

## CHAPTER I

### INTRODUCTION



#### Location and accessibility

Kanchanaburi province, about 120 kms west of Bangkok, is one of the well-known provinces not only for the long curious history, the beauty of natural scenery and forests, but also the wealth of mineral resources, e.g., tin, tungsten, lead, zinc, fluorite, iron and corundum.

Amphoe Bo Phloi which locates about 25 kms north of Kanchanaburi township is famous for the deposit of gem-quality corundum especially blue sapphire. It had been known since the period of King Rama the Fifth (1868-1910) for being the sources of black spinel and sapphire (Kaewbaidhoon and Potisat, 1974). Permission for the digging of blue sapphire was granted officially in 1920, during the reign of King Rama the Sixth (1910-1925). The mining has been carried out up to the present day. Recently, the new discoverable area namely Chong Dan which is approximately 6 kms north of Amphoe Bo Phloi is actively mined for blue sapphire.

The area of present study is located in the vicinity of Ban Bo Phloi, Amphoe Bo Phloi, Changwat Kanchanaburi. It is on the army topographic map scale 1:50,000, series L 7017, sheet 4937 IV (Amphoe Bo Phloi), and on the map scale 1:250,000, sheet ND 47-7, (Figure 1).

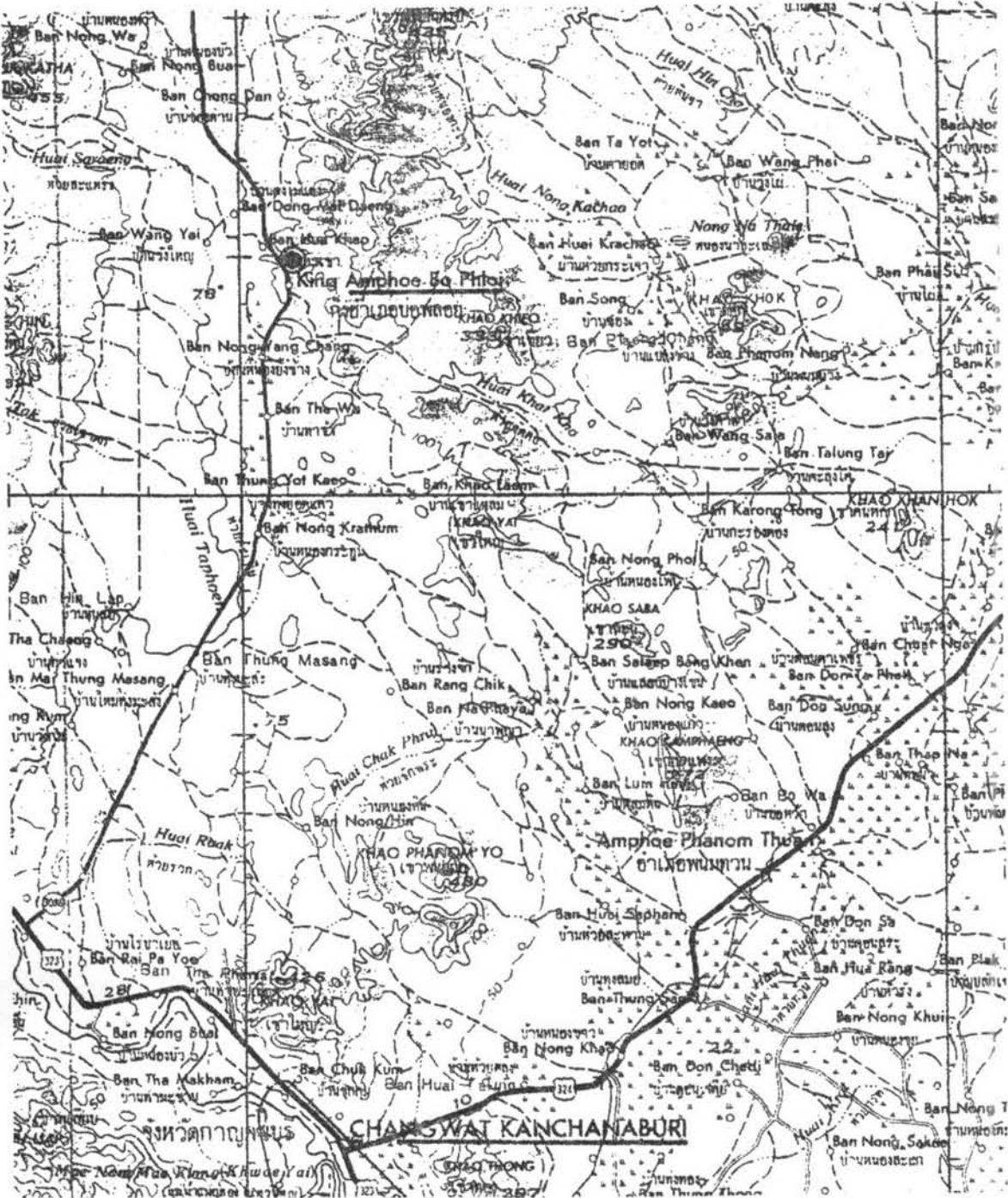


Figure 1 Location map of the Bo-Phloi Basalt, Kanchanaburi Province.

(scale 1: 250,000 Map sheet ND 47-7)

● Investigated area.

The area is accessible by two convenient highways :

Route no. 1 From Bangkok heading northeast to Patum Thani and then further east to Lat Lum Kaew (Highway no.307) - Bang Laen-Kampangsaen (Highway no.3035) - Phanom Thuan (Highway no.324) - Kanchanaburi township - Lat Ya (Highway no.323) and then to Amphoe Bo Phloi (Highway no.3086). It is about 200 kms by this route from Bangkok to Amphoe Bo Phloi, the studied area.

Route no.2 From Bangkok heading west by the Petchkasem highway (Highway no.4) to Nakhon Pathom - Ban Pong and Kanchanaburi township and joins route no.1 from Kanchanaburi township to Lat Ya and then to Amphoe Bo Phloi. It is about 160 kms from Bangkok to Amphoe Bo Phloi by this route.

