

## CHAPTER II

### REGIONAL GEOLOGY OF THE STUDY AREA

#### General Geology

The study area is situated in Amphoe Pak Chong, western part of Changwat Nakhon Ratchasima. Geologic map of the study area and adjacent areas is illustrated in figure 2.1. It was modified from geologic map; scale 1 : 250,000; Map Sheet ND 47-8 (Changwat Phanakhon Si Ayutthaya) compiled by Hinthong et al., 1985. Generally, rocks distributed in the study area and adjacent areas consist of sedimentary rocks of the Saraburi Group ranging in age from the Early to the Late Permian.

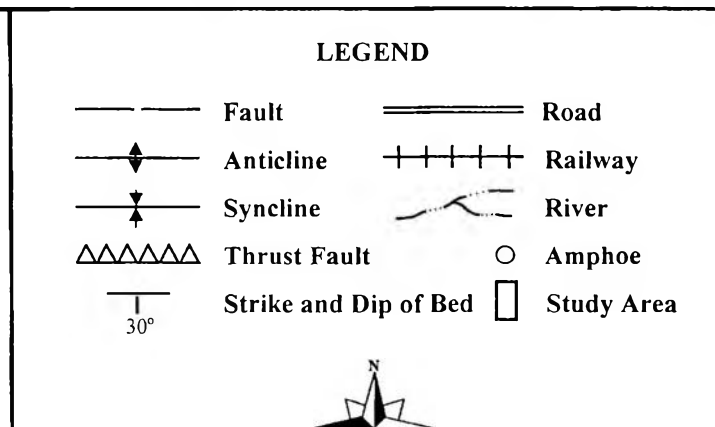
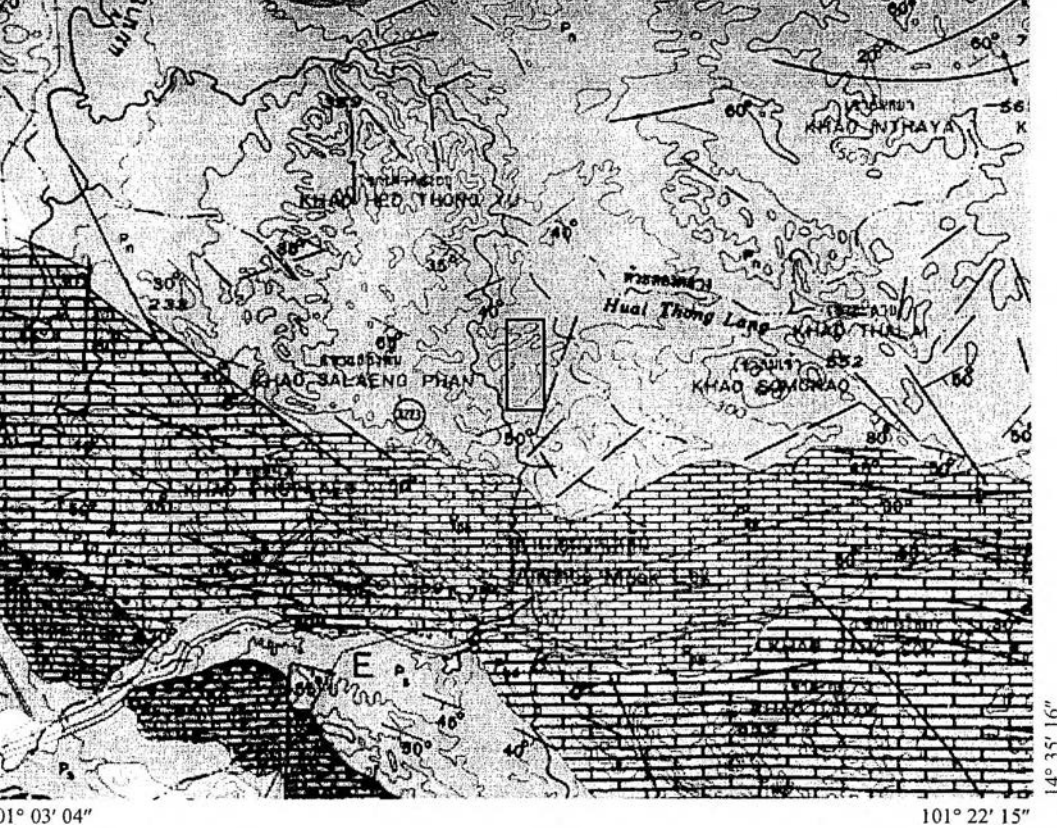
According to previous investigation by Bunopas, 1981 and Hinthong et al., 1985, the rocks in the study area are grouped in the Nong Pong Formation of the Saraburi Group. The rocks in adjacent areas also are carbonate rocks in Phu Phe, Pang Asok, Khao Khad, and Sap Bon Formations of the Saraburi Group and can be found in the south of the study area but the Khao Khwang Formation can be found in the north of the study area.

