

**PETROLOGICAL AND PETROCHEMICAL STUDIES OF  
IGNEOUS AND METASEDIMENTARY ROCKS IN BILIN  
AND ITS ENVIRONS, BILIN TOWNSHIP, MON STATE**

**PhD DISSERTATION**

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## ABSTRACT

The study area is situated in Bilin Township and its vicinity, Mon State. It is located between Latitude  $17^{\circ} 12' 45''$  N to  $17^{\circ} 21' 45''$  N and Longitude  $97^{\circ} 09' 00''$  E to  $97^{\circ} 14' 45''$  E. The area is bounded by vertical grid 690 to 800 and horizontal grid 860 to 104. It is a part of one inch topographic map number 94 G/3 and G/4. The total area coverage is about 116.5 km (45 square mile).

The study area is chiefly covered by igneous and metasedimentary rocks. Igneous rocks are well exposed in the northern, north-western and south-eastern parts and metasedimentary rocks are cropped out in the central and western parts of the study area. Best exposure is observed along the stream sections and along the crest of the ridges.

Igneous rocks include biotite granite, biotite-muscovite granite, diorite, microdiorite, hornblendite, pyroxenite, biotite microgranite, leucogranite and lamprophyre (spessartite). Biotite granite is the most abundant rock type in the study area. Biotite granite is exposed in the northern, north-western and south-eastern parts of the area; it is highly jointed and weathered. Diorite is the second widely exposed rock type. It is found as massive nature and segregations of mafic mineral are also observed. They are well exposed at Kyaukseing Taung (413 m peak) and near the foothill of the Kyaukkalahtaing Taung (184 m peak). Hornblendite is found as small patches within diorite bodies at Kyaukseing Taung. Pyroxenite is well exposed at the southern and south-western parts of the study area, especially at Alugale, Winpyan and Wegyi villages. Biotite-muscovite granite occurred on the peak of the Koktheinnayon pagoda (324 m). Biotite microgranite and leucogranite are exposed at the southern and north-eastern foothills of Myinthar range. Pegmatite dykes, aplite, quartzofeldspathic and quartz veins are intruded into the biotite granite.

Metasedimentary rocks are slate, phyllite intercalated with schist and quartzite. Metasedimentary rocks are distributed in the central and western parts of the study area. Phyllite intercalated with schist is well exposed along the bullock track of Alugale village and Alontaung pagoda (117 m peak). Quartzite is observed with phyllite at Alontaung pagoda and north of Paingdawe village. Placer gold occurred along Kadat Chaung, in the western part of Alugyi village. Placer titanium ore are found along the Gonnyinnwe Chaung, at the southern part of Gonnyinnwe village.

Specular hematite observed at the south-western part of Kyaukseing Taung. Laterite exposed at the south-eastern part of Alugyi and Alugale villages.

Geochemically, biotite granite, biotite-muscovite granite and biotite microgranite show calc-alkaline series and are predominantly peraluminous and the diorite and microdiorite exhibit calc-alkaline series and belong to metaluminous series. In Harker's variation diagram,  $\text{Al}_2\text{O}_3$ ,  $\text{TiO}_2$ ,  $\text{Fe}_2\text{O}_3$ ,  $\text{CaO}$ ,  $\text{MgO}$ ,  $\text{MnO}$  and  $\text{P}_2\text{O}_5$  are negatively correlated with  $\text{SiO}_2$ .  $\text{Na}_2\text{O}$  and  $\text{K}_2\text{O}$  are positively correlated with  $\text{SiO}_2$ . Plots of Harker's variation diagrams, selected trace elements of Ba, Sn, Nb, Zn, Rb, Zr, Y and Mo are positively correlated with  $\text{SiO}_2$ . Plots of trace elements Sr, Ni, Ce versus  $\text{SiO}_2$  show decreasing of those elements with increasing of  $\text{SiO}_2$  contents. The observation of geochemical analysis data, one biotite-muscovite granite and some biotite granites are high sodium content, normative corundum ranges from 0.831 to 0.974 and then one biotite microgranite is low sodium content,  $\text{K}_2\text{O}$  Vs  $\text{Na}_2\text{O}$  diagram show that the granitic rocks contains both I and S-types. According to the tectonic discrimination diagrams, the granitic rocks fall within the IAG+CAG+CCG field. In Y versus Nb diagram; all granitic rocks fall in the field of Syn-COLG and VAG and Y+Nb versus Rb diagram indicates that all granites are fitted in the VAG field.

Result of U-Pb zircon dating of the biotite granite cropped out at the northern part of Laykhin pagoda, gives the age of  $51.9 \pm 0.7$  Ma. The result from zircon crystallization suggests that the biotite granite was emplaced in Eocene.

In the present study area, biotite granite is analysed for age determination. On the basis of radiometric dating and field evidence, the sequence of igneous rocks, from the younger to older in the study area is recognized; 6. Dykes and Veins, 5. Leucogranite, 4. Biotite microgranite, 3. Biotite granite, Biotite-muscovite granite Eocene ( $51.9 \pm 0.7$  Ma), 2. Diorite, Meladiorite, Hornblendite 1. Pyroxenite.

The mineral assemblages indicated that the Bilin area had been subjected to two types of metamorphism; regional metamorphism reinforced by local contact and cataclastic metamorphism. According to the mineral assemblages, the regional metamorphism of the study area had taken place within the "Greenschist facies". The metamorphic rocks of the study area belong to the Mergui Group. Therefore, the times of metamorphism of the study area are probably "Silurian to Carboniferous" age.

In the study area, all the igneous rocks are considered to be magmatic in origin on the basis of the field investigation, petrographic description and petrochemical analysis. The igneous rocks of the study area belong to the central granitoid belt of Myanmar. They belong to calc-alkaline series.

The study area belongs to the western marginal zone of Shan Plateau and is structurally bounded by the Three Pagoda fault in the south and the Papun fault in the north. The trend of metasedimentary rocks is NNW-SSE and dipping toward the west. Folding, faulting and jointing are observed in the study area. Prominent and conspicuous joint patterns in both igneous and metasedimentary rocks are common. A large number of horizontal joints are observed in biotite granite at south-eastern hillside of Danu Taung. Nearly vertical joints nature of biotite granite occurs at Kyewin waterfall. Biotite granites show huge joints nature and are found at the south-eastern hillside of Danu Taung.

The important economic mineral deposits; especially placer gold are observed in the western part of the study area and occurred along the Kadat Chaung, in the western part of Alugyi village. Placer titanium ore are found in the north-western part of the study area, along the Gonnyinnwe Chaung, at the southern part of Gonnyinnwe village. Specular hematite occurs at the south-eastern part of Kyaukseing Taung. Laterite cropped out in the western part of the study area, especially at the south-eastern part of Alugyi and Alugale villages. Biotite granite can be extracted from Gonnyinnwe quarry, in the north-western part of Gonnyinnwe village. Pyroxenite can be excavated from quarry at Winpyan village.

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