

Identification of Hydrothermal Rock Alterations Based on Petrographic Analysis in Banturung Area, Bukit Batu District, Palangka Raya City

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Article Information	ABSTRACT
Article History Received : September 01, 2025 Revised : October 11, 2025 Published : October 20, 2025	The Banturung region mostly consists of the morphology of igneous rock hills where most of the rocks physically show that they have undergone a process of change, so more detailed research is needed to distinguish the types of rocks that exist at the research site. This study aims to determine the distribution and types of rocks that undergo alterations at the research site. The research method with petrographic analysis, due to mineral changes and changes in rock composition in alterations can be observed from microscopic observations by paying attention to the mineral composition. The rock sample is cut into thin incisions measuring 0.035 mm so that it can be observed under a microscope. From the results of the rock incision analysis, it is known that the characteristics of rock alteration at the study site include the type of Phyllic alteration with serisite as a key mineral, with a very low alteration intensity < 25%, and hydrothermal alteration processes in dacite and tonalite rocks. This alteration process can be an early indication of the formation of metallic minerals or mineralization of valuable minerals at the research site, which is also strengthened by the discovery of pyrite minerals at the research site so that it can be further developed as a source of mineral resource research.
Keywords: <i>Alteration; Banturung; Rock; Hydrothermal; Phyllic.</i>	

INTRODUCTION

Based on the geological map of the Palangka Raya sheet, the Banturung area is the Tangkiling hills, symbolized by the Granite rock unit (Kgr) which is a plutonic rock with a granite – granodiorite composition, Tangkiling Hill is located north of Palangka Raya City, is a group of inlier hills that rise in the middle of the flood runoff deposits of the Rungan River, a tributary of the Kahayan river. These hills are composed of late Cretaceous Sepauk tonality. Tonalite is a plutonic igneous rock with an acidic composition and phaneric texture, rich in plagioclase, quartz and biotite. Continuing west-southwest, the Tangkiling hills still continue as undulating plains, formed by a stretch of Plio-Pleistocene Formation quartz sandstone, which is mostly the result of the weathering of the Sepauk tonalite itself. The same rocks also appear on the southern coast of Central Kalimantan, with the Cintabirahi hills in the Sebangau National Park area as its inlier peak (Putrawiyanta, 2024).

In Central Kalimantan, the phenomenon of hydrothermal rock alteration is often found related to potential mineralization, such as in the Mount Muro area, Murung Raya Regency, which is part of the 'Golden Bow'. The most common type of alteration is the propylitic alteration, which is characterized by greenish-gray rocks due to the presence of minerals such as

chlorite, quartz, and smectite, and shows a mineral formation temperature between 140-220°C (Syaban, 2024). Central Kalimantan is an area that has a lot of economic geological potential, one of which is in mineral resources. The existence of this mineral resource is related to the existence of a magmatic path in the middle of the island of Kalimantan, otherwise known as the Central Kalimantan Arc which is the main path of metal mineralization (Abdullah, 2023).

Hydrothermal alteration is a complex process involving mineralogical, chemical and textural changes, caused by the interaction between hot fluids and rocks, under the influence of physico-chemical conditions (Syaban, 2024). The categories of variables that affect the formation of hydrothermal altered minerals are: Temperature, Fluid chemical composition, Concentration, Composition of the side rocks, Kinetic reactions, Duration of equilibrium, and Permeability (Nasaruddin, 2024). The interaction between the hydrothermal solution and the rock that passes through will change the physical and chemical of the rock including texture and mineralogy. These new minerals due to hydrothermal alterations will become a mineral assemblage (Chen, 2025). An area will show the similarity of the distribution of alteration mineral sets referred to as an alteration zone. An area that shows the spread of the same alteration mineral assemblage is called an alteration zone (Churchman, 2012).

The physical condition of the rocks in the Tangkiling hills of the Banturung region is dominated by hard rocks which are dark-colored igneous rocks, but in some areas there are light-colored rocks with a granular texture such as clay rocks. This is the reason for conducting this study, because the rock is physically qualified as a change or alteration rock that has the characteristics of a lighter colored appearance, and the appearance of granular clay minerals, further testing and analysis are needed to determine the type of changes or alterations that occur in the rocks in the Banturung area.

