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Daniel Perret, Mohd. Sherman Bin Sauffi, Stéphanie Leroy, Yohan Chabot. The Ongoing Sungai Jaong Archaeological Project (2018-2024), Sarawak, Malaysia: Preliminary Results. *Archipel*, 2024, 107, pp.47-73. 10.4000/12fvh . hal-04864983

HAL Id: hal-04864983

<https://hal.science/hal-04864983v1>

Submitted on 5 Jan 2025

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107 | 2024

Varia

The Ongoing Sungai Jaong Archaeological Project (2018-2024), Sarawak, Malaysia: Preliminary Results

Le programme archéologique de Sungai Jaong (2018-2024), Sarawak, Malaisie : résultats préliminaires

Daniel Perret, Mohd. Sherman bin Sauffi, Stéphanie Leroy et Yohan Chabot



Édition électronique

URL : <https://journals.openedition.org/archipel/3899>

DOI : 10.4000/12fvh

ISSN : 2104-3655

Éditeur

Association Archipel

Édition imprimée

Date de publication : 9 octobre 2024

Pagination : 47-73

ISBN : 978-2-910513-93-1

ISSN : 0044-8613

Référence électronique

Daniel Perret, Mohd. Sherman bin Sauffi, Stéphanie Leroy et Yohan Chabot, « The Ongoing Sungai Jaong Archaeological Project (2018-2024), Sarawak, Malaysia: Preliminary Results », *Archipel* [En ligne], 107 | 2024, mis en ligne le 10 octobre 2024, consulté le 08 novembre 2024. URL : <http://journals.openedition.org/archipel/3899> ; DOI : <https://doi.org/10.4000/12fvh>



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The Ongoing Sungai Jaong Archaeological Project (2018-2024), Sarawak, Malaysia: Preliminary Results

Introduction

The ancient history of the northern coast of the Borneo Island remains largely unknown, especially for the period spanning the middle of the first to the middle of the second millennium CE. Two core areas have particularly attracted the attention of historians, archaeologists and epigraphists since the 1950s.

The first core area is the present Sultanate of Brunei, about which research has focused in particular on the analysis of Chinese sources,¹ the excavations

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1. For recent publications on this topic, see in particular Kurz (2011, 2013, 2014, 2014-2015).

of several archaeological sites,² a corpus of Islamic tombstones,³ and local literature of a historical nature.⁴

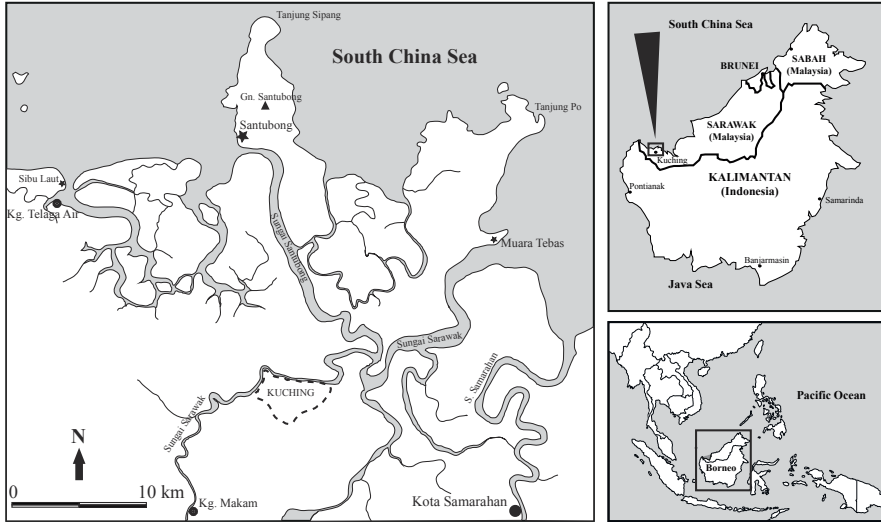


Fig. 1 – Sarawak River Delta map (D. Perret & Y. Chabot)

The second core area is the Sarawak River Delta (fig. 1). If chance finds have been reported there since the second half of the 19th century, it was actually from the 1950s that archaeological research revealed the existence of several sites of great historical value. Since the beginning of the 20th century, publications have referred to local literature, which could contribute to clarifying the ancient settlement history of the region.⁵ It is this second pole which is the subject of this article, especially the Sungai Jaong site, where a

2. Here must be mentioned the very interesting site of Sungai Limau Manis excavated in 2002 (Karim bin Pengiran Haji Osman, ed., 2004). Without going into detail, it is appropriate to recall the articles relating to surveys and excavations published in the *Brunei Museum Journal* (launched in 1969), and in the *Sarawak Museum Journal*.

3. Regarding the tombstones of the period which interests us here, cf. notably Kalus & Guillot (2003-2004, 2006), Franke & Ch'en Tieh-Fan (1973), Chen Dasheng (1991), Kurz (2016).

4. Especially the texts *Syair Awang Semaun* (cf. Siti Hawa Haji Salleh 1994), *Silsilah Raja-Raja Berunai* (cf. Sweeney, ed., 1968), or *Batu Tarsilah*, which also concerns epigraphy (cf. M. Shariffuddin & Abdul Latiff bin Haji Ibrahim 1974).

5. The easiest sources to access being Everett & Hewit (1909), Harrison (1949), Hill (1955), Harrison (1970). Versions of the history of Datuk Merpati, a famous hero in the region, were first published in the 1980s: Abdul Razak Abang Medaan (1986), Mohammad Tahir Abdul Ghani (1989).

new phase of archaeological research has been undertaken recently. Here is offered a brief presentation of the fieldwork carried out between 2018 and 2023, as well as our main interim conclusions and prospects.

The main archaeological sites in the vicinity of the Santubong River mouth

The region described as the Sarawak River Delta, which borders the South China Sea, stretches as the crow flies some 40 kilometres between Kampung Telaga Air in the west and the mouth of the Samarahan River in the east. Still as the crow flies, from the northwest to the northeast, this coastline is about fifteen to thirty kilometres of Kuching, the current capital of the State of Sarawak. About 120 kilometers long, the Sarawak River, which gives its name to the delta, has its source in the Upper Kapuas range and spreads over a basin of some 2,500 km². The deltaic plain, covered with mangroves and *nipah* swamps, is criss-crossed by a network of rivers including seven mouths, among them that of the Sarawak River to the east of Kuching, and that of the Santubong River to its north, which flows into the South China Sea in front of the village of the same name. The hinterland is accessible through a relatively easy southern passage towards other watersheds on Borneo, including towards the Java Sea.

