Chapter 3

Geologic Information and Data Acquisition

3.1 Introduction

Study areas are selected in various location in northern Thailand for the reason of preferable mineralization. First, Mae Chong area is located in Lumphun province, the upper part of northern Thailand. Second, Khao Khi Nok area is located in Uttaradit province, the southeastern part of northern Thailand. Third, Pong Nok Gaew area is located in Phetchabun province, the lower part of northern Thailand. Refer to Figure 1.1 in Chapter 1 for the location map of each study areas.

Data acquisition in these study areas are quite similar. Mae Chong area, data was surveyed by pole-dipole array configuration of 50 meter dipole separation. Total length of the survey line is of 2800 meter. Whereas, data acquisition of those Khao Khi Nok and Pong Nok Gaew areas are surveyed with several kind of array configuration and, furthermore, several dipole separation. Details of data acquisition of these study area can be summarized in Table 3.1.

Table 3.1 Specification of data acquisition of each study area.

Study area	Array configuration	Dipole separation (meter)	Total length (meter)
Mae Chong	pole-dipole	50	2,800
Khao Khi Nok	pole-dipole dipole-dipole	10, 20, 40 10, 20, 40	1,000 (per survey line)
Pong Nok Gaew	pole-dipole dipole-dipole	10, 20, 40 10, 20, 40	1,000 (per survey line)

In field data acquisition, the equipment used in the survey are (1) Braggs and Straton 4-stroke gasoline engine coupling to brushless alternator, power generator, (2) Scintrex TSQ-3 versatile time and frequency domains transmitter, and (3) Scintrex IPR-11 broadband time domain induced polarization receiver.

3.2 Mae Chong area

This area is located near Ban Mae Chong, Li district, Lumphun province. The exploration is executed under the concession of Padaeng (Public) Co. Ltd. Induced polarization surveys was conducted in many lines survey in which line L800N is selected because there is a drill-hole at the center of survey line.

Mae Chong area is situated on RTSD map, scale 1:50,000, sheet 4745 II (Ban Pang), series L7017. Topographic map of the study area is shown in Figure 3.1. Survey area is traversed over the hill at the center of survey line. The general topography of this area is quite flat and there is a hill at the center of line. There is high relief mountain situate in the western range and eastern range, since the basin is located in the center.

Geology of Mae Chong area are composed of five rock unit. Figure 3.2 shows local geologic map of Mae Chong area (modified after *Baum et al.*, 1982). The youngest is sand and gravel of Quaternary age, found beside the channel. In the eastern range, there is the oldest sandstone unit of Cambrian age exposed. Triassic granite exposed in the northeastern part. In the center, shale and sandstone of Ordovician age are laid in north-south direction, respectively. The western part is

