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Geoheritage assessment of Gua Sireh, Baling, Kedah

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Abstract. Gua Sireh is located in Baling, Kedah, Malaysia. Baling is a district that hold a variety of unique and beautiful geological features with geoheritage values and attractive geological landforms. The Gua Sireh is currently conserved by the Kampung Padang Che Mas's committee members as a part of their tourism site. The aim of this paper is to formally evaluate the potential geoheritage values of Gua Sireh as a geoheritage resources using the classification, assessment and evaluation methods. Based on this study, five geoheritage values had been identified in Gua Sireh, which are scientific/educational, aesthetic, recreational, historical/cultural and economic values. The scale of this geosite is small to medium, and the level of significance is local to state. By this initiative, it is hope that Gua Sireh can be preserved from any threats and continues to develop in order to sustain and protect the geological features while supporting the geotourism development in the state of Kedah.

1. Introduction

Baling District is the second largest district in Kedah with an area of 1,530 sq km or 590.32 square miles from Portal Rasmi Majlis Daerah Baling (2019). It is bordered by Thailand and the state of Perak to the east, bordering the districts of Sik and Kuala Muda on the west while the Kulim district to the south. The landform or topography of the Baling area is covered with hilly terrain and hilly areas on the border of Thailand. The district was managed by Baling District Council. There are also several tourism sites such as Gua Sireh, Air Terjun Lata Bayu, Asam Jawa, Celak Waterfall, Kampung Iboi, Gunung Baling, Air Terjun Lata Bukit Hijau, Gua Air and many more that were uncovered yet. The landform of Baling is beautiful and unique to be cover.

Gua Sireh is a unique limestone caves which is located at Kampung Padang Che Mas Dalam Wang, Baling, Kedah, coordinates: N 05° 34' 53.4", E 100° 51' 18.8" with elevation, 103 meters (Figure 1). Gua Sireh has beautiful landscape and interesting geological features that can attract the visitors to visit this cave. It was open for visitors since February 2019 and managed by villagers from Kampung Padang Che Mas. This cave is composed mainly of limestone and metamorphosed limestone which is marble and surrounded by other caves and villager houses. The dimension is about 90 meters and length about 20 meters, whilst the height of the main mouth of the cave is about 40-50 meters. The normal speleothem features such as stalactites, stalagmites, and columns or pillars are found inside the caves. The stunning landscape with the 3D wall and attractive stalagmite-with the shape of 'Sireh Junjung' or betel vows are the other attraction features in Gua Sireh. Other than that, this cave plays an important role in the habitat of bats. Gua Sireh also shows another interesting geological characteristic of the travertine layer formed by the rapid process of calcium carbonate precipitation. Thus, Gua Sireh can be proposed as the landmark of Baling tourism Malaysia due to its beauty and uniqueness.