RESEARCH METHODS

The research method is designed by studying the literature first, then conducting administrative preparations including research licensing, then technical preparation including tool readiness and preliminary surveys related to the preparation of sample point location plans. The way the research works is a hands-on review in the field by taking samples directly with the help of a geological hammer tool and storing them with special sample bags for further analysis of the samples in the laboratory with petrographic studies. Petrography itself is a method of rock analysis by making thin incisions of rocks and observing them with the help of a microscope (Sukandarrumidi, 2021). The parameters observed in petrographic studies are the parameters of the mineral composition of the rock samples.

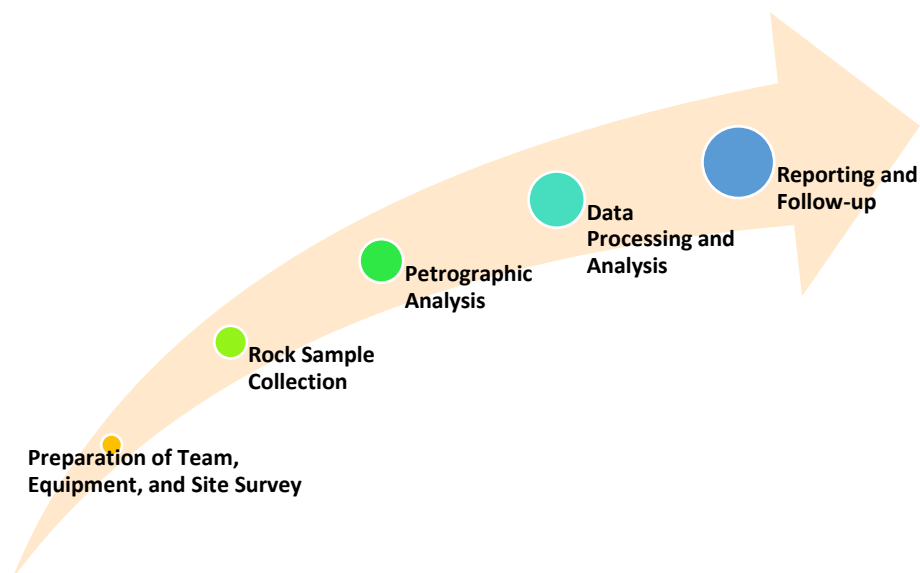


Figure 1. Research Roadmap

The research location is located approximately 34 kilometers from Palangka Raya City, precisely in Banturung Tangkiling Village, Bukit Batu District, Palangkaraya City, Central Kalimantan Province. The research location from Palangka Raya City can be reached by two-wheeled or four-wheeled vehicles with a time of 30-40 minutes through paved and relatively flat road conditions. The targeted research location is the location of the former community mining area and active mining areas carried out by the community to make it easier to find rock outcrops that appear on the surface and are not covered by vegetation. In addition, in active mining areas, they can directly ask for permission and discuss with the mining community regarding the production of their rocks and where the marketing of the mining rocks of the community goes. The results of the research at the location found igneous rock outcrops in several areas, the location was then plotted using GPS, then samples from the rocks were taken using a pick hammer tool to be analyzed in the laboratory.

