CHARACTERISTICS OF VOLCANIC ROCK CIKOTOK FORMATION AT CIHARA AND SURROUNDING AREA, LEBAK DISTRICT, BANTEN PROVINCE

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ABSTRACT

Volcanic rock of Cikotok Formation in southern part of the Bayah Dome, known as old andesite volcanic, is one of the parent rocks contain gold and base metal mineralization. This study aims to identify in more detail about texture, structure, and composition of mineral constituents of the rock by using field observation and petrographic methods. The result shows that the volcanic rocks of Cikotok Formation were came from shallow eruptions and relatively rapid cooling characterized by trachytic to porphyritic texture, embayment, and amygdaloidal structure. Most of these rocks have altered. These altered rocks are believed related to deformation at Oligo-Miocene that causing the presence of weak zone so that hydrothermal fluid can passes through.

Keywords: Cikotok Formation, shallow eruption, embayment structure, trachytic texture, hydrothermal

INTRODUCTION

The Bayah Dome area in Banten Province, is well known as one of the regions that rich of gold and base metal mineralization. These mineralizations are found in sedimentary rocks and volcanic rocks. Gold and silver mineralization were found at the volcanic rocks of Cikotok Formation (part of Bayah Dome) or better known as "*the old andesite volcanic*". Research of the rocks on this area has been carried out (Koolhoven, 1933; Bemmelen, 1949; Rosana, 2009; Hutabarat, 2016). The volcanic rocks in Bayah area are thought as a product of subduction between Indo-Australia and Eurasia plates since Paleogene. This idea was supported by geochemical data shown that volcanic rocks of Cikotok Formation are associated with magmatic calc-alcaline, Island Arc (Hutabarat, 2016) and formed at Oligo-Miocene (Koolhoven, 1933; Bemmelen, 1949).

This study will focus on the volcanic rocks of Cikotok Formation, precisely in the southern part of Bayah Dome. The aim of the study is to identify more in detail about the characteristic and formation processes of volcanic rocks of Cikotok Formation by using geological mapping and petrographic method. The results of this study is expected to provide the additional information related to the petrogenesis of volcanic rocks in Cikotok Formation as one of gold host rocks.

REGIONAL GEOLOGY OF RESEARCH AREAS

Geologically, Western part of Java is a product of the subduction between Indo-Australia and Eurasian plates since Late Cretaceous. It was characterized by Melange Ciletuh in the south of Western Java. At Oligocene to Miocene, volcanic activity has begun. This activity was responsible for development of magma along the Java Island (Rosana, 2009). Stratigraphically, the research area from older to younger, consist of metamorphic rock units, claystone member of Bayah Formation, Cikotok Formation, Granodiorite Cihara and Quaternary Volcanic (Sudjatmiko and Santosa, 1992; Patonah and Permana, 2018) (figure 1)**.**

Metamorphic units are thought as basement rock at Bayah area. This unit consist of schist, gneiss, quartzite, amphibolite and overlain unconformably by claystone members of Bayah Formation. This formation is composed by carbonate-claystone, black claystone, shale, and sandstone. Based on U-Pb dating, Bayah Formation formed at Middle Eocene (Clement and Hall, 2008). This formation has correlated unconformably with Cikotok Formation. Cikotok Formation or known as old andesite volcanic, consist of volcanic breccia, tuff, land lava which all of them have altered. This formation is believed as a product of the oldest vulcanism in Bayah geological history (Bemmelen, 1949) and has age of Late Eocene to Late Oligocene (Sudjatmiko and Santosa, 1992). At Oligo-

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Miocene, Granodiorite Cihara has intruded Cikotok Formation. This rock is composed by granodiorite, porphyry granodiorite, granite, porphyry dacite and aplite.

Geological structure in the area is dominantly included in Sunda Pattern with direction North to South (Martodjojo, 1984). The process of Bayah Dome is begun in Oligo-Miocene as the result of granodiorite intruded Cikotok Formation (Bemmelen, 1949).

