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Gold Mineralization in Paningkaban Areas Gumelar Sub-District, Banyumas Regency, Central Java

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Abstract: Hydrothermal alterations formed in the research area are carefully grouped into three types of alteration zoning and they are argillic alteration, propylitic alteration and sub-propylitic alteration. The mineralization then is carefully classified as pyrite (FeS_2), chalcopyrite ($CuFeS_2$), galena (Pbs), bornite (Cu_5FeS_4). In the research area, the mineralization process is controlled by geological structure such as fault and joint. The appearance of the mineralization is abundant and can be found many fulfilling the joint zone mainly shear joint trending Northeast-Southwest and Northwest-Southeast, the direction of joint sharpness measured in the field relatively trending North-South. This study will emphasize on the measurement and detailed analysis to know more about the gold mineralization process and other minerals controlled by structures patterns. The structural control analysis can really be a good helping hand in locating the mineralized areas because basically the activity and geological structure control process are corridor for magma and the its rest compound that brings minerals, so, the methods of mineral ores exploration by structure control can be used in determining ore gold mineralized deposits precipitate on gold deposits system and other minerals on a different area.

Key words: Hydrothermal, alteration, structure, mineralization, deposits

INTRODUCTION

Patterns and models of geological structures is crucial in determining the where abouts of gold mineralization and other ore deposits at a certain area and when the patterns and models of geological structures are already known, then if gold mineralization and ore being found, it will be easier to determine its existence (Goryachev and Pirajno, 2014). This area is an example area that the gold mineralization can be found relatively well in Central Java which until today is still being explore to obtain the existence of economical gold deposits.

Gold mineral and its accompanying minerals contained or crystallized in the veins of quartz (the magma residue/late magmatic) at the fracture/joint lines both in the tension fracture and shear fractures (shear zones) as well as the fault lines (fault zones). Quartz veins structure follows the pattern of fractures and faults in the research area that is trending Northwest-Southeast, Northeast-Southwest, North-South and West-East. Based on analysis regional structure, Paningkaban and its surrounding areas are a tectonic shift patterns Sumatra and Java tectonic pattern (Condon *et al*., 1996).

From the preliminary results, the geological structure and its relationship with mineralization and gold deposits in the Paningkaban area and its surrounding shows that there is an indication that the gold mineralization in quartz veins controlled by geological structure pattern. It is based on some researchers review results that the AAS analysis result on a sample of quartz veins in tension and compression fracture shows Au element (gold) is relatively high.

Generally, based on the selected structural lines in the Paningkaban area and its surroundings show that the structure pattern of the fractures and quartz veins are trending NW-SE (Northwest-Southeast), NE-SW (Northeast-Southwest), N-S (North-South) and some E-W (East-West). Furthermore, this research proposal will continue the study measurement and detailed analysis in the alignment area to obtain the certainty of any gold deposits and models that controlled by the structure patterns in such area.

MATERIALS AND METHODS

The methodology of the research is focusing in the secondary data collecting along with some previous studies results both published and unpublished. The primary data begins with landsat imagery and topography maps analysis, then followed by surface mapping

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(surface) with data collecting such as geology, outcrop observation, geomorphology, geological structures (faults, fractures and folds), alteration mineralization areas, quartz veins as well as taking rock samples for further analysis.

The equipments used in this research are geological compass, geological hammer, GPS, loupe and others. Mapping stages include; secondary data study in this designated area, morphology and topography observation, position measurement and rock samples collecting and also infrastructures and roads observation. Data processing stage has been carried out by the track and geological observation location map, geological map, geomorphology map, hydrology pattern map, alteration mineralization track map and alteration mineralization zoning map making. In the end all maps, analysis and interpretations are being combined together into the final report.

Geology: Based on the Majenang geological map sheets (Kastowo, 1975), geological structures are found in the form of fault, fold, straight alignment and fracture, involving Oligo-Miocene aged rocks up Holocene epoch. Faults are generally trending Northwest-Southeast to the Northeast-Southwest. The type of faults are thrust fault, normal fault and shear fault both sinistral and dextral and also involves rock aged Oligo-Miocene to Pleistocene, thrust fault is generally forming an arc showing slope variation of the fault plane to South until West direction whereas normal faults can be found scattered in local area. The pattern of folds are trending Northwest-Southeast with a slipped axis. The alignment that allegedly supposed to be fault section have a pattern spread such as fault patterns and generally trending Northeast-Southwest with few Northeast-Southwest which in some place they were intersect. The fractures are generally found and well-developed on tertiary and pleistocene rocks.

Tectonics in this area is at least having two periods which results in a different structure. The first structure occurs in middle miocene and produce thrust feature followed by the intrusion of andesite and basalt. Formation Jampang, Pemali, Rambatan, Lawak and Kalipucang limestone are folded and faulted especially forming normal faults trending Northwest-Southeast and Northeast-Southwest. The second period took place on Plio-Pleistocene epoch, produces strike slip fault and a thrust fault trending Northwest-Southeast and Northeast-Southwest. The Plio-Pleistocene tectonics period faults are formed generally in the boulder faults forms. Geophysical data shows that this latter tectonic activity is intensified back some normal faults (Asikin *et al*., 1992).