The Saraburi Group in the study area and adjacent areas is composed of six Formations; Phu Phe, Khao Khwang, Nong Pong, Pang Asok, Khao Khad and Sap Bon Formations. All of these Formations were previously mapped as part of the Ratburi Group (Hinthong et al., 1985). These Formations are described from older to younger as followed:

#### 1. Phu Phe Formation (P<sub>p</sub>)

The Phu Phe Formation consists of pinkish gray to gray limestone with chert in tabular nodule parallel with bedding and partially intercalated with slaty shale at some part. Some part of this Formation are banded chert or chert nodule intercalated in bed of limestone. They upthrust on the Sap Bon Formation and can be found in south-west of the study area.

Fossil found in this Formation indicated the Sakmarian age such as fusulinids; *Pseudoschwagerina* cf. *toriyamai*, *Pseudoschwagerina turbida*,



Khao Khad Formation



Black, very dark to light gray limestone; recrystalline argillaceous limestone and dolomite with nodular and bedded cherts; intercalated shale, sandstone. Fusulinids, corals, brachiopods, and algae are common.

Pang Asok Formation



Thin-bedded gray, bluish-gray, brown, and pale reddish brown shale, slaty shale, and slate with lenticular sandstone and limestone beds.

Nong Pong Formation



Black to dark gray, banded, and laminated limestone and bedded chert; gray, bluish, brownish-gray, grayish-brown, and buff shale. Crinoids, fusulinids, and coral are common.

Khao Khwang Formation



Black, dark and light gray limestone with nodular chert; locally dolomite and intercalated with few pale brown and greenish-gray shale, sandstone. Fusulinids, corals, crinoids, brachiopods, and algae are common.

Phu Phe Formation



Pinkish gray to very gray limestone with chert in tabular nodule parallel with bedding and partially intercalated with slaty shale. It upthrusts on the Sap Bon Formation and

Middle-Lower PERMIAN

Lower PERMIAN

*Pseudoschwagerina* sp., *Paraschwagerina* sp., *Pseudofusulina* sp., *Pseudodoliolina* sp., *Monodioxodina* sp., *Minojaponella* sp., *Schubertella* sp., *Triticites* cf. *ellipsoidalis*.

## 2. Khao Khwang Formation ( $P_{kg}$ )

The Khao Khwang Formation mainly consists of black, dark and light gray bedded limestone with nodular chert at some part. locally dolomite and intercalated with few pale brown and greenish-gray shale, sandstone. At the top part of the Formation, dark brown bedded chert can be found.

Fossil usually found at the bottom part of the Formation is fusulinids but at the top part corals, crinoideas, brachiopods, trilobites, and algae are present.

