PETROLOGY AND STRUCTURES OF VOLCANOCLASTIC SEDIMENTARY ROCKS AND IGNEOUS ROCKS IN SHINMATAUNG AREA, PAKOKKU TOWNSHIP, MAGAWE REGION

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Abstract

The study Shinmataung area situated between latitudes (21º 33' to 21º 37') N and longitude (95º 4' to 95º 10') E. Volcanic eruption might occur during and after the time of deposition of Irrawaddy Formation. Bender (1983) stated that west zone of "Pegu - Mt. Popa Line" begins south of Kabauk Village in the Shinmataung area and runs for about 100km with width of up to 18km via Salingyi, Silaungtaung and Twintaung to Natyintaung in the N. The lower Chindwin volcanic including Shinmataung area is situated north of Mt-popa and NNW striking section of the Central Volcanic Arc. The rocks are Tertiary in age except the igneous rocks of Salingyi area. Igneous rocks of the study area are rhyolitic agglomerate, breccia, diorite, olivine basalt, andesitic tuff and altered andesite. During the Miocene to sub-recent time, episodes of intermittent volcanic activity have been firstly recognized in the present area. The first phase was the extrusion of andesites. This activity appears to have been followed by the violent activity going rise to andesitic tuff-cones associated with rhyolitic agglomerate and breccia. Igneous rock units are also occurred in the western part of the present study area. These rock units are occurred isolated cone shaped hill half miles east of Kabauk village and Thardon- U hill about one mile south east of Kabauk. Moreover, dacite, fine-grained igneous rock also occurred in the valley between Taungnigyi and Shinmataung hill. Igneous rock units hill, lying nearly parallel to the Shinmataung hill, The study area (Shinmataung) is located in the Central Cenozoic Belt of Myanmar. Geologically, it is situated on the northeastern most edge of the Minbu Basin. This basin is a kind of gradually subsiding geosyncline related to subduction of India Plate beneath the Burma Plate in which tremendous thickness of clastic sediments were deposited during Oligocene to Pliocene?. The Shinmataung area is located in Yesagyo Township, Pakokku District, situated between are separated by a fault valley. Contact between igneous and sedimentary rocks can be noted beside Taunggya-Kabauk cart tract. In the Shinmataung area is the contemporaneous volcanic intercalations towards the base of the Oligocene and towards the upper limit of the composed strata.These volcanic rocks have been recorded as Miocene age in the present study area.

Keywords: andesite, rhyolitic agglomerate, breccia, diorite, olivine basalt, andesitic tuff, Pegu-Mt. Popa Line

Introduction

Location and size

The study Shinmataung area is located in Yesagyo Township, Pakokku District, situated between latitudes (21º 33´ to 21º 37´) N and longitude (95º 4´ to 95º 10´) E. It. The study area, 5.1miles long and 6.2 miles wide, covers 31.68 square miles.

The highest peak of Shinmataung is about 1723 ft about sea level. Shinmataung is a north plunging anticline ridge which is trending nearly NNW - SSE direction. It is located about 6 miles west of Yesagyo.

It is readily accessible through the year because is bounded by vertical grids 42 to 53 and horizontal grids 16 to 25 in one inch topographic map 84 O/2. It is bounded on the north by Mongywa-Yesagyo motor-car-road and on the east by Yesagyo-Pakokku road. (Fig.1.1) shows the location and aerial extent of the study area.

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Previous study

The Tertiary geology of Myanmar had been given much attention since 1854. Much progress has been made since the appearance of Theobald's memoir (1873), on the Geology of Pegu. During the intervening years up to the Second World War the investigators from the Geological Survey of India made some important contributions towards the subject.

Edwin Pascoe's reference to the vents of Shinmataung in (1908) appears to be the first published reference to the igneous rocks of the study area. In this reference, he mentioned that some of the volcanic rocks of the Shinmataung area are later age, but some at least are contemporaneous with the Pegu rocks.The volcanic occurrences and associated rocks further south of Shinmataung were studied by Dr. E Vredenburg in (1921). As a result of his investigation, he stated:

"Of particular interest, in the Shinmataung area is the contemporaneous volcanic intercalations towards the base of the Oligocene and towards the upper limit of the composed strata."

Dr. C. T Berber of the Geological Survey of India continued the work of the work of the letter four authors in Pakokku in 1925, 26. He described the regional geology of the area and studied the petrography of andesites, basalts, and pyroclastics of the area.

Bender (1983) stated that west zone of "Pegu - Mt. Popa Line" begins south of Kabauk Village in the Shinmataung area and runs for about 100km with width of up to 18km via Salingyi, Silaungtaung and Twintaung to Natyintaung in the N.

