CHAPTER I

INTRODUCTION

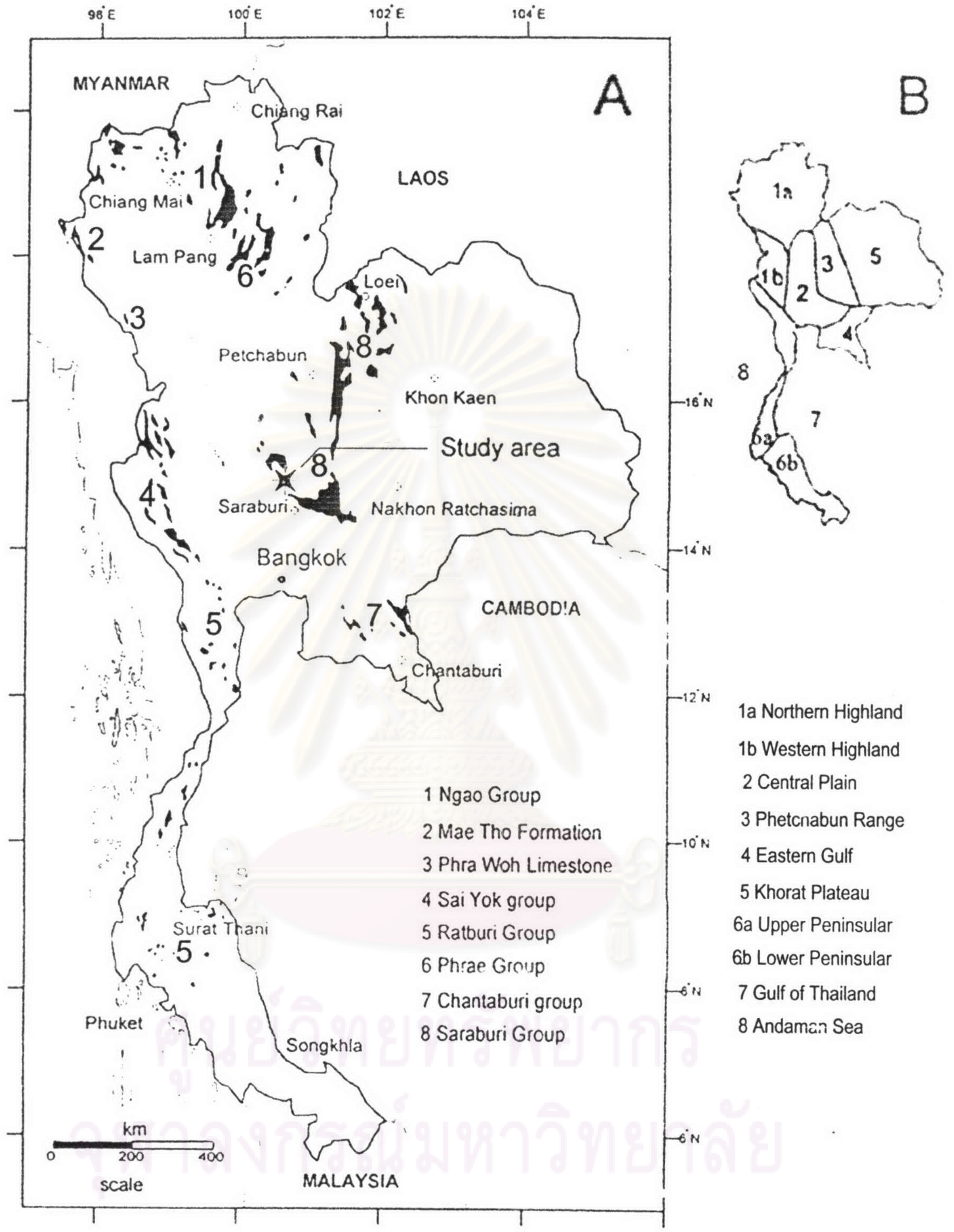
Constructions in new civilization consume a vast volume of rocks as construction materials. In Thailand, a great economic growth in the last 30 years has subsequently increased the demand of carbonate rocks, which are the most important sources of the construction materials. Several million tons of limestone and marble have been utilized as crushed stones and for cement production every year. Furthermore, the carbonate rocks have been used as the raw material in many other industries, such as, fillers, and source of lime for chemical purposes.

In Thailand, the most economically important and widely distributed carbonates are inferred to be Permian Period. They were primarily known as the Ratburi Limestone (Brown et al., 1951) and subsequently changed to Ratburi Group (Javanaphet, 1969).

