CHAPTER 2

GEOLOGIC SETTING

Geologic data and maps (Fig. 2.1 and 2.2) of the study areas and the vicinity is based on the 1:50,000 Geologic Map, sheet 4949 I Amphoe Mae Sai is compiled by Putthaphiban and Ya-anan (1988) and sheet 4949 II Amphoe Mae Chan is compiled by Paengkaew and Kitisarn (2000), Chiang Rai Province. The 1:250,000 Geologic Map, Chiang Rai Province is published by Braun and Hahn (1976). The areas of concern cover Northern Regions of Thailand and close to Thailand-Myanmar border. Geology of these areas is made up of igneous rocks, metamorphic rocks and sedimentary rocks that have formed in Paleozoic to Cenozoic era. The Mae Sai area is made up of Silurian igneous rocks, Carboniferous-Devonian metamorphic rocks, Carboniferous sedimentary rocks, Permian-Carboniferous sedimentary rocks, Triassic-Permian igneous rocks, Triassic granitic rocks and alluvial and terrace deposits. The Mae Chan area is covered by Carboniferous-Devonian metamorphic rocks, Permian-Carboniferous sedimentary rocks, Triassic-Permian igneous rocks, Triassic felsic plutonic rocks, Triassic sedimentary rocks and alluvial and terrace deposits. The distribution of the rocks in the study areas has an approximately long axis parallel/subparallel to a north-south direction. The Mae Chan fault is active fault in the Mae Chan area that lies E-W trending.

2.1 Silurian Igneous Rocks

The Silurian igneous rocks are located along the western side of the Mae Sai area and lie N-S orientation. The Silurian igneous rocks are made up largely of medium to coarse grained gabbro and diorite. Thses rocks show equigranular texture and fine to coarse grained gabbro or gabbroic diorite xenolith. The studied samples were collected from these mafic igneous rocks. Locally, the mafic igneous rocks are cut by aplite and pegmatite dyke. Diorite crops out around Doi Tung were dating by

