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PROCEEDINGS

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**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

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THE 10TH AUN/SEED-NET REGIONAL CONFERENCE ON GEOLOGICAL AND GEO-RESOURCE ENGINEERING

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TABLE OF CONTENTS

ENGINEERING CHARACTERISTIC OF FLAPPED SOILBAGS <i>Apiniti Jotisankasa¹, Kongkrai Pornpongphatthana², San Vijittpokin², and Chidpon Wongsakulkiat², Washirawat Praphatsorn¹, Kroekkiat Angkanawisalya¹</i>	<i>1</i>
DETERMINISTIC APPROACH OF DEVELOPING A PHYSICALLY-BASED MODEL FOR PREDICTING RAINFALL-INDUCED LANDLSIDES <i>Giancarlo P. Ventura.....</i>	<i>10</i>
Abandoned landfill boundary delineation using electrical resistivity imaging (ERI) technique: A CASE STUDY <i>Thanop Thitimakorn^{1,3*}, Narongsak Rachukarn² and Napassapong Jongjaiwanichkit⁴</i>	<i>19</i>
SPUN PILES FOUNDATION IN PHNOM PENH CAPITAL OF CAMBODIA <i>Peou Sieng</i>	<i>30</i>
ORIGINAL SUBSIDENCE IN SAIGON SOUTH AND RELATIONSHIP BETWEEN SUBSIDENCES WITH HOLOCEN LAYER <i>Vo Minh Quan, Tran Anh Tu, Nguyen Giang Nam, Le Thanh Phong, Vo Thanh Long, Nguyen Huynh Thong.....</i>	<i>53</i>
NATURAL PERCOLATING WATER INDUCING SLOPE FAILURES UNDER TROPICAL CLIMATE <i>Zainuddin Md Yusoff¹, Azlan Abd Aziz², Nik Norsyahariati Nik Daud³ and Haslinda Nahazanan⁴</i>	<i>63</i>
Application of Distributed Fibre Optic Sensor in Instrumented Pile Load Test <i>B.P. Tee¹, A.S.A. Rashid², R.A. Abdullah³, K.A. Kassim⁴, H. Mohamad⁵</i>	<i>73</i>
CENTRIFUGE MODEL TEST AND ITS NUMERICAL ANALYSIS ON TUNNEL DEFORMATION CAUSED BY REGIONAL GROUND UPHEAVAL <i>Sokkheang Sreng¹, Takuya Kusaka², Hitomi Sugiyama³, Hiroshi Tanaka⁴</i>	<i>83</i>
GEOTECHNICAL INVESTIGATIONS AND CHARACTERIZATION OF SOIL CONDITIONS IN NORTHERN YANGON AREA <i>KhinSoe Moe¹ and Kyaw Htun¹</i>	<i>94</i>
ASSESSING THE SUITABILITY OF MINE TAILINGS AS EMBANKMENT MATERIAL <i>Mary Ann Q. Adajar¹ and Mark Albert H. Zarco²</i>	<i>107</i>

EFFECT OF OVERBURDEN DEPTH AND SUPPORT SYSTEM ON STABILITY OF ROADWAY IN UNDERGROUND COAL MINE UNDER WEAK GEOLOGICAL CONDITION IN INDONESIA

Phanthoudeth PONGPANYA^{1,2}, Takashi SASAOKA¹, Hideki SHIMADA¹119

Hiroshi TAKAMOTO¹, Akihiro HAMANAKA¹, Sugeng WAHYUDI¹119

Analysis of electroseismic data for geothermal exploration through SHTE and PSVTM modeling approach: first result

Wahyudi W. Parnadi¹, Agus Laesanpura¹, Alamta Singarimbun², Andi Syamrizal¹, Apulina Priska¹139

Reservoir Quality of Ngrayong Sandstone in Tempuran Village Area, Rembang Zone, Western part of North East Java Island, Indonesia

