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Geomorphology of Jatigede and Surrounding Areas, West Java, Indonesia

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Abstract**—** *The research area is located on Jatigede and surrounding areas, Sumedang, West Java, Indonesia. It is located at coordinate 6°48'26,1" S - 6°56'31,7" S and 108°3'36,0" E -108°11'45,1" E. The purpose of this research is to determine the geomorphological characteristics of the research area and its relationship with the geology of the research area. This research uses studio analysis methods and field observations. Studio analysis consists of several activities which include analysis of slope, drainage patterns, and land use in the research area. The data used includes slope and drainage pattern map, also satellite imagery of the research area. The central to eastern part of the research area is located in an area dominated by elongated and partially curved hills with moderately steep to very steep slopes. Relatively sloping area is on the northeastern edge of the research area. Rectangular and fault trellis drainage patterns dominate the research area which shows active geological conditions. Field observations at several locations indicated that there was a predominance of sedimentary rocks in the research area with several indications of geological structure such as offsets, drag folds, and escarpment. Based on the results, it can be concluded that the research area has interesting geomorphological characteristics and can be one of the locations for studying geology.*

Keywords**—** *Jatigede, drainage pattern, geomorphology, geology, satellite imagery.*

I. INTRODUCTION

Geomorphology is a branch of geology that studies the surface of the earth, including various landforms, and the history of their formation [1], [2]. Studying geomorphology will also help identify geological conditions in a particular area. The research area is located on Jatigede and surrounding areas, Sumedang, West Java, Indonesia. It is located at coordinate 6°48'26,1" S - 6°56'31,7" S and 108°3'36,0" E -108°11'45,1" E. The research area has interesting geomorphological and geological conditions. We can identify this early through various preliminary studies in the area [3]–[5]. This research on the theme of geomorphology is important as an approach to knowing the geological conditions of the research area.

The purpose of this research is to determine the geomorphological characteristics of the research area and its relationship with the geology of the research area. geomorphological aspects of an area can also be related to land use conditions in the area [6]–[8]. Both geomorphology and land use of the research area can be identified early through remote sensing approaches which in this era has become one of the important analytical approaches.

It is common knowledge that remote sensing approaches have helped the process of initial identification of various research areas. Remote sensing approaches can be the first step to identify the condition of the earth's surface in an area. on the other hand, remote sensing can also help identify land use condition in a particular area [9], [10]. Topographic maps, satellite images, and aerial photographs are media that are often used in remote sensing analysis.

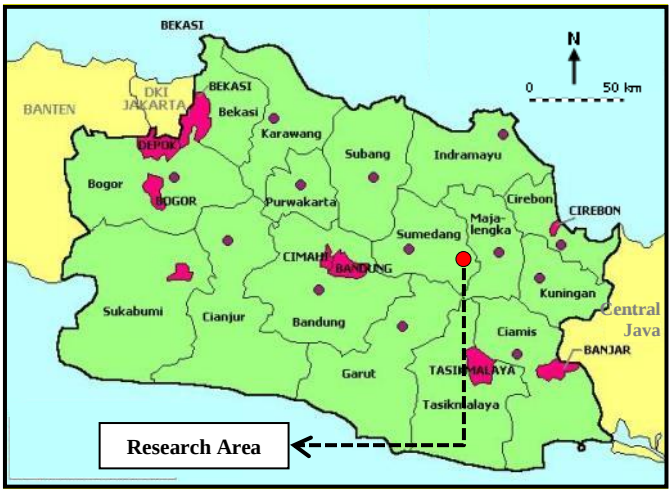

Fig. 1. The research area in the Jatigede and surrounding areas

II. METHOD

This research uses studio analysis method and field observation. Studio analysis consists of several activities which include analysis of slope, drainage patterns, and land use in the research area. The data used includes slope and drainage pattern map, also satellite imagery of the research area. In addition, the supporting software used to process and analyze data in the studio includes Map Info, Global Mapper, and Google Earth.

The slope map of the research area was obtained from the processing of SRTM DEM imagery with a resolution of 30 meters using Global Mapper software with reference to slope classification [11]. Drainage pattern map was obtained from river data extraction in the research area which then identified several drainage patterns in the research area by referring to the classification of drainage patterns [12], [13]. In addition, the geological map of the research area was obtained from the processing of the regional geological map of the research area [5]. Moreover, satellite imagery of the research area was obtained from download process through the Google Earth software.

