GEOLOGY OF BUAHDUA AREA, SUMEDANG DISTRICT, WEST JAVA PROVINCE

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ABSTRACT

Buahdua area is located in Sumedang District, West Java Province with coordinate 107°53'52,30" E - 107°59'18,83" E and 6°44'2,15" S - 6°38'38,39" S. This research aims to identify and characterize the geology of Buahdua area and its surrounding. This research used field observation, studio, and laboratory analysis method. Digital maps used to carried out processing step in studio and field tools such as geological hammer, camera, GPS, and compass used to carried out field observation. Rock samples are taken for laboratory analysis. Based on field observation, studio, and laboratory analysis, the research area can be divided into four morphology unit namely very gentle sloping hill, gentle sloping hill, rather steep hill, and steep hill morphology unit. Also, the research area has four drainage patterns namely anastomotic, subdendritic, subparalel, and subrectangular drainage pattern. The lithostratigraphic units in the research are can be divided into three units namely claystone (Tmbl), sandstone (Tmbpl), and volcanic breccia (Kbv) unit, and alluvium (Kal). The geological structures developed in the research area are shear joint and oblique fault (Cikandung and Kamal oblique fault). Geological history of the research area was started from middle Miocene (N9) when claystone unit was deposited in deep marine environment. In middle Miocene (N9 - N10), sandstone unit was deposited in deep marine environment. After those rock unit, there was tectonic activity in Pliocene - Plistocene caused geological structures, shear joint and oblique fault. Occurences volcanic activity after tectonic activity caused volcanic breccia unit was deposited. After those process, alluvium was deposited in Cikandung River until now.

Keywords: Buahdua, Geology, Morphology, Stratigraphy, Sumedang

INTRODUCTION

Buahdua area is located in Sumedang District, West Java Province with coordinate 107°53'52,30" E - 107°59'18,83" E and 6°44'2,15" S - 6°38'38,39" S. Based on preliminary studies, this research is interesting to be investigated further because this area has varied geological information such as stratigraphy and geological structure aspect. Therefore, This research aims to identify and characterize the geology of Buahdua area and its surrounding.

Aspect of morphology, drainage pattern, stratigraphy, and geological structure will be studied in this research. Those aspects are interrelated and can reveal the geological characteristic of the research area. Additional information such as geological resources and geological hazard potential also identified.

LITERATURE STUDY

Van Bemmelen (1949) has divided West Java into five physiographic zones, namely:

1. Coastal Plain of Batavia
2. Bogor Zone
3. Bandung Zone
4. Southern Mountains
5. Bayah Mountains

Based on those physiographic, Buahdua area is located in the Bogor Zone. In general, Bogor Zone has a hilly morphology, namely an anticlinorium that is convex to the north. In the north of the Bogor Zone, folds and thrust fault occured. These folds consist of Miocene and Pliocene sedimentary rocks such as sandstone and claystone. There are also several intrusion morphologies. The Bogor Zone has experienced two times of tectonic period, namely Miocen-Pliocene period and Pliocene-Plistocene period.

Based on Regional Geology (Silitonga, 2003), stratigraphy in the research area consist of Subang Formation, Kaliwangu Formation, Older Volcanic Product, and alluvial deposit.

a. Miocene Subang Formation consists of Claystone Member (Msc) and Sandstone Member (Mss). Claystone Member consists of claystone, marly limestone, marl, and limestone whereas Sandstone Member consists of sandstone, conglomerate-sandstone, breccia, limestone-claystone.
b. Pliocene Kaliwangu Formation (Tpk) consists of tuffaceous sandstone, conglomerate, claystone, and beds of

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calcareous sandstone and limestone in places.

c. Young volcanic products consists of undifferentiated volcanic (Qyu), tuff (Qyt), and lava (Qyl).

d. Alluvium (Qa) consists of clay, silt, sand, pebble, and boulder.

