CHAPTER V

INTERPRETATION AND CONCLUSION

5.1 Interpretation

An interpretative model of the four types of intrusive rocks in the study area is displayed sequentially in Figures 5.1 to 5.6. As mentioned above, all intrusive rocks are I-type affinity, calc-alkaline and high K calc-alkaline series, and metaluminous to peraluminous. These characteristics consistent with the tectonic discrimination diagrams which point out that most of intrusive rocks might intruded at the volcanic arc setting (Babarin, 1990; Pearce et al., 1984) during middle Triassic (230±4 Ma.) after the explosion of volcanic rocks (Figure 5.1). However, both extrusive and intrusive magmatic activities might have taken place at a very close time interval as indicated by the isotopic age dating.

When the magma of intrusive rock reached at high level, it intruded the country rocks, both limestone and volcanic rocks (Figure 5.2). Then crystallization began to take place from outer part of pluton and progressed inwardly. Petrographic study, however, indicate that the crystallization of both side in the pluton may took place under a different circumstance. The western part, gabbro and hornblende-biotite granodiorite, tend to crystallize in a more equilibrium condition while the eastern part, diorite and quart diorite, crystallized in a in-equilibrium condition (Hibbard,1995). Nevertheless, the two rocks in western part seem to crystallize under different condition because zoned plagioclase is common in the hornblende-biotite granodiorite but it is lacking in gabbro.

The inward fractionation process progressively took place as soon as the segregation process which brought interstitial melts into inner part of pluton (Figure 5.3). Consequently, contraction might taken place coupled with the subsidence of pluton. These processes induced the formation of fractures (Figure 5.4), then the inner residual felsic melt might escape along these fractures to the upper part of the pluton (Figure 5.5) to form another zoned pluton. Finally, all covered volcanic rocks were

removed by erosion process then intrusive rocks exposed (Figure 5.6) as seen at the present day.

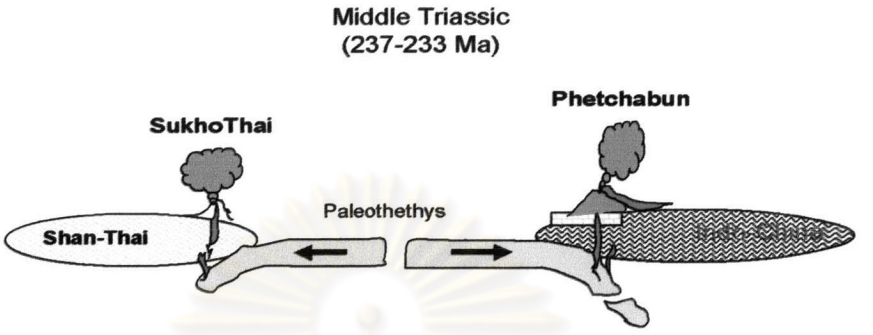

Fig. 5.1 Interpretative model illustrates eastward and westward subductions of paleothethys oceanic plate beneath the Indo-China and Shan-Thai plate, respectively.

