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RESEARCH ARTICLE

Geotourism on XIII Koto Kampar: An Approach for Sustainable Eco-Geo System

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Abstract

XIII Koto Kampar has become one of the potential geotourism destinations in Riau Province. The beauty of geomorphological view of XIII Koto Kampar is the main attraction for tourism. This study aims to expose the uniqueness of geological conditions that form the geomorphological of study for educational, social and economic purposes. The method used for this study is a combination of geological and geomorphological mapping and assess the inventory of geosites. Geomorphological of study area is consist of wide lake with some islands on it. Based on the elevation, geomorphology of study area devided into four which are flatland, gentle hill, steep hill and very steep hill. The result of geological mapping shown there are two dominated rock claystone and sandstone. Geotourism potential of study area classified into three main zone namely geomorphological landscape zone, water play zone and waterfall zone. Sustainable system of geotourism of XIII Koto Kampar is potential livelihood to increase the economical of local society.

Keywords: Geotourism, geology, geomorphology, sustainable, XIII Koto Kampar

1. Introduction

Geotourism is a form of special interest tourism activities that focus primarily on the geological appearance of the earth's surface and those contained therein in order to encourage understanding of the environment, nature and culture, further as a form of appreciation and conservation activities, as well as having a concern for local wisdom. Geological phenomena are basically very diverse, each forming a landscape that has its own value, exoticism and uniqueness, which is suitable to be managed as a tourist attraction.

The XIII Koto Kampar is one of sub-district at Riau Province in Sumatra Island. Sumatra island is formed by collision between oceanic crust (Pasific plate) and continental crust (Eurasia plate). There is a considerable diversity of geomorphological formed, lithological variety and geological structure and relief. Geotourism destination of XIII Koto Kampar formed by an enormous variety of natural and semi natural process. Geotourism become popular within a decade back. There are many publication about geological and geomorphological heritage, geotourism and geopark around the world (Arrad et al., 2020; Koh et al., 2014; Newsome et al., 2012; Rocha and Ferreira da Silva, 2014; Solarska and Jary, 2010; Yuskar, 2016)

The aim of the paper is measure the potential of geotourism including geological and geomorphological heritage within XIII Koto Kampar. The improvement and valorization of geotourism destination can be suggested to increasing the educational, social and economic local society and tourist. The final purpose is to develop the sustainable eco-geo system of tourism at XIII Koto Kampar.

2. Methods

This study conducted within 4 steps, geological mapping, geomorphological mapping, identification of geotourism destination and assessment of geosite inventory (Fig 1). The study begin with geological mapping that include study literature of study area. Literature review aiming to get brief idea about geological setting and condition of study area. The information that got will be useful during field observation. The authentic data of geology collected during fieldwork or field observation. Field observation performs with tracking the study area to find the outcrops, outcrops observation and plotted location using handheld GPS (Kausarian et al., 2019, 2018, 2016;

Suryadi, 2016). Second Steps is mapping the geomorphology of study area by using Digital Elevation Model (DEM). DEM of study area generate using demnas data that processed by ArcGIS application.

Third steps is identification of geotourism destination that done by ploting the location and produce a map that describe those destination. The geotourism destination will be classified based on the main attraction of it. Final steps is examined all the geotourism destination based on four main viewpoints which are scientific research, education, accessibility for geotourism and state of preservation (Knapik, 2007 on Solarska and Jary, 2010). All the viewpoints will measure with fix criteria. Each critetion has five features. They are diversified for the sake of quality and quantity and have appropriate poin weight (tabel 1).

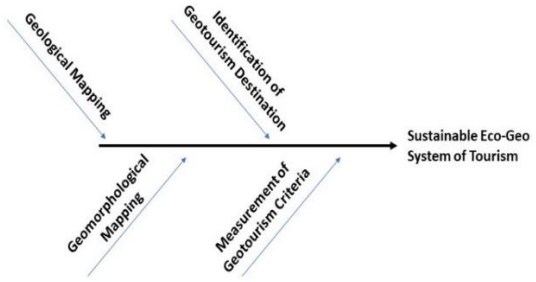

Fig 1. Workflow of this study

Table 1. Criteria of assessment for inventoried geotourism destination (according to knapik, et. Al, 2009, modified)

