CHAPTER 1

INTRODUCTION

1. 1 General Statement

Thailand is one of the major sources of the world tin-tungsten supply. In 1981, Thailand produced about 42,968 metric tons of tin concentrates and 2,348 metric tons of tungsten minerals (Department of Mineral Resources, 1982). Most of tin production came from placer deposits in the southern peninsula region. Even though the tungsten minerals were mainly produced in the northern, central, and southern parts of the country, only a very small amount of them were derived from the placer mines.

The major tin and tungsten deposits of Thailand (including Mae Chedi area) have a close spatial association with granitic rocks and usually occur near their contacts either within marginal zones of the plutons or in the adjacent intruded country rocks. The granitoids in the tin belt of S.E. Asia have been divided into three belts (Figure 1.1) namely the eastern, the central, and the western belts (Mitchell, 1977; Hutchison, 1978; Beckinsale, 1979; Mahawat, 1982; Nakapadungrat, 1982). Based on the distribution of these concerned granitoid belts, the Mae Chedi granites belong to the northermost portion of the central belt.

1. 2 Location and Accessibility

The Mae Chedi area is located at the southern portion of Wiang Pa Pao district, Chiang Rai province, northern Thailand

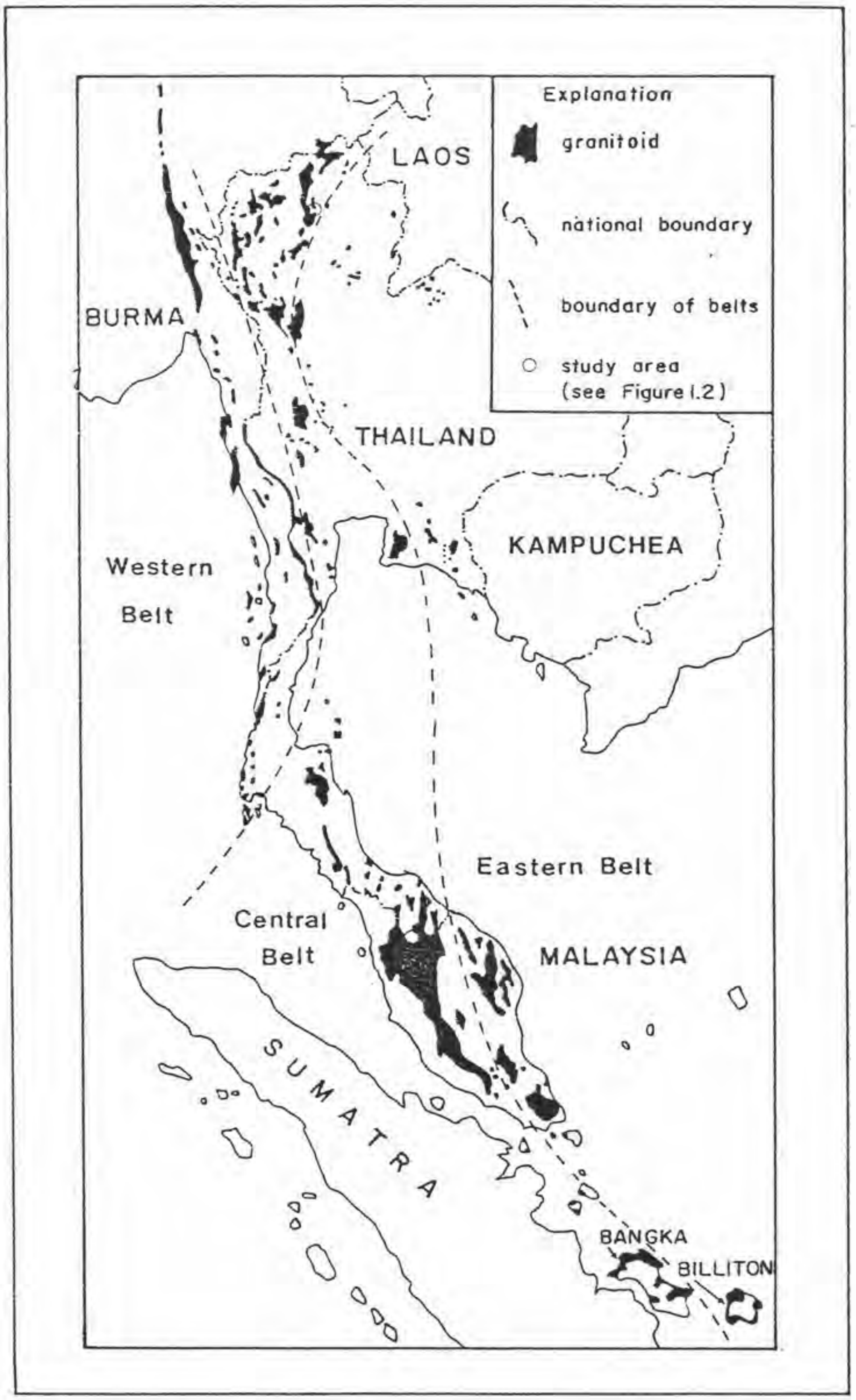

Figure 1.1 Sketch map showing the distribution of granitoids in the tin belt of S.E. Asia (compiled after Mitchell, 1977; Hutchison, 1978; Beckinsale, 1979; Mahawat, 1982; Nakapadungrat, 1982).

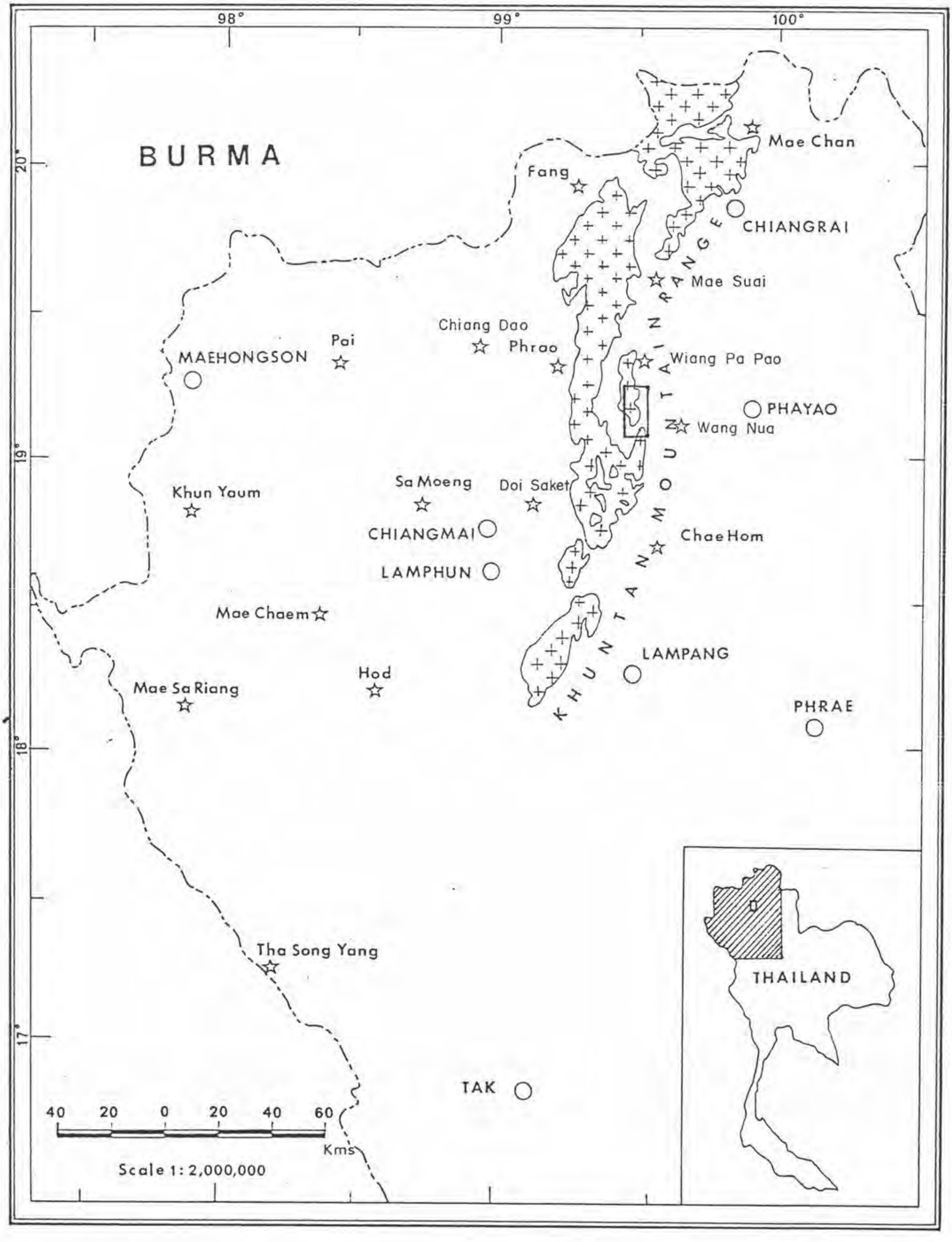

Figure 1.2 Index map of northern Thailand showing the location of the study area.