The geomorphology of research area is dominated by sloped hills that steep and relatively trending Northeast-Southwest and Northwest-Southeast with the erosion level about weak until strong. In general, the landscape is controlled by lithology, geological structure and processes of erosion factors. Classification then this research area can be divided into 4 original form units (volcanic, structural, karst, fluvial) and 10 units of land forms, namely volcanic hills landform unit, volcanic plateau landform unit, intrusion hill landform unit, Anticlinal Hill landform unit, Sinklinal valley landform unit, sloped Sinklinal Valley landform unit, Faulted Valley landform unit, Monoclinal hills landform unit, Eroded and sloped karst landform unit and Alluvial plain landform unit.

Based on data collection in the form of initial interpretation, previous research data, field data and laboratory analysis, the column stratigraphy of research area is being generated by the sequence of lithologies following the age from old until recent time. Basic naming technique on each lithology on the research area refers to Indonesian Stratigraphy Cipher (SSI) at 1996 by naming the unofficial unit based on the characteristics of the dominant lithology.

Based on the result of field data collection and analysis which has been carried out in the laboratory, stratigraphy study area was divided into 6 unofficial lithostratigraphy units and 2 litodem with the sequence of an old rock to young as follows: Halang volcanic breccia unit (TMB), Halang sandstone unit (TMBP), Kumbang andesite lava unit (TMA) andesite intrusion (TMI), Tapak volcanic breccia unit (TPB), Tapak sandstone unit (TPBP), Tapak limestone unit (TPBG) and Alluvial (Qa).

Alteration and mineralization: Alteration and mineralization process is an altering process in a rock on its chemical, physical and others as a result of a process with hot solution media influence. In this case, the rock which is have been influenced or changed known as wallrock. While the process that happen on the wallrock known as wallrock alteration process which is a chemical process that changes the original rock by hot flowing solution medium. After all, the most important aspects in the rock alteration and mineralization is the presence of fractures in the rock (channelway) which can be the path to discharge the hot solution to the surface and consequently, interact with the wallrock and the result is some new mineral deposits. The association of these new minerals is usually known as a type of alteration.

Rock lithology conditions in the research area are also included in the category in experiencing the process of alteration and minerallization, making the study area was being divided into three zones of alteration, namely:

argillic zoning, propylitic zoning and sub-propylitic zoning. This determination is based on the megascopic observation in the field using the helping tools such as loop and mineralography (poles). The alteration zones temperature range in the research area refer to the range of temperature and pH.

Argillic alteration: This alteration zones occupy ±10% from the total of the research area and the relatively located at western part of the research area. This alteration zoning spread relatively trending Southeast-Northwest. This zoning is generally giving some impression of the grayish white to dark gray, milky until cream and sometimes slightly reddish color. Possess hard-soft characteristic, sticky and fatty streak felt on the hand skin. This alteration is generally found in the Halang sandstone unit that cannot being identified the original form caused by the alteration and there is no trace of primary mineral in the wallrock body. This assumes that this type of alteration relatively change the rock with medium-strong intensity. This alteration type is also found in several places in conjunction with the quartz vein along with the sulfide minerals in a form of pyrite and chalcopyrite.

Megascopically on the field, the set of alteration minerals seen in outcrop location of this type of alteration in the research area is dominated by a set of clay minerals which can be seen and felt through its texture, color and streak. The alteration minerals contained in these alteration zones include: kaolinite, illite, quartz and chlorite. In addition, the presence of sulfide minerals are relatively occurring in this zone is in the form of pyrite and others. The observation point location of this type of alteration in the research area (Fig. 1).

Propylitic alteration: This alteration zones occupy ±9% from the total of the research area and the relatively located at western part of the research area. This alteration zoning spread relatively trending Southeast-Northwest and in the outside of former argillic alteration zone. This zoning is generally giving some impression of strong greenish white gray to green to blackish brown color. Possess hard-soft characteristic. This alteration is generally found in the Halang sandstone unit that cannot being identified the original form caused by the alteration and there is no trace of primary mineral in the wallrock body. This assumes that this type of alteration relatively change the rock with medium-strong intensity. This alteration type is also found in several places in conjunction with the quartz vein along with the sulfide minerals in a form of pyrite, chalcopyrite, galena and this alteration semilar with at Tindikala-Boton area (Gouet *et al*., 2013).

Fig.1: a) The appearance of argillic alteration type outcrops on the location of the observations 9 (Coordinates: X: 278,872, Y: 9,179,848, elevation 160 m); b) the appearance of a collection of dominance clay minera; c) quartz veins containing sulfide minerals such as pyrite and d) quartz veins embedded in the body of rock that dominated by clay minerals. Direction of the image; outcrop N 160°E, parameter N 141°E

Megascopically on the field, the set of alteration minerals seen in outcrop location of this type of alteration in the research area is dominated by a set of minerals chlorite, calcite, kaolin, illite, quartz and clay-sized minerals which can be seen and felt through its texture, color and streak. In addition, the presence of sulfide minerals are relatively occurring in this zone is in the form of pyrite and others. The observation point location of this type of alteration in the research area (Fig. 2).