On the coastline, the mouth of the Santubong River hosts several sites, some of which have been surveyed and excavated intermittently between 1947 and 1966. They are located at the foot of Gunung Santubong (fig. 2). Culminating at an altitude of 810 m, this steep and rocky ancient sandstone massif dated to the Tertiary period, was certainly an important landmark for navigators in ancient times.



Fig. 2 – Gunung Santubong (ph. D. Perret, Oct. 2023)



Fig. 3 – Sarawak River Delta map - archaeological sites (D. Perret)

On the right bank of the Santubong River, from upstream to downstream, these sites (fig. 3) are: Sungai Jaong (N 01° 43.015'; E 110° 20.688'), the site discussed in this article; Kampong Ayer (N 01° 43' 6.2"; E 110° 19' 30.8"),⁶ Bongkisam (N 01° 43.150'; E 110° 19.398'), today situated within the village of Santubong; Bukit Maras (N 01° 43.142'; E 110° 20.688'), on the hillside above Bongkisam; the coastal cemetery of Tanjong Tegok to the northwest of Santubong. The sites are less numerous on the left bank: Sungai Buah and the coastal cemetery of Tanjong Kubor.

Tom Harrisson and the Sungai Jaong site

The name associated with pioneering archaeological research in the Sarawak River Delta is that of Tom Harrisson. Born in Argentina in 1911,⁷ Tom Harrisson began to make a name for himself in England in the late 1930s, first as an adventurer who had lived among cannibals, then as the founder of Mass-Observation, an organization that pioneered doing social surveys in England. During that decade, he also often appeared in the press and on the BBC radio and television on various subjects, including ornithology and ecology. Tom Harrisson was inducted into the British Army in 1942 and became involved in weekly broadcasting.

Joining Special Operations Executive (SOE) in 1944, he dropped by parachute in the middle of Borneo in March the following year. He had already organized a four-month expedition to explore Sarawak's inland flora and fauna in 1932, but this time the objective was entirely different. His mission was to set up an intelligence network to fight the Japanese with a few Australian officers and men, and prepare the invasion of the coast of northwest Borneo by an Australian Division. He went beyond his instructions by raising a thousand-man army of blowpiping *orang ulu* to join the fight.⁸ In December 1945, when the war was effectively over in the middle of Borneo, Tom Harrisson moved back to the highlands to serve with the British Borneo Civil Affairs Unit (BBCAU). Back in England in September 1946, he was nominated by the colonial office to be curator of the Sarawak Museum and government ethnologist. He reached Kuching in June 1947.

From the start of this new position, Harrisson set himself among his objectives to shrink the gaps in knowledge about various fields regarding northern Borneo, including history and prehistory, despite having no training

6. Considering that this is the site surveyed by Doherty et al. in March 2006 (cf. Doherty et al. 2007). While Doherty et al. do not mention the name of Kampong Ayer, just 40 years earlier Tom Harrisson conducted excavations there and provided indications on its location which fit with the information given by Doherty et al. (cf. Harrisson & O'Connor 1969a, pp. 8, 14, 30).

7. The following biographical elements are taken from Heimann (1997).

8. An experience recounted by Tom Harrisson himself in the fascinating *World within: a Borneo story* (1959).

in both fields. Criss-crossing Sarawak on foot, by boat, and from the air, he noticed that the Santubong area, in the Sarawak River Delta, looked promising, with the advantage of being relatively easily accessible from Kuching. Santubong is located some 22 kilometres away from Kuching, following the river, at the time within an hour by speedboat.⁹

In fact, the initially chance discovery of archaeological remains in the Santubong region, then their systematic search by locals, looking for gold ornaments in particular (mostly beads), attracted the attention of Europeans from the middle of the 19th century. This is how Rajah James Brooke is said to have gathered a real treasure, which disappeared when his palace was sacked by Chinese in 1857.



Fig. 4 – The Batu Gambar rock-carving at Sungai Jaong (ph. D. Perret, Oct. 2023)

⁹. Harrisson 1970, p. 22.

Pottery and ceramic sherds, “broken crucibles”, “large quantities of black iron slag”, stone, glass and iron beads, glass bangles, silver ornaments, Chinese coins, and one small “Hindu image made of clay” figured among these “fragmentary relics”.¹⁰ Harrison could not ignore the existence of these finds. Moreover, it is on the site of Sungai Jaong that, in 1886, a local rediscovered a unique relief carving of human type, almost life size, with hands and arms stretched out, on a dome-shaped sandstone boulder.¹¹

It is in this context that at Sungai Jaong, Tom Harrison’s attention was first attracted by this sculpture, known as Batu Gambar (fig. 4), as well as by the high concentration of “iron slag and crucibles” nearby.¹²

A first trial trench was excavated in 1950, at the foot of this sculpture, which yielded notably stoneware and earthenware sherds, glass beads, and iron slag.¹³ The discovery of iron slag led Harrison to carry out systematic pedestrian surveys using army mine detectors.¹⁴ An arc of iron slag scatters, approximately three kilometres long, was thus uncovered between the village of Santubong and the Buntal Bay, on the opposite side of the island.¹⁵ However, it was in Sungai Jaong, uninhabited at the time, that Harrison decided, in 1952, to carry out the first intensive excavation season in the delta.¹⁶ It was followed by three other seasons of excavations on this same site in 1955, 1957, and 1966.

Harrison’s relatively numerous publications on his excavations in the Sarawak River Delta are devoided of plans of his Sungai Jaong excavations. It is by observing the current topography of the site that it is possible to figure out that these excavations (an area estimated at some 550 m²) were mainly concentrated on a single sector near the confluence of the Jaong River and the Raso Creek. As regards stratigraphy, he quickly dismissed the question: [stratigraphy] “heavily disturbed by ironworking related activities, by agricultural activities, by the root factor [...] slight, non-existent, or highly

10. Everett & Hewit 1909, pp. 5-12.

11. Published for the first time in 1896 (Ling Roth 1896, vol. 2, p 280).

12. Harrison 1949, pp. 87-88.

13. Harrison & O’Connor 1969a, p. 5; Harrison & O’Connor 1969b, p. 277; Harrison & O’Connor 1970, p. 8.

The precise year of this first excavation is not specified in Harrison’s publications, but photographs of this fieldwork bearing the year 1950 are currently kept in the archives of the Sarawak Museum Department (Many thanks to Mrs Angelina Anak Barau, Exhibition Section, for having facilitated access to these documents).

