Volcanism and Volcanic Structure of Ok-aing - Ywatha Area, Budalin Township, Sagaing Region

Aye Aye Mar[1], Hnin Win Kyi[2]

Abstract

The study area is located in Budalin Township, Sagaing Region. It is about 20 miles northwest of Monywa. Volanic rocks are found at Ok-aing village, and Ywatha village. Ok-aing - Ywatha crater is situated some 6 ½ miles north-east of the Chindwin at Shwezaye. All that remains is a circular depression, broad and shallow, sunk in soft sands of uppermost Irrawaddian age. The volcanic rocks in this area are lavas and volcanoclastic rocks (pyroclastic rocks). Andesites are found at Ok-aing crater as blocks and bombs. Andesite can be regarded into; augite andesite, hornblende andesite and hornblende augite andesite. Volcaniclastic rocks (pyroclastic rocks) are air- fall deposits. Pyroclastic rocks in this area are coarse tuff, lapilli tuff, agglomerate and volcanic (vent) breccias. Coarse tuff consists of crystals, rock fragments and glasses. Lapilli tuff consists of rock fragments, pumice and minor amount of ash and dust. Lava flows are found in the Ok-aing crater. Volcanic eruption might occur during and after the time of deposition of Irrawaddy formation. Therefore, age of the rocks in the study area can be Upper Miocene- Pleistocene age.

Key words: Volcanism, structure, Ok-aing – Ywatha area

Introduction

Location and Size

The project area in the Budalin Township is situated between N Latitude 22° 26' to 22°28' and E longitude 95° 3' to 95°9' of one inch topographic map 84 N/3. Being located on the southern side of Budalin- Kani road.

Structure

Volcanic Structure

Ok-aing - Ywatha crater

This crater is situated some 6 ½ miles north-east of the Chindwin at Shwezaye. All that remains is a circular depression (Figure 1), broad and shallow, sunk in soft sands of uppermost Irrawaddian age. In diameter the depression, from rim to rim, measure about half a mile, and is very shallow when compared with its width, averaging only about 150 feet in depth. The bottom is flat and sandy, and now partially under cultivation. There is no drainage outlet, however, the rim remaining intact with precipitous inner slopes.

There is a thin coating of ash on the surface of the western rim, but apart from this and the presence of sporadic block of lava of basaltic type strewn about the floor and on the outer flanks, subaerial denudation has done its best to remove all traces of the volcanic origin of the crater.

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Figure (1). Circular depression of Ok-aing crater.

Flow Structure

The lava of the study area shows parallel or subparallel bands or streaks at Ok-aing village (Figure 2). These structures are caused by the flows of magma or lava during cooling and crystallization. Thin and long flow structures are found at and near Ok-aing (Figure 3).

Figure (2). Lava flow structure occurs at Ok-aing village.

Figure (3). Thin and long flow structure occurs near Ok-aing village.

Volcanic Rocks

Andesites

Andesites typically found at Ok-aing village as ejected block. They also occur as short- thick flow structure is found in southwestern part of the area. Some andesites are found as a Lava flow in pyroclastic rock. Andesite can be regarded into; augite andesite, hornblende andesite and hornblende augite andesite.

Augite andesite

Augite andesite is found near Ok-aing village, and as block and bomb (Figure 4). This rock is dull grey, light grey and grayish black in colour on fresh and purplish, purplish-grey and yellowish-grey in colour on weather surface. It usually occurs as flows and pyroclastics.

The phenocrysts of augite can be seen four-sided, eight-sided shape and vary in size (Figure 5).

Figure (4). Augite andesite bomb near Ok-aing-Ywatha village

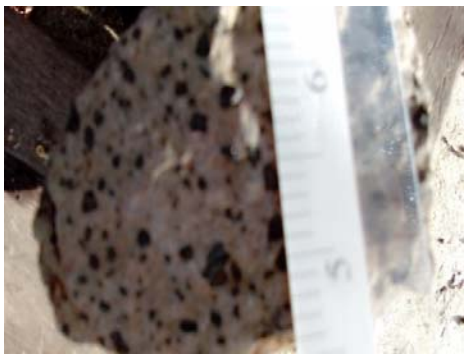

Figure (5). Close up view of the four-sided, eight-sided shape of augite phenocrysts in augite andesite.

Hornblende andesite

This rock is found together with augite andesite. It is dull grey in color is also found (Figure 6 a, b). They occur as the form of lava walls, pyroclastics and flows near Ok-aing village.