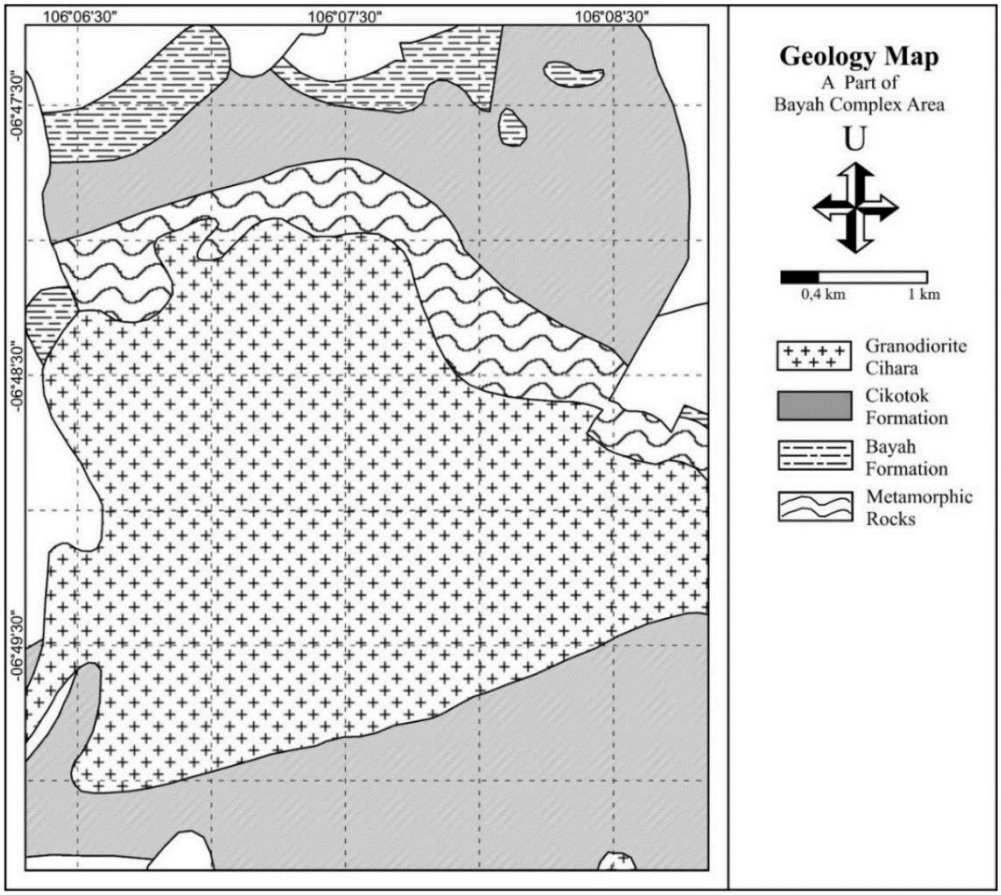

Figure 1. The geological of research area (modified by Sudjatmiko and Santosa, 1992

MATERIAL AND RESEARCH METHODS

The material in this research is volcanic rock in Cikotok Formation. This research is part of research activity Unpad Grant in year 2018. The research starting by conducting geological mapping in detail at Cisanun, Cibaong, Cibayawak, Cikahuruan and Cimarep Rivers. Based on field observations, several samples were collected for microscopic observation with the aims to identify texture, structure, mineral compositions, and naming the rocks by using Streckeisen (1976) and Schmidt (1981) classification. This analysis is used to interpret the genesis of the rocks.

RESULT AND DISCUSSION

GEOLOGICAL MAPPING AND PETROGRAPHY

The geological mapping was conducted along the Cisanun, Cibaong, Cibayawak, and Cimarep Rivers. The volcanic rock of Cikotok Formation in these areas consist of andesite and tuff, has generally been weathered and altered. These rocks are intruded by granodiorite and unconformably covered by tuff units (part of quaternary volcanic). Based on the fields observation, 5 (five) samples of andesitic and 3 (three) samples of tuff were collected to be analyzed in more detail (**figure 2**).