Further detailed investigations by many geologists have divided them into various lithostratigraphic units according to their different physiographic regions and tectonics regimes, based on Lexicon of stratigraphic names (Department of Mineral Resources [DMR], 1992) as shown in Figure 1.1.

The Saraburi Group has been proposed by Bunopas (1981) as the carbonate successions which were deposited in tectonic terrane different from the rocks previously referred to as the Ratburi Group. The Saraburi Group is widely exposed in Petchabun mountain range adjacent to the western rim of the Korat plateau extending from Saraburi province to Loei province. Thus, the greatest limestone productions for construction materials and cement industry have been produced from carbonate successions particularly in Lop Buri – Saraburi area.

Although the carbonate rocks from this area is the most economically important resource but their geological knowledge ,which is desirable for both scienctific and industrial aspects, has been poorly established particularly regarding to their detailed



INITIAL MICROFACIES AND LITHOSTRATIGRAPHY OF PERMIAN CARBONATE SEDIMENTS IN THE VICINITY OF KHAO LAMPHEAN, AMPHOE NONG MUNG, CHANGWAT LOPBURI.

Figure 1.1 Index map of Thailand showing the distribution of different lithostratigraphic unit of Permian rocks (A) and its physiographic regions (B) (Modified after Geological Map of Thailand scale of 1 : 2,500,000; DMR, 1987 and Lexicon of Stratigraphic Names of Thailand; DMR, 1992)

NITIPON NOIPOW 2004 | DEPARTMENT OF GEOLOGY, FACULTY OF SCIENCE CHULALONGKORN UNIVERSITY stratigraphy which still remains controversial due to the difficulties of their correlation with other carbonate succession in different areas.

For these reasons, this research is aimed firstly at establishing microfacies for the detailed lithostratigraphy and the interpretation of depositional environments of the carbonate sequences in the study area, and secondly to identify their paleontological quotients through a studying of fossil corals and fusulinids, which are the most important index faunas in Permian Period. The information of these faunas will be applicable to the correlation in other localities.

1.1 The Study Area.

1.1.1 Location.

The study area is situated in Central Thailand in the vicinity of Khao Lamphean, Amphoe Nong Muang, Changwat Lop Buri which bounded by the latitude 15° 14' 10" N to 15° 16' 20" N and longitude 100° 36' 20" E to 100° 38' 30" E. The area covers approximately 6.5 square kilometers and is located between two topographic maps scale 1: 50,000 [RTSD, Series L7017, Edition 2-RTSD], Map Sheet 5139 III, Ban Khok Sam Ran and Map Sheet 5139 IV, Amphoe Ban Mi (Figure 1.2 and 1.3).

1.1.2 Physiography and climate

The study area is located in the northern part of Changwat Lop Buri, Central Thailand. Its topography is characterized by scatter isolated limestone hills being surrounded by a rolling terrain. The elevation of the rolling terrain is between 60 to 100 meters above the mean sea level, whereas the elevations of the limestone hills are ranging from 100 to 400 meters above the mean sea level.

The climatic condition is referred to as a tropical grassland with the rainy season extends from May to October and the remaining period of the year is relatively dry. The average annual rainfall is 1,137.16 millimeters from 101.6 rainy days (averaging from 1969-1998). The annual mean temperature is 28.34 degree Celsius (averaging from 1984-1998).