(Figures 1.2, 1.3). The area covers 10 percent, the northeastern part, of the sheet 4847 II and the additional 5 percent, the northwestern part, of the sheet 4947 III, topographic map scale 1:50,000, series L 7017. In other words, it is bounded by latitudes 19° 06' 39" and 19° 15' 00" N and longitudes 99° 26' 50" and 99° 31' 25" E which occupies and area approximately of 100 km^2.

The Mae Chedi Mine is situated at 19° 07' 26" N, 99° 28' 27" E near the southern end of the area studied. It is accessible in all seasons, by travelling 65 km northeasterly from Chiang Mai province along the Highway 1019 or about 30 km southerly from Wiang Pa Pao along the same Highway. Another access is by travelling northwestwards from Wang Nua district, Lampang province to Ban Mae Khachan along the road for about 15 km and southwestwards along the Highway 1019 for approximately 12 km passing Ban Mae Chedi, Ban Mae Chomphu, and then to the Mae Chedi Mine.

1. 3 Climate and Vegetation

Chiang Rai province has a tropical sanvanna climate. The rainy season commonly ranges from May to October under the influence of the southwest monsoon. The cold dry season with the mean temperatures down below 20° C usually starts in November and lasts in February while the area has been influenced by the northeasterly prevailing wind. During this period, dense fogs frequently occur in the early morning. The summer is relatively short, with a rather dry period in March to April.

Vegetation in the area comprised shrubs and trees. The cultivated crops include rice, tobacco, soyabean, peanut, garlic,