Myo Min Htun^{1,2,3}, Sugeng Sapto Surjono^{2,4}, Jarot Setyowiyoto^{2,5}148

MONTE CARLO INVESION FOR PORE GEOMETRY AND ELASTIC MODULI ESTIMATION OF OCEANIC BASALT OF THE JUAN DE FUCA RIDGE

Kakda Kret¹, Tatsunori Ikeda², Takeshi Tsuji^{1,2}161

GEOLOGICAL CHARACTERISTICS AND CHALLENGES OF UNCONVENTIONAL HYDROCARBON PLAYS IN INDONESIA; A CASE OF THE SOUTH SUMATRA BASIN

Alfend Rudyawan^{1}, Benyamin Sapiie¹, Agus Handoyo Harsolumakso¹, Chalid Idham Abdullah¹, Indra Gunawan¹, Meli Hadiana¹, Dwiharso Nugroho¹, Asep H.P.K¹, Agus M. Ramdhan¹, Arii Ardjuna², Yarra Sutadiwiria², Alfian Usman², Rizky Nur Hakim², Wisnu Prihantono²170*

RESERVOIR CHARACTERIZATION OF E SEQUENCE, NAM VANG FIELD, CUU LONG BASIN, VIETNAM

Vo Thanh Hung¹, Jarot Setyowiyoto² and Djoko Wintolo³179

THE PETROLEUM FISCAL REGIME ANALYSIS: A CASE OF MOZAMBIQUE

Nelson Victor¹ and Thitisak Boonpramote²191

STRATIGRAPHIC POSITION AND THE AGE OF PITHECANTHROPUS ERECTUS VIII DISCOVERED IN SANGIRAN AREA, CENTRAL JAVA, INDONESIA

*C. Danisworo *)205*

The Effect of Sodium Metasilicate on IFT Reduction as Alkaline Flooding for Enhanced Oil Recovery

Chea Samneang¹, Kyuro Sasaki¹ and Yuichi Sugai¹218

GAS HYDRATE AND FREE GAS DISTRIBUTION IN THE NANKAI SUBDUCTION MARGIN: INSIGHT FROM AUTOMATIC SEISMIC VELOCITY PICKING

Chanmaly Chhun¹, Arata Kioka², Jihui Jia¹, Takeshi Tsuji¹.....224

Mineralogy, physical properties, and genesis of clay deposits as a raw material for brick industry from Gianyar, Kebumen and Magelang areas, Indonesia

I Wayan Warmada & Nursari Siregar.....241

DEVELOPMENT STRATEGIC FOR PILLOW LAVA AS GEOHERITAGE AND EDUCATION TOURISM IN YOGYAKARTA INDONESIA

Purbudi Wahyuni and Istiana Rahamawati.....249

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

Rian Dwi Anggara Putra¹, Sari Bahagiarti Kusumayudha¹, Sugeng Raharjo¹.....256

Geological Overview of Cisuru Prospect, Gurat Regency, West Java, Indonesia

Khayay Oo^{1,2}, I. Wayan Warmada¹, Anastasia Dewi Titisari¹ and Koichiro Watanabe².....265

Initial Study on Alteration and Fluid Inclusion Microthermometry in Oyadav South, Ratanakiri, Cambodia

Seang Sirisokha^{1}, Tetsuya Nakanishi², Kotaro Yonezu¹ and Koichiro Watanabe¹.....274*

PETROGRAPHY AND GEOCHEMICAL OVERVIEW OF THE ERTSBERG INTRUSION COMPLEX, WEST PAPUA, INDONESIA

Hnin Thet Lwin285

GEOLOGICAL CHARACTERISTICS OF KAOLIN CLAY FORMATION AT SCHIST GRANITE CONTACT ZONE IN KINTA VALLEY, MALAYSIA.