#### Physiographic Description

The area studied lies on the terrain which is on the western margin of the Chao Phraya plain and east of the western mountain ranges of northerly trend (Bunopas and Bunjitradulya, 1975). It is characterized by seven low hills of basaltic rock, forming continuously northeasterly trend, the highest basalt hill of this area is about 20 meters high. They are about 100 meters above mean sea level.

The drainage in the area is dominated by Huai Taphoen which runs southerly through the east of the area and joins the river Khawae Yai at the northwest of Ban Lat Ya. The exposures are excellent on the higher level, but during the harvest season the lower level is covered by heavy

vegetation. Reddish brown soil from decomposed basaltic rock covers down hill area where corundum, spinel and other megacrysts are accumulated.

### Geologic Setting

The geologic setting of the area is summarized from the work described by Bunopas and Bunjitradulya (1975). On the west of Amphoe Bo-Phloi, rocks of folded mountain ranges are predominantly Paleozoic age of Thung Song Group, Tanao Si Group and Ratburi Group. They range in trending from northwest-southeast to north-south directions and dip moderately. Rocks of the Thung Song Group (Ordovician) and Ratburi Group (Permian) are composed almost entirely of limestone whereas those of the Tanao Si Group (Silurian-Carboniferous) are quartzite, phyllite, chert, limestone, shale and sandstone. The Triassic and Jurassic rocks of non-marine origin are found only in faulted remnants in the far east and are considered to be minor component in the area.

The Bo-Phloi area is situated on the highlands east of the west mountain ranges which grade slowly down to the Chao Phraya central plain in the east. General geologic setting of the Bo-Phloi area is presented in Figure 2. The rocks in the area consist of Precambrian gneiss and marble which are best exposed at Khao Chong Insi, north of the area; Ordovician limestone on the eastern corner of the area at Khao Khan Hok; Silurian-Devonian rocks of Bo-Phloi Formation of the Tanao Si Group which are mainly quartzite, tuffaceous sandstone, tuffaceous shale and shale; Quaternary terraces and alluvium. The only igneous rocks found in the area is the Bo-Phloi Basalt which occurs in the fracture zone of

