

CHAPTER II



GEOLOGIC SETTING OF THE REGION

The Ratburi Group in this study area is the southern end portion of the approximately north-south trending continuous outcrops of the Upper Paleozoic carbonate/clastic unit which extends south at least 400 kilometers from somewhere in Laos, across Mekhong River into Changwat Loei, along the Loei fold belt (Bunopas and Vella, 1983) or Petchabun fold and thrust belt (Wielchowsky and Young, 1985) via Changwat Petchabun, Amphoe Chai Badan of Changwat Lopburi to Amphoe Pak Chong of Changwat Nakhon Ratchasima. There the trend ends at the Khao Yai Volcanics northern limit. In this southern limit, the Ratburi rocks are also bounded by the younger, Mesozoic Khorat Group clastic rocks to the east and north-west, and the Quaternary (?) alluvial deposits of Chao Phra Ya River to the west. From Amphoe Pak Chong to Amphoe Muang Lopburi the rocks expose as a chain of hills, ridges, knobs and mounds composing of predominantly the limestones and fine-grained clastic rocks. The limestones mostly occupy the area around Amphoe Phra Phutthabat and along the east-west limestone trend to the foot of Khao Yai near Amphoe Pak Chong. The rest of the area, except in the alluvial deposit terrain, is composed of the carbonate/clastic rock interbeds. The hill trends mostly correspond the measurable sedimentary structures, i.e. the east-west to northwest-southeast bedding plane strikes, of which the dips are mostly moderately to the southerly directions.

Several stratigraphers had tried to identify the complicated stratigraphy here. One of the oldest attempts is that of Abele and Beeser (1963) who divided, without any clear boundary, the clastic rocks from Muak Lek to Kaeng Khoi into 6 units, namely Lower Limestone, Lower Shale, Middle Limestones, Middle Shale, Upper Limestone and Upper Shale. The divisions were according to the corresponding lithology, and lied approximately east-west and successively from north-northeast to south-southwest. The 6 subunits of the Ratburi Group do not correspond with a much-later division proposed by Hinthong (1981) who also subdivided the rocks according to stratification, fossils and structures into 6 formations. These formations are, from older to younger, Phu Phe, Khao Khwang, Nong Pong, Pang Asok, Khao Khad, and Sap Bon. The formations cover the entire southern limit of the mentioned Ratburi trend. The section of Phu Phe formation is 593 meters thick and is characterized dominantly by the well-bedded limestones with lenticular and nodular cherts and subordinated shales and slaty shales. The 490 meter-thick Khao Khwang formation comprises mainly thick-bedded recrystalline limestones and is oftenly fossiliferous with fusulines, crinoids columns, coral (solitary as well as colony), brachiopods and algae. Nong Pong formation is characterized by the interbedded shales and medium- to thin-bedded limestones; either rock also forms lenses in the other corresponding rocks. Nong Pong formation is 673 meters thick and is with crinoid stems, fusulines, and coral. Pang Asok Formation is made up dominantly with shales and slaty shales and is 366 meters thick. Khao Khad formation is composed of the thick- to massive-bedded recrystalline limestones and dolomites with subordinate bedded chert and lenticular and nodular chert in limestones, and is

the thickest unit, 1,812 meters thick. Commonly fusulines, coral, brachiopods and algae are preserved in this unit. The youngest Sap Bon Formation comprises mainly of shales, siliceous shales, siltstones to sandstones, and is 1,103 meters thick.

The succeeding formations occur from north to south except the oldest unit, Phu Phe formation, which exposes only to the southern most portion (Figure 4).

Here, but in a rather limit extent, Tittirananda-Dawson (1976, 1978 a) subdivided the rocks which are equivalent to Hinthong's (1981) Khao Khad Formation along Highway 21, Km. 6 to Km. 14 into 7 lithostratigraphic units. In 5 of this 7 units, Comviravong (1985) had studied in the geologic structural aspect.