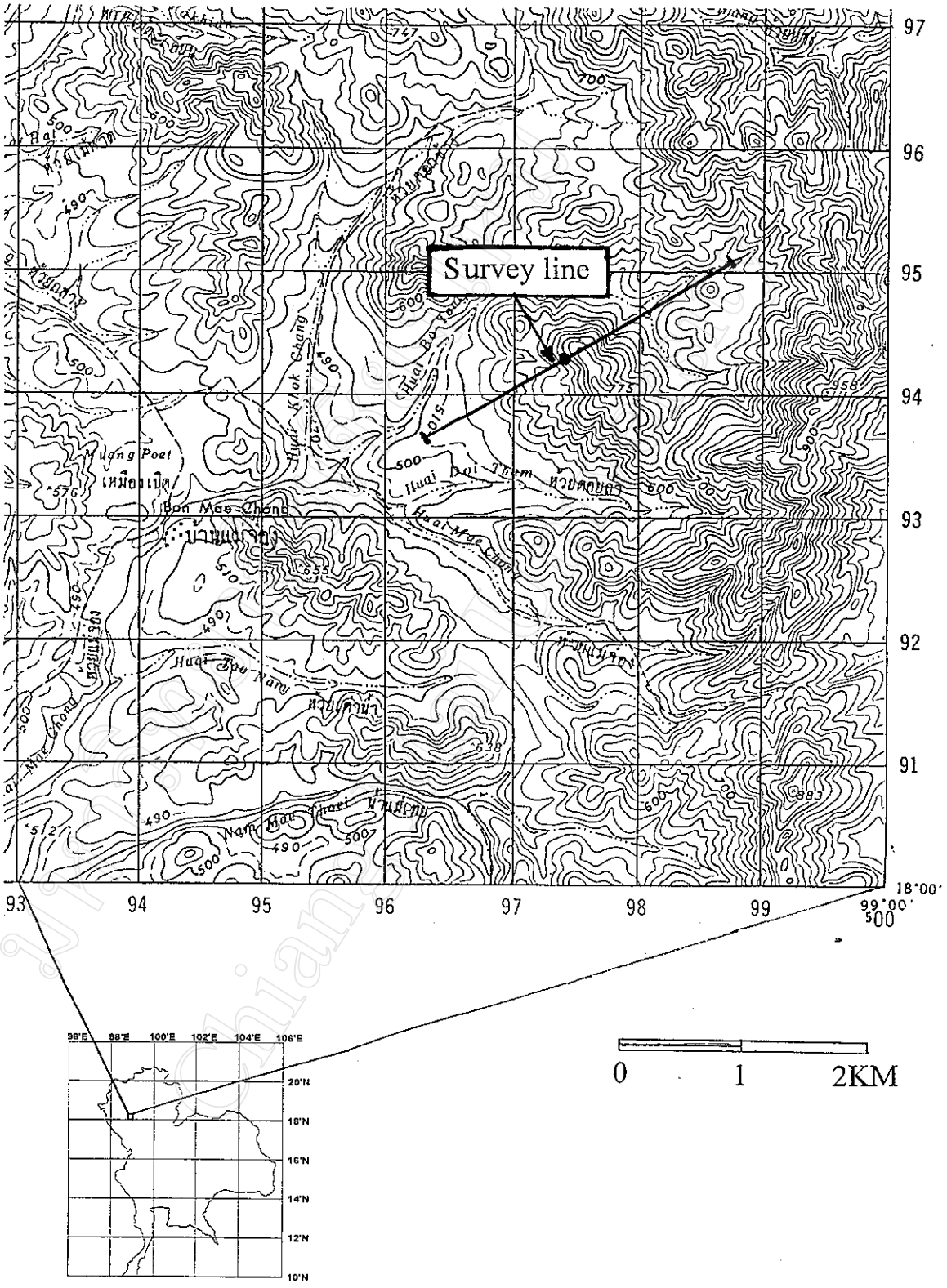

Figure 3.1 Topographic map of Mae Chong area.
Mapsheet 4745 II (BAN PANG), series L1017

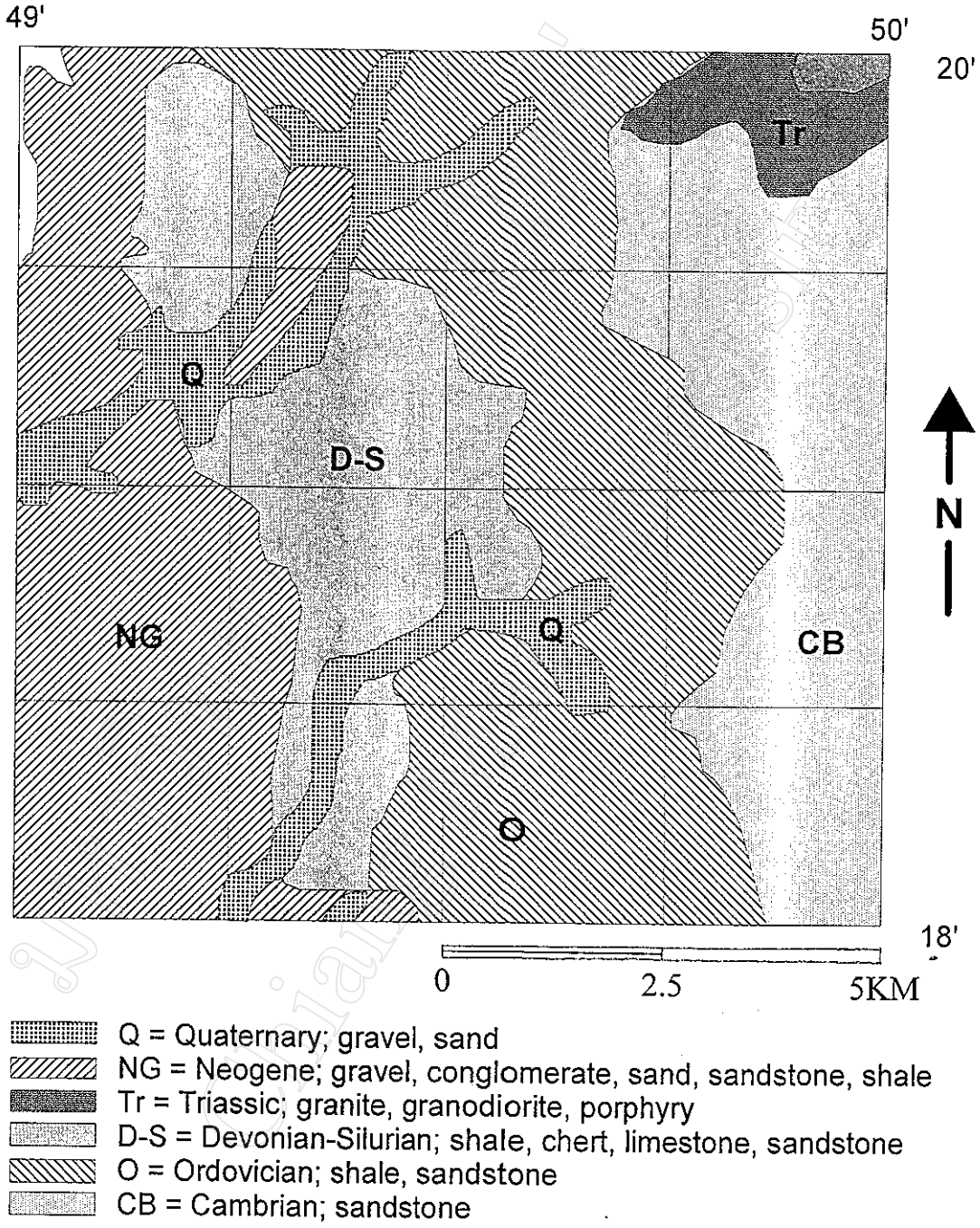

Figure 3.2 Geologic map of Mae Chong area (modified after *Buam et al*, 1982).

composed of gravel, conglomerate, sand, sandstone and shale of Neogene age. Then, the sediments of Devonian-Silurian age laid north-south direction between Neogene and Ordovician units. This unit composes of shale, chert, limestone and, sandstone.

Drill-hole is performed at the center of anomaly, drilled with 400 meters depth. Figure 3.3 shows lithologic log of Mae Chong area. Top soil is found from surface down to 1.5 meters depth and, consequently, residual soil down to 4.5 meters. Mineralization are pyrite, pyrrhotite, minor galena found at depth of 23-29 meters, moreover, these are also found at depth 166-119 meter and 174-189 meters (courtesy *Padaeng (Public) Co. Ltd.*).

