MINERALIZATION CHARACTERISTICS OF KIARAPAYUNG, CIBALIUNG DISTRICT, PANDEGLANG, BANTEN

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ABSTRACT

PT Cibaliung Tbk is one of active underground gold mining in West Java. The mineralization type is Au-Ag adularia-sericite low sulphidation (Angeles et al, 2002). Study area is located southeastward from main veins of Cibaliung, administratively in Kiarapayung village, Cibaliung District, Pandeglang, Banten. From previous study it is known that acid alteration typical of high sulphidation deposit also occurred in study area. This research aim to observe the characteristics of mineralization in study area, comprising of its occurrence, trend, and ore minerals present. This research use field observation and ore microscopy as main method to identify mineralization characteristics. Mineralization occurred in the field as quartz and silica veins with various textures; vuggy quartz; and silica-pyrite replacement bodies. Most veins have NW-SE trend, similar to trends of major faults in research area. Vuggy quartz and replacement zones distribution also found restricted to geological structures. Pyrite distribution in wallrock also showed trend that associated with geological structures. Textural observation with binocular microscope in veins and replacement zone showed rock brecciation process before ore-bearing alteration. Ore minerals present are pyrite and chalcopyrite with minor galena and chalcocite. Mineralization characteristics indicate there is low sulphidation and high sulphidation type mineralization in study area. Both mineralization are strongly influenced by geological structures.

Keywords: mineralization, veins, vuggy quartz, texture, structural control.

INTRODUCTION

Cibaliung epithermal deposit is located in Sunda-Banda magmatic arc in West Java (Carlile dan Mitchel, 1994; in Angeles, dkk., 2002). Radiometric dating from main veins of Cibaliung showed 10,5-11,8 m.a., not quite far from the age of volcanic rocks that act as its host rock, which is Honje volcanic complex (Harijoko et al, 2004). The age of Cibaliung mineralization differ from younger epithermal deposit found nearby in Bayah Dome, namedly Pongkor, Cikotok, Cikidang, and Cirotan (Milesi et al., 1999; Marcoux and Milesi, 1994; Rosana and Matsueda, 2002; in Harijoko et al., 2004). Thus, it is thought to be a result of late-stage volcanism of Honje Volcanic (Harijoko et al, 2004).

Hydrothermal alterations are found altering lithological units from Honje volcanic, consisting of andesitic lava, tuff, and monomict breccia. These volcanic rocks are overlain by unaltered younger sedimentary rocks of Bojongmanik Formation and Pliocene tuft. The unaltered tuft and sedimentary rocks act as a cover that helped preventing the deposit from erosion (Harijoko et al, 2004).

The main veins of Cibaliung, which are Cikoneng and Cibitung, are subvertical veins with NW-SE trends. The veins were jogs formed through intersection of NW-SE, NNW-SSE, and NE-SW strike-slip structures. Smaller veins near main veins also have similar trends and associated with fault indications in Cibaliung area.

Study area is southeastward from mining area of PT Cibaliung Tbk. It is inside of PT Antam Tbk's mining permit area. Previous studies showed the occurrence of acid alterations assemblage in research area.

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RESEARCH METHOD

Methods used in this paper are field observation and ore microscopy. In field observation wallrock alteration, mineralization orientations and geometries are noted. Geological and structural geology features also observed and recorded.

Around 8 polished samples from the field is taken for microscopic analysis. The samples comprising of veins, vuggy quartz, and replacement bodies. Polished samples are observed with binocular microscope to examine the microscopic texture and with reflected light microscope to identify ore minerals present in the samples.

