



CHAPTER I

INTRODUCTION

Mesozoic rocks in Thailand can be divided into 2 types based on depositional environments viz. marine deposits and continent deposits (Chonglakmani, 1983). Marine sediments are widely distributed in Thailand, mostly they occurred in Triassic times, particularly Lampang Basin (Charusiri et al., 1994), Phrae Basin (Chaodumrong, 1993), Songkhla Basin (Amphronmaha, 1995). Recently Jurassic marine sediments have been reported in western Thailand (Meesook et al., 1985). Most Triassic rocks are mainly clastics with intercalated limestones in some parts. The rock strata are regarded as Triassic due to the occurrence of index bivalve fossils as *Halobia* and *Daonella*. Detailed studies of Triassic rocks are described and reviewed in Chapter II. Triassic sediments have also been reported in Changwat Mae Hong Son (Bunopas, 1981). However, few reports has made described (e.g., Tofke et al., 1993; Caridroit et al., 1993).

Characteristics and compositions of marine sedimentary rocks are important for verifying depositional and paleogeography of the concerned area. In this circumstance, data from field investigations, petrographic study, and geochemical analysis.

Changwat Mae Hong Son (or Mae Hong Son Province) is selected for this study due to its recent accessibility, although the area is characterized by mountains and valleys. In the past, travelling was difficult, so geological knowledge of this area was poorly understood. This is the reason that no published paper has been made before 1970.

Triassic paleogeography of mainland Southeast Asia can be constructed on the basis of the distribution of Triassic sedimentary facies and related plutonism and volcanism (see also Chonglakmani, 1999). Therefore, detailed studies of Triassic stratigraphy, paleontology, and sedimentology are critical for understanding the geotectonic evolution and for imposing constraints on the proposed model.

1.1 Location and Geography

The study area is a north-trending area of about 120 km long, located in northwestern Thailand extending from Amphoe Muang Mae Hong Son-Amphoe Khun Yuam-Amphoe Mae La Noi to Amphoe Mae Sariang, Changwat Mae Hong Son (Figure 1.1). The study area is far from Bangkok about 940 kilometers to the northwest. It is located between latitudes 18°00'16" N-19°09'41" N, and longitudes 97°48'33" E-97°58'48" E. The area appears in the reference topographic map at a scale of series 1501 S is the sheet NE 47-2 (Amphoe Chiang Dao), and NE 47-6 (Changwat Chiang Mai) the 1:250,000 scale, Edition 12-RTSD, and parts of the topographic map sheets Ban Huai Pong (4547 II), Amphoe Khun Yuam (4546 I), Ban Mae La Luang (4546 II), Amphoe Mae La Noi (4545 I), and Amphoe Mae Sariang (4545 II) on the scale of 1:50,000, Series L 7017. The study area covers approximately 2,234 square kilometers and can be accessed by highway no. 108 from Amphoe Hod, Chiang Mai to Mae Hong Son.

The topography of the area is mostly high mountainous (85%) and valleys (15%). The area is characterized by a rugged topography with elevation ranging from 500 to 1,203 meters. The highest mountain in this area is at Doi Khun Mae Ki (1,203 meters MSL). The main river flowing to the south is Mae Nam Yuam. It passes Amphoe Khun Yuam, Amphoe Mae La Noi, and Amphoe Mae Sariang, with the total 215 kilometers long. It joins Mae Nam Moei at Ban Sob Moei, Amphoe Sob Moei.

The climate regime of the area is tropical zone of the northern hemisphere, and is under the influence of seasonal monsoon wind. Seasonal influences of the India Ocean trade winds and the Asiatic monsoons result in a tropical climate. The southwestern monsoon (or rainy season), occurs mainly between May and October, and the northeast monsoon or dry season is mainly between November and January. The average annual rainfall of the region is approximately 1,456 mm. The temperature may be down to below 10° especially in the mountainous area during cold seasons. The hot season extends from March to May of which the temperature may between 30° and 33° C.

