CHAPTER III

GEOLOGICAL SETTING

Sam Ngao-Ban Tak area, the area of investigation, is situated in Tak Province. The area has north-south trend and is encompassed by Khao Luang in the east and Doi Mun Luang mountain range in the west. In places, terrace landform was observed as small hilly terrain along both sides of the Ping and the Wang Rivers and also their tributaries, Huai Tak and Huai Mae Salit. Thus, abundant sediments of variable sizes such as cobble, pebble, sand, silt, and clay exist. Floodplain can also be found with a narrow strip along both sides of the main channels.

Piyasin (1974) conducted the geological investigation of Changwat Uttaradit Map Sheet NE 47-11 at a scale of 1:250,000 covering covering Amphoe Ban Tak, which is the study area. The main rock units of this region are composed of Precambian (?) metamorphic rocks, Triassic igneous rocks and Quaternary sediments. Later, in 1989, the detailed geological map (a scale of 1:50,000) of Amphoe Ban Tak sheet 4843 III was carried out by Boripatkosol *et al.* (1989). Rocks of the Precambrian (?) to Recent were described. Precambrian (?) metamorphic rock is the oldest rock, followed by Silurian-Devonian Don Chai Group and Quaternary sediments, respectively. Generally, igneous rocks in the area are intrusive rocks. Triassic granites cropped out extensively in the eastern part of the area. Some of the volcanic rocks in the area are Triassic andesitic and rhyolitic rocks extruding locally in the northeast portion of the area. Geologic map modified after their work is presented in Figure 3.1.

Dominant structure of the area is isolated by young faults. The majority set of fault directions lie northwest-southeast and also some minorities in northeast-southwest and north-south. The giant one is recognized in the north-south direction in the western part of the area.

In terms of stratigraphy, most of the rock units as mentioned above can be described from the oldest to the youngest in an ascending order as below.

Precambrian (?) rocks

This rock unit is composed of high-grade regional metamorphic rocks. It is classified as amphibolite facies by the presence of sillimanite in biotite gneiss (Boripatkosol *et al.*, 1989). It occurs around the Bhumipol Dam and at Doi Mun Luang. The inferred Precambrian (?) rock consists of coarse-to medium-grained biotite gneiss with pale gray to white or dark gray in color, and shows gneissic texture with referred orientation of biotite, feldspar and quartz in north-south direction. Minerallogically, the rock is composed of chiefly microcline, biotite, quartz and plagioclase as essential minerals and muscovite, sillimanite, chlorite, apatite, epidote and hematite as accessory minerals. Thickness of this unit is more than 800 metres. Age of biotite gneiss may be preferred to Precambrian based on its high-grade metamorphism in amphibolite facies.

Silurian - Devonian rocks

Don Chai Group consist of low-grade metamorphic rocks of greenschist facies (Piyasin, 1974). It occurs in the northern and western parts of the study area. Don Chai Group consists of quartzite with light gray to dark gray color, quartz-schist in light gray to gray color, mica-schist with gray to dark gray color, phyllite with light gray to gray color, and some marble and calc-silicate forming as lens in mica-schist. It is noted that mica schist is found at the bottom of metamorphic facies and followed up by quartz-schist, and quartzite to the top.

Mica schist comprises of biotite, muscovite, quartz, orthoclase, and plagioclase as essential minerals and chlorite, sericite and hematite as accessory minerals.

Light gray to gray fine-grained quartz-schist compris 70% of quartz, 15% of muscovite and 8% of feldspar as essential minerals. Accessory minerals are hematite and chloride.

Light gray to dark gray quartzite comprises 91% of quartz, 5% of feldspar as essential minerals and chlorite, hematite and sericite as accessory minerals.

Thickness of this group is about 800 meters and it is thought to refer to Silurian-Devonian in age based on its lithological correlation and stratigraphy (Boripatkosol *et al.*, 1989).

