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Fieldnotes & Photogrammetry: How Can Digital Conservation Techniques Aid Preservation of Punan Bah Kelirieng?

By
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Abstract

This work is the culmination of research I pursued in remote Sarawak, Malaysian Borneo. In collaboration with members of the Indigenous Punan Bah community, I set out to map, photograph and digitally model the Punan Bah's Kelirieng. The survival of these funerary monuments has direct legal implications for Punan Bah land rights under the Sarawak Land Code 1958. This legal and cultural urgency shaped the research from the outset. By combining informal interviews with GNSS mapping and photogrammetry, this research employs traditional anthropological methods alongside modern archaeological conservation techniques. Drawing on oral tradition, ethnohistorical literature and analysis of the monuments themselves, this study proposes a motif typology suggesting a development from the abstract mata jalo of the earliest Kelirieng to the figurative, apotropaic ikang and kelavet of later ones, a shift tentatively linked to cultural exchange with the Kayan people. The Kelirieng are further situated within a broader regional context of Austronesian secondary burial traditions, of which the Nulang Arc groups of Sarawak and Kalimantan represent distinct but structurally related expressions. The aim of this research has been to conduct a survey of Punan Bah ethnohistory, evaluate the contemporary significance of the Kelirieng, and assess whether low-cost digital conservation techniques can meaningfully contribute to their preservation. This research demonstrates that photogrammetry is both viable and accessible in this context, producing a permanent digital record of nine Kelirieng sites that may prove evidentially significant should the physical monuments deteriorate further. It also argues that this study is best understood as a foundation for the community-led, indigenous-owned conservation effort the Punan Bah ultimately need.

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List of Accompanying Materials

The following materials have been submitted separately to the module coordinator at c.elmer@soton.ac.uk via SafeSend:

1. Photogrammetry Models (×8): 3D digital models of Punan Bah Kelirieng sites A, B, C, D, F, G, H, and I, produced in Agisoft Metashape Pro. Site E was unsuitable for modelling due to jungle overgrowth.

Declaration Of Authorship

I, Thomas Laidlaw, declare that this dissertation and the work presented in it are my own and has been generated by me as the result of my own original research.

Fieldnotes & Photogrammetry: How Can Digital Conservation Techniques Aid Preservation of Punan Bah Kelirieng?

I am happy for the Dissertation PDF and supporting materials to be made freely available online and that there are no copyright or other reasons prohibiting this. I confirm that:

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3. Where I have consulted the published work of others, this is always clearly attributed;
4. Where I have quoted from the work of others, the source is always given. With the exception of such quotations, this dissertation is entirely my own work;
5. I have acknowledged all main sources of help;
6. Where the dissertation is based on work done by myself jointly with others, I have made clear exactly what was done by others and what I have contributed myself;
7. None of this work has been published before submission

Signed: 

Date: 4 May 2026

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I would like to thank Gebril Atong for his generosity, insight and guidance throughout my time in Punan Bah. This research would not have been possible without Gebril or the wider Punan Bah community who shared their stories, hospitality and resources. I am grateful to the Sarawak Government and Sarawak Economic Planning Unit for allowing me to conduct this research (See Appendix A). I would like to thank my supervisor Dr Josh Pollard at the University of Southampton for his advice and support throughout my research. Finally I would like to thank my friend and fellow Archaeology student, Oscar English, for his continued encouragement.

Contribution to Discipline

This study makes several contributions to the field of archaeology, and Bornean archaeology in particular. It represents the first systematic photogrammetric survey of Punan Bah Kelirieng, producing a permanent record of nine sites that did not previously exist in this form. In doing so it demonstrates the effectiveness of low-cost photogrammetry as a conservation tool, which could be utilised by external researchers or the communities themselves.

This study also proposes a typology of Kelirieng motifs, one which develops from the more abstract, low-relief *mata jalo* to the high-relief *ikang* and figurative *kelavet*. It is a modest but original contribution to the limited literature on the Punan Bah, a group that has received little archaeological attention. The study also situates the Kelirieng within the broader Austronesian secondary burial traditions, demonstrating that these traditions may date back as far as 7kya. It offers a comparative framework that may inform future inter-group analyses across Sarawak and Kalimantan.

Finally, this research highlights the intersection of archaeological research and indigenous land rights. Underscoring how archaeology can be used to evidence and reinforce indigenous land claims, and buttress indigenous tangible heritage against human and environmental threats.

Glossary of Terms

Animism: a relational belief system in which humans maintain ongoing relationships with non-human persons including spirits, animals and ancestors

Anthropology: The study of human society, culture and development

Balui: Common word used by the Punan Bah and others in the Belaga area to refer to the Rajang

Dopeang: A type of modern Punan Bah funerary material culture

Ethnography: A method of research that involves describing the culture, traditions and customs of a people usually through long-term, immersive observation. It is a fundamental method of anthropological research.

Etun oa: A supernatural being in Punan Bah mythology

GNSS (Global Navigation Satellite System): A satellite based system of precise geolocation, mapping and navigation

Ikang: A spiral motif, typically found on 19th century Kelirieng

Kampong: The Malay word for village

Kelavet: Malay word for a 'Gibbon'

Kelirieng: A funerary monument constructed by the Punan Bah to ensure the safe passage of aristocrats to the afterlife

Laja: The Punan word for 'aristocrat'

Lipien: The Punan word for 'slave'

Lo'o: The Punan word for a 'river confluence'

Nulang: The Berawan word which might be translated as "to bone", and usually refers to the Bornean tradition of secondary burial

Mata Jalo: A net style motif, typically found on 17th century Kelirieng

Panyin: The Punan word for ‘commoner’

Photogrammetry: A method of creating 3D virtual models by taking photographs from multiple angles
Punan Bah: An Indigenous group living in the upper Rajang River region of Malaysian Sarawak.

Reflexivity: Reflexivity means thinking reflexively about who has conducted and written ethnographic research, assessing how their cultural and personal background impact the value and conclusions of the ethnography produced

Ungei: The Punan word for ‘river’

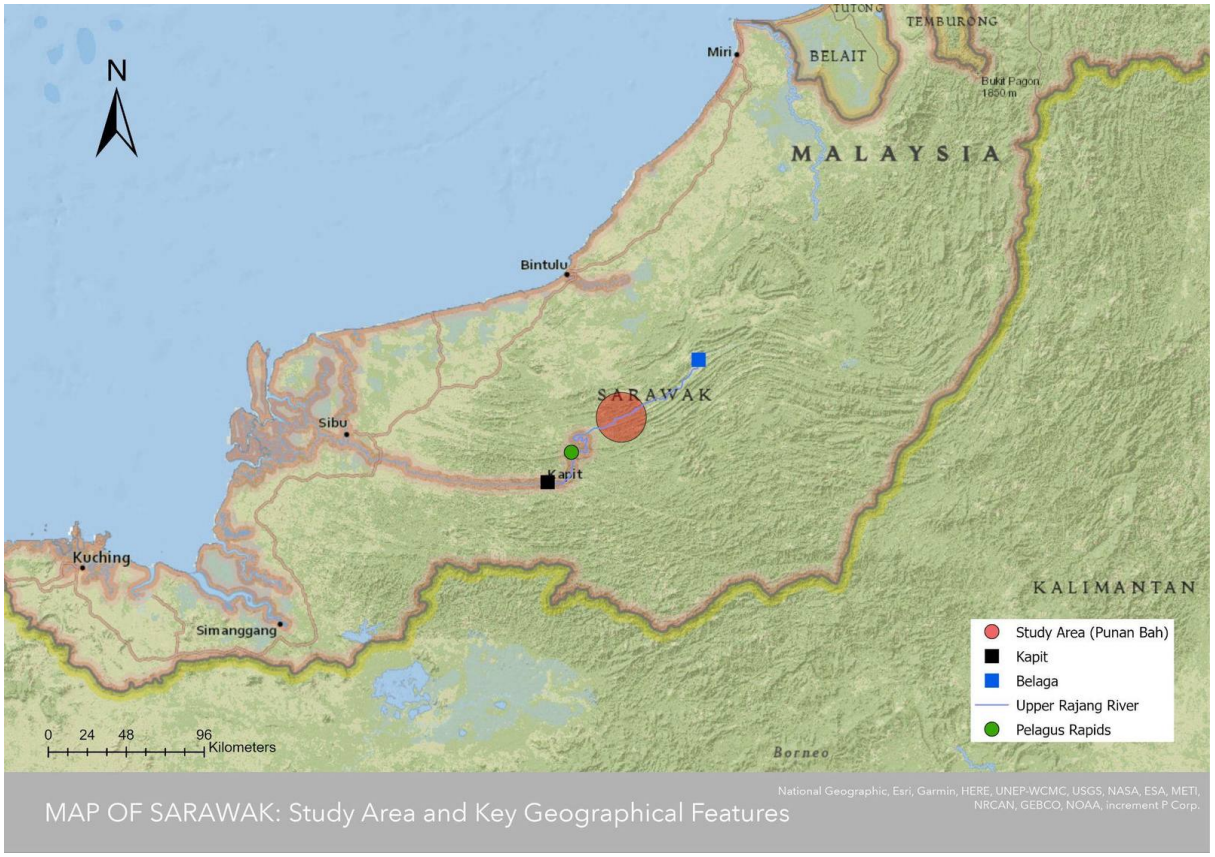


Figure 1.1: Map of Sarawak indicating the location of Punan Bah (study area), Kapit, Belaga, the Upper Rajang River (Ungei Balui), and the Pelagus Rapids (GNSS data recorded by author, 2025; basemap: National Geographic/Esri)

Introduction

The Kelirieng are funerary monuments of the Punan Bah people of Malaysian Sarawak. They are constructed of a single trunk of the Belian tree, and intricately carved with motifs that guide the deceased to the afterlife. The Kelirieng are one of the few remaining monuments that prove Punan Bah indigeneity to the region. Today they are at risk and in need of conservation.

In early 2025 I decided to visit Sarawak, Malaysia, in search of a dissertation research topic. Soon I found myself in the Upper Rajang River (Ungei Balui) area (See Figure 1.1; See also Figure 4.1), staying in Punan Bah, with which the indigenous people share their name. Punan Bah is located approximately 100km upstream from Kapit, which can be considered the final city before entering remote central and eastern Sarawak. I reached Punan Bah on the local river boat that carries people and goods between Kapit and the Longhouses along the banks of the Rajang, all the way to Belaga. Upon arrival I secured a lift on the back of a local boy's motorbike, and that was when I first heard about the Punan Bah Kelirieng. I was welcomed into Punan Bah by my host, now my friend and research assistant, Gebril Atong. I inquired about the Kelirieng, and Gebril was keen to tell me about them, it was then that he sent me the article that set this research into motion. Dr Antonio J. Guerreiro wrote 'Kelirieng: The Vanishing Monumental Heritage of Sarawak' in 2017. It is a concise summary of the ethnohistorical background of the Kelirieng, and importantly an evaluation of their conservation status.

Guerreiro, however, was not the first to raise concerns. In 1972 a unique double-trunk Kelirieng was donated to the Sarawak Museum, and now sits in the grounds of the Sarawak Cultures Museum in Kuching (See Figure 1.2). The museum also has a Punan Bah Kelirieng exhibit inside, however the plaque did not mention its original location (See Figure 1.3) Kelirieng C1 appears to have been moved to its current position in 1984 following conservation efforts (Nicolaisen, 1984, See also Appendix D) Another Kelirieng originating in Lo'o Pilah (Upper Rajang) seems to have been moved to Kuching as early as 1925 (Guerreiro 2017:23).