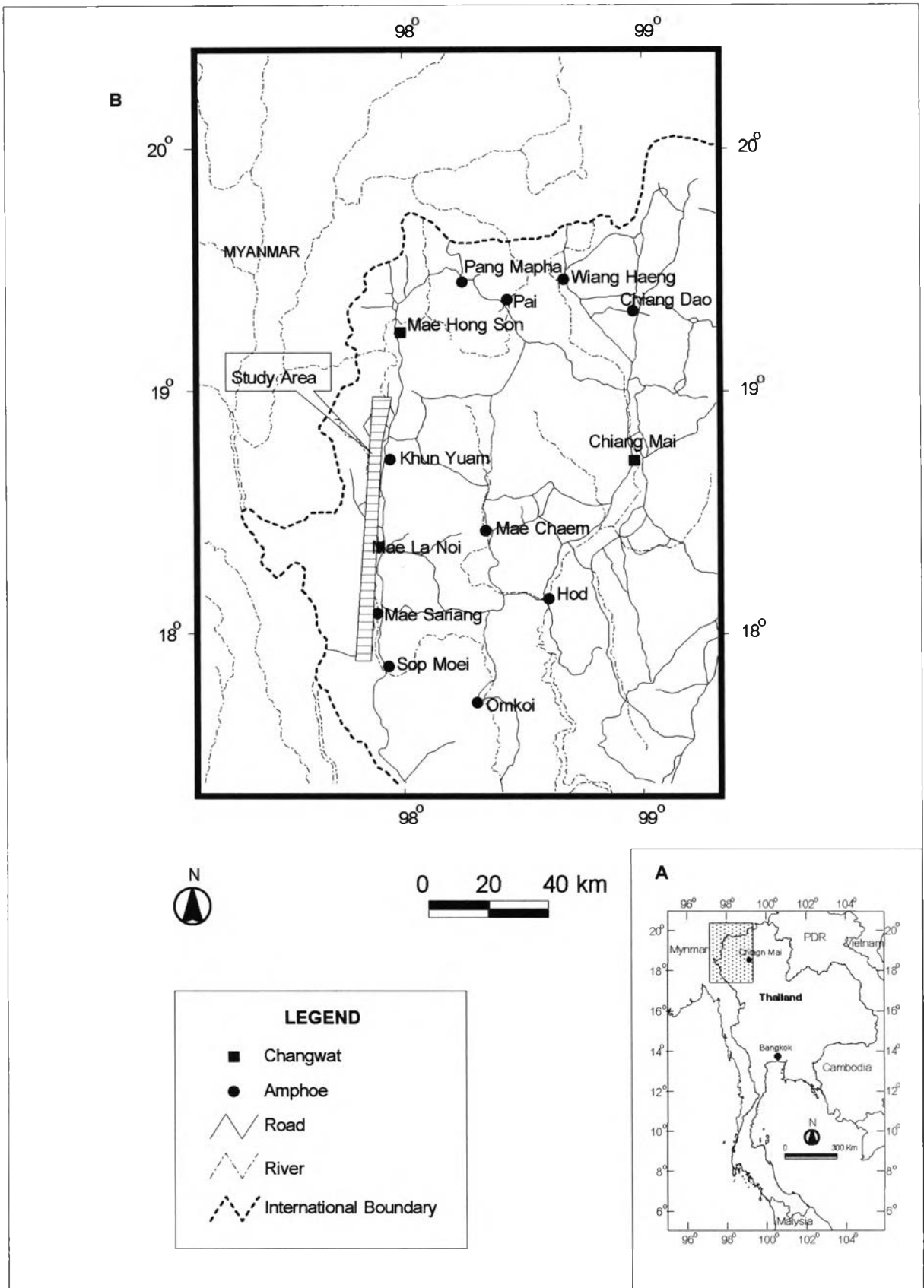


Figure 1.1 Index map of Thailand (A) showing location of the study area in Mae Hong Son province.