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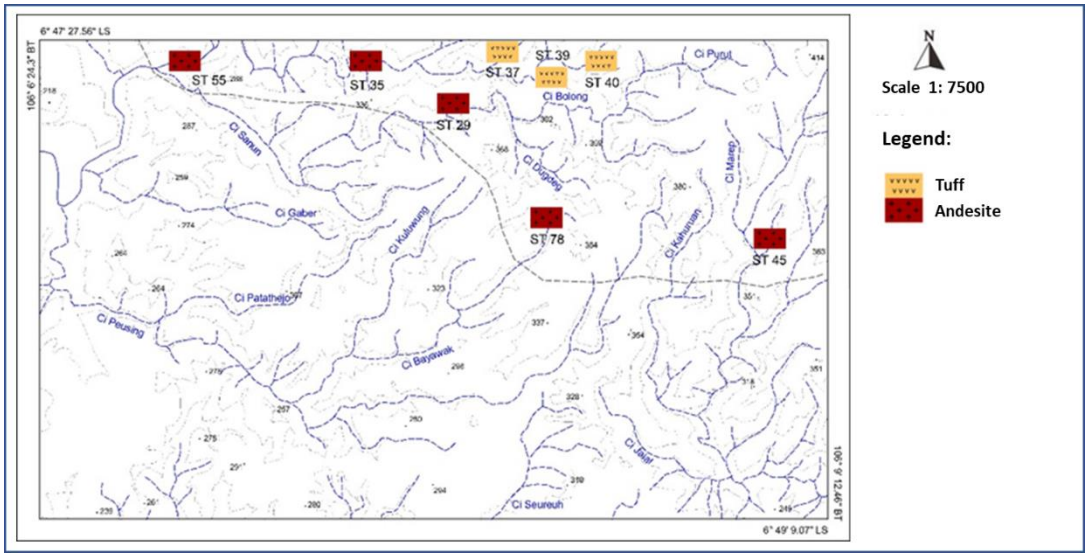

Figure 2. Sampling points are collected in research area

1. Andesite

These rocks is dominantly altered and weathered, distributed from SouthWest to North of research area, particularly Cimarep, Cibayawak and Cisanun Rivers (**figure 3A and 3B**). There rocks are characterized by light gray to dark gray, porphyritic texture with the fine-sized groundmass, partially fractured and filled by clay mineral, quartz, pyrite (samples 29, 35, 40, 45 and 55). These rocks are composed by dominantly plagioclase, some altered to clay mineral, sericite and chlorite, and epidote.

Microscopically, andesite exhibits a trachytic texture, some showing embayment structure, porphyritic texture with groundmass is volcanic glass and microlite plagioclase (0.1 – 3 mm), inequigranular, anhedral to subhedral, hipocrystalline. plagioclase as phenocryst, particularly andesine type (An30-An50), having granularity less than 3 mm, showing colorless, prismatic, subhedral – euhedral, having albite twins, carlsbad twins and albite – carlsbad twins, some showing wavy extinction and replacement by sericite, clay mineral carbonate and epidote (**figure 3C).**

The groundmass of andesite is divided by 2 (two) types. One has direction which generally showing trachytic texture and flow banding, consist of long prismatic microlite plagioclase and volcanic glass which filling space between crystal minerals (**figure 3D**). The other type does not have direction in their groundmass. This type composed by prismatic plagioclase. The space between crystalline is filled by volcanic glass which almost all volcanic glass replaced by clay mineral, chlorite, and quartz (**figure 3C).**

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Figure 3. (A) Andesite outcrops have fractured in Cimarep River; (B) Andesite has weathered at Cibayawak River; (C) Andesite shows porphyritic texture which groundmass has not direction; (D) Andesite shows trachytic texture.

2. Tuff

Tuff outcrops are distributed in almost all areas of the study, especially in North – Northeast of the area, Cisanun, Cibayawak, Cikahuruan and Cikadondong Rivers. Tuff outcrops has been altered which is characterized by present of chlorite and oxide minerals (figure 4A). This rock shows yellowish brown, dominantly medium grained, hard, composed by dominantly vitric tuff - rock fragment, felspar with the matrix is volcanic glass which is replaced by clay mineral. Some of tuff has altered which is marked by chlorite, clay mineral and secondary quartz replacing fragment and matrix, also vesicular structure which is filled by chlorite and quartz (figure 4B). Based on Schmidt classification (1981), it is included in Lithic tuff.

