PETROGRAPHIC DESCRIPTIONS OF MESOZOIC IGNEOUS ROCKS IN ZINGYAIK AREA, PAUNG TOWNSHIP, MON STATE

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Abstract

The study area is located at the northwestern part of Mawlamyine, Paung Township, Mon State. It lies between latitudes 16° 39' 00" to 16° 43' 00" N and longitudes 97° 26' 00" to 97°28' 00" E. One-inch topographic map sheet no. is 94 H/$_5$ of Myanmar Survey Department. The study area lies within a part of the Mogok belt which is extending from Putao in the north through Mogok to Mottama in the south. The research area also lies within a part of the Karen- Tenasserim unit. Igneous rocks of the research area are foliated biotite granite, porphyritic biotite granite, gneissose granite, biotite microgranite, tourmaline granite, schorl rock. Microgranite sill, leucogranite dyke, pegmatite dykes, aplite veins, quartz and quartzofeldspathic veins occur as minor igneous rocks. According to the diagrams, all igneous rocks are plotting in the "Granite" field. Due to field observations and geochemical characteristics, igneous rocks of the study area confirm in "S" type".

Keywords: *Granite, S-type*

Introduction

Location and Size

The study area is situated in the northwestern part of Mawlamyine, Paung Township, Mon State. One inch topographic map sheet no. is94 H/$_5$ of Myanmar Survey Department (Figure 1). It is commonly a mountainous rugged terrain. There are many streams in this area. The prominent drainage density of the study area is moderate to coarse-texture.

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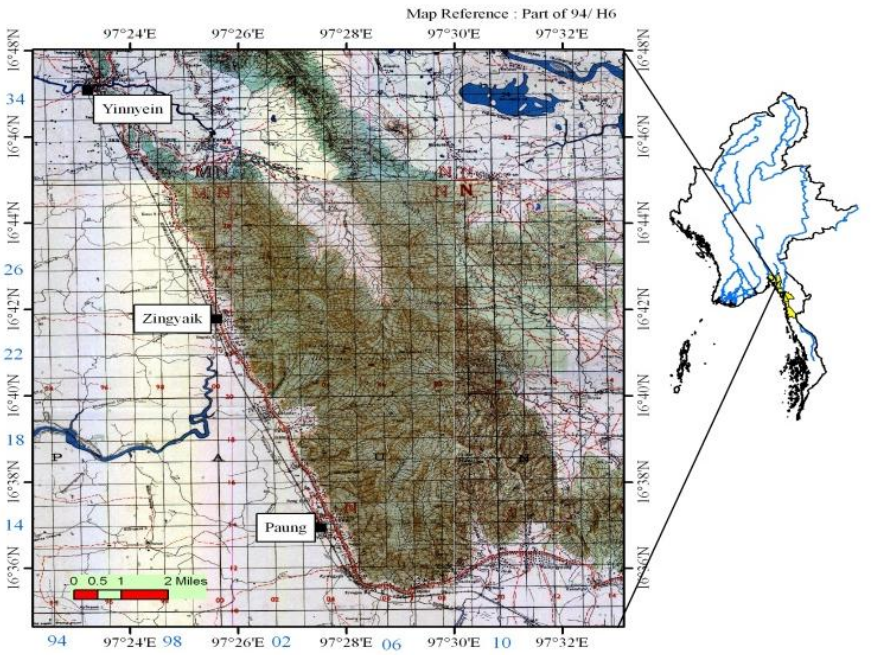

Figure 1: Location map of the study area

Regional Geologic Setting

Regional geological map of the study area and its environs can be seen in Figure (2). The study area lies within a part of the Mogok Belt (Searle and Haq, 1964) which is extending from Putao in the north through Mogok to Mottama in the south. Mg Thein regarded the Central Granitoid Belt of Burma as being developed in the tectonic setting of subduction related magmatic arc.The study area is situated in the northern part of Martaban Range which is a part of the western tin bearing batholith well known to be Western Tin Belt of South East Asia Tin Province (Mitchell, 1977, Nyan Thin 1984). The study area is covered by low to medium grade metamorphic rocks of Taungnyo Group (Lower Carboniferous), the igneous intrusions (Late Cretaceous to Early Eocene) and alluvial units (Quaternary).The general structural trend of the study area is NNW-SSE in direction.

