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KEDAH TUA KINGDOM ANCIENT RIVER JETTY ARCHITECTURE AS AN ICONIC TOURISM PRODUCT OF KUALA MUDA DISTRICT, KEDAH, MALAYSIA

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Abstract: Archaeological studies conducted at one of the sites located on the river banks of the Sungai Batu aim to reveal the architecture of the ancient river jetty structure. In order to obtain primary data related to the architectural appearance of this jetty, field research consisting of survey, mapping, excavation and analysis of artifacts was conducted to enable the final interpretation to be submitted. Based on the study has revealed the discovery of a monumental structure built entirely of brick directed and sloping towards the ancient river clearly suggests its function as a ancient jetty. The chronometric dating of the jetty was determined using the OSL method which was built since 582 BCE. Based on Outstanding Universal Value (OUV) data revealed by the world-impact jet site, it allows iconic travel packages to be created and offered to tourists in the district.

Key words: river jetty, chronometric dating, iconic product, archaeotourism

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INTRODUCTION

Archaeological research in the Sungai Batu Archaeological Complex with an area of about 4 sq km (Figure 1) have enabled primary data related to iron smelting industry workshops, river jetties, jetty administrative and ritual monument to be recorded (Table 1). This is because the results of the survey and mapping have recorded a total of 97 mound which are expected to have evidence embedded beneath them based on surface findings such as bricks, iron ore, iron slag and tuyere. This shows that the mound has the potential to conduct a comprehensive archaeological study to complement the results of the survey. Archaeological survey and mapping has provided positive data related to the potential of the site, the excavation process was carried out from 2009 to 2022. The excavation results in this complex until 2022 have revealed 17 iron smelting workshops (Mokhtar, 2012; 2019), 11 river jetties (Halim, 2014; 2019; Zakaria, 2014), 17 jetty administrative (Aminuddin, 2015; Ahmad, 2016; Yusof, 2016) and six ritual monuments (Hassan, 2018). Iron smelting sites are classified based on the findings ruins of furnaces, iron ore, iron slag, tuyere and iron ingots (Mokhtar, 2019). The jetty structure is classified based on the construction of buildings that are directed and sloping to the river which is built of bricks (Halim, 2019) while the administrative is built horizontally with the presence of small rooms (Ahmad, 2016).

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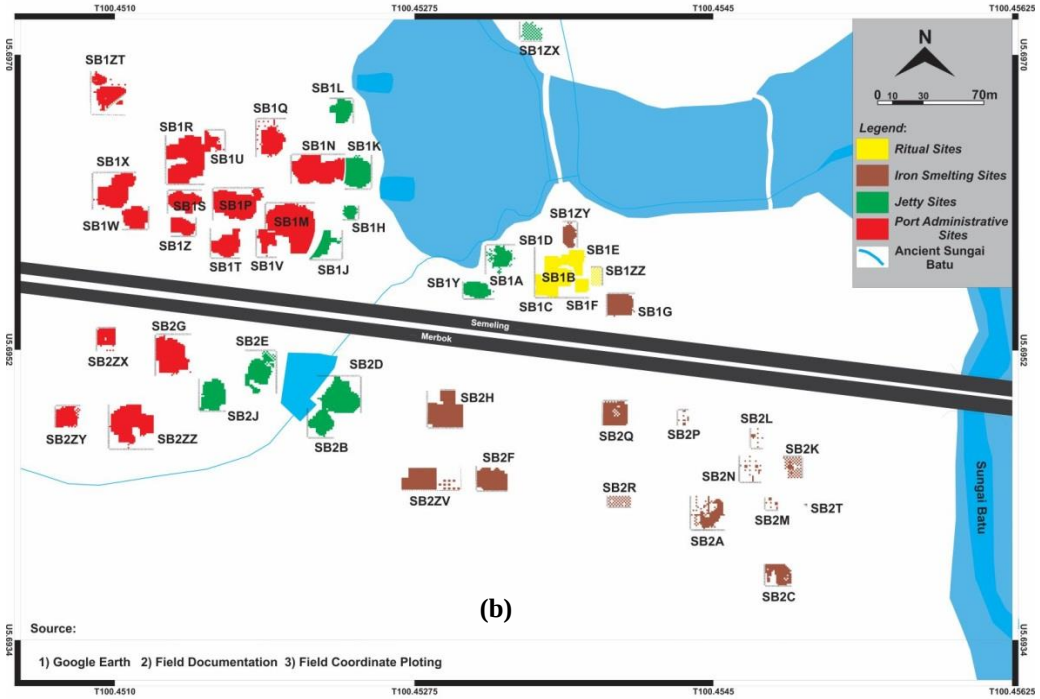