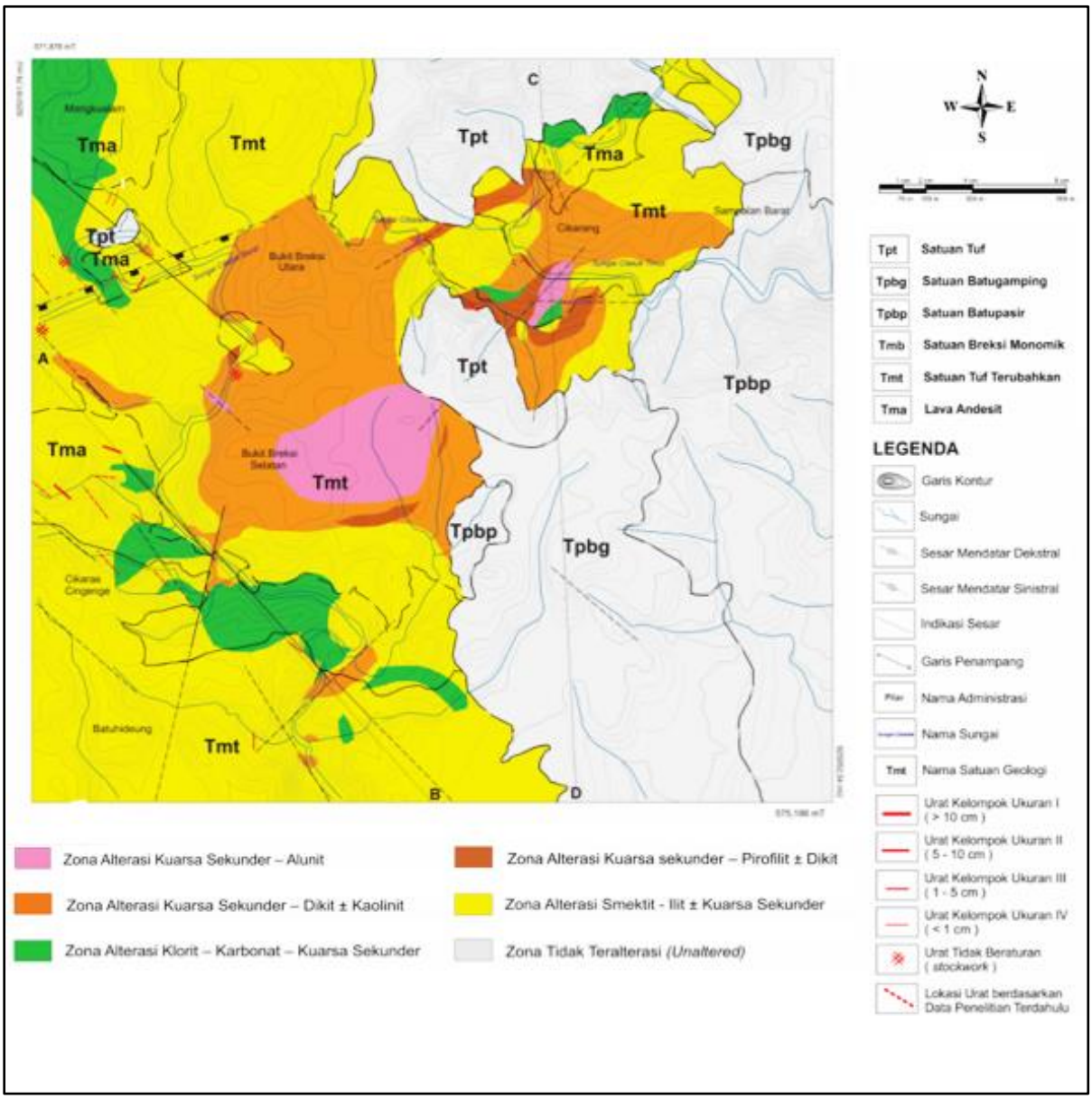

Figure 1. Alteration zonation in study area. Acid alteration dominant around NE part of study area.