Figure 1.2: Double-trunk Kelirieng on the front lawn of the Sarawak Cultures Museum (top), and the descriptive plaque (Bottom) (Photo By Author)

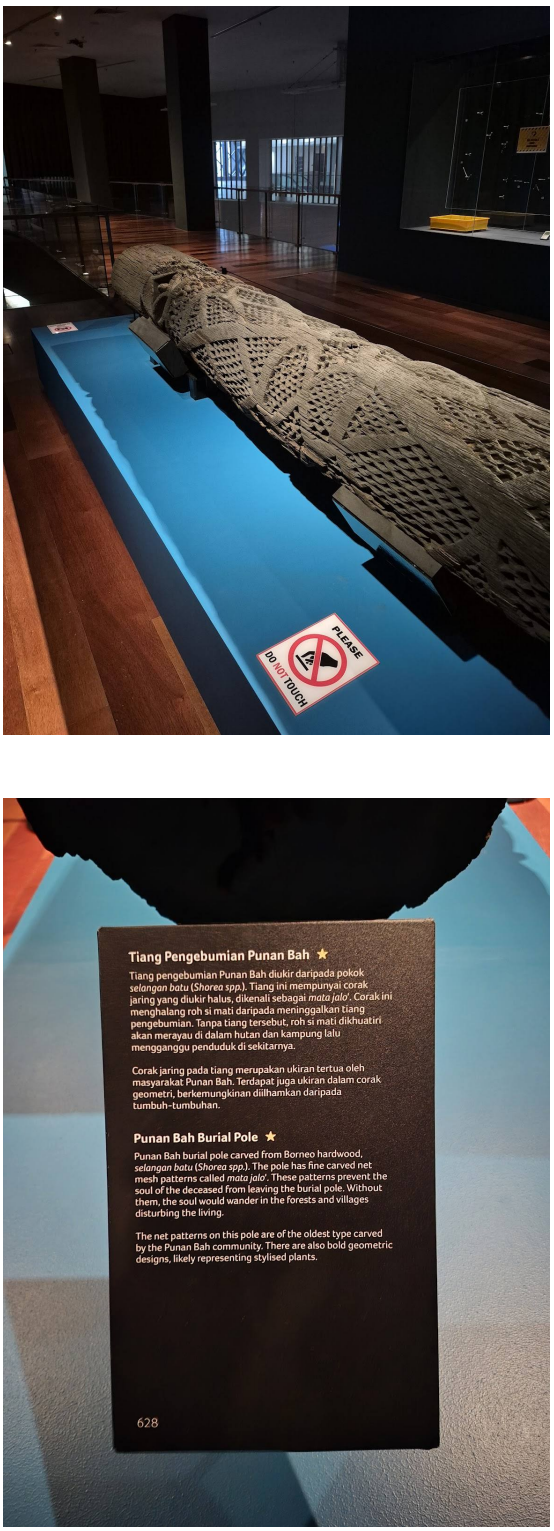


Figure 1.3: A Punan Bah Kelirieng exhibition at the Sarawak Cultures Museum. It is adorned with the mata jalo style motif (Top), the plaque explains that this motif is designed to prevent the deceased's soul from leaving the pole and wandering the forest (Bottom) (Photo By Author)

Anthropologist Ida Nicolaisen conducted fieldwork with the Punan Bah in 1976, and the subsequent essay remains one of the most comprehensive works on Punan Bah anthropology, and has contributed significantly to this dissertation (Nicolaisen, 1976). Peter Metcalf has also contributed to the anthropology of Sarawak's indigenous peoples and engaged tangentially with the Kelirieng (Metcalf, 1976; 2010), as did Bernard Sellato (2016). Guerreiro (2017:23) argued that due to various environmental processes, namely river erosion, the Kelirieng could vanish by the mid-2030s. My own inspection of the Kelirieng seemed to validate that assessment.

The Kelirieng are funerary monuments and are integral to the Punan Bah's tradition of secondary burial, although the practice has ceased in the modern day. Traditional Punan Bah society was divided between Aristocrats, Commoners and Slaves, which is also true for related groups in the region (Atong, personal communication, 2025; Janowski, 2003:16). It was the Aristocrats for whom the Kelirieng were constructed. The historical and contemporary importance of the Kelirieng cannot be overstated. Each Kelirieng was created of a single Belian Tree, colloquially known as "Borneo Ironwood", and was chosen for its durability. Folk knowledge and scientific research concur that Belian wood is resistant to decay, and uniquely resistant to termites in the Malaysian context (Wong et al 2005:16). The Belian Tree itself has been placed on the International Union for the Conservation of Nature's 'Global Red list of Threatened Species' due to overexploitation, habitat

destruction and slow regrowth (Md-Isa, 2019:736; Batrisyia et al, 2024:64). The Kelirieng represent both the cultural and ecological heritage of the region, both of which are endangered.

The territorial aspect of the Punan Bah Kelirieng is also of note. Traditionally tribal territory in the Upper Rajang, and its tributaries, was delineated by rapids such as the Pelagus Rapids located roughly 30km upstream of Kapit (Atong, personal communication, 2025). Since canoes were a primary mode of travel along the rivers, fast flowing rapids provided a significant barrier to territorial expansion. The other method of territorial delineation was, and remains, the Kelirieng (Abdullah & Langub 2011). These monuments are used to evidence the indigeneity of the Punan Bah to the Punan & Bah Rivers , and the nearby Rajang River.
The history of Sarawak under the Brooke Administration does not need to be covered here but the cessation of Brooke rule does. In 1946, Vyner Brooke seceded Sarawak to Great Britain, making it a Crown Colony. This state of affairs remained until 1963 when the Malaysia Declaration was signed, and Sarawak joined the Malaysian Federation (Brooke Heritage Trust 2016). Important for this study is the Sarawak Land Code 1958 which, in short, legislated what Native Customary Rights (NCR) is, and how it can be proven (Lo & Partners 2019). NCR designation comes with many benefits for indigenous communities, for example the right to use the land for cultivation or ceremony, the right to pass land to the next generation, and the right to defend against extractive industries be it timber or oil palm. The case of *Nor Anak Nyawai v Borneo Pulp Plantation* (2001) upheld the right of the Indigenous Iban to prevent Borneo Pulp Plantation Sdn Bhd from clearing land in order to grow trees to feed a paper mill. For the purposes of this study, the most important elements of the land code are 1: Any land in Sarawak that is not NCR or gazetted as Native Area Land (NAL) are the property of the state 2: NCR land cannot be designated unless the indigenous communities can prove occupation prior to January 1st 1958 3. The burden of proof for NCR is on the indigenous population and until sufficient evidence is provided the law assumes that the land is free of any NCR. Atong stressed the legal importance of the Kelirieng in the Punan Bah's own pursuit of NCR recognition. The legislation concurs in Section 5, Article (2) (D) of the Land Code: 'the use of land for a burial ground or shrine' prior to 1958 is grounds for NCR designation.

In light of this I conceived of a project to preserve the Kelirieng in perpetuity through digital modelling. The aim of my research is twofold 1: To provide some additional, and up-to-date ethnographic research with Punan Bah. Focusing mainly on their ethnohistorical traditions, traditional animism, and the Kelirieng. 2: Locate the Kelirieng with GNSS, and create 3D digital models of them. This would provide a digital repository of Punan Bah Kelirieng that could be accessed by future researchers and the Punan Bah themselves. Ultimately, this research seeks to use low-cost and non-invasive techniques to address a pressing

heritage concern 3: Beyond that, my research aims to add to the literature on archaeological photogrammetry, and provide a case study on the effectiveness and viability of low-cost digital conservation.

Methodology

The study consisted of three components 1. Ethnographic research, which involved semi-structured interviews, and extended informal conversations with Gebril regarding the history and contemporary meaning of the Kelirieng 2. The digital conservation element sought to document the Kelirieng visually and spatially through photography and GNSS records 3. Literature review of all available research on the Punan Bah, namely Ida Nicolaisen's work. These methods were suitable given the short fieldwork period, financial and legal restrictions. They formed the foundation of contextual understanding, and provided a low-cost process of meaningful conservation.

The fieldwork was based in Punan Bah, a village located on the banks of the Upper Rajang River, Sarawak. A guesthouse was built there by the Punan Bah a decade prior, and served as the accommodation for the duration of the fieldwork. It is paid accommodation, and provides a small amount of revenue for Punan Bah. In accordance with University of Southampton ethical guidelines, the research was conducted in collaboration with the indigenous people. All those who contributed to the research in the form of logistics were financially compensated. Gebril, however, offered his assistance free of charge due to his particular interest in the research.

Ethnohistory

As discussed, the ethnohistory relied heavily on semi-formal interviews and informal conversation with Gebril and his relatives. In total, the ethnohistorical interviews amount to roughly two hours of recorded content (See Appendix C). They took place on the verandah of the guesthouse, with Gebril present to facilitate and translate, as well as one or two older members of the village. Punan Bah, like much of Sarawak, has undergone rapid Christianisation, Islamisation, and modernisation, which has left few with the knowledge of traditional customs. Specifically, these interviews aimed to elicit information regarding Punan Bah creation myths, traditional animism, social structure and the Kelirieng.

The appropriateness of interviews for ethnohistorical research is up for debate. While interviews are broadly considered a favourite tool for qualitative researchers (Denzin & Lincoln 2004:353), ethnohistorical, and especially ethnographic, interviews are usually developed in the context of long-term anthropological fieldwork, which gives the interviewer a greater chance of asking the right questions. This raises the issue of reflexivity in anthropological practice. Researchers have been encouraged to examine themselves, the impact of the self, and its cultural background in the formation of research questions. As Scholte argued:

'Anthropological activity is never only scientific. In addition, it is expressive or symptomatic of a

presupposed cultural world of which it is itself an integral part' (1972: 431)

There is no doubt that the questions formulated for this research, and the researcher's behaviours during fieldwork, are informed broadly by their cultural background. Anthropologists also have an impact on the society they study, their mere presence affecting how the host society operates, thinks about themselves and changes (Goodman 2000: 152). However, Goodman (2000: 251) argues that the effects of translation should be embraced and incorporated rather than avoided.

Heyl described the ideal interview disposition like so:

'I want to know what you know in the way that you know it... Will you become my teacher and help me understand?' (2007:369)

Being able to ask questions that understand culture as the indigenous people do is precisely what Heyl meant, and it is an aspiration that is difficult to meet without sustained fieldwork experience. Great effort was made in deciding what needed to be asked, however informal interviews are naturally ad-hoc and must be receptive to new information. It is also entirely possible to omit useful questions without realising their value. In one instance, after all of the Kelirieng had been visited and photographed, the question came to mind: 'Are the Kelirieng oriented in a specific direction? And if so, why?' This turned out to be quite an important question, however without revisiting the sites it was very difficult to assert the orientation of each Kelirieng. This example demonstrates the pitfalls that lie at the juncture of the researcher's lack of knowledge and the indigenous people's intuitive understanding of their own cultural practices.

A clear line must nonetheless be drawn between this study and a fully fledged anthropological one. This study is intentionally bounded by its focus on the Kelirieng and their ethnohistorical context, and does not seek to study modern Punan Bah society in general. Interactions with Punan Bah society as a whole were fairly limited since the study did not take place in the longhouse. Therefore, while a certain degree of reflexivity is necessary to understand what questions underpin the research and why they were asked, it is not so imperative given that the scope of research is limited compared to the scale of Punan Bah life.

Photography

All photos were taken from the ground level on a Samsung Galaxy S24 FE with a 12MP Rear Camera. Shutter speed and aperture settings were left automated. Roughly 50 - 100 photos for each Kelirieng was typical, depending on size and layout of the site.

GNSS Recording

A Garmin InReach Mini 2 was used to collect GNSS data on the location of the Kelirieng and other points of interest. Garmin InReach devices are accurate to 3m, making them

highly accurate for the purpose of this study. Ground control points were not used, however, meaning that centimetre accuracy was not available.

Photogrammetry

Digital models were initially built in Polycam as it is suitable for basic photogrammetry on a mobile device. Polycam allowed the dataset to be tested in the field while reshoots were possible in case of failure. The models presented in this report were constructed in AgisoftMetashape Pro at the University of Southampton.

Ethnohistory of the Punan Bah

Ida Nicolaisen stated that the study of ethnohistory not only provides us with the historic prerequisites to understand contemporary societies, but also helps to maintain ethnic identity alongside economic and political rights (Nicolaisen, 1976:63). Certainly, the Kelirieng are a fundamental aspect of Punan Bah ethnic and cultural identity, and form a bulwark of claims to lands rights. In understanding the ethnohistory of the Punan Bah, the meaning, and function of the Kelirieng is elucidated.

