Vol 3-Sep2018
ISSN: 2541-3023

Unicharacteristic of Geomorphological Landscape & Depositional Environment in Talawi Hilir: Geotourism Value of Sawahlunto City, West Sumatra, Indonesia.

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Abstract. TalawiHilir Village, Talawi HilirSubdistrict, Sawahlunto City, West Sumatra Province is one of the areas that have interesting geological conditions to study. The objective of this research are interpret of some unicharacteristic include: geomorphologic processes, depositional environment and potentialgeotourism. The methods of study consist of geological data field collection and laboratory include: rock sample, collect data of strike/dip, contact between lithologies, structure of geology, geomorphological photo and map. The result of the analysis of geomorphological aspects of the study area was classified into four units: Alluvial Plain Fluvial Geomorphology Unit, High Hills Undulating Structural Geomorphology Unit, Steep Hills Structural Geomorphology Unit, Very Rough Mountains Denudation Geomorphology Unit. Petrological analysis classified into four units lithologies: Claystone Unit, Limestone Units, Sandstone Units and Breccia Unit. Claystone Unit as interprets in shallow marine depositional environments on the lower fan, which is characterized by the flow turbidite. Limestone Unit as interpret as depositional environments in shallow sea, the Sandstone Unit as interpret as lacustrine depositional environment and Breccia Unit as interpret as alluvial fan depositional environment. Geotourism potential particularly in geological variation, research area were unique characterization on landscape, landform, rock outcrop, rock unit, rock type, and minerals.

1. Introduction

The study area is located at 00 37 '00 "LU and 1000 46' 00" BT, which is included in the map of West Sumatra map scale 1: 12,500 with the area of the study 2.5 x 3 Km2. Talawi Hilir Village, Talawi Hilir Subdistrict, Sawahlunto City, West Sumatra Province is one of the areas that have interesting geological conditions to study, both from the aspects of geomorphology, petrology, stratigraphy, environment deposition and geotourism potential.In physiographic area of research into the basin zone Ombilin [1][2][3]. This research was conducted in the framework geological research, Ombilin Basin is a basin "pull apart" due to the movement of the Sumatra Fault System (Sumatra fault zone)[4][5][6]. Extends the overall geometry of the basin Ombilin with the general direction of Northwest - Southeast, bounded by faults trending Northwest-Southeast Fault Sitangkai in Northern and Southern Silungkang both more or less parallel to the Sumatra Fault System [7][8][9][10]. Ombilin Basin can be divided into some formations include of Brani Formation, Sangkarewang Formation, Ombilin Formation[11][12].

2. Method

Data collected and process in this research include of contour map or base map, rock sample, fossil content, and strike/dip. Method use in this research classified into three: Field orientation, laboratory and studio. The tools used for data collection in the field are: A contur map or basic map scale of 1: 12,500 map sheet Talawi Hilir. Geological hammer, hammer includes a hammer igneous and sedimentary rocks to take samples. Lup lens to observe mineral and fossil. Comparator grain size and mineral. HCl with solution 0.1 N used to test the content of carbonate rock samples were observed. Measuring tape to perform measurements onoutcrops.

The geomorphology is defined as a study that describes the shape of land and process and the relationship[13]. The landform and the process in the arrangement of spatial. The formation of the landscape is the result of the geomorphological process caused by the endogenous and exogenous forces. The landscape has varied shapes and can be classified based on certain factors such as process, phase, the type of composing lithology as well as the influence of geological or tectonic structures that work. The classification of landscapes (Table 1) and (Table 2) into geomorphological units based on several factors through five approaches are: Morphography is an aspect that describes the morphology of an area such as terrain, hills or mountains [14]. Morphometry is the value of an area geomorphology aspect, such as slope, elevation, slope length and roughness relief can be seen in Table 3. Passive morphostructure is the aspect that examines the lithology/rock type and rock structure associated with the erosion process, such as Cuesta, hogback and dome [15]. Active morphostructure is the aspect that examines the activity of endogenous processes such as vulcanism, fractures and creases, such as volcanoes, anticline mountains, fault slopes. Morphodynamics are aspects that describe exogenous processes associated with wind, water or ice motion, such as sand dune, fluvial plain, sedimentation or desert [1][16][17].