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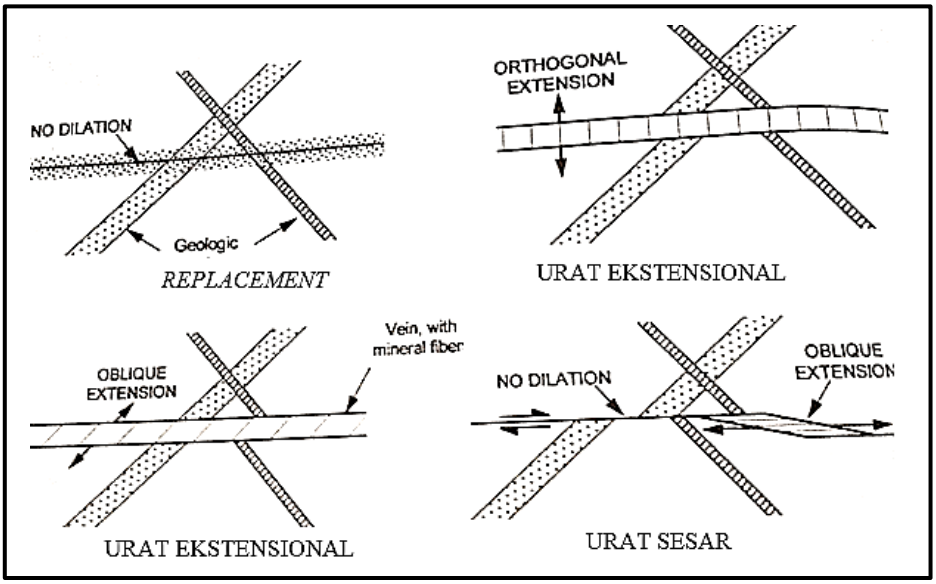
RESULT AND DISCUSSION

Alteration

Acidic to neutral-pH alterations are found in research area. Alterations mineral present are alunite, pyrophyllite, dickite, kaolinite, smectite, illite, chlorite, carbonate and secondary quartz. Alteration types are advanced argillic, argillic, and propylitic. Advanced argillic alterations are found in east to middle part of study area while the more pH-neutral alterations found in west part of study area. Higher temperature minerals like pyrrophyllite found localized in several places near geological structure indications.



Picture 2. Type of veins by their relationship to geological structures. Extensional veins formed from fracture filling of extension fractures and fault veins formed by dilation of faults (Hodgson, 1989; Robert and Poulsen, 2001).

Mineralization Trend

Mineralized rock in study area occurred as veins and replacement zones. Veins here used strictly to fissure fill vein, with definition fractures that filled with minerals. Meanwhile, replacement zones are zones in which partial or total rock mass had been replaced with alteration minerals. Veins found in study area are quartz and silica veins. Quartz veins have several textures which are massive, lattice bladed, comb, colloform and drusy. Silica (silicified) veins all have massive texture.

Mineralization also occurs as replacement zones in which the distribution limited to geological structures such as brecciated rock or fault plane. Mineralization of this type consist of vuggy quartz and silica-pyrite replacement. Vuggy quartz rarely found as an outcrop, mostly already become rock floats distributed throughout study area. Most vuggy quartz ore bodies is presumed to be already eroded.

The veins have two dominant trends which are NW-SE and N-S. Meanwhile replacement mineralization type dominant orientation is NE-SW. It is assumed due to different timing of structural geology and hydrothermal fluids that accompanied the structure. Most veins in study area formed associated with argillic and propylitic alteration, whereas replacement mineralization type associated with advanced argillic alteration.

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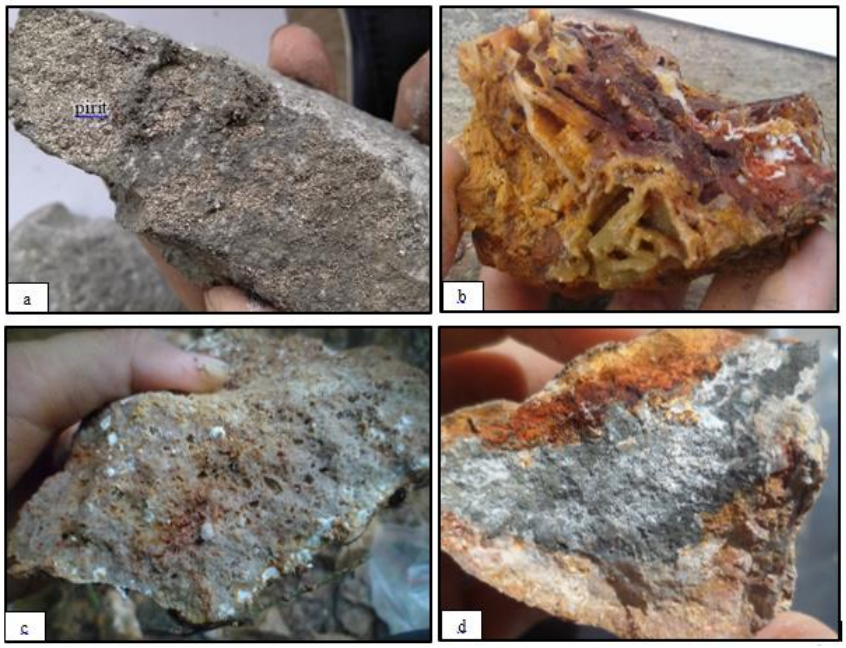