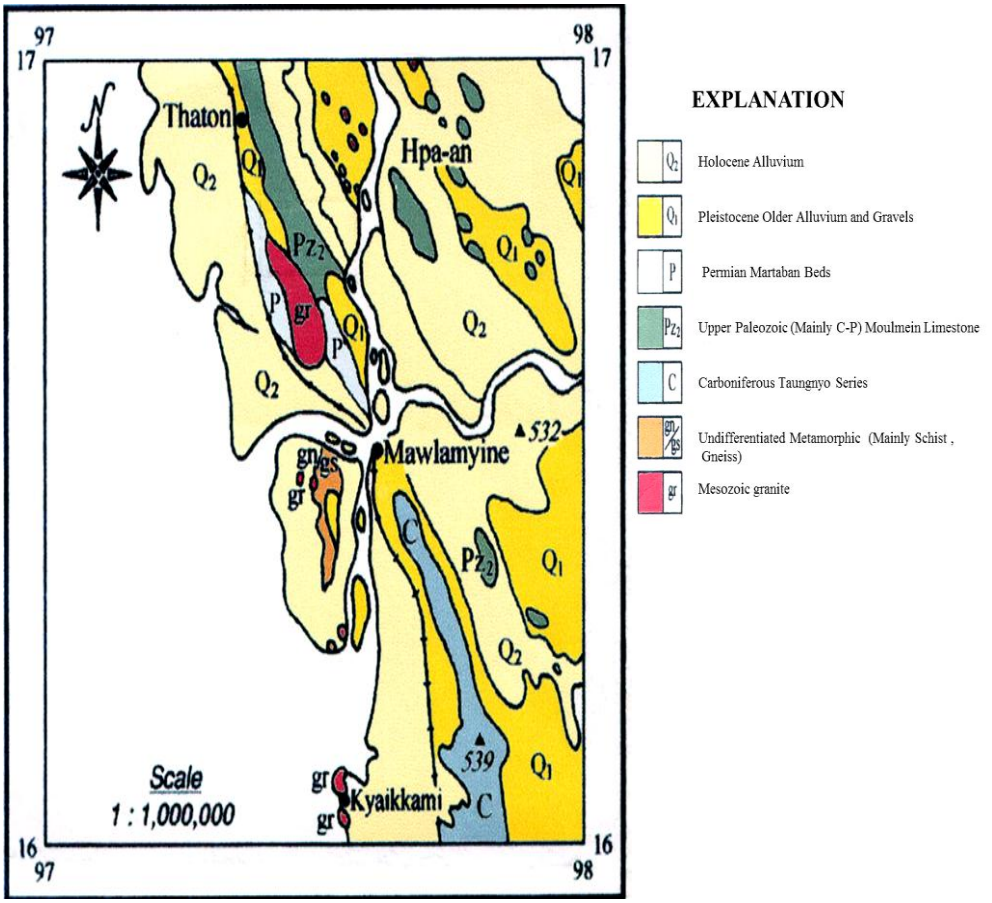

Figure 2: Regional geological map of the study area (From Geological Map of Myanmar Survey Department, 1977)

Rock Sequence of the Study Area

The rock sequence of the study area is shown in Table (1)**.**

Table (1) Rock Sequence of the Study Area

IGNEOUS ROCKS

-Quartz and quartzofeldspathic veins -Pegmatite dykes and aplite veins -Leucogranite dyke -Microgranite sill -Schorl rock -Tourmaline granite -Biotite microgranite -Porphyritic Biotite granite - Foliated biotite granite	Late Cretaceous

Distribution of Major Rock Units

The study area is mainly composed of igneous rocks. Igneous rock units are the most widespread unit in the study area. Foliated biotite granite, porphyritic biotite granite, gneissose granite, biotite microgranite, granite, schorl rock are the most significant igneous rock units of the study area. In addition, microgranite sill, leucogranite dyke, pegmatite dyke and aplite veins quartz and quartzofeldspathic veins are also seen. They are noticeably elongated (linear) bodies. Their axes are nearly parallel to NNW-SSE trending with the country rocks.

