# Alteration and Gold Mineralization Paningkaban

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# ALTERATION AND GOLD MINERALIZATION PANINGKABAN AREAS GUMELAR SUB-DISTRICT, BANYUMAS REGENCY, CENTRAL JAVA PROVINCE

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***ABSTRACT***

*The research location is located in Paningkaban area and its surrounding areas that included in the area of Gumelar Subdistrict, Banyumas Regency, and Central Java Province. The objective of the research was to show the presence of any structural geology control on research area that affect the distribution patterns of quartz vein and gold/ore mineralization.*

*The methodology in this research begins with data collecting process, which this preliminary data is then being compiled to determine the next phase of the study. This study covers the geomorphology, stratigraphy, any structural and alteration mineralization observation. The geomorphology of the study area composed of the four original forms: volcanic, structural, karsts and fluvial form. The stratigraphy composed of seven unclassified litho units and two litodem, namely (from old - young): Halang volcanic breccias unit, Halang sandstone unit, Kumbang andesite lava unit, Tapak volcanic breccias unit, Tapak sandstones, unit Tapak limestone unit, alluvial deposits, and andesite intrusion.*

*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 ($Cu_5FeS_4$). The macroscopic analysis of the structure in the study area based on the alignment of alleged traces of the geological structure in the form of fault, or directions of the fold axis alignment, obtained the general alignment directions trending N 305° E (NW - SE), and N 055° E (N.E - SW).*

*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.*

*Keywords: lithostratigraphy, structure, zone of opening, zone of alteration, mineralization, metal minerals*

## INTRODUCTION

Patterns and models of geological structures is crucial in determining the whereabouts 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. 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 area are a tectonic shift patterns Sumatra and Java tectonic pattern (Pulunggono & Soejono., 1989).

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 area Paningkaban 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.

Figure 1. Research area located on the Paningkaban village and its surrounding area, Banyumas Regency, Central Java

## RESEARCH METHODOLOGY

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 (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 earried out by the track and geological observation location map, geological map, geomorphology map, hydrology pattem 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.

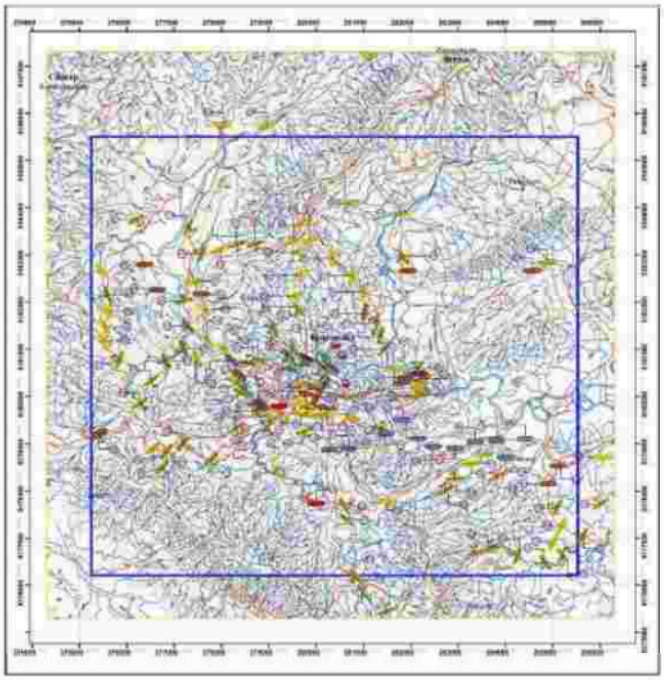


Figure 2. Tracks Map and Geological Location Observation in the research area, obtained various kinds of lithology, such as sandstones, breccias, limestones, and the imtrusion of andesite

## GEOLOGY

### Regional Tectonic Setting

Based on the Majenang Geological Map sheets (Kastowo and N. Suwarna., 1996), 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. Simanjuntak (1979) explains that 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 (Wiriosudarmo, 1979).

