CHAPTER I

INTRODUCTION

About two thirds of known antimony occurrences/mines are located in northern Thailand within the provinces of Chiang Rai, Chiang Mai, Mae Hong Song, Lamphun, Lampang, Phrae, Tak and Sukhothai (Figure 1.1). The rest is scattered in the other parts of the country. The occurrences/mines; in fact, are apparently restricted within the three adjacent Lamphun, Lampang and Phrae provinces. Mineralogically, antimony from most productive mines usually forms as stibnite with quartz and/or calcite and fluorite as gangue minerals (Asanachinda, 1981). Besides, stibnite has also been found as minor component or perhaps as of economic mineral in some other mineral deposits, for instant, in tungsten deposit at Doi Ngom, Phrae Province (Yokart, 1978).

Asanachinda (1981) grouped the stibnite bearing deposits based on their mineralogical association into four types as 1) stibnite-quartz with or without fluorite, 2) stibnite-fluorite or fluorite-stibnite, 3) ferberite-stibnite-fluorite-quartz, and 4) scheelite-stibnite association. The distribution of all four types is given in Figure 1.1.

Thailand has started her antimony production seriously since 1963 and the production was increased rapidly, reaching its peak at 11,172 tonnes in 1972. During 1970-1980 the production maintained its level between 5000-9000 tonnes/annual and dropped down to 2000-4000

