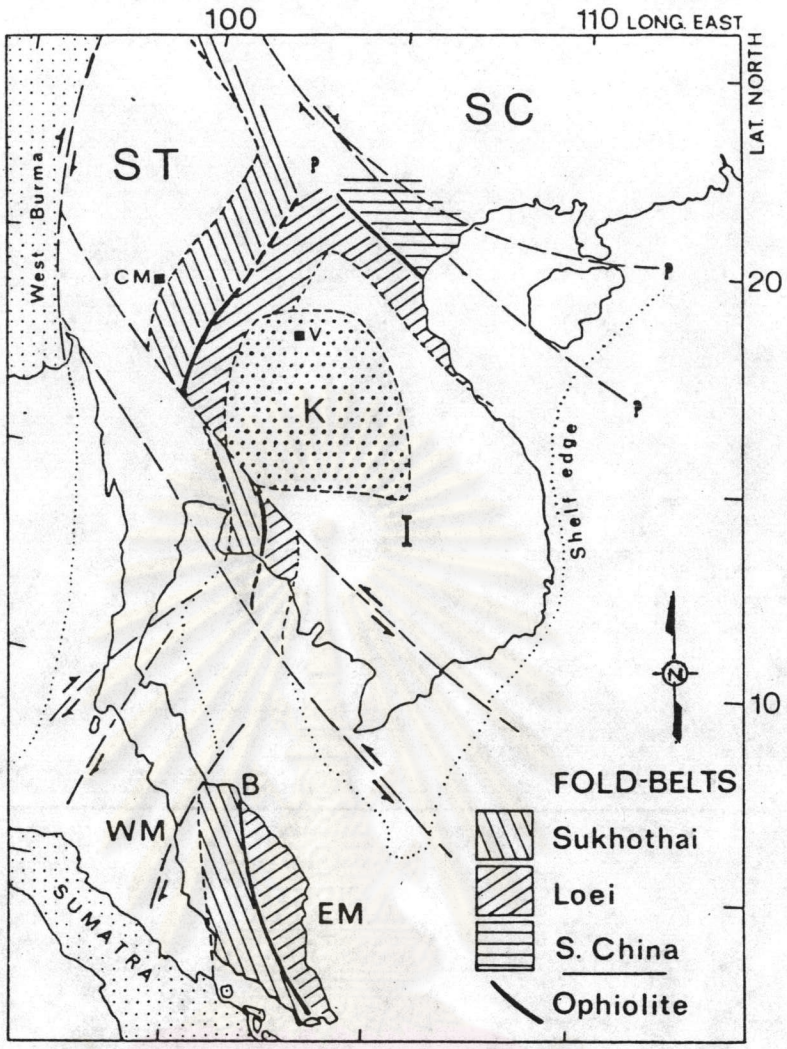


Fig. 2.4 Map showing Paleozoic to Trassic fold-belts of continental Southeast Asia.

I, Indochina (including eastern Thailand); SC, South China and ST, Shan-Thai (eastern Burma, western Thailand and Northwestern Malay Peninsula). Adjacent fold-belts are formed of thick mainly marine Paleozoic to Triassic sediments and tholeitic volcanic rocks that accumulated along the margins of the cratons. Loei Fold-Belt on west side of Indochina contains upper Devonian or Carboniferous to Triassic marine strata, on north-east side Cambrian to Triassic marine strata. Ophiolites lie between contiguous fold belts. Sinistral faulting and oroclinal bending occurred mainly during the Jurassic and Cretaceous. K, Khorat Basin; CM, Chiangmai; V, Vientiane; WM, West Malay Peninsula; EM, East Malay Peninsula; B, Bentong ophiolite line, (from Bunopas, 1981).

faulting and uplifting determined the present day topography of northern Thailand. Besides, Cenozoic basaltic rocks (lava flows with minor plugs and pyroclastic rocks) occur as small flows scattering in Changwat Lampang. The compilation of zircon fission track data and K-Ar data by Barr and MacDonald (1981) and paleomagnetic data (Haile and Tarling, 1973; Barr et al., 1976) indicate that the ages of these basaltic rocks are Late Cenozoic.