14. In the 1950s, as Commandant of the Sarawak Special Constabulary, Harrison was therefore able to have local personnel trained in the use of such equipment (Harrison & O’Connor 1969a, p. 32).

15. Harrison & O’Connor 1969a, pp. 10, 28-30.

16. Harrison & O’Connor 1969a, pp. 5, 10, 27-29, 37-40.

complex through disturbance.”¹⁷ Moreover, no comprehensive inventory of the archaeological finds was published. Harrisson had no previous training or experience in archaeology and, according to Alastair Lamb (1977, p. 9), “he was willing to turn hand, spade and labour force to any archaeological goal, yet he gave relatively scant thought to the longer term problems of recording and publication.”¹⁸ The three-volume final report (1969 and 1970), co-authored with Stanley J. O’Connor, is disconcerting, to say the least, being a mixture of partial statistics, typologies and thoughts written in a disorderly manner.¹⁹

These publications nevertheless have the merit of existing, and a very careful reading enable to extract a lot of interesting information and thoughts on the Sungai Jaong excavations in particular. Harrisson estimated the surface area of the iron slag distribution at around 36,000 m²²⁰ and interpreted iron slag as residues from smelting process. He also suggested that the usable raw metal was broken up into small lumps for insertion into crucibles, crucibles then smashed to release refined “steel”. Iron ore crushing operations, hammering of the “bloom” extracted from the furnace, smashing of the crucibles, as well as metal shaping would have been done using stone tools found on the site (“hammerstones”, “waisted stones”).²¹ But whole iron tools were seldom found in Sungai Jaong site in particular, and in the Sarawak River Delta sites in general.²² What intrigued Harrisson the most was not having detected any remains of furnace or semi-finished product in his excavations. Moreover, he stated that no ancient written source (Chinese in particular) mentions such activity in the region at that time, and there was no general belief that there had been a past and extensive population in Sungai Jaong.²³

This iron slag was mixed with fragments of clay cylinders, which Harrisson was inclined to interpret as crucibles, to which were added earthenware and

17. Harrisson & O’Connor 1969a, pp. 17, 34.

18. It was only during the last excavation season, that of 1966, that he invited Stanley O’Connor to join, a scholar in fact better known as an art historian than as an archaeologist (Harrisson 1967, p. 141; Harrisson & O’Connor 1969a, p. 6).

19. “This strange work, inflated and colloquial almost beyond the endurance of cis-Atlantic man, threatens to bring the craft of prehistoric archaeology into disrepute.” This is the reaction of William Watson (1971) in his review of the two volumes published in 1969. About the volume published in 1970, Ian Glover (1972) wrote: “[...] the organization appears to have developed out of random thought associations. Consequently, it is difficult to be certain what the authors’ main thesis is, and which data they think relevant to, or supporting such a thesis.”

20. Harrisson & O’Connor 1969a, p. 51; Harrisson & O’Connor 1970, p. 8.

21. Harrisson & O’Connor 1969a, pp. 26, 164, 167, 202; Harrisson & O’Connor 1969b, pp. 225, 238-240, 247, 330.

22. Harrisson & O’Connor 1969b, p. 225; Harrisson & O’Connor 1970, p. 140.

23. Harrisson 1967, p. 143; Harrisson & O’Connor 1969a, pp. 23, 68, 98; Harrisson & O’Connor 1969b, p. 225.

ceramic sherds, stone tools, fragments of iron tools, glass and stone beads, bangles, and gold objects.²⁴

Based on the Chinese ceramics, that he identified as mostly “Tang Dynasty wares” (9th c., perhaps 8th c., or even 7th c.), Harrison interpreted Sungai Jaong as the oldest smelting site in the Sarawak River Delta.²⁵ He also suggested the existence of a burial area (600 m²), characterised in particular by gold objects, including breach-cut gold leaves, numerous glass beads, and whole small Chinese stoneware vessels.²⁶

Moreover, the clearing of the site revealed numerous rock carvings, including human figures, incised forms, geometrical shapes chipped out in relief, as well as “mostly fairly well-shaped parallelograms”.²⁷ For Harrison, this “extensive system of rock-carvings” was related to ironworking, the “burial sector”, and the small artefacts.²⁸

Harrison was convinced that Sungai Jaong was occupied by indigenous peoples, and that ironworking activities, rock carvings, burials and small finds were all contemporaneous. For him, no doubt Sungai Jaong together with the other coastal sites in the Sarawak River Delta formed a major trade entrepôt over centuries.²⁹

It would take more than half a century before new archaeological research was carried out at Sungai Jaong.

New Archaeological Research at Sungai Jaong (2018-2023)

Preliminary survey

The outlines of a new archaeological project devoted to the Sarawak River Delta were defined in 2017, through a cooperation between the École française d’Extrême-Orient and the Sarawak Museum Department. At the same time, the Sarawak Museum Department was in the final preparation stages of its Santubong Archaeological Park project, of which the Sungai Jaong site was

24. Harrison & O’Connor 1969a, pp. 5, 98, 106; Harrison & O’Connor 1969b, pp. 262-275; Harrison & O’Connor 1970, pp. 3, 140, 145.

25. Harrison 1967, p. 141; Harrison & O’Connor 1969a, pp. 20, 140. In 1970, Harrison stated: “Jaong can be safely put “around and before 1000 AD”, running stoneware-wise through the Tang dynasty into the early Sung” (Harrison & O’Connor 1970, p. 8).

26. Harrison & O’Connor 1969b, pp. 251, 262, 266; Harrison & O’Connor 1970, pp. 8, 53.

27. Harrison & O’Connor 1969b, pp. 278-279; Harrison & O’Connor 1970, pp. 56, 111.

28. Harrison & O’Connor 1969a, p. 10; Harrison & O’Connor 1969b, p. 278; Harrison & O’Connor 1970, p. 54, 117.

29. Harrison 1967, p. 143; Harrison & O’Connor 1969b, p. 278; Harrison & O’Connor 1970, pp. 3-5, 117, 137, 197.

one component. The following year (2018), authorization was given to carry out a survey at Sungai Jaong in a mosaic of private plots.