Figure 1. Sungai Batu Archaeological Complex location in Southeast Asia region (a) and site mapping (b) based on archaeological research (Source: Google Map, 2022; Field Documentation, 2022; Field Coordinate Ploting, 2022)

Table 1. Archeological findings at Sungai Batu Archaeological Complex (Source: Research data analysis, 2022)

No.	SITES	COORDINATE	UNIQUENESS
1	SB1A	05 41 73.3 U; 100 27 19.7 T	1. Jetty structure; 2. 3rd Century AD; 3. The architecture is directed and slopes towards the river
2	SB1B	05 41 73.3 U; 100 27 19.7 T	1.Aminisme and Buddha temple; 2. 2nd Century AD; 3. The structure is a circle at the base, a rectangle in the middle and a small circle at the top
3	SB1C	50'41.5' U; 100'27.03' T	1. SB1B supporting building; 2. 3rd Century AD; 3. Ruins building of brick
4	SB1D	50'41.5' U; 100'27.03' T	1. SB1B supporting building; 2.1st Century BCE; 3. Ruins building of brick
5	SB1E	50'41.5' U; 100'27.03' T	1. SB1B supporting building; 2. 3rd Century AD; 3. Ruins building of brick
6	SB1F	05º41'43.89" U; 100º27'12.26" T	1. SB1B supporting building; 2. 12-13th Century AD; 3. Ruins building of brick
7	SB1G	5º41'43.61" U; 100º27'11.55" T	1. Iron Smelting Site; 2. 4-18th Century AD; 3. Find base of the furnace, tuyure, iron ore, iron ingots and iron slag
8	SB1H	05°41.45.8' U; 100°27.08.4' T	1. Iron Smelting Site; 2. 4-18th Century AD; 3. Find base of the furnace, tuyure, iron ore, iron ingots and iron slag
9	SB1J	05°41.45.2' U; 100°27.08.3' T	1. Jetty structure; 2. 1st Century BCE; 3. The architecture is directed and slopes towards the river
10	SB1K	05°41.46.3' U; 100°27.08.7' T	1. Jetty structure; 2. 1st Century BCE; 3. The architecture is directed and slopes towards the river
11	SB1L	05°41.47.5' U; 100°27.08.6' T	1.Jetty structure; 2. 1st Century AD; 3. The architecture is directed and slopes towards the river
12	SB1M	5°41.753' U; 100°27.115' T	1. Administrative Structure; 2. 1st Century BCE; 3. Small room and horizontal monument
13	SB1N	5°41.781' U ; 100°27.128' T	1. Administrative Structure; 2. 1st Century BCE; 3. Small room and horizontal monument
14	SB1P	05°41.764' U; 100°27.092' T	1. Administrative Structure; 2. 2nd Century BCE; 3. Small room and horizontal monument
15	SB1Q	05°41.779' U; 100°27.103' T	1. Administrative Structure; 2. 2nd Century BCE; 3. Small room and horizontal monument
16	SB1R	05º41.779' U; 100º27.077' T	1. Administrative Structure; 2. 5th Century BCE; 3. Small room and horizontal monument
17	SB1S	05º41.766:" U; 100º27.069" T	1. Administrative Structure; 2. 5th Century BCE ; 3. Small room and horizontal monument
18	SB1T	05º41.747" U; 100º27.094" T	1. Administrative Structure; 2. 2nd Century BCE; 3. Small room and horizontal monument
19	SB1U	05º41.787" U; 100º27.081" T	1. Administrative Structure; 2. 2nd Century AD; 3. Small room and horizontal monument
20	SB1V	05º41.743" U; 100º27.112" T	1. Administrative Structure; 2. 3rd Century AD; 3. Small room and horizontal monument
21	SB1W	05°41.765' U ; 100°27.052' T	1. Administrative Structure; 2. 7th Century AD; 3. Small room and horizontal monument
22	SB1X	05°41.754' U ; 100°27.130' T	1. Administrative Structure; 2. 2nd Century AD; 3. Small room and horizontal monument
23	SB1Y	5°41' 43.38" U; 100° 27' 10.95" T	1. Jetty structure; 2. 2nd Century AD; 3. The architecture is directed and slopes towards the river
24	SB1Z	05º41.750" U; 100º27.103" T	1. Administrative Structure; 2. 3rd Century BCE; 3. Small room and horizontal monument
25	SB1ZZ	05º41'43.89" U; 100º27'12.26" T	1. SB1B supporting building; 2. 12 Century AD; 3. Ruins building of brick
26	SB1ZY	5º41'45.13" U; 100º27'12.72" T	1. Iron Smelting Site; 2. 4th Century BCE; 3. Find base of the furnace, tuyure, iron ore, iron ingots and iron slag
27	SB1ZX	05° 41' 49.520" U 100° 27' 12.060'' T	1. Jetty structure; 2. Dating has not been obtanied; 3. The architecture is directed and slopes towards the river
28	SB1ZT	5º47.29" U; 100º27'01.72" T	1. Jetty structure; 2. Dating has not been obtanied; 3. The architecture is directed and slopes towards the river
29	SB2A	5°41.651' U; 100°27.277' T	1. Iron Smelting Site; 2. 1st Century AD; 3. Find base of the furnace, tuyure, iron ore, iron ingots and iron slag
30	SB2B	05º41'43" U; 100º27'59" T	1. Jetty structure; 2. 4th Century AD; 3. The architecture is directed and slopes towards the river
31	SB2C	5º41'38.05" U; 100º27'17.04" T	1. Iron Smelting Site; 2. 8th Century AD; 3. Find base of the furnace, tuyure, iron ore, iron ingots and iron slag
32	SB2D	05º41'64" U; 100º27'08.35" T	1. Jetty structure; 2. 6th Century BCE; 3. The architecture is directed and slopes towards the river