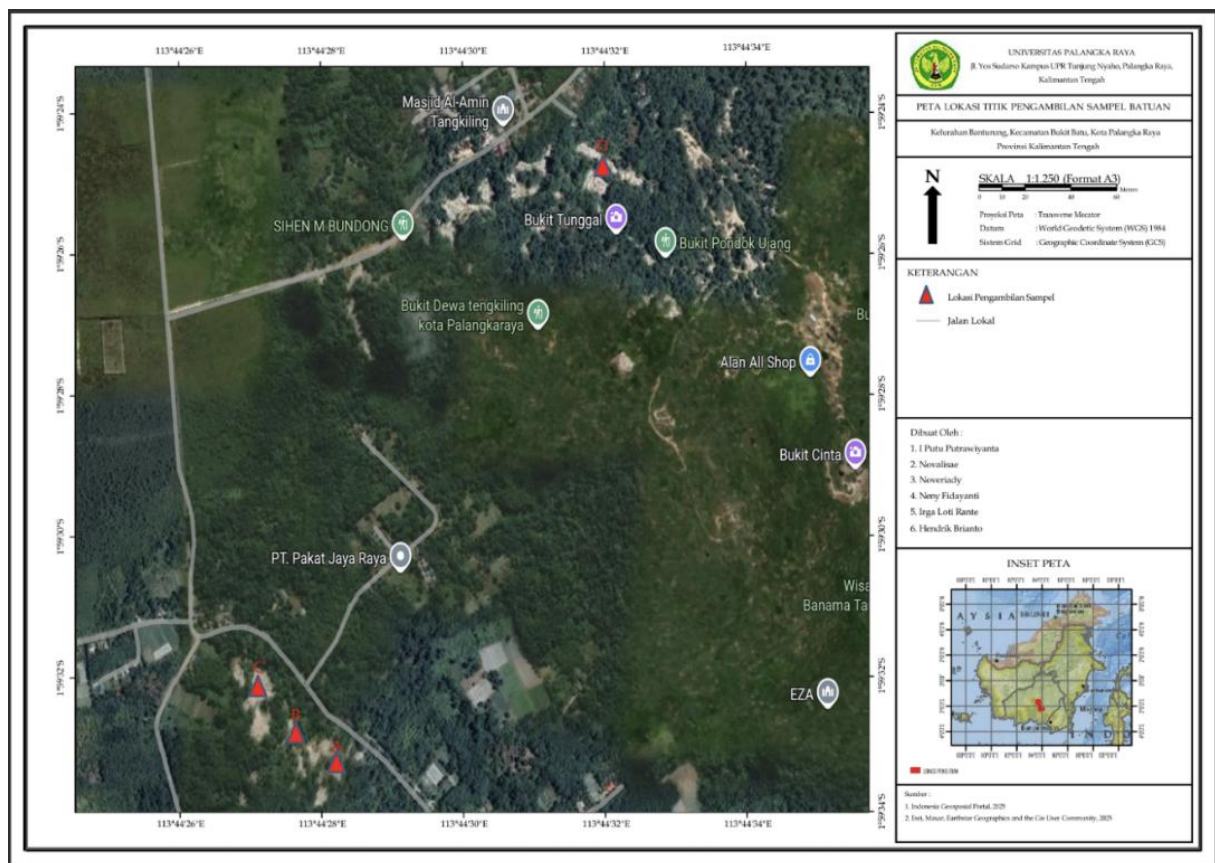


Figure 2. Overview of Research Locations

At the research location, rock outcrops with hilly morphology were found to be dominated by igneous rocks whose texture was predominantly coarse and partly smooth, light-colored and slightly dark. At this location, there is also a hole filled with water and overgrown with vegetation that looks like a former mining activity that has been abandoned for a long time.



Figure 3. Rock Outcrops at the Research Site

Following, one-handed rock sampling was carried out using a geological hammer. The samples taken were selected based on the difference in color, hardness and difference in rock texture. During sampling in the field, several pyrite minerals were also found which is an indication of the presence of metal mineralization.



Figure 4. Sampling Process

Then the rock samples that have been taken in the field, the sample preparation is carried out in the laboratory to then be cut and cut into thin incisions, so that it can be analyzed in the preparation under a microscope.



Figure 5. Sample Preparation for Preparation

RESULTS AND DISCUSSION

Rock samples that have been cut into thin incisions in preparation are then analyzed using a microscope to determine the composition of the minerals that make up the rock. The results of the analysis obtained 2 rock samples that were identified as altered or altered rocks based on the composition of the minerals that make up the rock.