Picture 3. Mineralization occurrences in study area. (a) Silica-pyrite replacement zone sample from MW046, located in Cibadak River. (b) Example of quartz vein with lattice bladed texture, sample from MW066 located in Cikarae-Cingenge area. (c) Vuggy quartz sample from MW002 in East Citeluk River. (d) Example of pyrites disseminated in wallrock, sample from West Citeluk River.

Based on vein and principal stress or sigma 1 (σ_1) orientation from stereographic analysis, veins in study area are divided into two groups, shear/ fault-veins and extensional veins. Though data limitations on geometry aspects of veins hinder the accuracy of this divisions, grouping based on orientation is adequate for current dataset. Observation of veins' subsurface geometries through coring might provide a great help to revise this grouping. Characteristics of shear/ fault-veins and extensional veins described further in Hodgson (1989) as well as Robert and Poulsen (2001).

NW-SE trending veins is grouped into shear-fault veins due to having similar orientation with major strike-slips fault in study area. It is assumed to be either generated through cavity filling of fault displacement or dilations from overlapping faults. Some veins of this trend also showed textural characteristic of multiple fluid pulses, for example quartz lattice bladed texture where quartz from supposedly latter fluid replaced lattice bladed texture commonly formed by carbonate. It is indicating that the faults might be active in veins deposition, providing multiple crack and seal mechanism of vein cavity.

Veins that having dominant N-S trend is grouped into extension veins. It is parallel with the orientation of major stress (σ_1) of study area. Veins of this group have massive texture and mostly found in northwest part of study area. Their generation is assumed due to the opening of extension fractures caused by normal fault that formed later after major strike slip fault.

Both NW-SE and N-S trending veins in study area have high dipping or almost vertical. It is similar with veins in Cibaliung mining area where the veins mostly subvertical. It is perhaps due to strike-slip fault plane and extension fractures generated by normal faults theoritically are mostly almost vertical.

The replacement mineralization commonly trending NE-SW. It is parallel to NE-SW geological structures indication that also associated with advanced argillic alteration. The NE-SW faults are assumed to form later after NW-SE trending fault.

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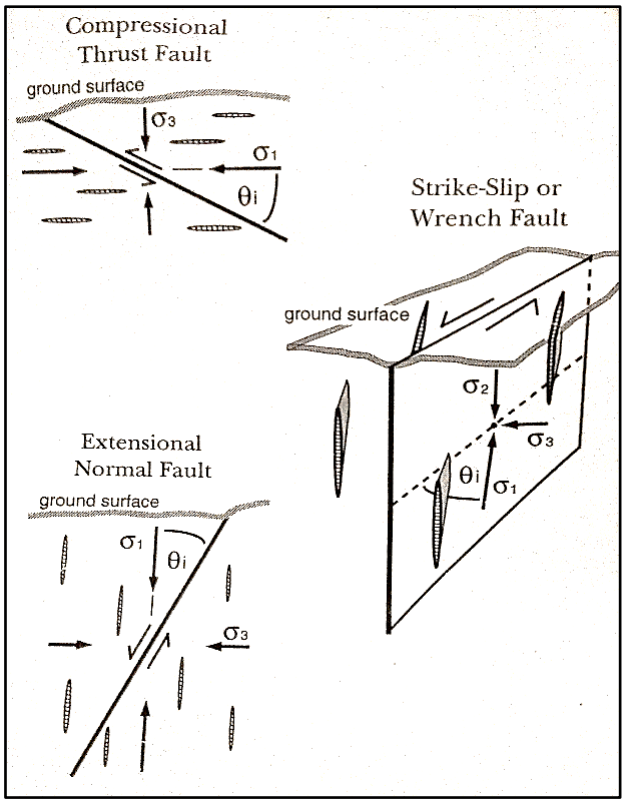
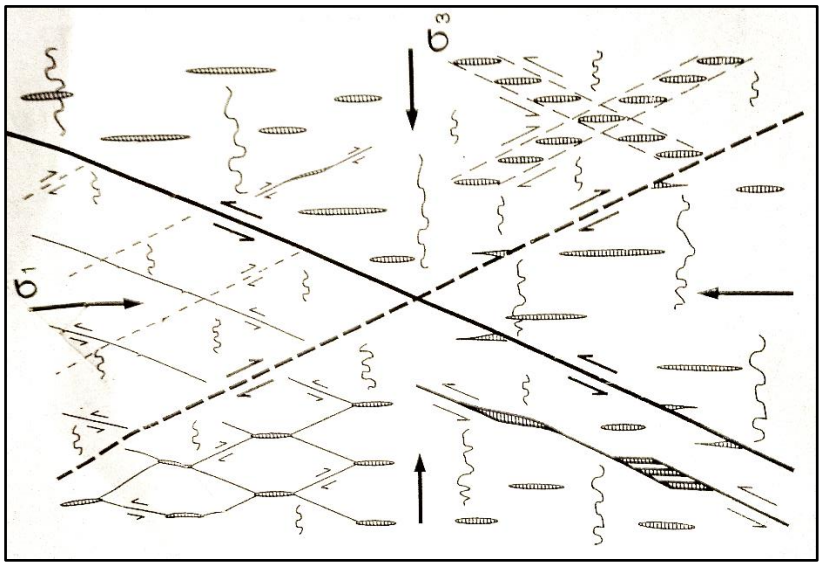