Table 1. Landscape Unit Classification Based on High

Relief Unit	Angle Slope (%)	High (m)
Flat or nearly flat	0-2	<5
Corrugated / sloping ramps	3- 7	5-50
Wavy	8 - 13	51-75
Hilly Wavy	14-20	76-200
Hilly sharp steep	21 -	55200-500
Mountains sharp cuts	55-140500	- 1000
Very steep	Mountains>140>	1000

Table 2. Classification of Landscape Unit

Landform	Symbol	Color
Structure Formation	S	Purple
Origin of volcano formation	V	Red
Denudation Formation	D	Coklat
Sea origin Formation	M	Biru Tua
river origin / fluvial Formation	F	Green
Wind Formation	A	Yellow
Karst Formation	K	Orange
Glacial Origin Formation	G	Blue Bright

Table 3. Classification Structural Landform

Geomorphologic alProcesess	Landform	Code	Structural Landform
Endogenous	Structural	S17	Valley Structural
Exogenous	Denudational	D1	Eroded Hills

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This lithology is used as controller in determining limit - geological units. Lithology may affect the morphology of rivers and topology networks that facilitate weathering and rock resistance to erosion. Petrography is an analysis of the composition of rocks using a microscope to determine the name of rocks more accurately for the purposes of determining the deposition environment based on the percentage of rock composition. In petrographic observations, we must be able to determine the amount of composition volumetrically to determine precisely the name and texture of the rock [1][18].

The basic used for the naming/classification of rocks is based on the composition of mineral constituents of rock and based on the texture of rocks. Both criteria are not only useful for the description (naming) of rocks but also for the origin of rock events. Calculation of percentage of mineral sedimentary rock composition can be seen in Figure 2 and Figure 3. Method of Rock Naming: Calculates the percentage of the presence of a major mineral, where the amount of Q + A + P + RF should be 100%. Q = Quartz, A = Alkali feldspar, P = Plagioclase, RF = Rock Fragment, show in Figure 1. If the number of primary mineral percentages is not 100% then the main mineral count is recalculated to 100%. Plot the percentage price of the main mineral into the diagram to get the name of the rock [1][19].

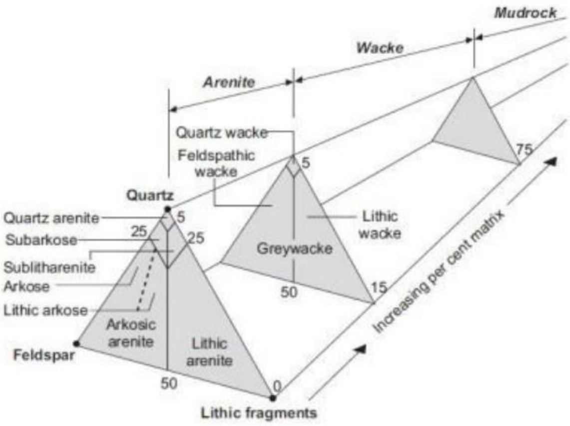

Figure 1. Classification of Sandstone according to Pettijohn (1975)

Geotourism is defined as tourism that sustains or enhances the distinctive geographical character of a place—its environment, heritage, aesthetics, culture, and the well-being of its residents [20][21][22][23][24][25][26][27]. Geological context used for geotourism evaluation consist of Landscape, Lanforms, Rock Outcrops, Rock Types, Sediment, Soils and Crystal, Show in Figure 2.

Figure 2. Geological context triangle used for geotourism evaluation

3. Result and Discussion

Result of study consist of 3 aspect, include of geomorphology, petrological and environment deposition, and geotourism potential.

3.1 Geomorphology

The characteristic of geomorphology unit of research area classified into four: Alluvial Plain Geomorphology Unit, High Hills Undulating Geomorphology Unit, Steep Hills Geomorphology Unit, Mountains Very Rough Geomorphology Unit, Show in Table 4.

Tabel 4. Geomorphology unit of research area

Geomorphology Units	Form of Origin	Code	Morphology		Morphogenesis	
			Morphometry	Morphography	Lithologi	Morphodynamic
Alluvial Plain Fluvial Geomorphology Unit	Fluvial	F1	Slope percentage 0-2%	Plain	Breccia, Sandstone.	Agradation/ Progradation
High Hills Undulating Structural Geomorphology Unit	Structural	S12	Slope percentage 2-7%	Undulating	Sandstone, Silt, Breccia.	Erosion, Weathering, Endogenic.
Steep Hills Structural Geomorphology Unit		S4	Slope percentage 7-30%	Steep	Sandstone, Siltstone	
Very Rough Mountains Denudational Geomorphology Unit	Denudation	D10	Slope percentage >30%	Very Rough Mountain	Claystone, Siltstone, Breccia, Crystalline limestone.	Erosion Weathering

a. Alluvial Plain Fluvial Geomorphology Units

This unit coverage is around 25% of the area of research that has lithology breccias and sandstones. With the percentage of slope of 0% - 2%, show in Figure 3.