Figure (6 a). Dull grey in color of hornblende andesite is observed near Ok-aing village.

Figure (6b). Close up view of the hornblende andesite.

Hornblende augite andesite

It is also petrographically similar to the andesites mentioned above. They occur as phenocrysts and flow. The phenocrysts of hornblende can be seen long-prism shape and vary in size (Figure 7 a,b). It is also occured at Ok-aing village.

Figure (7a). Hornblende augite andesite bombs near Ok-aing village.

Figure (7b). Long-prism shape of hornblende phenocrysts in hornblende augite andesite near Ok-aing village.

Pyroclastic Rocks

Pyroclastic rocks in this area are fine tuff, coarse tuff, Lapilli tuff, agglomerate, pyroclastic breccias and pyroclastic vent breccias (Figure 8 a, b). Fine tuff only occurs in the upper part of the pyroclstic beds of the Ok-aing crater (Figure 9) and coarse tuff is commonly found in this area. Coarse tuff consists of glass, rock fragments and crystals. Lapilli tuff composes of rock fragments, pumice and basaltic scoria with minor amount of ash and dust (Figure 10). Pumices are also found. Ultrabasic rocks and lithic fragments are found (Figure 11). Agglomerate is mainly composed of andesitic rocks. Some bombs of andesite and other igneous rocks are found.

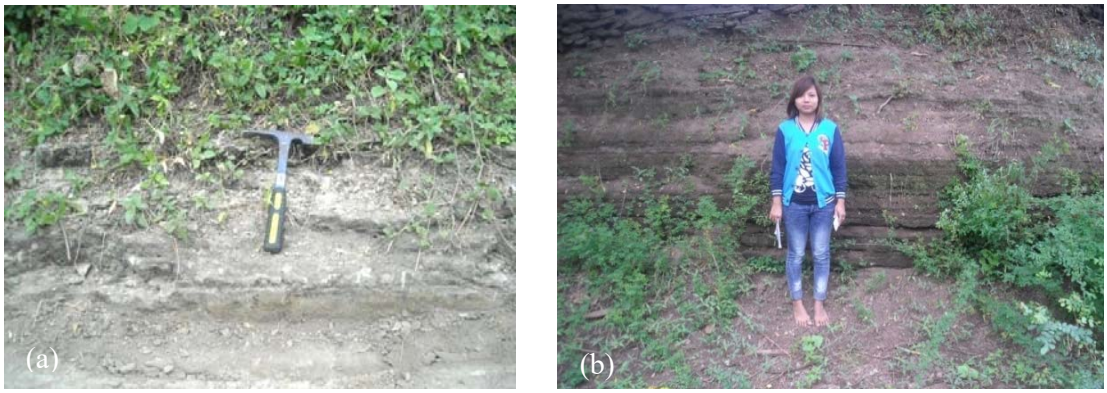

Figure (8 a, b) Fine tuff, coarse tuff, Lapilli tuff, agglomerate, pyroclastic breccias and pyroclastic vent breccias near Ok-aing village.

Figure (9). Pyroclstic beds of the Ok-aing crater.

Figure (10). Basaltic scoria in lapilli tuff at Ok-aing crater.

Figure (11). Lithic fragments at Ok-aing Crater.

PETROGRAPHY

Augite andesite

The rock has a fine-grained, porphyritic texture. It includes phenocrysts of plagioclase, augite and olivine. Plagioclase occurs as euhedral form. It shows polysynthetic twin (Figure 12). Plagioclase is abundant and roughly aligned in the groundmass trends to produce flow structure (Figure 13). Augite sometimes shows simple twin and subhedral to euhedral shape (Figure 14). Hornblende is anhedral to euhedral in shape. It is characterized by reaction rim (Figure 15). Iron occurs as inclusion in other minerals.

Hornblende andesite

It has a fine-grained, porphyritic texture. Plagioclase is euhedral in shape and shows polysynthetic twin (Figure 16). Zoining is apparently seen in the plagioclase. Hornblende is anhedral to euhedral in shape. It is characterized by reaction rim. Plagioclase shows penetration twin and polysynthetic twin.