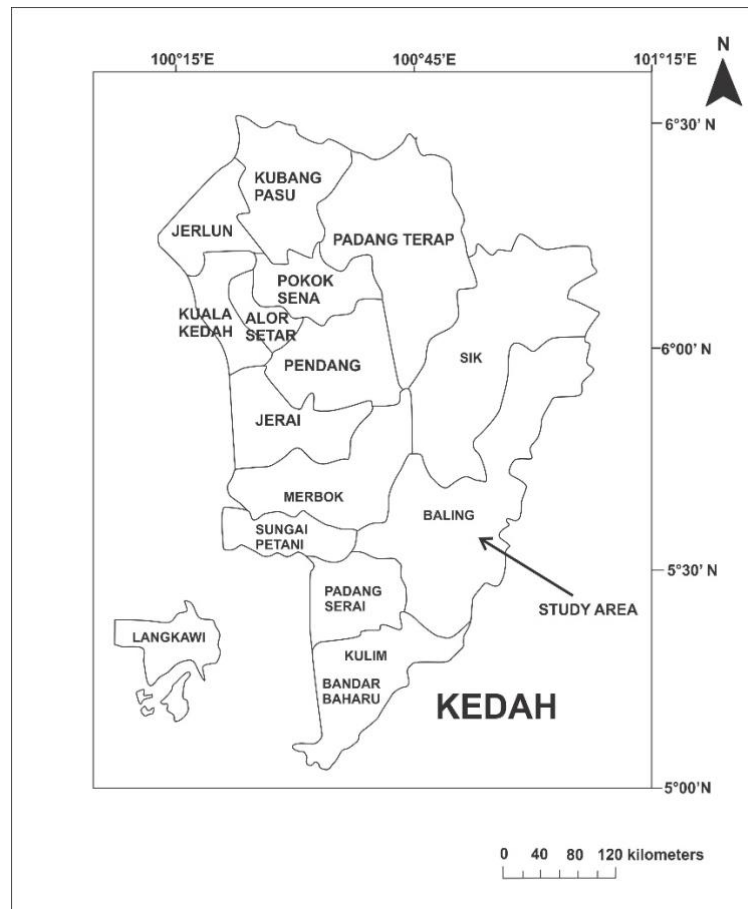


Figure 1. The location of Gua Sireh, Baling Kedah, in Kedah state map.

2. Methods and materials

The methods used for this study are divided into three parts, which are classification, assessment and evaluation of potential geoheritage resources as a part of systematic studies by [1]. The first part is classification which based on some categories; geodiversity [2], scope [3][4] and scale [3].

The second part is assessment, where it is divided into qualitative and quantitative assessments. The qualitative assessment is concerning on the types of geoheritage values [5] and level of significance [3], whilst the quantitative is the numbering score or rank of these geoheritage values. Six numbering score have been observed for this study; 0= none; 1= very bad; 2= bad; 3= fair; 4= good; and 5= very good [6][1]. Based on [7], the sum of the numbering scores will reflect the quality of geotourism site, where; 0-7 (much too low), 8-14 (a little too low), 15-21 (about right), 22-28 (little too high) and 29-35 (much too high).

The last part is the evaluation, where all those potential geoheritage resources had been evaluated in term of the strengths, weaknesses, opportunities and threats (SWOT). These evaluations can serve as a tool for geoconservation and management of the potential geoheritage resources. All the assessments and evaluations are subject to accessor's knowledge.

3. Results and discussion

3.1. Classification

The potential geoheritage resources at Gua Sireh, Baling are dominated by rocks, landform or landscapes features such as limestone hill and caves. The precious minerals like calcite are also valuable attraction at Gua Sireh as it goes shiny when the light is discharged by torchlight. For measurements, this site

range between small to medium scale of the geological features. Table 1 shows the Gua Sireh classification of potential geopatrimonial resources based on its geodiversity, scope and scale.

Table 1. The classification of Gua Sireh based on its geodiversity, scope and scale.

Geological site	Geodiversity [2]	Scope [3][4]	Scale [3]
Gua Sireh	Rock, landform/landscape process	Petrological site, geomorphological site, speleological site	Medium scale

3.2 Assessment

The qualitative approach concerned certain geodiversity and geoheritage potential values, mainly scientific/ educational, which are important for geological records and for learning the history or the process of the Earth whilst educating the professional geologists, students of universities, schools and the general public. On the other hand, the aesthetics values referring to any beautiful or rare features, recreational referring to different nature recreational activities, cultural value related to historical events and economic values is dependent on the nature [2][5][8].

3.2.1 Scientific/ educational values. Scientific or educational values usually referring to any geological features, landforms, mineral contents, fossils and anything that scientifically resemble the process or geological history of certain area. On the other hand, these values can be used to educate, not only the professionals or academicians, but the locals itself. In the study area, the basic structures that can be observed in most of caves which are stalactite and stalagmite (Figure 2). These stalactites and stalagmites, were long, elongated and formed from many types of minerals deposit. A stalactite hangs at the roof or walls like an icicle, whilst a stalagmite occurs like an upside down of stalactite. The other feature in this cave is travertine where it is the secondary structure formed from the dissolution of limestones, where the calcium carbonate had been precipitated (Figure 2).



Figure 2: a) The common structures in any caves, stalagmite and stalactite and, b) travertine that formed from calcium carbonate precipitation.

3.2.2 Aesthetic values. The aesthetic values are more or less related to any geological features with appealing or attractive view. In Gua Sireh, there is a 3D wall shaped inside the cave (Figure 3). The other unique shape of rock features that can be observed are like honeycomb, pillar, and

column (Figure 3). Other than that, the limestone shaped like a 'sireh junjung' and the shape of animal (a cub) can be clearly observed in the cave (Figure 3).