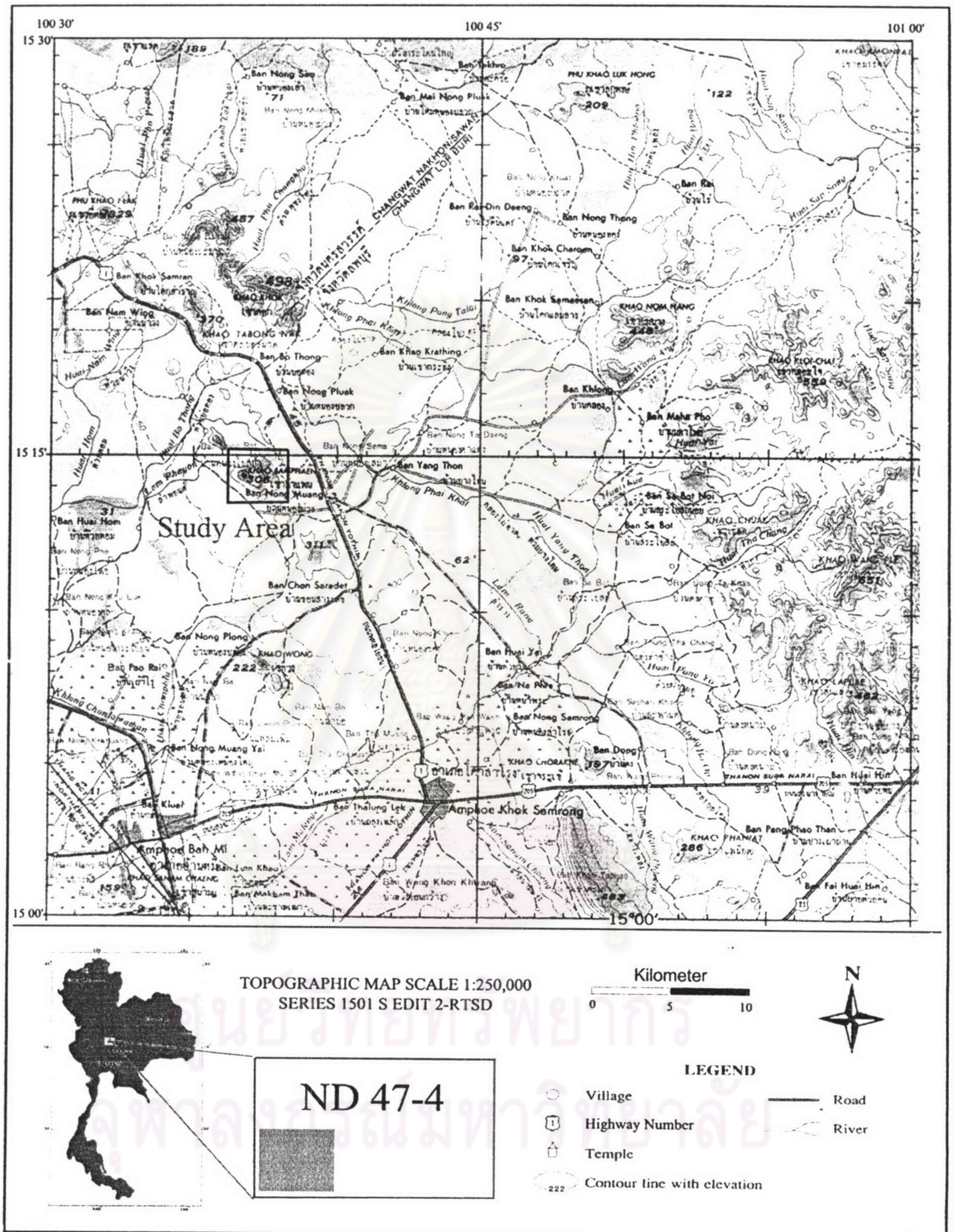


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Figure 1.2 Topographic map scale 1 : 250,000, sheet ND 47-4 Amphoe Ban Mi, series 1501S, edition 2-RTSD showing the location of the study area.

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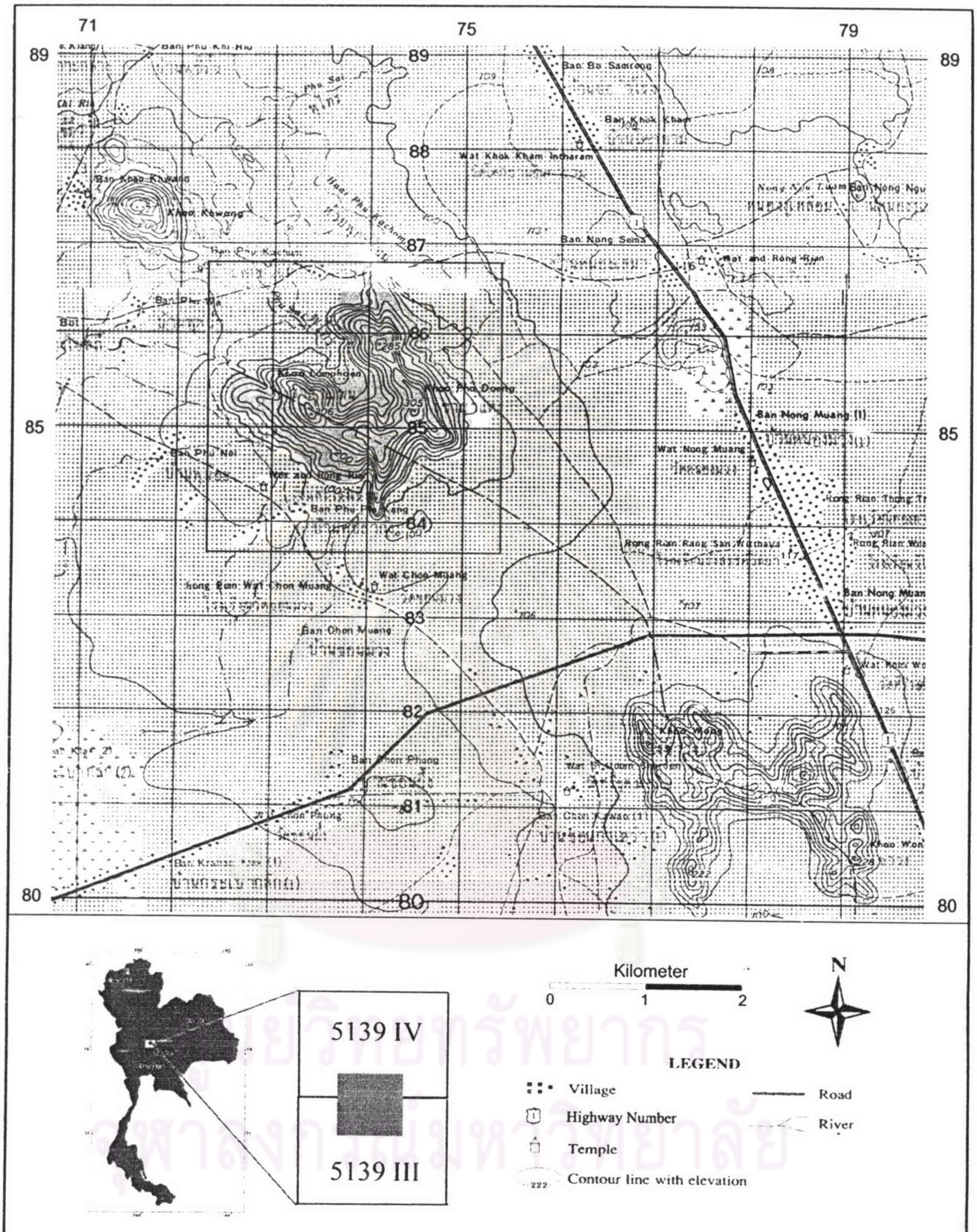

