ABSTRACT

The thesis is developed with two broad objectives:

1. To explain the geochemical and minerological characteristics of the Nongpoh granite and associated rocks including the enclaves within the granites, and to present a petrogenetic model.

2. To find out the age of the Nongpoh granite, source rock composition and the tectonic environment in which these granites were emplaced.

In and around Nongpoh (25°51'N-25°52'30"N, 91°50'25"E-91°53'E), an area of 100 Sq. kms. (approx.) is surveyed and it is found that the granitic rocks dominate the other rock types viz., quartzofeldspathic gneisses etc. and of these granitic rocks, porphyritic granite (pink and grey) is the most dominant variety covering almost 75% of the area. Other varieties of granitic rocks include coarse granied granite, medium granied granite, fine grained granite (aplitic type), pegmatite, quartz veins and quartzofeldspathic veins.

The rocks associated in and around these granites include quartzofeldspathic gneisses, hornblende biotite gneisses and dioritic rocks and migmatitic gneisses of local occurrence in the southern part of the area.

In addition to the study of general geology of the area (Chapter III) such as drainage pattern, weathering, erosion
etc., the inter-relationship between the rock units were evaluated in an extensive field survey carried out in four phases in the year 1995, 1996, 1997 and 1999. It is found that the Nongpoh granites have a sharp contact relationship with the quartzofeldspathic gneisses (country rock), and with the enclaves of hornblende biotite gneisses, and a diffused contact relationship with the dioritic enclaves. However, the study revealed a gradational contact relationship among the different varieties of granites viz., coarse grained granite, medium grained granite and porphyritic granite. The fine grained granite (aplitic type), pegmatites and other late derivatives have a sharp contact with the Nongpoh granite (Chapter IV).

The structural features (Chapter V) in the granites and the associated country rocks including the enclaves are identified and evaluated for various types such as flow layers, flow lines, joints, folds etc. The identification of the minerals, textures and microstructures is made on the basis of thin section study (Chapter VI). The overall minerology of the different varieties of granites are then compared on the basis of modal abundances of main rock forming minerals such as K-feldspar, plagioclase feldspar, quartz, biotite etc. and the microtexture. It is found out that except for grain size differences there is no other conspicuous difference
between them. The petrographic study revealed a subsolvus nature for the granites.

It has been shown (Chapter VII) through geochemical analyses that the Nongpoh Granite is normal granite (3a and 3b QAP-field of Streckeisen, 1976 and LeMaitre, 1989), high K-type (K₂O/Na₂O ratio > 1.00), calc-alkaline having peraluminous nature.

The emphasis on Th/U ratio (3.4-22) revealed a fertile nature for the Nongpoh granite with a possible, concentration of explorable amount of Uranium in downstream sediments having abundant reductants.

A rigorous exercise on various plots and schemes of petrogenetic significance revealed that the Nongpoh Granite has evolved from partial melting of a "minimum melt" composition at temperatures below 750°C.

The morphology of ORG normalised pattern and the geological context showed a Syn-Collision type of tectonic environment for these granites.

The enclaves in these collision related granites are metaluminous, ortho-dioritic rocks and peraluminous, parahornblende-biotite gneisses and quartzofeldspathic gneisses (Chapter VII). This characteristic feature alongwith some other characteristics indicates that the Nongpoh granite sway the I-and S-type granitoids of Chappell and White (1974) with some features pointing to S-type and some to I-
type granitoids.

Further, the geochronological study (Chapter VIII) on the Nongpoh granite revealed an Rb-Sr age of 727±29 Ma and an initial ⁶⁷Sr/⁶⁸Sr ratio of 0.71052±0.00042 reflecting a crustal source for the granite.

The present study showed a close relationship between granite geochemistry, isotope systematics and geological characteristics, because granite in the widest sense, arises as the end-stage of several generative processes involving different source rocks, each process and source being appropriate to a particular environment (Pearce et al., 1984). It is felt that correlation of geochemical characteristics and geological characteristics has helped to eliminate empiricism prevalent from isolated studies in the surveyed granite terrane, in and around Nongpoh.