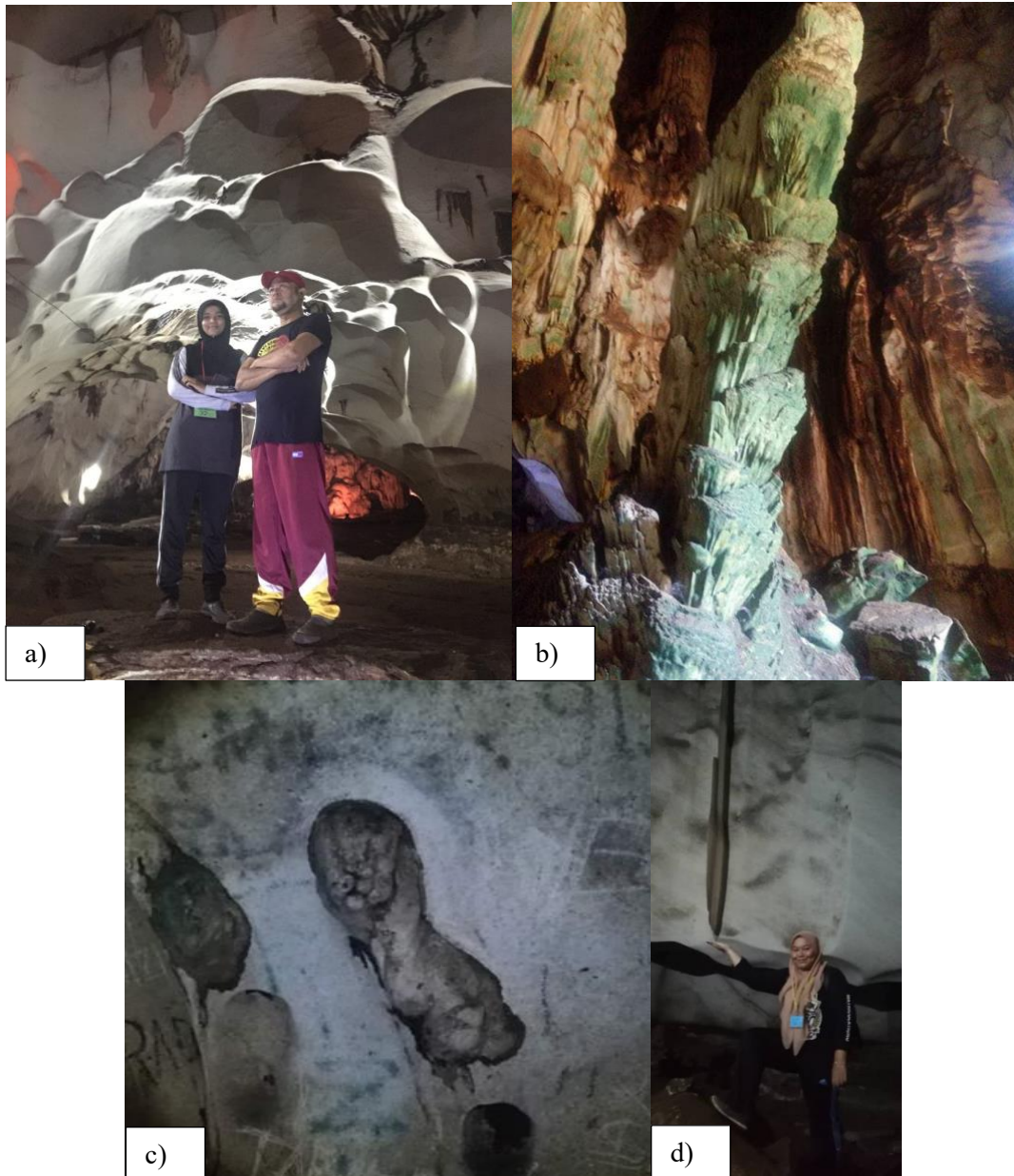


Figure 3: a) The presence of 3D wall structure make this cave unique, b) the 'sireh junjung' like structure formed from the stalagmite, c) the baby lion (a cub) like structure formed as part of stalactite and d) the column structure formed form water dropping on the stalactite.

3.2.3 Recreational values. The recreational values usually dealing with any tourism or recreational activities in certain area. The Gua Sireh had been open for all visitors to visit and the commercialization had been spread using social media of the villagers. They even have a facebook page to promote Gua Sireh for tourism or recreational purposes. However, to prevent any disturbance, the villagers decided to only offer a proper guider and restrict the unknown visit for the public.