Structurally, the rock units trend uniformly east/west to east-southeast/west-northwest and dip moderately to the south and southwest. The small-scale folds along this trend were also observed. Abele and Beeser (1963) believed that the rock sequence belonged to the southern flank of "a large gently westward plunging anticline" whose core lied somewhere further north (from the present study area), and a part of which was exposed near the eastern margin of Muak Lek area. Hinthong (1981) also mentioned the regional structure as an "anticlinorium". Abele and Beeser (1963) observed an unusual stratigraphic succession in the southern portion of Ratburi Group, and Borax and Stewart (1966) proposed a northward-moving thrust fault there (To be named in this paper "Thap Kwang Thrust" after the type locality near Ban Thap Kwang, Amphoe Kaeng Khoi, Changwat Saraburi) (Figure 5). Again in a limit extent, Comviravong analyzed the

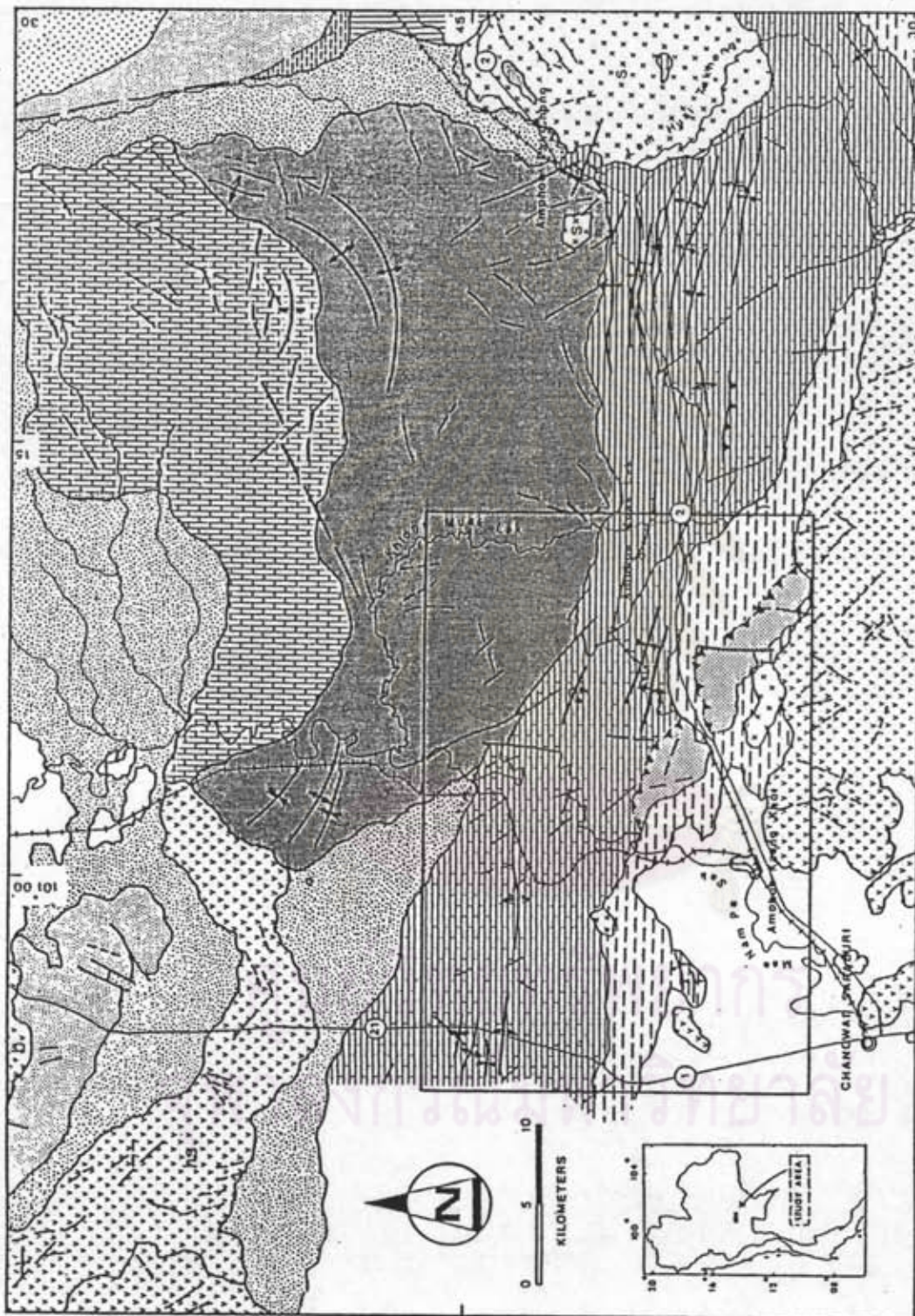


Figure 4 General geologic map of the study area (After Hinthong, 1981).

