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Alteration and Mineralization in the Coppo Village, Barru District, South Sulawesi Province

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ABSTRACTS

Hydrothermal alteration can be used to interpret and identify undiscovered mineralization, and can lead to the discovery of such mineralization. In the research area, it was found that there were outcrops that were altered with the physical characteristics of weathered outcrops. The research location is in the Camba Formation of Volcano Rock Members, and there are indications of sulfide mineralization, megascopically this study took 3 (three) alteration samples, selected based on the differences in color and texture of the rocks found. Samples we reanalyzed to determine alteration mineral assemblages using petrographic and XRD analysis methods, then to determine the type of alteration in sulfide deposits in the study area using the classification by Corbett and Leach, 1996. The results of the petrographic analysis showed that sample 1 consisted of chlorite, epidote, quartz and mineral assemblages. opaque minerals, sample 2 consists of plagioclase minerals, kfeldspar, clay minerals and quartz, sample 3 consists of epidote minerals, calcite and opaque minerals. The results of the XRD analysis showed that sample 1 consisted of the minerals quartz, chlorite, epidote and pyrite, sample 2 consisted of the minerals kaolinite, illite and pyrite, sample 3 consisted of the minerals quartz, chlorite, dolomite, epidote and auricuprite. The results of the analysis of alteration minerals assemblages were classified using Corbett and Leach, 1996 and it was found that the types of alteration in the research area were propylitic and argillic alteration types.

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INTRODUCTION

The Indonesian archipelago is a region traversed by three plate passes tectonics i.e. Indo-Australian plate, Pacific and Asia also called with the ring of fire. These three plates which forms the subduction pathway begins North Sumatra shifted northward passing through Nusa Tenggara to Sulawesi and Maluku. The existence of zones It is this subduction that causes the formation of volcanoes and activate volcanism activity and magmatism, especially on the island of Java which stretches along the coast south. Magmatism activity of a The area is closely related to the process hydrothermal alteration of rocks Forming mineral and mineral ore alteration (Suteja, et all, 2016).

Alteration and mineralization processes are very closely related to process phenomena chemistry and physics that occur in rocks due to the interaction of rocks with hydrothermal solution. Hydrothermal solution is a high-temperature liquid (100-500 ^{o}C) residual cooling of magma able to change existing minerals previous and forming minerals changes to the original rock and the formation of mineralized deposits metal sulfides under certain conditions (Bateman, 1981). Hydrothermal alteration is a process that occurs due to the interaction between the hot fluid and the side rocks through which it passes, so that the exposed primary minerals will be converted into secondary mineral series which are then called alteration minerals and under certain circumstances and conditions will produce a collection certain minerals are also called mineral assemblage or mineral assemblage, thus reflecting the chemical and physical conditions at the time of its formation (Sutarto, 2004). Hydrothermal alteration is a complex process because it occurs 4 changes in mineralogy, chemistry and texture due to the interaction of hydrothermal solutions with wall rocks that pass under certain physical chemical

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conditions (Pirajno, 1992). Some of the factors that influence the hydrothermal alteration process are:temperature, fluid chemistry (pH), side rock composition, duration of hydrothermal activity and permeability. However, fluid chemistry (pH) and temperature are the most influential factors (Maulana, 2017).

Previous researchers who have conducted research related to alteration types in sulfide deposits, especially on Sulawesi Island, namely the Cindakko Village Area Bontosomba Tompobulu District, Maros Regency, South Sulawesi, there are sulfide minerals, namely: pyrite, chalcopyrite, sphalerite, galena, bornite, tenantite, tetrahydrite, arsenopyrite and covyelite, and their alteration types are propilitic and argilic continued (Arif, 2020).

The research location is in Coppo Village, Barru Regency, South Sulawesi Province, which is in the Camba Formation of Volcanic Rock Members. In the study area, changes were found with the physical characteristics of weathered outcrops. Hydrothermal changes can be used to interpret and identify undiscovered mineralization in the study area, and can lead to the discovery of such mineralization (Chavez, 2000). The absence of preliminary information about the type of alteration and mineralization is important so this study was carried out.

