GEOLOGY OF SILIHWANGI AREA, MAJALENGKA DISTRICT, WEST JAVA PROVINCE

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ABSTRACT

Silihwangi area is located in Majalengka District, West Java Province with coordinate 108°13'22" E - 108°16'5" E and 6°57'41" S - 7°0'22" S. This research aims to identifiy and know the geology of Silihwangi area and its surrounding. This research used digital maps to carried out processing step in studio and field equipment such as GPS, camera, compass, geological hammer, etc to carried out field observation. Some rock samples are taken for further analysis. Based on field observation and studio analysis, the research area can be divided into five morphology unit namely very gentle sloping hill, gentle sloping hill, rather steep hill, steep hill, and very steep hill morphology unit. Other than that, there are subparalel, radial, and subdendritic drainage pattern that can be found in the research area. The lithostratigraphic units in the research area, namely Sandstone (Tmbp), Claystone (Tpbl), Andesite intrusion (Ki), Tuff (Kt), and Volcanic breccia (Kbv) unit. Joint and lithology offset can be found in the research area.

Keywords: Drainage pattern, Morphology, Geology, Silihwangi

1. INTRODUCTION

Silihwangi area is located in Majalengka District, West Java Province with coordinate 108°13'22" E - 108°16'5" E and 6°57'41" S - 7°0'22" S. According from preliminary studies, this research is interesting to be investigated further because this area has quite varied geological information. This research aims to identifiy and know the geology of Silihwangi area and its surrounding.

Morphology, drainage pattern, stratigraphy, and geological structure are aspects that will be studied in this research. Those aspects are interrelated and can indicate the geological characteristic in the research area. Other than that, this research is also expected to provide additional information about geological resources and geological hazard potential of the research area.

2. 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, the research area belongs to the Bogor Zone. The Bogor Zone is in the southern part of the Coastal Plain of Batavia and stretches from west to the east, which starts from Rangkasbitung, Bogor, Subang, and ends at Bumiayu. Bogor Zone is an anticlinorium area that is convex to the north. In the northern part of the Bogor Zone, the geological structures that occur are folds and thrust fault. These folds consist of Miocene and Pliocene sedimentary rocks. In the Bogor zone, there are also several intrusion morphologies. According to Van Bemmelen (1949), the Bogor Zone has experienced two times of tectonic period, namely Miocen-Pliocene period and Pliocene-Plistocene period.

Based on Regional Geology (Budhitrisna, 1986; Djuri, 1995), regional stratigraphy in the research area consist of Halang Formation, Kaliwangu Formation, Andesite, Older and Younger Volcanic Product.

a. Halang Formation (Tmhu) consists of Upper and Lower Member of Halang Formation. Lower Member of Halang Formation consists of volcanic breccia of andesitic and basalt, tuff, clay, and conglomerate whereas Upper Member of Halang Formation consists of sandstone, tuff, clay, and conglomerate.
b. Kaliwangu Formation (Tpk) consists of claystone with intercalations of tuffaceous sandstone, conglomerate, beds of calcareous sandstone and limestone in places.
c. Andesite (Ha), with vitreous groundmass, forms necks and dikes.
d. Old volcanic products-breccia (Qvb/Qtvb) consists of volcanic breccia, lahar

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deposits. Components consists of andesite and basalt.

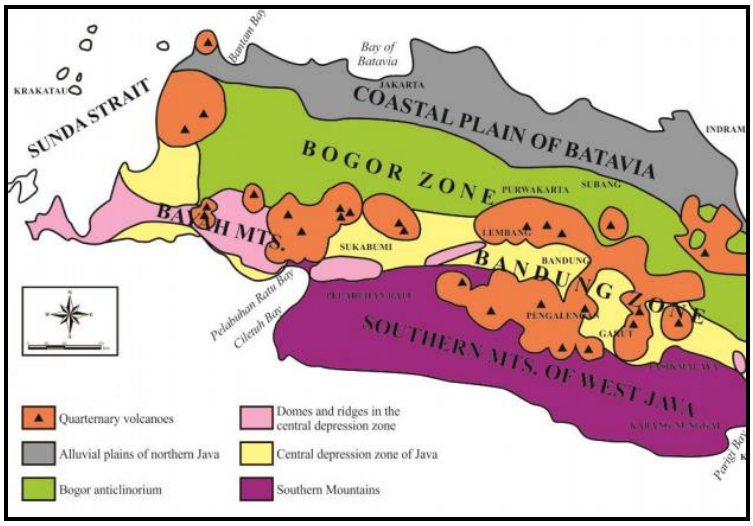

Figure 1. Physiographic map of West Java (modified from van Bemmelen, 1949)

