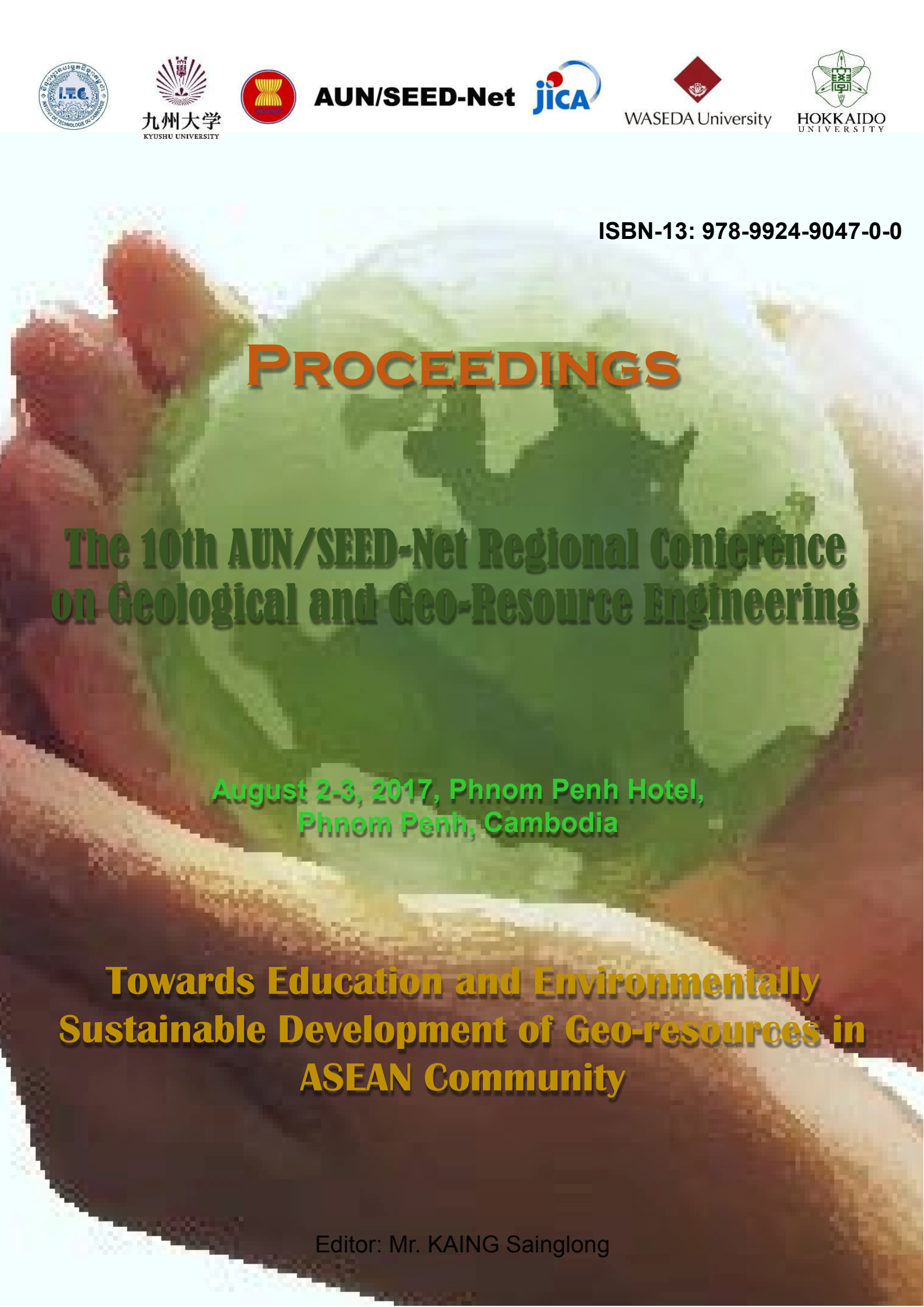

AUN/SEED-Net

ISBN-13: 978-9924-9047-0-0

Proceedings

The 10th AUN/SEED-Net Regional Conference on Geological and Geo-Resource Engineering

August 2-3, 2017, Phnom Penh Hotel,
Phnom Penh, Cambodia

Towards Education and Environmentally Sustainable Development of Geo-resources in ASEAN Community