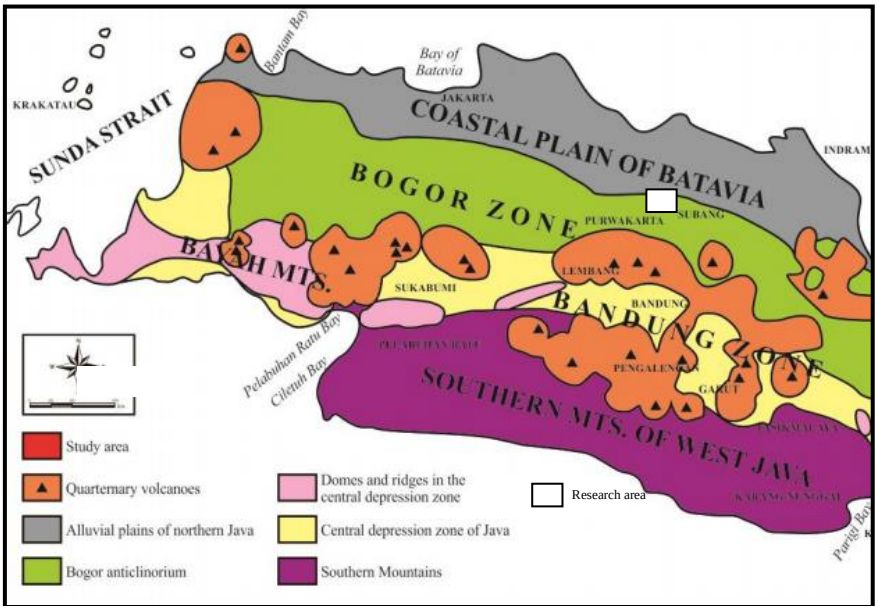

Figure 1. Physiographic map of West Java (modified from van Bemmelen, 1949)

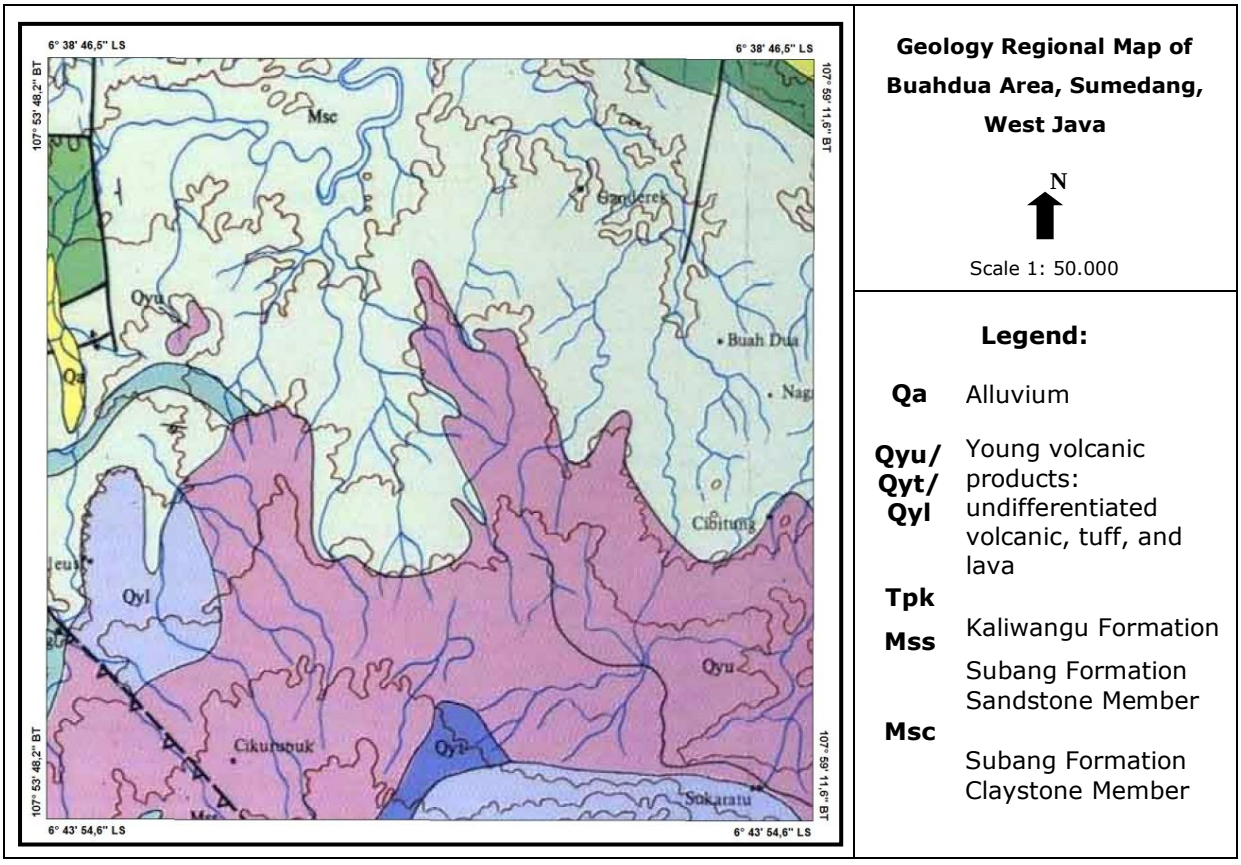

Figure 2. Regional Geology of the research area (modified from Silitonga, 2003)

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METHODS

This research activity is done by studio and laboratory analysis and also field observation. Digital maps are used to conduct initial and data processing step in studio. The research area is included in the Bakosurtanal map sheet 1209-342 Buahdua. Field tools such as geological hammper, gps, camera, compass, etc are used to conduct field observation. Research objects that will be identified and analyzed are morphology, lithology, river, and geological structure (joint, fold, fault). In general, geological setting of the research area can be determined by literature study. Field data obtained from outcrops using field equipment such as GPS, camera, compass, geological hammer, etc. Studio analysis was conducted by geologcal software such as Map Info, Global Mapper, etc.