Fusulinids discovered from this Formation indicated the Sakmarian age. The identified fossil from this Formation are as followed; *Afghanella* sp., *Charaloschwagerina* sp., *Neoschwagerina* sp., *Paraschwagerina* sp., *Pseudoschwagerina turbida*, *Pseudodoliolina* sp., *Verbeekina pontica*, and *Sumatrina* sp.

In addition, the identified brachiopods indicated age of Sakmarion such as, *Brachythyris strangwaysi*, *Composita* sp., *Dielasma* sp., *Enteleles* cf. *bowsheri*, *Echinaria* cf. *moorei*, *Goleomixa* sp., *Linoproductus* sp., *Martinopsis* sp., *Neophricodothyris* sp., *Orthotichia* sp., *Phricodothyris* sp., *Rhynchonellid* sp., *Terebratuloidea* sp., *Uncinunellina* sp., and *Recticulatia* sp.

## 3. Nong Pong Formation ( $P_n$ )

The Nong Pong Formation is characterized by grayish-brown, greenish-gray shale intercalated with banded or laminated gray to dark gray limestone, or argillaceous limestone. Shale bed usually found with siltstone and sandstone.

Most of the fossils found in this Formation are fusulinids ranging in age from the Artinskian to the Kungurian. Identified fusulinids are as followed; *Cancellina* sp., *Neofusulina* sp., *Pseudodoliolina* sp., *Pseudofusulina* sp., *Pseudofusulina* cf. *japonica*,

*Thailandina buravasi*, and *Verbeekina* sp. Ammonoids can be found from this Formation such as *Agathiceras* sp. Crinoideas and corals also occurred in this Formation.

#### 4. Pang Asok Formation (P<sub>pa</sub>)

The Pang Asok Formation consists of thin-bedded gray, blush-gray, bluish-gray, brown, and pale reddish brown shale, slaty shale, and slate with lenticular sandstone and limestone beds. Some part of rocks in this Formation is hornfels. Fossils are very rare in this Formation.

#### 5. Khao Khad Formation (P<sub>kd</sub>)

The Khao Khad Formation consists mainly of black, very dark to light gray limestone, recrystalline argillaceous limestone, and dolomite with nodular and bedded cherts intercalated shale, and sandstone. Some part the rocks are marble, calc-silicate, and hornfels.

Fusulinids usually found in this Formation are as followed; *Climacamina* sp., *Cribogenerina* sp., *Neoschwagerina* sp., *Neoschwagerina megasphaerica*, *Parafusulina* cf. *kaerimizensis*, *Pseudofusulina* sp., *Pseudofusulina parumvoluta*, *Pseudofusulina japonica*, *Parafusulina* sp., *Sumatrina annae*, *Sumatrina* aff. *longissima*, *Verbeekina verbeeki*. The coral; *Waagenophylum* cf. *indicum*, brachiopods, and algae also can be found in this Formation. According to the fossil record, this Formation is the Kungurian to the Wordian age.

#### 6. Sap Bon Formation (P<sub>s</sub>)

The Sap Bon Formation is characterized by thin-bedded, gray, brown, sandstone, siltstone, shale, siliceous shale, and chert, intercalated with gray limestone. Some part of this Formation the rocks are composed of phyllite, schist, and slate or slaty-shale.

Fossil ammonoid; *Agathiceras* sp. is usually found in this Formation. Fusulinids indicating the Kungurian to the Wordian age are *Pseudofusulina* sp., *Colania* cf. *douvillei*, *Neoschwagerina* cf. *magaritae*, and *Minojapanella* sp.