METHODS

In general, research methodology is carried out in two stages, namely field data collection and laboratory analysis (Wakila, et all, 2021). This stage of research begins with sampling at the location of alterated rock outcrops. Then take a hand-sized alteration sample Spiceman as many as 3 samples with using the chip sampling method. In addition to collection samples at several points were also observed on the geological conditions around the study area, and descriptions of rock samples to obtain information in the form of rock position, direction of rock distribution, outcrop coordinates, and mineral content of rocks megascopically (Wakila, et, all, 2021). The sampling process can be seen in the following figure (Figure 1).

Figure 1. Sampling Process

After sampling, the next analysis is carried out Petrography Analysis and X-Ray Diffraction (XRD). Petrography analysis is carried out to determine the set of minerals which will then be the basis for determining the type of alteration. XRD analysis is performed to determine the name of the mineral contained in the sample and its grade (percentage). Altered minerals indicated to be altered analyzed by XRD (Chalik, et all, 2022). The results of both methods will be combined to obtain the better results.

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RESULTS AND DISCUSSION

Megascopic Analysis

Megascopically, the sample taken is an outcrop that has alterated and is the result of alteration of igneous rocks, based on Regional geology there is an intrusion of Diorite type volcanic rocks.

Sample 1

Sample 1 shows a weathered white to greenish-gray color in the rock and shows an altered texture. The minerals seen are quartz, and plagioclase (figure 2).

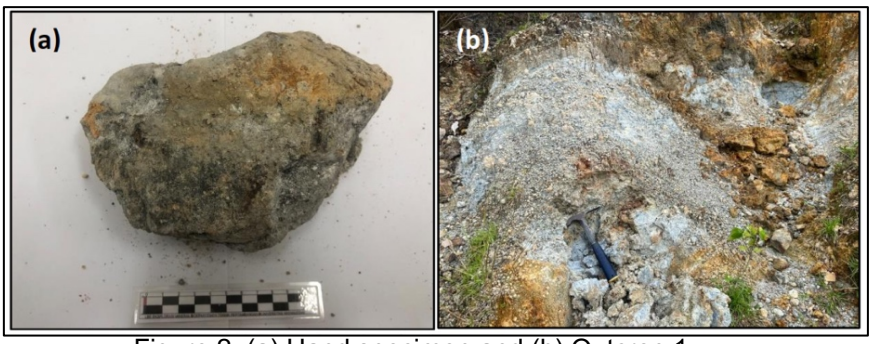

Figure 2. (a) Hand specimen and (b) Outcrop 1

Sample 2

Megascopically, these rock samples show textures that have undergone alteration with white to brownish weathered color, visible minerals are quartz minerals, and clay minerals such as kaolinite, illite, montmorilonite and others (Figure 3).

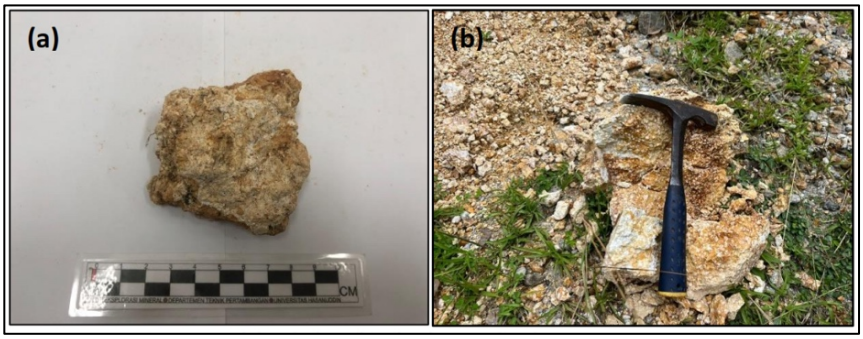

Figure 3. (a) Hand specimen and (b) Outcrop 2

Sample 3

Megascopically, these rock samples show textures that have undergone alterations with a weathered white to yellowish-brown color, visible minerals namely quartz and clay minerals such as kaolinite, illite, and others (Figure 4).