The Punan Bah are one of many minor ethnic groups in Sarawak. Their name is derived from the rivers Punan & Bah (Ungei Punan & Ungei Bah), which is where the Punan Bah are said to have originated. The Punan Bah creation myth asserts that their lineage was founded by Bua who was an *etun oa* (a supernatural being). Bua created the Bah River and the Punan Bah people, and then left for some time, however upon his return he found the Punan Bah people quarrelling and so made no more of them. After this event Bua left abruptly, leaving behind his quiver which turned to stone, and an imprint of his posterior on a boulder on the Bank of the Bah river (Nicolaisen 1976:65). The supposed location of the stone quiver remains a mystery, however the imprinted boulder is a well known feature of the river today (See Figure 2.1).



Figure 2.1: Bua's Seat is where myth suggests Bua sat before leaving (Photo by author)

Bua left two children, Tadou and Taga, through whom the Punan Bah trace their lineage. It is believed that these children were also *etun oa,* as were their immediate descendants, however the supernatural abilities of the Punan Bah waned over successive generations.

The dispersal of the Punan Bah from the upper Bah river to their current position on the Bah-Rajang confluence (Lo'o Ungei Bah) is explained in one of the Punan Bah's favourite myths, the disagreement between Kavo Oka and Kavo Oko. These two brothers entered a vicious dispute over a woman called Oro Saka which was so troublesome it threatened to destroy Punan Bah society altogether. In order to prevent this, a cousin of the two brothers, Payou, shot Oro Saka with a poison blow dart. Following Oro Saka's death the brothers decided to broker a peace, swearing on a

wood carving and on the 'tail of a dog'. Swearing an oath on a dog was considered the most powerful of all oaths by the Punan Bah. The site of this peace deal and the dog sacrifice is discussed in site C. Kavo Oko's son, Salaui, moved the Punan Bah to the Bah-Rajang confluence where modern Punan Bah kampong is situated (Nicolaisen 1976:67). This section of the Rajang River was sparsely populated, the nearest people being the Tanjong, near modern day Kapit, or the Sekapans close to Belaga. The Punan Bah were separated from these two groups by the Pelagus Rapids and Bungan rapids respectively. The Pelagus rapids presented a near impassable barrier between the Punan Bah and Tanjong, and remains a dangerous stretch of water today though modern, diesel powered boats are able to pass through it. This area between the Pelagus and Bungan rapids is considered by the Punan Bah to be their traditional territory (See Figure 2.2). Infighting and the aristocratic pursuit of recognition caused many episodes of dispersal from the Bah-Rajang confluence, with oral historical evidence suggesting some Punan Bah made it as far as the Kapuas River in Kalimantan. Though Nicolaisen's work should be consulted directly regarding this. At the time of her writing in 1976, the Punan Bah could trace their lineage back approximately 12 generations. As of 2026 that may have risen to 16 generations.

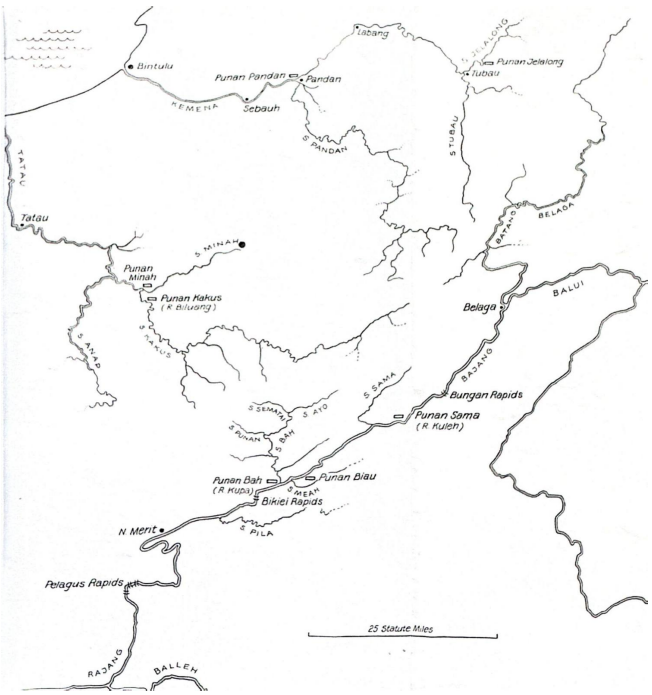


Figure 2.2: A map of the Rajang River region highlighting the Pelagus and Bungan rapids (Nicolaisen 1976)

Aristocrats, Kelirieng and Secondary Burial

A great deal has changed since the Punan Bah people were founded, notably the imposition of Brooke rule in 1841. The Brooke family, "the White Rajahs of Sarawak", imposed many laws and regulations on the indigenous people. James Brooke produced a set of laws in 1842 aimed at facilitating free trade in his new domain, and eliminating any hindrances to it. This included the prohibition of headhunting and slavery, which eventually altered Punan Bah societal structure (Gin, 1995: 23). The later accession of Sarawak to the Malaysian Federation had direct implications on Punan Bah lifeways as discussed in the introduction. Traditional Punan Bah society was originally divided between aristocrats (*laja*), commoners (*panyin*) and slaves (*lipien),* most of whom were descended from Bua. Some slaves, however,

were descended from defeated enemies. It was common to use enemy prisoners, captured in headhunting wars, as slaves. Ultimately, it is only those who achieved chiefdomship that have been remembered (Nicolaisen, 1976:66). Aristocrats had many advantages in Punan Bah society. They tended to organise annual meetings to discuss and decide on new areas to open paddy fields or fell trees. Commoners were required to perform work for the aristocrats, and could only focus on their own domain once the aristocrat's affairs were in order (Atong, 2025). It was for these aristocrats, the last of whom died in 2015, that the Kelirieng were built (Atong, personal communication, 2025). Aristocrats were initially buried in a tomb nearby the longhouse or adjacent to where the Kelirieng would be constructed and left for months until all of the flesh had decomposed. The remaining bones would be placed in an urn and interred in the burial chamber of the Kelirieng (Atong, personal communication, 2025). A slave would also be brought to the Kelirieng before it was erected, and after dancing around the site for a few rounds, they would be pushed into the Kelirieng's foundation hole. The Kelirieng would then be raised, crushing the slave in the process (Atong, personal communication, 2025). The orientation of the Kelirieng was important, the burial chamber was always placed facing perpendicular to the river, or facing downstream entirely. A burial chamber facing towards the flow of the river would prevent the aristocrat's soul from escaping and being carried successfully downstream to the afterlife. The Punan Bah feared that trapped spirits might return to harm the living (Atong, personal communication, 2025).

Beyok Animism

Traditionally, the Punan Bah subscribed to an animist belief system called Beyok which was relatively common throughout Sarawak. Though now it has largely been replaced by Christianity, and Islam to a lesser extent. Like other animist systems, Beyok was highly concerned with humanity's relationship with the non-human world. Gebril described it as 'your connection with nature' and this extended to the forest, its animals and forest spirits. Many of the laws that dictated Punan Bah behaviour were tied to appeasing spirits and ancestors to prevent illness, crop death and other maladies.
In an interview with Gebril's uncle, one of the eldest members of the Punan Bah, he said that people used to know which bird sounds were bad omens. Gebril went on to say:

'Okay, for instance, if you want to open up a new farm, farmland for your paddy planting, your paddy planting. Let's say tomorrow I go to that place, but suddenly I saw the kijang (mouse deer) there. So that means it's not a good sign. I have to cancel my plan there' (Atong, 2025)

Spirits could be appeased or thanked for good fortune by offering animal sacrifices. In simple terms, smaller animals such as chickens could be sacrificed for small fortunes and larger animals such as pigs for greater ones. It was common to sacrifice animals for a young

person's acceptance to university. The Punan Bah felt it important to offer annual sacrifices to the spirits, Gebril said:

'You appreciate them, just like you do some thanksgiving, that they're willing to protect you and willing to give you super power.
You have to do that every year. Otherwise, there are bad consequences also.' (Atong, 2025)

Harvey (2005: 117) argues that within animist metaphysics, humans often find themselves in more equitable relationships with the non-human world surrounding them, meaning they must constantly negotiate their relationships with it. There is a need to maintain relationships through ritual and by adhering to specific rules to avoid bad fortune such as crop failure or illness. It is not simply a belief in spirits, but a relationship in which living people must appropriately interpret and appease the non-human. This is seen most clearly in the regular sacrifices made for good fortune, or the avoidance of taboos.

Even death does not extricate individuals from their metaphysical obligations, or insecurities. Harvey (2005:118) argues that death rarely constitutes a fixed state opposed to life, but rather transforms a person and their relationships, though more significantly than other changes that occur during life. The orientation, engravings and sacrifices associated with the Kelirieng ritual are the manifestation of this. As discussed, the Kelirieng are critical in ensuring a smooth transition from the world of the living to the afterlife, but not an end to life.

Another fundamental aspect of this transformation is that social class often remains unchanged. Harvey (2005: 125) makes clear that what happens after death often perpetuates the 'social diversities' of pre-mortem life. In slave-owning societies this means that the slave remains enslaved and does not become a prominent ancestor. The Kelirieng ritual did involve the sacrifice of a human slave, and this is the animist logic that underwrites it.

Secondary Burial in Borneo: A Regional Context

The Punan Bah are, however, not the only group in Sarawak to practice secondary burial. Scholars have identified an area known as the Nulang Arc (See Figure 3.1), which is home to Sarawak's secondary burial cultures. Namely the Seping, Sekapan, Kayan, and Kajaman, Berawan, Kelabit and Punan Bah (Appleton 2011, Metcalf 1976). The word *nulang* is a Berawan word which might be translated as "to bone" or when translated to Malay becomes "to take bones" (Metcalf 1976: 97).

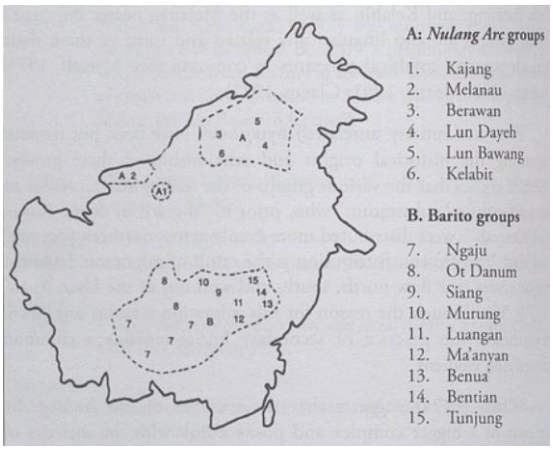


Figure 3.1: Map of Borneo specifying the location of the Nulang Arc (Appleton 2011: 140)

Evidence for secondary burial practices outside of the Nulang Arc is limited, though not entirely absent. A group known as the Ngorek, the descendants of which have now been culturally assimilated into the larger Kenyah group, performed a form of *nulang* very similar to those in the Nulang Arc. Ngorek burial rites followed a process consisting of the initial interment in a coffin (*lungan*), followed by a *nulang* festival approximately a year later. The skull and long bones would be retrieved, ritually washed and then placed in a ceramic jar to be placed atop a raised wooden pole called a *liang* (See Figure 3.2). It should be noted that the *liang* tradition is likely derived from an earlier tradition of urn-dolmen building (See Figure 3.3).

Such dolmens are found throughout the upper Bahau area, a few of which have been found with human skulls interred in them (Sellato 2016: 8). Sellato (2016) argues that since megalithic burial rites were generally designed to express the power and prestige of ruling aristocratic families, they were likely prohibited by conquering groups. As a result, the descendants of the Ngorek claim that, 'in the old times, stones were soft; then, they became hard, and we stopped making stone urns', instead turning to wooden *liang* (Sellato 2016:13).



