CHAPTER 1

INTRODUCTION

A number of the Late Cenozoic basaltic suites, part of those in mainland Southeast Asia, have been recognized in northern Thailand. These include Denchai basalt, Mae Tha basalt, Sop Prap basalt, Nam Cho basalt, Mae Lama basalt, Thoeng basalt, Chiang Khong basalt and Ngom Tham basalt. Following the early works of Barr and MacDonald (1978) and Vichit *et al*. (1978), more detailed studies have been done on Denchai basalt (Barr and MacDonald, 1979), Chiang Khong basalt (Barr and MacDonald, 1981; Barr and Dostal, 1986; Barr and James, 1990; Panjasawatwong and Youngsnong, 1996), Mae Tha basalt (Yamamoto, 1991) and Sop Prap basalt (Sutthirat, 1995). In addition, Ngom Tham basalt and Nam Cho basalt have been petrochemically studied by Panjasawatwong and Yaowanoiyothin (1993) and Sutthirat (1995), respectively. So far, Thoeng basalt has limited petrochemical information and therefore, petrochemical studies of Thoeng basalt have been carried out in more detail in this study.

1.1 Location and Accessibility

The study area embraces part of the Amphoe Muang, Amphoe Phaya Meng Rai, Amphoe Thoeng and Amphoe Pa Daed areas, Changwat Chiang Rai. It is located about 40 km southeast of Amphoe Muang, 20 km west of Amphoe Thoeng, 10 km south of Amphoe Phaya Meng Rai and 5 km north of Amphoe Pa Daed (Fig. 1). The area appears on the topographic map (series 1501S) sheet NE 47-3 (Changwat Chiang Rai) at a scale of 1 : 250,000 (Fig. 2), i.e. on three 1:50,000 topographic maps (series L 7017S) including sheets 5048 IV (Amphoe Phaya Meng Rai), 5048 III (Amphoe Thoeng) and 4948 II (Amphoe Pa Daed), and covers an area of approximately 500 km^2.

Accessibility to the project area can be done via many convenient routes. From Changwat Chiang Mai to Changwat Chiang Rai, it is comfortable to use a paved national highway no. 118 (Chiang Mai-Doi Saket-Wiang Pa Pao-Mae Suai-Chiang Rai) that is about 180 km long. From Changwat Chiang Rai, the area can be accessible by using a paved provincial highway no. 1020 (Chiang Rai-Thoeng) and then turn either right at Ban Chiang Khian (about 40 km from Chiang Rai) to a paved highway no. 1126 to the southern part of the study area or left at Ban Plong (about 50 km from Chiang Rai) to a paved provincial highway no. 1174 to the northern part of the area.