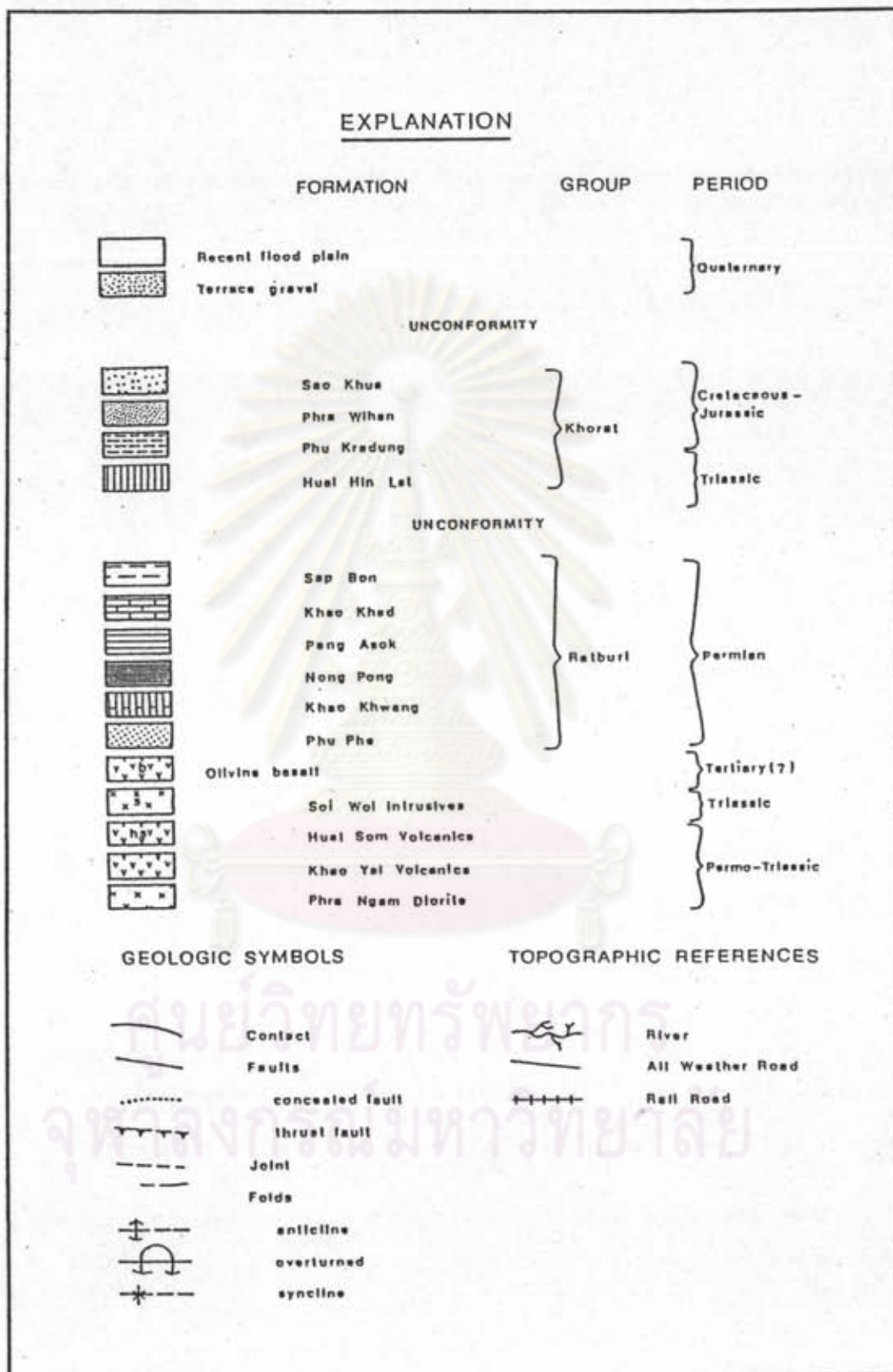


Figure 4 cont.