The main purpose of this survey was to carry out bore holes using a hand-operated auger in order to try to obtain a large number of soil samples, the results of which would guide the choice of sectors to be excavated. Sixty-seven bore holes were thus augered at altitudes varying between 2.50 m and 12 m under difficult conditions (dense forest cover with many roots of various sizes, high density of large sandstone boulders both on the surface and at various depths, high density of iron slag). While 19 bore holes did not reveal any iron slag, all the others yielded slag, the thickness of the deposit varying between a few centimeters to one meter, a purely indicative figure, since the deepest figure was linked to the limits of use of the hand-operated auger in this context. Despite the difficulties, this first fieldwork made it possible to delimit an area yielding traces of metallurgical activities and ancient artefacts, namely the slope of the hillock facing the Jaong River, which represents an area estimated between 7,000 and 9,000 m² (area in brown on fig. 5). Several areas dense with iron slag to be favored for future excavations were identified. The acquisition of the site land by the State of Sarawak in the months following this survey paved the way for the conduct of excavations in 2019, resumed in 2022 after an interruption due to the Covid-19 pandemic (fig. 5).

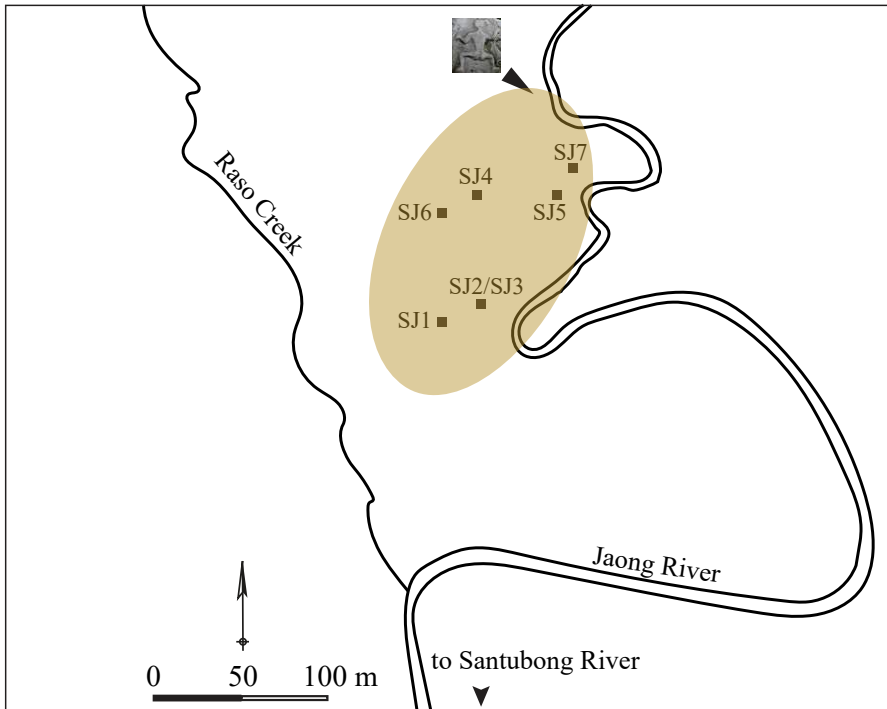


Fig. 5 – Sketch map of Sungai Jaong and the 2019-2023 trenches (D. Perret)

The low lying sectors (fig. 6)

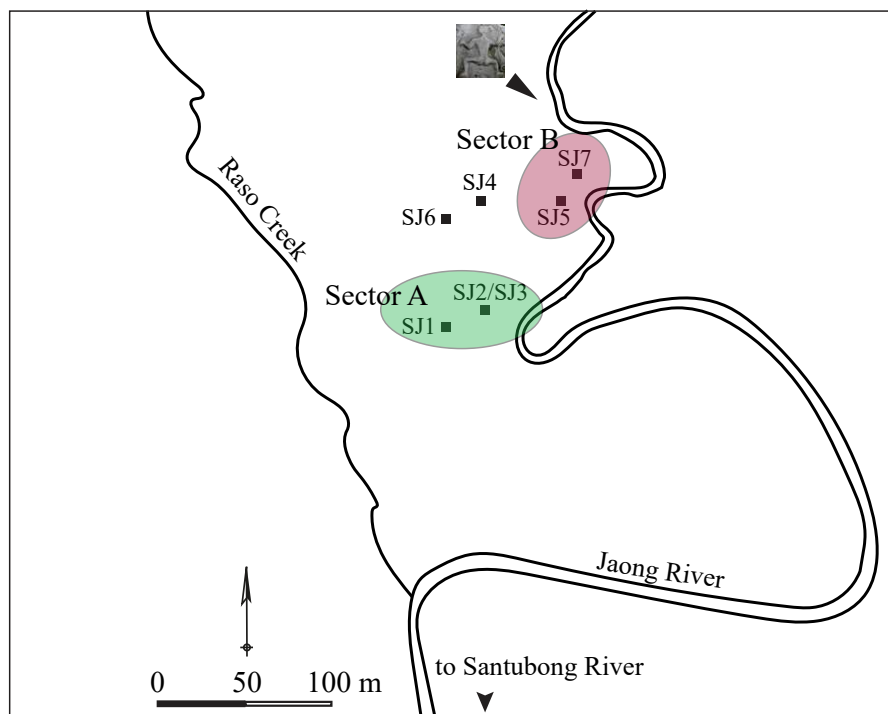


Fig. 6 – Sungai Jaong: sectors A and B (D. Perret)

Two sectors (A, B) were excavated in the low-lying area of the site, near the tidal Jaong River.³⁰ Sector A includes three trenches situated near the area excavated by Harrison some 80 metres from the confluence between the Jaong River and the Raso rivulet. Today, this confluence is a little more than 700 metres away from the Santubong River. Thanks to Harrison's work, we knew that this sector was very probably rich in various finds. The precise choice of both locations to be excavated in this sector A was also based on the results of the 2018 survey, with two promising core samples from the point of view of iron slag density. Trench SJ1 (N 01° 43.016'; E 110° 20.694'), 3 m×3 m, was therefore opened at the southwest edge of the Harrison's excavations (fig. 7).

³⁰. The width of its course varies from a few metres at low tide, outside the rainy season, to possibly more than 20 metres at high tide in the rainy season.



Fig. 7 – Trench SJ1 in front of the large sector excavated by T. Harrison (ph. D. Perret, June 2019)



Fig. 8 – Concentration of stones in SJ1 (ph. D. Perret, June 2019)



Fig. 9 – A working floor in SJ1 (ph. D. Perret, July 2019)

Trench SJ2 (N 01° 43.020'; E 110° 20.707'), 4 m×2.5 m, was opened some 40 m to the northeast of SJ1, and later extended to the west through trench SJ3 (1.50 m×1 m). The excavated surface area in this sector A is therefore 20.6 m².