Editor: Mr. KAING Sainglong

PROCEEDINGS

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GEOHERITAGES FOR GEOTOURISM DEVELOPMENT OF KARYAMUKTI VILLAGE AND SURROUNDING AREA, CIANJUR REGENCY, WEST JAVA, INDONESIA

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Abstract

Karyamukti Village, Cianjur Regency, West Java, Indonesia is high potential of geotourism, characterized by the presence of various geological heritages, but the tourism in this area has not optimally developed yet. The area is geologically composed of six rock units, namely Pogor Hornblende Andesite unit, Cikondang Andesite Lava unit, Cikondang Volcanic Breccia unit, Pyroclastic Breccia unit, Melati Andesite Intrusion, and Alluvial Deposit. Pogor Hornblende Andesite unit is Oligocene age. Cikondang Andesite Lava unit consists of volcanic breccia, volcanic sandstone, coarse tuff, and lava of late Miocene age. Cikondang Volcanic Breccia unit is composed of volcanic breccia and tuff sandstone, Pliocene age. Melati Andesite Intrusion consists of pyroxene andesite of Pliocene age. While Alluvial Deposits comprises materials of fine to very coarse grained (1 / 2-> 256 mm), Holocene age. There are lateral slip faults with strikes of Northwest-southeast, Northeast - Southwest, and North – South in the study area.

The tourism sites can be divided into four categories, including geological tourism, geomorphological tourism, river tourism, and cultural tourism of the Stone Age. Geological tourism consists of landscape of endogenous processes and landscape of mineral resource. Landscape of endogenous process includes Andesite of Pasirpogor Hill, Andesite Dyke of Cimenteng, and Andesite Lava of River Cimandiri. While the landscape of mineral resource is represented by Gold Mining of Cimandiri. Geomorphological tourism expresses as denudated tectonic features of the Cikondang Valley. River tourism is represented by the Cikondang Waterfall. While cultural tourism of Stone Age is expressed by the Megalithic Site of Mount Padang. Results of the study are expected can be used by the local government as the baseline information for integrated development.

Key Words: Geological tourism, Geomorphological tourism, River tourism, Cultural tourism

INTRODUCTION

Limited knowledge related to the potential of tourism generally makes its development is not maximally done. The development of a good tourism sector is related to the packaging and managing some aspects including classification and transportation to the tourism object. Development of tourism sector in general is very influential on the improvement of the local economy. In Karyamukti Village, Campaka District, Cianjur District, West Java (Figure 1) there are natural heritage sites with geological, cultural, recreational and aesthetic values of scenic beauty, that very suitable for the purpose of geotourism.

This research is conducted in order to identify, mapping, and geological assessing the potential sites that can be developed to support the development of geotourism.