Figure 3.2: Nyibun (descendent group of the Ngorek) liang with jar, upper Bahau River (Sellato 2016)



Figure 3.3: Standard urn-dolmen found in the upper Bahau area (Sellato 2016: 8)

The upper Malinau river, east of the Bahau area, is also home to a *liang-like* structure called *langkang (See Figure 3.4).* According to Sellato (2016) it was constructed by the Merap people, but is uncommon in the region. *Langkang* shares many design principles with both Ngorek liang and Nulang Arc monuments, such as 'a huge carved tree trunk, with a hollowed top section to place a ceramic jar containing the deceased's bones and a thick ironwood slab to cap it' (Sellato 2016: 24).



Figure 3.4: Merap langkang, upper Malinau River (Sellato 2016:24)

These cases are remarkably similar to the Punan Bah's Kelirieng, which are discussed briefly in Sellato's (2016) study. However, the practice of secondary burial or wooden monuments does not seem widespread beyond the Nulang Arc.

It should be no surprise that these groups share a degree of similarity in their burial practices, iconography and language. The modern day inhabitants of Sarawak and Kalimantan are descended from Austronesian populations who settled Borneo some 7 - 5 kya (Hoh et al 2022: 10). Linguistic and genetic evidence supports this, with both major Indigenous groups, the Dayak and Orang Ulu (the Punan Bah belong to the latter) classified as Austronesian language groups (Hoh et al 2022: 3). The possible Austronesian migratory routes are seen in figure 3.5.

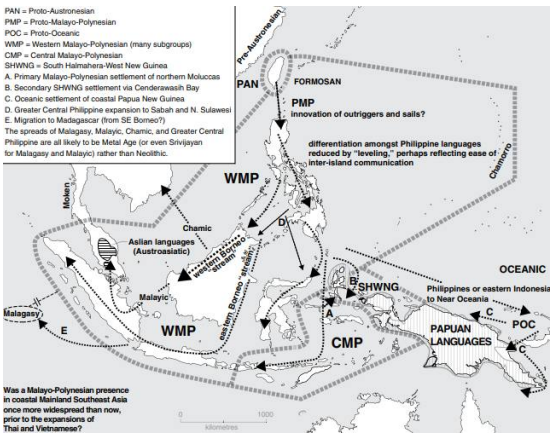


Figure 3.5: The likely migration routes of the Western Malayo-Polynesian linguistic sub groups of the Proto-Austronesian group (Bellwood 2017: 205)

The Austronesian origin of these groups also contextualises the broader regional distribution of secondary burial practices. Secondary burial in ceramic jars is documented among indigenous groups in Palawan and other areas of the Philippines (National Museum of the Philippines, 2021), which sits directly upstream of Borneo in the Austronesian dispersal sequence (Bellwood, 2017). This suggests that jar burial and the associated monument traditions of the Nulang Arc may represent regional variations of a shared Austronesian funerary tradition, carried southward through the Philippine archipelago and into Borneo before diverging into the distinct but structurally similar forms documented here. In this context it is also interesting to note the phonetic similarity between the Ngorek word 'liang' and the Punan Bah 'Kelirieng', both of which describe similar burial monuments. Whether this particular similarity reflects a shared linguistic ancestry or convergent naming is beyond the scope of this study, but it warrants further investigation

Findings

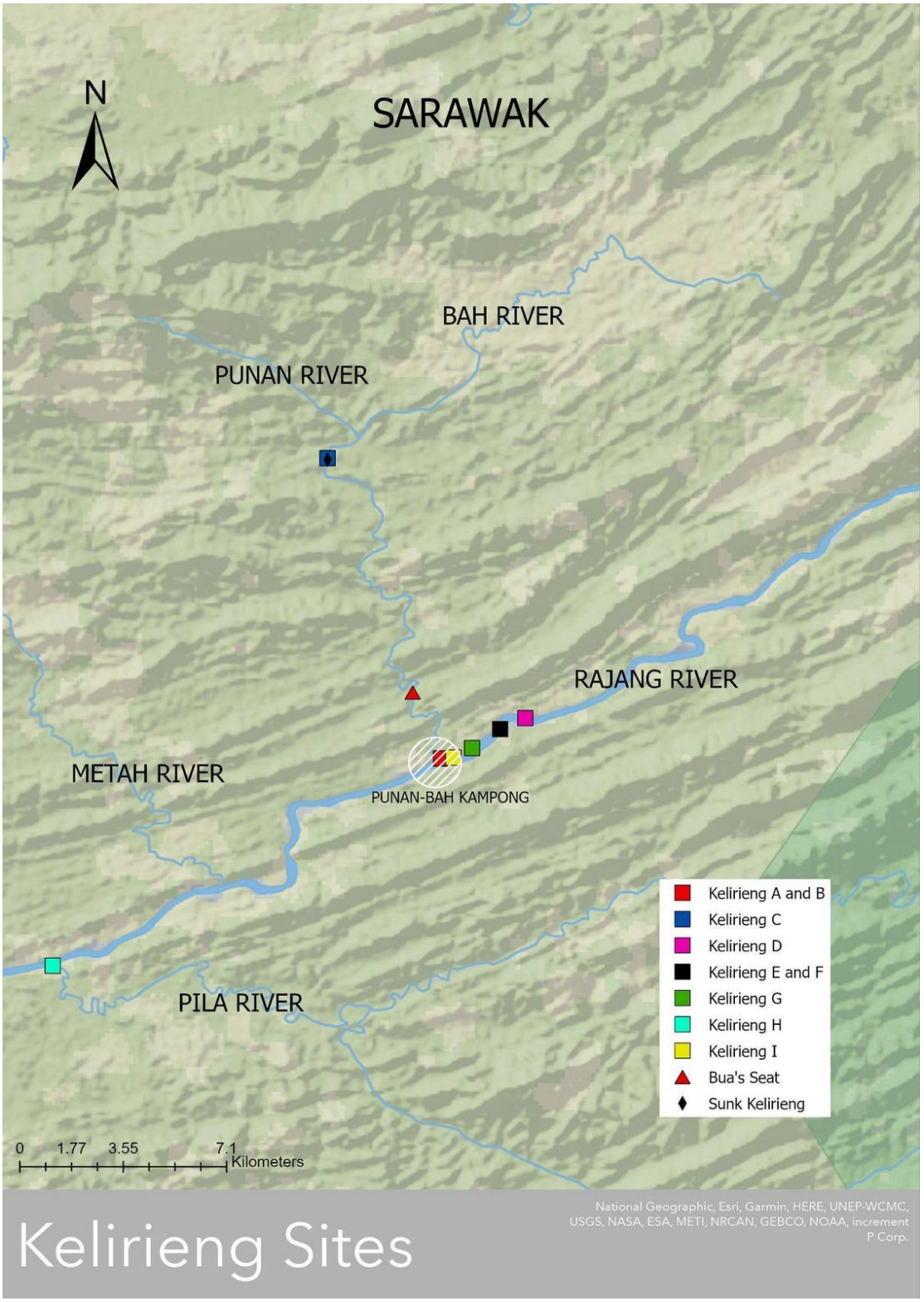


Figure 4.1: GNSS-derived map of Punan Bah Kelirieng sites (GNSS data recorded by author, 2025; basemap: National Geographic/Esri)

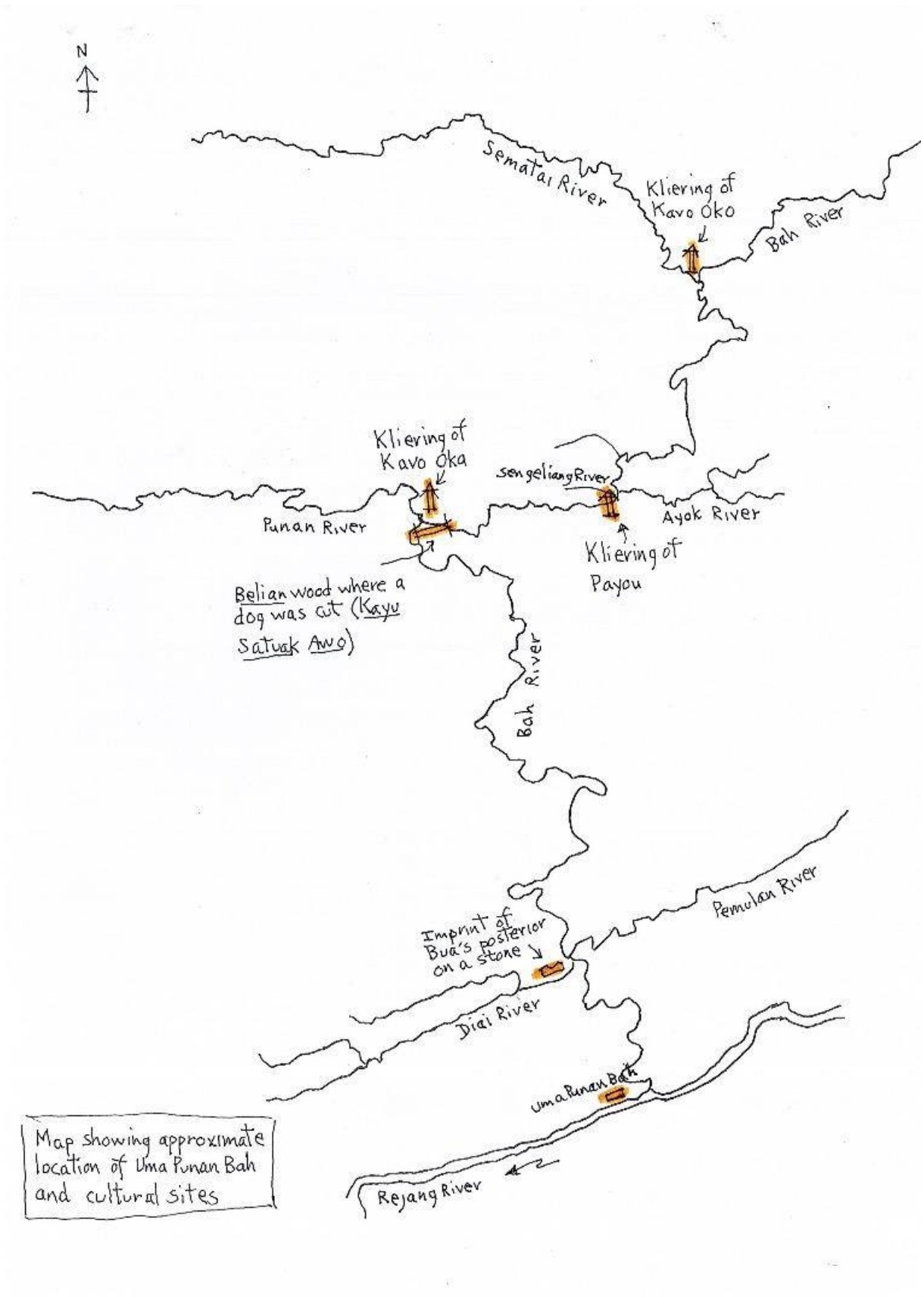


Figure 4.2: Hand-drawn map of Punan Bah Kelirieng sites produced by Langub (2016), shown for comparison with GNSS-derived survey data recorded by author, 2025 (See Appendix B)

Kelirieng are named after the respective aristocrats interred in them, for example Payou and Kavo Oko, beyond the Punan-Bah confluence (Lo'o Ungei Punan). The aristocrat associated with each Kelirieng in this report is not known, and so the sites are labelled with letters from A - I. Sites are further separated into Jungle and Kampong, distinguishing between the more remote sites and those found in Punan Bah village. Jungle and Kampong sites tend to differ in terms of degradation, conservation and threats.

Site A and B



Figure 5.1: Kelirieng A is propped up by a concrete alteration (Model by Author)



Figure 5.2: Kelirieng B is visibly black on the back side suggesting it was charred during the kampong fire (Model by Author)

This site contained two distinct Kelirieng in the heart of Punan Bah village. Site A (See Figure 5.1) was heavily degraded, with approximately ⅓ of the upper portion missing and requiring wire to hold it together. In addition the base of the Kelirieng was reinforced with concrete because it had rotted and become unstable.

Site B (See Figure 5.2) was in a slightly better condition, being able to stand alone. Both were blackened and covered in moss, it is likely that the same fire which destroyed many of Punan

Bah's Kelirieng could have scorched this site and contributed to the damage.

