

CHAPTER I

INTRODUCTION



General statement

Most of the exposed basalts in Thailand are always determined to have occurred in Late Cenozoic. Few of these basalts are principal sources of gems, such as corundum, garnet, zircon, spinel, etc. Gem Exploration Section of Economic Geology Division, Department of Mineral Resources (DMR) reported the occurrences of several gem-quality minerals including corundum, spinel, pyroxene, olivine in this study area, all of which occur relatively in basaltic area. The basalts are distributed into two areas - the Nam Cho basalt in the northern area and the Sop Prab - Ko Kha basalt in the southern area. The Nam Cho basalt was first discovered by air-borne magnetic interpretation and field investigation and was first done by geoscientists of Airborne Geophysical Data Interpretation Section. A more detailed study was carried out by Geological Survey Division (Charoenprawat, et al. 1986) and subsequently by geologists of Gemstone Exploration Section (Thayapink et al., 1993). This study area may be further developed as a new gem deposit, and the basalts are believed to be corundum-bearing basalts. This area is quite interesting since detailed informations on geology, petrogenesis, and geochemistry of these basalts have never been reported.

Location

The study area is located in Amphoe Ko Kha, Amphoe Sop Parb, and Ban Nong, Amphoe Mae Tha, Changwat Lampang in northern Thailand (Fig. 1.1). The area