Foliated Biotite Granite

Field and megascopic Study

This unit occurs at the southwestern part of the study area. Best exposure cropped out at the top hill of KyaukPone Taung and Pahtan Taung (Figure 3). It is medium to coarse-grained. At the peak of Kyauk Pone taung, this foliated biotite granite rocks are very scattered. On the visible surface, there is foliated nature with parallel arrangement of biotite mica flakes. Mosaic shaped cracks in foliated biotite granitecan be seen.

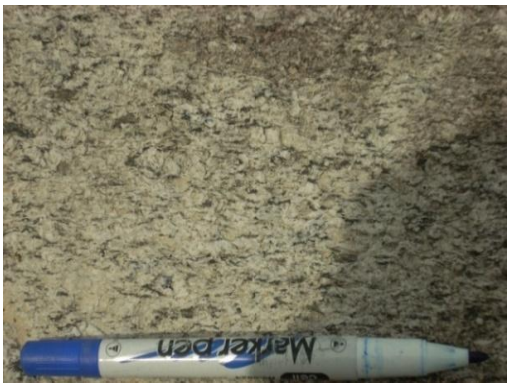

Figure 3: Best exposure of Foliated biotite granite at the top hill of Kyauk Pone Taung

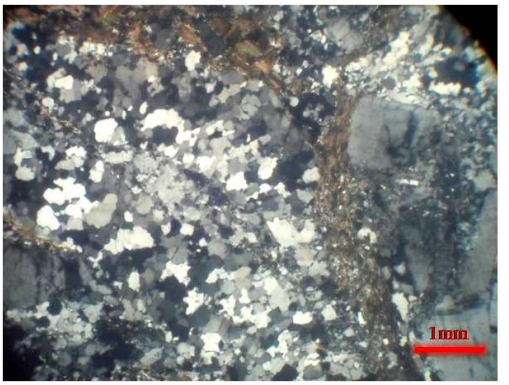

Figure 4: Foliated nature of mineral grains in foliated biotite granite, Between X.N

Microscopic study

It is medium to coarse-grained. It shows foliated nature with quartz, alkali feldspars, plagioclase (Figure 4). Quartz occurs as large to small grains with suture boundaries. It gives wavy extinction**).** Some quartz occurs as recrystallized minute anhedral aggregates forming around large feldspars. Orthoclase occurs as subhedral forms, show marginal granulation. It shows simple twinning. In foliated biotite granite, many orthoclase are observed. Some are sericitization. Plagioclase occurs as subhedral form with polysynthetic twinning Biotite occurs as subhedral forms. Some are bent due to deformation. Some biotite flakes are partially altered to chlorite. Sericite mica flakes are found among the foliated nature.

Porphyritic Biotite Granite

Field and megascopic study

This unit is the most widespread unit in the study area. This unit is well exposed at the peaks of Ka La Ma taung ,Yedagun taung and Min Tayatapar taung. Biotite granite is coarse-grained, porphyritic texture, with phenocrysts (megacrysts) of quartz, feldspars. It is mainly composed of quartz, feldspar and biotite. Tourmaline occurs as minor amount. It is light grey colour in fresh surface and pale yellowish colour is weathered surface. At Ka La Ma taung, this rock unit is well exposed. Most of this unit is highly

