The threat to the cave wall paintings in prehistoric bulu sipong I Pangkep Regency, South Sulawesi

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Abstract. Leang Bulu Sipong I Pangkep Regency is one of the prehistoric caves in the Maros-Pangkep karst area of South Sulawesi Province, which contains remnants of past human culture. One of the archaeological remains is the cave paintings. Prehistoric cave locations that are very close to the cement (factory) industry caused concern about the cave threats. This paper aims to provide an overview of the remains of paintings in Leang Bulu Sipong I and the existing conditions of the paintings. In addition, this paper also illustrates the monitoring efforts that have been carried out by the authorities in the preservation of prehistoric caves in the Maros-Pangkep area. The method used is descriptive-analytic through the stages of desktop study and field observation. The results showed that Leang Bulu Sipong I Pangkep had varied and interesting cave paintings consisting of handstamp, fauna painting, and human-like paintings with hunting scenes, but unfortunately, the condition of the painting is currently experiencing peeling which is quite alarming. The efforts that have been made related to maintaining sustainability are periodic monitoring and cave closure for general visitors.

1. Introduction

The Maros-Pangkep karst area in South Sulawesi Province is not only the longest and most beautiful group in the world, but in this area, there are approximately 135 prehistoric caves, of which 78 of them have remains in the form of rock images. Because of the uniqueness and superiority of cultural content, the Prehistoric Maros Pangkep Cave Area has been included in the UNESCO World Heritage List since 2010. Cultural heritage in caves in the region not only contains drawings or paintings but also contains artifacts stones, bone artifacts, shellfish artifacts, biofacts, human skeletons, and other archaeological remains from the era of humans inhabiting the karst region in the past.

Based on various archeological studies conducted by experts, it is known that caves that are in geographical units have been inhabited by humans since 30,000 years ago. The research has been conducted since 1902 by Paul and Fritz Sarasin. Then in 1985, Harun Kadir also conducted research related to cave paintings. Paintings of hog deer, fish, and handprints and geometric motifs are stated as the oldest art statements depicting experiences, struggles, and life expectancy [1]. In 1995, Citra Andari studied the technique of making drawings (handprints) experimentally on the cave. In 1998, Andi Vetriyani studied the meaning of images using ethnographic data and comparative analysis, by comparing
the handprints on the cave with the handprints on stilt houses in the village of Ralla in Barru Regency. In 2004, Yadi Mulyadi investigated the processing of computer-based Maros and Pangkep prehistoric painting data [2].

Furthermore, in 2005 Linda Siagian designed a tourism design in the form of the Prehistoric Maros Cave Interactive CD. There is also another researcher, R Cecep Eka Permana, in 2008, who examined prehistoric image patterns in the form of a palm using Digit D2: D4 to distinguish between female or male palm marks [3]. Furthermore, in 2014 a study was conducted by Anwar Thosibo to identify the elements of the material making prehistoric cave paintings. Then the research on the dating of cave paintings conducted by Aubert in 2014 (the research team from Griffith University and Wollongong in collaboration with the Arkansas Research Center, South Sulawesi Archaeological Center, and BPCB of South Sulawesi). The last study conducted by Godlef Arsten Pelestehaha in 2016 examined the analysis of potential disasters in the Prehistoric Cave Area based on Geographic Information Systems [4].

In terms of preservation, since 1985-1986 conservation efforts have been carried out in cave paintings by the Restoration and Maintenance Project of Historical Heritage and Archaeology of South Sulawesi, in the form of conservation of boat/sampan paintings in the Sumpang Bita Cave and the conservation of hog deer paintings in the Petta Kere Cave. The conservation efforts using chemicals include Barium Carbonate and Ciba Resin EP-IS [5].

In 2007, the Archaeological Heritage Preservation Institute (BP3) Makassar conducted a consultation in an effort to regulate the protection, use, and development of Bellae prehistoric caves. From 2008 to 2009, a study of cave paintings was conducted by the Borobudur Conservation Center. In 2012, Suhartono's publication of a study of the factors of damage to several prehistoric cave paintings in the Maros and Pangkep Regions. The results of his study concluded that in slowing the process of damage to the cave, it is necessary to consider the consolidation of cave paintings, the handling of microorganisms, the need to consider the total closure of the cave that has a variety of paintings by controlling humidity and temperature, counseling and socialization to the community, communication with related parties such as cement factories and immediately draw up a Preservation Master Plan [6]. In 2013, a study of damage to cave paintings was also carried out by the Conservation Preservation Center of South Sulawesi.

Although several studies have been conducted on several caves in Maros and Pangkep, the author is interested in studying the Bulu Buluong Cave Site I in Pangkep Regency. This cave is one of the caves which has unique and important paintings, but the condition of the paintings is quite alarming. The location of the site adjacent to the PT Semen Tonasa mine, according to the author, is a factor that threatens the sustainability of the site due to mining activities and the cement industry. Based on this, the writer is interested in knowing what the existing conditions of the paintings are and the potential threat that exists and what kind of efforts have been made by cultural conservationists in dealing with the current threat conditions of cave paintings.