3.3 Khao Khi Nok area

Uttaradit area is a part in one of five Airborne Electromagnetic (AEM) survey areas, called Uttaradit-Nan AEM surveys area. Figure 3.4 shows the location of five detail AEM survey area of Thailand. The AEM survey is conducted cover most part of Uttaradit-Nan suture zone in which there are many mines located around there. Khao Khi Nok area is one of anomalous area interpreted and exists in AEM anomaly. It was defined as bedrock conductor, mineralized bodies with low resistivity. Ground follow-up surveys was conducted with several kind of geophysical equipment for anomaly verification.

This area locate near Khao Khi Nok mountain, Thong San Khan district, southern part of Uttaradit province. Khao Khi Nok area is situated on RTSD topographic map sheet 5044-II (Ban Hatt Ngiu), series

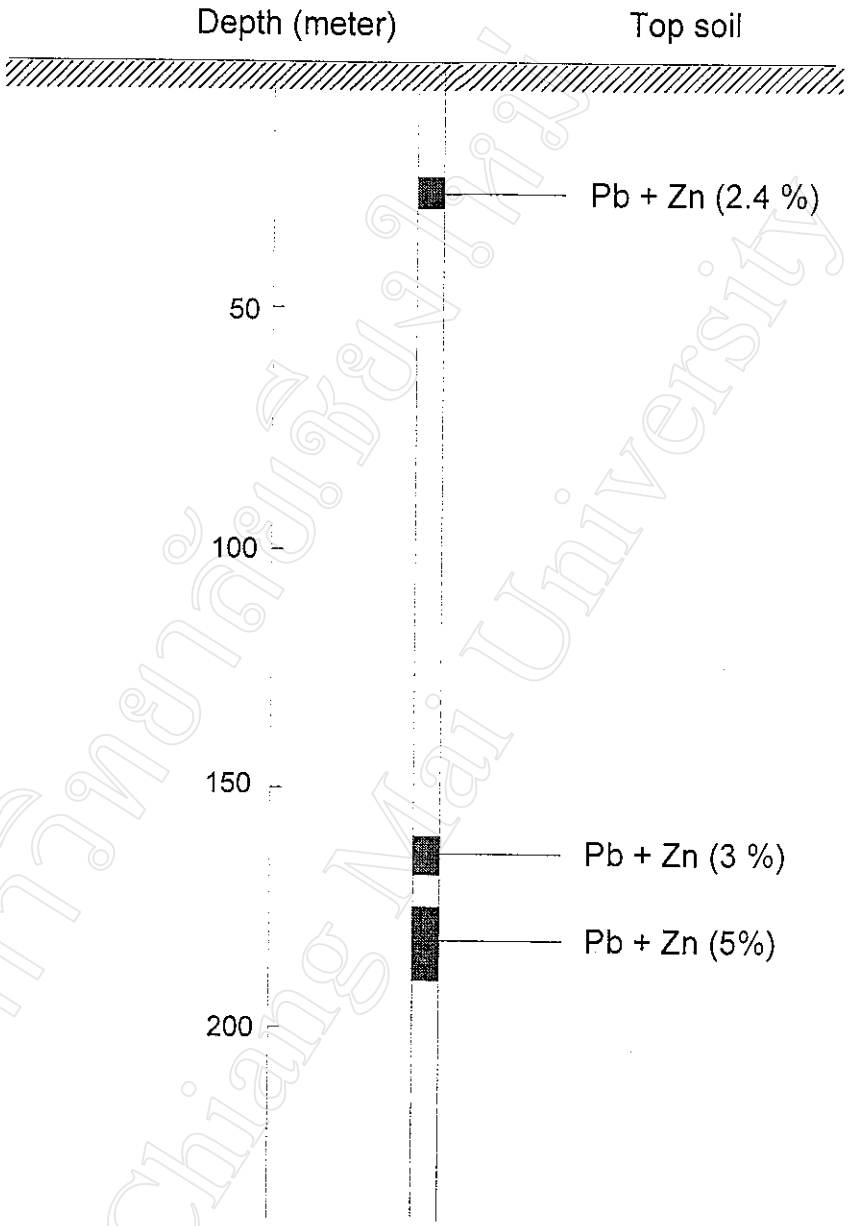

Figure 3.3 Drilling result of drill-hole DDH1Y of Mae Chong area (Courtesy Padaeng (Public) Co.Ltd).