Picture 4. Various fault type and extensional vein orientation, based on Andersonian concept (Sibson, 2001)



Picture 5. Orientation of stylolite, extensional veins, and fault veins related to the triaxial stress field. Fault veins showed can be formed by various mechanisms (Sibson, 2001).

Ore Distribution in Wallrock

Ore minerals also present disseminated in altered wallrock with various amount of percentages. Krigging interpolation was done to disseminated ore percentages in wallrock to find its distribution in study area. It is found that ore minerals distribution in wallrock showed certain trend and pattern. In study area ore disseminations are found near structural geology indications. Higher percentage of ore mostly located around intersections of NW-SE and NE-SW geological structures. This also apply to area with strong to total oxidation in study area. High percentage of disseminated ore also showed NW-SE trend.

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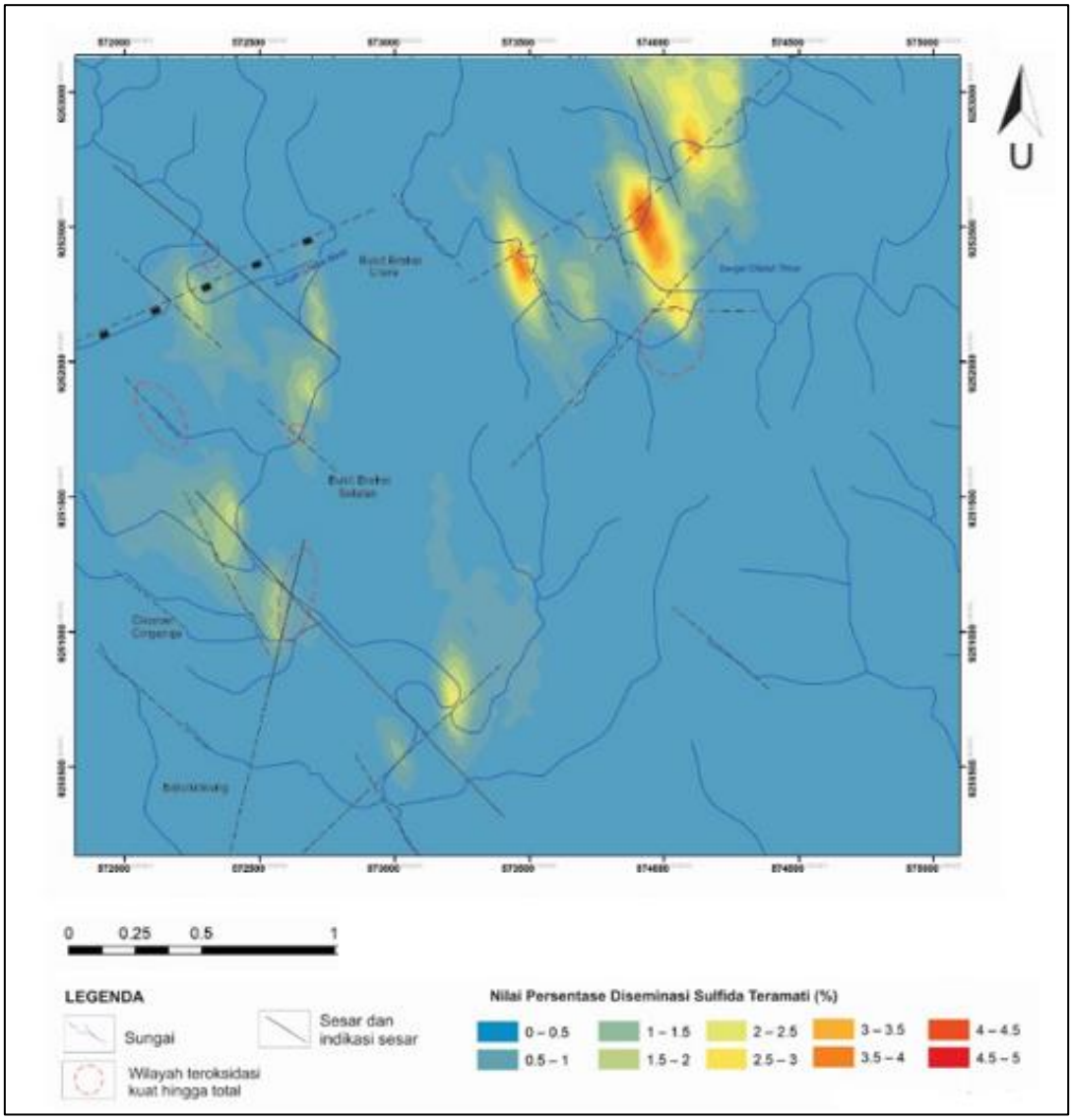
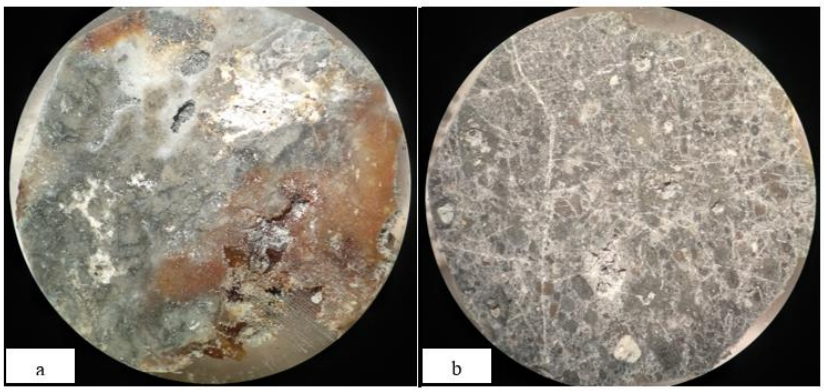


Picture 6. Distribution of sulphide percentages dissemination in wallrock. High percentage showing NW-SE trend.



Picture 7. Photo of textural observation with binocular microscope in 20x magnification. Both samples showed brecciation followed by crosscutting veinlets filled with ore minerals. (a) Lattice bladed vein sample from Cikarae-Cingenge. (b) Sample of one of replacement zone in East Citeluk River.