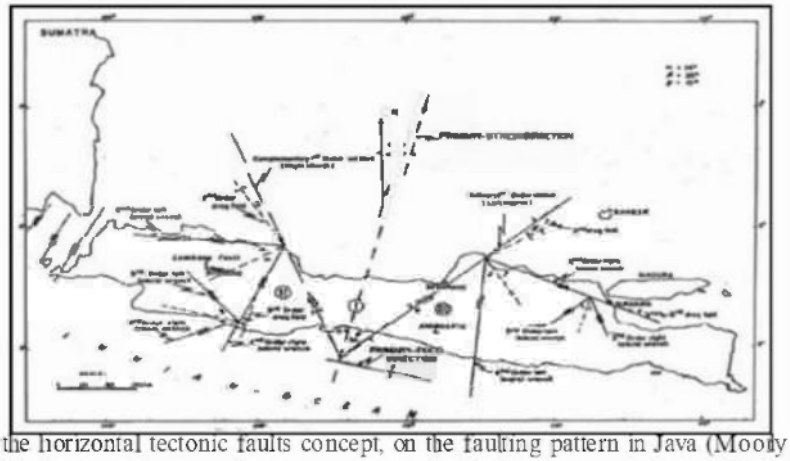



Figure 3. Application of the horizontal tectonic faults concept, on the faulting pattern in Java (Mooty and Hill, 1956 in Situmorang et al, 1976)

**The Geomorphology of Research Areas**

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. Based on that factors by using Van Zuidam (1983) classification then this research area can be divided into 4 original form units (volcanic, structural, karst, fluvial), and 10 units of land forms, namely:

1. Volcanic hills landform unit
2. Volcanic plateau landform unit
3. Intrusion hill landform unit
4. Anticlinal hill landform unit
5. Sinklinal valley landform unit
6. Sloped sinklinal valley landform unit
7. Faulted Valley landform unit
8. Monoclinal hills landform unit
9. Eroded and sloped karst landform unit
10. Alluvial Plain landform unit

**Regional Geology of Research Area**

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 (Figure 4). 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:

1. Halang volcanic breccia unit
2. Halang sandstone unit
3. Kumbang andesite lava unit
4. Andesite intrusion
5. Tapak volcanic breccia unit
6. Tapak sandstone unit
7. Tapak limestone unit
8. Alluvial

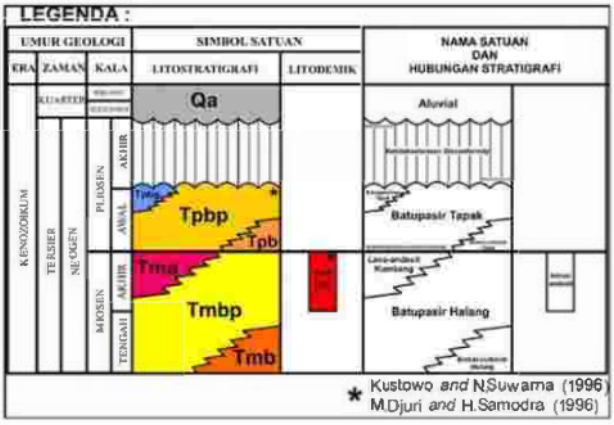



Figure 4. Paningkaban Area Regional stratigraphic column, Gumelar District, Banyumas Regency, Central Java Province

**1. Halang volcanic breccia unit (Tmb)**

This unit occupy ± 5% from the total of the research area and the relatively located at

northeast section of the research area. This unit is dominated by the kind of polimict breccia, but in some places encountered some monomict states. Characteristic of this lithology unit based on the field observation has the characteristics of fresh color: dark gray, weathered: dark brown, structure: massive, texture: the grain size: pebble-cobble (64 -> 256mm), sorting degree: bad, roundness degree: angular, fabric: open, with the mineral composition: fragments: andesite, clay, matrix: coarse sand - gravel, cement: silica. In field appearance, this unit has not experienced any alteration yet. This unit aged range from the early Middle Miocene - final Middle Miocene (M. Djuri and H. Samodra., 1996 in geology Purwokerto sheet map scale 1: 100,000), with the deposition environment is in the shallow sea and has a different stratigraphic facies relationship interconnected to Halang sandstones unit.

**2. Halang sandstone unit (Tmbp)**

This unit occupy ± 40% from the total of the research area and the relatively located at anywhere of the research area. This unit is dominated by the silliciclastic sandstone and carbonate. Characteristic of this lithology unit based on the field observation has the characteristics of fresh color: gray, weathered: brownish gray, structure: bedding and massive, texture: the grain size: clay-gravel (> 256 - 4mm), sorting degree: well sorted: roundness degree: rounded: fabric: closed, with mineral composition: fragments: quartz, hornblend, matrix: clay-fine sand, cement: silica and carbonate. In field appearance, this unit has been experienced any alteration with low-high intensity. This unit aged range from the early Late Miocene - final Late Miocene (Kustowo and N. Suwarna., 1996 in Majenang geological map sheet scale 1: 100,000), with the deposition environment is in the shallow sea and has a different stratigraphic facies relationship interconnected to Halang sandstones unit.