1.2 Objective of the study

Primarily, the purpose of this study is to define lithostratigraphy of some Triassic clastic rocks in southern part of Amphoe Muang Mae Hong Son, Changwat Mae Hong Son, northwestern Thailand. Additional purpose is to analyze the sedimentary sequences in terms of sedimentary facies and to reconstruct the depositional environment and tectonic setting of the sediments of this study area.

1.3 Methodology and scope of work

Basically, the previous and existing information on regional geology of the northern part of Thailand reviewed to server as a background of the present study. Later on, the study is focussing upon geological setting of Triassic clastic rocks in the southern part of Amphoe Muang Mae Hong Son and adjacent areas in order to fully understand the geological history, sedimentation model as well as the geological evolution of the study area.

In order to fulfill the objectives and scopes of the study, the methods of investigation (Figure 1.2) have been systematically performed as explained below:

1. The first stage involves one-fourth of all activities and time duration of the study project. It also depends partly on the existing data, and available financial support. Firstly, geological data of the study area were collected, reviewed, and compiled for further step of work, together with literature reviews of theories and related case studies of detrital chromian spinels.
2. The second stage is office-work study, including aerial photographic and satellite image interpretation, and checking reliability of data. Aerial photograph and satellite image investigation were undertaken on the 1:50,000 and 1:250,000 scale, respectively. All data from previous investigations were carried out to serve as a basis for further field investigation programs.
3. The third stage is systematic field and stratigraphic mapping and particularly measured rock sections were undertaken along Ban Huai Pong-Khun Yuam-