General Statements

The area investigated is situated in the lower Chindwin Area, lying NNW striking section of the Central volcanic are which coincides with the axis of the central Cenozoic Sedimentary Basin, dividing it into Western and Eastern Troughs. The occurrences of igneous rocks are here bound to two structural zones. The western zone is the continuation of the "Pegu- Mt.Popa"line. It begins at the Kabauk of the Shinmataung and Twintaung to Natyin Taung in the north. The second line runs parallel to the first, east of Monywa and can be followed for a distance of about 40km.

The present study area occurring at Minbu basin in the Central Lowland is composed of Cenozoic Rock Units. The Cenozoic sequence of the study area contains sedimentary rocks and igneous rocks. From the petrographic characteristics and reasonable evidences, the greater part of the source area was formed by the granitic plutons and low to high grade metamorphic rocks. The area might have been the Salingyi upland area and Kawlin-Wuntho area. During the period of Miocene to sub-recent time, episodes of intermittent volcanic activity have been firstly recognized in the present area. The first phase was the extrusion of andesites. This activity appears to have been followed by the violent activity going rise to andesitic tuff-cones associated with rhyolitic agglomerate and breccia.

Almost all of the andesites in the study area have been affected by alteration. The dominant processes alteration found in these rocks are porphylization, kaolinization, albitization and chloritization. The probable sequences of rock units mapped in the paper are recognized .The sedimentary rock units are classified according to the distinctive lithological characteristic of the each formation. They are described namely Shwezettaw Formation, Padaung Formation and Irrawaddy Formation. The Igneous rock units are given on the basis of petrographic characteristics.