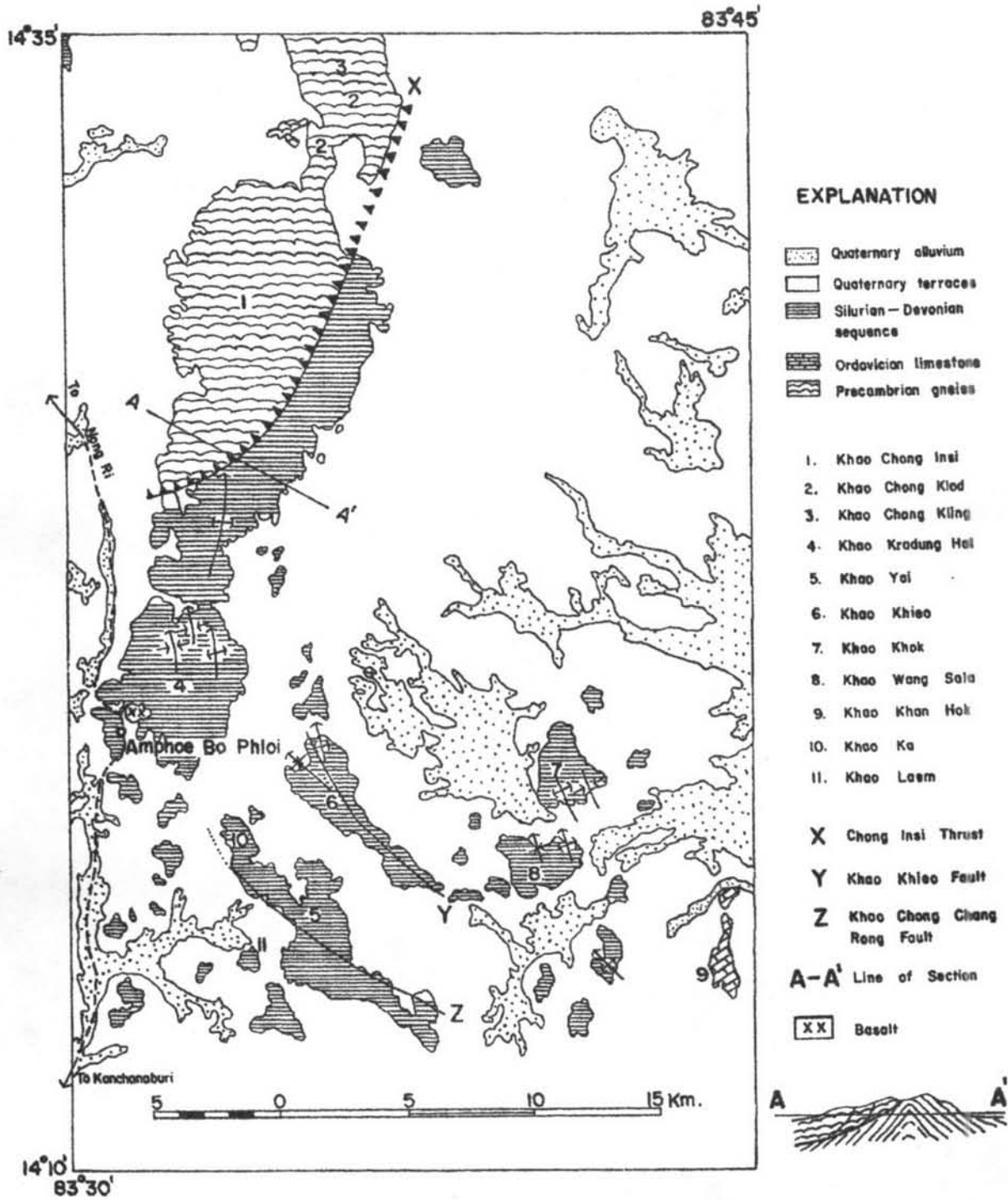


Figure 2 Geologic map of Bo-Phloi area, Kanchanaburi province. (after Bunopas and Bunjitradulya, 1975).

quartzite of the Bo Phloi Formation. Large thrust fault is observed at Khao Chong Insi, where the Precambrian gneiss was thrust over the Bo Phloi Silurian-Devonian rocks, and affected not only the already folded Mid-Paleozoic sequence but also the Ordovician strata on the eastern part of the area.