33	SB2E	05°41.42.9' U; 100°27.06.2' T	1. Jetty structure; 2. 3rd Century BCE; 3. The architecture is directed and slopes towards the river
34	SB2F	5º41'40.20" U; 100º27'11.55" T	1. Iron Smelting Site; 2. 1st Century BCE; 3. Find base of the furnace, tuyure, iron ore, iron ingots and iron slag
35	SB2G	05°41'42.2" U; 100°27.04.4 T	1. Administrative Structure; 2. 5th Century BCE; 3. Small room and horizontal monument
36	SB2H	05º41'41.42" U; 100º27'10.68" T	1. Iron Smelting Site; 2. 8th Century BCE; 3. Find base of the furnace, tuyure, iron ore, iron ingots and iron slag
37	SB2J	05°41'42.0" U; 100°27'05.2" T	1. Jetty structure; 2. 4rd Century Century; 3. The architecture is directed and slopes towards the river
38	SB2K	05° 41' 40.18" U 100° 27' 16.11" T	1. Iron Smelting Site; 2. 4th Century AD; 3. Find tuyure, iron ore, iron ingots, iron slag, shells and animal bones
39	SB2L	05° 41' 40.42" U; 100° 27' 16.01" T	1. Iron Smelting Site; 2. 5th Century AD; 3. Find tuyure, iron ore, iron ingot, iron slag and shells
40	SB2M	05° 41' 39.59" U; 100° 27' 16.01" T	1. Iron Smelting Site; 2. 3rd Century AD; 3.Find tuyere, iron ore and iron slag
41	SB2N	05° 41' 40.09" U; 100° 27' 14.85" T	1. Iron Smelting Site; 2. 3rd Century AD; 3.Find tuyere, iron ore and iron slag
42	SB2P	05° 41' 39.43" U; 100° 27' 16.70" T	1. Iron Smelting Site; 2. 3rd Century AD; 3.Find tuyere, iron ore and iron slag
43	SB2Q	05° 41' 41.48" U; 100° 27' 13.41" T	1. Iron Smelting Site; 2. 6th Century AD; 3.Find base furnace, tuyere, iron ore and iron slag
44	SB2R	05° 41' 39.69" U; 100° 27' 16.13.73" T	1. Iron Smelting Site; 2. 6th Century AD ; 3.Find tuyere, iron ore and iron slag
45	SB2T	05° 41' 39.43" U; 100° 27' 16.70" T	1. Iron Smelting Site; 2. Dating has not been obtanied ; 3.Find iron ore and iron slag
46	SB2W	05° 41' 39.30"U; 100° 27' 13.72" T	1. Iron Smelting Site; 2. Dating has not been obtanied; 3.Find laterite
47	SB2Y	05° 41' 40.36" U 100° 27' 12.83" T	1. Iron Smelting Site; 2. Dating has not been obtanied; 3.Find base furnace, tuyere, iron ore,iron slag and brick
48	SB2ZZ	05º41'41.4" U; 100º27'03.8" T	1. Port Administrative; 2. 2nd century Ad; 3. Small room and horizontal monument
49	SB2ZY	05º41'40.57" U; 100º27'2.18" T	1. Port Adminstrative; 2. 5th Century BCE; 3. Small room and horizontal monument
50	SB2ZX	05º41'43"; 100º27'01" T	1. Port Adminstrative; 2. Dating has not been obtanied; 3. Small room and horizontal monument
51	SB2ZV	U $5^0$41.39; T $100^0$27'09"	1. Iron Smelting Site; 2. Dating has not been obtanied ; 3.Find base furnace, tuyere, iron ore,iron slag and brick