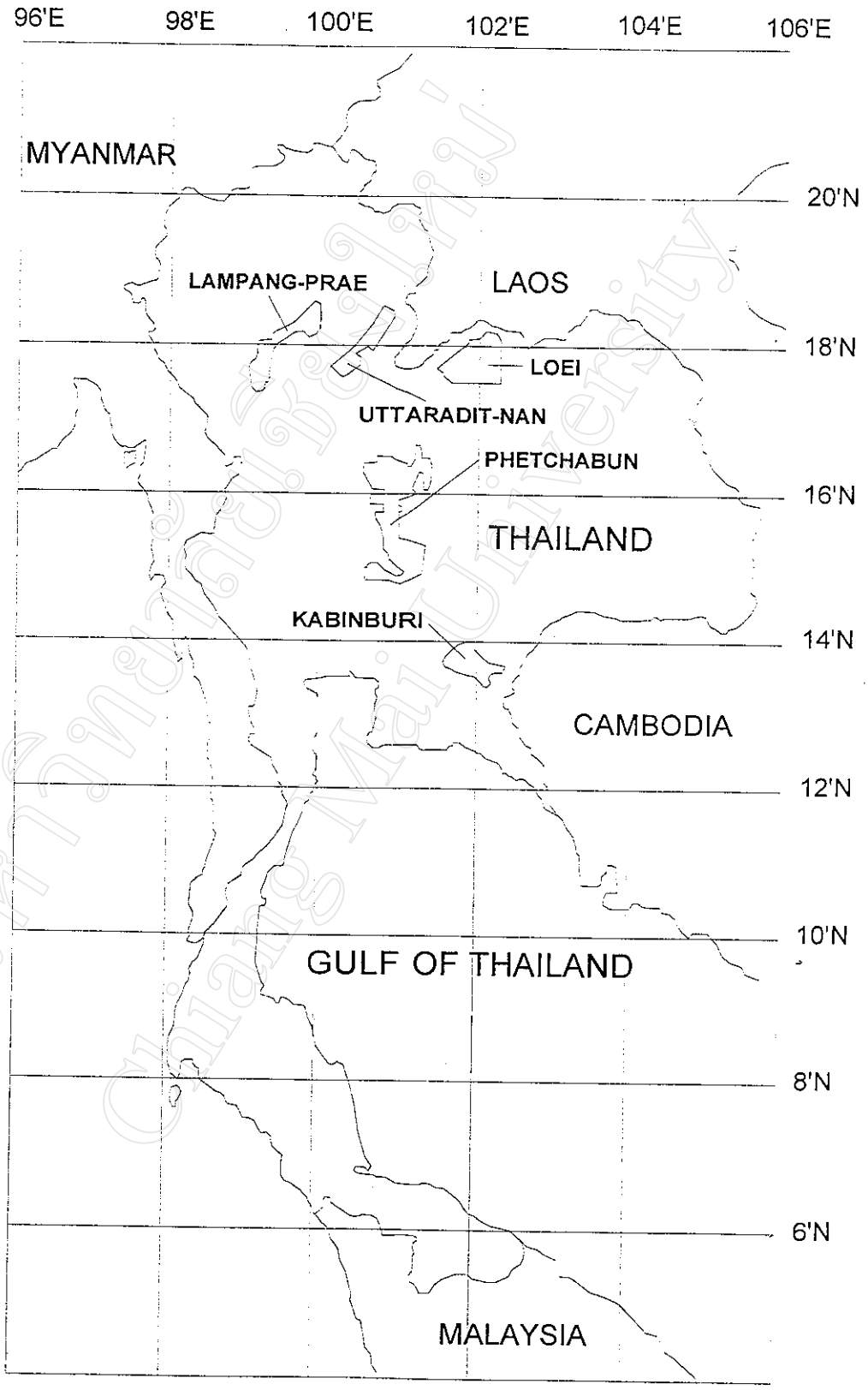

Figure 3.4 Airborne electromagnetic (AEM) survey areas in Thailand.

L7017. The topographic of this area is quite flat as show in Figure 3.5. Most areas are used in agricultural purpose. At northeastern corner of this area, there is a mountain of andesitic rock, called Khao Yai, and in southeastern direction there is low hill where marbles are mined, called Khao Khi Nok.

Geology of Khao Khi Nok area is composed of five rock types. Geologic map is shown in Figure 3.6. There is recrystalline limestone of Permain age, the oldest unit, and furthermore covered by volcanic rocks which mostly are rhyolytic tuff, breccia, and partly andesitic rock. Stratigraphically, this volcanoclastic rocks are Permo-Triassic in age. The rock unit is intruded by Triassic granite as evudenced by metamorphic rock in the vicinity area of the intrusion. Quaternary unconsolidated sediment is the youngest rock unit appears as the belt about 200 meter width and length extends from survey line L500S to L500N, respectively (*Surinkum and Siripongsatian*, 1992).

Surinkum and Siripongsatian (1992) also stated that there is a quartz vein in the Permo-Triassic sequence striking in northeast direction and dip 30-60 degree northwest. There is a fault contact observed between granite and recrytalline limestone at the eastern part of this area.

A vertical drill hole was performed at the center of anomaly peak in line L300S about station 460 with total depth of 150 meters. Figure 3.7 shows the lithologic log of this area. The results from drill-hole indicates that the occurance of with about 7 meters thick top soil. The conductive layers found consequently below top soil are graphitic shale, black shale and graphite with intercalation of quartz-sericite schist down