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Figure 1.3 Topographic map scale 1 : 50,000, sheet 5139 IV, Ban Khok Sam Ran and sheet 5139 III, Amphoe Ban Mi showing the boundaries and physiography of the study area.

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1.2 Purposes of Study

There are three main purposes of the study as follows:

(1) To identify microlithofacies of rock units in the study area with, emphasis on the sedimentary properties and type of grain components.

(2) To establish lithostratigraphy of the rocks units in study area and to reconstruct their respective depositional environments.

(3) To identify fusulinid and coral faunas for the age determination of rocks in the study area.

1.3 Methodology

The methodology employed in this study can be generally categorized into four main steps: office works, field works, laboratory works, and reporting as illustrated in Figure 1.4.

1.3.1 Office works

The office works include reviewing previous works (geological and paleontological aspects conducted at/near the investigation area), collecting topographic maps (scale 1: 50,000 and 1: 250,000), aerial photographs (approximate scale 1:50,000 and 1: 15,000), and carrying out photogeological work for subsequent field investigations.

1.3.2 Field investigation

The field investigation has been divided into two steps, reconnaissance field investigation and detailed field investigation.

Initial reconnaissance was carried out along 3 traverses, cross cutting the regional strike earlier determined by photogeological work.

A detailed field investigation was carried out intermittently from January, 2001 to July, 2001 for geological mapping and measuring 5 geological sections of a total 553.5