**3. Kumbang Andesite lava unit (Tma)**

This unit occupy ± 12% from the total of the research area and the relatively located at southwest of the research area. This unit is dominated by the andesite lava lithology type (Kustowo and N. Suwana., 1996) and also volcanic breccias. Characteristic of this lithology unit based on the field observation has the characteristics of fresh color: gray, weathered: brownish gray; structure: massive; texture: crystallization degree: hypocrystalline; granularity degree: fine to medium phaneric; crystal shape: euhedral; relationships: inquigranular; the mineral composition: plagioclase, hornblend, quartz, pyroxene, and K-feldspar. In field appearance, this unit has not experienced any alteration. This unit aged range from the Middle Miocene - final Late Miocene (Kustowo and N. Suwarna., 1996 in Majenang geological map sheet scale 1: 100,000), with the deposition environment is in the shallow sea and has a different stratigraphic facies relationship interconnected to Halang sandstones unit and related nonconformity to the Tapak sandstone unit.

**4. Andesite intrusion (ıni *an*)**

This intrusion occupy ± 3% from the total of the research area and the relatively located at the middle of the research area. This intrusion is mainly intermediate igneous rock namely andesite rocks. Characteristic of this intrusion unit based on the field observation has the characteristics of fresh color: gray; weathered: blackish brownish gray; structure: massive; texture: crystallization degree: hypocrystalline; granularity degree: fine to medium phaneric; crystal shape: euhedral; relationships: inquigranular; the mineral composition: plagioclase, hornblend, pyroxene, quartz and K-feldspar. In field appearance, this intrusion unit has been experienced any alteration with low-high intensity. This intrusion unit aged range from the early Late Miocene - final Late Miocene (M. Djuri and H. Samodra., 1996 in Purwokerto geological map sheet scale 1: 100,000).

**5. Tapak volcanic breccia unit (Tpb)**

This unit occupy ± 6% from the total of the research area and the relatively located at east and northeast section of the research area. This unit is dominated by the kind of polimict breccia, but in some places encountered some monomict states. Characteristic of this lithology unit based on the field observation has the characteristics of fresh color: dark gray; weathered: dark brown; structure; massive; texture: the grain size: gravel-pebble (4 -> 256mm); sorting degree: bad sorted; roundness degree: angular; fabric: open; with the mineral composition: fragments; andesit, basalt, clay; matrix: coarse sand-gravel; cement: silica. In field appearance, this unit has not

experienced any alteration yet. This unit aged range from the early Early Pliocene - early Middle Pliocene (M. Djuri and H. Samodra., 1996 in geology Purwokerto sheet map scale 1: 100,000), with the deposition environment is in the shallow sea and has a different stratigraphic facies relationship interconnected to Tapak sandstones unit and Halang sandstone unit with good conformity relationship.

**6. Tapak sandstone unit (Tpbp)**

This unit occupy ± 19% from the total of the research area and the relatively located at east and southwest part of the research area. This unit is dominated by the silliciclastic sandstone and carbonate. Characteristic of this lithology unit based on the field observation has the characteristics of fresh color: grayish green; weathered: brownish gray; structure: bedding and massive' texture: the grain size: coarse sand-pebble (1 - 4mm); sorting degree: bad sorted; roundness degree: subrounded-rounded; fabric: open; with mineral composition: fragments: andesite, quartz, clay; matrix: medium-fine sand; cement: silica and carbonate. In field appearance, this unit has not experienced any alteration yet. This unit aged range from the early Early Pliocene - final Early Pliocene (M. Djuri and H. Samodra., 1996 in Purwokerto geological map sheet scale 1: 100,000), with the deposition environment is in the shallow sea and has different stratigraphic facies relationship interconnected to Halang volcanic breccia unit (bottom) and Tapak limestone unit (top), and the older unit (Halang form.), directly conform with Halang sandstone unit, but not conform (nonconformity) to Kumbang andesitic lava unit.