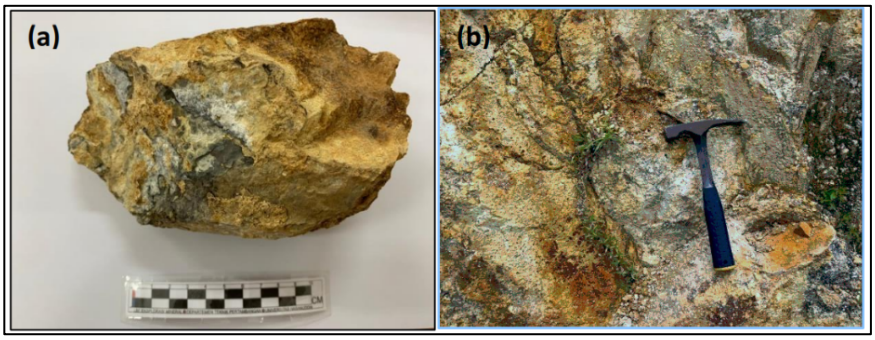

Figure 4. (a) Hand specimen and (b) Outcrop 3

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Petrography Analysis

Petrographic analysis is performed to determine the minerals contained in the sample with Using a polarizing microscope. Polarizing microscopes can also identify mineral texture through thin incisions from rock samples (Thamsi, et all, 2020). Petrography is the study of the characteristics of petrology and describe and classify rocks using a microscope. In describing rocks with petrographic methods is important in identifying the mineral composition and texture of rocks. The process of calcifying rocks based on observations on texture and main minerals is carried out and grouped later to find out the set. The results of petrographic analysis using a microscope produce the appearance of minerals with different fields of view to clarify the use of cross nickel and parallel nickel on the microscope, so that changes in the shape of minerals in the sample can be seen (Omang, 2011).

Sample 1

Under microscope, a thin incision of sample 1, showing a collection of minerals alteration, namely chlorite (chl) is present as a mineral characterizing alteration and is circumvented in Rock samples that are faded green, epidote (ep) present as Alteration minerals from feldspar characterized as constituents of igneous rocks, quartz (qtz) is present as an associated mineral in rock sample and opaque minerals (opq) that sample 1 is characterized as metallic minerals that carry sulfide mineralization in the study area. Sample 1 polished incision photomicrograph can see in Figure 5.

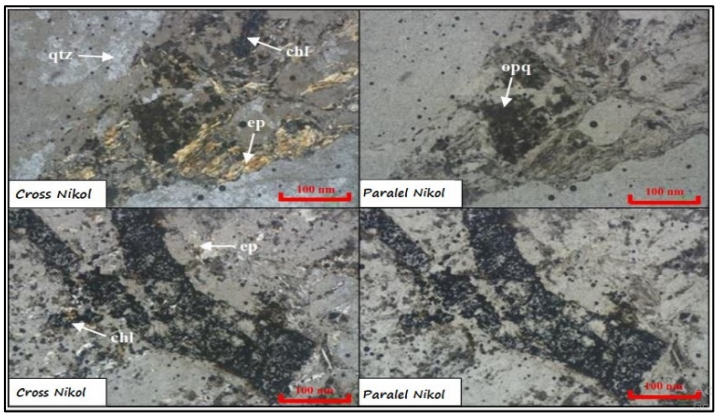

Figure 5. Photomicrograph Sample1, qtz (quartz), ep (epidote), and chl (chlorite)

Sample 2

Under microscope observation, a thin incision of sample 2, showing a collection of minerals Plagioclase (plg) is present as a common mineral forming igneous rocks and dominating rock samples, K-feldspar is part of the mineral Plagioclase is present as phenocryst in rock samples, clay minerals are minerals that have undergone alteration from plagioclase and quartz minerals (qtz) is present as an associated mineral commonly found in rock samples. Photomicrograph of sample 2 polished incision can be seen in Figure 6.

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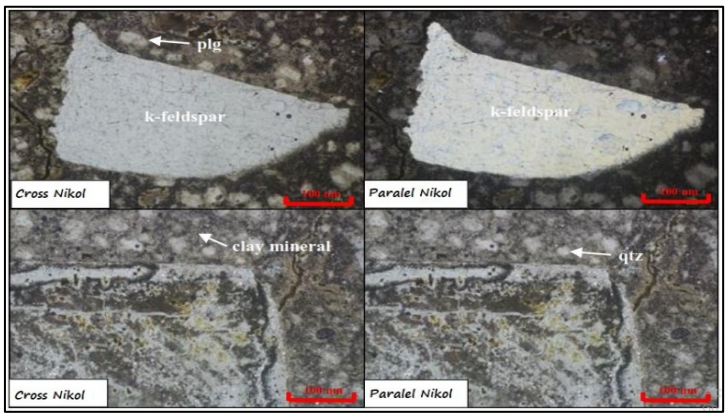