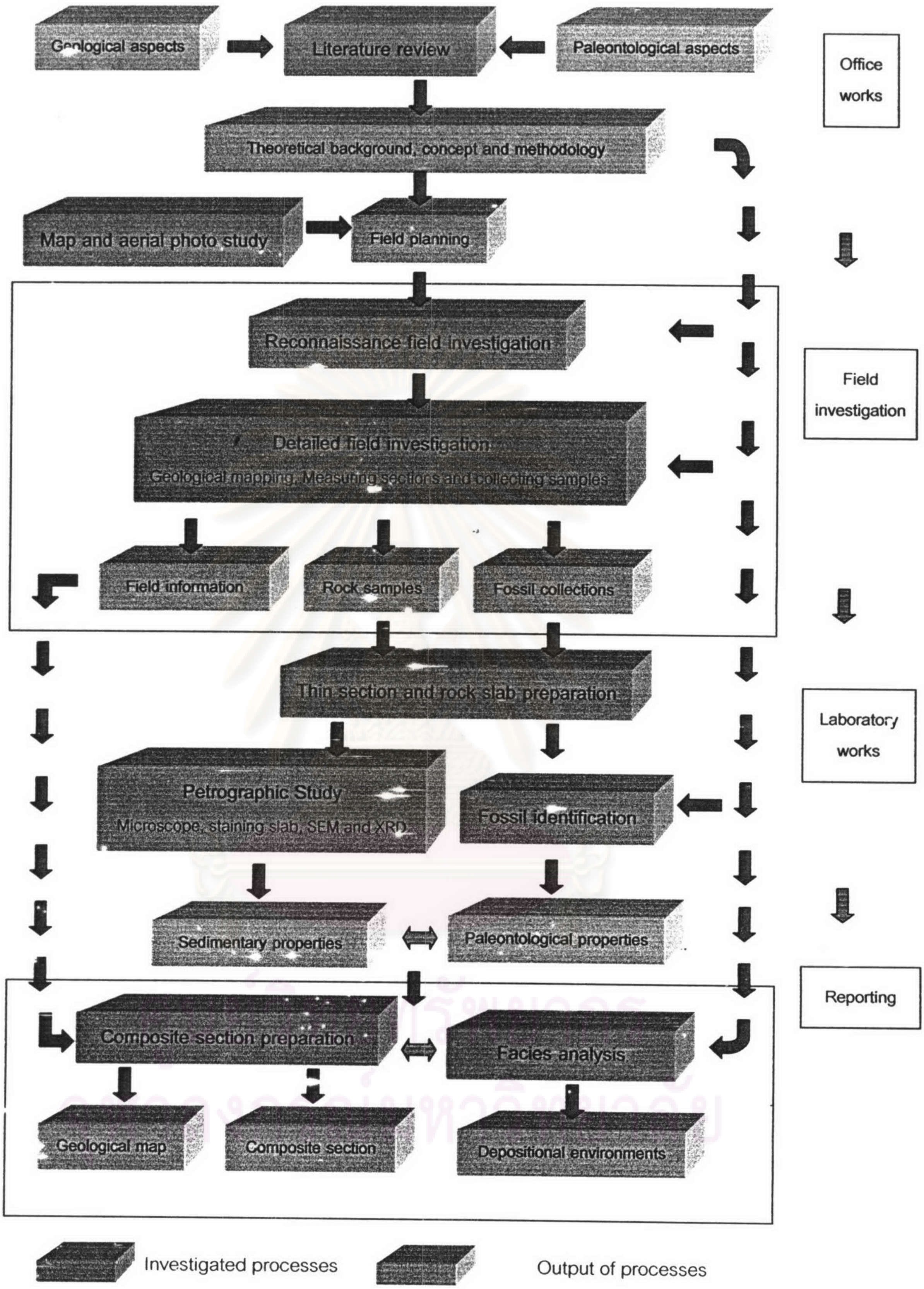

Figure 1.4 The summarized flow chart illustrating the methodology of the study.

meters in lengths including the sampling of 385 representative rock samples and faunas collections from the measured sections.

1.3.3 Laboratory works

The laboratory works consist of two phases, namely, sedimentary petrography and paleontology. In order to classify the carbonate rocks based on the classification proposed by Folk (1959 and 1962), a total of 158 thin-sections were carefully prepared and studied under a petrographic microscope. In additional, 12 rock slabs were stained using the staining technique proposed by Hutchison (1974). Besides, some samples were analyzed by X-ray diffractrometry powder technique and scanning electron microscope (SEM) for their mineral identification.

For the paleontological works, 45 thin-sections have been prepared from the collected fusulinid and coral faunas for identification.

1.3.4 Reporting

It clearly shown that the result of careful petrographical and paleontological investigation, different microlithofacies of the carbonate rocks can be recognized and a vertical sequence analysis of five composite stratigraphic sections, based on facies study, can be established. Their sequence boundaries are identified at surface of distinctive lithofacies. Moreover, vertical changes in lithofacies and biofacies have also been used to reconstruct temporal changes in their depositional environments.

1.4 Previous Works

Prior to the present study, numerous investigations were carried out by many workers regarding to regional geology, carbonate facies and stratigraphy.

Lee (1923) carried out a geological reconnaissance across Kaeng Khoi–Pak Chong, subsequently the name “Ratburi Limestone” was primarily designated for the successions consisting mainly of limestones and some clastic rocks which had the evidences of Permian and Carboniferous ages all over Thailand (Brown et al., 1951).

Borax and Stewart (1966) studied detailed stratigraphy of many Permian sections situated in the western rim of the Korat Plateau. Generally, the Permian sequence is characterized by limestones interbedding or interfingering with shales, sandstones, and conglomerates. The gray, fine grained of well-bedded fossiliferous limestones are mostly discovered, reef facies are proposed by the evidence of boulders of reef talus. The measuring indicated thickness of the Permian limestone ranges between 452 meters and 2,568 meters.