Quaternary unconsolidated sediments

The Quaternary deposits are unconsolidated terrace deposits and alluvium filled. They are composed of lateritic gravel of high and middle terrace landforms. In the central part of the area, the alluvium consists of unconsolidated sediments and formed dominantly as low terrace, floodplain and meander-belt deposits. The age of these deposits is thought to have formed during Pleistocene to Recent (Boripatkosol *et al.*, 1989).

Igneous rocks

Intrusive Igneous rocks

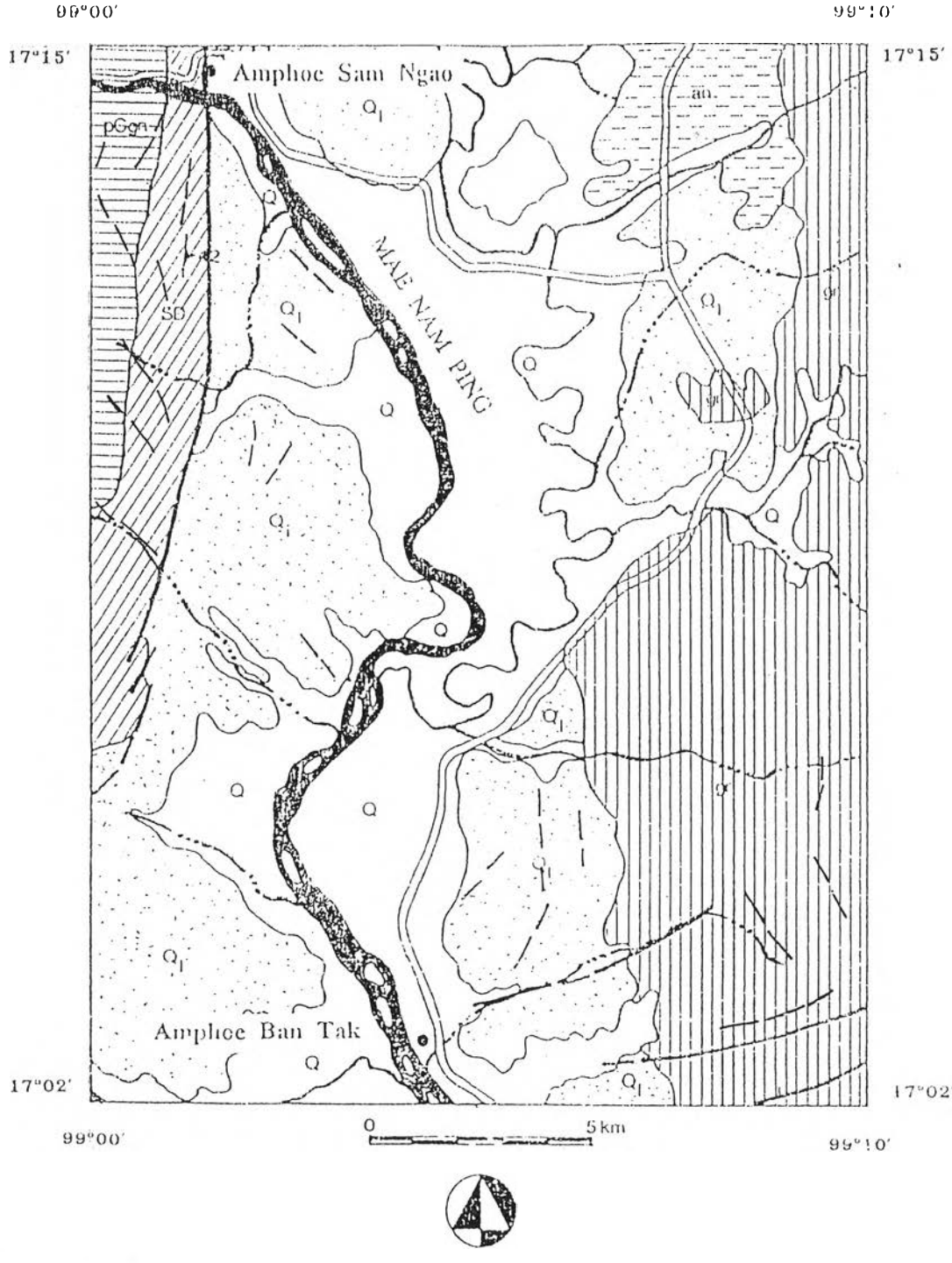
The intrusive rocks in the area occur as large batholith and has been classified as a part of Tak Triassic Granite Batholith (or Eastern Belt, see Charusiri, 1989) and it is recognised in the east of the area by Boripatkosol *et al.* (1989). The granite in this area can be classified into 4 groups as hornblende granite, biotite granite, quartz-diorite and granodiorite, and leucocratic granite. These rocks are generally medium-to coarse-grained and porphyritic granites. Tak Batholith of I-type granite in the Eastern Belt, which is presumably emplaced in Triassic (Boripatkosol *et al.*, 1989).