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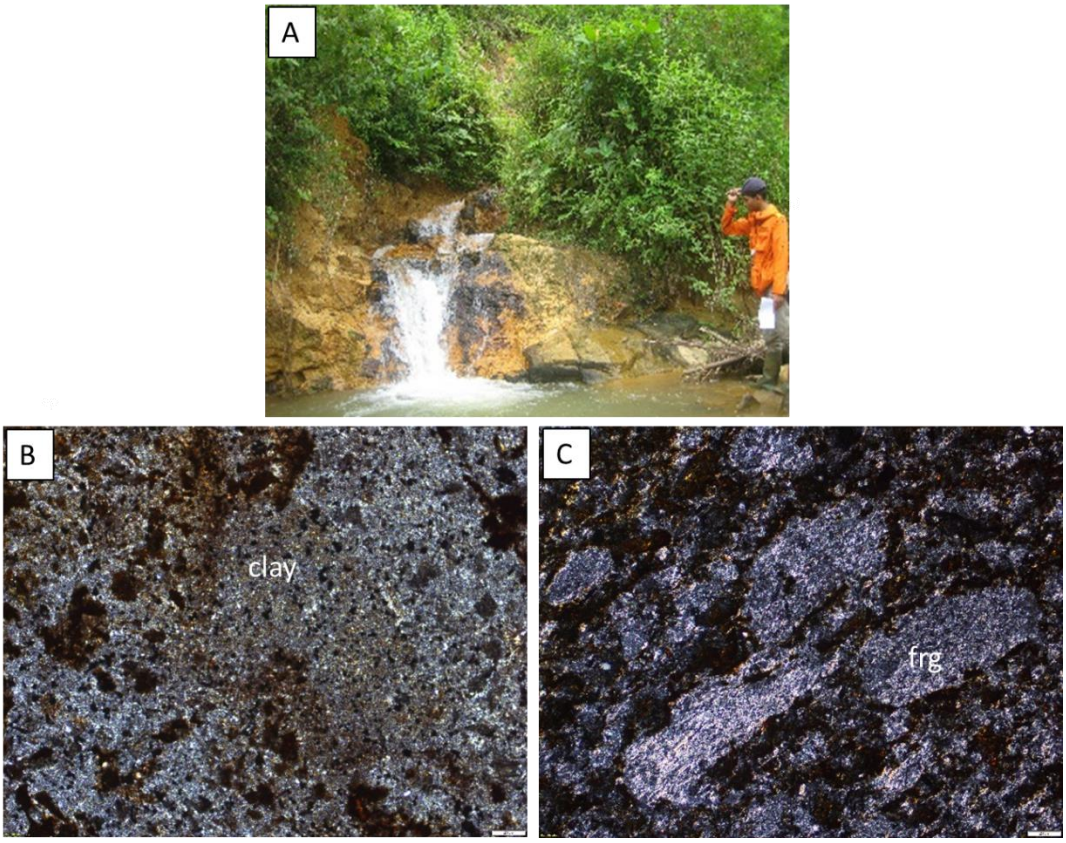

Figure 4. (A) Tuff outcrops at Cibayawak River; (B) Most tuff matrix is replaced by clay mineral, sericite, and quartz; (C) All rock fragments (vitric tuff) has altered to clay mineral and sericite.

ALTERATION

The volcanic rock of Cikotok Formation in the study area has altered which is indicated by present of mineral assemblages such as sericite, clay mineral, chlorite and epidote replacing plagioclase. Another indication is quartz and epidote filling veins.

Chlorite is found in almost rock samples, showing green color, aggregate, alteration from plagioclase, some filling veins and vesicular. Sericite shows colorless to brownish color, aggregate, replacing plagioclase. Epidote shows brownish color, granular (< 0.1 mm), high relief, replacing plagioclase, some filling veins. Quartz shows colorless, no cleavage, interlocking texture, filling groundmass and veins. Clay minerals show brown color, replacing groundmass and phenocryst.

Based on mineral assemblages which present in andesite and tuff, clay mineral, sericites, chlorite, epidote and quartz, the alteration zone is included in phyllic to propylitic type (Corbett and Leach, 1997).

DISCUSSION

Based on field observation and elevation data, volcano-stratigraphy of research area from older to younger is andesite lava and tuff. andesite is formed first and is followed by tuff. According to the texture, the rocks in research area show fining upward to the north so that it can be interpreted that the closer to the south the closer to the source.

Andesite has the main mineral composition of plagioclase with 2 (two) kinds of the texture characteristics. One has direction (trachytic texture) and flow banding, while the other type does not have direction. The variation of textures explains that there are two conditions when this rock is formed. Andesite which has trachytic texture shows direction due to a flow magma cooled onto the surface (lava); as for the other andesite that has not shown direction, the phenocrysts are surrounded by fine groundmasses. This is likely as a result of different cooling stages of magma. Magma that has a cooler temperature came to the surface and experience a rapid cooling due to the interaction with open air.

Structure which present in andesitic lava is amygdaloidal and embayment (figure 5). The vesicular which is found in this rock is traces of gases trapped in lava when it has cooled, then filled by chlorite (amygdaloidal).