Criterion	Traits	Points
Accessibility	Site clearly visible, located directly on the touristic trail or nature's path	5
	Site clearly visible, located on the road or path	4
	Site barely visible, located more than 250 m away from the path or road	3
	Site difficult to access for tourist (ex. Significantly overgrown or difficult to access	2
	Site unavailable for tourist	1
State of preservation	Well preserved site with no visible sign of degradation	5
	Site in slightly violation of its structure	4
	Partially destroy	3
	Site heavily modified by human	2
	Site destroyed – loss character of geosites	1
Scientific worth	Very high: one site in the region, unique in a wider scale	10
	High: very important for region studies	8
	Average: significant for regional research	6
	Low: common site with average value	4
	Very low: no particular distintive features	2
Education significance	Very high: number of represented issues: 5 and more	10
	High: number of represented issues: 4	8
	Average: number of represented issues: 3	6
	Low: number of represented issues: 2	4
	Very low: number of represented issues: 1	2

3. Result and Discussion

3.1 Geology of Study Area

Geology of study area is classified into two characteristic rock unit (Fig 2). The classification is based on field observation namely claystone unit and sandstone unit. Claystone unit is covered 19% of study area. The distribution of claystone at northeast of study area. Claystone has color in brownish gray (weathered) and gray (fresh). Particle size is clay with lamination sedimentary structure. The hardness of claystone is a bit hard that shown there is a compaction process. In petrographic analysis shown all the mineral has very small size that namely as matrix (Fig 3. a).

The rest of study area covered by Sandstone unit. The characteristic of sandstone are yellowish brown (weathered) and yellow (fresh) in color, particle size is fine up to medium sand, rounded in shape, well sorted and compacted. Based on observation under microscope, the mineral contain in sandstone are quartz (55%), rock fragments (20%), feldspar (15%) and matrix (10%). From percentage of mineral contains, the name of sandstone is Sublitarenite (Pettijhon, 1987) (Fig 3 b).

3.2 Geomorphology of Study Area

Study area has divided into four geomorphology based on Digital Elevation Model (Fig 4). First geomorphology is flatland that represented by gray color. This geomorphology has very low elevation ranging below 100 m. Second geomorphology is gentle hill that shown by dark green to light green with elevation ranging from 100 to 200 m. Third geomorphology represented by color red to purple with elevation 200 up to 300 m. This geomorphology namely as Steep hill. The last geomorphology is very steep hill with elevation above 300 m that shown by light brown to dark brown color. All geomorphology unit surrounded by very wide lake that call PLTA Koto Panjang Lake. The lake is formed by semi-natural process. There is a big dam at study area for electrical generator of Riau. One of causes of forming the lake is those DAM.

3.3 Geotourism Destination of Study Area

Conservation and entrepreneurship-based geotourism has very crucial value in the development of the region by combining natural attractions and tourism. Geotourism offers the concept of natural tourism that highlights the beauty, uniqueness, rareness, and a