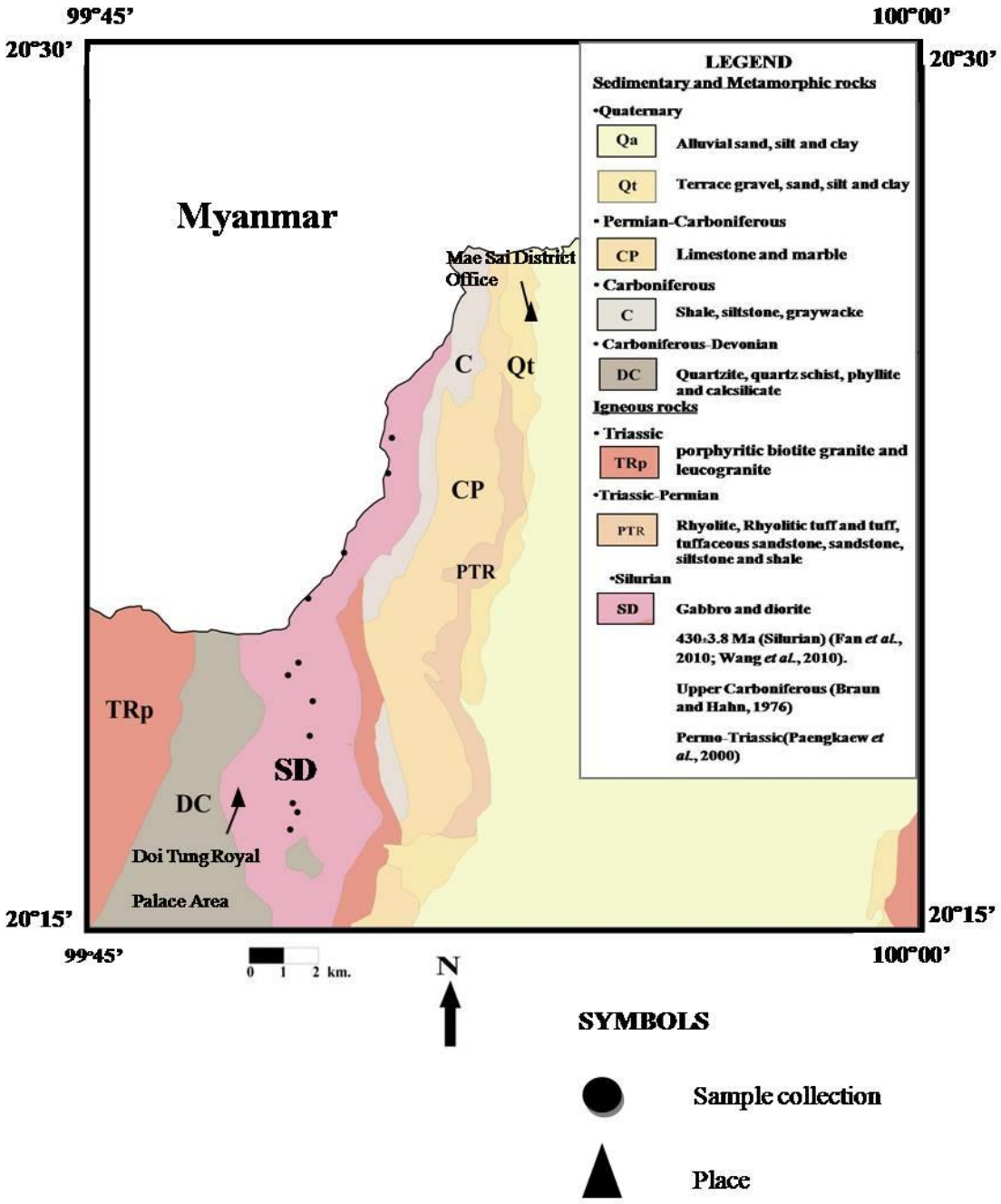

Figure 2.1 Simplified geologic map of the Mai Sai area and location of collected samples (solid circles) in the study area (modified from Braun and Hahn, 1976; Putthaphiban and Ya-anan, 1988)

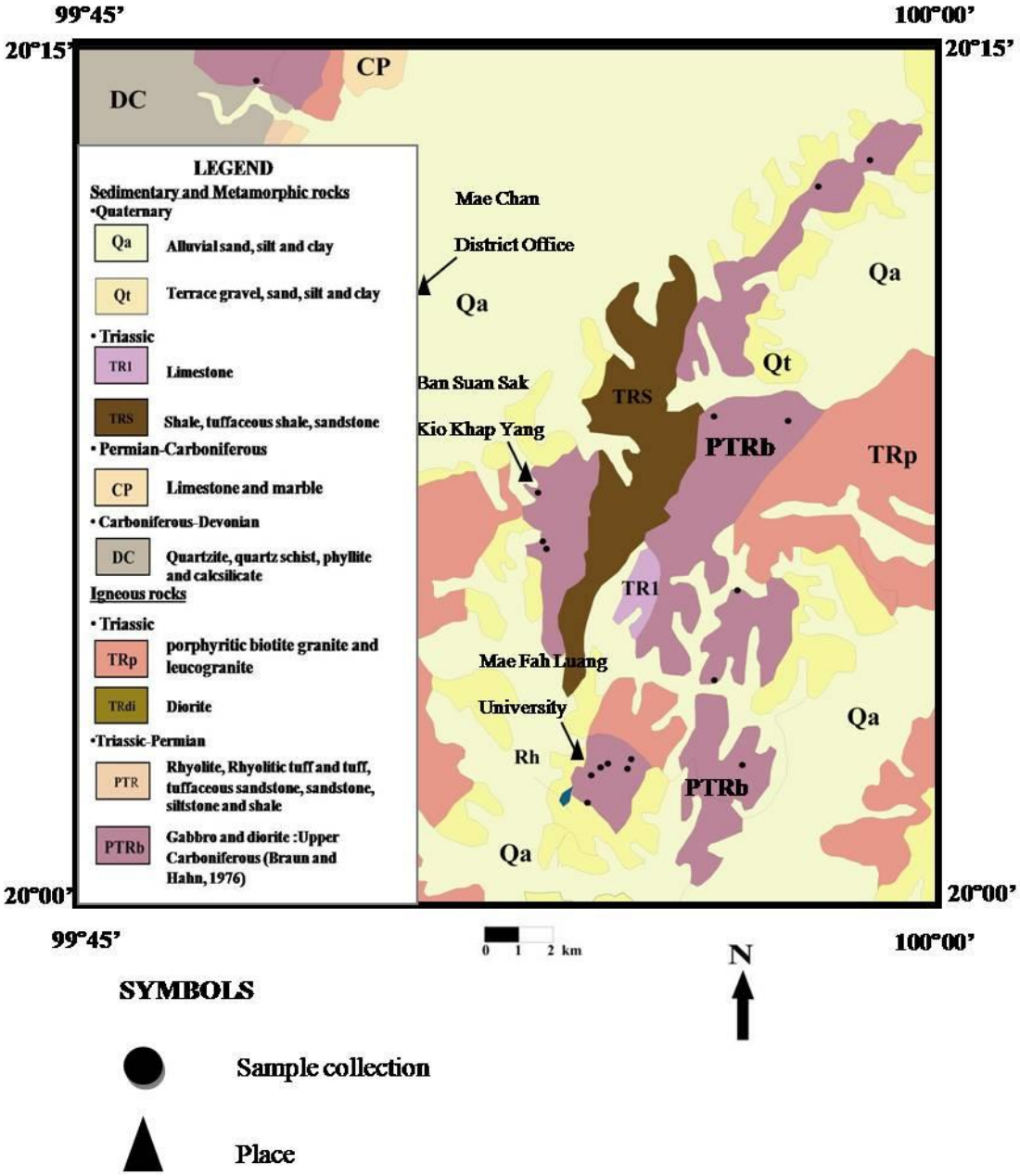

Figure 2.2 Simplified geologic map of the Mai Chan area and location of collected samples (solid circles) in the study area (modified from Braun and Hahn, 1976; Paengkaew and Kitisarn, 2000)