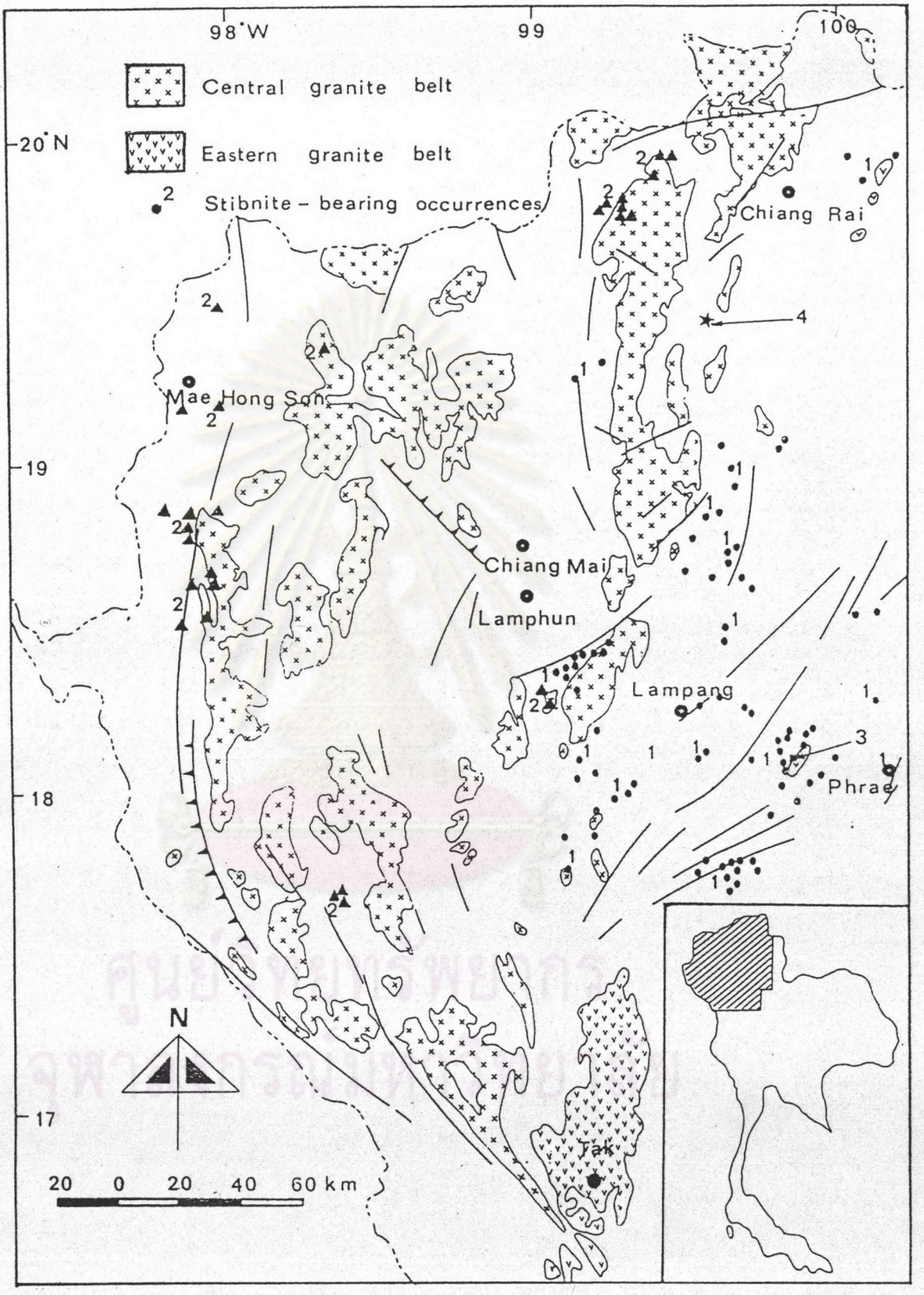

Figure 1.1 Distribution of stibnite occurrences in Northern Thailand (1, 2, 3 and 4 indicate stibnite-quartz, stibnite-fluorite, ferberite-stibnite-fluorite-quartz, sheelite-stibnite associations, respectively) after Asanachinda (1981).

tonnes/annual during 1981-1984, the production was still decreaseing until very recently (1989) at 1166 tonnes.

The geological information regarding antimony deposit in Thailand is still little known, particularly the most widespread "Stibnite-quartz association" type. Although other three stibnite association types have been studied at some deposits by Primgamone (1980) and Wanakasem (1980) the detailed study in geology, mineralogy as well as fluid inclusion at Chae Sorn will be the first of its kind ever carried out in Thailand.

1.1 Location and Accessibility

The Chae Sorn prospect is located at Tumbol Chae Sorn, King Amphoe Muang Pan, Changwat Lampang. It is about 50 kilometers north of Changwat Lampang and can be reached by driving up highway 1035 from Lampang for 60 kilometers and then turning off to the west on a dirt road for farther 33 kilometers (Figure 1.2).

The study area covers an approximately 14 square kilometers which is located between the latitude $18^{o}53'57"-18^{o}55'9"$ N and longitude $99^{o}29'8"-99^{o}31'36"$ E of the topographic map scale 1:50,000, sheet number 4846I and 4946 IV, series L7017 of Ban Huai Kaeo and Ban Rong Kho (Figure 1.3).

1.2 Physiographic Description

The study area is a mountainous terrain and covers a small part on the east of the Wiang Pa Pao-Khuntan batholith (Figure 1.2).The average elevation of the area is ranging from 450 to 1014 meters above mean sea level. The mountain is high on the western