In SJ1, iron slag appeared a few centimetres below the present ground surface. At a depth of ten centimetres, the excavation uncovered a shallow oval pit (90×70 cm) filled with two layers of stones. Two of these stones have been cut forming a waist running round their approximate centerline (fig. 8).

Such stones are described as “waisted stones” by Harrison, who thought that the waist was pecked for securing with some sort of lashing or haft, to use these hard igneous stones as hammers for ironworking.³¹ Scattered reddish soil fragments appearing from a depth of 15 cm indicated the proximity of a first workshop floor made of compact burnt clay mixed with metallurgical wastes. In fact, the excavations revealed three sufficiently well preserved floors (fig. 9) with more or less undulating profiles at depths between 20 and 55 cm.³² They are related to iron industry activities.

Radiocarbon dating of a charcoal fragment sampled from the floor closest to the current ground surface (-32 cm, alt. ca. 4.30 m), yielded a 13th century

31. Harrison & O'Connor 1969b, p. 240.

32. In the eastern section of the test-pit carried out in SJ1 in 2022.

CE calibrated dating³³, whereas a charcoal fragment sampled from the lowest floor (-53 cm, alt. ca. 4.09 m), yielded a very late 10th-mid12th century CE calibrated dating³⁴. The basal sterile layer, made up of sandstone in balls and very fine beige/whitish sand, was reached at a depth of about 80 cm³⁵.

In SJ2, areas dense in iron slag already appeared a few centimetres below the present ground surface and occurred down to a depth of some 60 cm. Contrary to SJ1, where sandstone boulders appeared near the bottom of the excavation, in SJ2 the tip of a large boulder was noticed less than 10 cm below the present ground surface. This sandstone boulder buried in iron slag turned out to show cutting traces to extract blocks (fig. 10).



Fig. 10 – Block-cut sandstone boulder in SJ2 (ph. D. Perret, July 2019)

Other boulders showing such cutting traces were found among iron slag in the same trench. A concentration of worked whitish and reddish stones, including a large rectangular parallelepiped block (50 cm long), appeared in the southwest part of the trench at a depth of 20-30 cm. The presence of this

33. Sample SJ1-2022-FL1, DirectAMS 049019 (Dec. 2022), 787±27 BP, OxCal 95.4%: 1220-1278 AD.

34. Sample SJ1-2024-FL3, Beta Analytic 697091 (May 2024), 990±30 BP, Cal 95.4%: 993-1155 AD.

35. Radiocarbon dating of a charcoal fragment sampled from the upper limit of the sand (-79 cm, alt. ca. 3.83 m), yielded a 11th-mid12th century CE calibrated dating (sample SJ1-2024-BOT, Beta Analytic 693900 (April 2024), 960±30 BP, Cal 95.4%: 1025-1159 AD).

concentration led to extend the excavation to the west, in trench SJ3. Stones combining whitish and reddish colours, as well as a line of whitish stones were uncovered in SJ3. At the end of the first phase of excavation in SJ2/SJ3 in 2019, two hypotheses started to take shape. Firstly, the worked blocks of sandstone probably originated from the block-cut boulders identified in SJ2. Secondly, these worked stones exposed to high temperature were probably the remains of one or several structures related to metallurgical activities.



Fig. 11 – Remains of furnace base and working floor in SJ3 (ph. D. Perret, Oct. 2023)

After two further phases of excavations in SJ2/SJ3 to reach the sterile layer, the existence of metallurgical activities conducted *in situ* was confirmed. In fact, it was during the 2023 season of excavations that parts of a rounded furnace base were uncovered in SJ3, down to a depth of some 30 cm. This furnace base comprises several layers of clay (lining) attesting to the reuse of the furnace several times. Interestingly, this furnace leans against a sandstone boulder probably cut to fit the rounded shape of the furnace bottom (fig. 11).

Moreover, the excavations revealed the remains of a working floor under and in the vicinity of the furnace. Radiocarbon dating of a charcoal fragment extracted from a rather dark silt layer (depth: 47 cm), below the level of the working floor, yielded a calibrated dating between the mid-11th and early 13th century CE.³⁶ The excavation in trench SJ2 did not reveal the existence of

36. Sample SJ3-3008-1, DirectAMS 053287 (Dec. 2023), 892±23 BP, OxCal 95.4%: 1046-1220 AD.

compact working floors like in trench SJ1, but the sporadic presence of burnt clay fragments has been noticed, especially near the bottom of the trench.

The excavations in sector A yielded more than four tons of iron slag and some five kilograms of tuyeres (table 1), representing respectively 61% of the iron slag and 9% of the tuyeres found in the 2019-2023 excavations.

| Trench | Surf. area (m ²) | Vol. of excavated sediment (litres) | Iron slag (kg) | Density (g/l) | Tuyeres (g) | Density (g/l) |
|--------------|------------------------------|-------------------------------------|----------------|---------------|--------------|---------------|
| SJ1 | 9 | 4,419 | 1,507 | 341 | 2,902 | 0.66 |
| SJ2-SJ3 | 11.6 | 5,849 | 2,884 | 493 | 2,172 | 0.37 |
| Total | 20.6 | 10,268 | 4,391 | 427 | 5,074 | 0.49 |

Table 1 – Sector A: Densities in residues of metallurgical activities (2019-2023)

The majority of the other artefacts found in sector A include earthenware and ceramic sherds (table 2), as well as worked stones. Regarding earthenware in particular, sector A yielded around 3% in number and 2% in weight of the sherds found in the 2019-2023 excavations. Regarding ceramics, sector A yielded around 7% in number and 6% in weight of the sherds found in these excavations.

| Trench | Earthenware (sherds/weight- g) | Density (per litre) | Stoneware (sherds/weight - g) | Density (per litre) |
|--------------|--------------------------------|---------------------|-------------------------------|---------------------|
| SJ1 | 71/384 | 0.016/0.086 | 108/760 | 0.024/0.171 |
| SJ2-SJ3 | 157/554 | 0.026/0.094 | 66/900 | 0.011/0.153 |
| Total | 228/938 | 0.022/0.091 | 174/1,660 | 0.016/0.161 |

Table 2 – Sector A. Densities in earthenware and stoneware (2019-2023)

Sector B comprises two trenches (SJ5, SJ7) located about a hundred metres to the northeast of SJ2. The choice of their locations took into account the iron slag density observed in the core samples collected in 2018 and 2023. The excavation in this sector had two main objectives: on the one hand to verify the possible existence of dwellings and/or the presence of in situ traces of ancient metallurgical activities on the banks of the Jaong River, on the other hand to collect a wide range of artefacts which would have been washed down the eastern slope of the hillock by rainwater for centuries.