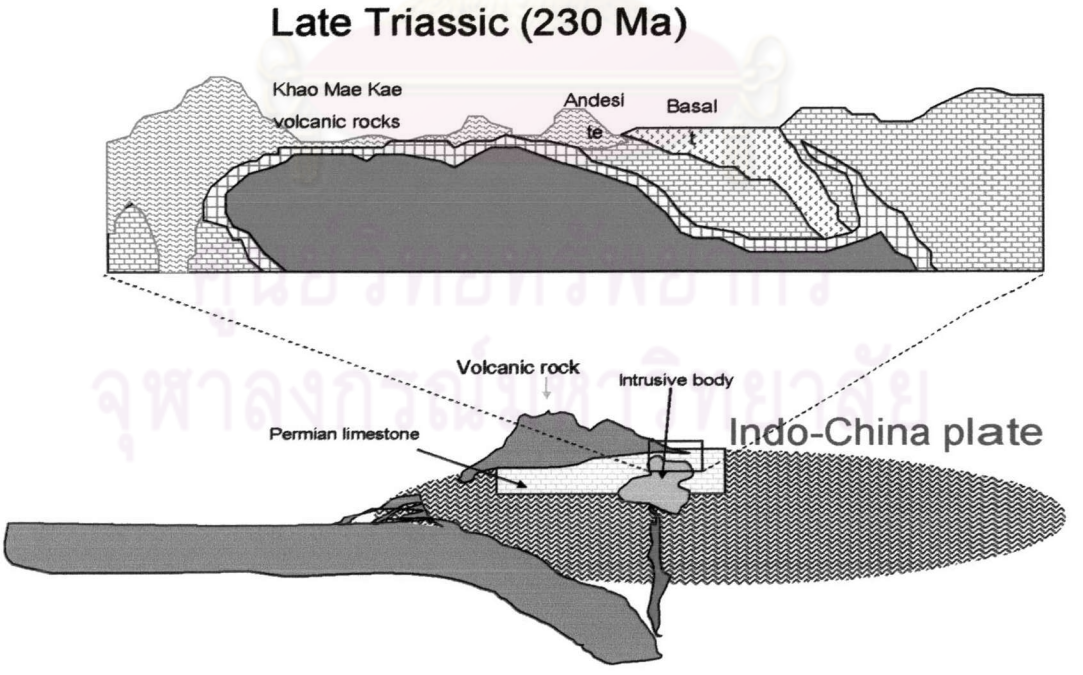

Fig. 5.2 Interpretative model illustrates intrusion of the intrusive rocks into limestone and volcanic rocks.

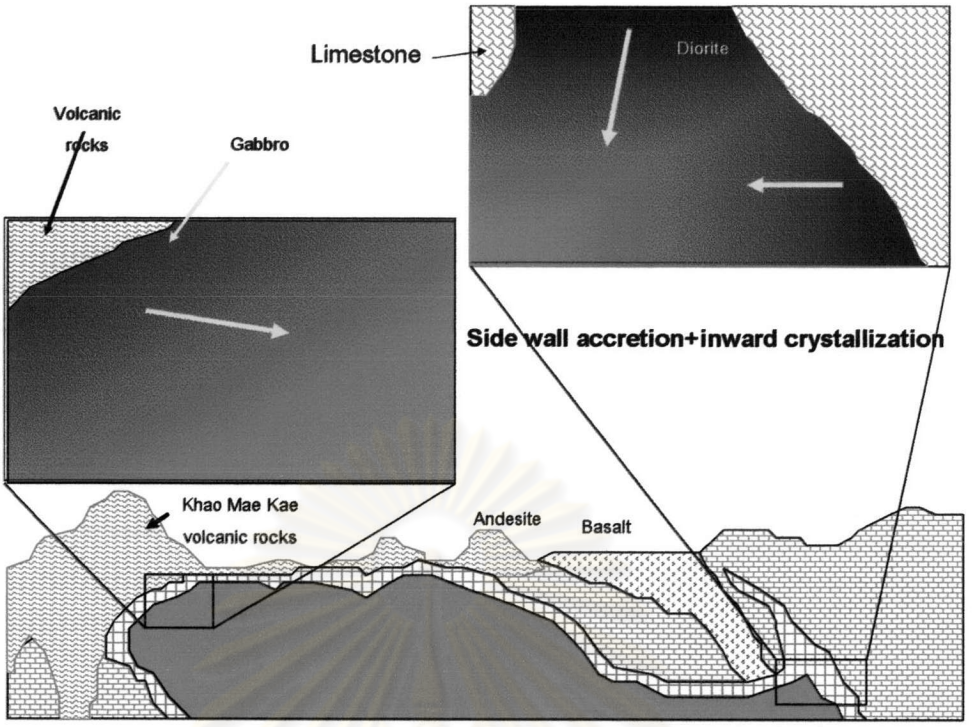

Fig. 5.3 Interpretative model illustrates inward inward crystallization that took place in the intrusive chamber.