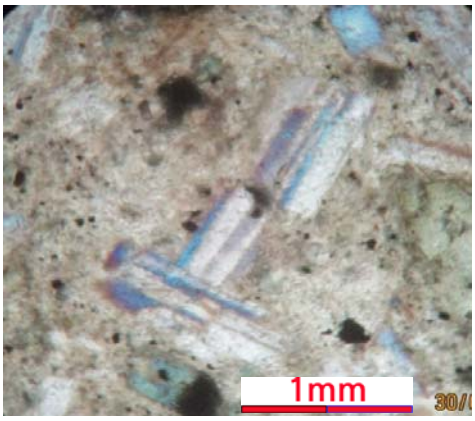

Figure (12). Euhedral plagioclase shows polysynthetic twin in augite andesite

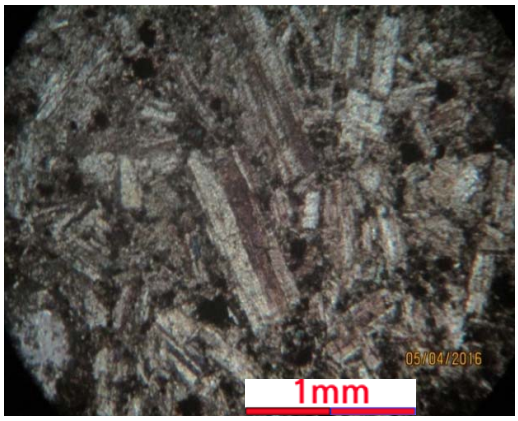

Figure (13). Flow structure in augite andesite.

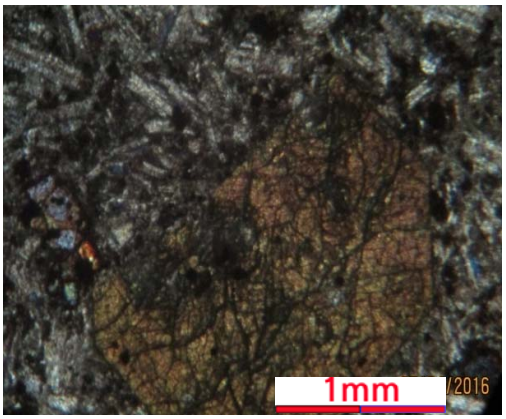

Figure (14) Euhedral augite in augite andesite.

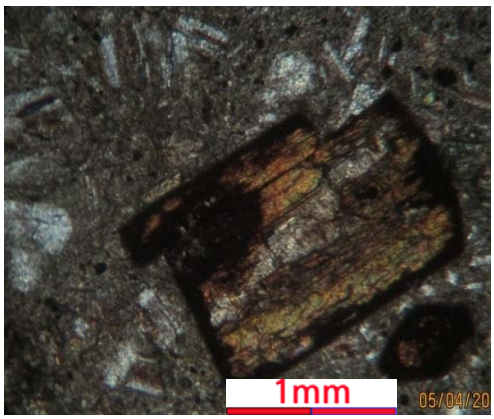

Figure (15). Euhedral hornblende phenocryst (rimmed by dark brown boder) in augite andesite.

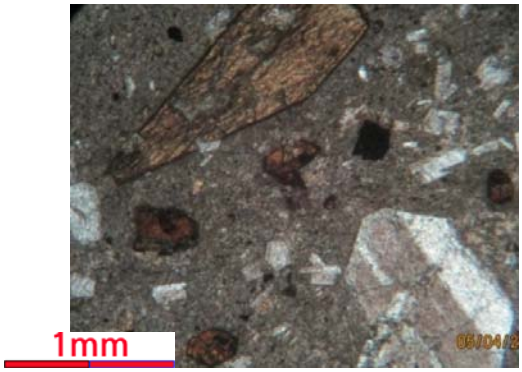

Figure (16). Euhedral hornblende and plagioclase twin in hornblende andesite.

Hornblende augite andesite

It is also fine –grained, porphyritic texture. The rock is mainly composed of hornblende, olivine and plagioclase. Plagioclase is usually subhedral to euhedral in shape and

polysynthetic twinning is common (Figure 17). Hornblende phenocrysts show subhedral and euhedral in shape. It is characterized by reaction rim (Figure 18). Hornblende is brownish or reddish color.

Olivine occurs anhedral to subhedral, subrounded shape. Fracture is common. It sometimes alters to iddingsite marginally to form reddish brown rim (Figure 19). This alteration is more pronounced in the andesite of volcanic blocks or bombs than in that of lava wall. Corrosion and resorption features are sometimes present. This shows flow structure (Figure20).