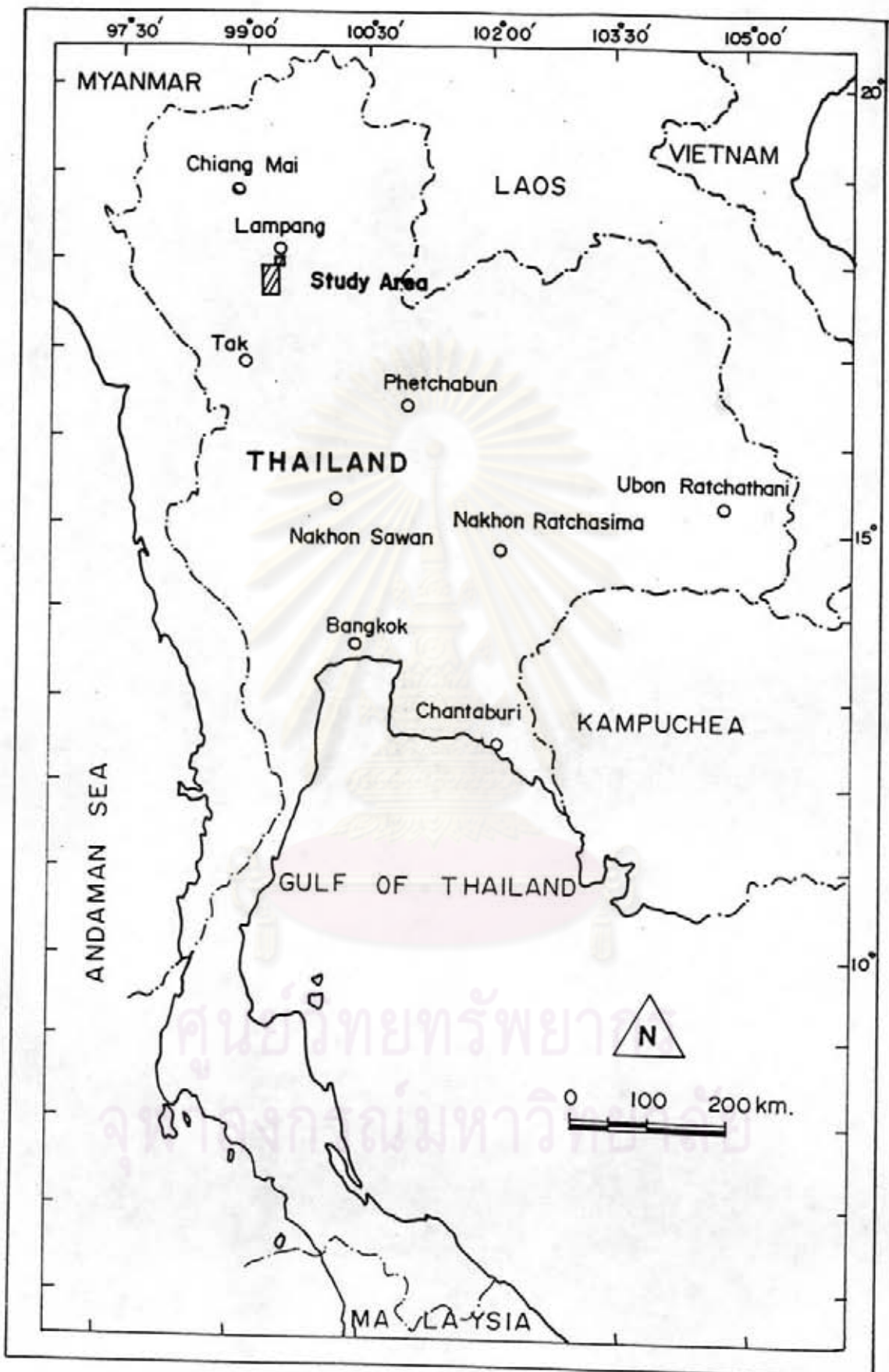


Fig.1.1. Index map of Thailand showing locality of the study area in Changwat Lampang, Northern Thailand.

lies on two topographic maps on the scale 1:250,000, sheet NE 47-7 (Changwat Lampang) and sheet NE 47-11 (Changwat Uttaradit), and on the topographic maps, scale 1 : 50,000, series L7017, sheet 4845 II (Amphoe Ko Kha) and sheet 4844 I (Amphoe Sop Prab). It comprises geographically 2 subareas as Amphoe Sop Prab - Ko Kha (larger area) and Ban Nong, Thambon Nam Cho, Amphoe Mae Tha (smaller area), covering the total area of 300 km². The north of the area is located about 10 km south of Amphoe Ko Kha, whereas the south is situated about 8 km north of Amphoe Sop Prab. Both subareas are bounded by latitudes 18°10'N and 18°55'N and longitudes 99°18' E and 99°28'E. These basalts approximately cover about 60 km² (20%) of this total study area.

Accessibility

Accessibility to this study area is done by many routes. From Bangkok it is accessible by using many convenient routes to Changwat Nakhon Sawan. Then turn northwest following Highway no. 1 to Changwat Tak, Amphoe Thum, Amphoe Sop Prab, and Amphoe Ko Kha, Changwat Lampang. The total distance from Bangkok to the study area is approximately 570 km. The Highway no. 1 crosscuts a volcanic crater of the Sop Prab - Ko Kha basalts in southern Amphoe Ko Kha. Many routes for forestation and agricultures in the area can be conveniently used only in the dry season, however some routes may be possibly used in the rainy season.

Physiography

The study area is located in the southern part of Changwat Lampang. Generally, topography of this area is composed largely of flat plains, small hills, and mountain ranges (Fig. 1.2). Flat plains are also present with small hills in north and south of the area.