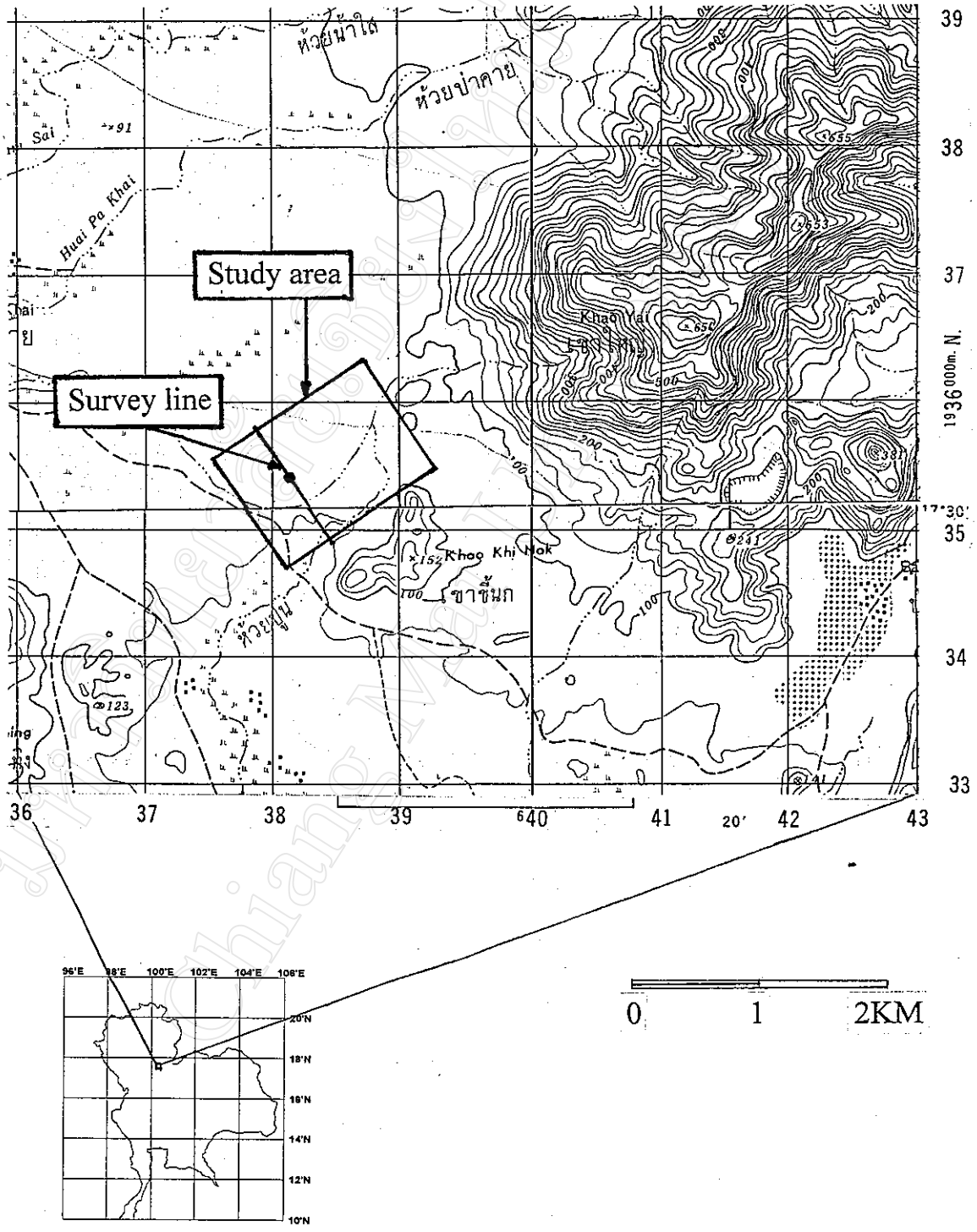

Figure 3.5 Topographic map of Khao Khi Nok area.
Mapsheet 5044 II (BAN HATT NGIU), series L7017