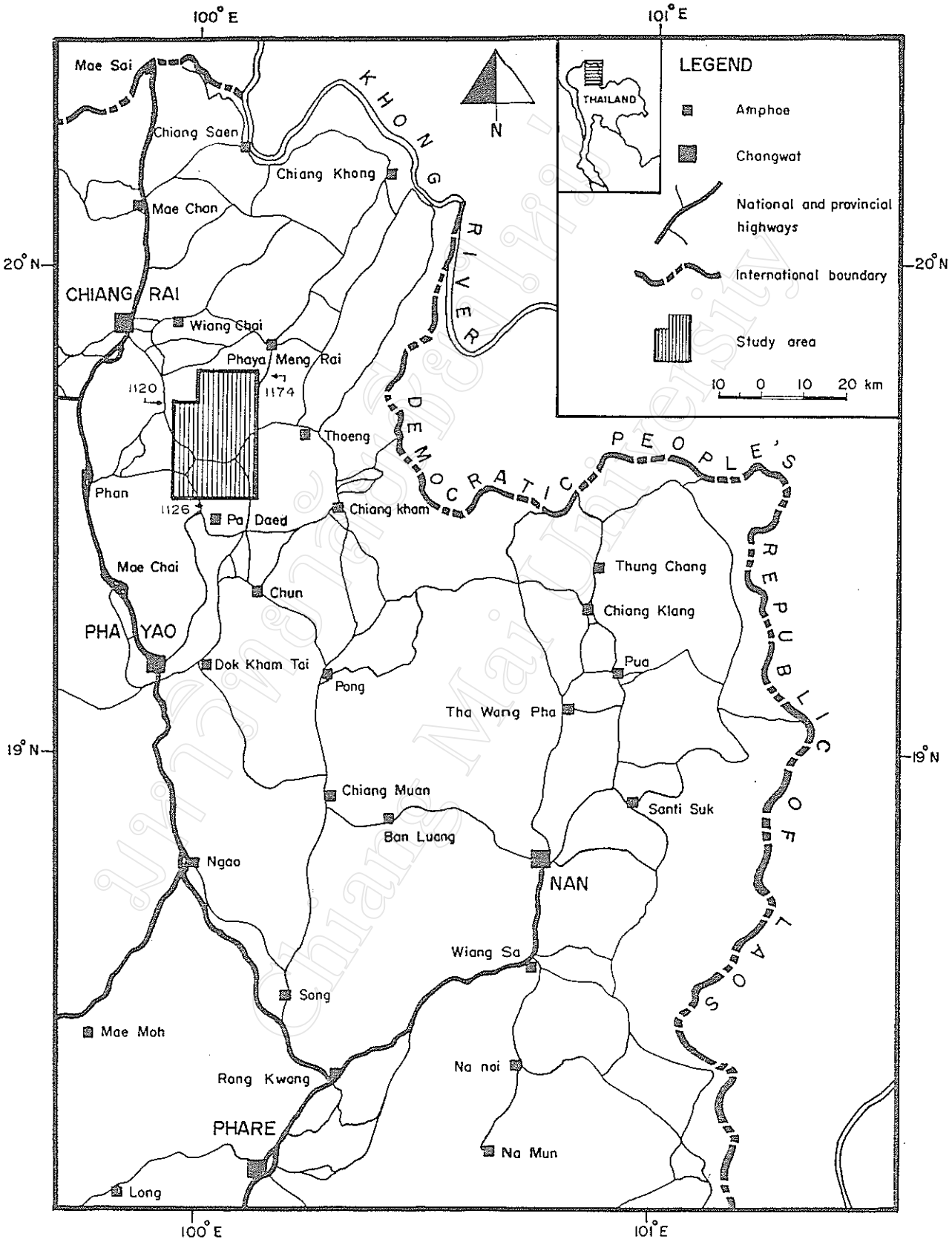

Figure 1 Map showing location of the study area, and national and provincial highways in the eastern part of northernmost Thailand (modified from Roads Association of Thailand, 1993).

1.2 Physiographic Description

The project area is constituted by a high mountain range, small hills and flat plains (Fig. 2). The high mountain range forms the central part of the area and runs approximately in NNE-SSW direction. It is of about 5-10 km wide and 30 km long, with elevations ranging from 470 to 900 m above mean sea level. This mountain range is bordered to the east and to the west by small hills and flat plains. Basaltic rocks and their weathering products (reddish soils) commonly form as plateaux on top of the mountain range. These basaltic masses may have occurred as a single plateau.

There are many creeks that run from the high mountain range to the flat plains on both sides; many are perennial. A number of small dams have been locally constructed across the perennial streams, especially in the eastern side of the high mountain range, to store water for public and agricultural purposes.

1.3 Previous Works

Petrochemical studies of the Late Cenozoic basalts in Thailand (Barr *et al.*, 1976; Barr and MacDonald, 1978, 1979, 1981; Vichit *et al.*, 1978; Sirinawin, 1981; Yaemniyom, 1982; Barr and Dostal, 1986; Sasada *et al.*, 1987; Barr and James, 1990; Yamamoto, 1991; Jungyusuk and Khositanont, 1992; Vichit, 1992; Intasopa, 1993; Panjasawatwong and Yaowanoiyothin, 1993; Charusiri *et al.*, 1995; Sutthirat, *et al.*, 1994; Sutthirat, 1995; Sutthirat *et al.*, 1995a; Sutthirat *et al.*, 1995b) reveal that these basalts are almost totally alkalic; the rest is tholeiitic basalts. The main bodies of the Late Cenozoic basalts in mainland Southeast Asia, however, comprise alkalic basalts and tholeiitic basalts in roughly equal proportion (Smith, 1996). The alkalic basalts in Thailand can be subdivided into two major groups, including basanitoid basalt and hawaiite basalt. The basanitoid basalt consists of nephelinite, basanite, nepheline hawaiite and nepheline mugearite; gem-quality corundum is generally associated with these basalts. Both the tholeiitic basalts and alkalic basalts have erupted in a continental rift environment and may have related to fracture openings operated in Gulf of Thailand and South China Sea as the result of an interaction between Indian and Eurasia plates (e.g. Jungyusuk and Khositanont, 1992; Smith, 1996) or mantle plumes (e.g. Barr and James, 1990; Hoke and Campbell, 1995; Smith, 1996). The basanitoid magma may have formed by partial melting of garnet peridotite mantle at pressures slightly less than 20-30 kb (Barr and MacDonald, 1978; Sirinawin, 1981; Yaemniyom, 1982). Barr and James (1990) proposed that the basaltic magmas with highly alkalic, moderately alkalic and mildly alkalic signatures might have formed by melting of the garnet peridotite with low to high degrees of partial melting, respectively. Panjasawatwong (1995), however, reported that mildly alkalic basalt may have formed by alteration of potassic trachybasalt.