weathered, brownish yellow is weathered and grayish white is fresh. Biotite granite is gradationally contact with microgranite,. Preferred orientation of coarse-grained minerals is found in biotite granite unit at Barr Mae cave (Figure 5). At the pagoda near Defense Service, many milky quartz grains are scattering. At the peak of Yedagun taung waterfall, (Local name-Ma Min Sein Waterfall), this unit is well exposed and highly weathered. Zoned feldspars are also observed on the visible surface**.** Tourmaline contains as minor amount. White and yellowish white colour megacryst quartz is found, scattered. Size of some quartz is 3 inch × 1.5 inch in length**.**Its length is 2 to 3 inch and width is about 5 inch. In addition, aggregates of biotite flakes are also observed in Yedagun taung .Some zoned feldspar porphyry is also observed. At the peak of Min Tayatapar taung, the northeastern part of the study area, spheroidal weathering nature can be seen at the Ko Yin Lay (Local name) monastery, large boulders are also found at this place (Figure 6).

Figure 5: Preferred orientation of coarse-grained minerals in biotite granite unit at Barr Mae cave, at the peak of Kalama Taung

Figure 6: Large boulders in Ko Yin Lay Monastery at the northern part of the study area

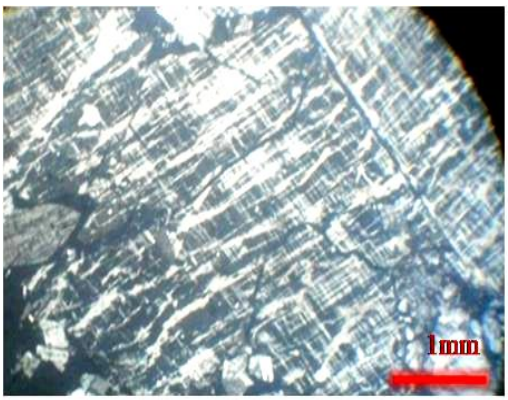

Figure 7: Perthite in biotite granite, Between X.N

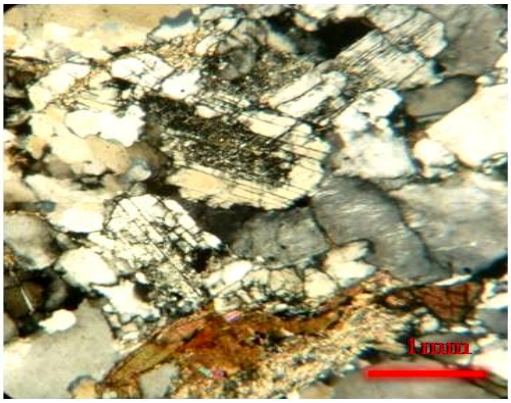

Figure 8: Saussuritization of plagioclase inbiotite granite, between X.N

Microscopic study

Biotite granite is coarse-grained, hypidimorphic, granular texture. It is essentially composed of alkalifeldspar, quartz, plagioclase, biotite. Apatite, zircon and opaque minerals occur as accessory minerals. These samples fall in the monzogranite and syenogranite field. Main alkalifeldspar occurs as perthite, orthoclase and microcline. Perthites are observed as vein perthite, string perthite, patch perthite, flame perthite and microcline microperthite (Figure 7). Seive texture and myrmekitic texture are also seen. Orthoclase shows simple contact twinning, it occurs as twinned and untwined. Sizes range from 2 to 5 mm. Perthite indicates that the temperature of formation will be less than 660° C. Perthites were developed at lower temperature and subsequently cooled slowly. Quartz occurs as two different forms. Some are large and some are found as interstitial anhedral grains. They show wavy extinction due to the strain effects. Some grains are embedded on the surface of some feldspars grains. Some quartz occurs as inclusions in perthite. Sericitization can be observed at the margin of orthoclase. In some orthoclase, there are inclusions**)**. In addition; some orthoclase are distorted. Plagioclase occurs as subhedral form with polysynthetic twinning. Saussuritization occurs in the centre of zoned plagioclases in Figure (8). Some plagioclases are normal zoning in and distorted zoned plagioclase can be seen**.** Biotite shows strong paleochroism. Some are bent and contorted. Microcline

mineral is also observed**.** Some biotites alter to chlorite. Muscovite mineral is also seen. Zircon occurs as inclusion in biotite. Bent biotite mineral is also found .Zircon, apatite, tourmaline minerals occur as accessory minerals.