3.2.4 Cultural values. As for the cultural values, it was usually resembling any cultural or historical events that occurred in that area. One of the cultural values in Gua Sireh was its name, where it was taken from the structure like 'sireh junjung' (Figure 3) inside the cave, hence it gave it the name of Gua Sireh. There is also a presence of living like cave murals around the cave door, however this feature is rarely found as it was covered by bat waste.

3.2.5 Economical values. The economical values is reflected by financial return from any geoheritage resources. As in Gua Sireh, the presence of bat wastes, make it possible to generate the income for villagers as the bat waste is currently used in agriculture and gardening. The other economical value come from the recreational values, as the more visitor, the more income generation can be occurred.

All these geoheritage values is summarize in Table 2, together with the qualitative assessment. The qualitative assessment was assessed based on the geoheritage values and the score or ranking of each values [6]. The total of ranking score is 19, which based on [7], the ranking is about right for geotourism site.

Table 2: The summary of quantitative and qualitative assessment of Gua Sireh, where the quantitative assessed the geoheritage values and evidences, whilst the qualitative is based on the ranking introduced by [1].

No	Geoheritage values (quantitative)	Evidences	Ranking score
1.	Scientific/ educational	Cave formation Stalactite Stalacmite Travertine Calcite deposits	5
2.	Aesthetic	Honeycomb, pillars and column 3D wall Sireh junjung feature A cub (baby lion) feature	5
3.	Recreational	Cave exploration Jungle trekking (Promotion through social media)	3
4.	Cultural	The naming of the cave (from Sireh Junjung feature) Few lively mural on the wall	3
5.	Economical	Bat waste commercialization Recreational values- attract visitors to come	3
TOTAL			19

3.3 Evaluations

In this study, the SWOT analysis was used to evaluate the strengths, weaknesses, opportunities and threats of potential geoheritage resources in the area as shown in Table 3.

Table 3: The summary of SWOT analysis of Gua Sireh.

No.	SWOT	Remarks
1.	Strengths	- Good potential for research and education - High geoheritage value such as scientific, educational, aesthetic, economical, recreational and cultural values.
2.	Weakness	- Good accessibility - Less support from authority - Lack of promotion of the area

3.	Opportunity	<ul style="list-style-type: none"> - Suitable for some activities such as cave exploration and trekking - Need information panels to serve visitor - Cooperation between local authority, university's student and community
4.	Threats	<ul style="list-style-type: none"> - Potential limestone extraction (quarry) - Continuing manure fertilizer

4. Conclusion

The concept of geoheritage is currently developing, where different scientists define or create different methods of geosite analysis or assessments in order to assess or evaluate the geological features of certain area for geoheritage purposes. In this study, three out of five systematic studies for geoheritage [1] had been used, which are classification, assessment and evaluation. In terms of classification, Gua Sireh composed of a basic limestone rocks with various landscape and landform as geodiversity, and the scope is more into the petrological, geomorphological and speleological site. The scale is only medium as Gua Sireh is not a huge cave itself.

In assessment part, it was divided into two parts, the qualitative and quantitative. The qualitative assessment shows that Gua Sireh possessed five geoheritage values which are, scientific/ educational, aesthetic, recreational, cultural and economical values. All these values had been assessed for the quantitative assessment by using the scale by [1]. There are two geoheritage values that score 5 (high); the scientific/ education and aesthetic values, whilst the recreational, cultural and economical values only scored 3, which represent fair. The cumulative score is 19, where it was ranked as about right [7] for geotourism site.

Due to the about right ranking for geotourism quality, the SWOT analysis, which represents the strengths, weaknesses, opportunities and threats had been done for this tourist destination. All the possibilities for SWOT had been evaluated in order to help the authorities to decide for further development or management of this geosite.

Even though the level of significance of Gua Sireh is only local, it is still considered as valuable geosite as this cave possessed a lot of history or processes for geomorphological, landscape, rocks and hydrological. This cave is still in the exploration phase, where tourists need a guider to explore this cave. It is suggested to hire a skilled and professional personnel with extensive knowledge of geology, which which can promote the geotour and indirectly preserve this geoheritage resource.

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