In order to obtain primary data related to monument architecture technology and the use of local raw materials in the construction process of river jetty in this area, contour mapping, sketching, stratigraphy and scientific analysis involving Petrography, XRD, XRF and SEM were conducted. This was done to prove the hypothesis related to the construction technology of the jetty structure in the Sungai Batu Archaeological Complex is to use local materials obtained in the area of the complex.

OBJECTIVES OF THE STUDY

This study was conducted with the main purpose to find out the architecture and function of each site on the left and right river banks of Sungai Batu in particular. The architectural appearance obtained during the excavation will determine the actual function of the monument. To determine the absolute age of the river jetty, some brick samples were also taken and sent to Korea Basic Science Lab, Korea to undergo Optical Stimulated Luminescence (OSL) method for the purpose of obtaining absolute chronometric dating data.

RESEARCH METHODOLOGY

To complete the primary data of this study, survey (potential and alluvial sediment using a core drilling technique) and mapping (geophysics, contour and cross section) activities on the river banks of the Sungai Batu were carried out comprehensively. After the potential of the site was identified, the process of cleaning and installation of the excavation grid measuring 1x1 square meters was done before the contour and geophysical mapping was carried out. After that, an excavation process was done to reveal the architectural form of the monument that is still in-situ at the site. During the excavation activities, any findings of artifacts, ecofacts, features (architecture) and studies on stratigraphic layers were conducted to determine which sites studied were in-situ were carefully recorded to enable a final interpretation to be submitted. Artifacts found will also undergo quantitative and qualitative analysis methods for the purpose of measurement and aggregation of artifacts during the field study. After that, selected artifacts that are still in-situ with the monumental architecture will be sent to obtain chronometric dating data at Korea Basic Sains Lab, Korea and XRD, XRF and SEM scientific analysis at the Earth Material Characterisation Laboratory, Center for Global Archaeological Research (CGAR), University Sains Malaysia, Pulau Pinang, Malaysia (Figure 2). All these data will help in the interpretation of the actual function of the site for which the study has been conducted.

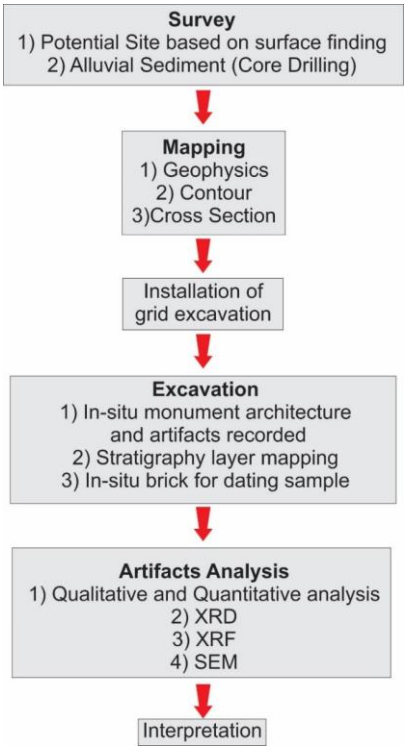

Figure 2. Field study methodology chart at Sungai Batu Archaeological Complex (Source: illustrated by author, 2022)