At an estimated altitude of 5 m, trench SJ5 (N 01° 43.060'; E 110° 20.739') measures 5 m×2.5 m. Excavated in 2022, this trench did not yield any conclusive evidence concerning the presence there of dwelling or metallurgical activities. But one of the objectives of the excavation was achieved, that is to bring together a larger quantity of various finds supposed to be more representative of all the phases of ancient occupation of the site than in the other trenches. Compared to the whole sector A, figures are about ten times higher as regards

the number and weight of earthenware sherds, and three times higher for ceramic sherds. This encouraging result led to the opening of a second trench in this sector B in 2023.

The SJ7 trench (N 01° 43.072'; E 110° 20.747'; est. alt., 4.5 m) was initially excavated over an area of 5 m×2.5 m, then extended to the north (2 m×1.5 m). The first half of the excavation process uncovered a stratigraphy and finds similar to trench SJ5. But the second half revealed features similar to features encountered in SJ1 and SJ2: boulders showing cutting traces to extract blocks, and sections of working floors related to metallurgical activities (fig. 12).



Fig. 12 – Traces of working floor at the bottom of SJ7, east section (ph. D. Perret, Oct. 2023)

Radiocarbon dating of a charcoal fragment sampled from one of these floors (-78 cm; alt. ca. 3.50 m), yielded a mid-11th-mid-12th century CE calibrated dating.³⁷ Moreover, what is probably the unique post-hole identified so far in the Sungai Jaong site was uncovered at a depth of some 50 cm.

The excavations in sector B yielded almost 1.5 tons of iron slag and almost 24 kilograms of tuyeres (table 3), representing respectively 20% of the iron slag and 41% of the tuyeres found in the 2019-2023 excavations.

³⁷. Sample SJ7-7032-1, DirectAMS 053290 (Dec. 2023), 945±19 BP, OxCal 95.4%: 1035-1158 AD.

| Trench | Surf. area (m ²) | Vol. of excavated sediment (litres) | Iron slag (kg) | Density (g/l) | Tuyeres (g) | Density (g/l) |
|--------------|------------------------------|-------------------------------------|----------------|---------------|---------------|---------------|
| SJ5 | 12.5 | 8,384 | 381 | 45 | 9,600 | 1.14 |
| SJ7 | 15.5 | 11,754 | 1,061 | 90 | 14,376 | 1.22 |
| Total | 28 | 20,138 | 1,442 | 71 | 23,976 | 1.19 |

Table 3 – Sector B: Densities in residues of metallurgical activities (2019-2023)

Like in sector A, the majority of the other artefacts found in sector B include earthenware and ceramic sherds (table 4), as well as worked stones. Regarding earthenware in particular, sector B yielded 85% in number and 86% in weight of the sherds found in the 2019-2023 excavations. Regarding ceramics, sector B yielded 73% in number and 66% in weight of the sherds found in these excavations.

| Trench | Earthenware (sherds/weight- g) | Density (per litre) | Stoneware (sherds/weight - g) | Density (per litre) |
|--------------|--------------------------------|---------------------|-------------------------------|---------------------|
| SJ5 | 2,104/11,485 | 0.25/1.37 | 548/5,227 | 0.065/0.623 |
| SJ7 | 3,541/21,625 | 0.30/1.84 | 1,260/13,927 | 0.107/1.184 |
| Total | 5,645/33,110 | 0.28/1.64 | 1,808/19,154 | 0.09/0.95 |

Table 4 – Sector B. Densities in earthenware and stoneware (2019-2023)

The sector on the top of the hillock (fig. 13)

In 2022, a trench was opened for the first time on the top of the hillock, at an estimated altitude of 12.5m. Here again, the survey conducted in 2018 provided results interesting enough to open at least one trench in this sector identified here as sector C.

Some 70 meters to the northeast of SJ1, trench SJ4 (N 01° 43.061'; E 110° 20.710') measures 5 m×2 m. A compact layer of mixed material made of burnt clay with metallurgical wastes was revealed in the northeast corner of the trench, about 20 cm below the current ground surface. This first section of working floor (SJ4-FL1, alt. ca. 12.34 m) is approximately 3 cm thick. The continuation of the excavation in SJ4 in fact revealed four other successive vestiges of working floors, at the following approximative depths: 26 cm (SJ4-FL2, alt. ca. 12.28 m), 51 cm (SJ4-FL3, alt. ca. 12 m), 67 cm (SJ4-FL4, alt. ca. 11.84 m), and 84 cm (SJ4-FL5, alt. ca. 11.62 m). Radiocarbon dating of charcoal fragments extracted from floors FL2, FL3 and FL5, yielded the following respective calibrated dates: late 12th-13th century CE,³⁸ mid-11th-

