CHAPTER I

INTRODUCTION

1.1 GENERAL STATEMENT

Thailand, one of the developing countries, exhibits the similar pattern of increasing petroleum demand annually. This is basically due to the fact that petroleum is the most important source of energy for most of these countries. In addition, Thailand in particular is not the petroleum producing country, and petroleum has to be imported with relatively high economic cost as compared with the Gross Domestic Product, GDP. However, many parts of the country, particularly within Tertiary basins are geologically attractive to search for petroleum which lead to minimizing the import substitution of petroleum. Petroleum exploration in Thailand started in 1918 when the first oil occurrence was discovered in Chiangmai province, northern Thailand. Consequently, many national and international petroleum companies have continuously explored numerous potential areas. Among those companies, Thai Shell Exploration and Production Company began exploration program in April 1981; after that the commercial volume of oil was firstly estimated from "Lan Krabu-A01" exploration well at Lan Krabu district, Kampaengphet province. That discovery is a significant event because this oil field is the largest commercial onshore oil field of Thailand. This oilfield was subsequently named after Her Majesty the Queen as " Sirikit oil field " in 1983.

Sirikit oil field is located in the north of the central plain of Thailand, about 400 kms north of Bangkok (Figure 1.1). Geologically, it is the deepest part of the Phitsanulok Tertiary basin. Geological details of the area will be reported in the next chapter. In the early stage of exploration, localities of well were planned to cover regional structures and boundaries of the basin. Consequently, the model of basin could be roughly constructed, and the distribution of potential reservoirs has been defined. Geophysical logs and core lithofacies were investigated together in that stage.