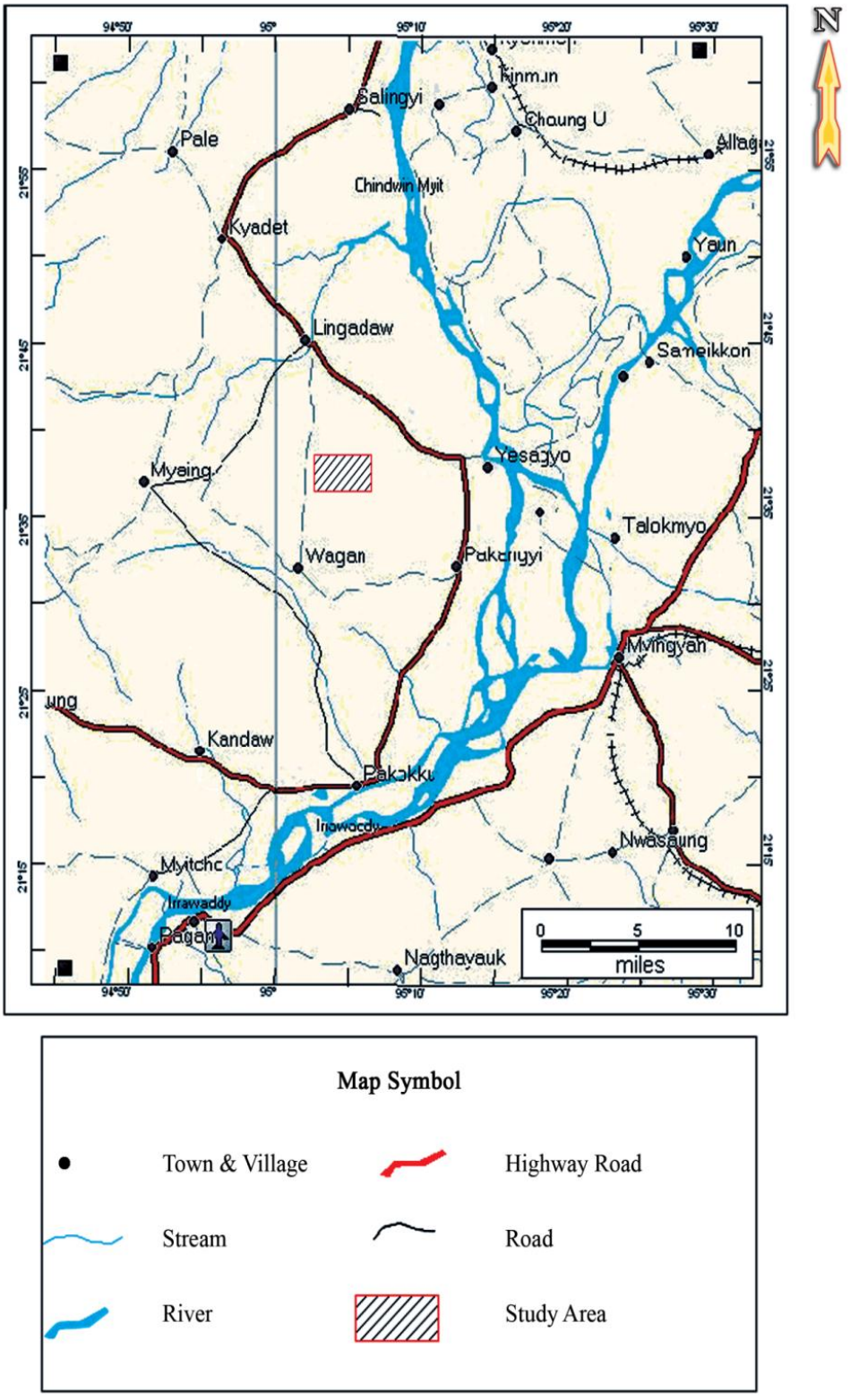

Figure 1 Location Map of the Study Area

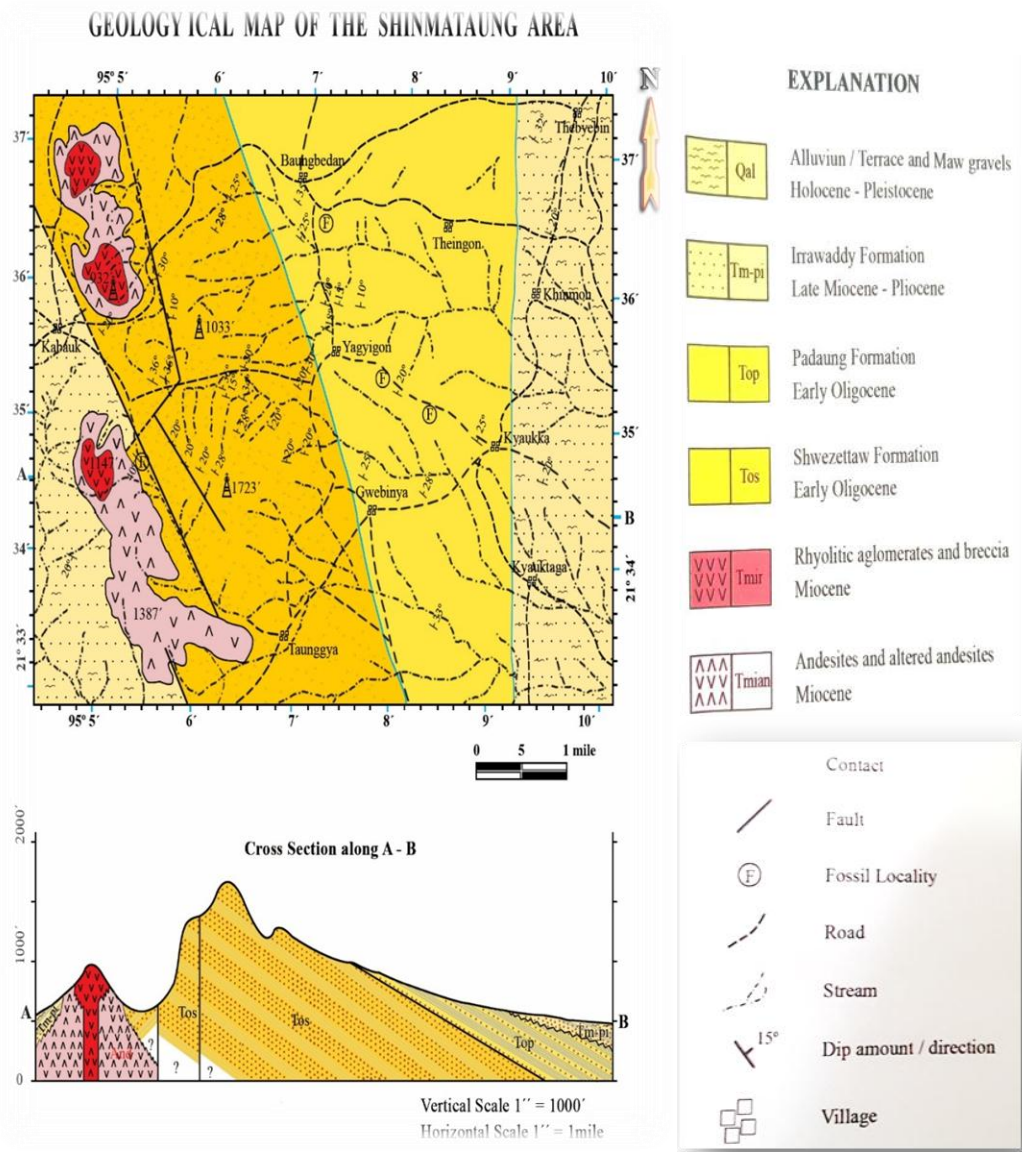

Figure 2 Geology Map of the Shinmataung Area

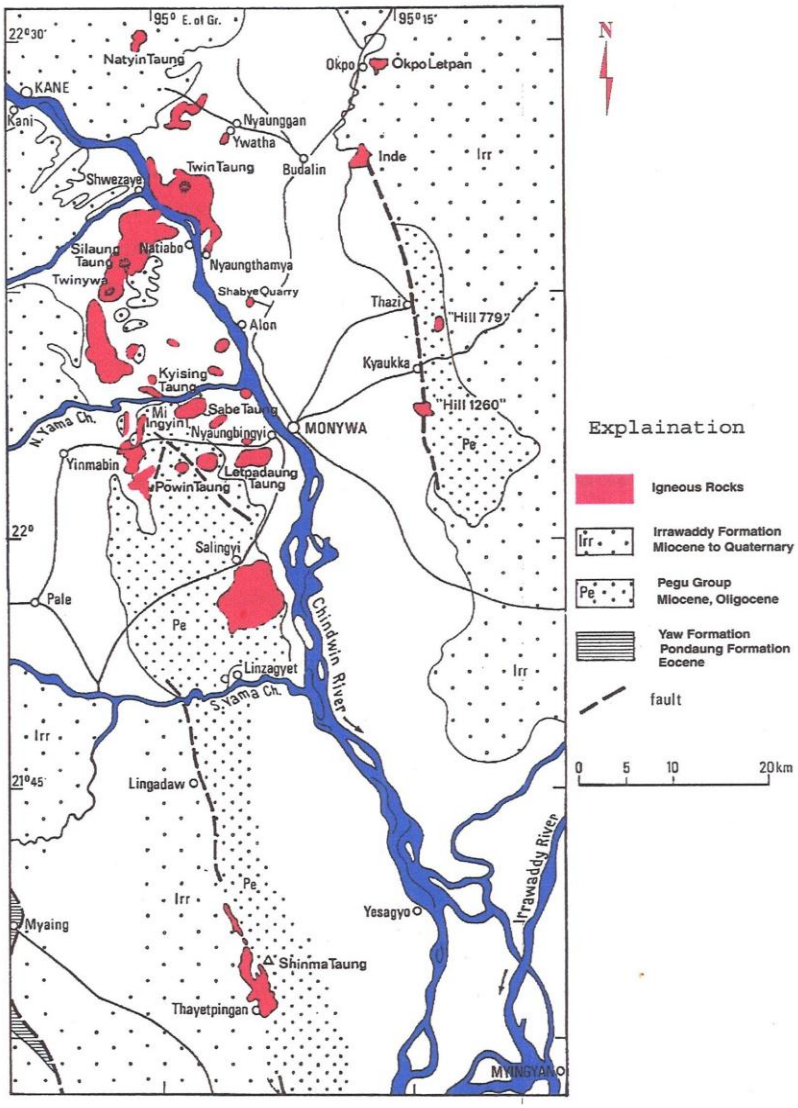

Figure 3 The occurrences of igneous rocks of lower Chindwin area (base on Bender 1983)

Structures of Volcanoclastic Sedimentary Rocks and Igneous Rocks

Shinmataung Valley Fault (F_1) between the main Shinmataung hill and volcanic units, and steep scarps on the western side of the Shinmataung are good indicators for this fault. Kabauk Fault (F_2) is developed in the east of Kabauk village. The Irrawaddy Formation is faulted against Shwezettaw Formation. In the northern part of this fault, the contact of volcanic rocks and Irrawaddy Formation along the fault can be noted**.** Taungwataung Fault (F_3) is developed in the western base of Taungwataung ridge half mile east of Kabauk. This fault is between Taungwataung and volcanic unit. The volcanic rocks extruded along the fault zone. The volcanic structures in the area are mesa-like structure, pyroclastic cones, and flow structures ropy and blocky structures, vesicular and fragmental top and pyroclastic structures.

Petrography of Volcanoclastic Sedimentary Rocks and Igneous Rocks

The hard-sandstone bands contain then tuffaceous sandstone and hard sandstone of Shwezettaw Formation commonly contain many fossils in this section. In some thin section of Shwezettaw sandstone, (mainly the place where close to the volcanic eruption), volcanic fragment comprise 50 percent of total rock volume.

Igneous rock units are also occurred in the western part of the present study area. These rock units are occurred isolated cone shaped hill, half miles east of Kabauk village and Thardon-U hill about one mile south east of Kabauk. Moreover, dacite, fine-grained igneous rock also occurred in the valley between Taungnigyi and Shinmataung hill. Igneous rock units hill are lying nearly parallel to the Shinmataung hill, which is separated by a fault valley. Contact between igneous and sedimentary rocks can be noted beside Taunggya-Kabauk cart tract.