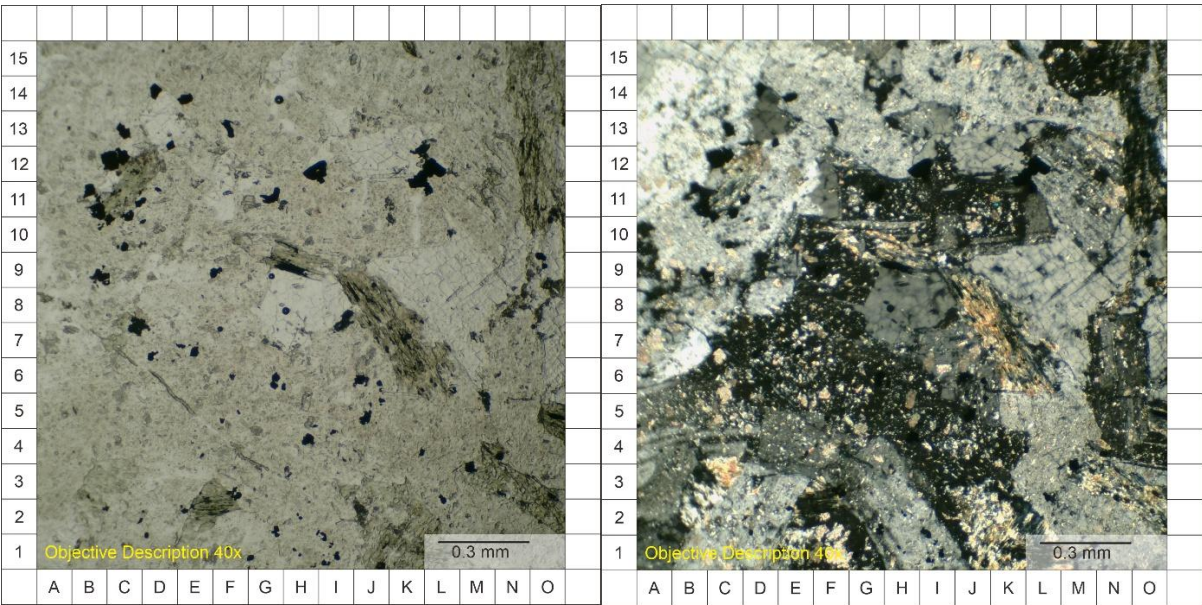


Figure 6. Appearance of Incisions of Dasite Altered Rocks Under the Microscope (Left : Plane Polarized Light, Right : Cross Polarized Light)

Observation of thin incisions was made on altered igneous (Volcanic) rocks with 10 times ocular magnification and 40 times objective magnification. It has a general texture with a holocrystalline crystalline level, fine crystal size (<1mm), inequigranular granularity (porphyroafanitic), euhedral-subhedral crystal shape, Intergranular special texture, The composition of the rock is composed of quartz minerals (44%), chlorite (18%), plagioclase (19%), sericite (10%) and opaque (9%).

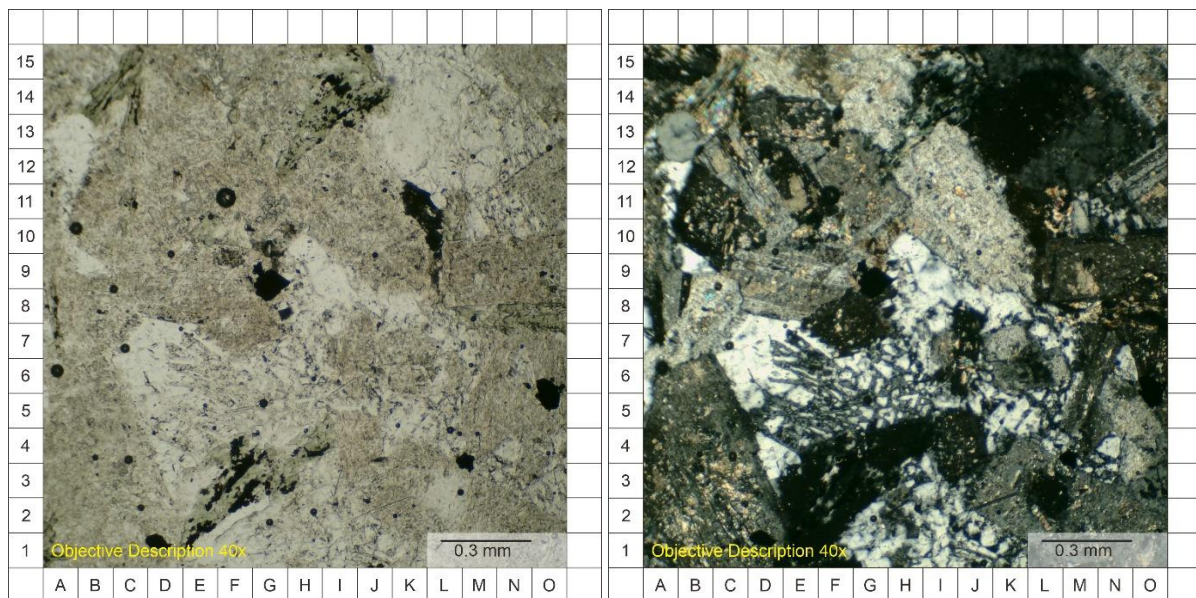


Figure 7. Appearance of Incisions of Tonalite Altered Rocks Under the Microscope (Left : Plane Polarized Light, Right : Cross Polarized Light)

Observation of thin incisions was made on igneous rocks (Plutonic) with ocular magnification of 10 times and objective magnification of 40 times. It has a general texture with a holocrystalline crystalline level, fine crystal size (<1mm), inequigranular granularity (porphyroaphanitic), euhedral-subhedral crystal shape, Intergranular special texture, The composition of the rock is composed of quartz (28%), myrmerkite (23%), plagioclase (25%), sericite (8%), chlorite (13%) and opaque (3%).