2. Methods
2.1. Research location
The research location is in Minasa Te'ne Subdistrict, Pangkajene Kepulauan Regency (Pangkep) with administrative boundaries;
- The north is bordered by Bungoro District
- In the south, it is bordered by Balocci District and Maros Regency
- Eastside is bordered by Tondong Tallasa District
- The Westside is bordered by the Pangkajene district.

Leang Bulu Sipong I Site, administratively located in the Bontoa Village, Minasa Te'ne District. Astronomically located at 4 ° 48' 23.22" S and 119 ° 36' 36.37" E with a height of 20 meters above sea level (masl).
2.2. Method
The method used in this study consisted of three stages, the first stage of data collection which included a desktop study (literature study) of the study report and efforts to preserve the Leang Bulu Sipong I Site that had been carried out by the Office of Conservation of South Sulawesi Cultural Preservation. Furthermore, traced directly to the field both in archaeological objects and the surrounding environment. Second, is the stage of the description of the painting, and identification of damage to the painting. In addition, at this stage, the form of conservation efforts that have been carried out at the Leang Bulu Sipong I site by the Office of Conservation of South Sulawesi Cultural Preservation is outlined. Third, the stage of drawing conclusions on the threat of Bulu Sipong I cave wall paintings and the form of conservation efforts that have been made to the site.

3. Result and Discussion
3.1. Environmental description
The Leang Bulu Sipong I site is on a kars hill that is next to the Bulu Matojeng hill. Besides this cave, there are also three other caves named Leang Bulu Sipong II, Leang Bulu Sipong III, and Leang Bulu Sipong IV. At the front of the cave, there is a hollow / puddle containing water. According to site observers, the basin is a former quarry owned by PT Semen Tonasa. Vegetation around the site consists of perennials such as the Banyan Tree, White Teak, Trembesi, Tamarind, and shrub.

![Figure 1](image1.jpg)

Figure 1. The environment around the court of the cave (a) and the front of the site is a dredging puddle (b).

At the entrance to the cave, there is a warning board attached to visitors who will visit the cave. At present, the site's land status is within the Kehati (Biodiversity) park area of PT Semen Tonasa Indonesia (Persero) and in the protection of the Cultural Preservation Hall (BPCB) of South Sulawesi. In this status, special purpose visitors who have received permission from the company and BPCB South Sulawesi can visit this cave site.
3.2. Paintings description

Bulu Buluong I Cave has two main rooms, a lower room and upper room. In the first room, three handprints and three pig paintings were found. The pig's hand stamp on the painting is red and is already in flaky condition.

Table 1. Description of the findings of the mural in the basement of Leang Bulu Sipong I site.

| Findings | Form | Length (cm) | Width (cm) | Color | Information |
|----------|------|-------------|------------|-------|-------------|
| Painting 1 | Arm  | 17.2        | 13.5       | Red   | Peeled off  |
| Painting 2 | Arm  | 18          | 13         | Red   | Peeled off  |
| Painting 3 | Arm  | 17          | 13         | Red   | Clear       |
| Painting 4 | Pig   | 60          | 16         | Red   | Peeled off  |
| Painting 5 | Pig   | 122         | 77         | Red   | Peeled off  |
| Painting 6 | Pig   | 23          | 7          | Red   | Peeled off  |

In the upper room on one wall in the north, there are rows of anoa paintings, babirusa, hand and footprints, and an unclear picture. One of them is a large and almost intact Anoa painting that looks like it's being snared by a hunter's rope surrounded by four dogs. Human paintings with dogs are very small and already look faded. One anoa painting is not intact, leaving the head.

Table 2. Description of the findings of the mural in the upper room of the Leang Bulu Sipong I site.

| Findings | Form | Size | Color | Information |
|----------|------|------|-------|-------------|
| Painting 1 | Anoa | 59 | 18 | Dark red | Peeled off |
| Painting 2 | Human | 6 | 2 | Dark red | Faded |
| Painting 3 | Dog | 5 | 2 | Dark red | Peeled off |
| Painting 4 | Anoa | 61 | 36 | Dark red | Peeled off |
| Painting 5 | Anoa | 21 | 7 | Dark red | Peeled off |
| Painting 6 | Big Anoa | 81 | 32 | Dark red | Peeled off |
| Painting 7 | Anoa (?) | 60 | 7 | Dark red | Peeled off |
| Painting 8 | Small Anoa (?) | 20 | 4 | Dark red | Peeled off |
| Painting 9 | Big Hog deer | 120 | 60 | Dark red | Peeled off |
| Painting 10 | Unidentified | 31 | 10 | Dark red | Peeled off |
| Painting 11 | Spiky Hand Stamp (?) | 4 | 5 | Dark red | Peeled off |
3.3. Damage form of painting

Based on observations, most of the paintings in this cave are peeled off so that some of the images cannot be observed anymore (incomplete paintings).