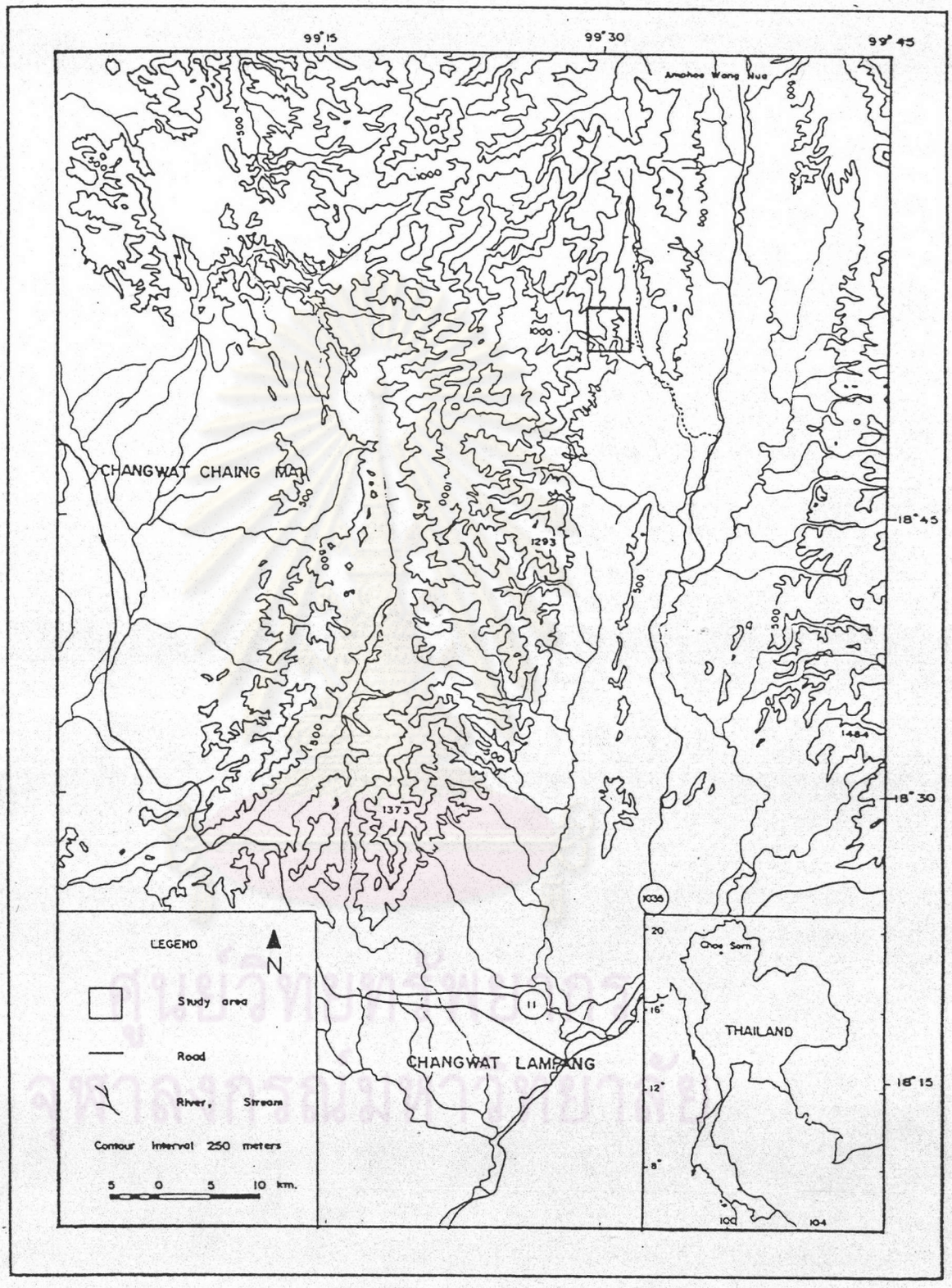

Figure 1.2 Topographic map showing the accessibility to the area. Note the N-S trending mountain range in the middle of the map is apart of Wiang Pa Pao-Khuntan batholith.