Extrusive Igneous rocks

Extrusive igneous rocks can be chronologically divided into 2 groups Lower Triassic and Upper Triassic (Boripatkosol *et al.*, 1989). The Lower Triassic rocks are found in the northeast of the study area, and consist of andesitic and rhyolitic rocks. They comprise greenish gray andesitic tuff, green andesite, green to greenish gray porphyry andesite with andesine, hornblende, pyroxene, epidote, chlorite and pyrite as essential minerals. In addition, this rock unit also includes porphyry rhyolite and rhyolitic tuff with light pink to purple color with quartz, plagioclase and sanidine as essential minerals and epidote, pyrite, iron, and glass as accessory minerals. The age of this rock is referred to Lower Triassic (Boripatkosol *et al.*, 1989). The Upper Triassic rock consists of light green, fine-grained andesite with andesine, plagioclase, pyroxene, and hornblende as essential minerals and pyrite and iron oxides as accessory minerals. Furthermore, gray very fine-grained rhyolite with quartz, sanidine, and plagioclase as essential minerals and chlorite, limonite and epidote as accessory minerals are also observed.

Historical geology of the study area

According to Boripatkosol *et al* (1989), historical geology of the area can generally be explained. Firstly, in Precambrian (?) there was the deposition of sediments in the basin as part of Shan-Thai craton (Bunopas, 1981), then it was uplifted because of the adjustment of global plate motion. After long time compaction and diagenesis, the sediments became dynamothermally metamorphosed with the metamorphic grade up to gneiss, which is observed in the west of the area at the moment. There is no deposition during Cambrian and Ordovician. The deposition was taken place in Silurian-Devonian on to the passive continental margin of Shan Thai (Charusiri et al., 1997) caused huge deposition of sandstone and shale, then they were once again metamorphosed to quartzite, quartz-schist, mica-schist, and phyllite, as observed in the west of the area. During Lower Triassic, calc alkali volcanic eruption due to the westward subduction occurred and scatterly distributed along the region from Changwat Lampang down till Changwat Tak. The volcanics are rhyolitic tuff, rhyolite porphyry, rhyolite, andesite porphyry, andesite, and andesitic tuff. In Upper Triassic, the interaction between Shan-Thai and Indosinian plates was responsible for I-type granite intrusion and also the eruption of volcanoes. After long-time motion of plates, the earth's surface was stable, making the unconformity with Quaternary sediments. Perhaps the physiographic feature of the study is dominated by surface process during late Pleistocene (Boripatkosol *et al.*, 1989).



Legend

Q	River gravel, sand, silt, clay, and mud.	Quaternary
Qt	Terrace gravel, sand, silt, and clay.	
	DON CHAI GROUP	
SD	Quartzite, quartz-schist, mica-schist, locally with marble and calc-silicate lens in mica-schist.	Devonian-Silurian
pCgn	Biotite-hornblende granite, porphyritic granite.	Precambrian
gr	Pinkish granite, including quartz-vein (gtz).	Triassic
an	Andesite and rhyolite.	Lower Triassic

Symbols

- Stream
- Road
- Fault
- Boundary
- 42 Strike and dip
- Foliation

Figure 3.1 Generalized geological map of Sam Ngao and Ban Tak area (modified from Piyasin, 1974 and Boripatkosol *et al.*, 1989).