**7. Tapak limestone unit (Tpbg)**

This unit occupy ± 10% from the total of the research area and the relatively located at eastern part of the research area. This unit is dominated by the limestone and reef limestone. Characteristic of this lithology unit based on the field observation has the characteristics of fresh color: gray; weathered: gray-brown to brown; structure: massive; texture: the grain size: arenit (0.5-1mm); sorting degree: well-sorted; roundness degree: rounded; fabric: closed; with mineral composition; allochem; bioclast, micrite; sparite: mud clay. In field appearance, this unit has been experienced any alteration. This unit aged range from the middle Early Pliocene - final Early Pliocene (M. Djuri and H. Samodra., 1996 in Purwokerto geological map sheet scale 1: 100,000), with the deposition environment is in the shallow sea and has a different stratigraphic facies relationship interconnected to Tapak sandstones unit and disconform with the alluvial plain above it.

**8. Alluvial Plain (Qa)**

This unit occupy ± 5% from the total of the research area and the relatively located at southeast of the research area. This unit is dominated by the deposits that mainly composed of loose materials derived from rock weathering process and yet consolidated. This deposit sized clay to boulder.

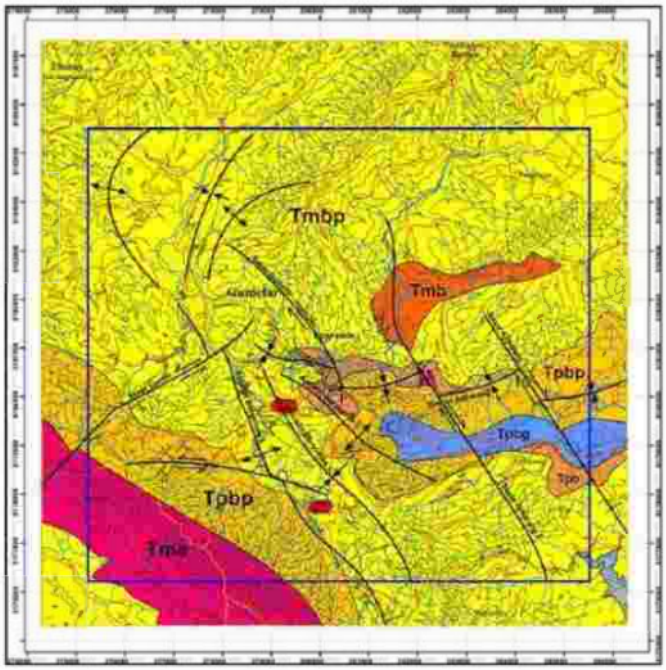



Figure 5. Paningkaban Area Geological Map, Gumelar District, Banyumas Regency, Central Java Province

## 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 minreallization 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 according according to Corbett and Leach (1998).

**Alteration Research Areas**

**1. 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, stick y 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, namely: LP 5, 9, 26, 50, 54, 56, 57, 58, 59, 61, 65, 66, 67, 89, 90, 150, 151, 157, and 158.