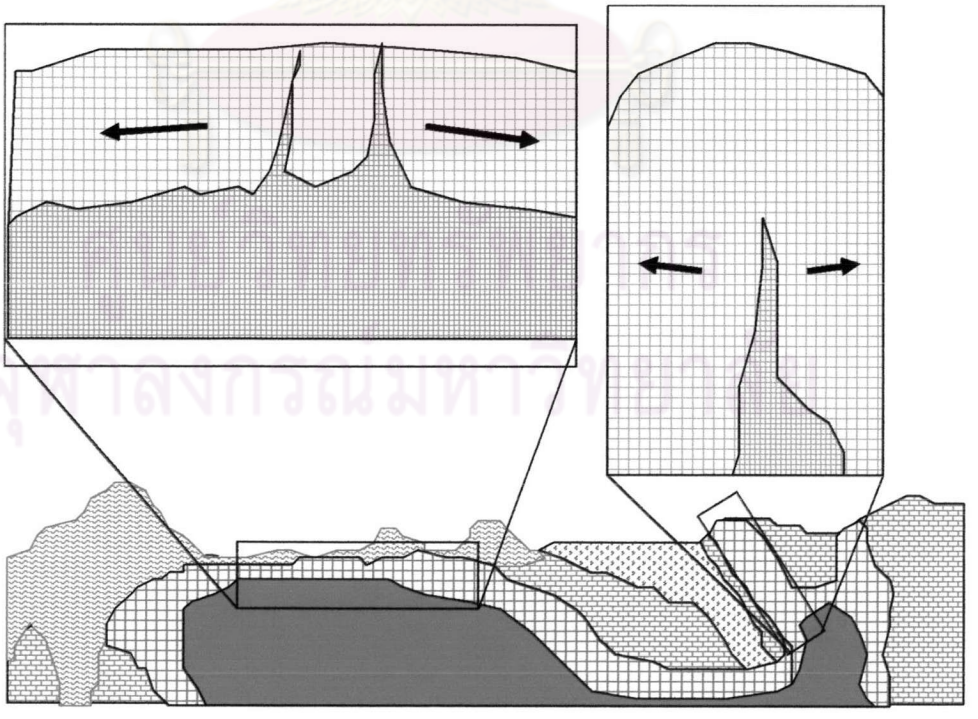

Fig. 5.4 Interpretative model illustrates the fracturing process in the intrusive chamber.

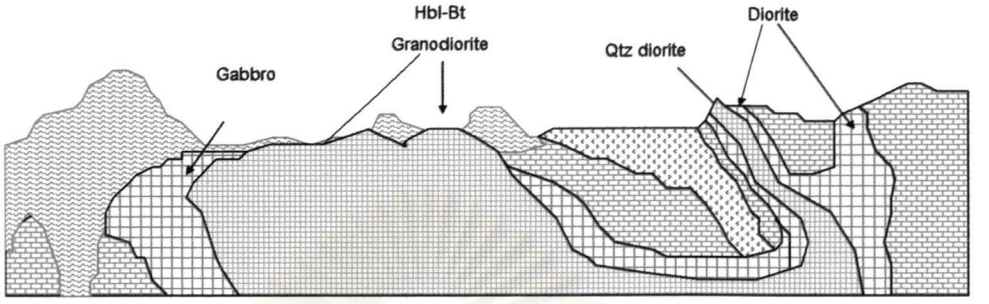

Fig. 5.5 Interpretative model illustrates a complete result of inward crystallization.