Figure 5. Photomicrograph Sample2, plagioclase (plg), k-feldspar, clay minerals and qtz (quartz)

Sample 3

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Under microscope observation, a thin incision of sample 3, showing a collection of minerals epidote (ep) is present as an alteration mineral of the feldspar that is characterized as a constituent of igneous rocks, calcite (cal) as a carbonate mineral is found in alteration and opaque mineral (opq) contained in sample 3 as well characterized as metallic minerals that carry sulfide mineralization in research area. Photomicrograph of sample 3 polished incision can be seen in Figure 6.

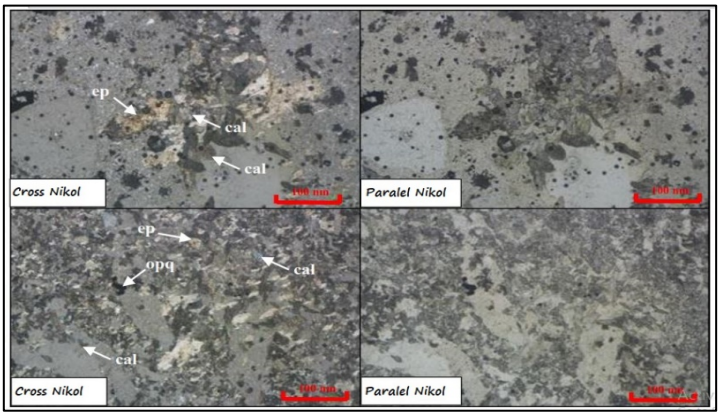

Figure 6. Photomicrograph of sample 3, ep (epidote), cal (calcite), and opq (opaque)

X-Ray Diffraction (XRD) Analysis

XRD analysis is performed to determine the mineral content of the rock sample. Minerals that cannot be seen in later microscopy analyzed using XRD (X-Ray Diffraction) method. The working principle of the tool for mineralogical analysis methods known as XRD (X-ray diffraction) which is by using X-rays derived from metals with its wavelength, thus forming an angle of reflection of light that can be detected. According to Bragg's law, diffraction data is used to calculate the distance of the atomic plane that produces a certain angular magnitude (Fatimah, 2017). Most explanations of XRD address techniques for analyzing and identifying the crystalline phase of the material. The form of crystalline varies greatly in each material or mineral, so it is these are used as anomalous characteristics of certain minerals (Heriansyah, 2018).

Sample 1

The results of XRD analysis on ST.1 samples showed the presence of alteration minerals such as: quartz (34.2%), chlorite (36.2%), epidote (27.0%), and pyrite (2.6%). The diffractogram of the sample 1 can be seen in Figure 7.

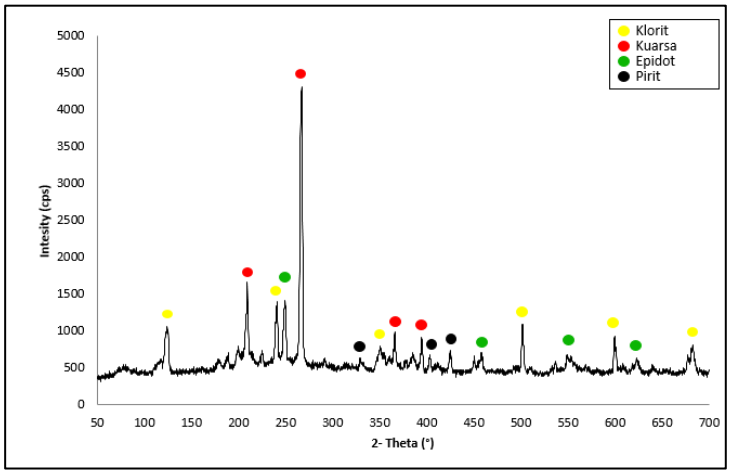

Figure 7. Diffractogram XRD sample 1

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Sample 2

The results of XRD analysis in sample 2 showed the presence of minerals kaolinite (54.6%) and illite (16.4%) which are minerals made from clay minerals and pyrite (29.0%) which is a sulfide ore mineral. Diffractogram of Sample 2 can be seen at Figure 8.