Khong Ling Han, Hareyani Zabidi, Kamar Shah Ariffin.....294*

THE ATTRIBUTION OF CAMBODIAN SILICA SAND AND POSSIBILITY TO EXPORT TO THAILAND

Apisit Numprasanthai^{1}, Somsak Saisinchai² and Narumas Pajonpai³.....305*

Community Engagement for Sustainable Mineral Development

Thitisak Boonpramote¹.....316

THE EXPERIMENTAL STUDY OF SOLIDIFICATION OF POTASH MINE WASTES

Thao Nguyen Anh Ngo¹ and Sunthorn Pumjan².....322

**GEOCHEMISTRY AND WALL-ROCK ALTERATION
ASSOCIATED WITH HYDROTHERMAL GOLD
MINERALIZATION AT ONZON-KANBANI AREA, THABEIKKYIN
TOWNSHIP, MYANMAR**

Aung Tay Zar^{1,2}, I Wayan Warmada¹, Lucas Donny Setijadji¹, and Koichiro Watanabe³335

**GROUNDWATER CHEMISTRY OF SPRINGS IN THE SOUTHERN
SLOPE OF MERAPI VOLCANO, SLEMAN REGENCY,
YOGYAKARTA SPECIAL REGION, INDONESIA**

Johnny Boulom¹, Doni Prakasa Eka Pruta², Wahyu Wilopo².....351

**GROUNDWATER FLOW AND ITS APPLICATION TO PREDICT
THE SOURCE OF COPPER CONTAMINANT IN AQUIFER, CASE
STUDY IN MANTRIJERON DISTRICT, YOGYAKARTA CITY,
INDONESIA**

Ho Gia Duc¹, Doni Prakasa Eka Putra² and Heru Hendrayana³366

**REMOVAL OF SELENIUM (Se) IN WATER BY USING ZEOLITE
TUFF AS ADSORBENT FROM TEGALREJO AREA,
GEDANGSARY DISTRICT, GUNUNGKIDUL REGENCY, SPECIAL
PROVINCE YOGYAKARTA INDONESIA**

*Manixone Thepgothy^{*1}, Doni Prakasa Eka Putra¹, Wahyu Wilopo¹385*

**Evaluation of Aquifer Characteristics and Hydrochemical Analysis in
Budalin, Monywa and Chaung-U townships of Sagaing Region,
Myanmar**

Zaw Myo Oo¹, Day Wa Aung²392

**DISTRIBUTION OF ARSENIC IN RIVER SEDIMENTS
AFFECTED BY NATURALLY OCCURRING ARSENIC IN
GROUNDWATER**

*Masataka SHIMAMURA^{*a}, Asumi SAKAGUCHI^a, Kana ODASHIRO^a, Nobuyasu ISHIBASHI^b
and Toshifumi IGARASHI^a407*

**Relationships between Contaminations and Land Use around
Citarum River Basin in Indonesia**

*Ritsuto Hayashi¹, Toshifumi Igarashi¹, Shunitz Tanaka², Ryusuke Hatano³, Takashi Inoue³,
Tsubasa Otake¹, Junjiro Negishi², Masayuki Ikebe⁴, John Bower⁵, Hajime Matsushima³, Ryo
Takeda¹, and Herto Dwi Ariesyady⁶415*

**Arsenic Removal from Groundwater using Cambodian Clayey Soil:
Batch and Column Study**

*Pich B.^{*1}, Oum B.¹, Beak S.¹, Ty B.², Orn K.², Long R.C.², and Sato T.³423*

**BALL CLAY FROM LANGKAP PERAK AS A POTENTIAL
ABSORBENT MEDIA**

Zulaika Zakaria, M. Mukhri Mohamed, Kamar S. Ariffin, Norlia Baharun.....423

**REDUCTIVE LEACHING OF SYNTHETIC MANGANESE ORE
USING BAMBOO SAWDUST AS REDUCTIVE AGENT: A
COMPARISON BETWEEN DIRECT HYDROLYSIS-LEACHING
PROCESS AND SIMULTANEOUS HYDROLYSIS-LEACHING
PROCESS**