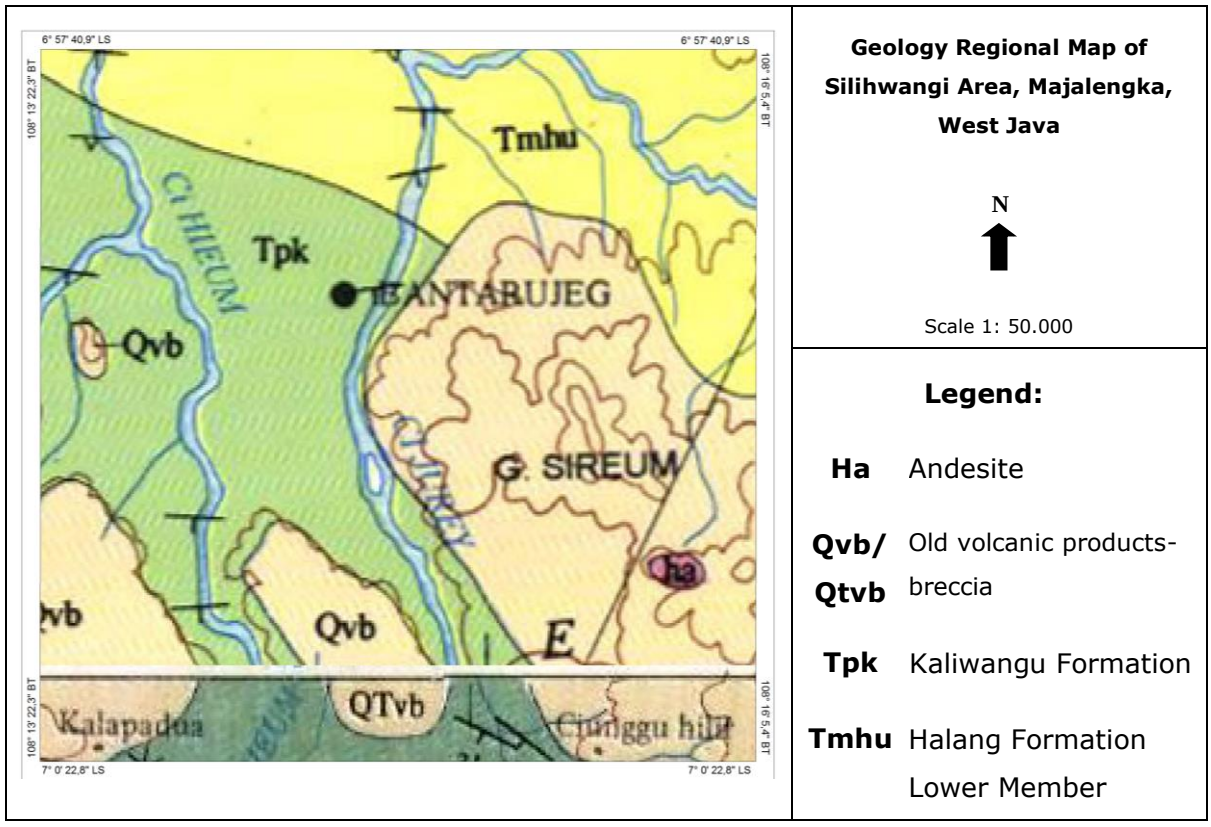

Figure 2. Regional Geology of the research area (modified from Budhitrisna, 1986; Djuri, 1995)

3. METHODS

This research conducted through studio analysis and field observation. This research used digital maps to carried out processing step in studio and field equipment such as GPS, camera, compass, geological hammer, etc to carried out field observation. Some rock samples are taken for further analysis. The

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research objects are geomorphology, lithology, stratigraphy, and geological structure.