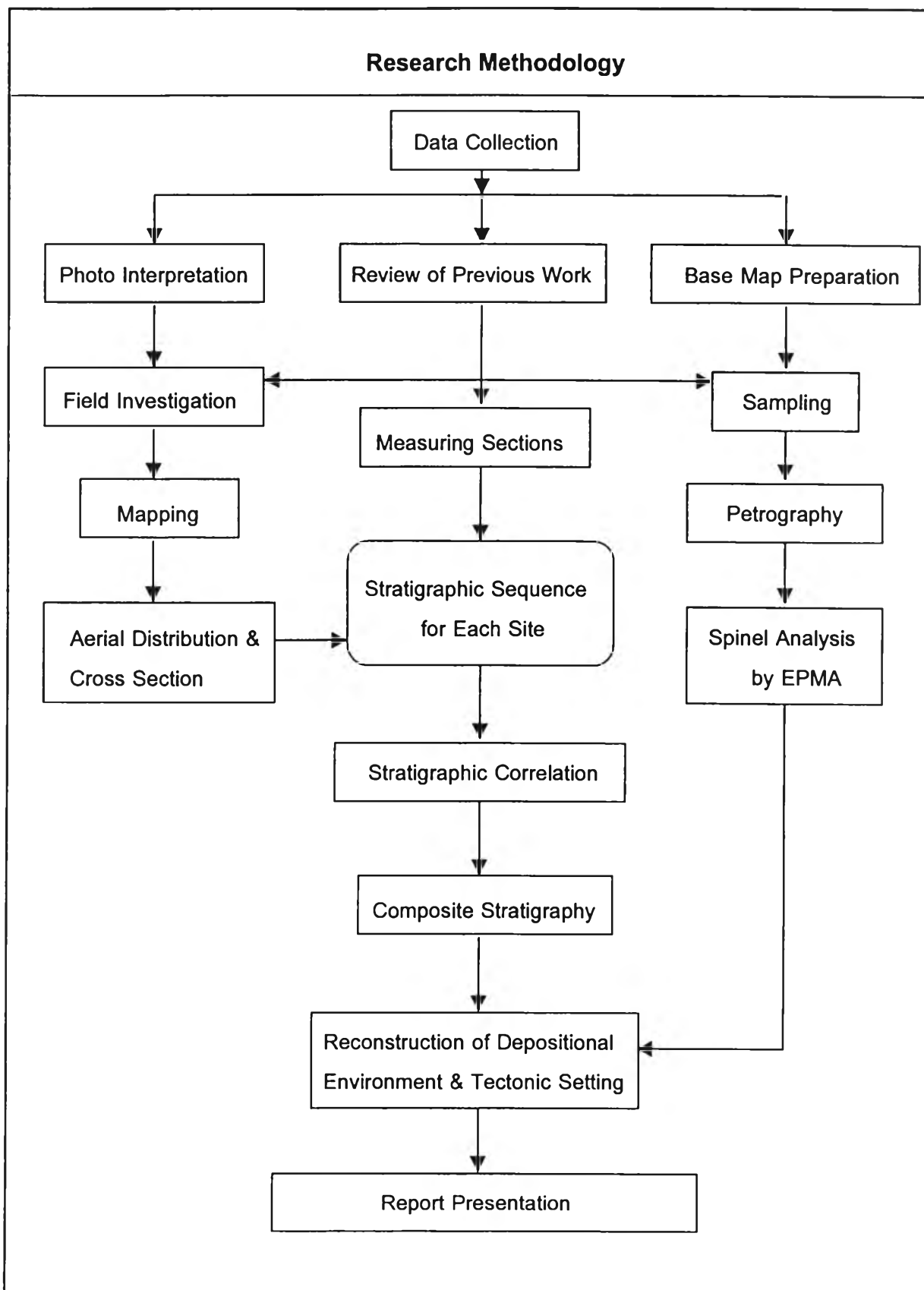


Figure 1.2 The summarized flow chart illustrating methodology used in this study.

Mae La Noi-Mae Sariang. Representative rock sampling of the Triassic clastic rocks was carried out for more detailed investigation in the laboratory. Collected sedimentary rocks were described under classifications of Pettijohn (1975), and interpretation of rock was done following Selley (1996).

4. The fourth stage commences with laboratory investigation. The sedimentary structures, textures, and compositions were studied by petrographic techniques. For the petrographic work, it includes the determinations of 3 rock-slaps and 65 thin-sections. Subsequently, appearance, distribution, morphology and composition of detrital chromian spinels usually found in sandstones, were petrographically identified and described, and later on were geochemically analyzed. Quantitative major element analysis of detrital chromian spinels was carried out by the Electron Probe Microanalysis (EPMA) at the Chemical Analysis Center, the University of Tsukuba, Japan.
5. The fifth stage involves synthesis of all geological data, related information, and data of detrital chromian spinels. Finally, conclusion was made for the stratigraphic designation, depositional environment, and tectonic evolution of the Triassic clastic rocks of southern part of Amphoe Muang Mae Hong Son.

1.4 Data Sources and Previous Investigations

1.4.1 Data sources

The studied data have been provided by the Geological Survey Division, the Department of Mineral Resources in Bangkok. The data comprise of geological map of Thailand 1:1,000,000 scale, geological maps of Sheet Chiang Dao 1:250,000 scale, sheet Chiang Mai 1:250,000 scale, and geological maps 1:50,000 scale of sheets, Ban Huai Pong (4547 II), Amphoe Khun Yuam (4546 I), Ban Mae La Luang (4546 II), and Amphoe Mae La Noi (4545 I).

1.4.2 Previous investigations

A. Geology and structure

Baum et al. (1970) first described sediments with Triassic fossils in the Mae Sariang-Mae Hong Son area and include thick sequences of sandstone, shale and limestone.

Bunopas (1976) reported type sections of the Mae Sariang Group at several road cuttings and streams east and west of Mae Sariang and at Khun Yuam about halfway between Mae Sariang and Mae Hong Son. The best exposure is between 5 and 10 kilometres west of Mae Sariang across a ridge that separates the Salween River to the west from the Mae Sariang valley to the east. The beds exposed include basal red conglomerate 50 metres thick, followed by grey shale, and interbedded grey siltstone and fine-grained sandstone, in all about 700 metres thick. Part of the shale contains chert and limestone bands with the bivalves *Daonella* and *Halobia*, but the thickness and stratigraphic position of this calcareous sequence are not well defined. The beds dip mainly to the east, and many small folds are observed. The top of the group is about 100 metres of sandy shale, grey and red sandstone and frequent beds of limestone outcropping along the road between Mae Sariang and Mae La Noi on the Mae Sariang-Mae Hong Song Highway. The total known thickness of the Mae Sariang Group is 850 metres.