Biotite Microgranite

Field and Megascopic Study

Biotite microgranite unit is found at the southern part of the study area. It is well exposed at Thingan Hlyan Taung and Kyauk Chaw chaung (Figure 9 and Figure 10). It has medium-grained, light grey colour on fresh surface and buff to brownish grey colour on weathered colour. The alignment of metasedimentary xenoliths also can be seen. Some xenolith has reaction rim. Various sizes of xenoliths are shown in Figure (11). Striations on the surface of xenoliths can be observed**.** Some xenoliths are round. Alignment of feldspars is obvious at Loc.N 040192 along Myaukso Chaung.

Figure 9: Biotite microgranite unit at the peak of Thingan Hlyan Taung

Figure 10: Well exposed nature of Biotite microgranite unit in Kyauk Chaw chaung, Loc.039190

Figure 11: Various sizes of xenoliths in Biotite microgranite in Kyauk Chaw chaung, Loc.039191

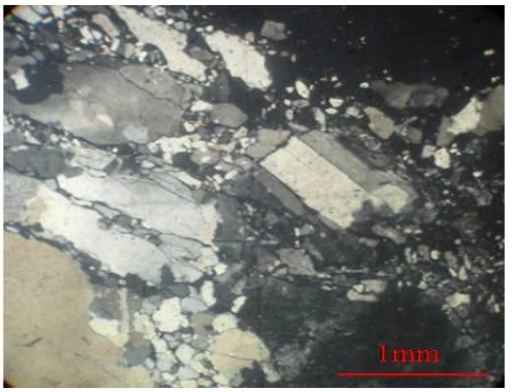

Figure 12: Simple twinning with orthoclase inBiotite microgranite

Microscopic Study

It is medium-grained, hypidiomorphic granular texture**.** It is mainly composed of quartz, orthoclase, plagioclase, biotite and muscovite. Orthoclase has euhedral to subhedral forms. It shows simple twinning (Figure 12). Some are distorted. At the centre of some orthoclase, many inclusions are also observed. Some alkali feldspars alter to sericite**.** Quartz shows wavy extinction. Some quartz occurs as anhedral grains**.** Plagioclase occurs as subhedral forms with polysynthetic twinning**.** Chlorite is also found as alteration product of biotite.

Tourmaline Granite

Field and Megascopic Study

This unit occurs at the northern part of the study area. Best exposure cropped out at the foot hill of Min Tayartapar Taung (Figure 13). It is coarse-grained (Figure 14). On the visible surface, there is mineralization with parallel arrangement of biotite mica flakes and tourmaline (Figure 15).

Figure 13: Best exposure nature of Tourmaline granite at the foot foot hill of Min Tayartapar Taung

Figure 14: Closure view of medium-grained Tourmaline granite at the foot foot hill of Min Tayartapar Taung

Figure 15: Mineralization with parallel arrangement of biotite mica flakes and tourmaline in Tourmaline granite at the foot foot hill of Min Tayartapar Taung

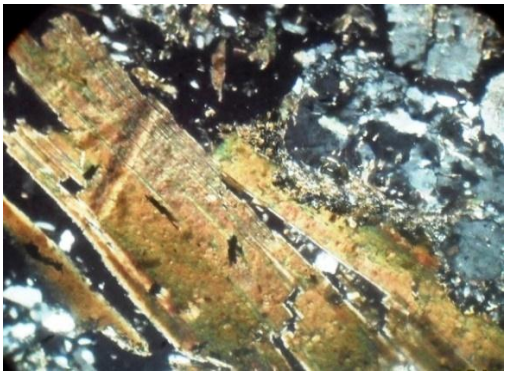

Figure 16: Subhedral form tourmaline mineral in Tourmaline granite, Between X.N.