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An embayment structure is structure of ingestion of plagioclase minerals so that they form like a bay. The embayment structure explains that minerals have been eroded by younger minerals or due to corrosion of residual magma solution. Based on the characteristics, it shows that the formation of lava takes place relatively quickly and is believed due to fluctuating temperature changes.

The alteration process is caused by the presence of weak zone so that hydrothermal fluid passes through previously formed rocks. The effect of hydrothermal solution is demonstrated by the presence of replacement of plagioclase by sericite, chlorite, clay mineral and epidote, opaque and oxide minerals. According to Corbett and Leach (1997), it can be classified into phyllic to propylitic types (table 1).

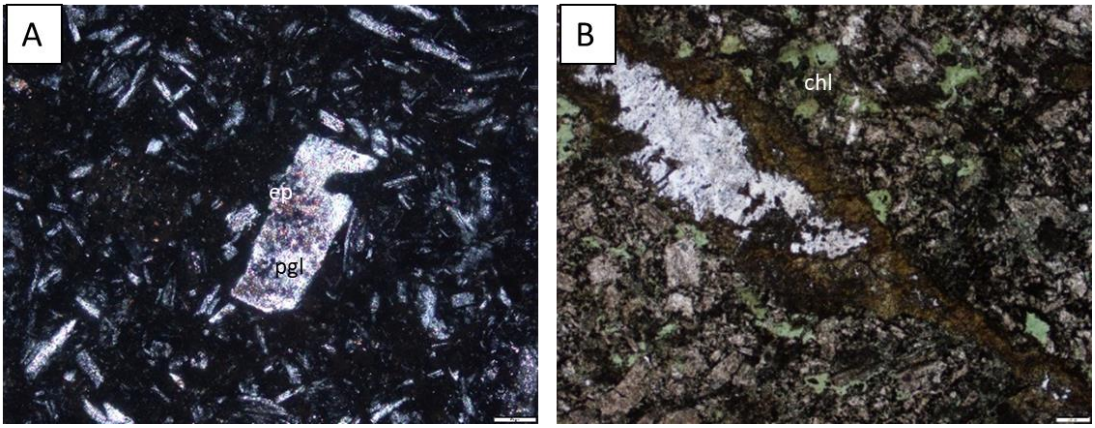

Figure 5. (A) Embayment structure; (B) amygdaloid structure filled by chlorite minerals

Lithic tuff in the study area has dominated by vitric tuff – rock fragment and matrix which is dominated by volcanic glass. This formation process is thought originally from result of large and shallow eruptions shown by the presence of volcanic glass and vitric tuff fragments characterized by ash lapilli - fragment sized (Fisher and Schmincke, 1984). Volcanic glass in this rock shows the rapid cooling of the eruption while vitric tuff – rock fragment indicated the magnitude of the eruption which destroy the caldera wall.

The alteration process that occurred in lithic tuff is shown by presence of quartz which filling vesicular and matrix, also replacement vitric tuff – rock fragment and matrix by sericite and clay minerals.

Table 1. Andesite constituent mineral paragenesis

Mineral	Primary mineral	Secondary mineral
Plagioclase	———	
Volcanic glass	———	
Chlorite		———
Sericite		———
Epidote		———
Quartz		———
Clay mineral		———
Opaque mineral		———
Oxide mineral		———

After those rocks are formed, deformation occurred at Oligo-Miocene (Sudjatmiko and Santosa, 1992). This is supported by almost of the rocks has fractured and filled by minerals. In addition, phenocryst of plagioclase has been bent, wavy extinction

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and fractured and filled by epidote. Moreover, groundmass of andesite and matrix of lithic tuff are replaced by clay mineral, sericite, chlorite, and quartz.

CONCLUSION

Volcanic rock of Cikotok Formation in the research area is dominantly composed by andesite and lithic tuff. Andesite shows trachytic and porphyritic texture with volcanic glass-groundmass, embayment and amygdaloid structure which is filled by chlorite. It is indicated the shallow eruption process relatively quickly and fluctuating temperature changes. Both of phenocryst and groundmass of this rock have altered to sericite, chlorite, epidote, and clay minerals. As well as lithic tuff, vitric tuff-rock fragment and matrix which are composed by volcanic glass have altered. Moreover, both these rocks have deformed. Based on the characteristic, volcanic rock of Cikotok Formation has deformed and is thought associated with granodiorite intruded Cikotok Formation at Oligo-Miocene so that hydrothermal fluid passes through previously formed rocks and altered the rocks.

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