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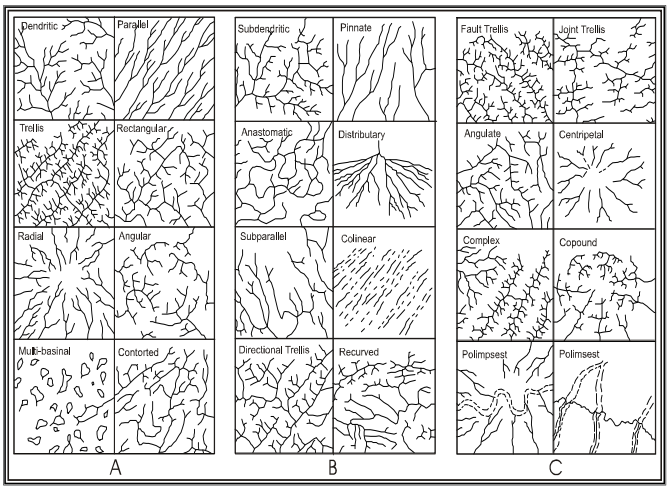

Fig. 2 Classification of drainage patterns [12], [13]: (A) Basic pattern; (B and C) Modified pattern

TABLE 1. Slope classification (modified after [11])

Classification	Slope	
	Percentage (%)	Degree (°)
Flat	0-2	0-2
Gently Slope	2-7	2-4
Sloping	7-15	4-8
Moderately Steep	15-30	8-16
Steep	30-70	16-35
Very Steep	70-140	35-55
Extremely Steep	>140	>55

III. Result and Discussion

Based on the results of SRTM DEM image processing, the central to eastern part of the research area is located in an area dominated by elongated and partially curved hills with moderately steep to very steep slopes. Relatively sloping area is on the northeastern edge of the research area. It can be seen in slope map of the research area (Fig. 3).

Analysis of drainage patterns shows that the research area has several drainage patterns such as rectangular, fault trellis, subdendritic, subparallel, and anastomotic drainage patterns (Fig. 4). Rectangular and fault trellis drainage patterns dominate more than half of the research area, subdendritic drainage pattern can be identified in the northwestern part of the research area, subparallel drainage pattern can be identified in the southwestern part of the research area, and anastomotic drainage pattern can be identified in the northeastern part of the research area. Those drainage patterns show distinctive geological characteristics.

The rectangular drainage pattern shows many right angle bends of main stream and its tributaries while the fault trellis drainage pattern shows the short subsequent streams meet the main stream at right or sharp angles. Both drainage patterns can be found in folded and faulted sedimentary rocks. The subdendritic drainage pattern shows branching pattern of main stream and its tributaries like tree roots. It can be found in relatively homogeneous sedimentary rocks. Rectangular, fault trellis, and subdendritic drainage patterns indicate that the research area has active geological or tectonic conditions. Subparallel shows the main river and its tributaries are relatively parallel to each other. It indicates relatively elongated hills. In addition, anastomotic drainage pattern shows a meandering shape with the presence of interlocking channels. It indicates an area with relatively low topography and the possibility of a flood plain.