RESULT AND DISCUSSION

Geomorphology

In general, the research area is a hilly area consisting of very gentle hills to steep hills with elevation ranging from 74-688 masl. The highest elevation in the research area (688 masl) can be found in the Pasir Nangkod, Cibitung village while the lowest elevation in the research area (74 masl) can be found in the Karangbubur village. Based on the morphology condition, the research area can be divided into four morphology unit namely very gentle sloping hill, gentle sloping hill, rather steep hill, and steep hill morphology unit. The endogenous process is identified by the faults structure in the west of the research area. Furthermore, exogenous processes are determined by erosion, and transportation of sedimen materials along the Cikandung river of the research area. A wide river like the Cikandung river shows intensive erosion process. Also, U-shaped valley in the Cikandung river shows that horizontal erosion is dominantly occur whereas the other small rivers show dominant vertical erosion. There are two main rivers in the research area namely Cikandung and Cigalagah river. Those two rivers and its tributaries develope four drainage patterns refers to Howard (1967) namely anastomotic, subparallel, subdendritic, and subrectangular drainage pattern.

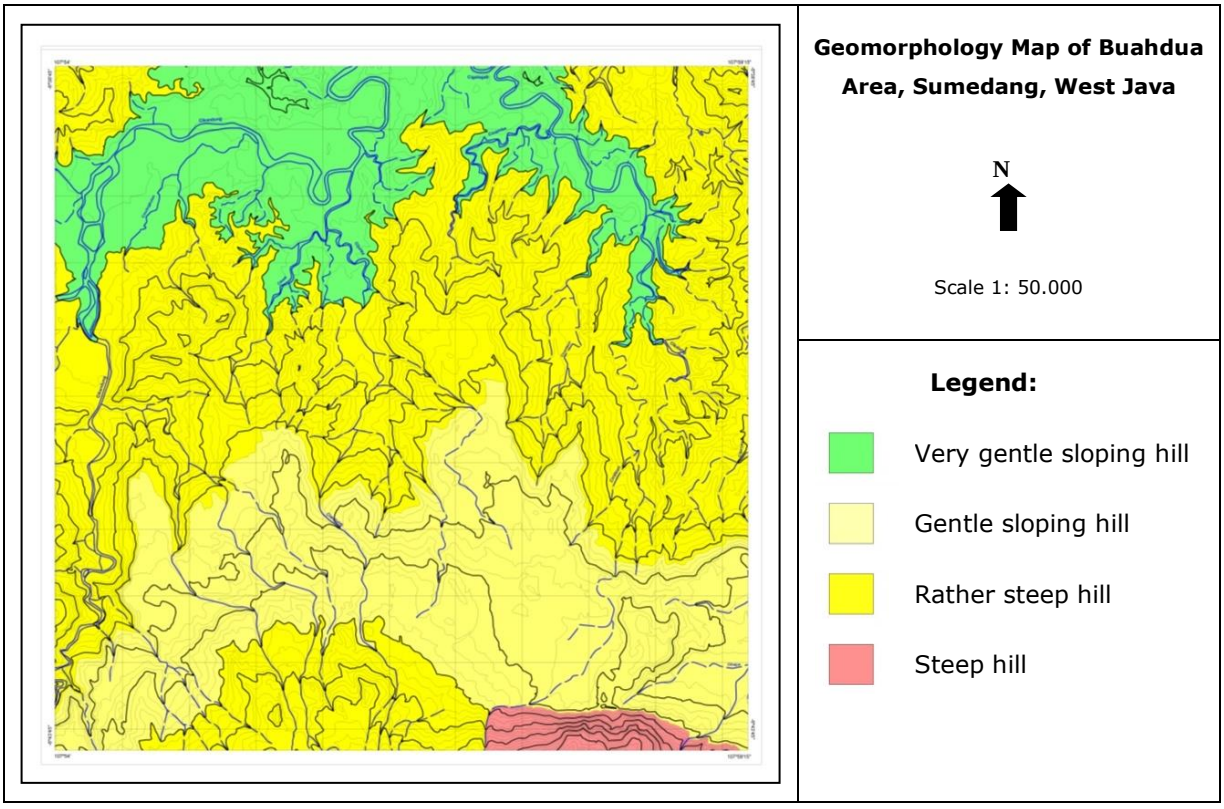

Figure 3. Geomorphology map of the research area

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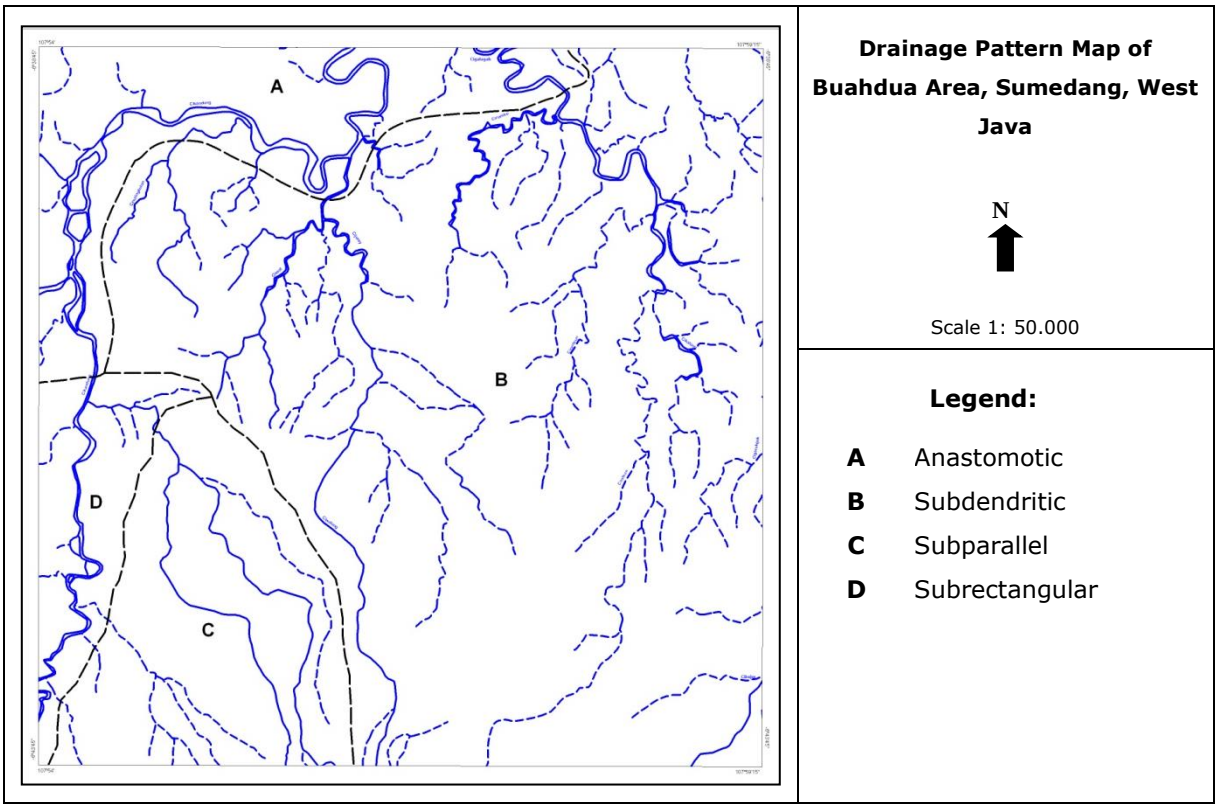

Figure 4. Drainage pattern map of the research area

1. Very gentle sloping hill unit.