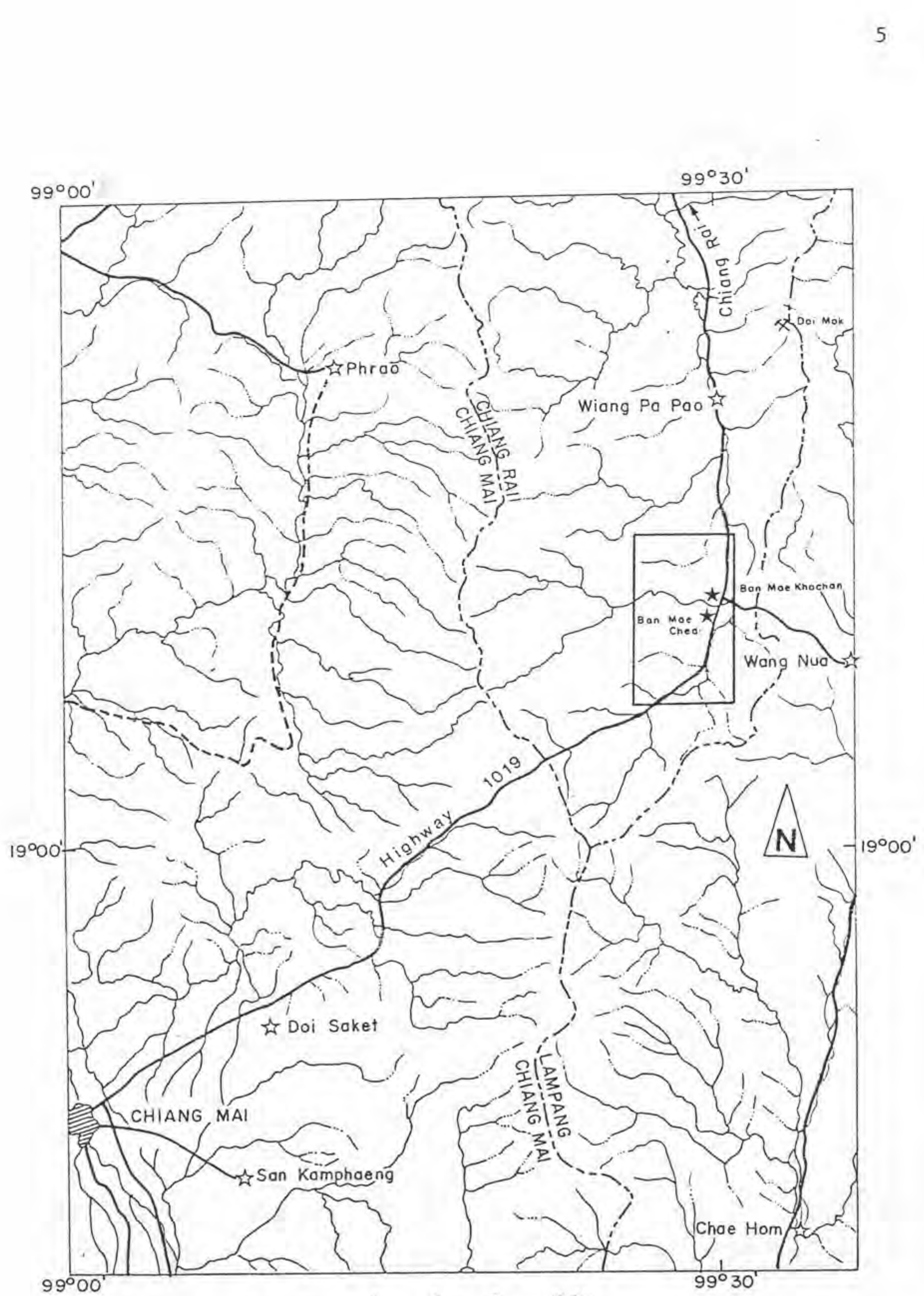

Figure 1.3 Map showing the main access to the Mae Chedi area.

corn, and fruits such as pineapple, jack fruit and banana. The main crop is rice, which is grown extensively in flat plains of alluviums and colluviums.

1. 4 Physiography

The Mae Chedi area (Figure 1.2) is situated in the eastern margin of the N-S trending mountain range that lies on the south-western margin of the Wiang Pa Pao flood plain. The Mae Chedi Mine is located near the southern end of the area and attains an elevation of about 680 m above sea level (a.s.l.). The topography of the study area is rugged, with elevations ranging from 560 m a.s.l. along the Nam Mae Lao on the northeast corner to 1096 m a.s.l. at Doi Chom Phu on the western edge.

The principal drainage of the area is Nam Mae Lao which flows generally northeast along a major fault and turns to the north at Ban Cham Bon. Huai Chomphu and Huai Mae Chedi, two smaller streams originated 2.5 and 7.5 km north of the Mae Chedi Mine, drain eastward into Nam Mae Lao at Ban Chom Phu and Ban Mae Chedi, respectively.

A hot spring has occured at Ban Sob Pong (1.5 km southwest of the Mae Chedi Mine). It is believed that this hot spring is associated with Nam Mae Lao fault (Vichit, 1976).

1. 5 Previous Work

From 1965 to 1971, the German Geological Mission, in cooperation with the Department of Mineral Resources, undertook the systematic regional geological mapping and prospecting in the northern and western parts of Thailand with the coverage area of approximately 81,000 km^2. The preliminary reports on the geology of northern Thailand accompanied with a geologic map at a scale 1:1,000,000 were conducted by Baum et al. (1970). The final report had been published by German Geological Mission in 1972.

Baum and Hahn (1977) compiled the geology of northern Thailand and published the geologic map at a scale of 1:250,000. The geochemical prospects and geology of tin deposits, Nam Mae Kaung-Nam Mae Lao area which included the Mae Chedi area have been done by Vichit (1976). The radiometric datings of the main batholiths in northern Thailand were carried out by Teggin (1975); Braun et al. (1976); Beckinsale (1979); and Nakapadungrat (1982).

Chemical analyses of granites from the western part of Wiang Pa Pao, along the Wiang Pa Pao-Phrao highway including Mae Chedi have been made by Boom et al. (1979) in order to characterize the tin-ore bearing and barren granites. Later investigations on detailed geologic map in western and southwestern Wiang Pa Pao together with western Chiang Rai at a scale of 1:50,000 including chemical analyses of various granites and structural analyses have been done by Charoenprawat et al. (1980), Gebert et al. (1980).