Literature study was conducted to determine the geological setting and stratigraphy of the research area. The research area on the map is from part of Bakosurtanal Map sheet 1309-112 Bantarujeg, 1309-121 Talaga, 1308-443 Cikijing, and 1308-434 Pagerageung. Field observation data obtained from outcrops using field equipment such as GPS, camera, compass, geological hammer, etc.

Studio analysis was conducted to determine geomorphology aspects such as morphometry (slope and drainage patterns), morphography (landform), and morphogenetic (related to geology characteristics). Those aspects were analyzed by Map Info software.

4. RESULT AND DISCUSSION

4.1 Geomorphology

The research area shows hilly land, from very gently hills to steep hills which have elevation from 312-739 masl. Based on this elevation, the research area can be divided into five morphology unit namely very gentle sloping hill, gentle sloping hill, rather steep hill, steep hill, and very steep hill morphology unit.

Based on geomorphology aspects, the research area has experienced various processes, both endogenous and exogenous process. The endogenous process is characterized by the existence of a geological structure such as faults and rock intrusion in the southeast of the research area. In addition, exogenous processes are characterized by weathering, erosion, and transportation of sedimen materials along the river of the research area. Ridges and valleys in the research area are the evidence of erosion activities. Shape of the valleys tends to be drainage for rivers which consist of U-shape valley and V-shape valley. The U-shape valleys are found in rivers with the dominance of horizontal erosion while the V-shape valleys are around in rivers with the dominance of vertical erosion.

There are three main rivers that flow in the research area, namely Cihieum, Cijurey, and Cilutung river. Those rivers form drainage patterns. Drainage patterns developed in the research area refers to Howard (1967) are subparallel, radial, and subdendritic.