In addition to peeling off, the paintings in this cave also experience a change in color to black due to overgrown with algae and fungus so that this often obscures the color of the painting that was originally red to black. Algae growth is triggered by cave humidity [6].
Figure 5. Handprints that are overgrown with algae (a) and Moss that covers the walls of the cave (b).

3.4. Potential threats to cave wall paintings

In essence, all archeological resources will experience interacting with their environment. The interaction is a part of natural processes that cannot be avoided because, basically, all objects in this nature will undergo a process of degradation, which results in a decrease in the quality of archeological resources if the aging process is triggered by internal factors in the form of weaknesses contained in the archeological resource itself which is influenced by the material, its position and texture and external factors in the form of external threats caused by nature such as temperature and water, as well as threats due to human activities such as mining and agriculture around archeological resources [7].

Based on observations of paintings, the greatest form of damage is a peeled cave wall painting. Thus, as early as possible, efforts are made to minimize the factors that have the potential to be a threat to faster and more severe damage to paintings.

The proximity of the cave to the cement industry has the potential to accelerate the decline in the quality of cave wall paintings. Although this is still an assumption, it should be noted that the blasting activity could have an impact on the cave wall vibrations. The impact of vibrations from an explosion, especially if on a large scale, can propagate in limestone. The vibration can easily reach the cave so that it causes the least peeling of rock skin, which is already fragile. Thus vibration can cause damage to cultural heritage.

In addition, the location of the site that faces the land transport truck lanes every 1 hour, produces a collection of dust that can enter and coat the walls of the cave. The natural conditions of the humid cave room will cause a colony of microorganisms in the painting. Another threat comes from human activities (visitors) where currently, one area of the cave wall in the basement has graffiti irresponsible visitors.
3.5. Preservation efforts

The efforts to protect Bulusipong I Cave have been carried out since 2016 by BPCB Sulsel by placing one site keeper and site guardrail. Furthermore, in 2018 (still running until now), monitoring the rate of damage to paintings is carried out. In this activity, observations of the conditions of the micro, macro, the physical environment, and systematic documentation of the cave wall paintings. Including measuring the level of sun exposure and wind speed into the cave. Monitoring activities have been carried out regularly in three months.

Another effort is to restrict visitors to the cave (visitor management). This aims to reduce the risk of increased temperature and carbon dioxide fluctuations arising from visitors' breathing, body temperature, and human sweat. In addition, visitor arrangements also at least minimize the increase in dust due to visitors' footsteps in the cave room.

The biggest challenge from the decline in the quality of cave paintings stems from an increase in the number of visits to the cave. Therefore, it requires strict regulation of visits. Surely, it must be accompanied by the presentation of adequate information so that visitor satisfaction can also be met.
Although each site has different needs, challenges, and approaches that do not always fit all scenarios, in general, simple solutions such as site guards, well-designed notice boards, sidewalks, and visitor books reduce the occurrence of vandalism on archeological sites. The interpretive panel can also present several functions including giving an impression of the significance of cultural heritage and introducing the concept of protecting cultural resources, as well as offering information on visitor etiquette, points of interest, fauna and flora, geology, and trail statistics such as length, the time required and information for pedestrians.

For the presentation of information, now, the Preservation Hall of South Sulawesi Cultural Heritage is also working on the design of an information center related to prehistoric caves, which are placed in the Leang-Leang Prehistoric Cave Site Complex in Maros Regency. The step of coordination with stakeholders, in this case, PT Semen Tonasa, has also been taken by BPCB of South Sulawesi. So at this time, the industry has begun to give its main attention to site facilities such as the addition of stairs to the site space, signage, and site information.

![Iron stairs are leading to the site (a) and nameplate and site information prepared by PT Semen Tonasa (b) [4].](image)

**Figure 8.** Iron stairs are leading to the site (a) and nameplate and site information prepared by PT Semen Tonasa (b) [4].

4. Conclusion

The Bulu Sipong I Pangkep cave wall painting is currently at an alarming rate considering the ongoing peeling of paintings. The priority supervision of the Bulu Buluongong I Site by the South Sulawesi Cultural Heritage Preservation Agency and coordinating efforts with PT Semen Tonasa currently gives great hope to the preservation of the site considering the location of the site which is close to the mining industry which is estimated to potentially threaten the preservation of the existing sites and paintings.

Suggestions for the preservation of Bulu Buluung Cave Site now need more intensive supervision, especially the measurement of the level of air and dust pollution contamination and the intensity of vibrations caused by blasting activities. Thus, the results of the monitoring can be taken into consideration for the industry to redesign its activities. In addition, the socialization of the importance of prehistoric caves and their environment must continue to be promoted to the main community who are close to archeological sites.
5. References

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