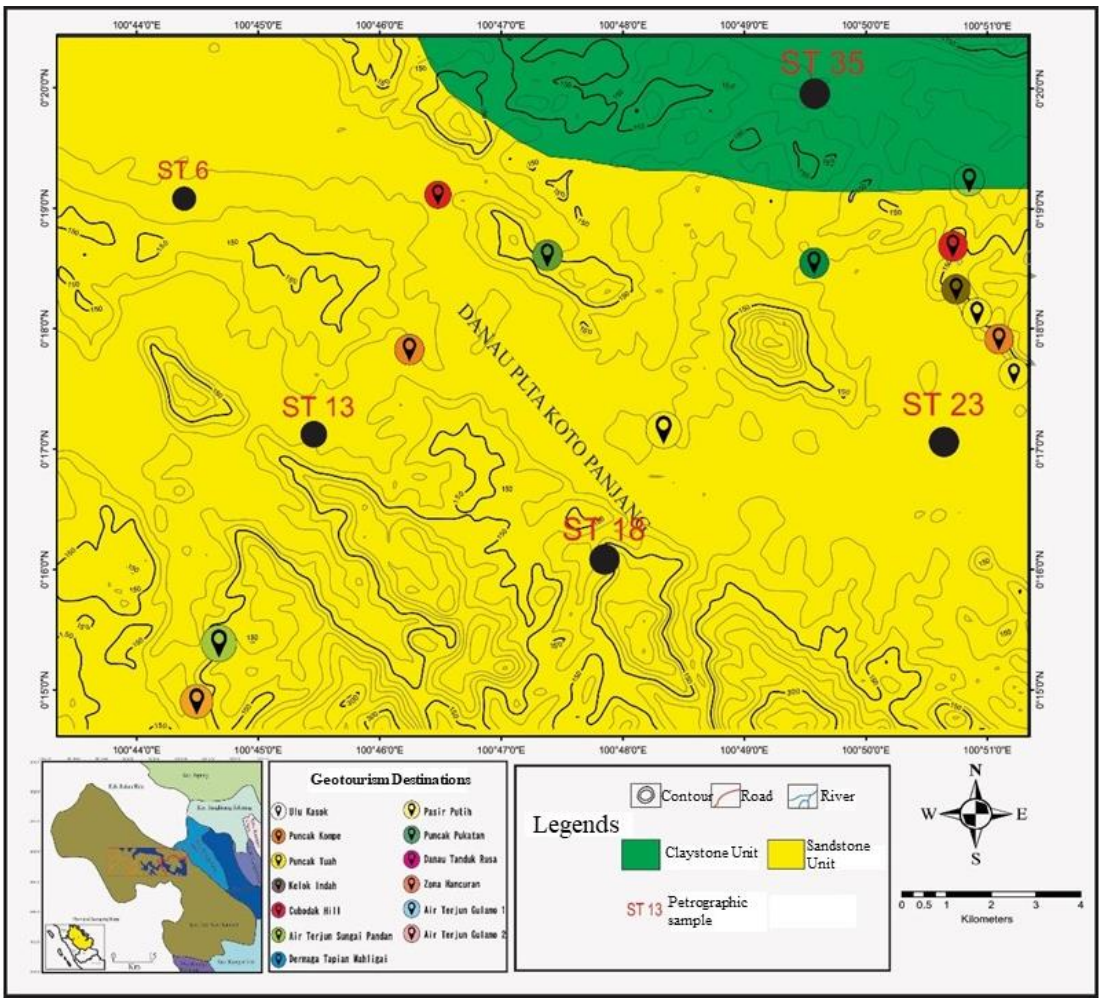

Fig 2. Geological maps of study area that shown the distribution of geological units

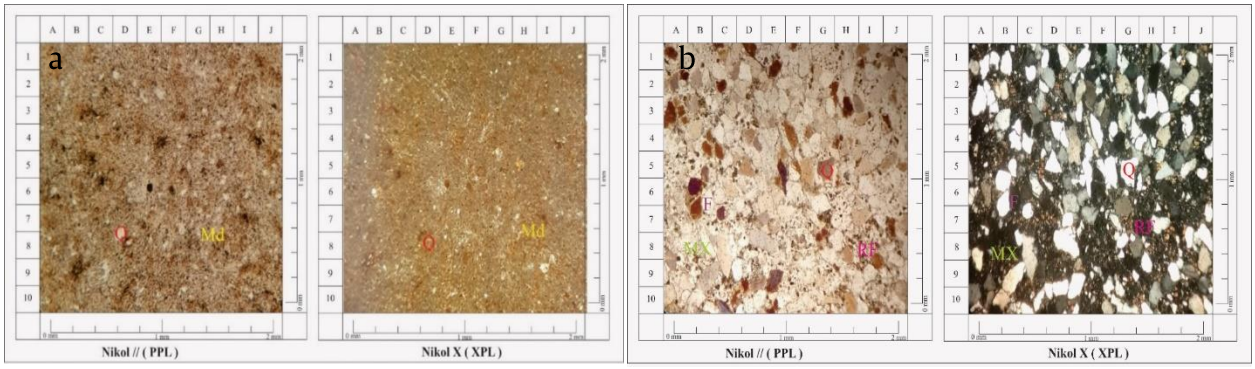

Fig 3. a) Petrographic view of Claystone that shown mostly consist of matrix, b) Petrographic view of Sandstone that consist of quartz (55%), rock fragments (20%), feldspar (15%) and matrix (10%) namely as Sublitarenite (Petijohn, 1987)

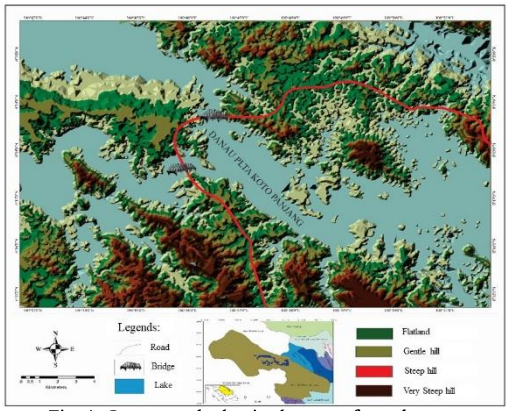

Fig 4. Geomorphological map of study area

natural phenomenon that is closely related to geological symptoms described in popular or simple language (Kusumahbrata, 1999 in Hidayat, 2002) including tourist satisfaction (Hermawan, 2016 , 2017). Based on those characteristic, geotourism destination of study area devided into three main group, Geomorpholgical landscape zone, Water play zone and Waterfall Zone.