Both site A and B have clear motifs making them valuable for analysis and comparison.

Site C



Figure 6.1: A top-down orthomosaic of the Kelirieng at site C (Model By author)

The most distant Jungle site from Punan Bah, Site C (See Figure 6.1) contained three Kelirieng and a sacrificial Belian log. These Kelirieng had been retrieved from the nearby Punan River in the 1980s and placed under an open shelter. The original location of Kelirieng C1 was the Lukap - Bah confluence (Lo'o Ungei Lukap), upriver from the Punan - Bah confluence. The original location of the other Kelirieng at this site is unknown, but it is likely not far from their current position on the Punan River. Kelirieng C4 and C2 (See Figure 6.2) were highly eroded, losing most of their mass and exterior motifs. Kelirieng C1 was in better condition, with its motifs visible and its burial chamber still distinct. According to the map (See Figure 4.2) one of these Kelirieng is likely Kavo Oka's, however which one is not known.

The sacrificial Belian log was well preserved, with the "cutting" location still marked with light motifs (See Figure 6.3). According to Punan Bah tradition, this Belian log is where Payou brokered a truce between two warring brothers Kavo Oka and Kavo Oko by sacrificing a dog (Atong, personal communication, 2025).

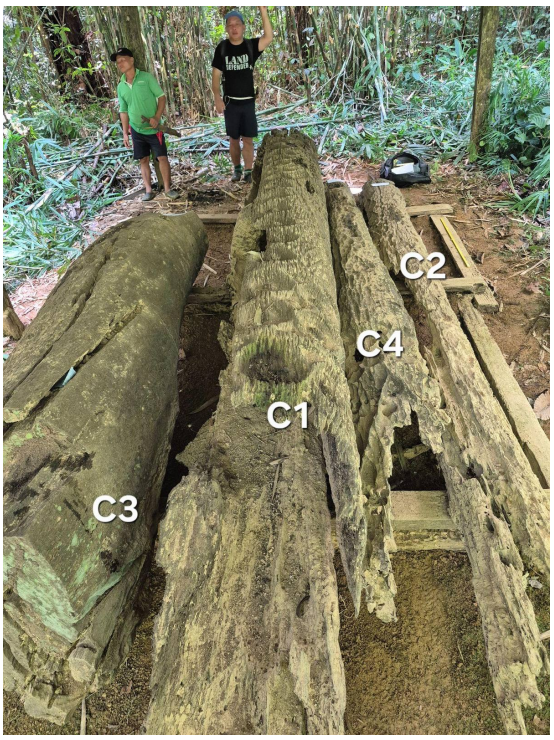


Figure 6.2: Three Kelirieng at Site C which were recovered from the nearby Punan River, and the log where "they cut the dog" (Photo by author)



Figure 6.3: The sacrificial Belian log with a small section of motifs. The log is stained with beer which was poured as an offering by Gebril (Model by Author)

Site D



Figure 7.1: Kelirieng D with its top cap resting at the base (Model by Author)

Site D (See Figure 7.1) is a relatively well preserved jungle site, with distinct motifs and burial chamber. The wooden cap that would have once been on top of the Kelirieng is now resting at the base. However, areas around the burial chamber have degraded, with holes and splits appearing. It appears that wire was tied around the top of the Kelirieng to prevent large sections from splitting off (See Figure 7.2). There appears to be a slight, perhaps 3 degree, lean that may exacerbate in the future. Like many of the Kelirieng discussed, a small fence has been erected at the base.



Figure 7.2: Wire has been tied around the Kelirieng roughly 1.5m from the top to prevent splits from rupturing the whole structure (Photo by author)

Site E

The Kelirieng at this site (See Figure 8) was severely decomposed, with only ½ still standing. The other half had fallen and was difficult to access without cutting away shrubbery. The standing portion faced significant organic intrusion, with plants covering large portions of it. This made producing a photogrammetry model impractical, as it confused the software. Many of its motifs were still visible, however, especially at the top.



Figure 8: Kelirieng E is heavily degraded with only ½ of the original structure still standing (Photo by Author)

Site F



Figure 9: The Kelirieng at site F (Model by author)

This site along with Sites H and I, was one of the best preserved jungle sites. Notably, the wooden top cap remained in place which is highly uncommon. Although a large split had developed on the opposite side to the burial chamber, as seen in figure 9, the Kelirieng appeared sturdy and well preserved, with little organic degradation. It was also one of the largest Kelirieng, both in terms of height and circumference, and with high-relief motifs.

Site G



Figure 10: The Kelirieng at Site G has been partially consumed by a tree (Model by Author)

The Kelirieng here (See Figure 10) has been partially consumed by a tree, leaving only ½ of it still visible. It has been pushed to an angle of

roughly 5°, and with the decay seen at the base, it is possible that it could collapse in the coming years.

Site H



Figure 11: The Kelirieng at Site H which is heavily overgrown but generally well preserved (Model by author)

Accessing this site required meeting with a neighbouring village elder to gain permission. It is perhaps the largest Kelirieng in this report and was heavily overgrown (See Figure 11), especially towards the top. Wooden props had been placed at the base to support the Kelirieng, however there did not appear to be an imminent risk of collapse.

Site I



Figure 12: Kelirieng I is a well preserved Kampong site with the top stone still present, and high relief motifs (Model by Author)

Site I (See Figure 12) is a kampong site and among the best preserved Kelirieng in this study. Unlike the majority of Kelirieng documented, the top stone remains in place, which as noted at Site F, is highly uncommon. The high-relief motifs are clearly visible across much of the surface, making it particularly valuable for motif analysis. There is minimal organic intrusion relative to other kampong sites, and the structure appeared stable with no significant lean or decay at the base observed during fieldwork.

Motif Style

Kelirieng C1 is characterised by small oblong shapes, which are bounded by longer strips running vertically. These oblong shapes are approximately 5 - 10cm in length. This design is known as 'net' (*mata jalo*) (See Figure 13.1). The Kelirieng at site D appears to have a similar net pattern, although with larger oblong shapes that are spread more widely (See Figure 13.2). Kelirieng at all other sites (A, B, E, F, G, H, and I) are primarily characterised by high-relief spiral shapes (*ikang*) (See Figure 13.3). Interestingly, humanoid and gibbon (*kelavet*) motifs are common on these Kelirieng (See Figure 13.4), but are absent at sites C and D.

The spiral design isn't, however, entirely missing at sites C and D, appearing in smaller sections of these Kelirieng (See Figure 13.5, & 13.6).

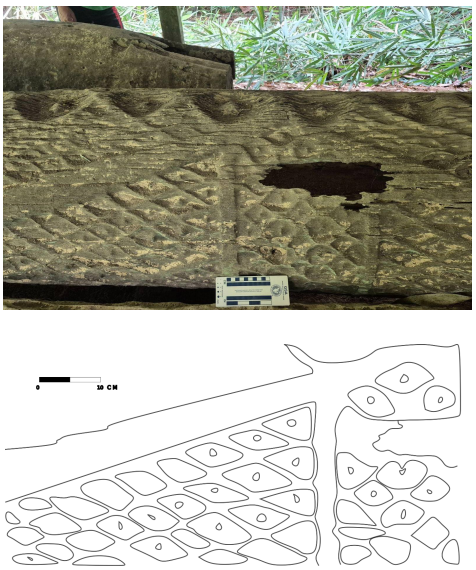


Figure 13.1: Photo of Kelirieng C1 (top) and a sketch of a portion of exterior engraving style on C1 (bottom) (Photo and Sketch by Author)

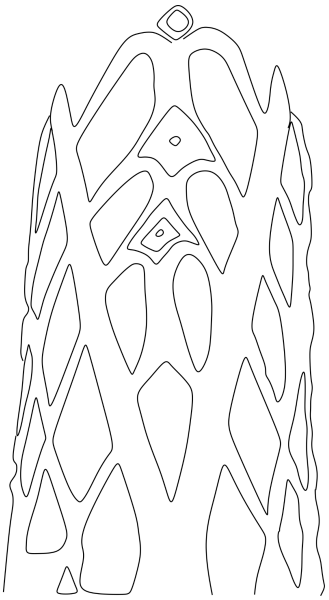


Figure 13.2: A sketch of motifs on Kelirieng D (Sketch by Author)

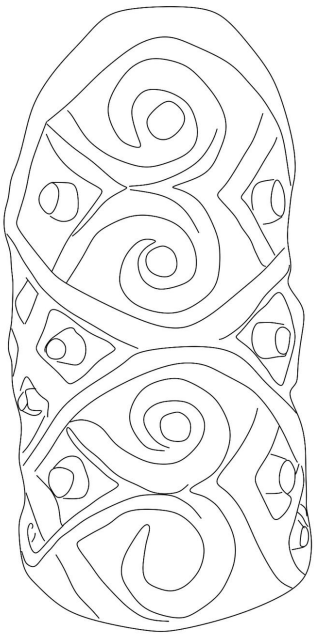


Figure 13.3: A sketch of the motifs on Kelirieng B (Sketch by Author)

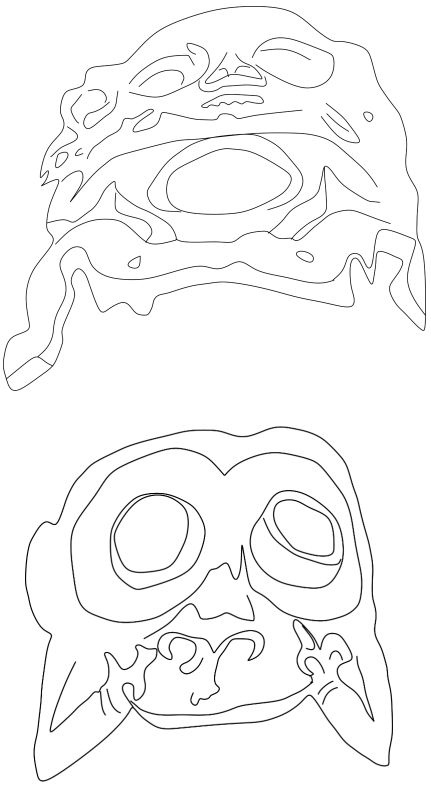


Figure 13.4: Sketches of figures engraved in Kelirieng F (Top) and Kelirieng G (Bottom) (Sketch by Author)





Figure 13.5: Screenshot from Kelirieng C1 model showing spiral style engraving (top) and a sketch (bottom). The engraving is heavily degraded, losing almost all detail beyond the outline 9Sketch by Author)



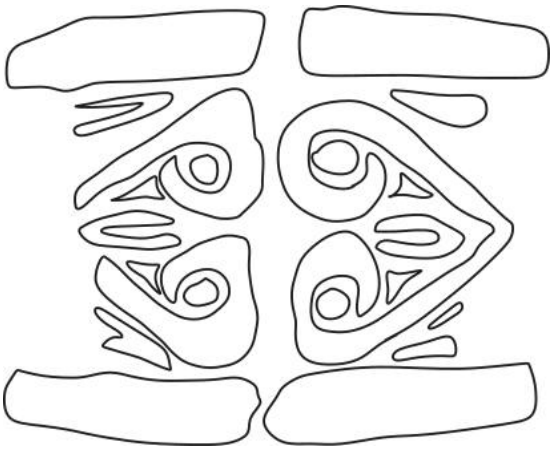


Figure 13.6: Screenshot of Kelirieng D model highlighting a spiral design (top) and sketch (bottom) (Sketch and Model by Author)

Discussion

Interpreting Kelirieng Motifs

As discussed, the individual aristocrat associated with each Kelirieng is not known which makes an age assessment difficult. However, the wear patterns at Site C, alongside the trajectory of Punan Bah history suggests it is the earliest site. The oral-historical timeline of the Punan Bah confirms the later relocation of the Punan Bah to the Bah-Rajang confluence, meaning that Kelirieng sites in the Upper Bah River predate sites nearer to the modern day kampong. Both Nicolaisen (1976) and Guerreiro (2017) broadly support this, agreeing that the earliest Kelirieng in the Upper Bah River likely date to the mid-17th century, while those on the banks of the Rajang River were probably constructed around the mid-19th century.