38. Sample SJ4-2022-FL2, DirectAMS 049023 (Dec. 2022), 819±22 BP, OxCal 95.4%: 1179-1270 AD.

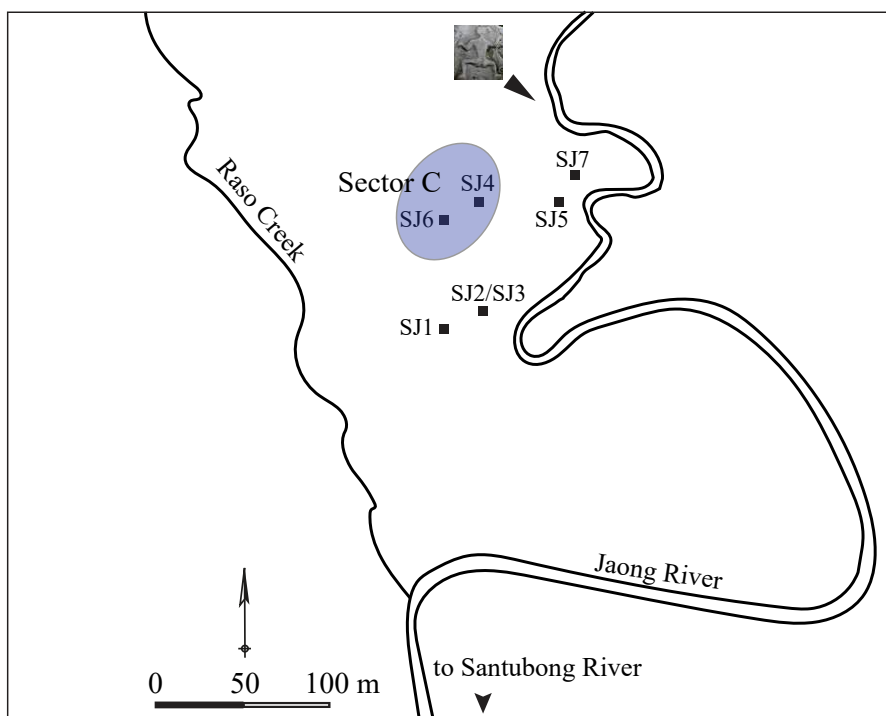


Fig. 13 – Sungai Jaong: sector C (D. Perret)

late 12th century CE,³⁹ mid-11th-mid-12th century CE.⁴⁰ In SJ4 the sterile layer (fine beige/whitish sand) was reached at a depth of about 90 cm.

In the same trench, remains of a circular structure made of stones appeared about twenty centimetres below the current ground surface. The size and shape of this structure, partially set in a pit some 25 cm deep, allow it to be linked with high probability to the base of an iron ore reduction furnace consisting of a circular stone layout (about 80 cm in diameter) partially covered with a clay coating on the inner side (fig. 14).

³⁹. Sample SJ4-2022-FL3, DirectAMS 049024 (Dec. 2022), 920±23 BP, OxCal 95.4%: 1038-1203 AD.

⁴⁰. Sample SJ4-2022-FL5, DirectAMS 049026 (Dec. 2022), 946±23 BP, OxCal 95.4%: 1034-1158 AD.



Fig. 14 – Base of an iron reduction furnace, SJ4 (ph. D. Perret, Oct. 2022)

It turned out that the second working floor (FL2) partially covers the wall of the pit housing the base of this furnace. This working floor is therefore contemporaneous with the furnace, and the radiocarbon dating mentioned above, that is late 12th-13th century CE, is also relevant for this structure. The base of the stone wall is covered with a clay coating or lining about 5 mm thick on its concave internal part. These stones include both roughly cut blocks of sandstone showing traces of heating and large oblong pebbles in hard material.⁴¹ At least three of these pebbles show a groove round the approximate centerline of the stone. These “waisted stones”, according to Harrison’s terminology, have very clearly been reused to build (or rebuild) the furnace. The state of the remains does not allow to easily deduce, at this stage of the research, the details of the smelting operation and the related technical elements, such as the supply air mechanism used and the elevation of the superstructure. The heterogeneity of the remaining technical elements as well as the absence of the superstructure might suggest the dismantling of the walls after each smelting process to pull out the raw metallic mass.

The drawing of the stratigraphy in this trench SJ4, carried out at the end of the 2022 season, yielded a number of indications remaining to be clarified at the bottom of its south section. A new cleaning of this south section during the

⁴¹. In the Santubong region, these materials are igneous rocks, mostly of gabbros and dolerites types, as well as hardened (hornfelsed) shale (Doherty et al. 2007, p. 67).

2023 season revealed the remains of another furnace base, very probably still in situ, almost at the bottom of the excavation (fig. 15).



Fig. 15 – Base of iron reduction furnace, bottom of SJ4 excavation (ph. D. Perret, Oct. 2023)

Radiocarbon dating of a charcoal fragment collected near the southwest corner of the trench, at the bottom of the excavation just above the sterile soil, between a fragment of tuyere and a reddish stone (depth: 89 cm), yielded a calibrated dating between mid-11th and mid-12th century CE.⁴² This result is the same as the dating of the lowest floor (FL5) mentioned above. It is therefore clear that the remains of the furnace bottom identified in 2023 cannot be dated earlier than this time bracket.

Located approximately 10 m south of SJ4, the trench SJ6 was opened to try to uncover better preserved remains of furnaces. At an altitude of some 11m above sea level, SJ6 (N 01° 43.055'; E 110° 20.697') was initially opened over an area of 5 m×2.5 m, subsequently completed by a west extension (2.5 m×2.5 m), then an east extension (2 m×2 m). Rather unexpectedly, the excavation of SJ6 revealed a context very different from that in SJ4, although distant of only some ten meters to the north. In SJ6, there are no remains of working floors in situ, nor remains of iron ore reduction or blacksmithing structures in situ. The layer of metallurgical wastes, whose uniform thickness

42. Sample SJ4-2023-2, DirectAMS 053288 (Dec. 2023), 931±19 BP, OxCal 95.4%: 1039-1162 AD.

was observed in the initial trench, then in both its extensions, as well as the frequency, in a horizontal position, of plate-shaped iron slag, as well as ceramic and earthenware sherds (including sherds belonging to the same vessel), allow us to suggest the hypothesis of a circulation area set up near an area of furnaces destined for the reduction of iron ore and possibly for blacksmithing (fig. 16).



Fig. 16 – Circulation area in SJ6 (ph. D. Perret, Sept. 2023)

The excavations in sector C yielded almost 1.5 tons of iron slag and some 29 kilograms of tuyeres (table 5), representing respectively 19% of the iron slag and 50% of the tuyeres found in the 2019-2023 excavations.

| Trench | Surf. area (m ²) | Vol. of excavated sediment (litres) | Iron slag (kg) | Density (g/l) | Tuyeres (g) | Density (g/l) |
|--------------|------------------------------|-------------------------------------|----------------|---------------|---------------|---------------|
| SJ4 | 10 | 6,224 | 234 | 38 | 3,468 | 0.56 |
| SJ6 | 22.75 | 7,754 | 1,155 | 149 | 25,529 | 3.29 |
| Total | 32.75 | 13,978 | 1,389 | 99 | 28,997 | 2.07 |

Table 5 – Sector C: Densities in residues of metallurgical activities (2019-2023)

Like in sectors A and B, the majority of the other artefacts found in sector C include earthenware and ceramic sherds (table 6), as well as worked stones. Regarding earthenware in particular, sector C yielded 12% in number and weight of the sherds found in the 2019-2023 excavations. Regarding ceramics, sector C yielded 20% in number and 28% in weight of the sherds found in these excavations.

| Trench | Earthenware (sherds/weight- g) | Density (per litre) | Stoneware (sherds/weight - g) | Density (per litre) |
|--------|--------------------------------|---------------------|-------------------------------|---------------------|
| SJ4 | 380/1,610 | 0.06/0.26 | 85/776 | 0.013/0.124 |
| SJ6 | 409/3,011 | 0.05/0.39 | 400/7,424 | 0.051/0.957 |
| Total | 789/4,621 | 0.056/0.33 | 485/8,200 | 0.034/0.586 |

Table 6 – Sector C. Densities in earthenware and stoneware (2019-2023)

Interim conclusion and prospects

The survey conducted in 2018 at Sungai Jaong led to the identification of the most promising area to conduct excavations, between the top of the hillock (alt. 12 m) structuring the site along a northeast-southwest axis, and the western bank of the Jaong River. This area is limited to the south by the confluence of the Jaong River and the Raso Creek, and some three hundred meters to the north, by the anthropomorphic sculpture in high relief called Batu Gambar.