By more detailed stratigraphy, the department of mineral resources [DMR.] published a geological map, scale 1:1,000,000, of Thailand and proposed the so-called "Ratburi Group" for successions of their associated clastic rocks of Permian age (Javanaphet, 1969).

In 1981, the regional stratigraphic correlation of stratigraphic succession in Thailand have been drawn out on the basis of tectonic evidences for the first time (Bunopas, 1981). The new concept divided Thailand into two tectonic terranes as the so-called Shan-Thai terrane and Indochina terrane.

The Ratburi Group was restricted only to the carbonate successions of the Shan-Thai terrane located in the western region and the peninsula of Thailand. Likewise, the "Saraburi Group" was referred to the Permian carbonate–clastic successions consisting predominantly of massive to thinly bedded limestones with some minor shale and sandstones which were cropped out in the western passive margin of the Shan-Thai terrane that so-called "Loei fold-belt" (Bunopas and Vella, 1983). The fold-belt is north-south trending by continuous outcrops of upper Paleozoic rock, which at least 400 kilometers extends southwards from Laos though Loei, Petchabun and Lop Buri Province.

Since 1992, Bunopas revised his hypothesis and proposed 7 stratigraphic belts of Thailand (Figure 1.5) according to their difference in stratigraphy and tectonic setting. The