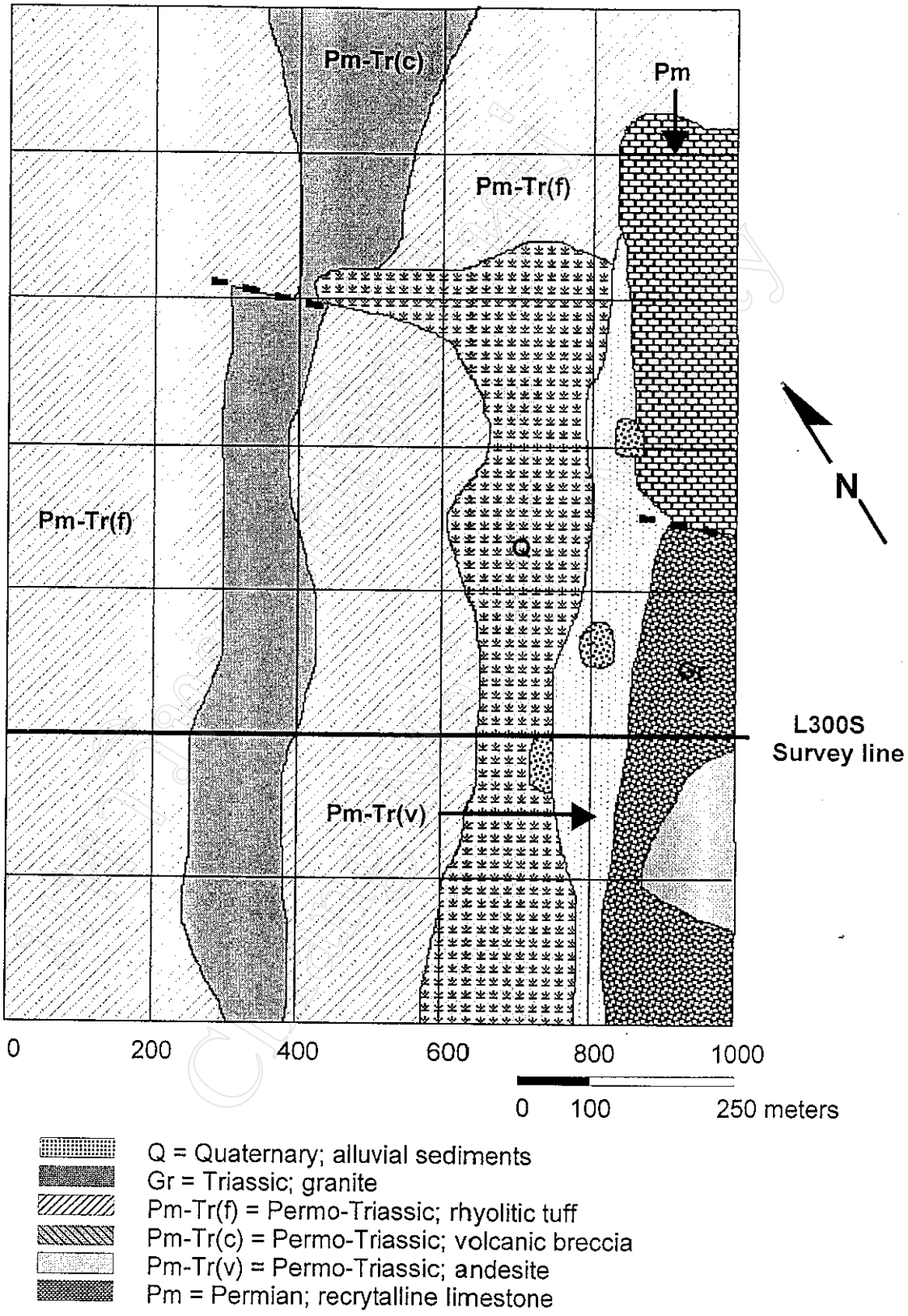

Figure 3.6 Geologic map of Khao Khi Nok area (after Surinkum and Siripongsatian, 1992).

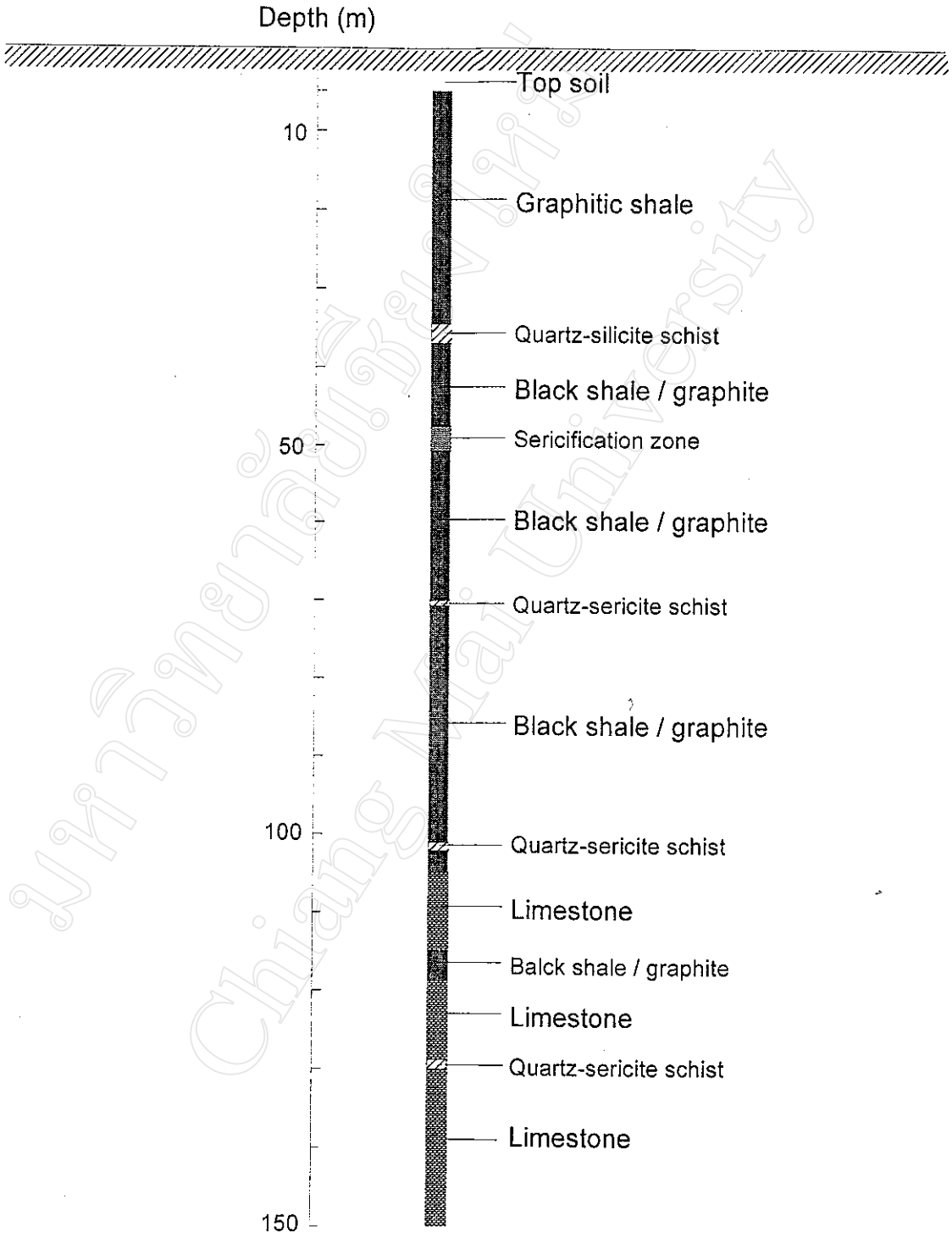

Figure 3.7 Drilling result at station 520of Khao Khi Nok area (after Prasittikarnkul, 1994).

to depth of about 100 meters. Graphite was found at shallower depth, from 7 meters to 70 meters, with low concentration of pyrite. Pyrite concentration in graphite increases up to maximum 30 percent between depth of 70-120 meters (*Prasittikarnkul*, 1994a).