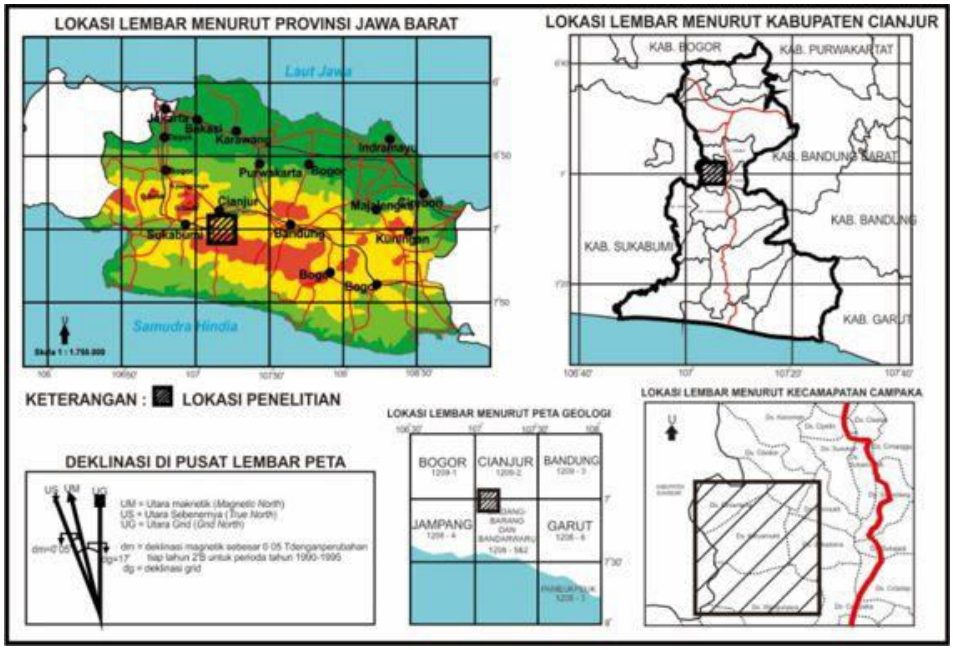

Figure1. Location Map of the Study Area

LITERATURE REVIEW

Geology

Campaka District and its surrounding area are geologically composed of sedimentary rocks and volcanic deposits (Sudjatmiko, 1972), and Cikondang Member of Beser Formation (Koesmono et.al, 1996). Based on the geomorphology classification of Van Zuidam (1983), land form of this area can be divided into 5 units: Volcanic Valley, Volcanic Hills, Intrusion Hills, Volcanic Terrace and Alluvial Plain. According to Bronto (2006), there was a great volcanic activity in Oligocene epoch, characterized by the presence of hornblende andesite igneous rock. In the early Miocene to middle Miocene the area was uplifted resulting the discontinue of deposition phase, substituted by intensive erosion process, bringing about the presence of hornblende andesite rock. At the end of Miocene, the second volcanic activity occurred, portrayed by the existence of ancient Cikondang volcanic products (Bronto, 2006), in the form of andesitic volcanic rock. In the Pliocene epoch the volcanism continued to produce pyroclastic breccia, followed by magma intrusion. The volcanism was accompanied by tectonic that resulted in faulting, continued by erosion and denudation processes.

Geotourism

Geotourism can be categorized as nature tourism or alternative tourism, which utilizes geological potential in a sustainable manner as a tourism resource (Komoo & Othman, 2002). In addition, geotourism provides geoscience knowledge for public in general and students (Chen, et al, 2015). Chen et al (2015) established a classification of tourism as shown in Table 1. And Table 2, as follows.

Table 1. Classification of Cultural Hystorical Tourism Type (Chen, et.al. 2015)

Major Category	Category
Historical and Culture Tourism Resource	Historical Culture
	Culture site of the stone age

	Culture in China's History
Ancient Architectures and Projects	Wood and Stone Architectures
	Garden Architectures
	Ancient Mausoleums
	Ancient Architectural Works
Religious Culture Landscapes	Distribution of Religions
	Religious Activities
	Religious Cultures
Ethnic Customs	Civilian Houses
	Other Ethnic Customs

Table 2. Classification of Natural Resources (Chen, et.al. 2015)

Major Category	Category
Tourism Resources of Lithosphere	Geological Tourism Resources
	Geomorphological Tourism Resources
	Cave Tourism Resources
Tourism Resources of Hydrosphere	Marine Tourism Resources
	River Tourism Resources
	Lake Tourism Resources
	Groundwater Tourism Resources
Tourism Resources of Biosphere	Bantanic Tourism Resources
	Zoological Tourism Resources
Tourism Resources of Atmosphere	Meteorological Tourism Resources
	Climatological Tourism Resources
	Clean Air Tourism Resources
Tourism Resources of Geosphere	Universe and Outer Space Tourism Resources
	Astronomical Tourism Resources

The classification of tourism based on natural resources and historical culture must be very clear, scientific, and futurist. It must then have a clear hierarchy in providing classification details, therefore the classification scheme can be used as a guide for exploration and tourism development.

METHOD of the STUDY

This study uses descriptive analytical method. In the implementation, there are several stages, including pre-mapping, data retrieval, data analysis, and synthesis. The pre-mapping stage involves initial data acquisition which aimed to be used as the supporting data. Some secondary data were collected in this stage such as Geological Map of Cianjur sheet (Sudjatmiko, 1972) Sindangbarang and Bandarwaru (Koesmono et.al, 1996), Garut sheet (Alzwar et.al. 1992) and West Java Province Map.