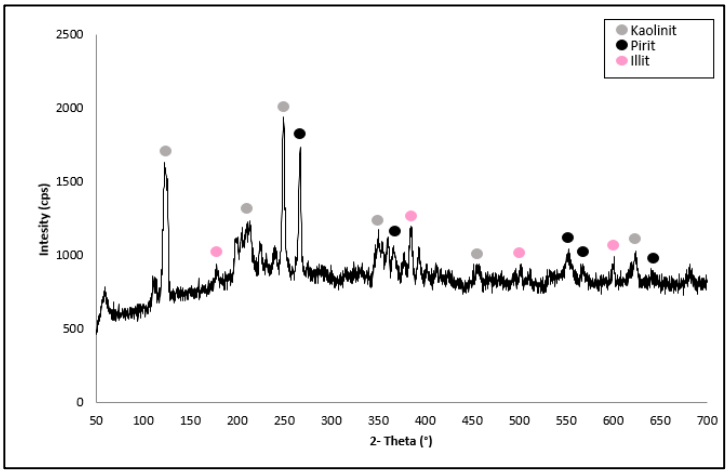

Figure 8. Diffractogram XRD sample 2

Sample 3

The results of XRD analysis in sample 3 showed the presence of minerals quartz (52.2%), chlorite (24.2%), dolomite (19.2%) as carbonate minerals, epidote (4.1%) and auricuprite (0.3%) as Au carrying ore minerals, pyrite (0.5%) which is mineral sulfide ores and sphalerite (0.3%) as zinc sulfide ores. Result The diffractogram of the sample 3 can be seen in Figure 9.

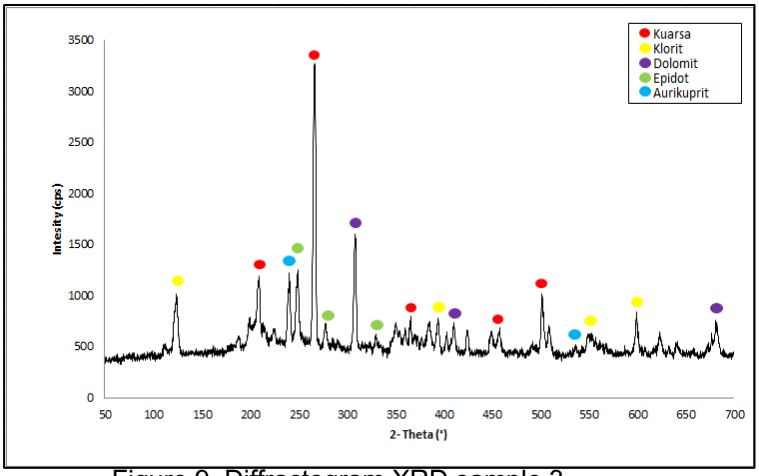

Figure 9. Diffractogram XRD sample 3

Types of Alteration

Types of hydrothermal alterations are generally divided into several types based on alteration mineral sets. The results of the analysis then showed some minerals can be classified as alteration-type characterizers. Based on the presence of alteration minerals present, it can tabulated alteration mineral sets and alteration types based on type diagrams alteration by Corbett & Leach, 1996 as in Table 1, the alteration types that develop in the study area are propilitic and argylic.

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Table 1. Set of alteration minerals and alteration types

No	Name	Alteration Minerals		Types of Alteration
		Petrography	XRD	
1	Sample 1	Chlorite, epidote, quartz and opaque minerals	Quartz, chlorite, epidote, and pyrite	Propilytic
2	Sample 2	Plagioclase, k-feldspar, Clay Minerals and Quartz	Kaolinite, illite and pyrite	Argilic
3	Sample 3	Epidote, calcite and opaque minerals	Quartz, chlorite, dolomite, epidote and auricuprit	Propilytic

CONCLUSION

The conclusion of this study are: the set of alteration minerals in the research area, namely minerals chlorite, epidote, quartz, pyrite, plagioclase, k-feldspar, kaolinite, illite, dolomite and aurikuprit. The types of alterations that develop in the research area based on the set the minerals are propilitic and argylic.

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