   This unit occupies around 25% of the research area in the nortwest-north of the research area. This unit has very gentle sloping hills with elevation ranging from 74-118 masl. Anastomotic and subdendritic drainage pattern can be found in this area. Slope ranges from 2°-4° with dominantly exogenous process such as weathering and erosion occur in the Cikandung river. This unit is composed by claystone and alluvium.
2. Gentle sloping hill unit.
   This unit occupies around 27% of the research area in the center-south of the research area. This unit has gentle sloping hills with elevation ranging from 263-385 masl. Subparalel drainage pattern can be found in this area. Slope ranges from 4°-8° with exogenous process such as weathering and erosion occur in the tributaries of Cikandung river while endogenous process such as volcanic activity produces volcanic products. This unit is composed by claystone, volcanic breccia and lava.
3. Rather steep hill unit.
   This unit occupies around 45% of the research area in the northwest, northeast, center and south of the research area. This unit has rather steep hills with elevation ranging from 129-532 masl. Subparalel, anastomotic, and subdendritic drainage pattern can be found in this area. Slope ranges from 8°-16° with exogenous process and endogenous process occur. This unit is composed by volcanic breccia, claystone, *sandstone,* and lava.
4. Steep hill unit.
   This unit occupies around 3% of the research area in the Pasir Nangkod. This unit has steep hills with elevation ranging from 363-688 masl. Subparalel drainage pattern can be found in this area. Slope ranges from 16°-35° with endogenous process produces volcanic products. This unit is composed by volcanic breccia.