The data retrieval stage was directly done in the field, covering data collection on geological, geotourism, and other supporting data. The analysis stage involved dividing the land form and rock into units, and classifying the tourism type. Data analysis included laboratory analysis and studio analysis. Laboratory analyzes included petrology, petrography, and structural geology. Synthesis stage involved existing data combination both primary and secondary.

The classification of tourism types as supporting the development of geotourism map refers to the classification of the tourism type of natural resources and the tourism type of cultural history by Chen, et.al. (2015) which will be referred to create the geotourism map.

RESULTS and DISCUSSION

Geology

Based on the classification of Van Zuidam (1983), geomorphology of the study area can be divided into two units consisting of the volcanic origin and the fluvial origin units. The volcanic origin unit includes four land forms: volcanic hills, volcanic valleys, intrusive hills, and denudated volcanic hills. The fluvial origin unit expresses as alluvial plain.

Lithology in the study area, from the older to the younger respectively consists of Pogor Hornblende Andesite unit, Cikondang Andesite Lava unit, Cikondang Volcanic Breccia unit, Pyroclastic Breccia unit, Melati Intrusion, and Alluvial Deposit. The Pogor Hornblende Andesite unit consists of andesite lava, Oligocene aged (Soeria-Atmadja et al, 1994; Bronto, 2013). The Cikondang Andesite Lava unit is composed of volcanic breccia, volcanic sandstone, coarse tuff, and andesite lava with massive, sheeting joint and vesicular structures. Cikondang Andesite Lava unit is early Miocene. The Cikondang Volcanic Breccia unit is composed of volcanic breccia and tuff sandstone. The Pyroclastic Breccia unit is composed of andesite intrusion, fine tuff and pyroclastic breccia. The age of this unit is Pliocene. Melati Andesite Intrusion consists of pyroxene andesitic intrusion which includes two adjacent mountains of Mount Melati and Mount Kendang. This unit is Pliocene-aged (Koesmono et.al, 1996). Alluvial deposits consist of loose materials of various grain sizes, rough-sized sand to boulder (1 / 2-> 256 mm). The age of alluvial deposits is Holocene.

The geologic structures in the research area are joints (gash fracture, shear fracture of some which are filled with minerals) and faults. The main stresses directions are North-South and Northeast-Southwest, resulting in three general directions of fault: the Northwest-Southeast, Northeast-Southwest, and North-South. Cikondang River Fault, based on the Rickard (1972) classification belongs to Normal Right Slip Fault. Mount Melati Fault is classified into Reverse Right Slip Fault. The Cikondang Fault 2 including the Left Slip Fault. The Cimanggu Fault belongs to the Left Slip Fault. Pogor Fault is Normal Right Slip Fault. Geological map of research area can be seen in Figure 2.