U/Pb zircon to be 430±3.8 Ma (Silurian) (Fan *et al*., 2010; Wang *et al*., 2010). Braun and Hahn (1976) reported that the studied rocks are the upper Carboniferous period while, Paengkaew *et al*. (2000) presented that the studied rocks were formed in the Permo-Triassic period. By field investigation in the Mae Sai area, the fault contact is along between the Carboniferous and Permian rock units that follows a long, narrow N-S trending.

2.2 Carboniferous-Devonian Metamorphic Rocks

The Carboniferous-Devonian metamorphic rocks are distributed on the western part of the Mae Sai area and the northwestern of the Mae Chan area, with almost N-S orientation. This unit contains shale, limestone and chert, which are mostly metamorphosed to phyllite, marble and metachert. They are overlain by the Carboniferous rocks which comprise sedimentary rocks. In addition, the Carboniferous-Devonian Metamorphic Rocks are made up gray to dark gray quartzite, quartz schist and calcsilicate.

2.3 Carboniferous Sedimentary Rocks

The Carboniferous rocks are present along the northwestern side of the Mae Sai area and lie N-S orientation. The Carboniferous sedimentary rocks include dark gray shale interbedded with gray siltstone, fine grained sandstone and greywacke. The Permian tuff unit was previously inferred to unconformably overlie the Carboniferous sedimentary rocks. The Carboniferous sedimentary rocks are juxtaposed by thrust faults.

2.4 Permian-Carboniferous Sedimentary Rocks

The Permian-Carboniferous rocks are spread on along the middle of the Mae Sai area and small area in the northwestern of the Mae Chan area with almost N-S orientation. The Permian-Carboniferous rock unit overlies the Carboniferous rocks and is made up of marble and gray to dark gray limestone, with *Cribrostromum sp, Tuboritina sp,* and Echinoidea plate. Also, present is sandstone interbedded with gray shale.

2.5 Triassic-Permian Igneous Rocks

The Triassic-Permian rocks are scattered on the western side of the Mae Sai area and the middle to eastern side of the Mae Chan area, with approximately N-S orientation. These rocks are made up largely of maroon to light gray rhyolite, rhyolitic tuff and tuff, conglomerate interbedded with tuffaceous sandstone, sandstone, siltstone and shale in the upper part. Also, presents are mafic plutonic rocks which comprise largely of medium-coarse gabbro and diorite. The Triassic-Permian mafic plutonic rocks are the studied samples in the Mae Chan area. Braun and Hahn (1976) reported that these rocks are the upper Carboniferous period while, Paengkaew *et al*. (2000) reported that these rocks were formed in the Permo-Triassic period.

2.6 Triassic Sedimentary and Igneous Rocks

The Triassic sedimentary rocks are distributed throughout the Mae Chan area and mostly lies N-S orientation. The Triassic rocks comprise sedimentary rocks and igneous rocks. The Triassic sedimentary rocks are made up of gray to greenish gray shale, tuffaceous shale and sandstone. Shales are interbedded with sandstone, siltstone and mudstone that are thinly beds. Triassic limestone (Lampang Group) is distributed on a small area and consists of dark gray to gray, fine to medium grained, well bedded and thin to thick bedded limestone.

The Triassic igneous rocks are scattered on mostly the western side of the Mae Sai area and the western side and partly eastern side of the Mae Chan area. These rocks are made up of biotite granite, hornblende-biotite granite which have medium to very coarse grained, equigranular to large porphyritic texture. Leucogranites are fine to medium, equigranular texture, with aplite and pegmatite dyke. Also, Triassic igneous rocks are made up of medium gray to dark gray diorite, with equigranular texture, and fine to medium grained. The Triassic grainitic rocks are part of the central granite belt of Thailand (Charusiri *et al.*, 1993) and are mostly S-type granite.

2.7 Recent Sediment Deposits

The other area is partly covered by the recent sediments that are made up of alluvial and terrace deposits. Recent Sediment Deposits are mainly semi-consolidated and unconsolidatd sediments. The alluvial sediments (Quaternary) are commonly sand, silt and clay of flood plain deposits. The alluvial terrace deposits (Quaternary) comprise largely of gravel, sand, silt and clay.