Kimberly Tay¹, Nurhidayah Muthalib¹, Kamar Shah¹, Suhaina Ismail^{1}*429

**IMMOBILIZATION OF HEAVY METALS CONTAINED IN MINE
WASTES OF KABWE, ZAMBIA BY DIFFERENT ADSORBENTS**

*Kenta NOTOa, Toshifumi IGARASHIa, Mayumi ITOa, Kazunori NAKASHIMAa, Tsutomu
SATOa, Lawrence KALABAA, Shun TAKAKUWAA, Naoto KIYANAGIb, Yuki MATSUDAb,
Hokuto NAKATAc, Shouta NAKAYAMAc, and Mayumi ISHIZUKAc*439

**THE EFFECTS OF GEOMETRICAL PROPERTIES OF PARTICLES
ON RECYCLING TREATMENT BY PHYSICAL SEPARATION
TECHNIQUES: A REVIEW**

Theerayut Phengsaart^{1,}, Mayumi Ito², Naho Kitajima¹, Arisa Azuma³, Carlito Baltazar
Tabelin², and Naoki Hiroyoshi²*446

**RESEARCH ON ALUMINA EXTRACTION FROM KAOLIN OF
PHUTHO PROVINCE BY SOLID STATE REACTION**

The Vinh La, Minh Khoi Vu460

**RECOVERY OF BENTONITE FROM WASTE DRILLING MUDS IN
BORED PILES**

Jakapan Pimolrat^{1,}, Somsak Saisinchai² and Apisit Numprasanthai³*467

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.

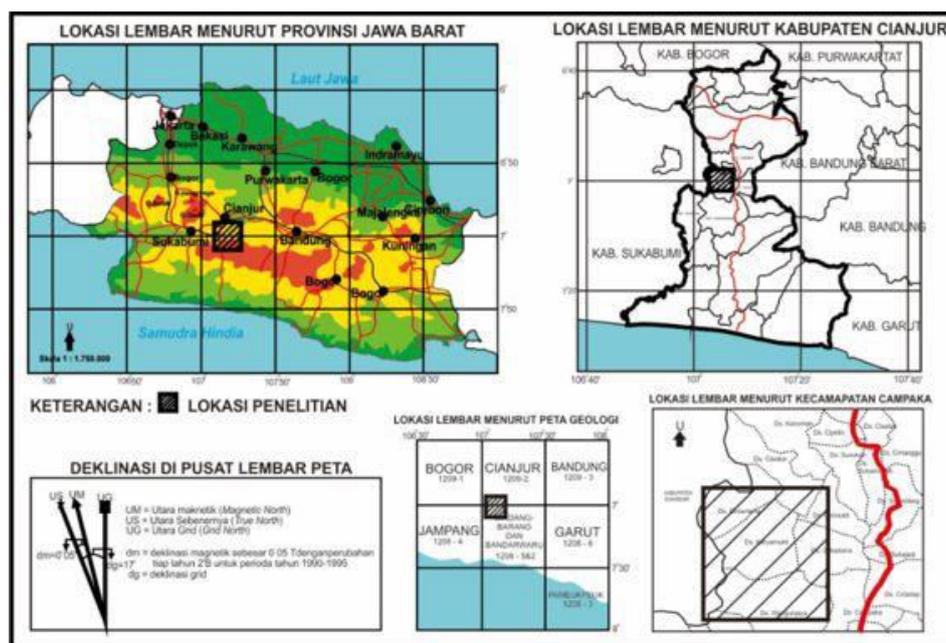


Figure 1. Location Map of the Study Area

LITERATURE REVIEW

Geology

Campaka District and its surrounding area are geologically composed of sedimentary rocks and volcanic deposits (Sudjatmiko, 1972), and Cikondang Member of Besar 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

Ancient Architectures and Projects	Culture in China's History 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.