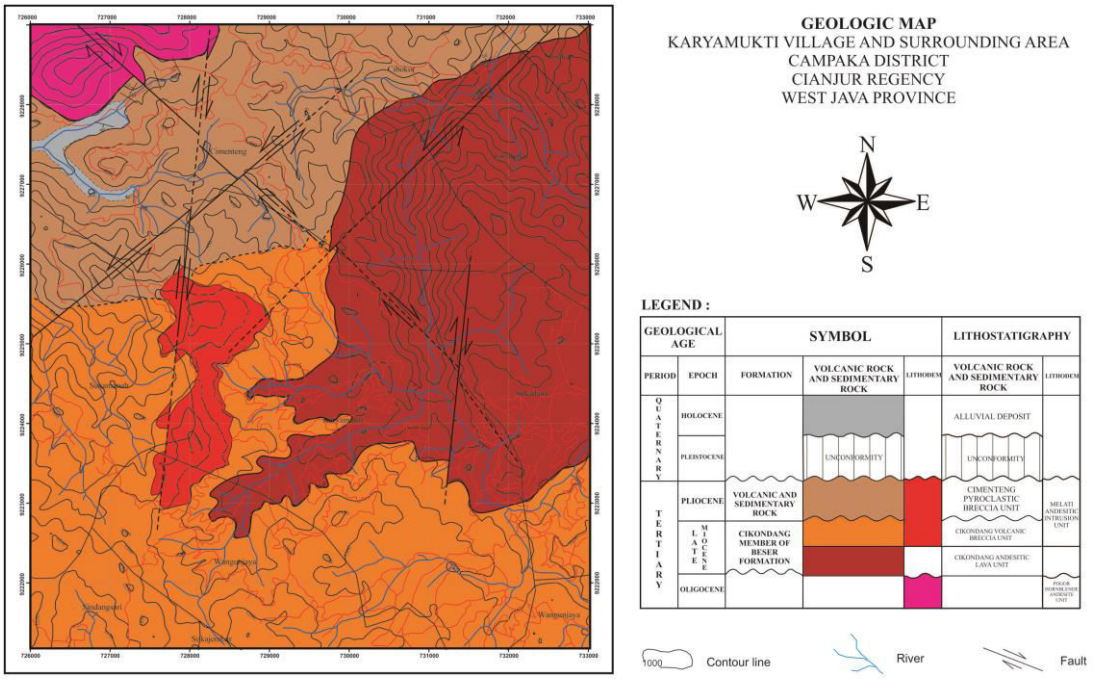

Figure 2. Geologic Map of Karyamukti and Surrounding Area

Geologic Heritages for Geotourism Development

The development of tourism in the study area is strongly influenced by the comfort of transportation infrastructure to access, which can be divided into public transport and private transportation. To get the tourist attractions in Karyamukti and surrounding areas, visitors are able to reach them by land route only, through Cianjur city, West Java. To achieve Cianjur can be done through Bandung, or Bogor city. Further visitors have to pass by the main road of Cianjur-Sukabumi towards Warungkondang Village. After arriving at the Warungkondang village, the visitors go to Cipadang - Cibokor - Lampegan - Pal Dua - Ciwangin - Cimanggu villages and finally get Mount Padang.

In the study area, based on Chen's classification there are 7 (seven) sites of four tourist types, namely geological tourism, geomorphology tourism, river tourism and stone age cultural sites that can be developed for geotourism, and detailed as follows.

1) Andesite of Pasirpogor Hill

Andesite of Pasirpogor Hill is located in Cimenteng village in the northwest of the study area, coordinates X: 727540 and Y: 9228450. It is rflecting an evidence of endogenous power that produces a hill in the form of horblende andesite rocks with massive structure, the highest elevation is 950 meters. According to Soeria-Atmadja et.al. (1994) and Bronto (2013) this hill is 32.30 ± 0.30 million years old (Oligocene epoch). As a geotourism, it belongs to a sub-category of geological endogenous landscape processes. In this hill the tourists will get a geological knowledge and experience related to igneous rock (Figure 3.)

Figure3. Pogor Hornblende Andesite Hill (A) Andesite outcrop (B). Andesite Lava (C).

2) Andesite Dyke of Cimenteng

Andesite dyke of Cimenteng is the result of magmatic activity that breaks through the weak zone of joints and faults, then frozen tobe andesite igneous rock. This object is located in Cimenteng village, precisely at the coordinates X: 727456 and Y: 9227159. The dyke is very unique to be a geological tourist destination because this belongs to a rare outcrop. In this location the visitors will get geological knowledge related to intrusion process including the contact evidence between the igneous rock and the intruded rock, i.e. pyroclastic breccia. This site belongs to geological tourism, subcategorized into landscape of geological endogenous processes.

3) Andesite Lava of River Cimandiri

Andesite lava of River Cimandiri is the result of magmatism activity from ancient Cikondang volcano that produced volcanic materials including lava flows. This object (Figure 4) is located in Cimandiri village precisely in the coordinate X: 730299 and Y: 9223942. In this destination, the visitors will get knowledge about the geological history on the Cikondang ancient volcano. This site belongs to geological tourism, subcategory the landscape of geological endogenous processes.

Figure 4. Andesite Lava at River Cimandiri

4) Gold Mining of Cimandiri

This is a gold mining. Cimandiri Gold Mine is located in the coordinates X: 728984 and Y: 9223363. In this site the visitors are able to find quartz veins which are characterized by cracks filled with minerals resulted from hydrothermal solution deposition, and clay minerals that reflected an alteration process of argillic zone. In the veins, there are some ore minerals such as manganite, galena, and pyrite. The visitors will be pleased to enter the pit observing the existing geological phenomenon. This site belongs to geological tourism, subcategory landscape of mineral resources (Figure 5).