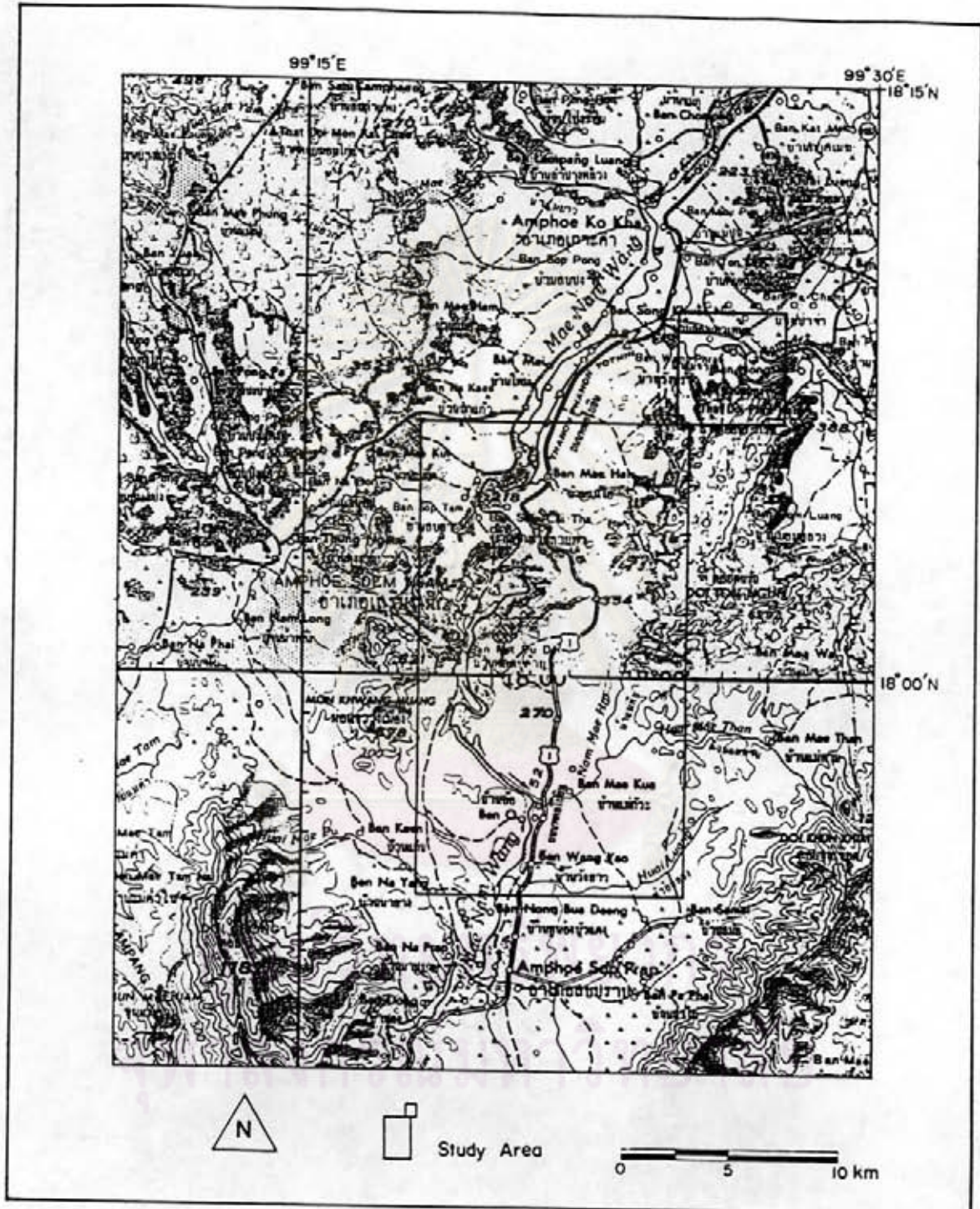


Fig.1.2. Topographic map of the study and adjacent areas showing some accessibility and physiography (Map sheet index NE 47-7 and NE 47-11).

The high-relief, N- and NE- trending mountain, with elevations ranging from 250 m to about 540 m (above msl), along the western and eastern edges. The basaltic plateau covers about 55 km² in the central area, with elevations ranging from 200 m to higher than 350 m (msl). The highest elevation (380 m above msl) are located along the volcanic crater on the central part.

The principal drainage of the area is Mae Nam Wang which flows roughly from north to south. Though it flows partially northwest along a fault zone. Radial drainage pattern is found around the volcanic crater. The other small streams generally distribute in the area.

Climate and Vegetation

Changwat Lampang has a tropical savanna climate. The cold dry season with the mean temperatures 18° to 20°c usually starts in November and lasts until February, which the lowest temperature frequently occurs in December. The area has been influenced by northeasterly prevailing wind. The summer is relatively short, with the mean temperatures 25° to 30°c in March to May. The highest temperature is in April. The rainy season commonly ranges from June to October under the influence of southwest monsoon. The mean annual rainfall is approximately 700 to 1,200 mm³.