3.3.1 Geomorphological Landscape Zone

Geomorphological landscape zone is a group of zone that shown the beauty of geomorphological view

known with name Ulu Kasok (Fig 5). Landscape with view of very wide lake with green water and some islands spread on it. The beauty of those landscape can be enjoyed at some high spot like Puncak Tuah, Kelok Indah, Puncak Kompe and Puncak Pukatan. Geomorphology such it similarly with geomorphology view of Raja Ampat in Papua. However, geological process of Ulu Kasok is totally different. Ulu Kasok formed by sedimentation process of terrigenous material at quaternary age. All the geomorphology deformed by process of uplifting during subduction process of pacific plate with Eurasia plate that resulting hilly area at the back arc. The water level of study area increasing because of DAM for electrical Generator. Combination of natural geological process and manmade process resulting a beauty geomorphological landscape like Ulu Kasok Now.

Fig 5. Geomorphological landscape of Ulukasok

3.3.2 Water Play Zone

Water play zone is a tourism object that focused on water destination. Beside of beauty of landspace, PLTA Koto Panjang Lake used by local society to attract the tourism with make some paly zone (Fig 6). In geological process, lake is a resulting from accumulation of river that has not enough runway of water. Those rivers will transport the sediment material that finally settle down on the bottom of lake. Mostly particle sediment of lake is clay because the current flow very slow (laminar). Some destination of water play zone can be enjoy at Cubadak Hill, Dermaga Tepian Mahligai and Tanduk Rusa Lake.

Fig 6. Water play zone of Tanduk Rusa Lake

3.3.3 Waterfall Zone

Some waterfalls found at study area such as Gulamo Waterfall and Sungai Pandan Waterfall. Waterfall also become geotourism destination that can attract the tourist (Fig 7). Mostly, waterfall formed by geological structure like fault. The waterfall of study area is naturally formed and has own attractiveness. Gulamo waterfall has valuable geological information such as sedimentary structure. There are Cross-bedding and Graded bedding structure. This can be valuable attraction especially in educational purpose to tourism. Besides that, conservation of those geodiversity is very important to know the geological history of formation process.

Fig 7. Gulamo 1 Waterfall

3.4 Measurement of Geotourism Criteria

Examination of geotourism destination value using modification of Knapik et al (2009) can be shown at Table x. The measurement is subjective based on authors perception in four aspect are accessibility, state of preservation, scientific worth and education significance. There are 12 geotourism destination that rated Gulamo Waterfall, Puncak Pukatan, Puncak Tuah, Dermaga Tepian Mahligai, Cubodak Hill, Ulukasok, Sungai Pandan Waterfall, Puncak Kompe and Tanduk Rusa Lake. The total point of those tourism destination ranging from 13 up to 19 with maximum point is 30. The lowest point is from aspect of accessibility. The accessibility is barely visible but a bit for from main road and the infrastructure of road is a bit difficult to access because the path hilly. State of preservation point is ranging from 2 up to 5. Some places like Puncak Tuah, Dermaga Tepian Mahligai and Cubodak Hill has very good preservation. However, preservation of geological diversity must be socialized to local society because the destruction of geodiversity come naturally (erosion and weathering) and manmade (mining and quarry). Based on view of Scientific worth, all the destination has varying point from 6 to 8. Geological condition of study area still has millions mystery that can be resolved. Lastly from the view of education significance, educational process for tourist still very

limited because the information such as information sign is not available at all geotourism destination. The tourist only enjoyed the landscape without getting additional knowledge of geological setting and process of geotourism destination.

4. Conclusions

The XIII Koto Kampar are potentially attractive for geotourism. Geotouristic value is represented by three main destination are geomorphological landscape zone, water play zone and waterfall zone. Uniqueness of geological process that form those destination has very high value in scientific worth aspect but lack in educational information for tourism. The most aspect that need to be improve is aspect of accessibility. Local society must be cooperate with government to upgrade the accessibility of geotourism destination at XIII Koto Kampar. The preservation of geodiversity must be socialized to local society to make the XIII Koto Kampar become a Sustainable Eco-Geo System destination.

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Table 2. Measurement of Geotourism destination result

No	Geotourism Destination	Criteria				Summerized value
		Accessibilty	State of Preservation	Scientific Worth	Educational Significance	
1	Gulamo 1 Waterfall	2	3	8	6	19
2	Gulamo 2 Waterfall	2	3	8	6	19
3	Puncak Pukatan	3	2	8	4	17
4	Puncak Tuah	3	5	6	2	16
5	Dermaga Tepian Mahligai	3	5	6	2	16
6	Cubodak Hill	3	5	6	2	16
7	Ulukasok	3	2	8	2	15
8	Air Terjun Sungai Pandan	2	3	6	4	15
9	Puncak Kompe	3	2	6	2	13
10	Kelok Indah	3	2	6	2	13
11	Danau Tanduk Rusa	3	2	6	2	13

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