3.4 Pong Nok Gaew area

Phetchabun area is one of the five areas where Airborne Electromagnetic survey was done (refer to Figure 3.4). Pong Nok Gaew area is one of the observed anomalous area in Phetchabun AEM area. The ground follow-up survey was firstly done by using multifrequency horizontal loop electromagnetic (HLEM) surveys only to verify AEM anomalies. Due to the geological information that indicated the priorities of this area which covered by Quaternary sediment.

Pong Nok Gaew area is locate at Ban Pong Nok Gaew, Chondan district, Phetchabun province. Pong Nok Gaew area is located in RSTD topographic map sheet 5141-III (Ban Khao Sai), series L7017. Anomalous zone locate at about 68475/178880 in UTM grid references. The study area is quite flat and is completely covered by young terrace gravel, sand, silt, clay, and laterite of Quaternary age as shown in Figure 3.8 and Figure 3.9.

Vertical drill hole, whose lithologic log is shown in Figure 3.10 was performed at station 540 to the depth of 40 meters. The log indicates that the conductive layer beneath 6 meters thick overburden is the hogh porosity alteration zone which composes of kaolinite, mylonite and trace of anhydrite which extends to 19 meters depth. An overburden overlaid

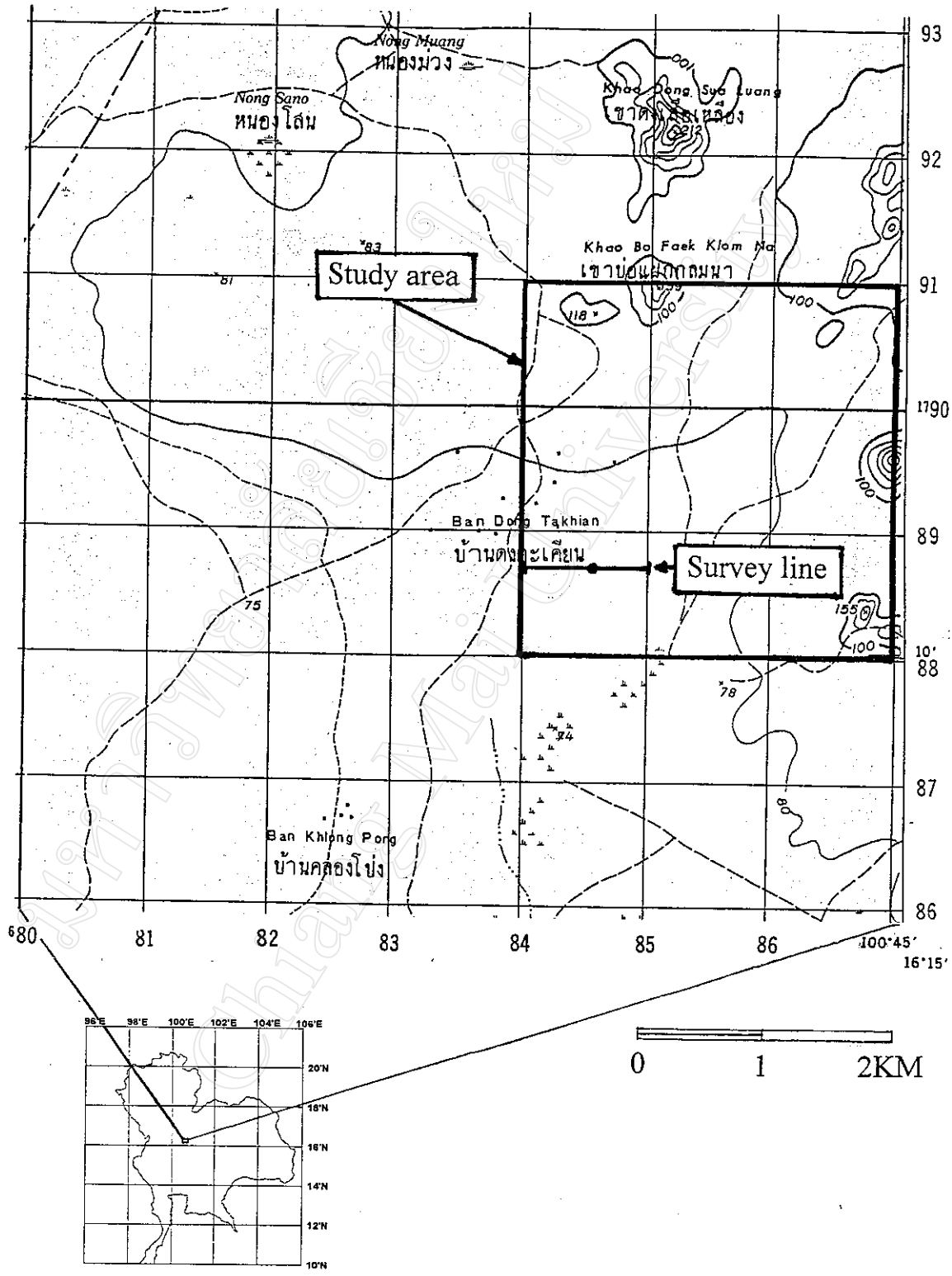

Figure 3.8 Topographic map of Pong Nok Gaew area.
Map sheet 5141 III(BAN KHAO SAI), series 7017.