#### Previous Works

Blue sapphire was first reported to have close relationship with basaltic rock at Khao Yao and Khao Wong in the vicinity of Ban Bo Phloi (Amphoe Bo Phloi, at present) by Phra Udom-Pitayaphumichan and Khun Phian-Lohapitaya (1934). This basaltic rock was later given different names by different workers in the area, e.g., nepheline-olivine basalt (Charaljavanaphet, 1951; Bunopas and Bunjitradulya, 1975), olivine basalt (Kaewbaidhoon and Potisat, 1974), nepheline hawaiiite (Barr and Macdonald, 1978 and 1981) and basanitoid (Vichit et.al., 1978).

The basalt was found to cut through and emanate along the fracture zones of slate and quartzite of the Kanchanaburi series (Charaljavanaphet, 1951) and forms a subcircular plug about 300 meters in diameter (Barr and Macdonald, 1978). It shows columnar jointing near the base of a small basalt hill (Charaljavanaphet, 1951). Petrography and also some chemical analyses of this basaltic rock have been studied by Bunjitradulya and Prepaitrakul (1973), Bunopas and Bunjitradulya (1975), Vichit et al. (1978) and Barr and Macdonald (1978 and 1981). They generally agree that the rock is fine-grained, porphyritic and loaded with megacrysts and phenocrysts (diopside, olivine, spinel, nepheline,

sanidine, plagioclase and anorthoclase) and xenoliths (peridotite and gneiss). Barr and Macdonald (1978) believed that the basalt is strongly alkali rock and possibly derived from primary magma. However, Vichit et al. (1978) suspected that this basalt has undergone differentiation before erupted to the surface. They further suggested that the  $K_2O$  content of this basalt is relatively higher than the  $K_2O$  content of the basalts from Chanthaburi and Trat provinces.

The age of this Bo-Phloi basalt was thought to be Tertiary (Charaljavanaphet, 1951 and Bunjitradulya and Prapaitrakul, 1973) or perhaps Quaternary (Bunopas and Bunjitradulya, 1975). However, Barr and Macdonald (1981) had dated the Bo-Phloi Basalt by K-Ar age determination and gave the age of  $3.14 \pm 0.17$  m.y.. This would correspond to the Pliocene of Tertiary age.

#### Purpose and Method of Investigation

The objectives of this study are to study in detailed on the mineralogy, petrology, and geochemistry of the Bo-Phloi Basalt and its related nodule and megacryst. The data collected from these studies will be used to delineate the genesis of the Bo-Phloi Basalt and its related inclusions. The occurrence of corundum-gem will also be explained by relating to the genesis of the basalt.

Field investigation and sample collection of the Bo-Phloi Basalt were carried out during late 1978 and early 1979. The army topographic map on a scale 1:50,000, series L 7017, sheet 4937 IV of Amphoe Bo-Phloi was used as general basic information. However, map on scale 1:100 was

constructed to show the sample locations (Figure 3). Rock samples including xenoliths and megacrysts were collected from seven low hills of basalt outcrops. In addition, large megacrysts of pyroxene as large as 10 cms in dimension and spinel were collected from residual soil on decomposed basalt.

Forty thin sections of basaltic rock and six thin sections of pyroxene megacrysts have been prepared for petrographic determinations. Twenty of at least 2 kg of considerably fresh rock samples were chosen for bulk chemical analysis for normal standard major and minor constituents. Each of these 2 kg rock specimens has been crushed into small chips of less than 0.5 cm in diameter. These chips are later hand picked to avoid xenoliths, megacrysts, amygdales and perhaps weathered materials. In addition, six peridotite nodules separated from rock specimens, nine pyroxene megacrysts and one each of olivine and spinel megacrysts have been analysed for their chemical compositions. Method and technique of chemical analysis of rocks and minerals for major and minor elements employed two-solution procedure of Shapiro (1975). Rock standards, RGM-1, AGV-1, BHVO-1, and PCC-1, provided by Flanagan of the U.S.G.S. were used as a calibration curve for chemical analyses. Mineral determinations in rocks, nodules and megacrysts are also carried out by X-ray diffractometric method addition to the microscopic method.