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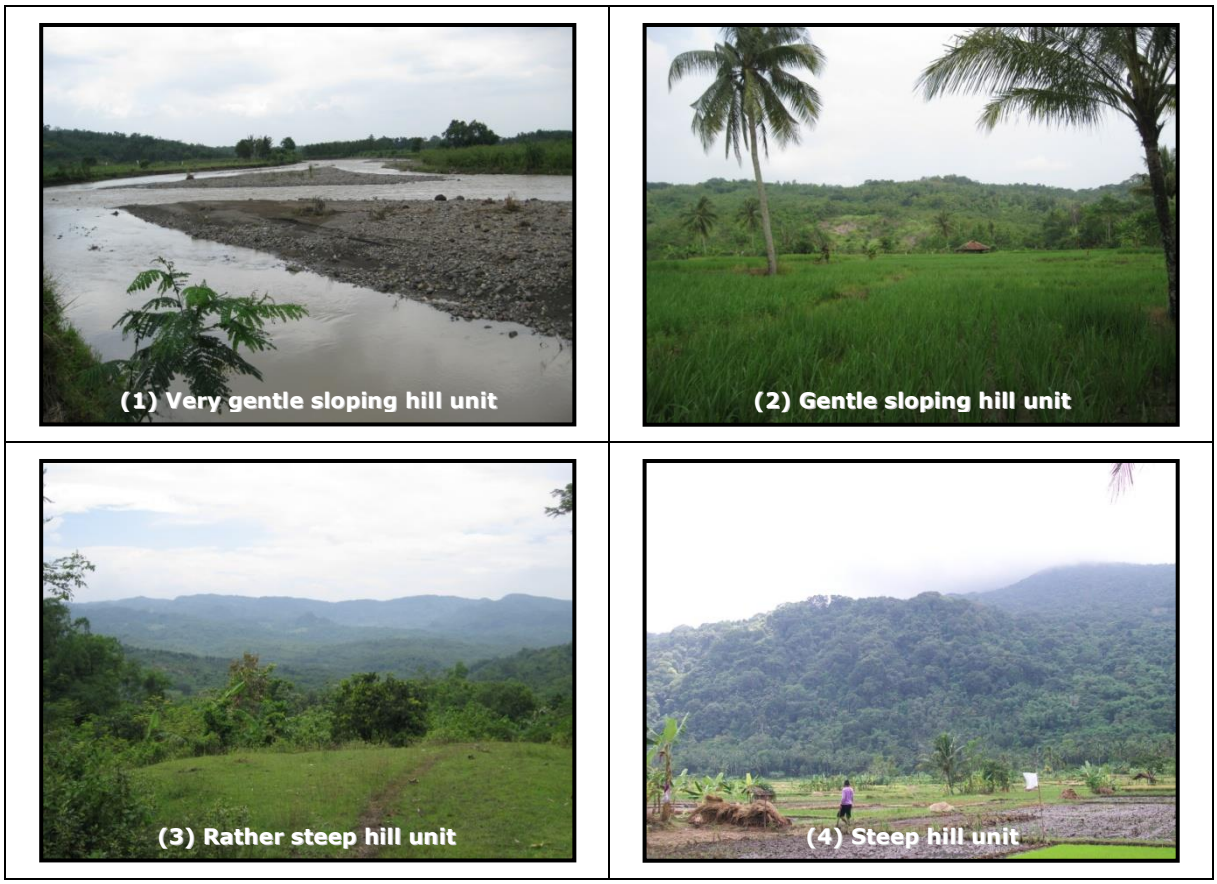

Figure 5. Morphology of the research area

Stratigraphy

Stratigraphy of the research area can be determined based on lithostratigraphy, due to the rock characteristics. Paleontology analysis is also used to determine the relative age of rock units. Based on lithostratigraphy, the research area can be divided into three rock units and alluvial deposit namely:

1. Claystone Unit (Tmbl)
   The Claystone unit (Tmbl) occupies around 30% in the northeast, center, and west of the research area (Cikandung and Cinambo River). This unit consists of 15-110 cm claystone and 10-100 cm claystone intercalated by sandstone. Based on petrography analysis, the thin section of claystone can be classified into mudstone refers to Pettijohn (1975). This claystone unit contains foraminifera. Based on fossil analysis, the Claystone unit (Tmbl) which refers to Bolli and Saunders (1985) has relative age of Middle Miocene (N9) and deposited in the upper bathyal zone (200-500 m).