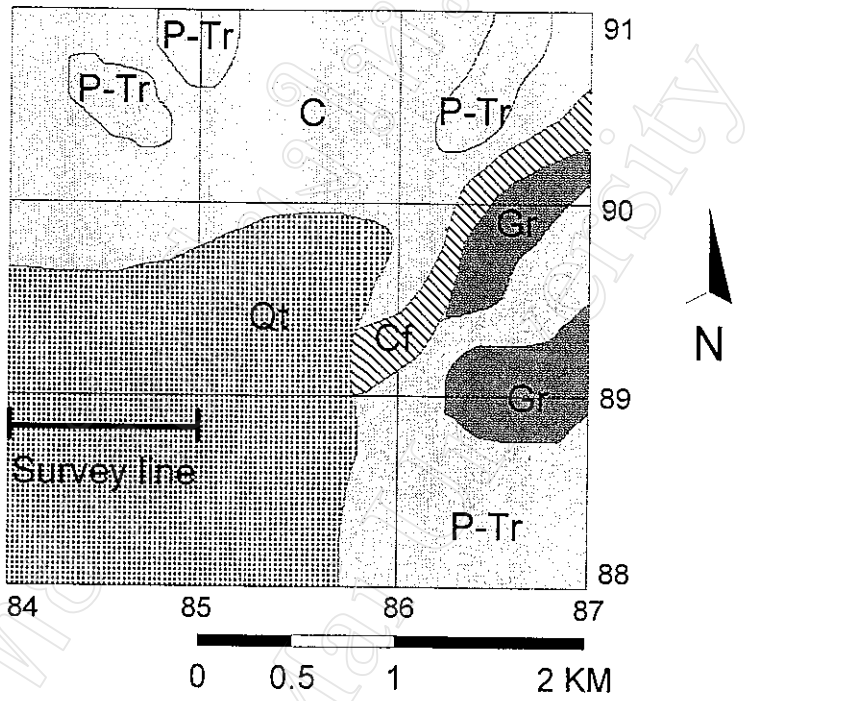

Figure 3.9 Geologic map of Pong Nok Gaew area (after Rotthamanee, 1991).

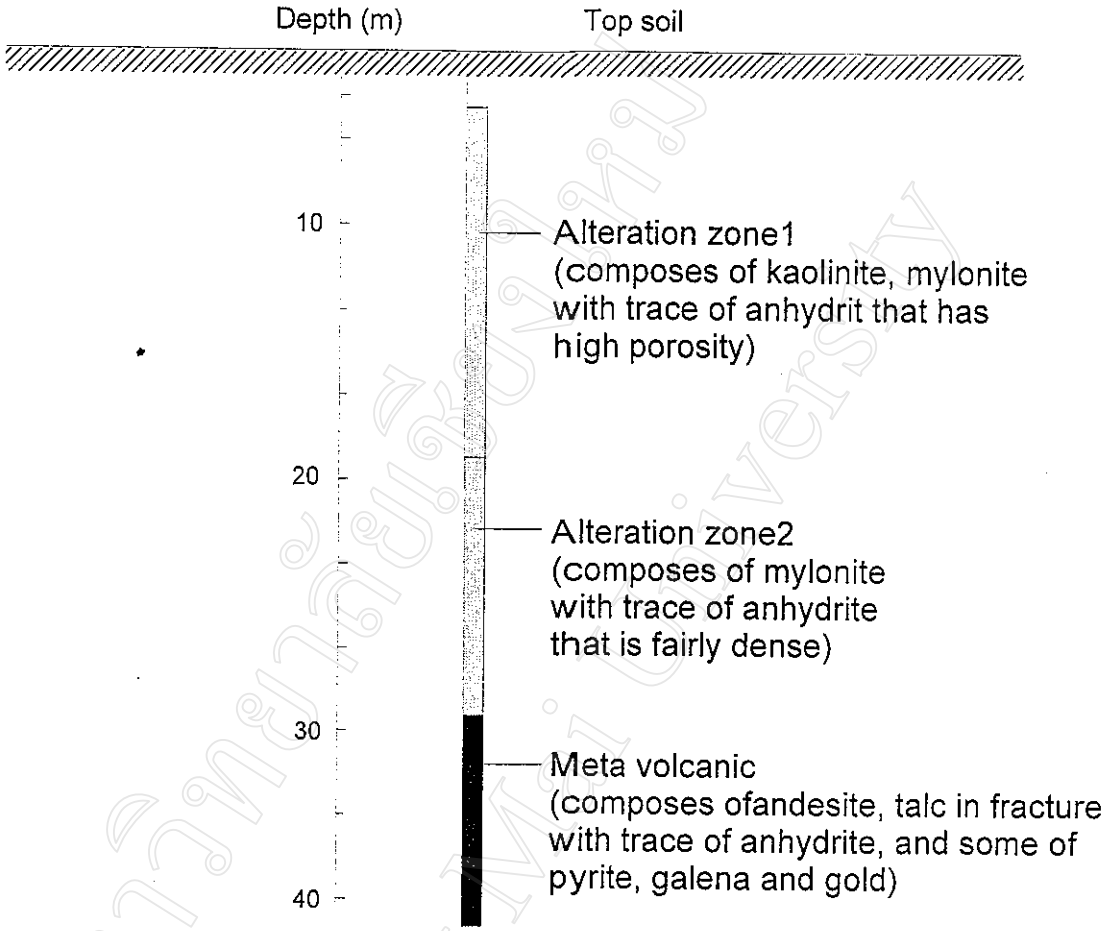

Figure 3.10 Drilling result at station 450 of Pong Nok Gaew area (after Prasittikarnkul, 1994).

this conductor from ground surface down to 6 meters. It should be noted that the alteration zone is, in fact, extended to the depth of about 28 meters but its porosity beyond 19 meters depth is relatively low. At the bottom range, there is meta andesite with talc veinlets and traces of anhydrite, pyrite, galena and gold (*Prasittikarnkul*, 1994b).