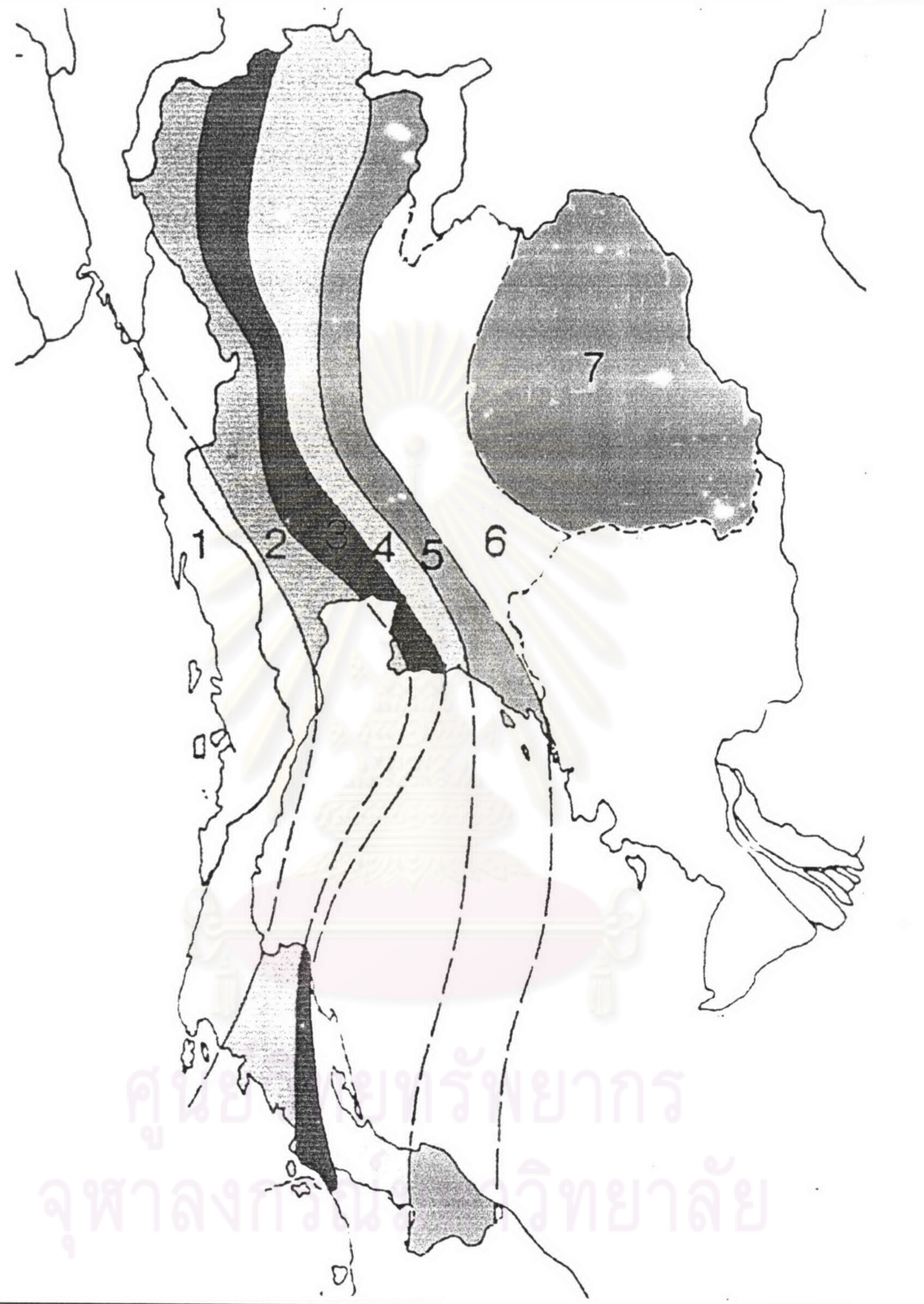

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Figure 1.5 The map of Thailand showsing seven stratigraphic belts; the belts No.1-5 on Shan-Thai terrane and the belts No.6-7 on the Indochina terrane (Bunopas, 1992)

Permian Saraburi Group were assigned only in the belts NO.6 and 7 which was located in the Indochina block to the east of Nan Suture (Table 1.1). Thus, the present study area, which is on the belt NO.6 in the Western Plateau Margin, is accordingly a part of the Saraburi Group.

Previously, The Saraburi Group was subdivided into various formation by many geologists according to their 1:250,000 scale, geological maps conducted by [DMR] in many different parts of the Loei fold-belt between the years 1975-1985, namely, Loei-Nong Bua Lumphu area (Charoenprawat et al., 1984), Phetchabun-Chaiyaphum area (Chonglakmani and Sattayarak, 1984), Khok Samrong-Nakorn Sawan area (Nakornsri, 1976, and 1981), Saraburi-Loei area (Bunopas, 1981) and Saraburi area (Hinthong, 1981, and 1985).

However, the correlation of Saraburi Group in different areas still remains controversial because tne lack of their detailed stratigraphy and rare widely recognized type sections.

Permian has commonly been divided into 2, 3 or 4 subsystems on historical, geological, biostratigraphical or geographical basis. This fact may rise problems, for example the term "Lower Permian" does not mean the same stratigraphical range for all authors.

In Thailand, the previously investigations presented different standard Permian subdivision but this work will not mention about it, the Permian subdivision of the previous works will be referred to the same as proposed in the original.

A new scheme for Permian chronostratigraphic subdivisions was lately proposed by the Permian chronostratigraphic Subcommission [ICS] (Jin et al., 1997). It was standardized by selected fossil zones, which the names of series and their constituent stages being based on marine successions from respective references from Ural, Southwest USA, and South China (Table 1.2), and include the correlation of different subdivisions from many authors. To avoid confusion, this scheme will be applied in the present study.