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Figure 6. Claystone outcrops in the Cikandung and Cinambo river

2. Sandstone Unit (Tmbpl)
   The Sandstone unit (Tmbpl) occupies around 10% in the west-southwest of the research area. This unit consists of 8-100 cm sandstone and 10-100 cm claystone intercalated by sandstone. Based on petrography analysis, the thin section of sandstone can be classified into mudstone lithic greywacke refers to Pettijohn (1975). This sandstone unit contains foraminifera. Based on fossil analysis, the Sandstone unit (Tmbpl) which refers to Bolli and Saunders (1985) has relative age of Middle Miocene (N9-N10) and deposited in the middle bathyal zone (500-2.500 m).

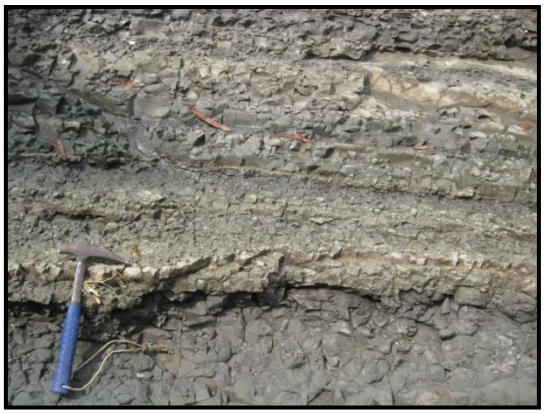

Figure 7. Sandstone intercalated by claystone

3. Volcanic Breccia Unit (Kbv)
   The Volcanic Breccia Unit (Kbv) occupies around 45% in the center-south of the research area. Based on petrography analysis, the thin section of breccia component can be classified into andesite porphyri refers to Travis (1955) whereas the thin section of breccia matrix classified into crystal tuff refers to Schmidt (1981). This unit does not have fossils which can be used to determine relative age. However, based on the field data reconstruction, the Volcanic Breccia Unit (Kbv) has relative age Quarter, younger than Claystone and Sandstone Unit.

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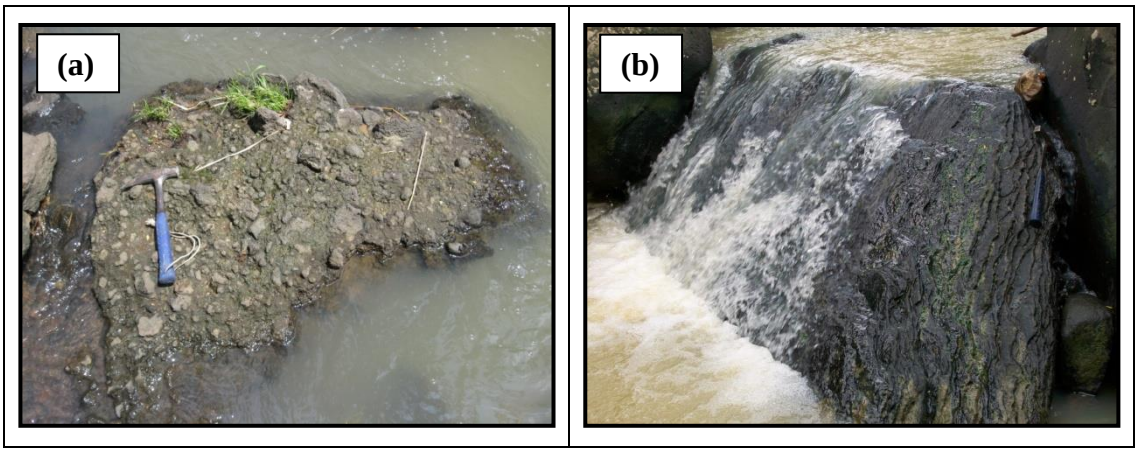

Figure 8. Volcanic breccia outcrop (a) and basaltic lava outcrop (b)

4. Alluvium (Kal)
   Alluvium (Kal) occupies around 15% in the northwest of the research area, especially in the Cikandung river. This alluvial deposit consists of clay, sand, pebble, and boulder found along the Cikandung river and its tributaries.

Figure 9. Alluvium in the research area

Geology Structure

Geology structures developed in the research area are shear joint and oblique fault. The shear joint formed as a result of compression force. It can be found in the sandstone outcrop (Figure 10). The oblique fault can be identified by slicken side that can be found in the research area. There are two oblique faults namely Cikandung Fault and Kamal Fault. Both faults can be interpreted by Digital Elevation Model (DEM) through studio analysis.