Some of the igneous rocks are later age, but some sedimentary rocks are contemporaneous exposed on the surface of the Shinmataung area. These volcanic rocks have been recorded as Miocene age in the present study area. Igneous rocks of the study area are rhyolitic agglomerate, breccia, andesitic tuff and altered andesite.

Diorite

Diorites occur as bomb and vine type in Sonetaung .They are usually found together with andesite and basalt. Diorite has a course grained, hypidiomorphic granular texture. It is composed mainly of plagioclase and hormblende. It can be said to be oversaturated due to the presence of quartz. Besides, biotite occurs in subordinate amounts.

Rhyolitic Agglomerate and Breccia

In the present study area, the hill tops above half mile east of Kabauk and west of Shinmataung are covered by rhyolitic agglomerates and breccias. They are composed of block of igneous, metamorphic and sedimentary rocks. These blocks are welded by tuff. Both rounded and angular igneous rocks ranging in size from 1 inch to 2 ft in diameter are more predominant than sedimentary rocks.

On the slope of the western foot of these hill, fragments of metamorphosed rock are scattered among the rhyolitic agglomerates and breccias.

Figure 4 Breccia in handspecimen

Figure 5 Breccia in West Shinmataung (21º 37´) N Longitude (95º 08´)

Figure 6 Rhyolitic agglomerates in handspecimen

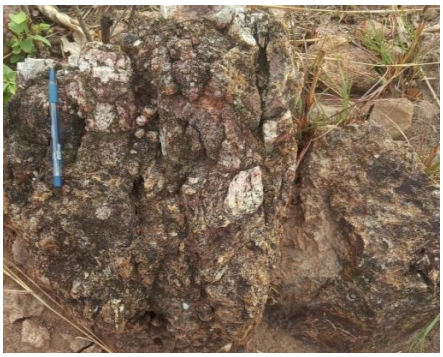

Figure 7 Rhyolitic Agglomerates in West of Shinmataung latitudes (21º 36´) N Longitude (95º 08´) E

Andesitic Tuff and altered Andesite

In the vicinity of Thardon-U hill, about one mile south east of Kabauk, it is occupied by altered andesites and andesitic tuffs. Some andesites are weathered to red clays. The dark gray to bluish gray fresh andesite are not occurred and associated with agglomerates and breccias. The andesties of the study area show porphyritic texture in which the phenocrysts are attributed to early crystallization.

Altered andesite is occupied on the Taungle and west of Taunglungyi, Taungshe and Taungbed. The isolated nature of these hill and appearance of volcanic plugs may suggest that each have the separate focus of eruption.

Taungnigyi, eastern most part of these volcanic hills is also occupied by the altered andesites. A small dolerite intrusion is found in the valley the relationship of the dolerite with the adjacent rocks is not easy to identity because of thick capping of soil and dense vegetative cover.

At the lower part of these hills, andesitic tuffs are occurred. By the study of the isolated nature of these hill and scattered of various igneous rock, the igneous rocks from the area may be fracture eruption. In the present study area, dark grey to bluish grey dacite can be found in the valley between Taungnigyi and Shinmataung hills.

Figure 8 Diorite Vein in Basalt in handspecimen

Figure 9 Augite Andesite in handspecimen

Figure 10 Basalt in handspecimen

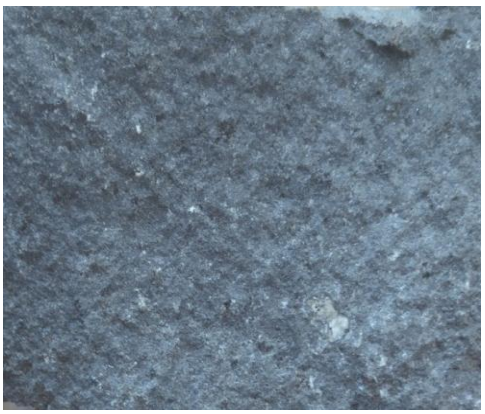

Figure 11 Andesite Tuff in handspecimen

Table 1 Terms for mixed pyroclastic-epiclastic rocks

Phyoclastic	Tuffites (mixed phyoclastic-epiclastic)	Epiclastic (volcanic and/or nonvolcanic)	Avg Clast size (mm)
Agglomerate, agglutinate, phyoclastic breccia	Tuffaceous conglomerate, tuffaceous breccia	Conglomerate, breccia	64
Lapilli tuff			2
(Ash)tuff	Tuffaceous sandstone	Sandstone	1/16
Coarse	Tuffaceous siltstone	Siltstone	1/125
Fine	Tuffaceous mudstone, shale	Mudstone, shale	
75		25	%by volume
	← Phyoclastic → Volcanic+ nonvolcanic epiclastic (minor amounts of biogenic, chemical sedimentary and authigenic constituents		