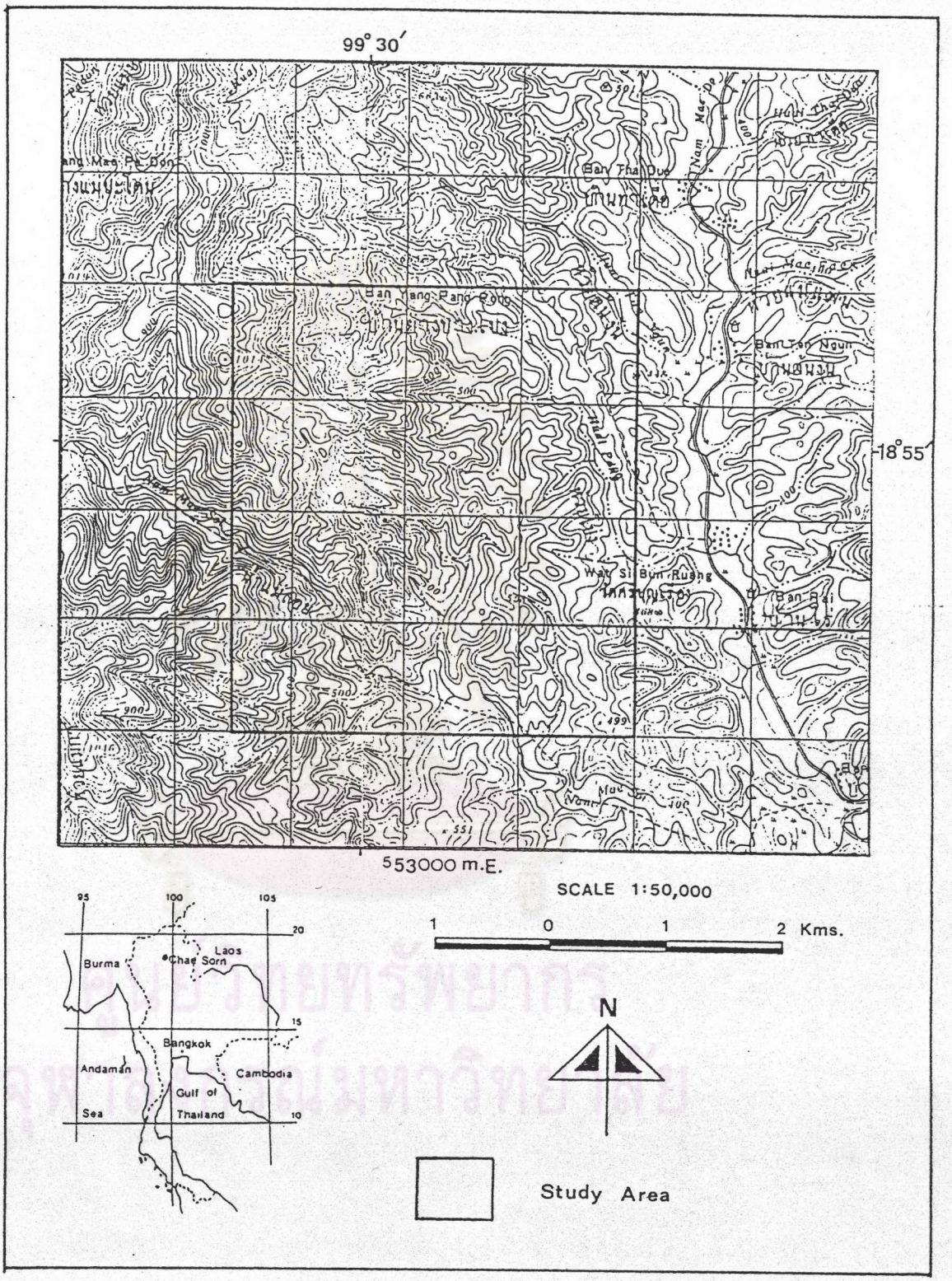

Figure 1.3 Location map of the study area.

side and decreases its elevation toward the east (Figure 1.3). The highest peak is up to 1014 meters above mean sea level. Nam Mae Soi flows through the southwestern portion of the study area (Figure 1.3).

1.3 Climate and Vegetation

The climate of the area is tropical monsoon with heavy annual rainfall. The average annual rainfall for a period of 5 years (1985-1989) is 1056.4 mm. in which August is the month of most heavy rainfall. The temperature is slightly variable according to the season, the average maximum and minimum temperatures for a period of 5 years (1985-1989) is 33.3 ^{o}C and 20.8 ^{o}C, respectively.

The area is under forestry reserve. However, plantation has also been carried at nearby Nam Mae Soi.

1.4 Previous Investigation

The first published report related to the study area was carried out by Piyasin (1972) which included a geologic map scale 1:250,000 that covered the area of changwat Lampang. According to this work the study area was mapped mainly as Don Chai Formation (Silurian-Devonian) and Mae Tha Formation (Carboniferous). In 1987, Siam Antimony Co Limited had made a geologic map scale 1:10,000 and also conducted a geochemical stream sediment survey of 32 square kilometers area covering the study area. Detailed drilling was carried out subsequently to estimate grade and ore reserve.

1.5. Purpose of Study

Eventhough the works related to the antimony occurrence at Chae Sorn were carried out by a number of workers, they were essentially directed toward the ore reserve estimation. No detailed study on geology and mineralization, particularly fluid inclusion has been carried out at Chae Sorn. Therefore, the purposes of this study are firstly to compile and make more detailed geologic map and to carry out a petrographic study of rocks in the area; secondly, to study the nature of antimony-gold mineralization in terms of mineralogy, textural relationships and paragenesis; and thirdly, to carry out the fluid inclusion study to get a better insight into its thermal history.

1.6 Methodology

Field investigation has been carried out in order to study a general geology and structural geology of the ore deposit and its adjacent area. Rock specimens including metasediment, clastic and igneous rocks were collected. In addition, much attention was given to the ore body by collecting several specimens for further laboratory study. Logging and sampling of rocks and ore samples from diamond drilling cores of total 25 holes has been performed.

In laboratory, the mineralogy and textures of rock were studied on standard thin sections under polarizing microscope with accompanying hand specimens. In case of ore specimens, doubly polished thin sections and standard polished thin sections were used for mineralogical and textural studies. Moreover, thin sections were also made at almost the same position to its doubly polished thin

sections in order to obtain more precise identification of non-opaque minerals. This is because most doubly polished thin sections are slightly thicker than the normal thin section as they are also prepared for fluid inclusion study. Microscopic study of ore minerals is always accompanied by the study of hand specimens. All together 60 doubly polished thin sections and polished thin sections have been made from outcrop and core samples. The problematic minerals were identified by the aid of X-ray difractometry.

The fluid inclusion study was carried on quartz, and some on sphalerite. Petrographic examination was conducted in order to differentiate fluid inclusion types, establish their nature and distribution. Microthermometric measurement was carried out to investigate temperature condition of the entrapment. The microthermometric measurement performed carried out on a heating and freezing stage manufactured by Linkan Scientific Instruments. The stage was mounted on a Leitz microscope equipped with long focal length objective and condensing lens. The stage is calibrated against a series of standards (e.g. Merck 9640, Merck Benzoic Acid, Merck 9670, Merck 9700, Merck 9800, Merck 9780 and Napthalin).