Microscopic study

It is coarse-grained, hypidiomorphic granular texture**.** It is mainly composed of quartz, orthoclase, feldspar, biotite and tourmaline. Tourmaline mineral occurs as subhedral form (Figure 16).

Leucogranite Dyke

Field and Megascopic study

Leucomicrogranite dyke intruded into porphyritic biotite granite at Loc. N 019272. It is located at the left side of the car road from Zingyaik to Min Tayatapar taung (Figure 17). Its weathered colour is yellowish white and fresh colour is white. Its trend is 110˚-290˚.It is medium-grained.

Microscopic study

It is coarse-grained. It contains feldspar quartz, biotite and muscovite. Quartz shows anhedral forms. It is made up of unequal quartz grains (Figure 18). It shows wavy extinction. Some feldspars have many cracks**.**

Figure 17: Intrusion of Leucogranite dyke in Biotite granite at Loc. N019272 (N 16˚43' 34.3"-E 97˚26'32.6"), Facing-Due West

Figure 18: Quartz and feldspar minerals in Leucogranite, between X.N

Microgranite Sill

Field and Megascopic study

At Loc. N 011226, microgranite sill intruded into biotite gneiss at the midst of Zingyaik Waterfall (Local name- Kyauk Thin Baw Waterfall) well observed. It is also found at elevation 122' of Zingyaik waterfall (Figure 19). Its trend is 170˚-350˚ and length is about 250 feet. At the left side of this waterfall, a normal fault is also found near the microgranite sill. Fault trend is 60˚-240˚.

Pegmatite Dykes

Field and Megascopic study

Pegmatite dykes are found at Loc. N 014279 in Min Tayatapar taung (elevation 2069′) intruding biotite granite (Figure 20). Quartz, feldspar and tourmaline are found as main constituents. Minerals'' alignment is 110˚-290˚. At U Pann Shwe's garden (Loc .N 030264), pegmatite vein is also observed in (Figure 21). Its vein trend is 285° -105°. It shows yellowish white colour in weathered surface and fresh colour is grayish white.

Figure 19: Microgranite sill intruded into biotite gneiss at Kyauk Thin Baw Waterfall (Local name- Zingyaik Waterfall), Loc.N 16˚41'18.4"- E97º26'12.8", Facing - Due East.

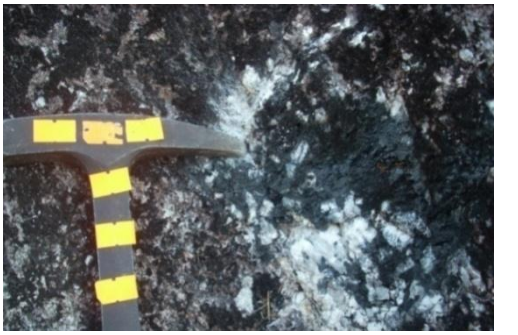

Figure 20: Pegmatite vein with tourmaline minerals in biotite granite at Min Tayatapar taung, Loc.N012280, Facing - Due south

Figure 21: Small pegmatite vein in Biotite granite near Min TayataparTaung, Loc. N012280, Facing - Due south

Figure 22: Quartzofeldspathic vein in biotite gneiss at Zingyaik Waterfall quarry, Loc. **N**008235, N 16˚41'44.5"- E 97 26'02.6", Facing 85˚

Quartzofeldspathic and quartz veins

Field and Megascopic study

Quartzofeldspathic vein is found in biotite gneiss at Zingyaik waterfall quarry, trending with 105˚-285˚and width is about 1.8 feet at elevation 55 feet (Figure 22). Quartz veins are found at Loc.N050291, near Se Daw Oo pagoda at the eastern part of the Kadaik Dam (Figure 23). Vein's trend is 30˚-210˚.Aplite vein is also found intruded into biotite microgranite at Myaukso chaung, Kyauk Chaw of Otada village (Figure 24).