Figure 5. Cimandiri Gold Mining

5) Cikondang Valley

The Cikondang Valley is formed due to tectonic processes that result in joints and faults. The weak zone is strongly eroded by the river, bring about the formation of a steep valley. Cikondang Valley is located in Karyamukti village, precisely at the coordinates X: 730681 and Y: 9225254. At this destination the visitors can study the genethic, dimensions, geometry, and geomophology of the valley that extends as far as 3.5 km. This site belongs to geomorphology tourism, subcategory landscape of denudated tectonic landform (Figure 6).

Figure 6. Cikondang Valley

6) Cikondang Waterfall

Cikondang waterfall is located in the village of Karyamukti on the coordinates X: 731618 and Y: 9223894. It is formed by a fault scarp expressed as the wall of the waterfall. In the fault area can be observed the presence of brecciation, with a very steep waterfall walls. In this destination the visitors can enjoy the beauty of the waterfall and learn the nature of waterfall formation that is controlled by geologic structures. This site is included into geomorphology tourism, subcategory landscape of river waterfall (Figure 7).

Figure 7. Cikondang Waterfall

7) Megalithic Site of Gunung Padang

Megalithic Site of Gunung Padang is located in Karyamukti Village, Campaka District, Cianjur Regency or X: 727166 and Y: 9226464. It is composed of brocken columnar joints of andesite rock that are cemented by clay. According to data got during excavation, drilling, geoelectric, georadar, and tomography seismic conducted by an independent integrated research team (2014), at the depth of 15 meters there is a lava body. This lava body indicates the natural formation of Padang volcano. There are such human cultivations at Gunung Padang, shown by the position of the columnar stones that is well organized almost parallel to the layer plane, whereas actually the orientation of the columnar joints are perpendicular to the direction of the magma/lava flow. In addition, there is a matrix between the columnar stones at Gunung Padang. Megalithic Site of Gunung Padang is classified as cultural site tourism, subcategory the megalithic young Stone Age. (Figure 8).

Seven tourism sites located in the same area is a great potential to perform a geotoursm development in Karyamukti village. In order to support it, a geotourism map of Karyamukti village is created as seen in Figure 9. It is expected that the local governments will follows up this idea by opening investment opportunities to encourage the tourism sector of this area. In addition the local communities need to be empowered to involve in development of their

region. They can contribute in the management, tour guidence, transportation facilities, home stays, or culinary supporting tourism. Tourism development is unlikely to stand alone. It requires support of other sectors including social, economic, cultural, and infrastructure. Thus tourism development will simultaneously realize integrated development of the region.