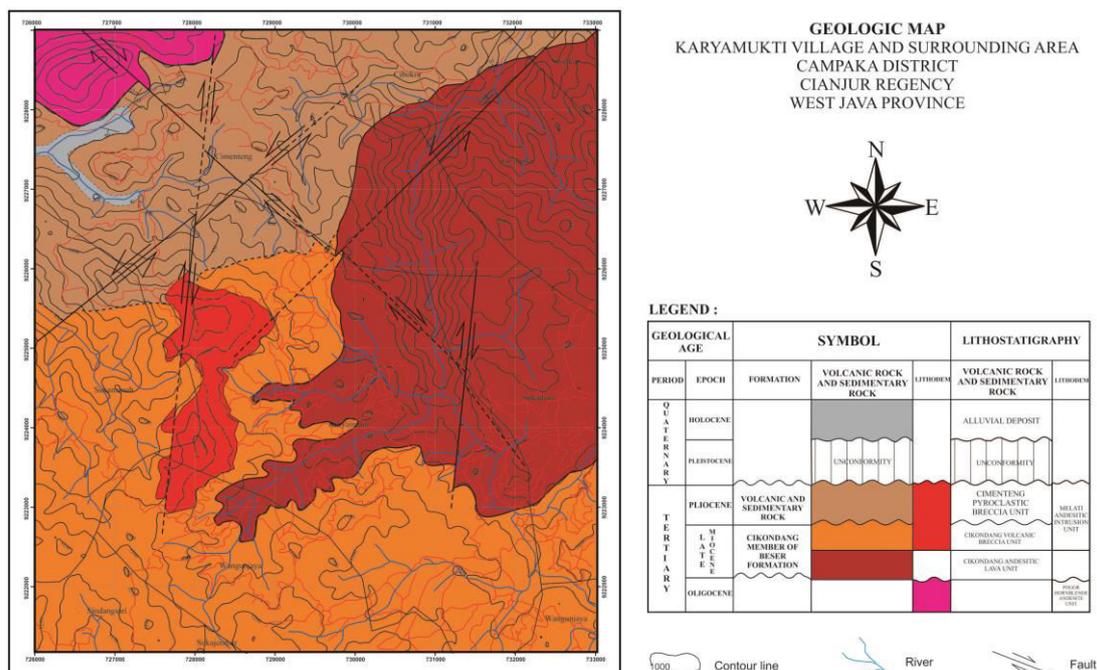


Figure 2. Geologic Map of Karyamukti and Surrounding Area

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 reflecting an evidence of endogenous power that produces a hill in the form of hornblende 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 subcategory 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 to be 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).

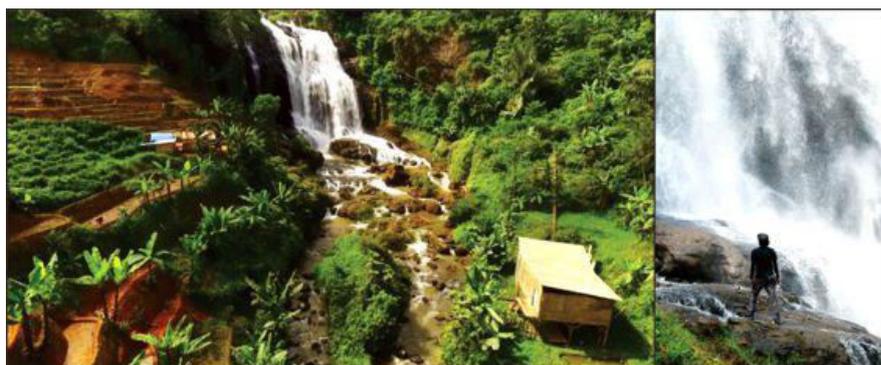


Figure 7. Cikondang Waterfall

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 broken 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 geotourism 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 follow 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 guidance, 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.

