The study of geoheritage potential in the Northern Bangka Island as future geopark of Bangka Belitung Islands Province

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Abstract. The background of this study is the geological richness in Bangka Island which is geosite that has significance in science, scarcity, aesthetic, and education. Activities in Geopark are not only limited to geological, but also archeological, ecological, historical, and cultural aspects. In the activities to protect natural heritage from destruction or environmental degradation, Geopark area has become the location of the examination of the enforced protection method. Besides, Geopark is also fully open for any activity such as study and research of any science and appropriate technology. The aims of this study are: to inventory the spread of geological sites in the northern Bangka Island, to determine the sites of geological heritage that will be set as sites should be conserved. The data was taken from rock outcrop that was eventually examined using XRD, rock and mineral petrography. This research showed that from 5 locations there were 2 types of dominant rock outcrops metamorphic rock and igneous rock (granite), in addition there are also other types of rock that are quaternary, namely limestone reefs and conglomerates. Its uniqueness and can be used as a geosite location.

1. Introduction
The majority of Bangka Belitung’s geological wealth is still exploited for mining activities as well as supporting raw materials in the manufacturing industry. The impact, not a few of these industrial activities actually cause a variety of negative effects in the form of a decline even damage to ecological functions (natural order) in areas ex-geological mining. The concept of Geopark is a thought that is offered as a sustainable regional development strategy that contains various geological elements that have meaning and function as natural heritage. As an area, Geopark must have firm and real boundaries and sufficient surface area, so that it can support various future development action plans. As a means of introducing earth's heritage, Geopark contains a number of geological sites (geosite) which have meaning in terms of science, scarcity, beauty (aesthetics), and education.
Geopark activities are not limited to geological aspects, but also other aspects such as archeology, ecology, history and culture. In the activity of protecting natural heritage objects from damage or deterioration in the quality of the environment, the Geopark area is a testing ground for the methods of
protection that are in place. In addition, the Geopark region is also fully open for various studies and research activities in various appropriate sciences and technologies. Geopark is a management concept of an area that has uniqueness and scarcity and is recognized as a geological inheritance (Geoheritage). The geological heritage has a high knowledge value and is recognized nationally and globally, as well as supporting biodiversity and cultural diversity. Geological heritage through Geoheritage identification based on the modification of Ibrahim Komoo and UU no 26/2017. The concept of geodiversity originated in Australia, in the 90s. The concept is defined as the diversity of the properties and systems of the Earth [1], then continues to develop into levels or diversity of geology (bedrock), geomorphology (landscapes) and the properties, associations, systems and processes of the soil [2] and most recently defined by Gray [3] are levels of natural (diversity) geological (rock, mineral, fossil), geomorphological (landscape, process) and nature land including its associations, relationships, characteristics, interpretations and systems. Economic and Functional Value; assessed from the use of mineral resources as well as geodiversity and geoheritage utility facilities to become a means of geotourism and geo-education activities [2],[4],[5].

The geological sites that are inherited are then designated as conservation areas that involve communities around the conservation area, so that in the future it can be developed as a tourist attraction (geotourism) or education (education). The rock formations and alluvial deposits that form on Bangka Island are the Pemali Metamorphic Complex, Diabas Penyabung igneous rocks, ancient sedimentary rocks of the Tanjung Genting Formation, Klabet Granite plutonic rocks which are all millions of years old, also alluvial deposits of rivers and young beaches [6]. Based on geological investigations, the Klabet Granite igneous rock is the constituent of Bukit Kukus, with its morphology part of the Menumbing Hill hill complex which has a moderate to slightly steep slope [6]. The research area is an area that has the potential for rock uniqueness, especially in terms of geological age, such as in the village of Pejem which has a Skiss rock outcrop with quartzite sisispan. The outcrop is a basement formation of Bangka Island estimated to be Carbon-Permian age [7] and the presence of conglomerate rock outcrops that are younger than the Skiss rock outcrops found. Other locations in the research area that have unique potential are the outcrop along the Siangau Beach in the form of sandpaper cracks, polymetallic mineral veins, xenoliths, and weathering phenomenon of rare onion skinning granite rocks, as well as along the Tuing Beach having geological structural phenomena in the form of sliding faults, and skiss outcrops with Skiss weathering granules which are rare, peeling onions, as well as along the Tuing Beach have geological structural phenomena such as sliding faults, and Skiss outcrops with rare weathering granite rocks. quartzite veins of various sizes (centimeters to meters).

2. Methods
This study examines several aspects, namely regional geology, which includes: regional physiography, geomorphology, stratigraphy, and the geological structure of the area. The uniqueness and diversity of geology in the study area are related through several aspects, namely: Landscape, geological structure, rocks / minerals, fossils, and processes. The assessment of geological heritage sites to be determined as the area of approval and the agreed implementation model can benefit the community. The study sites included 5 locations in the northern part of Bangka Island, while the research locations were indicated by the following map at figure 1, below.

![Figure 1. Research plan location in north of Bangka](image-url)
Analysis conducted on rock outcrops includes petrographic analysis, geochemistry and several other geological analyzes by observing in more detail the location of the study.

3. Result
Observations and analyzes from 5 research locations show some geological uniqueness described as follows:

3.1 Geomorphology
3.1.1 Siangau Beach
This location is located at the tip of the northern part of Bangka Island which is part of Jebus District, this area is a beach with low morphology but there is a granite outcrop which is a large intrusion with a size reaching > 5 meters as in Figure 2 below.