Figure 3. Alluvial Plain Fluvial Geomorphology Units

b. High Hills Undulating Structural Geomorphology Unit

This unit coverage is around 65% of the study area, with the percentage of slope 7% - 15%. Geomorphological unit is composed of lithology such as sandstone, silt, and breccia, show in Figure 4.

Figure 4. High Hills Undulating Structural Geomorphology Unit

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ISSN: 2541-3023

c. Steep Hills Structural Geomorphology Unit

This unit coverage is around 15% of the study area with the percentage slope of 15% - 30% composed were sandstone and siltstone lithology, show in Figure 5.

Figure 5. Steep Hill Structural Geomorphology Unit

d. Very Rough Mountains Denudation Geomorphology Unit

This unit coverage is around 5% of the study area with the percentage slope of 70% - 140% composed of sandstone lithology. The characteristic of lithology unit of research area classified into four consist of: Claystone Unit, Sandstone Unit, Breccia Unit, and Crystalline Limestone Unit, show in Figure 6.

Figure 6. Very Rough Mountains Geomorphology Unit

3.2 Petrological and Depositional Environment

Petrology analysis uses several parameters to analyze rock lithology, namely, colors consisting of fresh colors and colors, texture consisting of large, grain shape, container, sorting, permeability, hardness, sedimentary structure, carbonate content, mineral composition, hardness and contact. Stone units in the study area are four: Claystone Unit, Sandstone Unit, Breccia Unit, and Crystalline Limestone Unit. Claystone unit has depositional environment in turbidite flow area, Sandstone U nit in lacustrine area, Breccia Unit in lower part of alluvial fan and Crystalline Limestone Unit in shallow marine, show in Table 5.

Table 5. Stratigraphic coloumn of study area

Age	Formation	Litology Unit	The continuity of regional stratigraphic relationships	Depositional Environment
Early Miocene	Lower Member of Ombilin	Claystone		Turbidite flow
Oligocene				
Eocen				
Paleocen	Sangkarewang	Sandstone		Lacustrine
	Brani	Breccia		Lower part of alluvial fan
Pre-Tertier	Silungkang	Crystalline Limestone		Shallow marine

a. Claystone Unit

Claystone in the research area shows characteristics weathered colour is greenish brown and fresh colour is brown, grain size <1/256 mm, grain shape is rounded , well sorted , permeability being shown with absorption fast enough when drops of water, can be soft squeeze, show in Figure 7. Spreading widely available in the northern part of the study area. Characteristic of depositional environment of this lithology unit is interpret in the lower part of the fan, which is characterized by the existence of the turbidite flows.

Figure 7. Photo geology show claystone outcrop

b. Sandstone Unit

Sandstones in the research area shows the characteristics weathered colour is grayish yellow, fresh colour is gray, grain size from 0.125 to 0.25 mm were classified as a fine sandstone, grain shape is very

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ISSN: 2541-3023

rounded, very well sorted with a uniform grain size, poor permeability sandstone indicated by the length of absorbing when drops of water, hardness is very compact, show in Figure 8. Sandstone in research area classified as a arkose sandstone with percentage of 55% quartz, 40% feldspar, 5% rock fragments. Characteristic of depositional environment of this lithology unit is interpret in lacustrine area.

Figure 8. Photo geology show sandstone outcrop

c. Breccia Unit

Breccia in the area of research show characteristics of weathered colour is brownish gray whereas the fresh color dark gray, size of fragments is 64-256 mm classified as a cobble, roundness of grain is very angular, low permeability indicated by the grain size is not uniform, and very compact, show in Figure 9. This classified as polymic breccia with fragments type consist of igneous and sedimentary rocks. Spreading widely available in the west to the east area of research. Characteristic of depositional environment of this lithology unit is interpret in lower part of alluvial fan area.