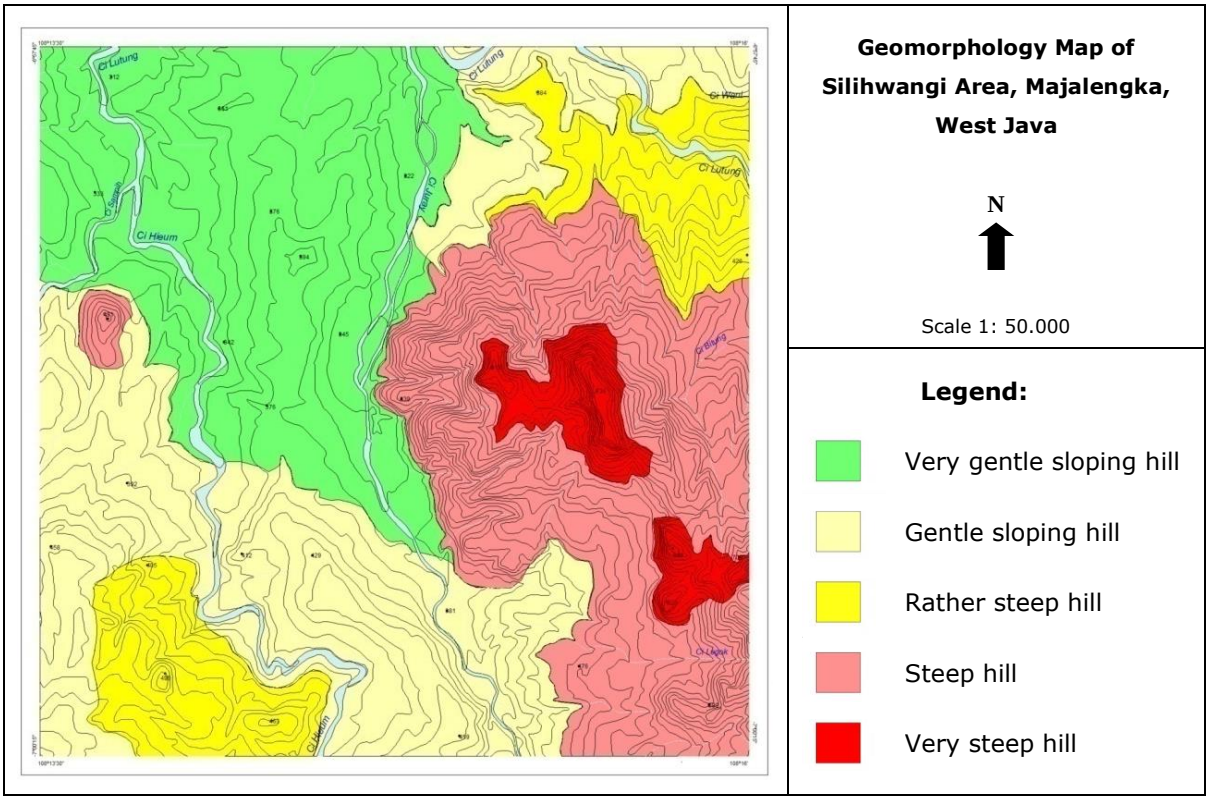

Figure 3. Geomorphology map of the research area

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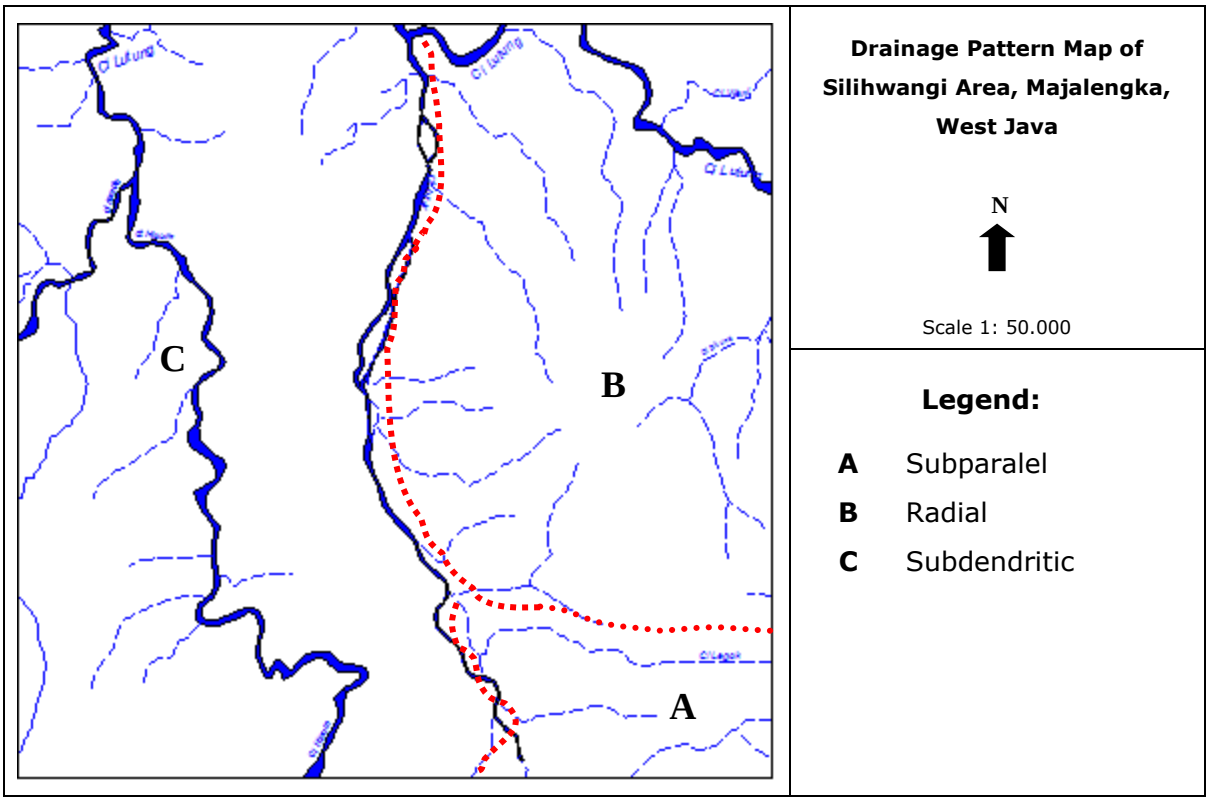