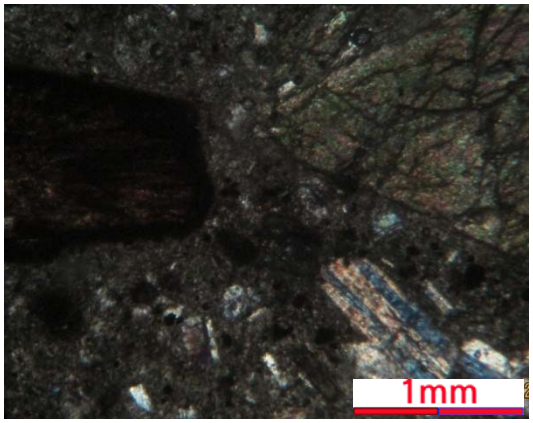

Figure (17). Plagioclase shows poly-synthetic twin in hornblende augite andesite

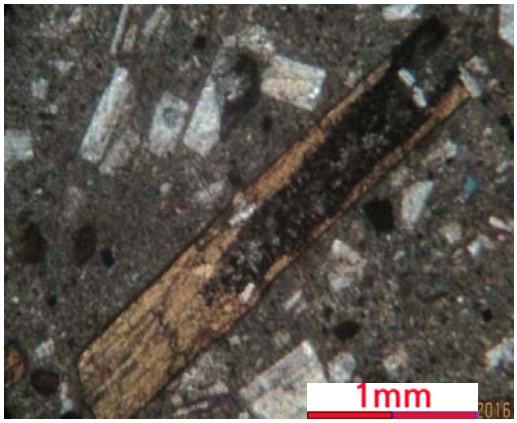

Figure (18). Photomicrograph showing the hornblende phenocryst (rimmed by dark brown border) in hornblende augite andesite

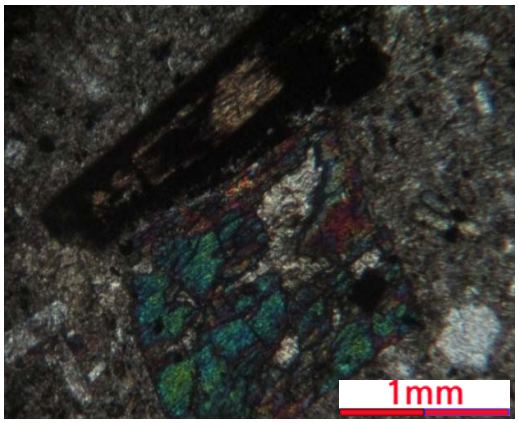

Figure (19). Photomicrograph showing olivine phenocryst in hornblende augite andesite.

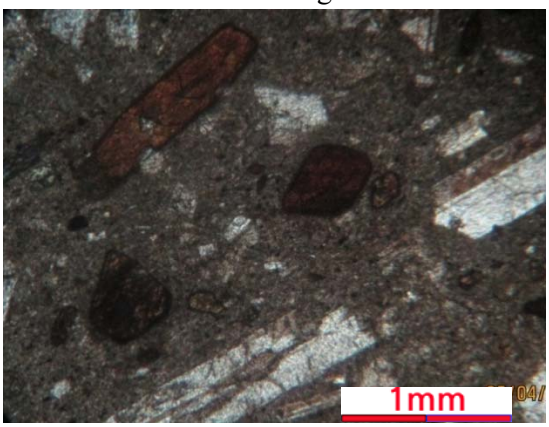

Figure (20). Flow structure occurs in hornblende augite andesite.

Igneous Activity

Volcanic Eruption

Products of Volcanic eruption

The investigated area lies in the Central Volcanic Arc. This volcanic arc is onshore volcanic arc. It constitutes the back-bone of the Central Cenozoic belt. The volcanic eruption of this arc is post-paleocene to Recent in age.

The volcanic rocks of this area are andesites and volcaniclastic rocks. Most volcaniclastic rocks are pyroclastic air-fall deposits in nature. The volcaniclastic rocks in this area are tuff, agglomerate and volcanic breccias.

The characteristic feature of pyroclastic air-fall deposits in this area are as follow;

(1) Well-bedded nature (2) Bed thickness decreases away from the site of eruption. (3) Blocks and bombs are deposited relatively close to the site of the eruption. Agglomerate beds, bombs and blocks are therefore found at Ok-aing-Ywatha Crater. Particle size decreases away from the site of eruption. Lapilli tuff and agglomerate are therefore not found in lowland area which is always from the central crater. (4) Presence of bomb-sags, formed by the impact of bombs which depress the bedding in tuff. (5) Presence of layering (andesite flow) and lamination in tuff.