Recently, Suensilpong and Jungyusuk (1981) studied on the geochemistry and petrography of granites from three scheelite deposits with and without tin mines in northern Thailand namely; Samoeng, Mae Chedi (Khunplin), and Doi Mok Mines. They did point out that the fine-grained biotite granite from those mines are the so-called "I - type" granites and suggested that most granites related to scheelite mineralizations are fine-grained biotite granites which are younger than porphyritic granite of Upper Triassic age.

1. 6 Purpose and Methods of Investigation

The purpose of this study is to characterize in detail on the mineralogy, petrology and geochemistry of the Mae Chedi granites and their relation to tin-tungsten mineralization. Discovery of some certain petrochemical criteria may possibly be employed in delineating targets of potential mineralization. This will contribute a great deal of geological knowledge not only to the mineral exploration in the study area but also elsewhere in Thailand and possibly in other countries.

Field mapping and sampling were carried out during late 1980 and mid 1981. The topographic map scale 1:50,000, sheet 4847 II, 4947 III, series L 7017, and modified topographic map scale 1:500 of the Mae Chedi Mine were used as base maps. Sample locations and their elevations have been carefully plotted on map of the Mae Chedi Mine. The aerial photographs were also used to guide the ground survey mapping and to delineate the regional and structural geology of the study area.

The mineralogy and texture of rock samples were studied in standard thin sections using the petrographic microscope. Plagioclase composition was determined by the a-normal sections. K-feldspar determination was also carried out by X-ray diffractometric method, in addition to the microscopic method, in the Physics Division, Office of Atomic Energy for Peace. X-ray diffractograms of some granitic samples are illustrated in Appendix 1. The optic angle (2v) of K-feldspar was determined by using a universal stage. Staining techniques applying method modified after Ruperto et al. (1964, cited in Hutchison, 1974), Reid (1969), and Norman (1974) have been used to facilitate the mineral grain counting. For thin sections, K-feldspar and plagioclase were both stained whereas only K-feldspar was stained for rock slabs. Procedures of these techniques are described in Appendix 2. The modes of all granitic rocks were counted from thin sections except for the porphyritic granites of coarse-grained varieties which are counted from rock slabs. The traverses for thin sections were made on the area of 16 mm by 25 mm, and were spaced 0.33 mm and 0.4 mm apart, The modal composition of the rocks is obtained on the total 3000 point-counts. The traverses for rock slabs were made on the area of 10 cm by 10 cm, with spacing grids of 0.2 cm. The mode is obtained on the total 2000 point-counts.

Each of at least 1.5 kg of fresh granite and metabasite samples for chemical analyses were crushed into small pieces of less than 1 cm in diameter. All weathered or stained joint surfaces were removed and later carefully detected by ultraviolet short wave to avoid scheelite contamination. Sampling by the method of quartering has been used before pulverization in a tungsten carbide vessel. For samples to be analysed for tungsten content, a chrome-steel vessel was used in order to prevent tungsten contamination. The powders were mixed well and stored in small glass bottles. Prior to further analyses, all sample powders were dried in an oven at 110°C for 1.5 hours.

All major element-oxide analyses except for H_2O^+ were carried out at the Department of Geology, Chulalongkorn University. H_2O^+, S, Li, F, Sn, W, Cu, Pb, Zn, and Ni were analyzed by the staffs of the

Table 1.1 Methods used for quantitative determination of elements

Element	Method
SiO_2, TiO_2, Al_2O_3, total Fe_2O_3	Spectrophotometry
MnO, P_2O_5	Spectrophotometry
FeO	Volumetry
MgO, CaO, Na_2O, K_2O	Atomic Absorption Spectrometry
H_2O^+	modified Penfield Method
S	Gravimetry
Li, Sn, Cu, Pb, Zn, Ni	Atomic Absorption Spectrometry
F	Ion selective electrodes
Rb, Sr, Ba, Zr, La, Ce	X-ray fluorescence
W	Spectrophotometry
U	Neutron activation analysis

N.B. Fe_2O_3 was calculated from total Fe_2O_3 and FeO by using the relationship : % Fe_2O_3 = total Fe_2O_3 - (FeO x 1.1113)

Chemistry Section, Geological Survey Division, Department of Mineral Resources. Rb, Sr, Ba, Zr, La, Ce, and U were analyzed by the staffs of the Physics Division, Office of Atomic Energy for Peace.

The chemical analyses of the rocks have been determined by using several different methods as shown in Table 1.1. Their detail analytical techniques are given in Appendix 3.