Figure 4. Drainage pattern map of the research area

1. Very gentle sloping hill unit. This unit occupies around 25% of the research area. This unit is characterized by very gentle sloping hills with elevation between 338-394 masl, subparallel and subdendritic drainage pattern, slope ranges from 2°-4°, and the exogenous process such as weathering and erosion that affects the landform. This geomorphological unit is composed by claystone and sandstone.
2. Gentle sloping hill unit. This unit occupies around 30% of the research area. This unit is characterized by gentle sloping hills with elevation between 392-484 masl, subparallel and subdendritic drainage pattern, slope ranges from 4°-8°, and the exogenous process such as weathering and erosion, also the endogenous process that affects the landform. This geomorphological unit is composed by claystone, sandstone, and tuff.
3. Rather steep hill unit. This unit occupies around 15% of the research area. This unit is characterized by gentle sloping hills with elevation between 384-499 masl, subdendritic drainage pattern, slope ranges from 8°-16°, and the exogenous process such as weathering and erosion, also the endogenous process that affects the landform. This geomorphological unit is composed by claystone, sandstone, and tuff.
4. Steep hill unit. This unit occupies around 25% of the research area. This unit is characterized by gentle sloping hills with elevation between 394-499 masl, radial drainage pattern, slope ranges from 16°-35°, and the endogenous process that affects the landform. This geomorphological unit is composed by tuff, volcanic breccia, and andesite.
5. Very Steep hill unit. This unit occupies around 5% of the research area. This unit is characterized by gentle sloping hills with elevation between 612-739 masl, radial drainage pattern, slope ranges from 35°-55°, and the endogenous process such as rocks intrusion. This geomorphological unit is composed by volcanic breccia and andesite.

4.2 Stratigraphy

Geology of the research area can be determined based on lithostratigraphy, due to the rock characteristics in the field. In addition, paleontological analysis is used to determine the relative age of rocks. The research area

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can be divided five rock units. Rock units from the oldest to the youngest rock units, namely:

1. Sandstone unit (Tmbp)
   The sandstone unit (Tmbp) occupies around 10% of the total research area, especially in Cilutung and Cijurey River. This unit is consist of sandstone 5-25 cm thick intercalations of claystone 2-10 cm thick. In some location, sandstone is found with foraminifera fossils. Based on fossil analysis, the Sandstone unit (Tmbp) which refers to Bolli and Saunders (1985) has relative age of Middle Miocene – Late Miocene (N13-N17) and deposited in the bathyal environment (400-1.120 m).

Figure 5. Sandstone intercalations of claystone in the Cilutung river

2. Claystone unit (Tpbl)
   The Claystone unit (Tpbl) occupies around 45% of the total research area, especially in Cijurey and Cihieum River. This unit is consist of claystone 10-30 cm thick intercalations of sandstone 5-10 cm thick. In some location, claystone is found with foraminifera fossils. Based on fossil analysis, the Claystone unit (Tpbl) which refers to Bolli and Saunders (1985) has relative age of Pliocene (N16-N22) and deposited in the bathyal environment (400-1.000 m).

Figure 6. Claystone intercalations of sandstone

3. Andesite Intrusion (Ki)
   The Andesite intrusion (Ki) occupies around 5% of the total research area, especially in Mt. Jambubarange, southeastern of the research area. The intrusion emerge to the surface in dykes shape that breaks through Claystone unit. It can be proven with the baking effect process. This unit is not contain fossil which can be used to determine relative age and depositional environmental. Based on the field data reconstruction, the Andesite intrusion (Ki) has relative age Quarter, younger than Sandstone and Claystone unit.

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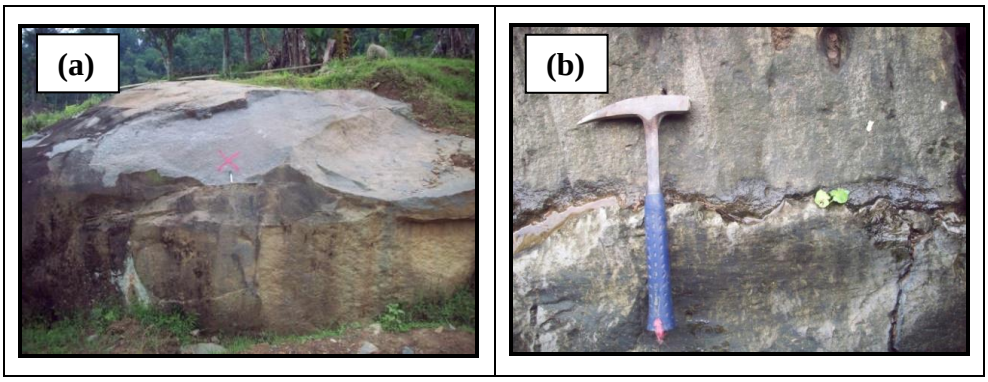

Figure 6. Andesite intrusion outcrop (a) with baking effect (b)

4. Tuff unit (Kt)
   The Tuff unit (Kt) occupies around 15% of the total research area, especially in southwestern and central of research area. This unit is not contain fossil which can be used to determine relative age and depositional environmental. Based on field data reconstruction, the Tuff unit (Kt) has relative age Quarter, younger than Sandstone and Claystone unit, also deposit in the terrestrial environment.