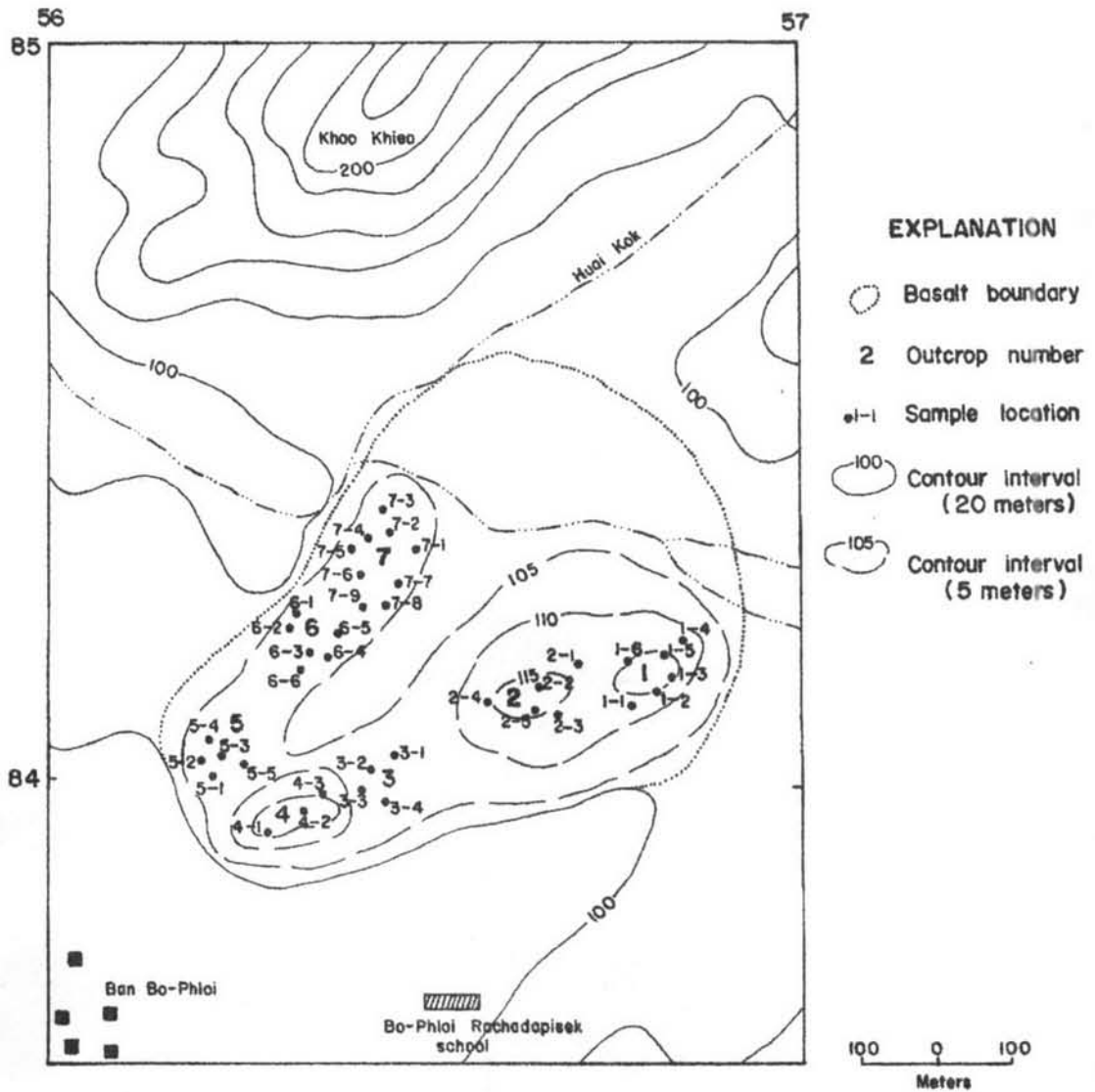


Figure 3 Sample location map of the Bo-Phloi Basalt, Kanchanaburi province. An enlargement of the topographic map scale 1:50,000, series L 7017, sheet 4937 IV (Amphoe Bo-Phloi).