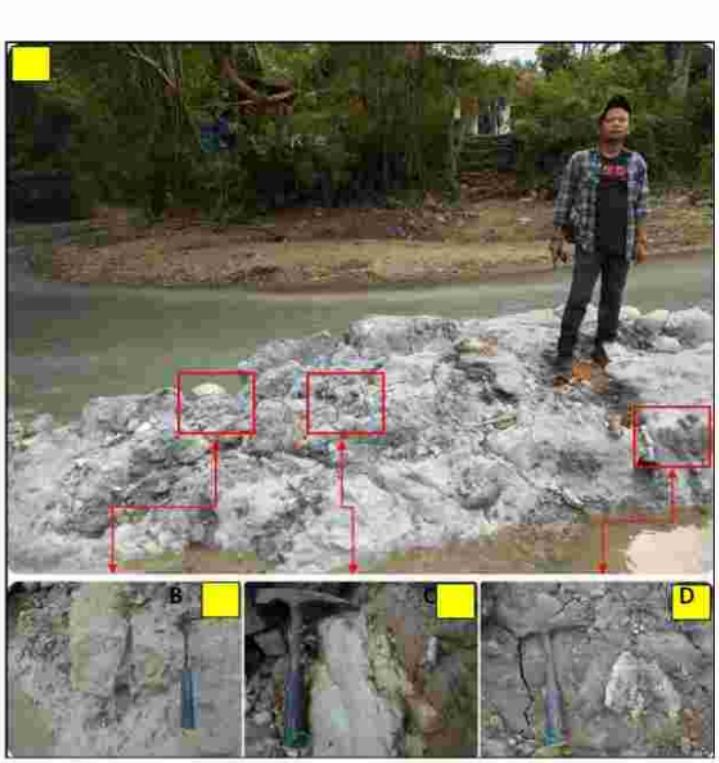



Figure 6. (a) The appearance of argillic alteration type outcrops on the location of the observations 9 (Coordinates: X: 278,872, Y: 9,179,848, elevation 160 m), (b) the appearance of a collection of dominance clay mineral, (c) quartz veins containing sulfide minerals such as pyrite, (d) quartz veins embedded in the body of rock that dominated by clay minerals. Direction of the image; outcrop N 160°E, parameter N 141°E.

**2. Propyllitic 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 bornite.

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, namely: LP 2, 6, 7, 19, 20, 62, 63, 70, 72, and 149.

A B

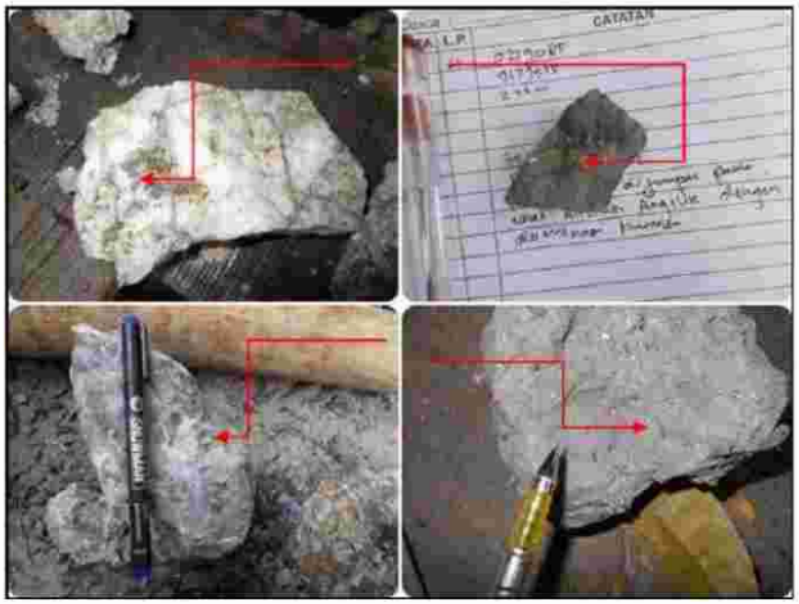
Figure 7. (a) The appearance of propylitic alteration type outcrops in the location of the observation 20 (Coordinates: X: 280,074, Y: 9,180,125, elevation 153 m), (b) the appearance of a collection of dark green chlorite minerals dominance, kaolin, quartz, and the montmorillonite mineral. Direction of the image; outcrop N 284°E, parameter N 254°E.

### 3. Sub-propyllitic 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.

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, kaolin, calcite, quartz, 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. The observation point location of this type of alteration in the research area, namely: 13, 16, 87,153,154,155, and 156

A




B

Figure 8. (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.

### 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:

1. pyrite ($FeS_2$)
2. chalcopyrite ($CuFeS_2$)
3. galena (Pbs)
4. bornite ($Cu_5FeS_4$)