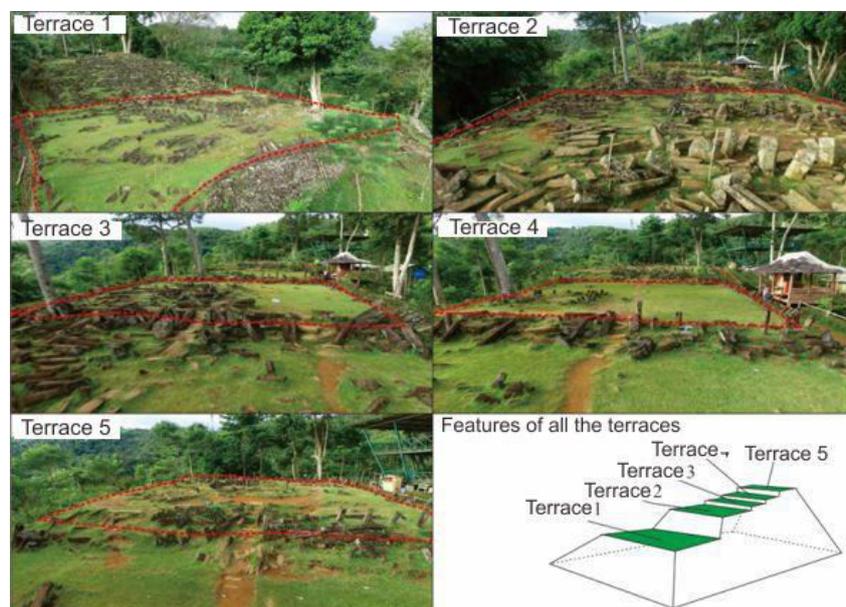


Figure 8. Megalithic Site of Gunung Padang: Consists of 5 Terraces

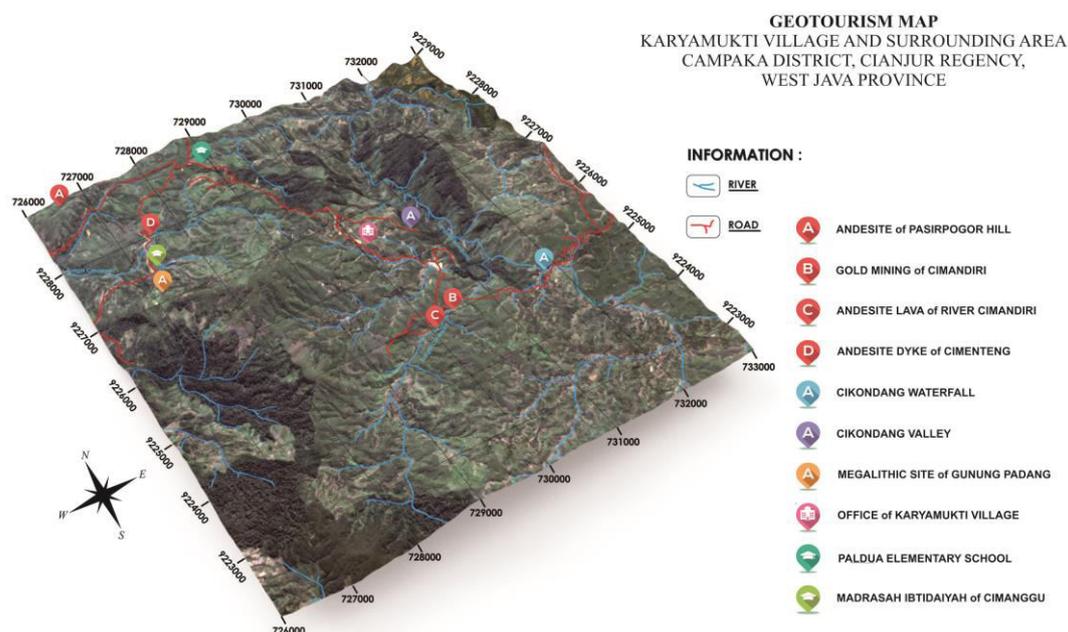


Figure 9. Geotourism map of Karyamukti and Surrounding area

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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