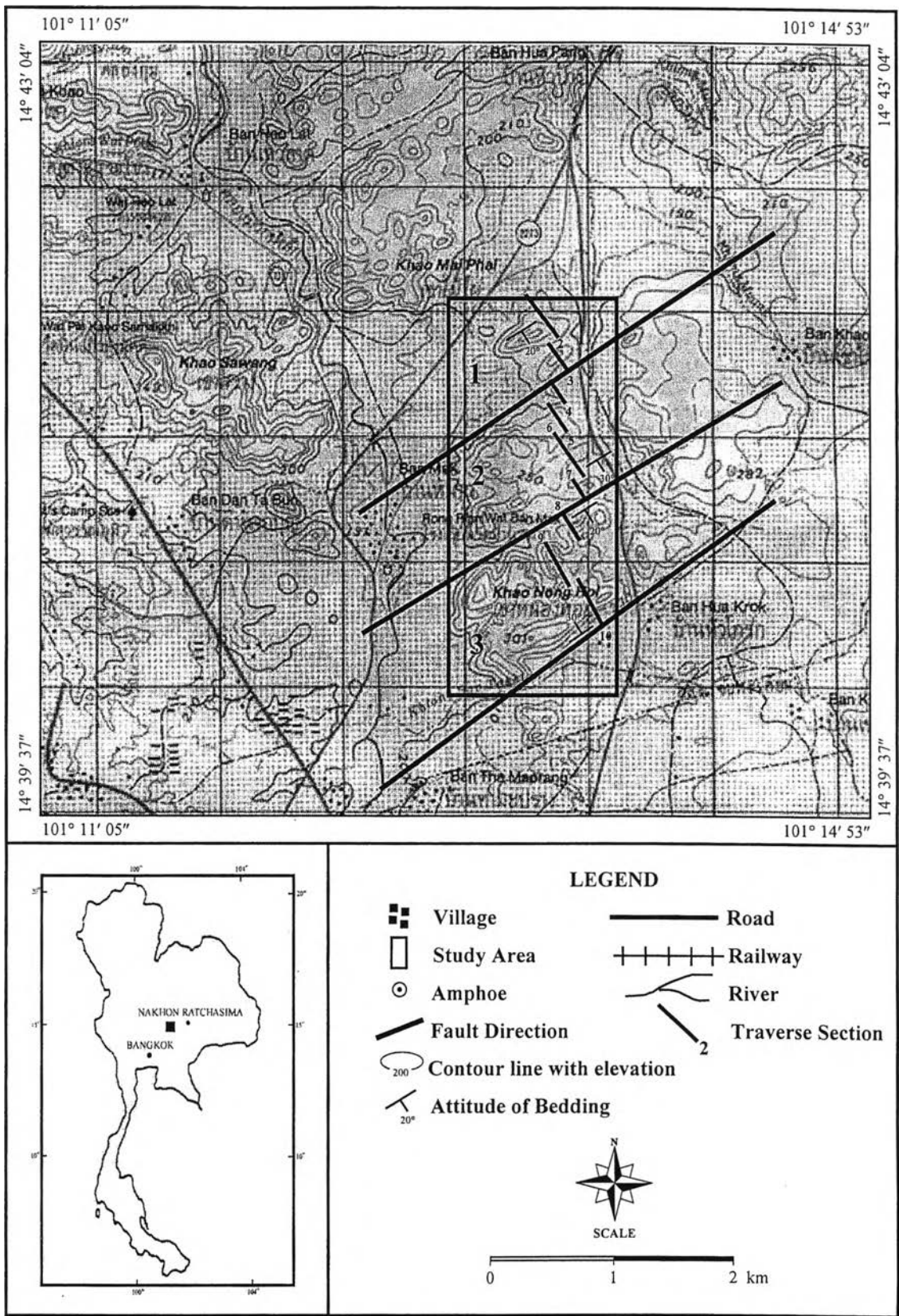
## Stratigraphy of the Study Area

According to figure 2.1, the study area is located within the Nong Pong Formation of the Saraburi Group (Hinthing et al., 1985). The rocks in the study area are mainly composed of thickly bedded limestones. The main structure of the study area is controlled by fault. The 3 main faults exist in the study area with the attitude of strike  $54^\circ$ ,  $59^\circ$ , and  $55^\circ$  from the northern to southern part of the study area respectively. This set of fault divided the rocks in the study area into 3 stratigraphic blocks as illustrated in the figure 2.2. The stratigraphic block 1 is at the northern part of the study area. The stratigraphic block 2 is at the central part of the study area, and stratigraphic block 3 is at the southern part of the study area. Mainly attitude of bedding are  $40^\circ - 50^\circ$  of strike and dipping to the southeast direction with gentle dipping ( $10^\circ - 30^\circ$ ) and some part is steep slope ( $40^\circ - 60^\circ$ ). The traverse sections for measuring section and sample collecting are illustrated on figure 2.2.