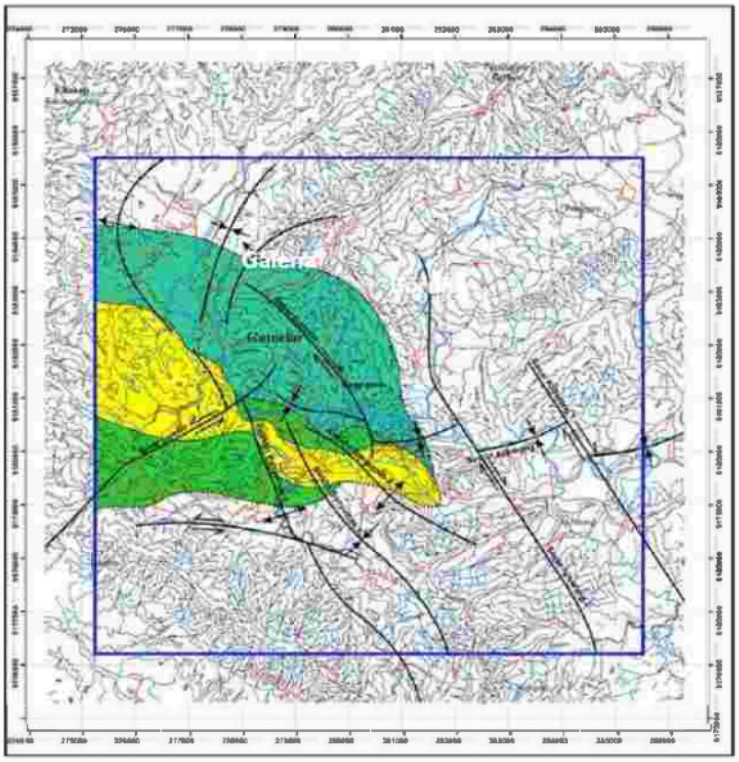


Figure 9. The photograph of sample collection in the research area, Paningkaban village, Gumelar District, Banyumas Regency, Central Java Province

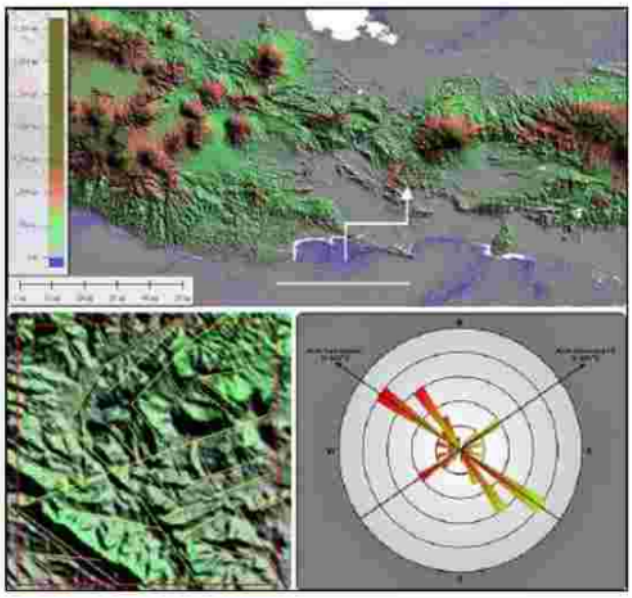


Figure 10. Alteration and mineralization zoning map, Paningkaban village, Gumelar District, Banyumas Regency, Central Java Province

## 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 the research area.

### Macroscopic Structural Analysis

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:

| GENERAL ALIGNMENT STRUCTURAL GEOLOGY INTERPRETATION (SRTM) | | |
|---|---|---|
| Alignment Direction | | |
| N.....$^0$E | N.....$^0$E | N.....$^0$E |
| 306 | 334 | 330 |
| 282 | 335 | 327 |
| 314 | 305 | 70 |
| 301 | 324 | 68 |
| 299 | 329 | 71 |
| 341 | 306 | 59 |

| | | |
|---|---|---|
| 328 | 305 | 80 |
| 320 | 32 | 226 |
| 318 | 53 | 308 |
| 308 | 306 | 96 |
| 322 | 43 | 59 |
| 288 | 55 | 355 |

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.

Figure 11. Analysis of macroscopic structure based image SRTM, Paningkaban village, Gumelar District, Banyumas Regency, Central Java Province

AAS (*Atomic Absorption Spectroscopy*) Analysis Results

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 in LP 48, LP 51 and LP 45 shows increase in sulfide mineralization which is characterized by the abundance of the elements Cu, Pb, Zn, Ag, Au da n. While the LP 24, LP 22 and LP 40, elements of Au increases compared with other elements.

Table 2. AAS results of sulfide mineral in the research area

| No. | Exp Code | Cu ppm | Pb ppm | Zn ppm | Ag ppm | Au ppb |
|---|---|---|---|---|---|---|
| 1 | LP09 | 93 | 76 | 100 | 4,4 | 131 |
| 2 | LP25 | 36 | 51 | 62 | 5,3 | 31 |
| 3 | LP43 | 44 | 58 | 59 | 6,3 | 450 |
| 4 | LP47 | 65 | 74 | 107 | 6,8 | 283 |
| 5 | LP48 | 88 | 129 | 208 | 19,1 | 824 |
| 6 | LP51 | 1215 | 2560 | 8580 | 8,6 | 3225 |
| 7 | LP45 | 118 | 999 | 4190 | 5,8 | 4440 |
| 8 | LP36 | 39 | 132 | 154 | 4,4 | 52 |
| 9 | LP29 | 9 | 162 | 254 | 5 | 558 |
| 10 | LP 24 | 49 | 225 | 675 | 7,4 | 3688 |
| 11 | LP 22 | 41 | 139 | 262 | 8,9 | 4755 |
| 12 | LP40 | 148 | 369 | 145 | 4,1 | 3055 |