Figure 7. Tuff outcrop

5. Volcanic Breccia unit (Kbv)
   The Volcanic Breccia unit (Kbv) occupies around 25% of the total research area, especially in the Mt. Balukbuk and Mt. Sireum. This unit is not contain fossil which can be used to determine relative age and depositional environmental. This unit consists of rock component (andesite) and matrix (tuff). Based on field data reconstruction, the Volcanic Breccia unit (Kbv) has relative age Quarter, younger than Sandstone and Claystone unit also deposit in the terrestrial environment.

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Figure 8. Volcanic breccia outcrop

4.3 Geology Structure

Geology structures developed in the research area are shear joint and lithology offset. This shear joint formed as a result of compression force. It can be found in the sandstone outcrop (Figure 9). Besides, lithology offset also can be found as a geology structure in the sandstone outcrop (Figure 9). It might be expected as thrust fault in the research area.

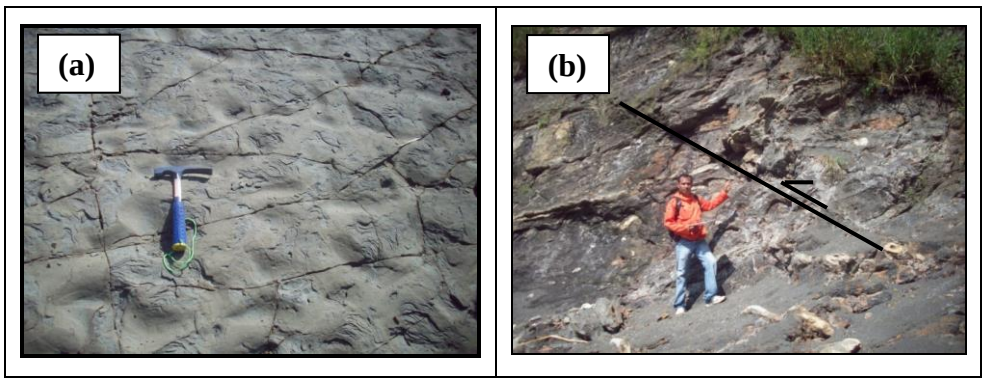

Figure 9. Shear joint (a) and lithology offset (b) in the research area

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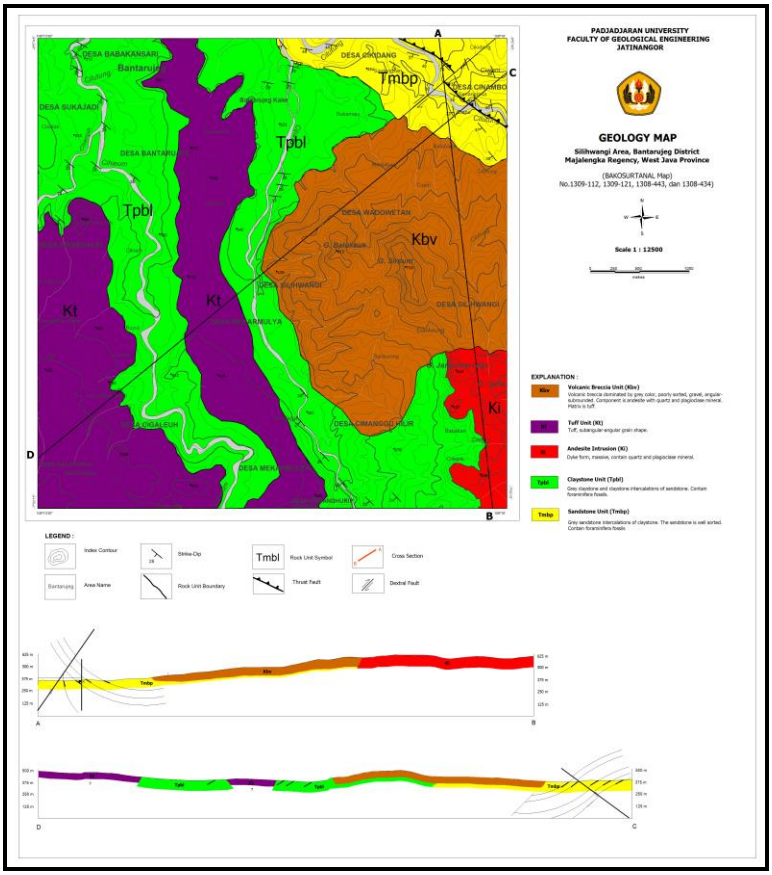