Charusiri et al. (1992) studied lineaments in 3 provinces of northern Thailand namely Chiang Mai, Tak, and Mae Hong Son, and areas adjacent to the Thailand-Myanmar border. Space-borne image interpretation indicates two major faults; i.e., the N-trending Mae Hong Son and NW-trending Mae Ping (or Moei-Uthai Thani) Faults. Both large-scale faults are inferred to be closely related to nearly parallel substantial foldings and thrustings. Four sets of lineaments have been observed, namely N-S, NE-SW, NW-SE, and E-W trendings, all of which are considered to take essential roles in the occurrences of various mineral deposits.

Tofke et al. (1993) studied detailed stratigraphy in the region of Mae Sariang, and reported Triassic turbidite sequence of typical pre-orogenic and syn-orogenic strata.

Caridroit et al. (1993) studied a clastic sequence west of Amphoe Mae Sariang that used to report as Triassic. Their mapping and paleontological data proved that this clastic sequence is not of Middle Triassic age but is younger (Late Triassic or younger). This conclusion is based largely on radiolarians of Middle to Late Permian age and radiolarians of Triassic age found in pebbles contained in these clastics. The outcrops studied are located approximately at km 36.5 on the highway that links Mae Sariang with Ban Mae Sam Leab. The sequence consists mainly of red conglomerate, sandstones, and shales.

Meesook et al. (2000) summarized Triassic strata of the Mae Sariang area, Changwat Mae Hong Son that they are unconformably underlain and overlain by Paleozoic and Jurassic, respectively. It can be divided into 2 informal formations as upper and lower formations with total thickness of 220 meters. The sequence comprises in ascending orders as red and greenish gray chert, thin-bedded (<10 centimeters), interbedded with claystone, thin-bedded limestone in some places; conglomerate, sandstone, and mudstone, red and gray. The sedimentary characteristics are the Bouma sequence with graded beds, and fining upward sequence. Clasts of conglomerate and sandstone consist of chert, metamorphic rock, and granite. The bivalves *Halobia comata*, *Posidonia*, *Halobia styriaca* Mojs, *Daonella cf. sumatrensis* Volz are found. These well-defined fossils indicate Triassic age.

B. Detrital chromian spinels

In Thailand, studies on detrital chromian spinels to interpret their provenances and tectonic activities are quite new knowledge. A few papers reported analytical data of chromian spinel. Punjasawatwong (1991) first reported crystalline chromian spinel data from ultramafic rocks along the Nan-Uttaradit suture zone using EPMA analysis. However the first analysis on detrital chromian spinel from sedimentary rocks is that of Chutakosikanon (2000) who studied detailed field investigation on the Nam Duk formation along the Lom Sak-Chum Phae Highway along km 16.0 to km 42.0 in Phetchabun. Chemistry and morphology of detrital chromian spinels occurring in marine sediments point to the existence of exposed ultramafic-mafic rocks during sedimentation of the Nam Duk Formation. The result reveals that the arc-related tectonic setting may

have developed in the region during Middle Permian prior to more violent subduction activity of Permo-Triassic period.

Hisada et al. (1998) reported, based on detrital chromian spinels from clastic of the Nam Maholan Formation, that the Loei area was influenced by subduction tectonic prior to Middle Permian.

Charusiri et al. (1999) also reported chemical data on detrital chromian spinels from mafic/ultramafic and clastic sedimentary rocks at six locations in Thailand. Their study indicate there the 80-called Nan-Uttaradit, Sra Kaew, and Narathiwat-Pattani sutures occurred in island-arc tectonic setting.