By analysing the motifs at Site C and comparing them to other sites, a typology begins to emerge. The Site C Kelirieng are characterised primarily by the *mata jalo* or refined 'net' design, which Guerreiro (2017) identifies as a feature of older poles across the region. The Kelirieng at Site D share a similar but looser version of this pattern. Whereas the Kelirieng at all other sites are dominated by high-relief spiral motifs (*ikang*), sometimes accompanied by humanoid and gibbon (kelavet) figures that are entirely absent at Sites C and D. This suggests a development from the *mata jalo* toward the high-relief, spiral style with the inclusion of figures over time.

The development of the kelavet iconography as a dominant theme in later Punan Bah Kelirieng warrants further discussion. The kelavet seem to have specifically apotropaic properties in Beyok animism. When asked about the importance of the kelavet, Atong stated:

‘Because in our belief, in our traditional belief, gibbon design or gibbon pattern can
scare away the bad spirit’ (Atong, 2025).

This confirms that the inclusion of the kelavet is not decorative, but rather holds metaphysical value insofar as it defends the souls of the deceased on their journey to the afterlife. The absence of the kelavet or distinct figurines on earlier Kelirieng suggests that this iconographic tradition was either not-yet developed or at least understated. The underlying reason for emergence of the kelavet as a key style is difficult to express. It may represent an independent development within Punan Bah theology, or perhaps one spurred by their interaction with the Kayan people (Atong, personal communication, 2025). This remains an open debate, and one which future comparative research into Kayan and Punan Bah animist traditions may yet resolve.

Nicolaisen (1976: 68) records that various Kayan groups closed in on Punan Bah territory during Salaui’s chiefdom, which immediately erupted into violence. Eventually a peace was brokered, when the Kayan headman, Dian, married his daughter, Usun Dian, to Salaui. This was supposedly followed by further

intermarriage between the groups. It is plausible, then, that this cultural syncretism caused a shift in Kelirieng construction practices. The humanoid and *kelavet* motif is prominent in Kayan traditions, and its increasing dominance in later Punan Bah Kelirieng would be consistent with a period of sustained cultural exchange. Notably, rock-carved motifs at Kayan Hilir in West Kalimantan (See Figure 14) bear a strong resemblance to the humanoid figures found on later Punan Bah Kelirieng (Sellato 2016), which tentatively supports this hypothesis and points toward the value of a broader inter-group motif study.

It is important to note that the *ikang* motif is not entirely missing at earlier Kelirieng sites. Faint spiral engravings are visible in sections of the Site C and D Kelirieng (See Figure 13.5, 13.6), though heavily degraded. This suggests the motif was present in Punan Bah design thinking from an earlier period, but becoming predominant later on. This nuance would be difficult to detect through conventional photography alone, and it is here that photogrammetry demonstrates particular value. The 3D models produced in this study allowed for the examination of degraded surface detail at angles and resolutions that ground-level photography could not consistently achieve. In this sense, the motif typology proposed here is not only an interpretive contribution but also a demonstration of what digital conservation techniques make possible for the analysis of deteriorating heritage.





Figure 14: A Kayan rock carved motif depicting a humanoid figure, found at Kayan Hilir in West Kalimantan (top) (Sellato 2016) and a similar motif on Kelirieng I (bottom) (Model by Author)

Modern Funerary Motifs

The construction of Kelirieng is now an antiquated practice. In the modern day, the Punan Bah produce a *Dopeang* (See Figure 15) to be placed by the grave on the day of burial. Gebril explained that the Dopeang;

'Act as a guiding light for the spirit of the deceased to pass through the dark passage before their spirit reaches the gates of heaven'

The function, it seems, is quite similar to the Kelirieng in that it offers guidance to the deceased on their way to the afterlife. Analysing the motifs, it is also clear that they share some similarities to those on the Kelirieng. The *ikang* shape is present, though the kelavet motif isn't. There is, however, an *Ulei Inan Benyai* (Snake Body with Woman's Face) at the centre. Gebril explained that this motif, alongside the Ulei Ureang (Prawn), and Ulei Asok (Dog) are the other types of funerary drawings.

The Dopeang demonstrates that, while the Kelirieng as a physical form has been abandoned, the underlying spiritual concern they solved persists. The shared presence of the *ikang* spiral across both objects suggests it belongs to a broader Punan Bah funerary visual vocabulary, its appearance on Kelirieng therefore reflecting deliberate spiritual intent rather than decoration. The serpent-woman, prawn and dog motifs appear unique to the dopeang, suggesting an iconographic tradition that has developed independently from the Kelirieng.



Figure 15: Modern Punan Bah community members taking part in the creation of a Dopeang (Top), the Ulei Inan Benyai is visible (Bottom) (Photo by Atong)

Photogrammetry for Conservation

Although Guerreiro estimated that the Kelirieng may start to vanish by the middle of the 2030s, this seems unlikely given their overall good condition. Certainly Kelirieng C, G and E are quite deteriorated, and may lose their motifs or structural integrity before the others. However, considering the dimensions and durability of Belian wood, it is unlikely that they will vanish entirely for a century or more. What is at greatest risk are the exterior motifs, which as seen on Kelirieng at site C, become shallow and faint over time. Indeed, as demonstrated in the motif analysis above, it is precisely this kind of surface degradation that photogrammetry is best placed to record before it is lost entirely.

The Kelirieng at Kampong sites face a different and more unpredictable threat, namely fire, which represents a categorically different threat to Kelirieng than the gradual environmental processes affecting jungle sites. Whereas erosion, vegetation intrusion and insect activity degrade a Kelirieng incrementally, allowing for monitoring and intervention, fire can destroy a monument entirely and without warning. At least five Kelirieng in Punan Bah have already been lost or severely damaged this way (See Figure 16). The density of longhouses, and their wooden construction, makes kampong environments inherently more volatile. Longhouse fires have been a persistent issue in Sarawak, with electrical faults and open fires accounting for most instances (Dayak Daily 2018). This makes the case for digital conservation of Kampong sites particularly urgent, a photogrammetric record may prove to be the only surviving, high quality documentation of a Kelirieng that no longer exists in a decade. In this sense, the Kampong sites present the strongest argument for prioritising digital conservation now rather than treating it as a future consideration.

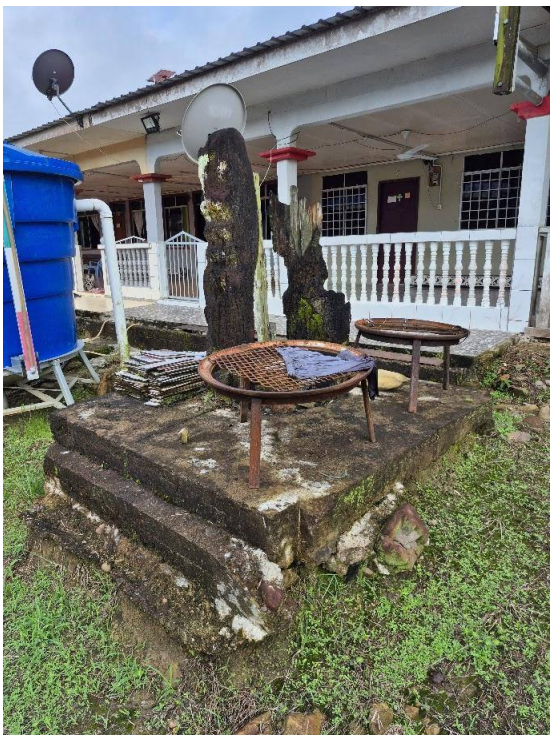


Figure 16: One of three Kelirieng which was completely destroyed by fire in Punan Bah. The open-air cooking equipment that causes many longhouse fires are seen next to the burned monuments (Photo by Author)

Broadly, without being actively conserved, the Kelirieng will deteriorate, succumbing to weather, river erosion, vegetation or burrowing insects. It is for this reason that an accurate GNSS based map of the Kelirieng, and associated 3D models, is valuable. Such a record is indefinite, and can be archived, reproduced and disseminated, extricating the Kelirieng from their physical limitations. Crucially, it also provides a baseline which future conservators can consult to assess the rate of change and estimate lifespan more accurately. Should photogrammetry surveys be conducted periodically, the rate of deterioration could be tracked with considerable precision, allowing conservators to prioritise the most vulnerable sites and intervene before irreversible

loss occurs. Photogrammetry surveys have been employed in this way by University of Melbourne researchers working on rock art sites in Kakadu, Australia, since the 1980s (Gillespie 1983). Importantly, photogrammetry is generally non-invasive, requiring nothing more than a camera and access to the site. This is particularly significant in the context of the Punan Bah, who have limited resources and for whom invasive archaeological methods such as excavation would be both costly and potentially controversial. The benefit of photogrammetry to current and future scholars is well addressed in the literature (Al-Razouq 2012, Saipi 2025) and the Kelirieng are no exception. The limited budget of this study also demonstrates the cost effectiveness of photogrammetry as a tool of heritage conservation. Although programmes such as AgisoftMetashape Pro are expensive and require significant computing power, communities and individual researchers could conduct basic photogrammetry surveys using mobile phone applications such as Polycam or RealityScan. Doing so would allow them to create comprehensive and accessible interactive models of cultural heritage sites, which are more intuitive to navigate than a selection of photographs. The proliferation of photogrammetry software has, in a sense, democratised it as a tool of heritage conservation (Waas & Zell, 2013: 1).

Photogrammetry in Heritage and Territorial Management

The application of these digital technologies should not be limited to small scale, and sporadic modelling of Kelirieng. Such an effort may well become clumsy, inconsistent and ineffective for achieving measurable political aims. A single external study, although valuable, remains a static piece of evidence which is not entirely owned by the Punan Bah themselves. Instead, indigenous led digital conservation and monitoring efforts at Australian heritage sites might be modelled to achieve political goals. Provost (2025: 1441) characterises indigenous heritage sites as mnemonic landscapes, which are embedded repositories vital to the continuation of indigenous cultures. Yet these landscapes remain under persistent threat from industrialisation, development, mining and poor management (Nicholas 2022: 402). In response to these threats, Indigenous Australians have turned to community-led digital conservation initiatives. Macdonald et al (2021) provide a compelling theoretical model of this at Jarrangbarnmi in Kakadu National Park, northern Australia, where Jawoyn Traditional Owners co-designed protocols for the use of drone technology to monitor their biocultural landscape. The research ensured that Indigenous governance was championed by implementing a ‘Steering Committee’. The committee centred Indigenous Elders at the heart of the decision making process regarding project aims and methods (Macdonald et al 2021: 306). Additionally, researchers focused on fostering ethical and trusted research relations with Indigenous people, ensuring they were ‘transparent and collaborative in

describing how digital technologies could be responsibly co-designed and applied to understand management actions to care for Jarrangbarnmi' (Macdonald et al 2021: 307). However the most significant aspect of the research design, and what is most relevant to this study, was the enabling of 'on-going Indigenous-led technological innovation' in the sphere of heritage and territorial management (Macdonald et al 2021: 309). The practical benefits of such community-led frameworks are well demonstrated beyond Australia. The United Nations Food and Agriculture Organisation implemented a community forest monitoring project with indigenous communities in Panama between 2015 and 2017, training members of eleven indigenous territories in drone operation, GIS, image processing and mapping (FAO 2018: 1). Communities trained in these digital tools were able to generate precise data that was useful to effective decision making regarding their territory (FAO 2018: 9). Specifically, Indigenous people were able to monitor illegal logging activity, forest fires and water resources. The continuous monitoring of territory by newly trained GIS technicians was found to be particularly useful in legal proceedings regarding land rights (FAO 2018: 7). The value lies in the community autonomy, allowing them to exercise full rights of their digital data, and innovate on new applications. The FAO programme in Panama is directly relevant to the Punan Bah. A community trained in GNSS, GIS, photogrammetry and drone operation could sustainably monitor heritage sites, forest resources and the encroachment of extractive industries into their territory. These tools would also support the creation of high-quality and data driven maps that could support or defend land rights claims. The basic GNSS derived map provided in this study could be used as a framework for a more comprehensive one. This study is, therefore, best understood as a foundation rather than a finished product. Its most important contribution may be demonstrating that low-cost digital conservation is viable in the Punan Bah context, and pointing toward the community-led stewardship that should follow.