Figure 10. Geological Map of the research area

4.4 Geological Resources and Geological Hazard Potential

There are geological resources that can be found in the research area, i.e. andesite, boulder, sand, clay, etc. Those can be utilized by local people to help their economy. In the other hand, geological hazard potential in the research area can be identified from wall cracks in the local people house. It certainly can be dangerous for local people.

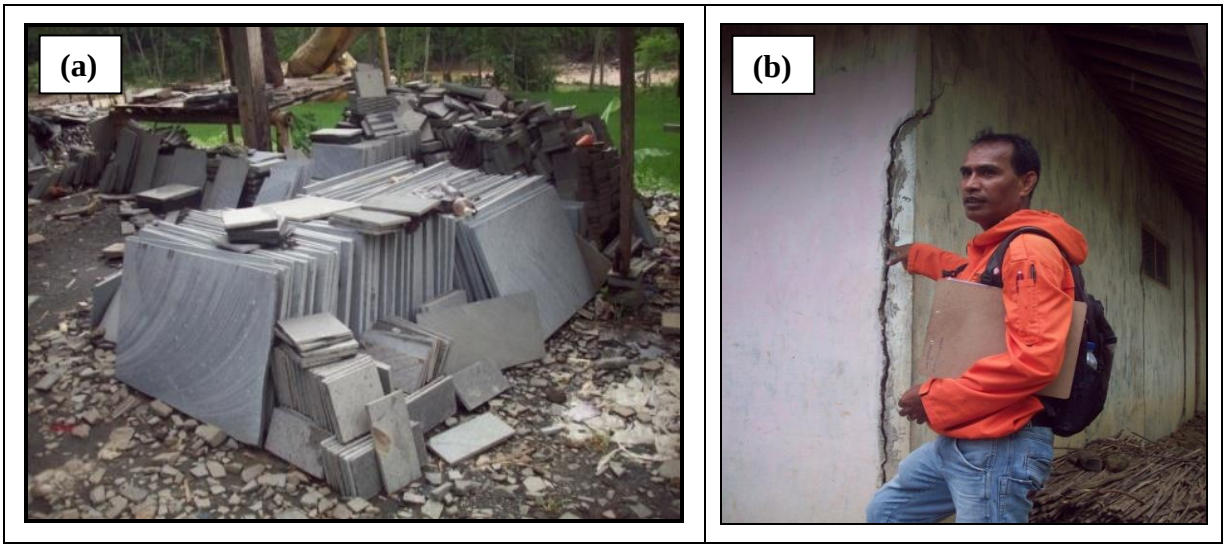

Figure 11. Geological resources and geological hazard potential

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5. CONCLUSION

1. According to the morphology aspects, research area can be divided into five morphology unit namely very gentle sloping hill, gentle sloping hill, rather steep hill, steep hill, and very steep hill morphology unit.
2. The lithostratigraphic units in the research area, namely Sandstone (Tmbp), Claystone (Tpbl), Andesite intrusion (Ki), Tuff (Kt), and Volcanic breccia (Kbv) unit. Joint and lithology offset can be found in the research area.
3. Geology structures developed in the research area are shear joint and lithology offset.
4. Geological resources in the research area, i.e. andesite, boulder, sand, clay, etc. Geological hazard potential in the research area can be identified from wall cracks in the local people house.

ACKNOWLEDGMENT

The author would like thank to researcher team in Geological Engineering Faculty, Padjadjaran University who helped our research activity and the preparation of scientific article. We hope this article is beneficial for science and environment development.

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E-ISSN : 2579 – 3136