Microscopic Study of Volcanoclastic Sedimentary Rocks and Igneous Rocks

Diorite

Diorite occur in Songtaung near Taunggar Village. They are usually found together with andesite and basalt. Diorite has a course-grained, hypidiomorphic granular texture. It is mainly composed of plagioclase and hormblende and biotite. Plagioclase is 1.3 to 2.7 mm in grain size. It is subhedal in shape.Twin bands are well developed. Fractures are commonly found due to tightly forces. Some plagioclase crystals show oscillatory normal zoining. Hormblende is 1.7 to 2.7 mm in grain size. It is subhedral to anhedral in shape. Cleavages of hormblende are sometime bent. Biotite occurs in subordinate amounts. Biotite is 0.4 mm in grain size. Some boitites have bent cleavage. It is subhedral in shape. Some diorites are found to be totally altered rocks. The rocks are greenish in colour due to chloritization.

Andesitic Tuff

The andesitic tuff consists of the fragments of andesite, quartz-sericite-schist and feldspar crystals. The diameter of pyroclasts varies from 0.3mm to 1mm in length. Some fragments of quartz sericite schist are as large as 8mm in length and 1.5mm in width. Small needles of green tourmaline are also present in it. Due to feldspar determination method of Michel Levees**,** the average content ranges from 35 to 40 per cent which falls in andesite composition. Some feldspar crystal were slightly zoning with the care of more acid in composition. Some feldspar crystals are mostly altered to kaolinite that is somewhat strained by limited.

Tuff

Tuff consists of crystals, rock fragments and glass. Tuffs are feldspar (plagioclase), hornblende and quartz. Feldspar and hornblende are juvenile pyroclasts. They have been produced by disruption of magma. Quartz is accidental pyroclast. It has been derived from the country rocks (Irrawaddy Formation). Identifiable crystals in thin section are 0.1 to 0.2 mm in

size. The other constituents are minute rock fragments, dust and glass. Any clast in tuff having less than 0.25 mm in size is known as dust.

Olivine Basalt

The basalts in this area are olivine basalt. The basalt has a porphyritic texture with phonocrysts of olivine and plagioclase embedded in fine grained groundmass composed of plagioclase microlites, augites granules, magnetite grains and glass. The vesicle size varies from 0.2mm to 3mm. Subhedral to anhedral minerals of the groundmass are sometimes protruding into the visicles. Olivine phenocrysts occur as subhedral to anhedral crystals. Olivine boundaries are dark brown due to ircipient rimming by iddingside and magnetite. Olivine is also found in groundmass. Plagioclase is euhedral and subhedral in shape. Plagioclase phenocryst is 1.3mm in average grain size. Plagioclase phenocrysts show zoing. Plagioclase microlites in groundmass are lath shaped. They are 0.5mm to 1mm in grain size. Plagioclase microlites are randomly oriented and sparsely unique. But when closer to the phenocrysts, presences of microlites are considerable. They bear abundant and some weakly and roughly aligned in groundmass trends to produce flow structure.

Agglomerate

It is composed mainly of andesite blocks. Some bombs of andesite and other igneous rocks are found. The other igneous blocks are rarely found. The size blocks in agglomerate are usually more than 20 cm in diameter.

Rock fragments

Dark brown volcanic glass is also present in this rock. Some fragments of andesite have rounded out lines whereas the metamorphic fragments are subangular in shape.