When viewed from the formation of constituent minerals, the alteration zone includes Phyllic, which is an alteration zone characterized by the presence of secondary minerals dominated by sericite and quartz. In addition, pyrite and anhydrite can also appear. This type of alteration is formed due to neutral to acidic solutions at medium temperatures, which range from 200-400°C (Corbett, 1997).

The presence of sericite key minerals describes the process of hydrothermal alteration that undergoes the replacement and filling of constituent minerals in temperature conditions ranging from 150 -200°C and if it undergoes a mineralization process, it is likely that porphyry mineral deposits rich in metals will be formed (Schwenzer, 2013).

Hydrothermal alterations are closely related to the formation of porphyry deposits. Porphyry deposits are a type of ore deposits formed from hydrothermal activity associated with the intrusion of porphyritic igneous rocks. Hydrothermal alteration zones can be used as a guide to search for ore deposits. Altered zoning patterns can help geologists to determine locations relative to potential intrusion centers and mineralization zones.

In addition, if associated with mine planning, hydrothermal alterations can weaken the rocks, which can affect the stability of the slopes and walls of the mine. An understanding of the type and intensity of alterations is important for mine planning and management.

Common Mineralogy in Hydrothermal Systems

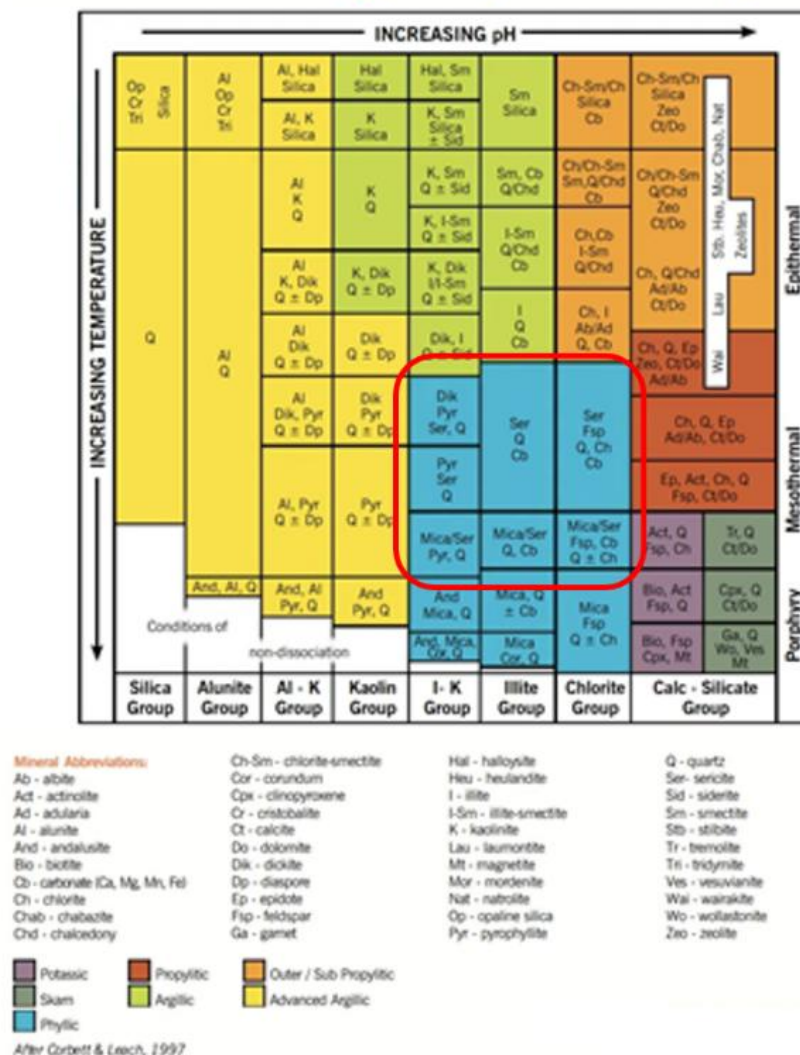


Figure 8. Determination of zones and types of alteration deposits according to Corbett & Leach

CONCLUSION

Based on the mineral composition, temperature, and mineral associations that dominate an altered rock, it can be concluded that the alteration zone is Phyllic, with the key mineral being sericite, formed in a hydrothermal system with altered rocks in the form of altered Tonalite and Dacite. Hydrothermal alterations at the study site are very likely to form porphyry deposits or ore deposits, so further analysis such as XRD or geochemistry is needed to determine the detailed composition of the altered rocks and the type of mineral resources.

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