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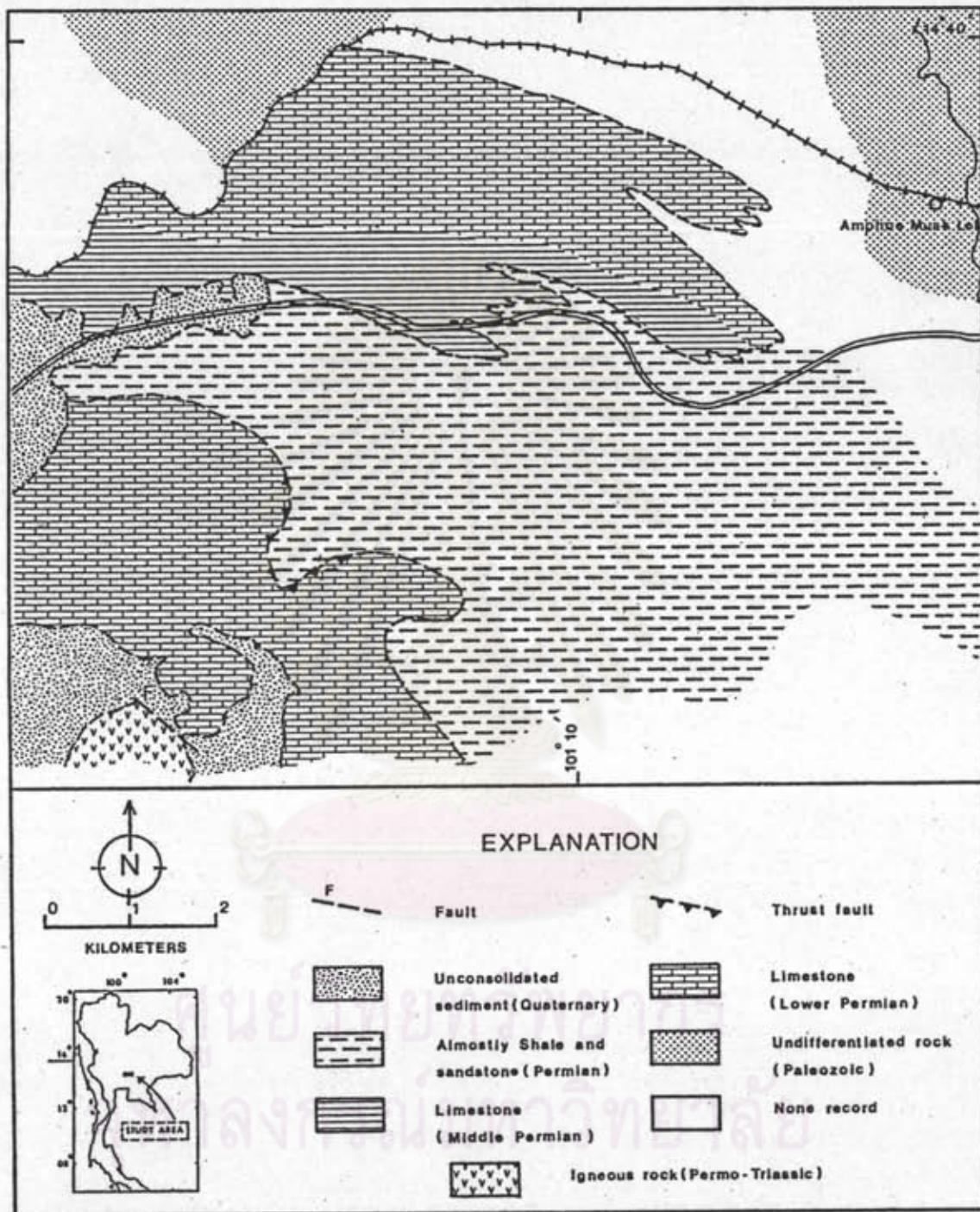