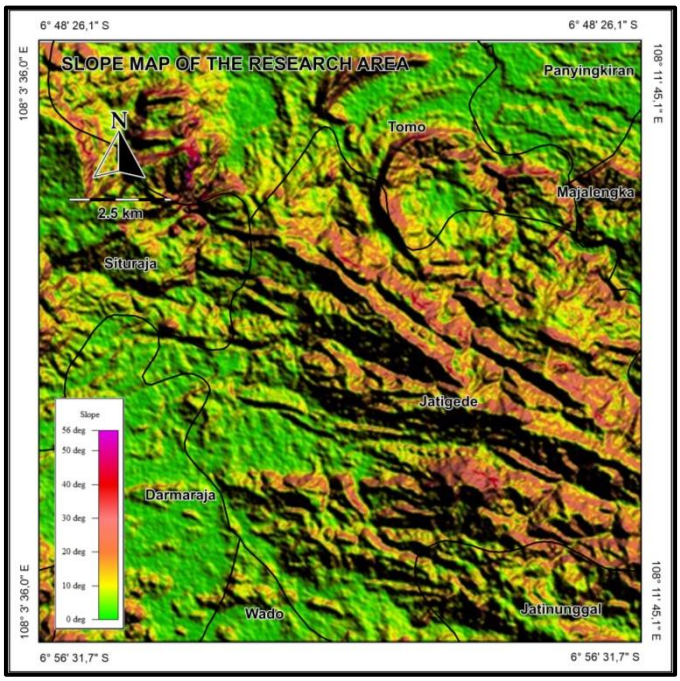

Fig. 3. Slope map of the Jatigede and surrounding areas

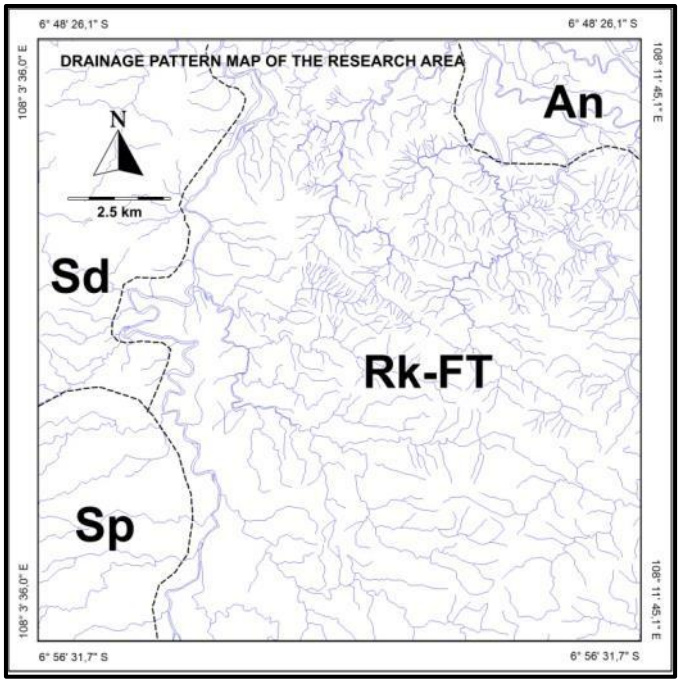

Fig. 4. Drainage pattern map of the research area (Sd: Subdendritik; Sp: Subparallel; An: Anastomotic; Rk-FT: Rectangular-Fault Trellis)

The drainage patterns are also able to show the geological conditions of the research area. The presence of rectangular, fault trellis, and subdendritic drainage patterns indicates that the research area is dominated by folded-faulted sedimentary rocks. This is in accordance with the regional geological map of the reserch area [5] (Fig. 5) which shows the dominance of

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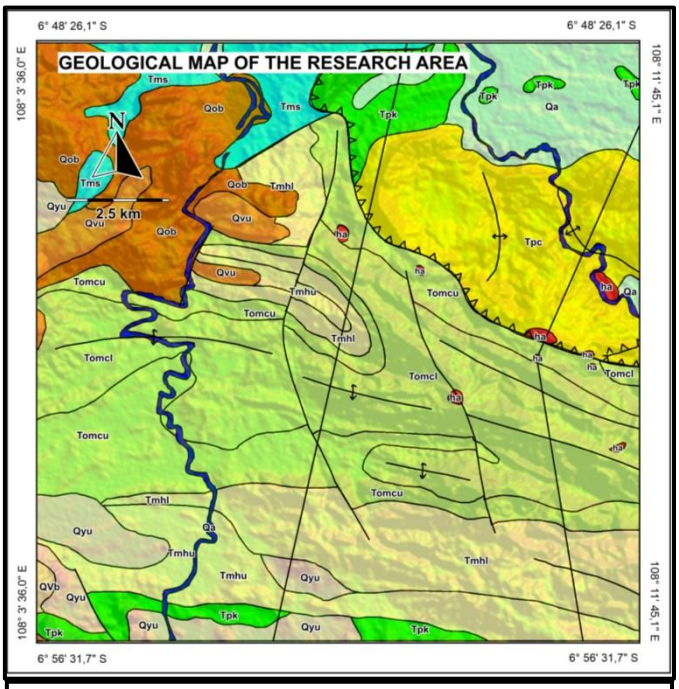
sedimentary rocks such as sandstone, claystone, shale, etc in the Citalang (Tpc), Kaliwangu (Tpk), Subang (Tms), Halang (Tmhu/Tmhl), and Cinambo (Tomcu/Tomcl) rock formation. It also shows a relationship between drainage pattern as one aspect of geomorphology and geological characteristics in a particular area [14]–[17].