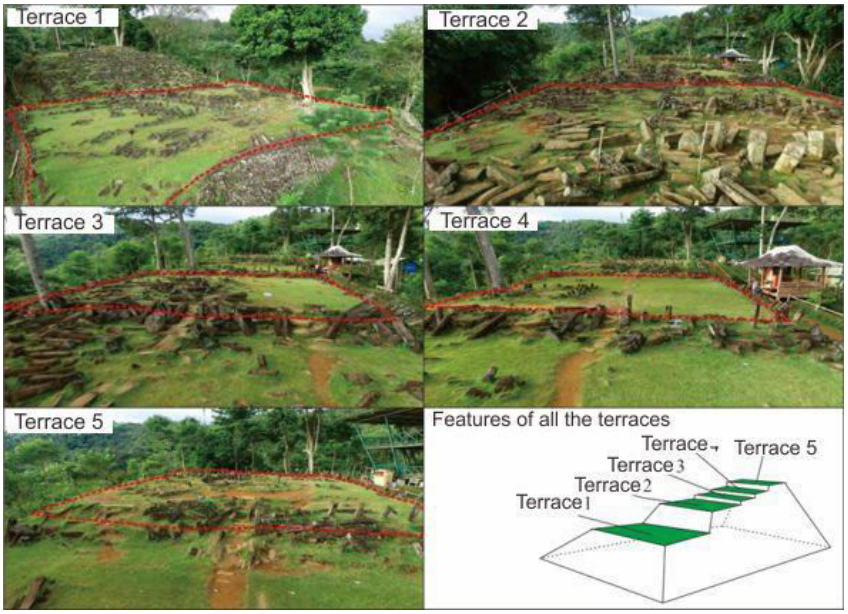

Figure 8. Megalithic Site of Gunung Padang: Consists of 5 Terraces

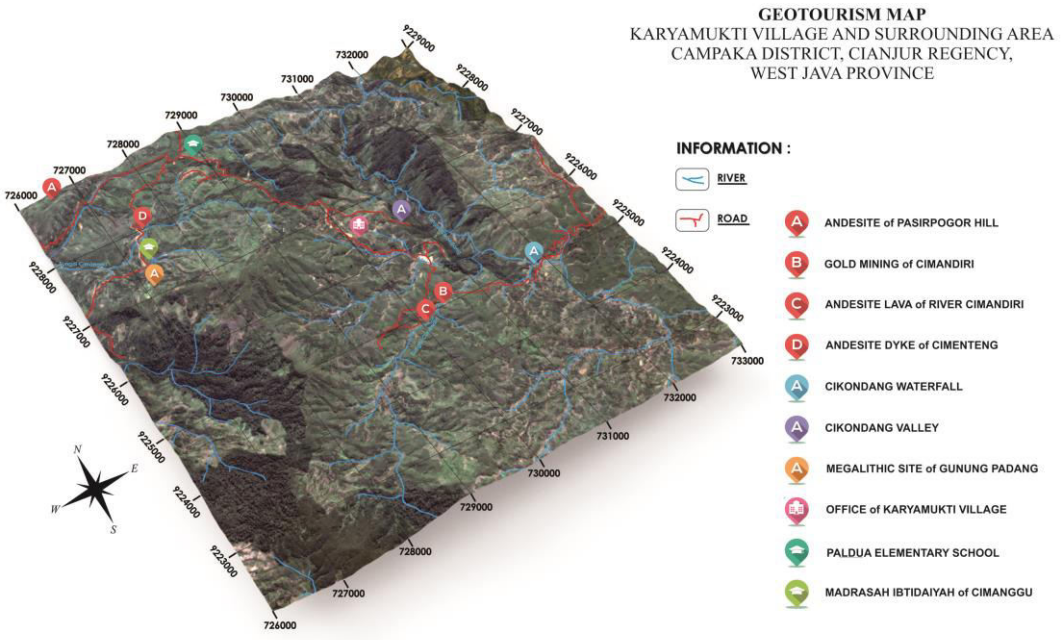

Figure 9. Geotourism map of Karyamukti and Surrounding area

CONCLUSSIONS

Based on the results of the study, it can be concluded as follows:

1) Geomorphology of the study area can be divided into two units of volcanic origin and fluvial origin. The volcanic origin unit consists of four land forms: volcanic hills,

volcanic valleys, Intrusions hills, and denudated volcanic hill. The Fluvial origin consists of Alluvial Plain.

2) Stratigraphy of the study area consists of six rock units from the older to the younger including Pogor Hornblende Andesite unit (Oligocene), Cikondang Volcanic Breccia unit (Miocene End), Cikondang Andesite Lava unit (Late Miocene), Pyroclastic Breccia unit (Pliocene), Melati Intrusion (Pliocene) and alluvial deposits (Holocene).
3) The geologic structures in the research area consist of joints and four faults, i.e. Cikondang Normal Right Slip Fault, Cikondang Left Slip Fault, Melati Reverse Right Slip Fault, Cimanggu Left Slip Fault, and Pasirpogor Normal Right Slip Fault
4) Geotourism in the research area can be classified into 4 categories including geological tourism, geomorphological tourism, river tourism and cultural sites tourism. Geological tourism consists of two subcategories namely landscape tourism of endogenous geologic processes and landscape tourism of mineral resource. Geomorphological tourism consists of landscape tourism of denudated tectonic landform. River tourism is in the form of landscape tourism of waterfall. Cultural site tourism is in the form of megalithic young Stone Age.
5) Tourism development in Karyamukti and surrounding villages requires good commitment of the local government and community empowerment in the framework of realizing integrated development in the area.

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