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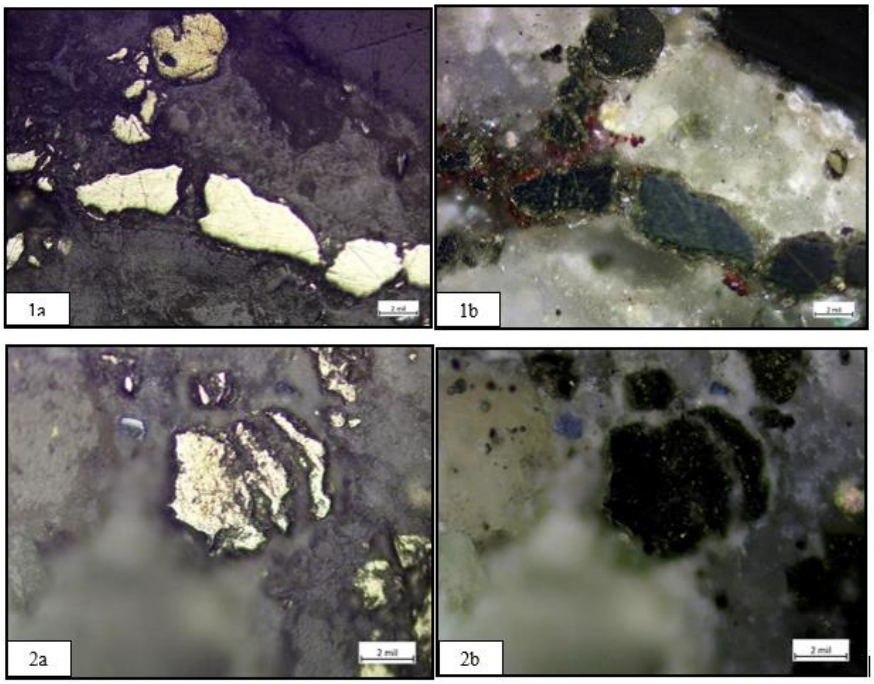

Picture 8. Ore microscopy with refracted light microscope. (1a, 1b) Pyrite and chalcopyrite veinlet in sample MW146 from East Citeluk River. Pyrite is light yellow and chalcopyrite brassy yellow. (2a, 2b) Minor chalcocite (bluish grey) occurs very minor compared to pyrite (light yellow). Sample from lattice bladed vein in Cikarae-Cingenge.

Ore Microscopy

Microscopic observation was done on binocular microscope and reflected light microscope to observe gangue and ore minerals as well as their texture. Observation was done to massive veins, lattice bladed vein, vuggy quartz and silica-pyrite replacement zone. Based on observation, mineralization in study area have some similar characteristics.

The gangue minerals in mineralization are quartz and clay. Massive veins and vuggy quartz mostly composed of very fine grained quartz, while well-formed, crystalline quartz only found in vein with lattice bladed texture. The quartz is dotted with spots of white clay mineral. Lattice bladed vein and sample from silica-pyrite replacement zones showed brecciated texture. Sulphides occurred disseminated in quartz and inside veinlets crosscutting both massive and brecciated texture. Spots of hematite oxidation also found in most samples.

Based on ore microscopy observation ore minerals present in the samples are pyrite, chalcopyrite, galena, and chalcocite. The pyrite is pale yellow, subhedral to euhedral, cubic shaped, isotropic and not having internal reflection. Chalcopyrite is brassy yellow with weak bireflectance, anisotropic, and anhedral. Some chalcopyrite have bluish tint because being tarnished. Galena is greyish white, anhedral, isotropic and lack internal reflection. Triangular pit commonly characterized galena not present in samples. Chalcocite is bluish grey, anhedral, with weak yellowish bireflectance and bluish green anisotropy. Chalcopyrite, galena and chalcocite formed after pyrite.

Pyrite and chalcopyrite are the dominant ore minerals. Galena and chalcocite are very minor compared to pyrite and chalcopyrite, they occurred only as very small spots disseminated between gangue minerals. Chalcocite is assumed to form from supergene process because the samples were collected from the surface, thus susceptible to weathering and reactions with meteoric water.

CONCLUSION

Mineralization occurred in the field as veins, vuggy quartz and silica-pyrite replacement zones. The veins have various texture and mostly have NW-SE trend. Vuggy quartz and silica-pyrite replacement zones dominantly NE-SW oriented and found in narrow area restricted to core zone of geological structures. Distribution of disseminated ore percentages showed NW-SE trend and enrichment in intersections of NW-SE and NE-

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SW faults. Microscopic textural observation showed the rocks are brecciated and crosccutted with ore bearing veinlets. Ore minerals present are pyrite and chalcopyrite with minor galena and chalcocite. Based on mineralization characteristics it is indicating that mineralization is strongly influenced by geological structures.

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