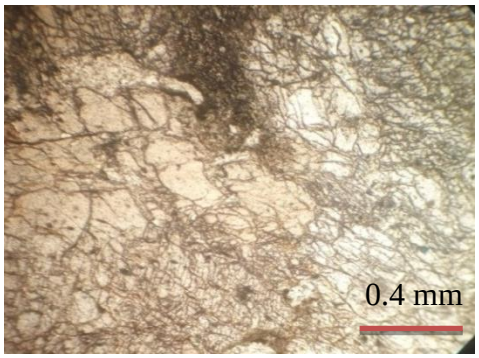

Figure 12 Microscopic Study of Diorite. Under PPL

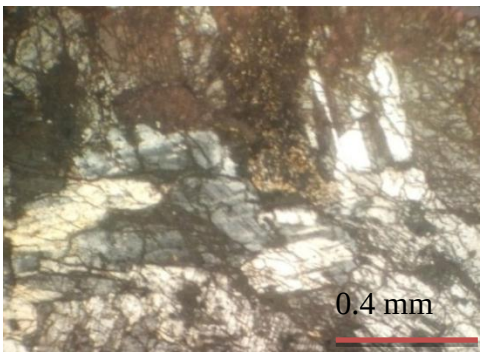

Figure 13 Microscopic Study of Diorite. Between XN

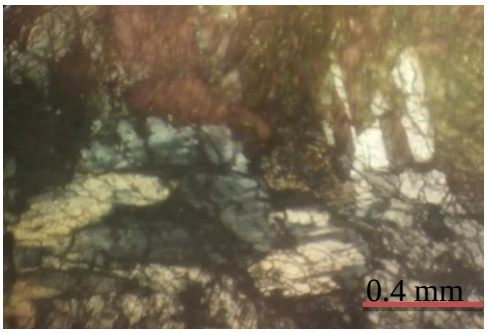

Figure 14 Microscopic Study of Diorite. Between XN

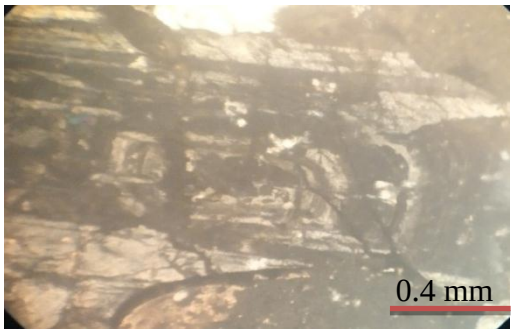

Figure 15 Plagioclase showing oscallatorry normal zoning in diorite

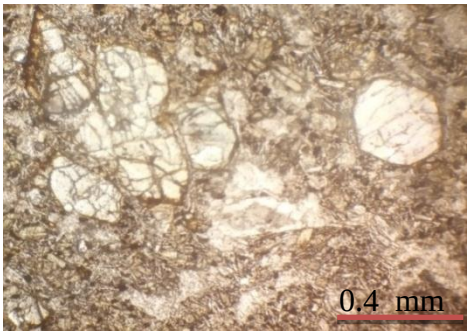

Figure 16 Microphraph showing plagioclase microphenocryst in Olivine Basalt. Under PPL.

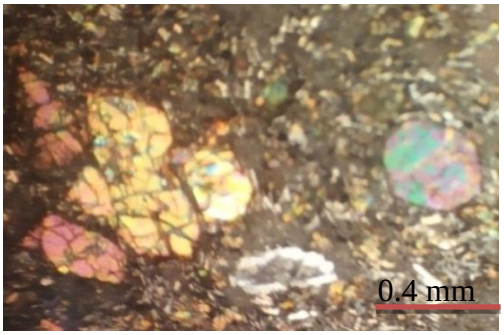

Figure 17 Microphraph showing plagioclase microphenocryst in Olivine Basalt. Between XN.

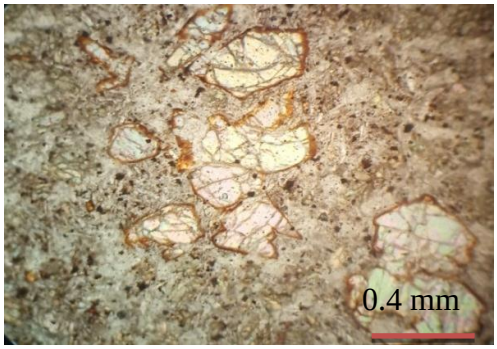

Figure 18 Microphraph showing of Olivine Basalt. Between XN.

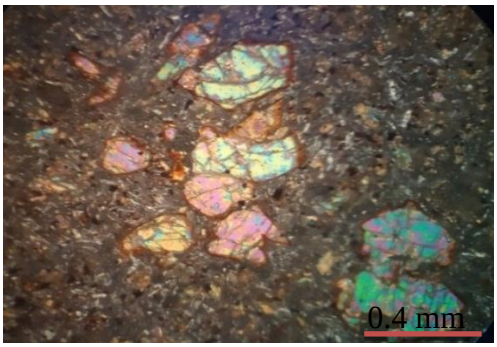

Figure 19 Microphraph showing of Olivine Basalt. Between XN.

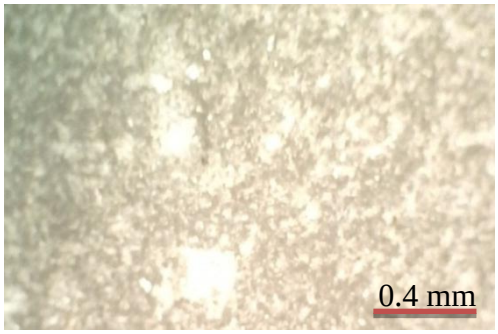

Figure 20 Microphotograph showing tuff.