Figure 5 Geologic map along Highway 2, between Amphoe Kaeng Khoi and Amphoe Muak Lek (After Borax and Stewart, 1966).

petrofabrics, using the bedding planes and small-scale fold elements to illustrate the fold style along Highway 21, Km. 0 to Km. 12 to be the rather cylindrical, horizontal to gently-plunging folds with the fold axis followed the general stratigraphic trend, but also with some cross undulation folds. He also followed the idea of Hinthong (1981) that the "anticlinorium" core located to the north of his study area.

The folding event probably occurred during the Late Triassic to Early Jurassic Indosinian Orogeny (Hinthong, 1981). The rocks were also intruded by the granodiorite of Permo-Triassic (Hinthong, 1981) Phra Ngam Diorite. The evidences of thermal metamorphism occurred in the Ratburi rocks around the intrusive bodies where the marbles, hornfels, and skarns characterized the event. The slaty cleavage and schistose structure probably indicate the small degree of dynamothermal metamorphism to associate the folding event.

From the fossils, bryozoans and fusulinids, as had been noted by Pitakpaivan (1965), Borax and Stewart (1966), Tittirananda-Dawson (1976, 1978 a) and Hinthong (1981), the fusulines indicate the ages from Lower Permian to Upper Permian. These rocks were noted to deposit in a shallow shelf sea or platform environment (Abele & Beeser, 1963, Tittirananda-Dawson, 1978 a) where the landward side is either to the south (Tittirananda, 1976), deep marine area to the north (Wielchowsky and Younge, 1985), or the cratonic side is to the easterly direction if inferred from the location of the area which is within the Loei fold belt of Bunopas and Vella (1983).

As mentioned, the Ratburi Group was unconformably overlaid to the south by Khao Yai Volcanics which covered an area from Highway 1 at Amphoe Hin Gong of Changwat Saraburi to Khao Yai National Park in the east at the western limit of the Khorat Plateau. The volcanic rocks are Permo-Triassic in age (Hinthong, 1981). The Mesozoic Khorat Group clastic rocks has never been found to have a direct contact with the Ratburi Group. But with their overlying the volcanic rocks on the top of Khao Khiew, the highest peak of Khao Yai, this indicates that the Mesozoic continental clastic unit is even younger than the Post-Ratburi Volcanic rocks.

The unconsolidated sediments occurred as the alluvial deposit along the Pa Sak and Muak Lek rivers, as the alluvial terrace on the southwest portion of the study area, and as the lateritic soils all over the place. The detail study of the Middle to Upper Pleistocene done by Takaya and Thiramongkol (1982) is illustrated as Figure 6.