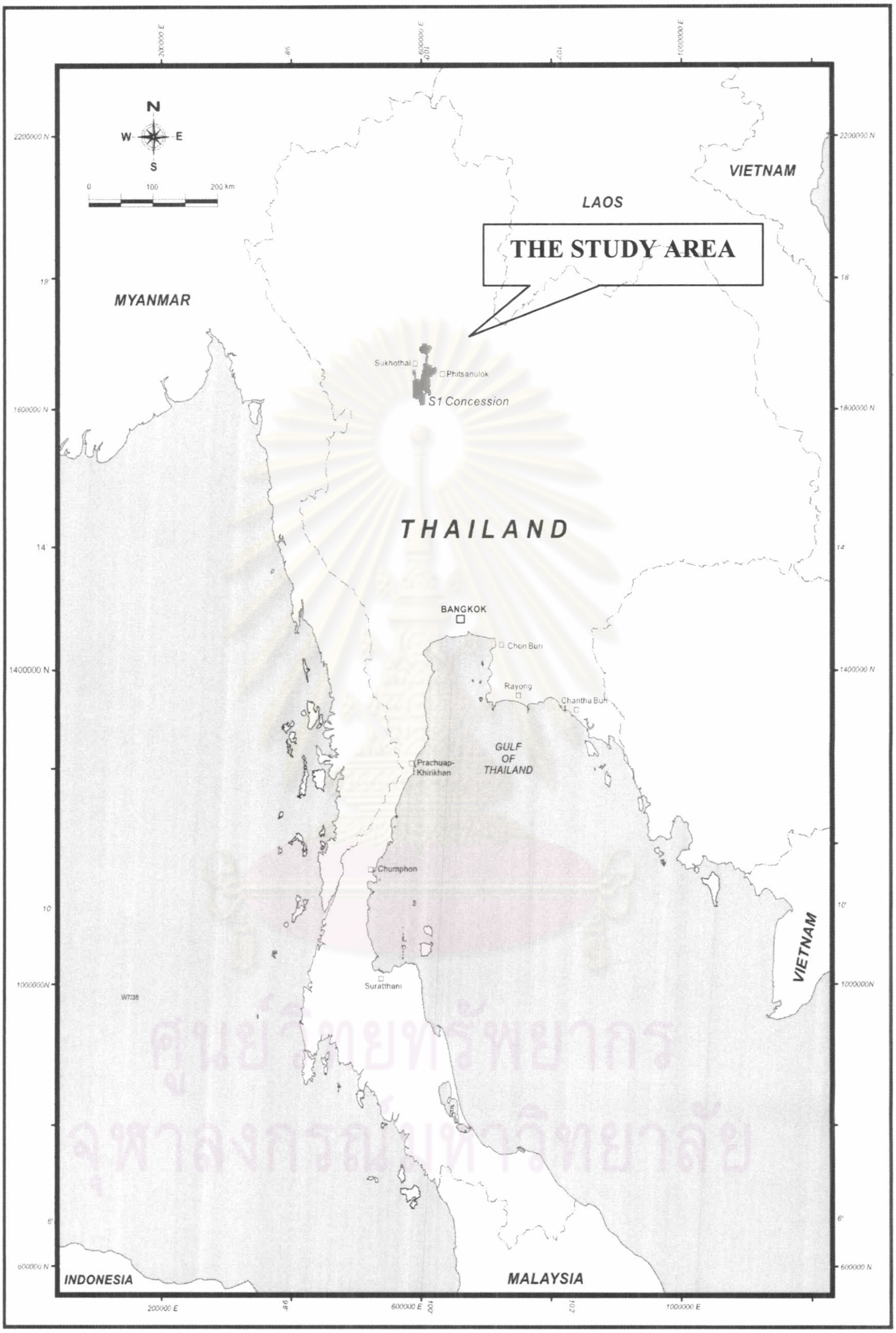

Figure 1.1 Map of Thailand showing location of the study area, Sirikit oil field in the Phitsanulok basin, northern Thailand.

Currently, the basin analysis and reserve estimation are still carried out in details along side with the production of Sirikit oil field. The reservoir development, such as reservoir modeling, is developed base on geological data. However, cores are often only available from few wells. Therefore, the evaluation from well log data represents a significant technical as well as economic advantage. Then core sampling cannot be taken place in all exploration wells; on the other hand, geophysical logging is more suitable to carry out instead. However, geophysical signals reflect physical properties of individual rock.

Core provides the significant data for interpretation of the depositional environment such as features and characteristics etc. Moreover, thickness and distribution of reservoir layers are obtained clearly using core data. Although core samples provide such good geological data, core collecting cost are expensive. Well log data are available on substantial number of wells whereas core samples are also available from few wells. Thus the core and geophysical calibration could be developed to indicate the lithofacies form geophysical log signature.

Since 1981, the study of relationship between core and geophysical log characteristic has been researched to support the depositional interpretation. Flint et al. (1988) studied the lithofacies analysis in Sirikit oil field. Lithofacies were defined based on cores taken through the reservoir formations in seven wells and firmly substantiated using macro- and micro-palaeontological data and palynological data. The core-derived lithofacies associations were matched with their corresponding log responses to enable recognition in uncored wells. Jahn et al. (1989) studied the lithofacies classification and log response using lithofacies detailed by Van Geuns and Burgisser (1982). Eventually they suggested that the core-log calibration is not reliable for all lithofacies, even there are just four lithofacies (e.g. floodplain claystone, lacustrine claystone, sand of lacustrine and fluvial origin and marginal heterolithic lithofacies of various origin). In 1997, Knipscheer reconstructed a new classification of lithofacies, based on core samples from thirteen wells; then ten lithofacies were introduced and have been referred until the recent works. Detail and description of these lithofacies are reported in Chapter 3. More detail of Knipscheer's lithofacies scheme would directly cause complexity and inconsistency of lithofacies interpretation using geophysical log data. Therefore this research project is proposed to solve or to reduce those problems. In order to obtain such reasonable procedure, core samples and log data from thirteen wells are used as database. After statistical analysis and hypothesis testing, the obtained method may be very useful for lithofacies interpretation, which extensionally supports the petroleum exploration in this area.

1.2 OBJECTIVE

The main intention of this study is to assess the relationships between geophysical logs and core lithofacies in the Lan Krabu Formation. Therefore, this leads to establishment of criteria for identification of lithofacies using geophysical logs. However, principal works on core lithofacies and geophysical characteristics of each rock unit need to be investigated in great detail before moving on to comparison and reaching the above target.

1.3 METHODOLOGY

Literature review **:** Regional geology, subsurface geology and details of lithofacies particularly emphasized on the Lan Krabu Formation are undertaken from previous works. This step leads to understanding of geological aspects, and then the strategy of this study will be formulated afterward. In addition, principle of geophysical log is assessed to build up specific idea for further discussion.

Core description **:** Basically, the core samples are crucial information for lithofacies analysis. Subsequently, this visible evidence is being used to calibrate with geophysical log signature, so that, the relationships can be well established in the present study.

Geophysical logging investigation **:** Various geophysical logs are the most common data available for subsurface geological analysis. Each log signature represents the relationships between lithological and geophysical characteristics. Interpretation of lithofacies is probably undertaken from geophysical logs using all the logs registered in individual well. However, method for interpretation should be initially systematized using lithofacies relationships, facies association, geophysical log shapes and absolute geophysical log values, consequently an application is eventually established for identification of lithofacies using geophysical logs.

Hypothesis testing **:** Although most of lithofacies are likely observed from geophysical logs, the assumption need to be proven before submitting. Hence the assumption obtained from this study is tested with two types of well. Firstly, it is tested with wells LKU-C01 and LKU-G01, which contain information of lithofacies described by Knipscheer (1997). After the firs test, well LKU-E17 is then selected for unknown lithofacies testing; however there are lithological data available for confirmation.