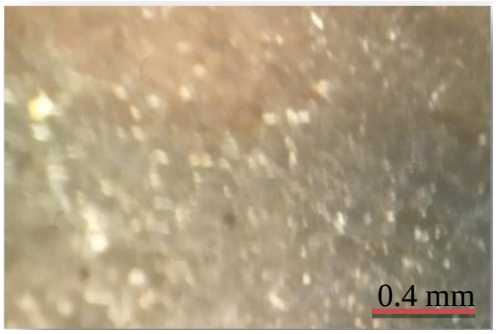

Figure 21 Microphotograph showing tuff. Between XN

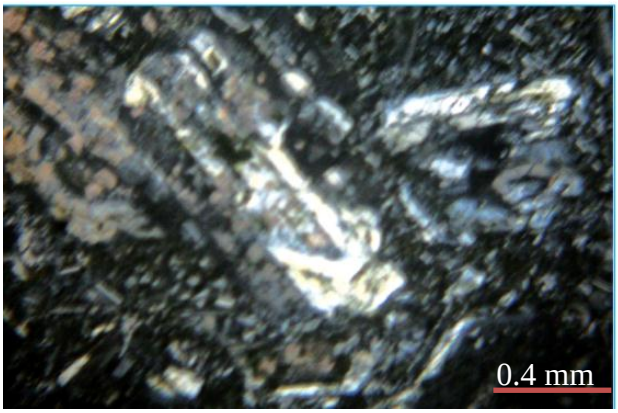

Figure 22 Microphotograph showing andesite tuff. Between XN

Summary and Conclusions

The Shinmataung area between lat (21° 33´- 21° 37´) N & Lon (95° 4´- 95° 10´) E, is located by vertical grids 42 to 53 and horizontal grids 16 to 25 in one-inch topographic map 84 O/2. It is situated about 6 miles west of Yesagyo Township, Magwe Division, covering a surface area of 31.68 square miles. The study area, a small segment of central igneous line is located at the north eastern part of Minbu Basin in the Central lowland. It is composed of Cenozoic sedimentary and volcanic rocks. The lithostratigraphic units older than Oligocene age are not encountered. The lithologic units of formation rank are ascending over are: Shwezettaw Formation, Padaung Formation and Irrawaddy Formation.

Igneous rocks of the present area are mapped and they are rhyolitic agglomerate and breccia, olivine basalt, andesitic tuff; and altered andsite. From the petrographic characteristics and reasonable evidences, the greater part of the source area was formed by the granitic plutons and low to high grade metamorphic rocks. The area might have been the Salingyi upland area and Kawlin-Wuntho area. During the period of Miocene to sub-recent time, episodes of intermittent volcanic activity have been firstly recognized in the present area. The first phase was the extrusion of andesites. This activity appears to have been followed by the violent activity going rise to andesitic tuff-cones associated with rhyolitic agglomerate and breccia.

Almost all of the andesites in the study area have been affected by alteration. The dominant processes alteration found in these rocks are porphylization, kaolinization, albitization and chloritization.In the study area, the strata of lower Pegu Group & Irrawaddy Formation are exposed and the volcanic rocks extruded along the fault zone. This condition may indicate that the reservoir rock and the channel way for the migration of oil and gas were probably not occurred in the study area.

Acknowledgements

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References

Barber C. T., (1936), The Extrusive and Intrusive rocks of the Shinmataung area. Mem. Geol. surv. India. V.E.S, Pt.2, p.159-160.

Bender F., (1983), Geology of Burma: Gerbruiider Borntraeger, Berlin Stuttuart, p. 49-70.

Khin Maung Tun, (1993), Petrology of the Shinmataung Area, Yesagyo Township, Magway Division, M.Sc. Thesis, unpub. paper, M.U., Geol. Dept., 122p.

Ko Ko Gyi, (2008), A Study on the Sedimentation and Volcanic Activies in the Shinmataung-Sonetaung Area, Pakokku District., *Ph.D Prelim Paper.* Geol. Dept. M.U., 95p.

Neotling F., (1894), Note on the Geology of Wuntho in Upper Burma. Rec. Geol. Surv. India, V.27, 4: p.115-124.

Williams. H., F.J. Turner & C.M. Gilbert, (1953), PETROGRAPHY, An Introduction to the Study of Rocks in Thin Sections. 2nd Edn.

Win Swe, (1972), Tectonic Evolution of the Western Ranges of Burma. VII. Burma Res. Congr. Rangoon, 49p.