Figure 23: Quartz vein near Se Daw Oo Pagoda at the eastern part of Kadaik Dam, Loc. N 050291, Facing-295°

Figure 24: Aplite vein in Biotite microgranite at Myauksochaung, Loc.N039191

Analytical data

Nine representative samples were selected for petrochemical analysis. The granitoid rocks such as porphyritic biotite granite, foliated biotite granite and biotite microgranite of the research area were sent to the geochemical laboratory of Department of Earth Resources Engineering, Faculty of Eng., University of Kyushu, 744 Motooka, Nishi-ku, Fukuoka, 19-0395, Japan. X-ray fluorescence spectrometry was used for major oxides and trace elements determination. According to these analytical data, igneous rocks of the research area fall in “Granite” Field (Figures 25 and 26). In addition, field observations and geochemical characteristics, igneous rocks of the study area confirm in "S" type" (Figure 27).

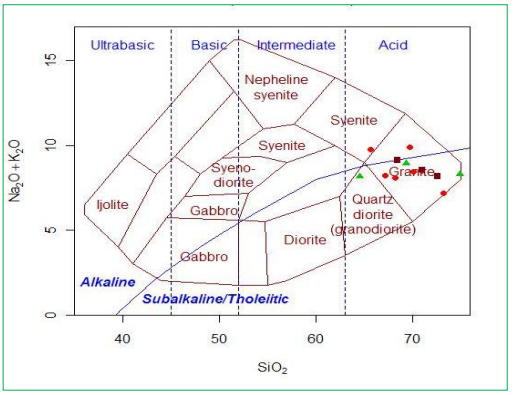

Figure 25: TAS diagram of Cox et.al (1979) showing the igneous rocks of the research area

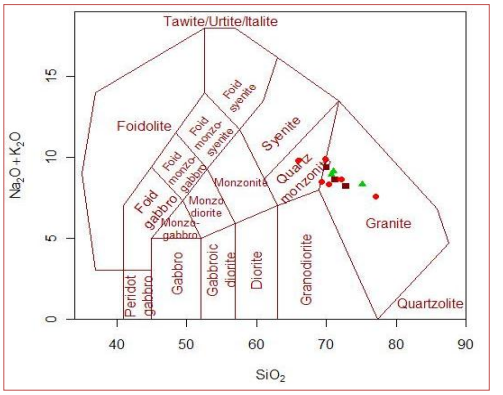

Figure 26: TAS diagram of Middlemost (1985) showing the Granite field of the research area

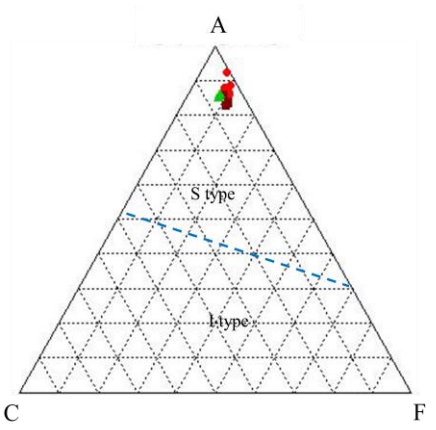

Figure 27: ACF diagram for the igneous rocks of the study area (after Hine et al.,1978) Molar ratio: A=Al_2O_3-Na_2O-K_2O,C=CaO, F=Fe_2O_3 + MgO

Summary and Conclusions

The study area is situated at the north northwestern part of Mawlamyine, Paung Township. The study area lies within a part of the Mogok belt. It also lies within a part of the Karen- Tenasserim unit. Major

igneous rocks are foliated biotite granite, porphyritic biotite granite, biotite microgranite, tourmaline granite, schorl rock. Minor igneous rocks are microgranite sill, leucogranite dyke, pegmatite dykes, aplite veins, quartz and quartzofeldspathic veins occur. According to field observations and petrographic datas, all igneous rocks are plotting in the "Granite" Field. Due to field interpretations and geochemical characteristics, igneous rocks of the study area confirm in "S" type".

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