Despite an excavated surface area limited to seven trenches covering some 81 m² in the Sungai Jaong site, the conduct of metallurgical activities in ancient times has been recognised and attested without any doubt for the first time in the Sarawak River Delta. On the top of the hillock, the 2022 excavation in trench SJ4 uncovered, at about twenty centimetres below the current ground surface, the whole base of a circular iron smelting furnace partially buried, laid out using heterogeneous stones. The use of stones to build the furnace walls explains why sandstone boulders were cut into rough rectangular parallelepipeds on the site. This furnace is associated with a more or less compact layer of burnt clay a few centimeters thick, mixed with metallurgical wastes dated late 12th-13th century CE. In the same trench, part of another iron smelting furnace base was identified in 2023 at the bottom of the excavation. It can be safely dated between mid-11th and late 12th century CE. The presence of a third remain of iron smelting furnace base was confirmed in 2023 in trench SJ3. A radiocarbon analysis leads to suggest also an early second millennium CE dating. These three remains could therefore represent the first iron smelting furnaces, dated to early second millennium CE, reported so far on the whole island of Borneo.

At least fifteen working floors related to metallurgical activities have been identified, both at the foot of the hillock and on its ridge. Radiocarbon dates obtained on eight of these floors place metallurgical activities at Sungai Jaong between the very end of the 10th and late 13th centuries.

The 2019-2023 excavations produced more than seven tons of very irregularly distributed iron slag over the site, leading to think that the metallurgical activities were probably most intensively conducted at the foot of the hillock, near the confluence of the Jaong River and Raso Creek (see table 7). It is unfortunately in this area that Harrison concentrated his extensive excavations between 1952 and 1966. Still in connection with the metallurgical activities, the recent excavations yielded more than 3,200 fragments of tuyeres whose distribution on the site as well as their typo-morphology vary widely (table 7). From the

rapid investigation of the finds during the drying and cataloguing stages, the identification as tuyères is confirmed, an observation that at the same time provides some clues regarding the air supply mechanism related to the furnaces. The fact that complete specimens are absent could be related to the dismantling or cleaning phases of the furnaces, which do not allow the reuse of the tuyères in their original state. Grooved stones found in three trenches (SJ1, SJ4, SJ6) may have been used as hammering or crushing tools.

Other finds include earthenware sherds, also very irregularly distributed over the site (table 7). Most of them belong to the fine paste category, a feature which distinguishes Sungai Jaong (and probably the neighboring sites of the delta), from contemporaneous settlement sites elsewhere in Maritime Southeast Asia, whether in Peninsular Malaysia, Java, or Sumatra. Stoneware shards are also very irregularly distributed over the site (table 7). The preliminary observations on these shards by Bing Zhao⁴³ indicates vessels contemporaneous with the metallurgical activities on the site.

| Sector | Iron slag (w.) | Tuyeres (w.) | Earthenware (n/w.) | Stoneware (n/w.) |
|--------------|----------------|--------------|--------------------|------------------|
| A | 61 | 9 | 3/2 | 7/6 |
| B | 20 | 41 | 85/86 | 73/66 |
| C | 19 | 50 | 12/12 | 20/28 |
| Total | 100% | 100% | 100%/100% | 100%/100% |

Table 7 – Relative representativity of finds according to sectors

As fieldwork was completed by late 2023, work is now devoted to the analyses of the various finds. As regards iron slag in particular, the huge quantity of finds has been sorted out to select samples of tap slag for compositional analysis. The majority of these samples originate from the 2019-2023 excavations in Sungai Jaong, but samples collected during surveys conducted previously in two other delta sites (Bongkizam and Sibu Laut) are also added to the analysis for comparative purpose. Overall 100 samples will be submitted to a compositional analysis. Its objective is to get some clues about the characteristics of the technical processes implemented locally, as well as to determine the chemical fingerprint of the raw materials, such as the iron ore(s) used for the reduction. Measurements of elemental concentrations (trace and major elements) for compositional analyses will be conducted through Inductively Coupled Plasma Mass Spectrometry (ICP-MS) and Atomic Emission Spectroscopy (ICP-AES). Comparative analysis of slag samples by studying chemical variations will enable us to study the differences, evolution and/or possible changes in time and space, of metallurgical practices. It will also help us to hypothesize the nature of the metal (iron or steel) locally

43. CNRS, UMR 8155 (Centre de recherche sur les civilisations de l'Asie orientale). Assisted by Tang Hui in 2019.

produced. On a more general level, these data will feed a reference database in order to improve current knowledge on the iron production and exchange or distribution of iron products in the region but also more widely in Southeast Asia for this period.

Archaeological research at Sungai Jaong also includes a geomorphological study to shed light on the interactions between the ancient occupation of the site and the environment over the *longue durée*. It is to this end that sediment and phytolith samples have been collected at Sungai Jaong in 2019 and 2023. Analyses are currently carried out at the Laboratory of Physical Geography (Thiais) in order to (1) define the geomorphological contexts of the site and (2) to document the evolution of the vegetation and the impact of human activities (e.g. land clearings, burnings, cultivations).

Acknowledgments

The Sarawak archaeological program is carried out within the framework of a cooperation between the École française d'Extrême-Orient and the Sarawak Museum Department. It received financial support from the École française d'Extrême-Orient and from the French Embassy in Malaysia since it started, from PSL University (Program IRIS-études globales) in 2018 and 2019, and from the Advisory Commission for Archaeological Research Abroad (Ministry for Europe and Foreign Affairs) in 2022 and 2023.

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