Phase of Volcanic Eruption

The volcanic eruption in the area can be divided into two types;

1. The older tuff found as interclations in the Irrawaddy Formation and

2. The younger volcanic mainly found at Ok-aing crater.

The former is produced from subaqueous, volcanic eruption in this area. The later is lava and subaerial fall out.

The older tuff represents earlier phase of the volcanic eruption in this area. The volcanic eruption was contemporaneous with the deposition of the Irrawaddy Formation. It was probably related to the eruption of east Twintaung immediately south of the investigated area.

Nature and Type of Volcanic Eruption

Stages of Volcanic Eruption

In this area, the nature of the volcanic eruption of earlier phase cannot be known clearly because of the limited outcrops of the older tuff. However, it can be said that this volcanic eruption is an explosive or pyroclastic eruption in subaqueous environment on the basis of the following :

1. Intercalation of tuff in Irrawaddy Formation 2. Presence of tuffaceous sandstones in Irrawaddy Formation 3. Presence of fabric produced by soft-sediment deformation such as slump structures in Irrawaddy Formation.

The nature of the volcanic eruption of later phase can be said to be explosive or pyroclastic eruption on the basis of the following:

(1) Presence of andesite with phenocrysts as flow andicates magma is relatively rich in voltiles and (2) higher viscosity which can cause explosive eruption.

Age of rocks in study area

Irrawaddy formation was designated to Upper Miocene to Pliocene in age (OTCA 1973). During the Cenozoic, the subduction and trench retreat to the west. The Monywa Area becomes invaded by Calc- alkaline volcanism and the copper sulphides are supplied at the end of a long period of igneous activity.

Probable age of rocks in the study area can be mainly Cenozoic. Calc-alkaline volcanism invated Monywa area during Late Cenozoic (Gossens, 1978). The Lavas in all cases are very similar, no matter the mass occurs wholly in Peguan or in Irrawaddy sands. Natyindaung and Oakpho-Letpan in Budalin Township are definitely post Irrawaddian in age, indicating that these masses were intruded during the period when the volcanic activity of the region at its zenith (Chibber 1934, Aye Aye Mar 2018).

The volcanic rocks of the study area are interbedded with the Irrawaddy formation. Therefore, age of these volcanic rocks can be regarded as Upper Miocene-Pleistocene age.

Summary and Conclusions

The study area is located in Budalin Township, Sagaing Region. Volcanic rocks are found Ok-aing – Ywatha. Andesites are found at Ok-aing crater as blocks and bombs. Andesite can be regarded into; augite andesite, hornblende andesite and hornblende augite andesite. Microscropically it has a fine –grained porphyritic texture. Flow structure is present in augite andesite. Under the microscope, augite is anhedral to euhedral and shows simple twin. Hornblende andesite has hornblende phenocryst. Hornblende shows subhedral to euhedral in shape and it is usually rimmed by dark brown border which is sometimes corroded or resorbed. Some deformed augite can be seen in hornblende augite andesite. The volcanic rocks in this area are lavas and volcanoclastic rocks (pyroclastic rocks). Volcaniclastic rocks are air- fall deposits. They are tuffs, lapilli tuff, agglomerate and volcanic (vent) breccias. Lava flows are found in the Ok-aing crater. Pyroclastic rocks in this area can be divided as the older tuffs and younger tuffs. The older tuffs are coarse tuff. Younger tuff consists of coarse tuff and lapilli tuff. Coarse tuff consists of crystals, rock fragments and glasses. Lapilli tuff consists of rock fragments, pumice and minor amount of ash and dust. Probable age of the rocks in the study area can be mainly Cenozoic. Calc-alkaline volcanism invaded Monywa area during Late Cenozoic. Andesitic volcanoes are often associated with subduction zone. According to Chibber (1934), Natyindaung and Oakpho- Letpan in Budalin Township are definitely post Irrawaddian age, indicating that the masses were intruded during the period when the volcanic activity of region. In the study area, volcanic eruption might occur during and after the time of deposition of Irrawaddy formation. Therefore, age of the rocks in the study area can be regarded as Upper Miocene-Pleistocene age.

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