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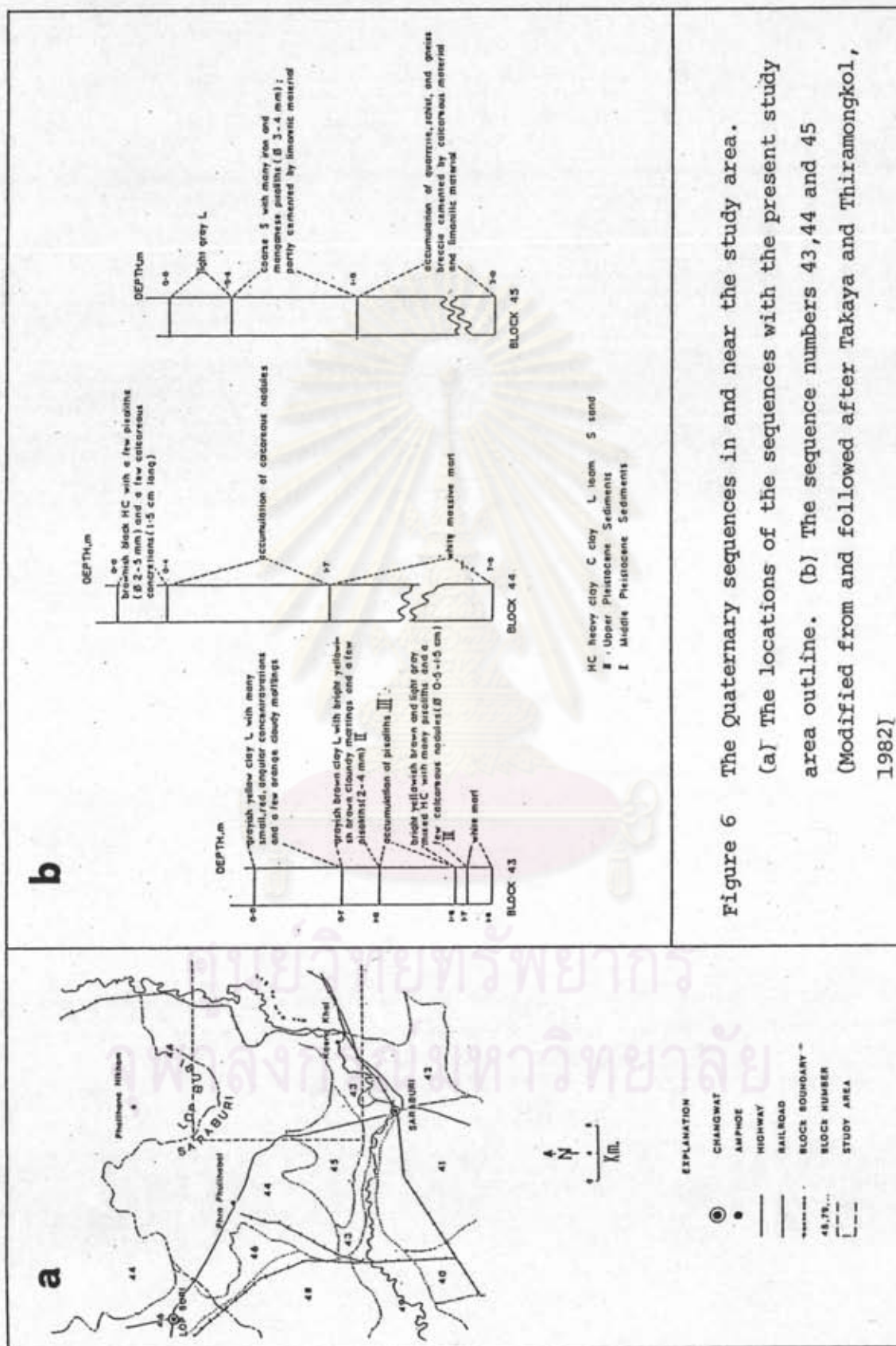


Figure 6 The Quaternary sequences in and near the study area.
 (a) The locations of the sequences with the present study area outline. (b) The sequence numbers 43,44 and 45 (Modified from and followed after Takaya and Thiramongkol, 1982)