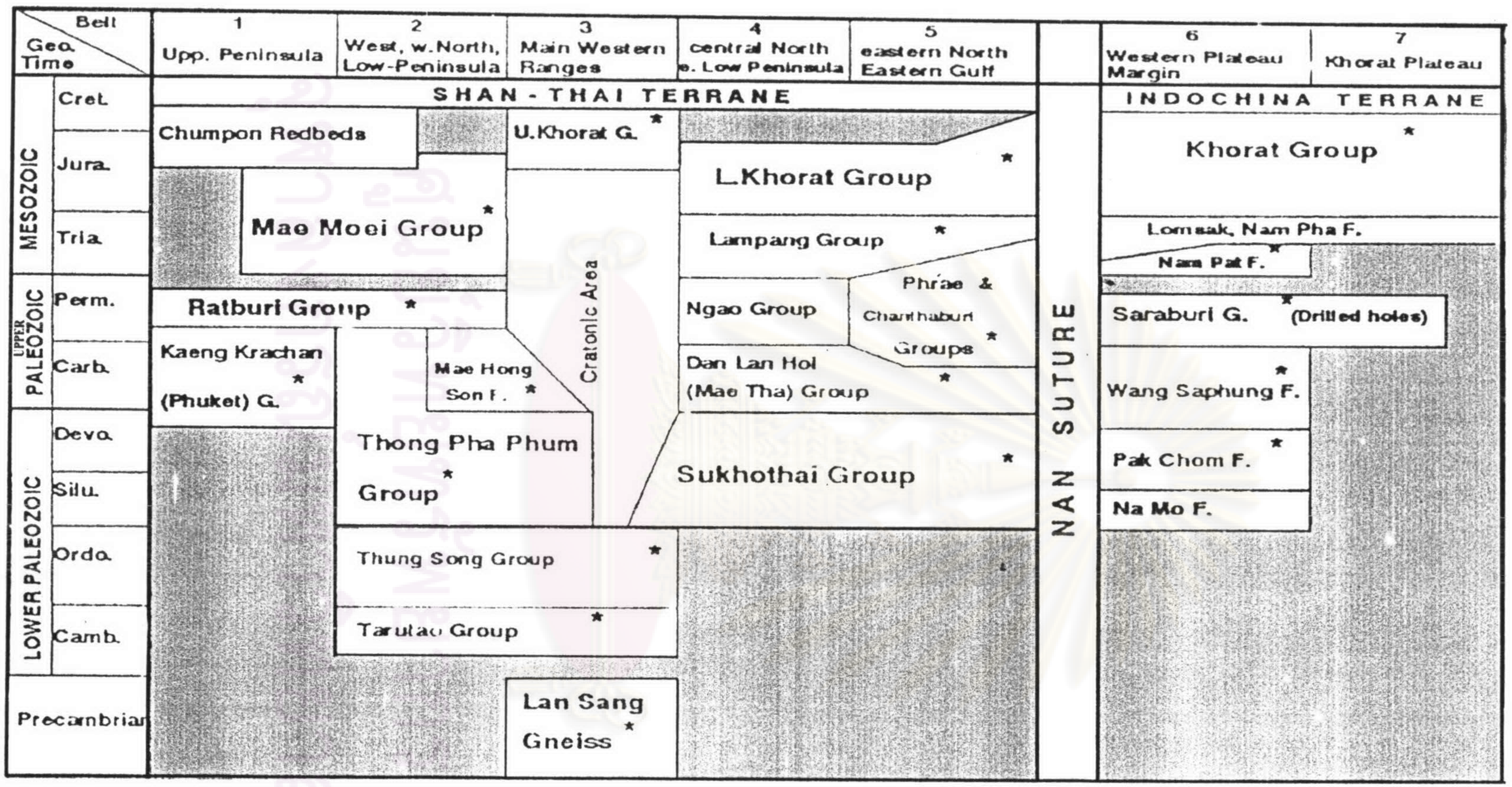

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Table 1.1 Generalized stratigraphic nomenclature of Thailand within seven stratigraphic belts (After Bunopas, 1992).

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SERIES		STAGES	SELECTED FOSSIL ZONES			Polarity	Ma
			Ammonoids	Conodonts	Fusulinids		
Triassic		Griesbachian	*Ophiceras* *Otoceras*	*Hindeodus parvus*			251.1
PERMIAN	Lopingian	Chang-hsingian	*Pseudotirolites* *Paratirolites - Shevyrevites* *Iranites- Phisonites*	*Clarkina changxing-ensis* *C. subcarinata*	*Palaeofusulina sinensis*		± 3.6 253.0
		Wuchia-pingian	*Araxoceras-Konglingites* *Anderssonoceras* *Roadoceras- Doulingoceras*	*C. orientalis* *C. leveni* *C. dukouensis* *C. postbitteri*	*Nanlingella simplex- Codonofusiella kwangsiana*		± 0.3
	Guadalupian	Capitanian	*Timorites*	*Jinogondolella altudaensis* *J. postserrata*	*Lepidolina* *Yabeina* *Polydiexodina shumardi*		264.1
		Wordian	*Waagenoceras*	*J. asserata*	*Neoschwagerina craticalifera*	Illawarra Riversal	± 2.2
		Roadian	*Demarezites* *Stacheoceras discoidale*	*J. nankingensis*	*Praesumatrina neoschwagerinoides* *Cancellina cutalensis- Armenina*		
	Cisuralian	Kungurian	*Pseudovidrioceras dunbari* *Propinacoceras busterense*	*Mesogondolella idahoensis* *Neostreptognathodus pnevi-* *N. exculptus*	*Misellina claudiae* *Brevaxina dyhrenfurthi*		272.2
		Artinskian	*Uraloceras fedorowi* *Aktubinskia notabilis- Artinskia artiensis*	*N. pequopensis* *Sweetognathus whitei-* *M. bisselli*	*Pamirina* *Chalaroschwagerina vulgaris*		± 3 2 280.3
		Sakmarian	*Sakmarites inflatus* *Svetlanoceras strigosum*	*S. primus* *Streptognathodus postfusus*	*Robustoschwagerina schellwieni* *Sphaeroschwagerina sphaerica*		± 2.6
		Asselian	*S. serpentinum* *S. primore*	*S. constrictus* *S. isolatus*	*S. moelleri- P. fecunda* *S. vulgaris*		290 6 ± 3.0
Carboni-ferous		Gzhelian	*Shumardites confessus- Emilites plummeri*	*S. wabaunsensis* *S. elongatus*	*Daixina robusta- D. bosbytauensis* *T. stuckenbergi*		300.3 ± 3.2

Table 1.2 Permian Chronostratigraphic Subdivision approved by the Permian Subcommission, ICS (Jin et al., 1997).