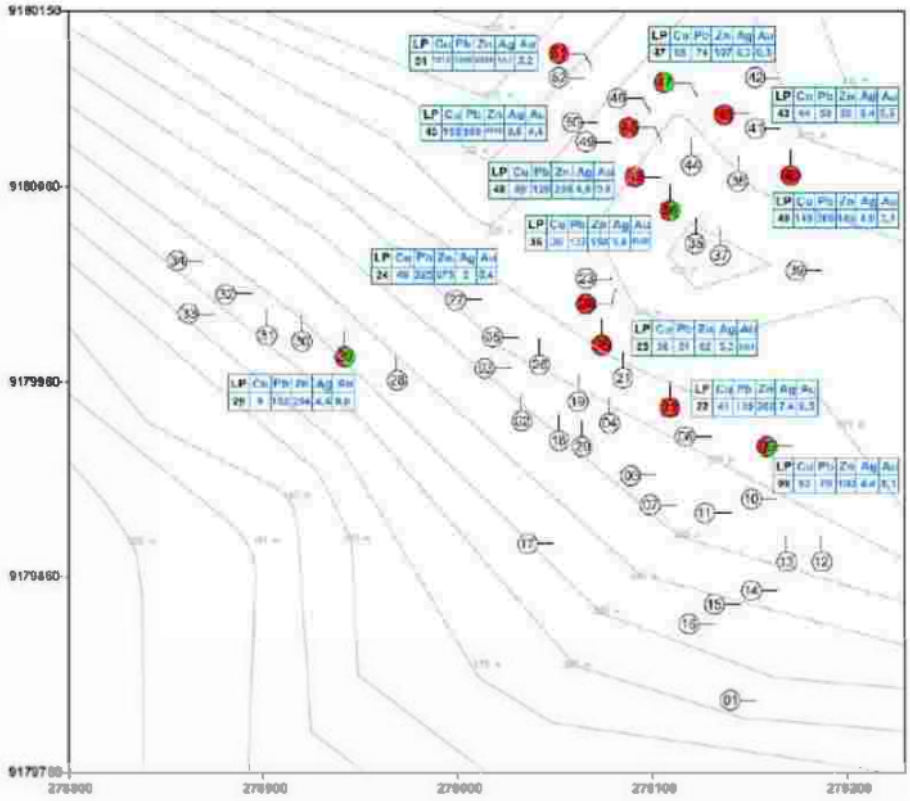



Figure 12. Location observations with AAS analysis results show the presence of sulfide mineralization which followed by elements Cu, Pb, Zn, Ag, and Au

## CONCLUSION

Based on the data and analysis in this study, it can be concluded some important things, such as:

1. The study area is located in the border of Cilacap regency, Banyumas regency and Brebes regency.

2. Geomorphology of the research area composed of four original units, they volcanic, structural, karst and fluvial. Furthermore, it's still divided into ten different units of landform, the volcanic hills (V1), volcanic plains (V2), intrusion hills (V3), anticlinal hills (S1), sinklinal valley (S2), sloped sinklinal valley (S3), faulted valley (S4), monoklinal hills (S5), sloped eroded karst (K1), and the alluvial plains (F1).

3. Stratigraphy is composed of seven unofficial lithostratigraphy units and two litodem, from old to young: Halang volcanic breccia unit (Tmb), Halang sandstone unit (Tmbp), Kumbang andesite lava unit (Tma), Tapak volcanic breccia unit (Tpb), Tapak sandstones unit (Tpbp), Tapak limestones unit (Tpbg), alluvial plains (Qa), andesite intrusion (Tmi*an*).

4. Hydrothermal alteration which is formed in the research area is grouped into three types of alteration zoning named argillic alteration, propylitic alteration, and sub-porpylitic alteration.

5. Mineralization found in research area is pyrite ($FeS_2$), chalcopyrite ($CuFeS_2$), galena (Pbs), and bornite ($Cu_5FeS_4$).

6. 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 N305°E (northwest-southeast).

7. 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.

8. 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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