Survey

Survey activities conducted at the site near the river banks of Sungai Batu have recorded the discovery of bricks and roof tiled on the ground surface (Figure 3) which revealed the potential of the site in archaeological studies such as the interpretation of Hester et al., (1975), Wilkinson (2007) and Sobotkova and Ross (2018). Furthermore, the location of the study site is also close to alluvial sediment deposits as recorded by the Geological Map of Malaysia (Geological Map, Sheets 2-1/2 & 2-1/6, Years 1972) (Figure 4) and on the river banks of the Sungai Batu based on the Topographic Map

(Topographic Map, No. Sheets 16, Years 1970) (Figure 5). This provides preliminary information related to the facility to obtain clay to be used as a raw material for the manufacture of bricks and roof tiled (Halim, 2019) for the construction of monumental structures in this area in particular. The results of core drilling conducted on 11 drilling localities suggest that the Sungai Batu Complex area consists of several alluvial sediments, soil layers and sedimentary rocks that have been fully weathered and highly weathered. The alluvial sediment is about 3 meters thick except in the locality of ADH 9 which reaches a thickness of 4.5 meters. Fully weathered to highly weathered sedimentary rocks are characterized by clay or silt rocks that have characteristics similar to the argillite facies of the Sungai Petani Formation and have a high iron oxide content (Bradford, 1972). Based on the drilling logs ADH3, ADH5, ADH6, ADH7, ADH 9 and ADH 10 (Figure 6) suggest the deposition of the alluvial layer was between 0.5 meters to 4.5 meters and the lake level at that time was 14 meters above sea level. Survey activities were also conducted around the Sungai Batu Archaeological Complex to see the raw materials for burning and smelting iron. The results of the survey clearly show that the abundant raw material recorded its findings around one kilometer from this complex which shows its potential as an industrial area (Figure 7). Even with the presence of Sungai Merbok which is also within one kilometer from this complex which is able to supply fuel from mangrove wood for the smelting process (Figure 8) is also one of the triggering factors to the suitability of the surrounding area of this complex developed as a large-scale industrial area.

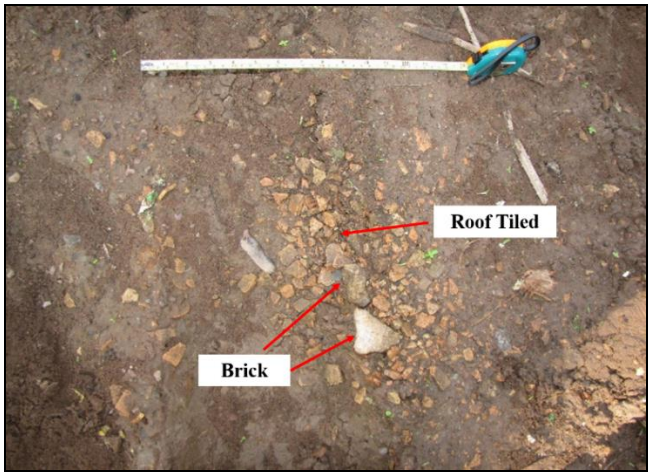

Figure 3. Surface findings of roof tiled and bricks suggesting that site had a potential for archaeological studies (Source: Result survey by the author, 2022)