Digital Conservation and NCR

The importance of the Kelirieng to Punan Bah NCR claims was briefly addressed in the introduction but must be drawn out more fully. The Sarawak Land Code 1958, Section 5, Article (2) (D), designates burial grounds or shrines constructed prior to 1958 as grounds for NCR designation. The Kelirieng are the Punan Bah's strongest evidence to uphold land rights claims based on this definition. The conservation of the Kelirieng is, thus, a legal imperative as much as an archaeological one. However, the Kelirieng face many challenges as the condition assessments above demonstrate. The Kelirieng at site C are not in their original position. River erosion eventually caused them to crumble into the river, from which they were retrieved and placed in their current location (Atong, personal communication, 2025). The 'sunken Kelirieng' near site C, noted on the map, is also a potential example of this. Each time a Kelirieng is destroyed, or displaced from

its original position, Punan Bah territory constricts in a legal sense.

The Sarawak Land and Survey Department recognises genuine NCR claims and has a documented history of compensating communities when NCR land is acquired for development (Mahmood, 2010). The challenge for the Punan Bah is not the absence of legal protection but the difficulty of meeting the evidentiary burden that the legislation requires. Without Kelirieng, the Punan Bah have little beyond oral history to defend claims to their traditional territory. This project seeks to rectify this issue in part by creating a substantive, and permanent record of Punan Bah Kelirieng, their motifs and location as of 2025. Should the condition and integrity of the Kelirieng deteriorate due to environmental or human processes, then the Punan Bah will not be without evidence for NCR claims in the future. It should be noted that the Land and Survey Department utilises aerial photography, as well as relevant documents such as 'land-use maps' and 'fieldbooks' (Mahmood 2010). The spatial, digital and ethnohistorical research conducted for this project could be used to fulfill evidentiary criteria usually expected by the Land and Survey Department.

Limitations

This study faced several practical constraints which affected the scope and completeness of the digital models produced. No funding was available, meaning that drones, laser scanners and RTK receivers were unavailable. This constrains the accuracy of Kelirieng location data since they are only accurate to 3m. The absence of drone access meant that models are incomplete in inaccessible areas such as the upper portions of the Kelirieng. Similarly, vegetation frequently hampered access to sites or distorted the models, meaning that not all Kelirieng were suitable for photogrammetry and are discussed in this report with images alone. Low water levels during the dry season also rendered the river beyond the Punan-Bah confluence inaccessible by canoe, meaning the Kelirieng of Payou and Kavo Oko could not be documented. A standard archaeological metre scale bar was also unavailable due to luggage constraints, and a folding yellow ruler was used instead. While visible in the images, the modelling software tended to filter it out, making technical scaling difficult. The single fieldwork visit also precluded any return to sites, meaning that questions which emerged late in the research process, such as the orientation of each Kelirieng relative to the river, could not be revisited. Time constraints further limited the ethnographic depth of this study, and the earlier work of Ida Nicolaisen has been relied upon heavily to fill key knowledge gaps. Gebril, too, was relied upon heavily for interpretation of cultural objects and practices, and for translation. Reliance on a single interlocutor is generally inadvisable for ethnographic or ethnohistorical research, since discussion with various informants is advised for effective qualitative research (Denzin & Lincoln, 2004). However, given the financial constraints and the limited number of

community members with sufficient English, few options were available.

It must also be noted that the motif typology proposed here is tentative, based on a small sample of monuments and without corroboration from comparative material analysis or from community members themselves. The proposed cultural connection between Punan Bah, Kayan and Ngorek motif traditions similarly requires further comparative research before it can be stated with confidence.

There are also limitations inherent to photogrammetry as a conservation technique. Models and maps cannot reproduce the totality of a site's setting and environment. Most importantly, photogrammetry cannot substitute the traditional knowledge associated with these monuments. It inherently abstracts them from their cultural setting and social meaning (Provost, 2025: 1441), something which this study has aimed to offset through in-depth dialogue on Punan Bah ethnohistory. Digital conservation is therefore best understood not as a replacement for lived cultural knowledge, but as a complementary tool that preserves what is physically observable while it endures.

The photogrammetry models produced in this study are currently inaccessible to the Punan Bah. This is because there is no means of hosting large, open-source 3D models for free, and paid options would burden the researcher with continuous payments. More work must be done to secure a place for the models on an open-source platform, perhaps with the Sarawak Museum, however this would still lie beyond Punan Bah ownership. Thus, the argument for indigenous conservation work is reiterated, so that the process and product of heritage conservation is in the community's possession.

Future Research

The literature on the Punan Bah and Kelirieng in particular is thin, consisting of two primary researchers, Ida Nicolaisen and Antonio Guerreiro. As a result, opportunities for future research are numerous. Gebril pointed to the location of a sunken Kelirieng near the Punan-Bah river confluence. The Kelirieng is not visible, likely having been silted over. Its existence even remains up for debate. However, an underwater archaeological investigation, perhaps utilising sub-bottom profiling, could elucidate it. Whether an underwater excavation could be conducted remains unknown, and attempts to retrieve it would be further complicated by conservation issues such as structural collapse (Kaye 1995: 37).

Additionally, the Kelirieng of Kavo Oka and Kavo Oko, beyond the Punan-Bah confluence remain to be modelled using photogrammetry. As discussed, the other groups of the Nulang Arc practice secondary burial. Just as this study compared earlier and later Punan Bah Kelirieng motifs, a similar study on inter-group motif analysis might elicit more information. A typology of regional burial monuments could be created by identifying families of style and motifs. Sellato's (2016) work highlighted many sites throughout Borneo, including Kalimantan, that may be relevant to a study of Sarawakian motifs.

Therefore, a broad and up-to-date literature review of known sites would be exceptionally valuable to Bornean heritage studies. The addition of a clear, well researched and interactive map of sites may also help to visualise and connect disparate sites.

An ethnographic project focused on discerning similarities and differences in practices, beliefs and myths surrounding the burial monuments would also be valuable to produce a more coherent understanding of secondary burial in Borneo.

Furthermore, none of the Kelirieng retain the burial urns in which the deceased aristocrats were interred. As discussed in the ethnohistory section, once the Brooke administration quelled tribal violence in the Upper Rajang river, merchants were able to travel deeper into Sarawak's interior, trading products for "jungle goods". This is likely when the burial urns began to go missing, either through trade or theft. A comprehensive study of trade in this era may be able to illuminate the fate of the Punan Bah burial urns.

Conclusion

This research set out with two aims; The first was to gain new insights into Punan Bah ethnohistory and traditional animism. The second was to assess whether low-cost digital conservation techniques could meaningfully contribute to the preservation of Punan Bah Kelirieng. On both counts, I believe it has been successful, though with the caveats that short fieldwork periods and limited resources inevitably impose.

The Kelirieng are important features of the Punan Bah's cultural landscape, and act as mnemonic objects that maintain the thread of Punan Bah history. A tradition that, as I have argued in this paper, may stretch back as far as the Austronesian settlement of Borneo some 7-5 thousand years ago. This regional context, explored through the secondary burial traditions of the Nulang Arc and the structural similarities between the Kelirieng and related monuments such as the Ngorek liang, suggests that the Punan Bah funerary tradition is not an isolated phenomenon but a regional variation of a shared Austronesian heritage. As a result, the Kelirieng have become a fundamental tool in the legal preservation of Punan Bah territory, providing proof of long term habitation on the banks of the rivers Punan, Bah and Rajang. The digital record produced by this study now provides an evidential backup should physical Kelirieng be lost, displaced, or further degraded. This prospect has direct implications for the Punan Bah's ongoing pursuit of NCR designation under the Sarawak Land Code 1958.

The motif typology proposed here suggests a development from the abstract *mata jalo* of the earliest sites to the figurative, apotropaic ikang and kelavet of the later ones. This is a contribution to the limited literature on Punan Bah material culture, which has only been briefly addressed by other scholars such as Guerreiro (2017). The connection between the kelavet's protective function and the soul's downstream journey to the afterlife, confirmed through oral tradition and visible in the archaeological record, is one of the more satisfying findings of the fieldwork, precisely because it emerged from the intersection of conversation and observation rather than from the literature alone. The survival of the *ikang* spiral in the modern Dopeang further suggests that, while the Kelirieng as a physical form has been abandoned, the funerary visual vocabulary it embodied persists, and is an indication that the spiritual concerns the Kelirieng once addressed remain important.

The digital conservation element demonstrated that photogrammetry is viable and accessible in this context. The models produced are imperfect, constrained by ground level photography, jungle vegetation, and the absence of drone access, but they remain clear and detailed. Should a Kelirieng succumb to fire, flood or neglect, there is now a record. At present, however, these models remain inaccessible to the Punan Bah themselves, a limitation that underscores the need for the

community-led, resourced initiative this study has argued for.

This study cannot substitute a community-led, sustained monitoring effort that the Punan Bah ultimately needs. The most important contribution of this research may not be the models or the motif analysis, but the demonstration that such work is possible with minimal resources, and that the Punan Bah have both the heritage and the legal standing to pursue it on their own terms.

References

Abdullah, A.R. & Langub, J. 2011. *Seping Secondary Burials: Past Practices and Present Day Significance*. The Sarawak Museum Journal, 69(90), pp.127-138. doi:10.61507/smj22-2011-PCXZ-07.

Al-Razouq, R. 2012. Photogrammetry for archaeological documentation and cultural heritage conservation. *Spec. Appl. Photogramm*, p.97.

Appleton, A. 2011. 'Melanau secondary treatment of the dead: re-membering connections', *The Sarawak Museum Journal*, LXIX(90), pp. 139–160.

Atong, G., 2025. Interview transcript: Beyok Animism and Kelirieng traditions. Appendix C. Unpublished interview conducted by Thomas Laidlaw, Punan Bah, Sarawak.

Batrisyia, D.D., Asif, N. & Sanusi, A.N.Z. 2024. *A preliminary investigation into the unique features of timber application in Sarawakian traditional architecture.* Borneo Journal of Sciences & Technology, 6(1), pp.57–66. Available at: https://doi.org/10.35370/bjost.2024.6.1-07

Bellwood, P. 2017. *First Islanders: Prehistory and Human Migration in Island Southeast Asia*. Hoboken: John Wiley & Sons.

Brooke Heritage Trust. 2016. *History of Sarawak*. Available at: https://www.brooketrust.org/history-of-sarawak

Dayak Daily. 2018. Longhouse fires in Sarawak, a growing concern – Part 3. Available at: https://dayakdaily.com/longhouse-fires-in-sarawak-a-growing-concern-part-3/

Denzin, N., & Lincoln, Y. (Eds.) (2004). Handbook of qualitative research. Thousand Oaks, CA: Sage

FAO. 2018. Drones for community monitoring of forests: new technologies for self-management of indigenous territories in Panama. Rome: Food and Agriculture Organization of the United Nations.

Gillespie, D., ed. 1983. The Rock Art Sites of Kakadu National Park - Some Preliminary Research Findings for Their Conservation and Management. Canberra: Australian National Parks and Wildlife Service.

Gin, Keat. 1995. An Economic History Of Sarawak During the Period of Brooke Rule, 1841-1946. The University of Hull. Accessible at: https://hull-repository.worktribe.com/preview/4209882/content-hull_3479a.pdf

Goodman, R. 2000. Fieldwork and Reflexivity: Thoughts from the Anthropology of Japan. In P. Dresch, W. James and D. Parkin, eds. *Anthropologists in a Wider World*. New York: Berghahn Books.

Guerreiro, A.J. 2017. *Kelirieng: The Vanishing Monumental Heritage of Sarawak*. KINOKELIRIENG, pp.1–23. Available at: https://www.artoftheancestors.com/blog/kelirieng-antonio-guerreiro

Harvey, G. 2005. Animism: Respecting the Living World. Columbia University Press. New York.