Figure 9. Photo geology show breccia Outcrop

d. Crystalline Limestone Unit

Limestone in the research area shows the characteristics weathered colour is Grayish white whereas fresh colors is white, irregular sides of the field, the pieces show the surface area of the rugged, compact hardness, carbonated consists of 99% crystallize calcite, show in Figure 10. Characteristic of depositional environment of this lithology unit is interpret in shallow marine. Depositional environment of research area was show in Fig11.

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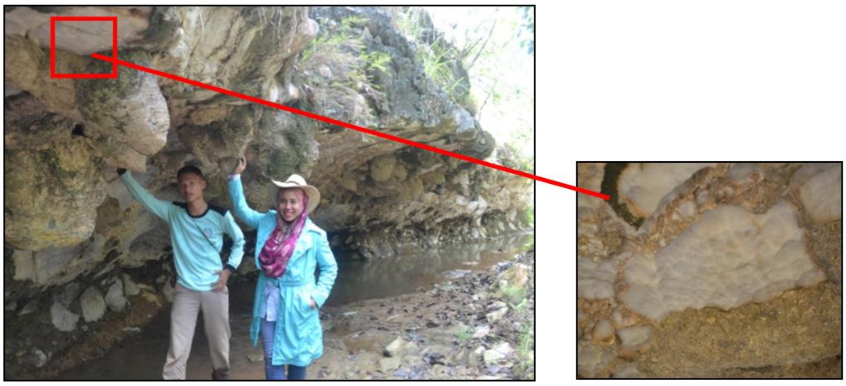

Figure 10. Crystalline limestone outcrop

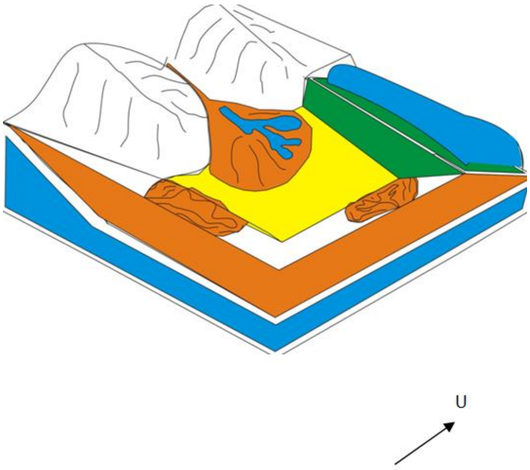

Figure 11. Depositional environment illustration of study area .

3.3 Geotourism Potential

Based on geotourism potential particularly in geological variation, research area have unique characterization on landscape (consits of Alluvial Plain Fluvial Geomorphology Unit, High Hill Undulating Structural Geomorphology Unit, Steep Hill Structural Geomorphology Unit, Very Rough Mountain Denudation), landform (consists of Alluvial, High Hill Steep Hill, Mountain), rock outcrop (clearly seen some of outcrop such as Claystone outcrop, Sandstone outcrop, Breccia outcrop, Crystalline Limestone outcrop), rock unit (consist of Claystone Unit, Sandstone Unit, Breccia Unit, and Crystalline Limestone Unit), rock type (consist of claystone, sandstone, breccia, and crystalline limestone) and mineral composition (observed by naked eye consist of quartz, feldspar, rock fragment and calcite), show in triangle Figure 12.

Figure 12. Triangle geoturism potential particularly in geological variation in study area

4. Conclusion

Unicharacteristic of Talawi Hilir consist of lithology, depositional environment geomorphology have particular apart. The characteristic of geomorphology unit classified into four: Alluvial Plain Fluvial Geomorphology Unit, High Hills Undulating Structural Geomorphology Unit, Steep Hills Structural Geomorphology Unit, and Very Rough Mountains Denudation Geomorphology Unit. This unicharacteristic contributes to the potential value of geotourism in the research area. The characteristic of lithology unit classified into four consist of: Claystone Unit, Sandstone Unit, Breccia Unit, and Crystalline Limestone Unit. Depositional environment interpret from alluvial fan, lacustrine until shallow marine. Based on geotourism potential particularly in geological variation, research area were unique characterization on landscape, landform, rock outcrop, rock unit, rock type, and minerals.

5. Acknowledgments

Acknowledge to LPPM Universitas Islam Riau which has provided research grants. To all field teams that help collecting data, also labor Geological Engineering, Faculty of Engineering, Universitas Islam Riau which provides facilities and tools.

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