According to the main attitude of bedding in the study area, the stratigraphic block 1 is the lower part by the stratigraphic position in the study area. The stratigraphic block 2, and stratigraphic block 3 are situated at the central part and upper part in the study area respectively by the stratigraphic position. (Figure 2.2)

The stratigraphic block 1 is approximately 200 m thick, mainly composed of very thick-bedded light gray to white recrystalline limestone. Some part is the secondary dolomitic limestone, chert nodule. This part contains abundant of crinoideas. Gastropods, sponges, rugosa coral are also present. Fusulinids discovered in this part usually large size up to 1 – 1.5 cm in diameter. This stratigraphic block 1 underlies stratigraphic block 2 by fault contact.

The stratigraphic block 2 is total approximately 450 m thick. This part consists of 2 rock units. The bottom unit is composed of thickly bedded of light gray to gray wackstone intercalated with dark gray packstone. This bottom unit is approximately 320 m thick. The top unit is approximately 130 m thick. The rocks in this unit are composed of thickly bedded of dark gray packstone intercalated with gray mudstone. Dike and sill of volcanic rocks exist at this unit at many localities. Some bed characterize by thinly bedded argillaceous limestone, some part contain chert nodule, secondary iron concretion. Ammonoids and Fusulinids are dominantly in this part. Other fossil assemblages are crinoideas, gastropods, rare rugosa coral and tabulata coral. This stratigraphic block overlies stratigraphic block 1 and underlies stratigraphic block 3 by fault contact.



**Figure 2.2** Topographic map of the study area showing the 3 stratigraphic blocks, traverse sections, and attitude of bedding in the study area.

The stratigraphic block 3 is approximately 100 m thick, consist of 80 m thick of bottom unit and 20 m thick of upper unit. The rocks in lower unit are composed of very thick-bedded, light gray to gray mudstone. The rocks in the upper unit consist of gray to dark gray packstone. Limestone breccia, chert nodule, and dolomitic limestone also exist at some locality. Fossil assemblages in stratigraphic block 3 are composed of numerous rugosa coral, tabulata coral, crinoideas, and smaller forams. Fusulinids are very rare. Ammonoids occurred at the upper unit. This stratigraphic block 3 overlies stratigraphic block 2 with a fault contact. The clastic rocks consist of greenish-gray siltstone intercalated with gray shale.

The composite geologic column of the study area with brief description is illustrated in Table 2.1. According to the small scale in the Table 2.1, all of description could not be illustrated in detail. The detail of rock descriptions, sample locations, attitude of bedding, and fossils containing in 9 traverse sections (section number 2 to section number 10) are illustrated in the appendices.