![Figure 2. The morphology of Siangau Beach](image)

3.1.2 Klabat Hill
Klabat Hill is one of the isolated hill by the intense weathering that occurred on the northern part of Bangka Island, precisely in Jebus District, with a height of 138 meters above sea level, this location is a protected forest area that has dominant lithology of weathered granite and fresh granite, this location is directly adjacent to Klabat Bay where the level of erosion is very strong, resulting in steep valleys and river channels with high sedimentation. The condition of Klabat Hill is shown in Figure 3 below:

![Figure 3. Outcrops in Klabat Hill : a. Weathered granit; b. Klabat morphology;c. Fresh granit, and d. Klabat Hill.](image)
3.1.3 Pejem Beach
Pejem Beach morphology can be considered unique where entering the coastal area there is a plateau that extends to a height of 98 meters above sea level, to go to this beach must pass through a fairly steep descent, in contrast to the beaches in other Bangka Island, Pejem Beach has the beach is narrow with a beach shape that experiences a fairly high abrasion process and there are several small islands around it. Tides are a major factor in accelerating coastal abrasion which can erode the surrounding land. Pejem Beach morphology can be seen in Figure 4 below:

Figure 4. Pejem morphology with highland (a), and Pejem beach abration(b).

3.1.4 Tanjung Putat Beach
The tourist area in Belinyu Subdistrict has a sloping topographic formation, there are several important public facilities such as a harbor for passengers and the navy as well as a storage place for Pertamina's fuel. The beach that is managed by this community group is a beach whose land protrudes into the sea wide enough and overgrown with mangrove plants, there are several intrusions of granite that are distinguishing on this beach because the distribution is quite wide. The situation of Tanjung Putat Beach is shown in Figure 5 below:

Figure 5. Tanjung Putat beach situation (a), and Granit outcrops in Tanjung Putat Beach (b).

3.1.5 Tuing Beach
Tuing Beach is located in Mapur Village with the morphology of the beach that protrudes to the sea wide enough there are outcrops of metamorphic rocks, the shape of the beach illustrates the dominant abrasion conditions, this beach is directly facing the Natuna Sea so that it has large currents and waves. Behind the beach there are some positive morphologies which are hills with a height of 157 meters (Kupak Hill) and 245 meters (Tuing Hill). The appearance of Tuing Beach is in the following figure 6:

Figure 6. Landform of Tuing Beach
3.2 Litologi dan Structural Geology

Table 1. Litology and Structural Geology in research location

| No | Location           | Structural Geology (strike/dip) | Appearance in the field |
|----|--------------------|---------------------------------|-------------------------|
| 1. | Siangau Beach      | Strike and Dip outcrop:         |                         |
|    |                    | 1. N 85° E/77°                  |                         |
|    |                    | 2. N 202° E/80°                 |                         |
|    |                    | 3. N 158° E/86°                 |                         |
|    |                    | 4. N 340° E/15°                 |                         |
| 2. | Klabat Hill        | no geological structure found   |                         |
| 3. | Pejem Beach        | Lamination in skiss:            |                         |
|    |                    | N 141° E/58° dan N 310° E/42°   |                         |
|    |                    | Quartz Vein:                   |                         |
|    |                    | N 148° E/49°                   |                         |
| 4. | Tg. Putat Beach    | Joint in Granit Outcrops:      |                         |
|    |                    | N 272° E/82° dan N 170° E/82°  |                         |
| 5. | Tuing Beach        | Lamination in skiss:            |                         |
|    |                    | N 291° E/75°                   |                         |
|    |                    | N 189° E/61°                   |                         |
|    |                    | N 26° E/43°                    |                         |
|    |                    | N 300° E/70° (Quatz vein, 1-3 cm) |                     |
|    |                    | Slip Fault in skiss:           |                         |
|    |                    | N 90° E/77°, N 82° E/74°, N 108° E/81° |                  |
|    |                    | (The value of dip in the fracture plane shows that it is oblique). Direction / azimuth relative stress of sliding fault (Sigma 1): N 20° E, N 30° E dan N 40° E | |
3.3 XRD Result
The results of the analysis of several rock samples at each research location indicate the dominant minerals contained in them are as in the following table:

| No | Location     | Rock Sample | Mineral content                      |
|----|--------------|-------------|--------------------------------------|
| 1  | Siangau Beach| Granit      | Kuarsa, plagioklas, biotit, hornblende|
| 2  | Klabat Hill  | -           | -                                    |
| 3  | Pejem Beach  | skiss       | Kuarsa, ilit, mika, plagioklas        |
| 4  | Tg. Putat Beach| Granit    | Kuarsa, plagioklas, biotit, kaolinit  |
| 5  | Tuing Beach  | skiss       | Kuarsa, ilit, mika, plagioklas        |

3.4 Unique Geoheritage
The uniqueness of the 5 research sites is outlined in the following table:

| No | Location     | Uniqueness                                                        | Information                     |
|----|--------------|------------------------------------------------------------------|---------------------------------|
| 1  | Siangau Beach| Litology : Granit, Mineralogy : Plagioklas, Kuarsa dan Biotit    | Outcrop high >10m               |
| 2  | Klabat Hill  | Litology: Granit, isolated hill                                  | -                               |
| 3  | Pejem Beach  | Litology: Skiss, kuarsit, Mineralogy: kuarsit, mika, illit       | Founded with conglomerate       |
| 4  | Tg. Putat Beach| Litology: Granit, Retas Aplit, Mineralogy: quart, plagioklas, biotit |                                  |
| 5  | Tuing Beach  | Litology: Skiss, kuarsit, Mineralogy: kuarsit, mika, illit       | Founded with limestone (reef)    |

4. Conclusion
This research showed that from 5 locations there were 2 types of dominant rock outcrops, metamorphic rock and igneous rock (granite), in addition there are also other types of rock that are quaternary, namely limestone reefs and conglomerates. Its uniqueness and can be used as a geosite location.

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