Vegetations in the area comprise shrubs and trees. The cultivated crops include sugarcane, rice, tamarind, and corn. They are grown extensively in flat plains of alluviums and colluviums. The wilds are generally timber forests, composed largely of *teetona grandis* (teak tree), dipterocarpaceae, inferior trees, and other non-economic trees.

Previous works

Previous geological data of the study area were roughly reported by some researchers. Geologic maps used as reference were compiled by Geological Survey Division, Department of Mineral Resources (DMR). The regional geology of the study and adjacent areas were performed on the geologic map scale 1:250000, sheet NE47-7 (Changwat Lampang), and sheet NE47-11 (Changwat Utaradit) by Piyasin et al. (1971 and 1974). Charoenprawat et al. (1986) partially reported geological information of this area on the geologic map scale 1:50000, sheet 4844I (Amphoe Sop Prab). These geologic data were mentioned in chapter 2.

Petrochemical informations of basalts from this study area were rarely reported. Barr and Macdonald (1978 and 1981) suggested from one basaltic sample from this area that the basalt was geochemically classified as hawaiite, whereas basalts from east of Lampang (Mae Tha basalts) were generally defined as basanite and hawaiite. Later investigation of geochemistry, including major and trace elements in this basaltic area was reported by Barr and Jamest (1990), which one sample was classified as trachybasalt. They further suggested that trachybasalts are chemically similar to basanites, but with somewhat higher silica and lower alkali contents.

Barr et al. (1976) also investigated paleomagnetism and age of the underlying pebble tools in the Lampang basalts. These results indicated that ages of Lampang basalts range from 0.69 to 0.95 Ma. K/Ar ages of 0.6 ± 0.2 Ma and 0.8 ± 0.3 Ma were next suggested by Sasada et al. (1987). Recently, Sutthirat et al. (1994) reported $^{40}\text{Ar}/^{39}\text{Ar}$ age of 0.59 ± 0.05 Ma from Mae Tha basalts.

Purpose

The objectives of this investigation are :

1. To study petrographic features and geochemical compositions of these basalts.
2. To establish the relationship between these basalts and associated gems.
3. To study compositions and origins of these basalts.
4. To serve as a case study for future exploration of corundum-bearing basalts and their associated gems.

Methods of Investigation

Field mapping and sampling are regarded as preliminary works. They were carried out during mid 1992. The geologic maps (scale 1:50,000), sheet 4845II and 4844I, series L7017 were modified, and sample locations were plotted on these maps. This field study was cooperated with the Gemstone Exploration Division, Economic Geology Division, DMR. The aerial photographs and landsat images were also used to guide ground survey mapping, to delineate rock boundaries and structural geology of the study area.

The basalt samples and some associated minerals were prepared for petrographic investigation and chemical analyses. Sixty - five of fresh basaltic samples were prepared using jaw crusher and disc mill to produce powder samples. Before grinding, contamination of samples are avoided by getting rid of weathered surfaces, megacrysts, xenoliths, and amygdules. These powdered products were prepared for chemical analyses. About 120 thin-sections for petrographic description under polarizing microscope were prepared from these 65 basalt samples.

Mineralogy and texture of samples were studied in standard thin sections using the petrographic microscope. Major elements and some trace elements were analyzed using X-ray fluorescence (XRF) by Mr. Somsak Sangsila, Mrs. Suchada Sripairojthikoon, and Miss Sasithon Panthong, except FeO using volumetric method by Miss Piyanut Amnachskul, Mineral Resources Analysis division, DMR. Some rare earth elements, containing La, Ce, Nd, Sm, Eu, Tb, Dy, Yb, and Lu were analyzed using neutron activation analysis by Mr. Chanchai Asvavijitkulchai, staff of the Physics Division, Office of Atomic Energy for Peace. The determinations of megacrysts and xenoliths were also carried out by X-ray diffraction (XRD) method, from Department of Geology, Chulalongkorn University.

Most data of previous works and this study are present in the other chapters. These data are used for conclusion and discussion.



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