Cikandung fault is located in the west of the research area. Two slicken sides has been determined with strike-dip and pitch values for first slicken side is N20^{o}E/54^{o} and 27^{o} while the second is N30^{o}E/65^{o} and 65^{o} (Figure 12). Based on those values, Cikandung fault can be classified into left reverse slip fault refers to Rickard (1972).

Kamal fault is located in the southwest of the research area. Slicken side has been determined with strike-dip and pitch value N150^{o}E/69^{o} and 55^{o} (Figure 13). Based on those value, Cikandung fault can be classified into right reverse slip fault refers to Rickard (1972). Also, lithology offset can be found in the sandstone outcrop (Figure 13).

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Figure 10. Shear joint in the research area

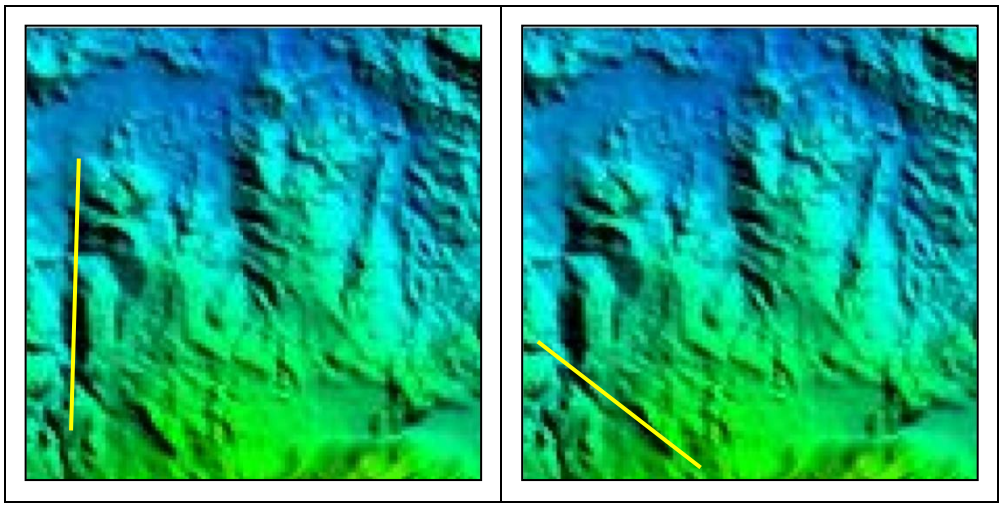

Figure 11. Fault interpretation from Digital Elevation Model: (a) Cikandung Fault; (b) Kamal Fault