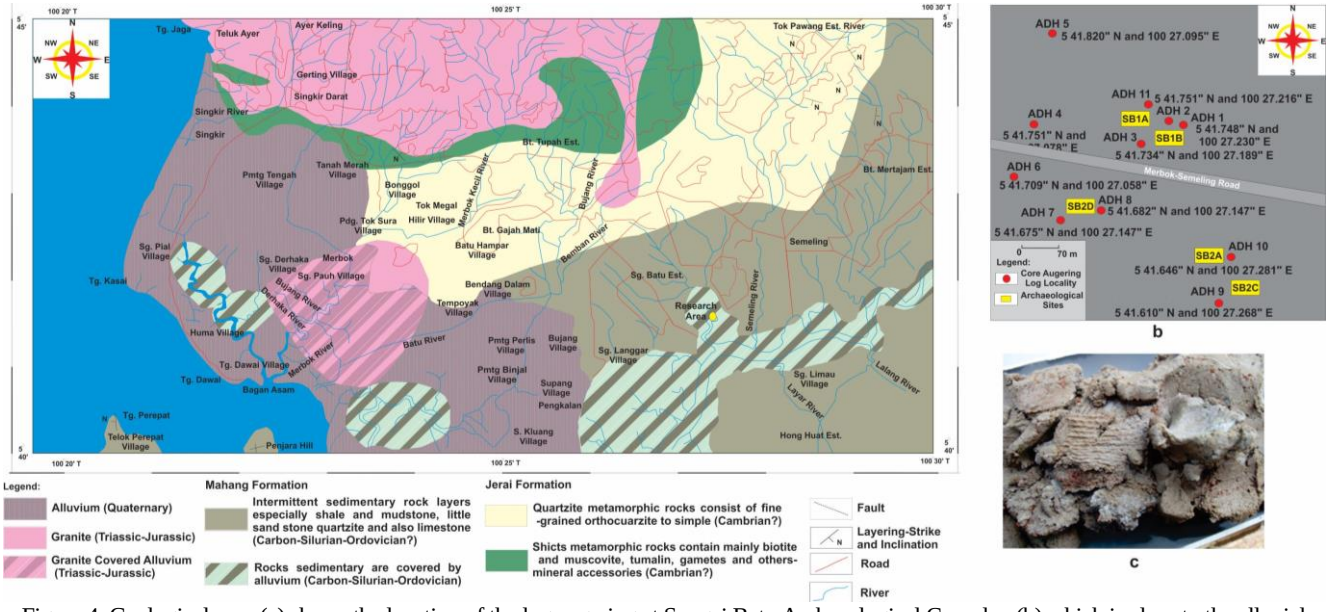

Figure 4. Geological map (a) shows the location of the log augering at Sungai Batu Archaeological Complex (b) which is close to the alluvial sediment (c) that allows it to be used as a raw material for bricks making (Source: Geological Map, Sheets 2-1/2 & 2-1/6, Years 1972)

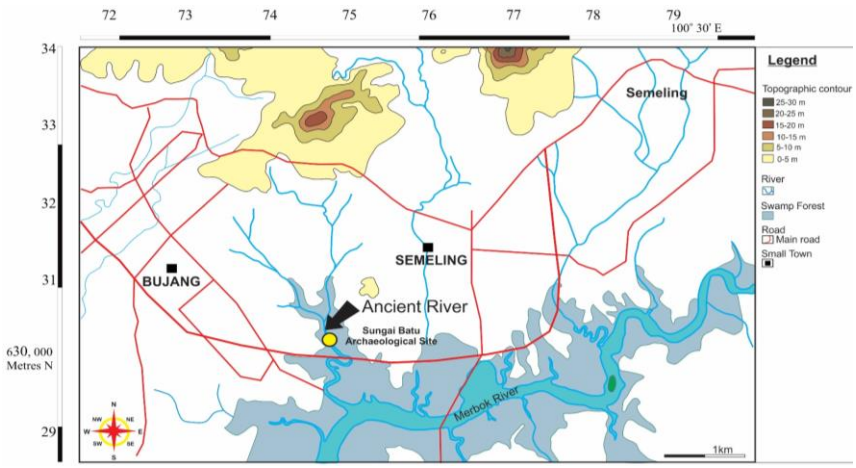

Figure 5. Topographic map of Sungai Petani area shows the existence of the Sungai Batu Archaeological Complex near the ancient river which provides an abundance of clay (swamp forest area) for the purpose of bricks making (Source: Topographic Map, No. Sheets 16, Years 1970)