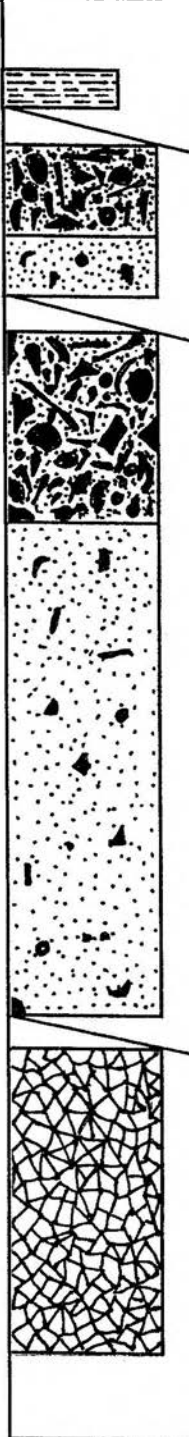
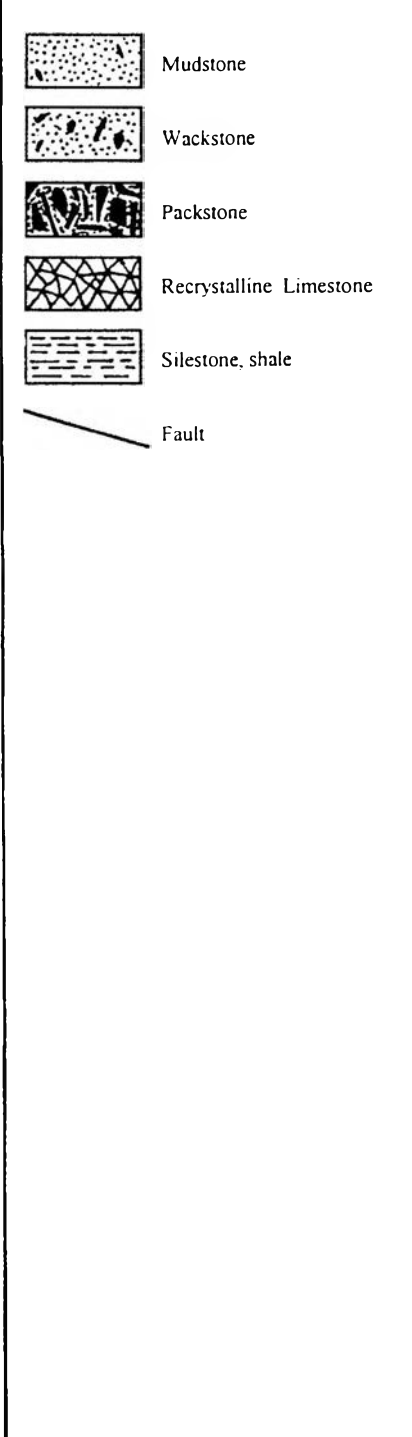
COMPOSITE GEOLOGIC COLUMN	AMMONOIDS	FUSULINIDS	DESCRIPTION	EXPLANATION
	<p>•••</p> <p>•••••</p> <p>•</p>	<p>•</p> <p>••</p> <p>••</p> <p>•</p> <p>•</p> <p>•</p>	<p>Greenish gray siltstone intercalated with gray shale</p> <p>Gray to dark gray packstone with limestone breccia, dolomitic limestone and chert nodule. Rich rugosa coral, tabulata coral, crinoideas, smaller foram, very rare fusulinids</p> <p>Very thick bedded light gray to gray wackstone with dolomitic limestone. Sill and dike of volcanic rock present. Rugosa coral, crinoideas, gastropods, nautiloid, and rare fusulinids</p> <p>Dark gray packstone intercalated with thin bedded gray mudstone. Dike and sill of volcanic rock present. Rich ammonoids and fusulinids. Crinoideas, gastropods, nautiloid, and sponges present.</p> <p>Light gray to gray wackstone intercalated with dark gray packstone and thinly bedded gray mudstone with secondary dolomitic limestone, and iron concretion. Fusulinids dominantly, crinoideas, gastropods, tabulata coral, and algae present. Rare ammonoids.</p> <p>Very thick bedded, light gray to white recrystalline limestone. Abundant crinoideas, rugosa coral, tabulata coral, and fusulinids.</p>	 <p>Mudstone</p> <p>Wackstone</p> <p>Packstone</p> <p>Recrystalline Limestone</p> <p>Siltstone, shale</p> <p>Fault</p>

Table 2.1 Composite Geologic Column of Khao Nong Hoi, Amphoe Pak Chong, Changwat Nakhon Ratchasima.