Explanation

Qa	:	alluvium
Ha	:	hornblende andesite
Qyu	:	undifferentiated volcanics and pyroclastic sediment
Qvb	:	breccia
Qvu	:	undifferentiated volcanics
Qob	:	folded breccia
Tpc	:	conglomerate, breccia, sandstone
Tpk	:	clay with mollucs, conglomerate, tuffaceous sandstone lenses
Tms	:	clay, marl, sandstone lenses
Tmhu	:	sandstone and sandy shale
Tmhl	:	breccia and sandstone
Tomcu	:	shale
Tomcl	:	calcareous, shale

Fig. 5. Geological map of the research area (modified after [5])

The geomorphological and geological characteristics known through the analysis and interpretation of previous maps are in accordance with the results of field observations. Dominance of sedimentary rocks with indications of geological structure found in several locations of the research area. There are sandstones and claystones which were found to have changed in position (offset) (Fig. 6). A drag fold was found in one of the tributaries of the Cimanuk river (Fig. 7). Moreover, escarpment was also found in the research area (Fig. 8).

Based on satellite images of the research area (Fig. 9), it can be seen that most of the Jatigede and surrounding areas are in elongated hilly areas. Geomorphological conditions can be seen through satellite imagery interpretation which at the same time can also indicate the initial geological conditions of the research area. On the other hand, we also need to periodically monitor changes in land use in a particular area. This is to prevent an area from experiencing extreme environmental degradation due to massive changes in land use.

Fig. 6. Lithology offset in the research area

Fig 7. Dragfold in the research area

Fig. 8. Escarpment in the research area

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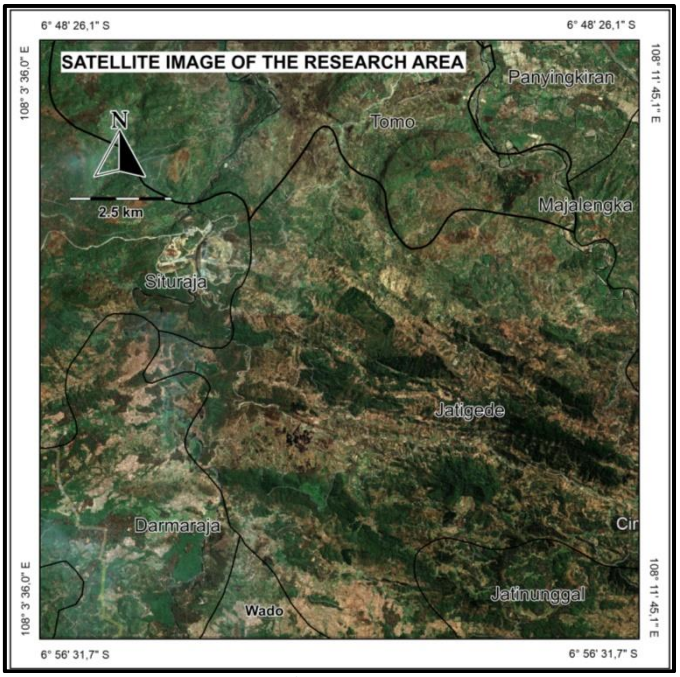

Fig. 9. Satellite image of the Jatigede and surounding areas (source: Google Earth, Imagery date December 2012)

IV. CONCLUSION

The research area is located on Jatigede and surrounding areas, Sumedang, West Java, Indonesia. It is located in an area dominated by elongated and partially curved hills with moderately steep to very steep slopes. Only a small part of the research area has a gentle to very gentle slope. Several drainage patterns such as rectangular, fault trellis, subdendritic, subparallel, and anastomotic were identified in the research area. The presence of rectangular, fault trellis, and subdendritic drainage patterns indicates that the research area is dominated by folded-faulted sedimentary rocks. This is in accordance with the geological conditions of the research area which can be seen from the geological map and field observation, also the geomorphology of the research area which can be seen from satellite imagery. Based on the results, it can be concluded that the research area has interesting geomorphological characteristics and can be one of the locations for studying geology.

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