# CHAPTER 5

## CONCLUSION

The rocks exposed in the Long District area comprise abundant sedimentary rocks and volcanic rocks, and minor plutonic rocks. The major rock types can be separated into five major lithostratigraphic units from older to younger as follows: Permian sedimentary rocks, Triassic sedimentary rocks, Upper Triassic – Lower Jurassic volcanic rocks, Cenozoic volcanic rocks and Quaternary unconsolidated sediments. The Permian to Triassic sedimentary sequences were intruded by plutonic masses that are Upper Triassic in age. The Upper Triassic – Lower Jurassic volcanic rocks are part of Chiang Khong - Tak volcanic belt and composed largely of pyroclastic rocks, with minor chemically equivalent lava flows and hypabyssal rocks of felsic to mafic compositions. Only least-altered, mafic volcanic rocks and hypabyssal rocks are petrochemically presented in this study.

The studied, mafic rock samples almost totally show slightly - highly megacrystic textures. The phenocryst and microphenocryst assemblages include plagioclase, clinopyroxene, unidentified mafic mineral, Fe-Ti oxide and/or apatite. They may occur as isolated grains, and monomineralic and polymineralic clusters. These megacrysts are embedded in the groundmass, consisting largely of plagioclase laths, with minor clinopyroxene, unidentified mafic mineral, Fe-Ti oxide and interstitial quartz in different proportions. The groundmass is either holocrystalline, with felty and trachytic textures, or glassy. The clinopyroxene crystals may show ophitic/subophitic relationship to plagioclase laths, respectively. Secondary patches of sericite, chlorite/serpentine, clay minerals, epidote minerals (zoisite/clinozoisite and/or epidote), pumpellyite, carbonates, quartz, Fe-Ti oxide, hematite/iron

hydroxide, sphene/leucoxene and/or amphibole are rarely present. Tiny cavities and fractures that may be sealed by chlorite, epidote minerals (zoisite/clinozoisite and/or epidote), quartz, carbonates, hematite/iron hydroxide and/or Fe-Ti oxide have sparsely been observed in very few samples.

The studied hypabyssal rocks include microdiorite and microdiorite/microgabbro samples. The microdiorite sample is a seriate-textured, fine-grained rock that contains plagioclase and clinopyroxene as the principal constituents; secondary patches of chlorite, sphene/leucoxene and carbonates are present in minor amount. The microdiorite/microgabbro sample contains abundant plagioclase and clinopyroxene, and occasionally unidentified mafic megacrysts. They occur as isolated grains, and monomineralic and polymineralic clusters. The groundmass constituents have largely undergone alteration. The severely altered portion contains secondary patches of sericite, epidote minerals (zoisite/clinozoisite and epidote), pumpellyite, chlorite/serpentine, Fe-Ti oxide and sphene/leucoxene.

The studied volcanic rocks are chemically classified as calc-alkalic andesite and andesite/basalt. Similarly, the hypabyssal rocks are calc-alkalic microdiorite and microdiorite/microgabbro, the plutonic equivalents of the andesite and andesite/basalt in respect manner. These rocks have co-magmatic origin, and have formed by different degrees of crystal fractionation of the parental magma. Five representative samples show LREE enrichment and relatively flat HREE, with (La/Sm)cn and (Sm/Yb)cn values ranging from 2.96 to 3.79 and 2.63 to 3.30, respectively. The representatives of the andesite/basalt samples presented in this study are analogous to the calc-alkalic basalt and basaltic andesite from Salina, Aeolian Arc, Italy in terms of chondrite-normalized patterns and N-MORB normalized multi-element patterns. Consequently, the studied mafic volcanic rocks and hypabyssal rocks are interpreted to have formed in an active continental margin that is closely linked to the complex collision between Shan-Thai and Indochina cratons.