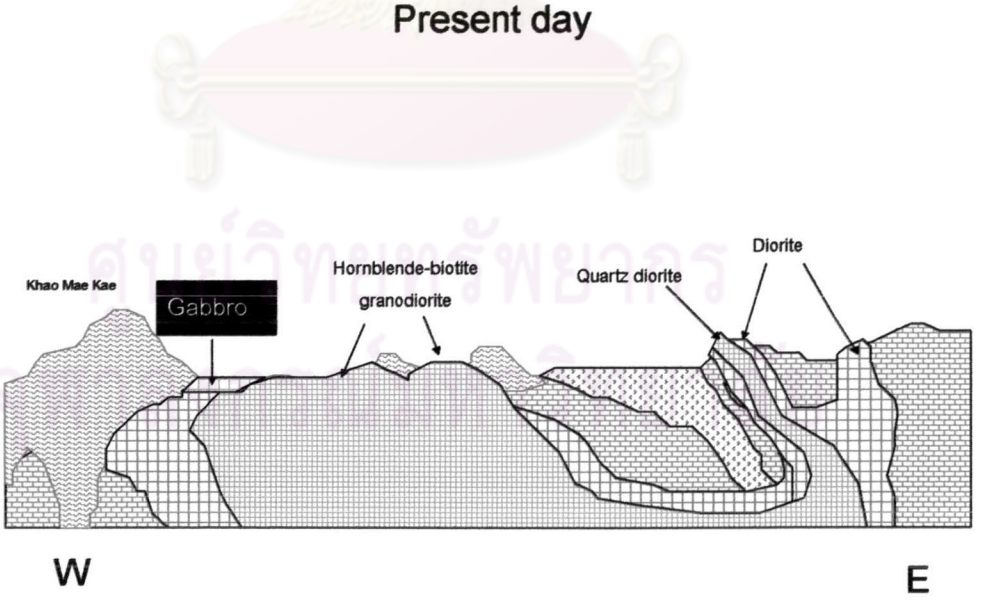

Fig. 5.6 Interpretative model of style of present relationship among the intrusive rocks, volcanic rocks and limestone in the study area.

5.2 Conclusions

1. Based on field observation, petrographic study and geochemical analyses, the intrusive rocks can be categorized into four types which consist, from mafic to felsic, of gabbro, diorite, hornblende-biotite granodiorite and quartz diorite, respectively.
2. The equigranular, coarse-grained gabbro is composed of plagioclase, pyroxene, hornblende, K-feldspar and small amount of quartz. Its mineral composition seems to change spatially by which pyroxene decreases while K-feldspar and quartz increase eastward.
3. The porphyritic, fine-grained diorite is mainly composed of plagioclase, hornblende, quartz and K-feldspar.
4. The porphyritic, fine-grained quartz diorite cross-cut the diorite. Both intrude along the beds of limestone. Quartz diorite consists of plagioclase, hornblende, K-feldspar and quartz. Granophyric and micrographic are the distinctive features of this rock.
5. The equigranular, medium to coarse-grained hornblende-biotite granodiorite comprises plagioclase, hornblende, K-feldspar, biotite, quartz and subordinate pyroxene. This rock commonly shows replacement of hornblende by biotite. The rock also shows the compositional variation eastwardly.
6. Summary of petrographic and geochemical characteristics of intrusive rocks in the study suggest that most of them are the I-type affinity (Chappell and White, 1974; Cobbing et al.1986; Babarin 1990). Such characteristics are as follows:

6.1 Hornblende is common ferromagnesian mineral while muscovite is absent.

6.2 Sphene is visible .

6.3 They show extended compositional range (SiO_2 =51 to 66 %).

6.4 Most rocks are metaluminous and subordinate peraluminous.

6.5 Most of them has a high contents of CaO (3.74 % at SiO2 66.45%), Na2O (>2.2% in mafic rocks and >3.2 % in felsic rocks) and Sr but low Rb.

6.6 Most of the intrusive rocks are calc-alkaline and some high K calc-alkaline series and volcanic arc granitic rock.

7. Their Harker variation diagrams show linear continuous change neither decrease nor increase with respect to increasing SiO_2 content.

8. Fractionation of plagioclase and clinopyroxene might have been the main causes of compositional variation that found among the intrusive rocks in the study area.

9. Based on the rare earth-chondrite normalized patterns and vector diagram, most of them suggest co-magmatic series which might generate from the fractional partial melting process rather than from the batch partial melting process.

10. The Al-in-hornblende barometry suggests the pressure of emplacement at about 1.0 to 2.8 kbar while the amphibole-plagioclase thermometry suggests the temperature of emplacement at approximate 610 to 670 ^{0}C.

11. The zircon age suggest that intrusive rocks in the study area emplaced during middle Triassic period (230 ± 4 Ma). If compared with their associated volcanic rocks, these intrusive rocks were spatially and temporally related with those volcanic rocks (Intasopa, 1993).

12. Based on above characteristics, it can be concluded that the four different intrusive rocks in the study area related to each other as a "normal zoned pluton" which comprise gabbro, diorite, quartz diorite and hornblende-biotite granodiorite from outer to inner. Their variations were dominantly controlled by the side-wall accretion process (or inward fractional crystallization process). Such characteristic, zoning, is commonly found in I-type granitic pluton (Pitcher, 1997).

13. These intrusive rocks intruded during middle Triassic which was the time of amalgamation between Shan-Thai and Indo-China plates. Such event might have taken place as eastward subduction of paleothethys oceanic plate beneath the Indo-China continental plate (Bunopas, 1981; Bunopas and Vella, 1983).