Heyl, B. 2007. Ethnographic Interviewing. In (Eds) Paul. A, Amanda. C, Sara. D, John. L, & Lyn. F., Handbook of Ethnography, 2007. Sage Publications. Accessible at: https://ethnographyworkshop.files.wordpress.com/2014/11/heyl-2007-ethnographic-interviewing-handbook-of-ethnography.pdf

Hoh, B.P., Deng, L. and Xu, S. 2022. The Peopling and Migration History of the Natives in Peninsular Malaysia and Borneo: A Glimpse on the Studies Over the Past 100 Years. *Frontiers in Genetics*, 13, p.767018. DOI: 10.3389/fgene.2022.767018

Janowski, M. 2003. *The Forest, Source of Life: The Kelabit of Sarawak*. London: Routledge.

Kaye, B. 1995. Conservation of waterlogged archaeological wood. *Chemical Society Reviews*, *24*(1), pp.35-43.. Available at: https://doi.org/10.1039/CS9952400035

Langub, J. 2016. *Map showing approximate location of Punan Bah and cultural sites* [unpublished document]. Produced as witness statement in NCR land case Punan Bah vs Samling S/B. Accessed via Gebril Atong, personal communication, 2025

Lo & Partners. 2019. *Sarawak Land Code Chapter 81 (1958 Edition) [Cap. 81]*. Available at: https://www.lopartners.com.my/sarawak-land-code-chapter-81-1958-edition-cap-81/

Macdonald, J.M., Robinson, C.J., Perry, J., Lee, M., Barrowei, R., Coleman, B., Markham, J., Barrowei, A., Markham, B., Ford, H., Douglas, J., Hunter, J., Gayoso, E., Ahwon, T., Cooper, D., May, K., Setterfield, S. and Douglas, M. 2021. Indigenous-led responsible innovation: lessons from co-developed protocols to guide the use of drones to monitor a biocultural landscape in Kakadu National Park, Australia. Journal of Responsible Innovation, 8(2), pp.300-319.

Mahmood, A.Z.B. 2010. NCR Basics. Sarawak Land and Survey Department. Available at: https://landsurvey.sarawak.gov.my/web/subpage/webpage_view/614

Md-Isa, S.F. 2019. "Identification of microfungi isolated from *Belian* fruits." *CABI Digital Library*. Available at: https://www.cabidigitallibrary.org/doi/pdf/10.5555/20193325751

Metcalf, P. 2010. *The Life of the Longhouse: An Archaeology of Ethnicity*. Cambridge: Cambridge University Press. ISBN 978-0521110983. (cambridge.org)

Metcalf, P. 1976. Who are the Berawan? Ethnic classification and the distribution of secondary treatment of the dead in Central North Borneo. *Oceania*, 47(2), pp.85–105. Available at: http://www.jstor.org/stable/40330278

Nicholas, G. 2022. Protecting Indigenous heritage objects, places, and values: challenges, responses, and responsibilities. International Journal of Heritage Studies, 28(3), pp.400-422.

National Museum of the Philippines. 2021. Burial Jars. Available At: https://www.nationalmuseum.gov.ph/our-collections/archaeology/burial-jars/

Nicolaisen, I. 1984. 'Heritage, Identity and Cultural Policy: The Case of Sarawakian Burial Posts', *Sarawak Gazette*, CX(1484), pp. 3–6.

Nicolaisen, I. 1976. Form and Function of Punan Bah Ethno-historical Tradition. The Sarawak Museum Journal. Vol. XXIV, N.45. Kuching.

Nor Anak Nyawai and Others v Borneo Pulp Plantation Sdn Bhd and Others. 2001. *Australian Indigenous Law Reporter*, 6(3), pp.82–84. Available at: http://www.jstor.org/stable/44655951

Provost, S., Jones, T., Marshall, M., Wesley, D., Rangers, N., & Nayinggul, A. 2025. Contextualising digital cultural heritage: Bininj GIS and 3D modelling for conservation at Ubirr rock art complex, Kakadu National Park, Australia. *International Journal of Heritage Studies*, *31*(11), 1440–1469. https://doi.org/10.1080/13527258.2025.2543749

Saipi, S. 2025. Digitizing the Past: The Role of Photogrammetry in Architectural Heritage Conservation. *Journal of Balkan Architecture (JBA)*, *1*(2), pp.93-105.

Scholte, B. 1972. Toward a Reflexive and Critical Anthropology. In D. Hymes, ed. *Re-inventing Anthropology*. New York: Pantheon, pp.430-457.

Sellato, B. 2016. *The Ngorek of the Central Highlands and 'Megalithic' Activity in Borneo*. In: C. Jeunesse, P. Le Roux and B. Boulestin, eds. *Mégalithismes vivants et passés: approches croisées / Living and Past Megalithisms: Interwoven Approaches*. Oxford: Archaeopress, pp.117–149. ISBN: 9781784913458.

Waas, M. and Zell, D. 2013. Practical 3D photogrammetry for the conservation and documentation of Cultural Heritage. In *International Conference on Cultural Heritage and New Technologies, Vienna*. Accessible at: https://archiv.chnt.at/wp-content/uploads/Waas_Zell_2014.pdf

Wong, A.H.H., Kim, Y.S., Singh, A.P. and Ling, W.C. 2005. Natural durability of tropical species with emphasis on Malaysian hardwoods–variations and prospects. *Proceedings of the IRG/WP*, pp.05-10568.

Bibliography

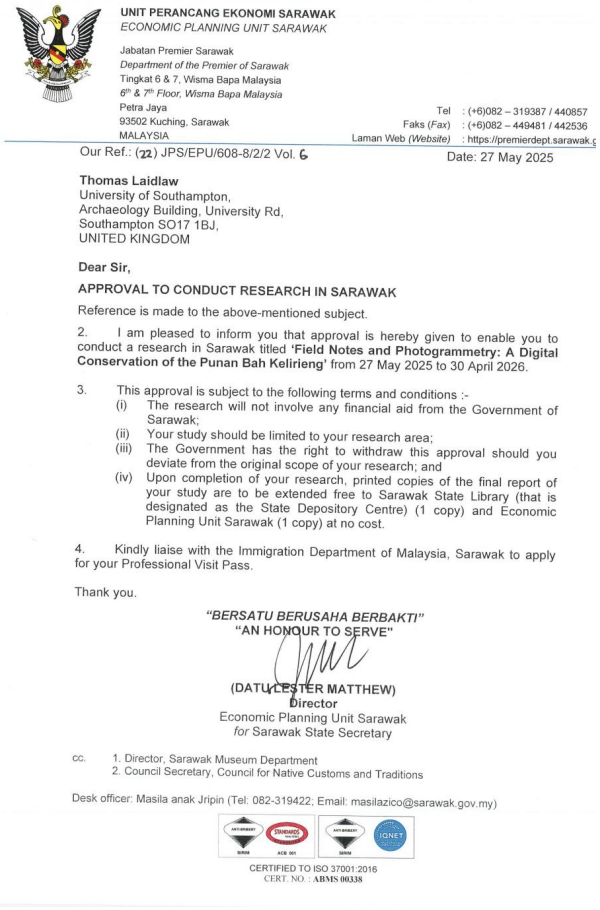
Brooke, C.A.J. 1866. *Ten Years in Sarawak*. Vol. 1. London: Tinsley Brothers.

Harrisson, T. 1962. 'Borneo Death', *Bijdragen tot de Taal-, Land- en Volkenkunde*, 118(1), pp. 1–41. Available at: http://www.jstor.org/stable/27860346

Sarawak.gov.my. 2024. *Ritual - Sarawak Museum Department*. Available at: https://museum.sarawak.gov.my/web/subpage/webpage_view/110 [Accessed 5 Nov. 2025].

Appendix

A. Letter of Research Permission, Economic Planning Unit, Jabatan Premier Sarawak, 27 May 2025



UNIT PERANCANG EKONOMI SARAWAK
ECONOMIC PLANNING UNIT SARAWAK

Jabatan Premier Sarawak
Department of the Premier of Sarawak
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Faks (*Fax*) : (+6)082 – 449481 / 442536
Laman Web (*Website*) : https://premierdept.sarawak.g

Our Ref.: (22) JPS/EPU/608-8/2/2 Vol. 6
Date: 27 May 2025

Thomas Laidlaw
University of Southampton,
Archaeology Building, University Rd,
Southampton SO17 1BJ,
UNITED KINGDOM

Dear Sir,

APPROVAL TO CONDUCT RESEARCH IN SARAWAK

Reference is made to the above-mentioned subject.

2. I am pleased to inform you that approval is hereby given to enable you to conduct a research in Sarawak titled **'Field Notes and Photogrammetry: A Digital Conservation of the Punan Bah Kelirieng'** from 27 May 2025 to 30 April 2026.

3. This approval is subject to the following terms and conditions :-
(i) The research will not involve any financial aid from the Government of Sarawak;
(ii) Your study should be limited to your research area;
(iii) The Government has the right to withdraw this approval should you deviate from the original scope of your research; and
(iv) Upon completion of your research, printed copies of the final report of your study are to be extended free to Sarawak State Library (that is designated as the State Depository Centre) (1 copy) and Economic Planning Unit Sarawak (1 copy) at no cost.

4. Kindly liaise with the Immigration Department of Malaysia, Sarawak to apply for your Professional Visit Pass.

Thank you.

"BERSATU BERUSAHA BERBAKTI"
"AN HONOUR TO SERVE"

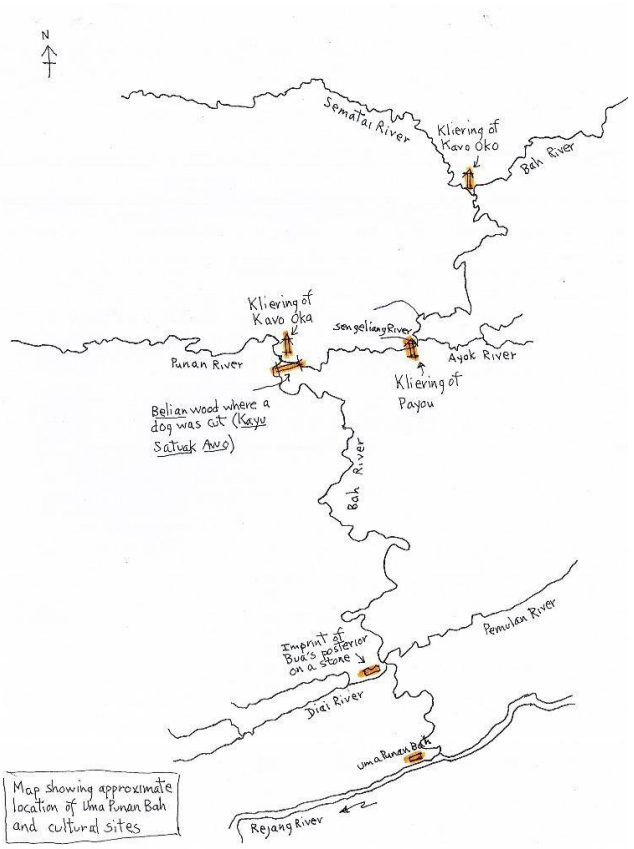
(DATU LESTER MATTHEW)
Director
Economic Planning Unit Sarawak
for Sarawak State Secretary

cc. 1. Director, Sarawak Museum Department
2. Council Secretary, Council for Native Customs and Traditions

Desk officer: Masila anak Jripin (Tel: 082-319422; Email: masilazico@sarawak.gov.my)

CERTIFIED TO ISO 37001:2016
CERT. NO. : **ABMS 00338**

B. Map produced by Jayl Langub, retired civil servant and current associate research fellow at the Institute of Borneo Studies, UNIMAS. Produced as part of witness statement in NCR land case Punan Bah vs Samling S/B 2016



C. Ethnographic Interview Transcripts

- Transcription 1 - Bayók Animism…
- Transcription 2 - Beyok Animism…
- Transcription 3 - Beyok Animism…

D. Nicolaisen's 1984 Article from the Sarawak Gazette

- Sarawak Gazette 1984