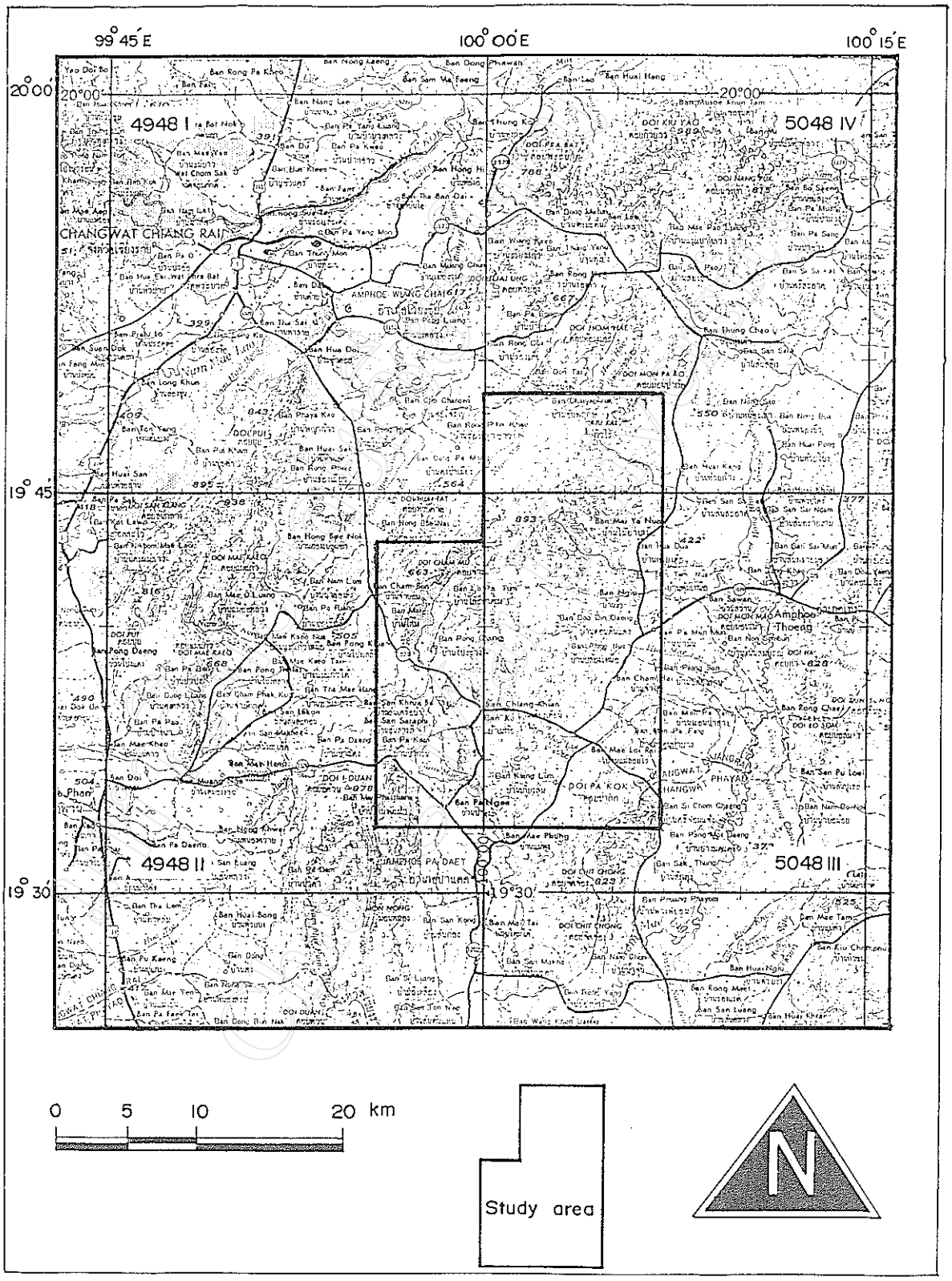

Figure 2 Part of the topographic map (series 1501S) sheet NE 47-3 (Changwat Chiang Rai) illustrating location of the study area.

A few Thoeng basalts were chemically studied by Barr and MacDonald (1981). The result has shown that Thoeng basalts are all tholeiitic, on the basis of major oxides, and have a K-Ar age of 1.69 ± 1.25 Ma (Pleistocene).

1.4 Objectives

The main purposes of this study are

(1) to delineate the occurrence of Thoeng basalts and their relationships to basement rocks,
(2) to characterize Thoeng basalts in terms of petrography, whole - rock chemistry (major and minor oxides, trace elements and rare-earth elements), and
(3) to clarify the genesis of Thoeng basalts.