Sub-propylitic alteration: This alteration zones occupy ±16% from the total of the research area and the relatively located at Western part of the research area. This alteration zoning spread relatively trending Southeast-Northwest and in the outside of former propylitic alteration zone. This zoning is generally giving some impression of greenish gray, gray to light green and brownish color possess hard characteristic. This alteration is generally found in the Halang sandstone unit and can be identified its original. This assumes that this type of alteration relatively change the rock with weak intensity. This alteration type is also found in several places in conjunction with the quartz vein along with the calcite veins.

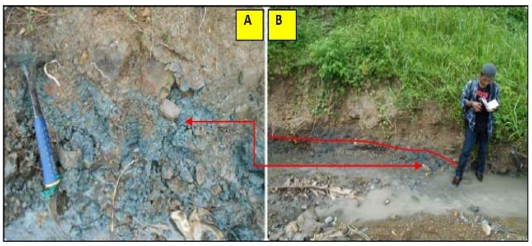

Fig. 2: a) The appearance of propylitic alteration type outcrops in the location of the observation 20 (Coordinates: X: 280,074, Y: 9,180,125, elevation 153 m); b) the appearance of a collection of dark green chlorite minerals dominance, kaolin, quartz and the montmorillonite mineral. Direction of the image; outcrop N 284°E, parameter N 254°E

Fig. 3: a) The appearance of sub-propylitic alteration type outcrops on the location of the observation 13 (Coordinates: X: 279,666, Y: 9,180,616, elevation 148 m); b) the appearance of sulfide minerals pyrite in quartz veins (quartz veins) and wallrock which has been altered and shows the chlorite minerals. Direction of the image; outcrop N 290°E, parameter N 315°E

Megascopically on the field, the set of alteration minerals seen in outcrop location of this type of alteration in the research area is dominated by aset of minerals chlorite, kaolin, calcite, quart and clay-sized minerals (clay) which can be seen and felt through its texture, color and streak. In addition, the presence of sulfide minerals are relatively occurring in this zone is in the form of pyrite (Fig. 3).

Mineralization in the research areas: Mineralization found in the research area is relatively associated to quartz veins (veins or veinlets) in the Halang sandstone unit as well as on the intrusion body in the study area. Ore mineralization contained in research area such as sulfide minerals such as: pyrite (FeS_2), chalcopyrite ($CuFeS_2$), galena (Pbs) and bornite ($Cu_5 FeS_4$) (Fig. 4).

Fig. 4: The photograph of sample collection in the research area, Paningkaban village, Gumelar District, Banyumas Regency, Central Java

RESULTS AND DISCUSSION

Structural geology results and analysis: Geological structures analysis is carried out in the megascopic and mesoscopic scale. Both analyses have an important role in the understanding and analysis of geological structures in all the research area (Davis and Hippertt, 1998).

Macroscopic analysis performed by interpreting the straightness alignment in the SRTM topographic maps images. Straightness alignment data is then processed into the program named DIPS, making the a rosette diagram showing the direction of alignment obtained from the reflection of geological structure traces direction in the research area.

The straightness alignment data obtained from the SRTM image interpretation: the general direction of the geological structure traces direction alignment in the research area which is relatively trending N 305°E (Northwest-Southeast) and N 055°E (Northeast-Southwest) that supposed to be the traces of geological structures either fault or fold axis alignment.

Results of the analysis of AAS (Atomic Absorption Spectroscopy) or atomic absorption spectrophotometry is used to determine the content of sulfide mineral elements contained in a sample betuan. The analysis shows increase in sulfide mineralization which is characterized by the abundance of the elements Cu, Pb, Zn, Ag and Au, some places elements of Au increases compared with other elements, this same with Jangglengan Area.

CONCLUSION

Hydrothermal alteration which is formed in the research area is grouped into three types of alteration

zoning named argillic alteration, propylitic alteration and sub-propyllitic alteration. Mineralization found in research area is pyrite (FeS_2), chalcopyrite ($CuFeS_2$), galena (Pbs) and bornite (Cu_5FeS_4). Macroscopic structural analysis in the research area based on the direction of past geological structure traces alignment in the form of fault, fold axis lineament that relatively trending N 305°E (Northwest-Southeast).

In the research area, mineralization process is controlled by geological structures such as faults and fractures. An area where many abundant mineralizations found is fractures area especially shear fracture that generally trending Northeast-Southwest and Northwest-Southeast with the direction of fractures sharpness is measured relatively trending North-South. Alteration and mineralization found in the surrounding Sadahayu village as well as in the Paningkaban village. Areas with lithological interaction between igneous and breccia deposits potentially have a feature as a gold carrier deposit.

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