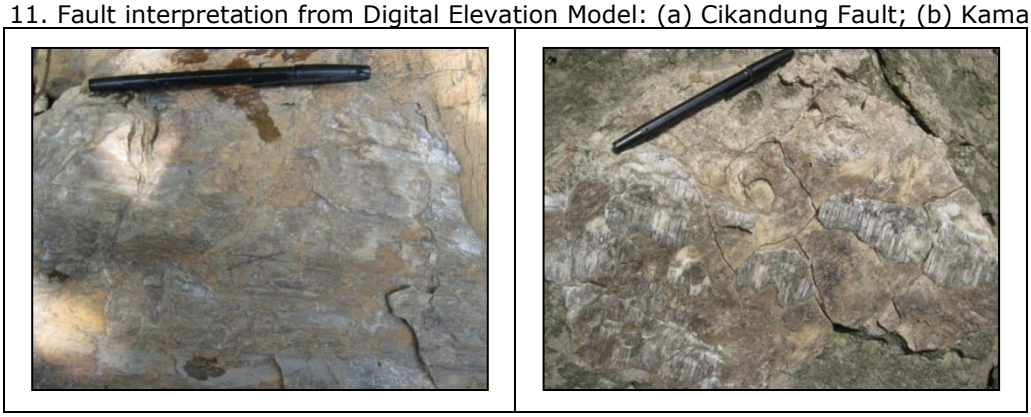

Figure 12. Slicken sides in the Cikandung river

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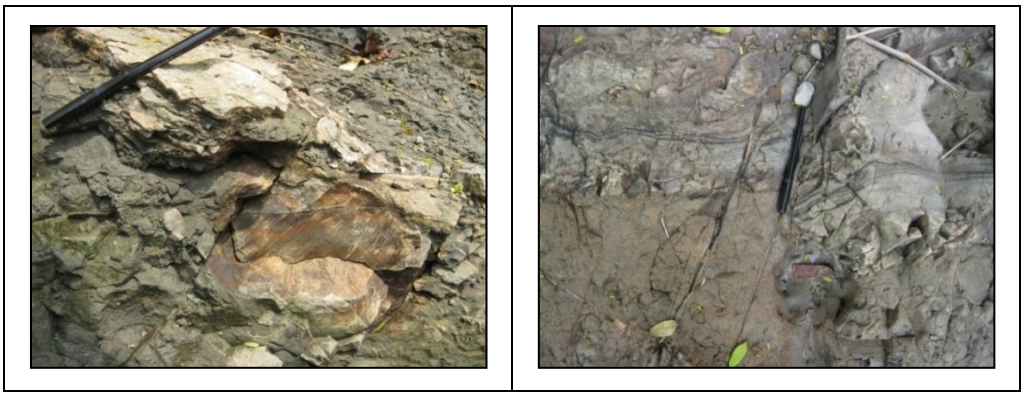

Figure 13. (a) Slicken side in the Kamal vilage; (b) lithology offset in the claystone outcrop

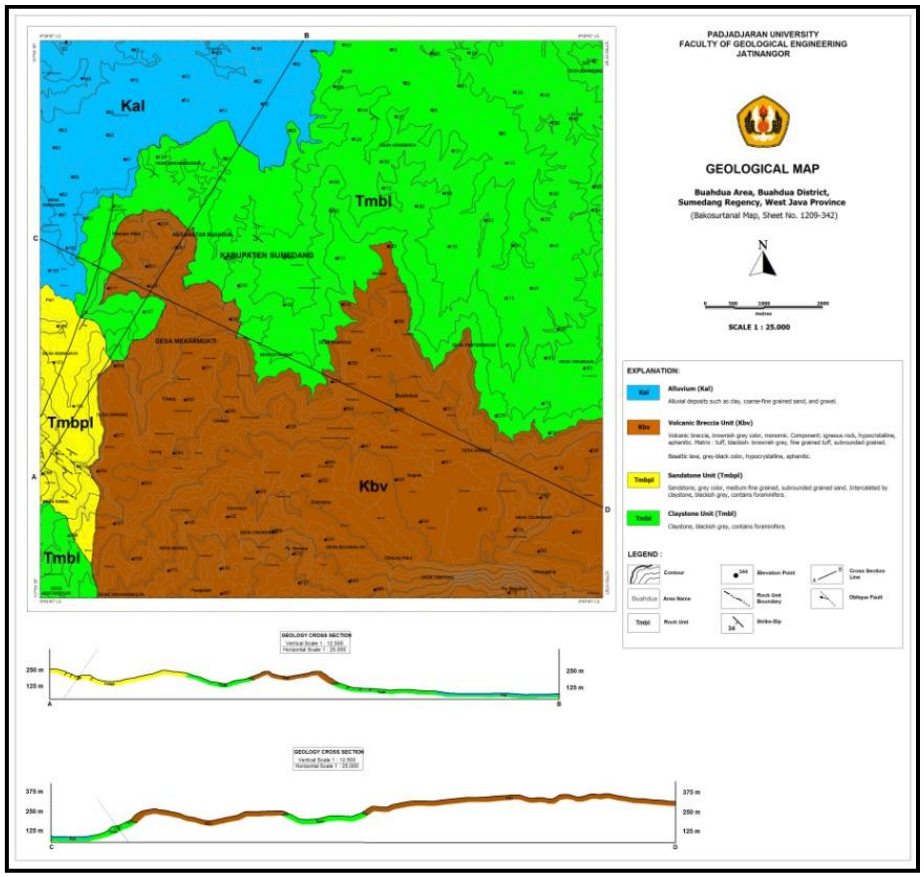

Figure 14. Geological Map of the research area

Geological Resources and Geological Hazard Potential

Geological resources in the research area that can be used by local people such as clay, sand, pebble, boulder, etc. People can take the materials along the Cikandung river. On the other hand, geological hazard potential in the research area is landslide. Landslide occured in the Hariang Village (Figure 15). It can be identified from a relatively steep slop.

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Figure 15. Landslide in the research area (Hariang village)

CONCLUSION

1. According to the morphology aspects, the research area can be divided into four morphology unit namely very gentle sloping hill, gentle sloping hill, rather steep hill, and steep hill morphology unit.
2. The lithostratigraphic units in the research are can be divided into three units namely claystone (Tmbl), sandstone (Tmbpl), and volcanic breccia unit (Kbv), and alluvial deposit or alluvium (Kal).
3. The geological structures developed in the research area are shear joint and oblique fault (Cikandung and Kamal oblique fault).
4. Geological resources in the research area are clay, sand, boulder, etc that can be found in the Cikandung river. In addition, landslides are susceptible to occur due to relatively steep slope in some places in the research area.

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