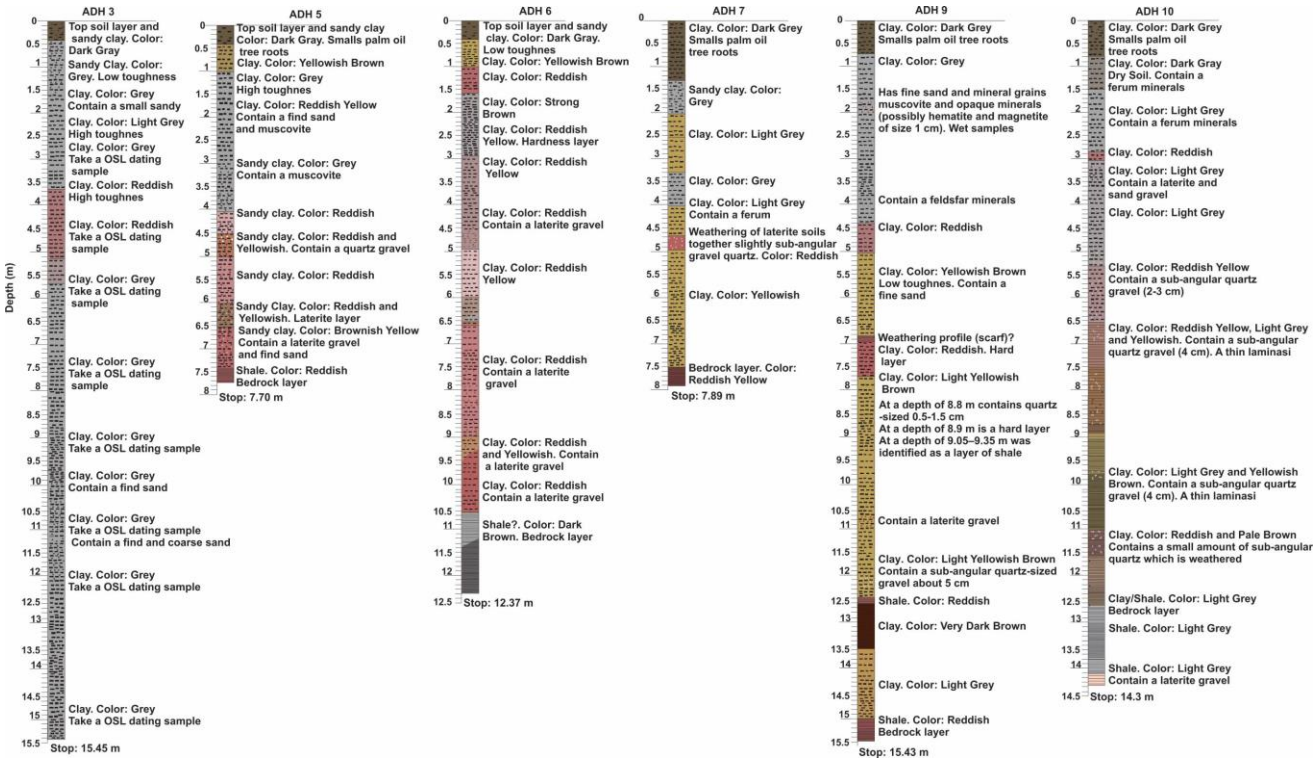

Figure 6. Stratigraphic log sequence of core drilling locality ADH3, ADH5, ADH6, ADH7, ADH 9 and ADH 10 at Sungai Batu Archaeological Complex revealing alluvial deposition (Source: Research data analysis, 2022)

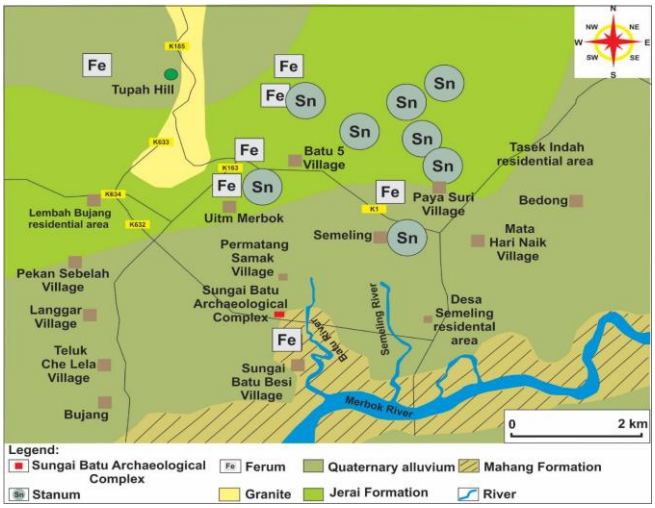

Figure 7. Location of the iron smelting raw material survey which showed an abundance of iron ore found around one kilometer from the Sungai Batu Archaeological Complex (Source: Jones, 1972 and illustrated by author, 2022)

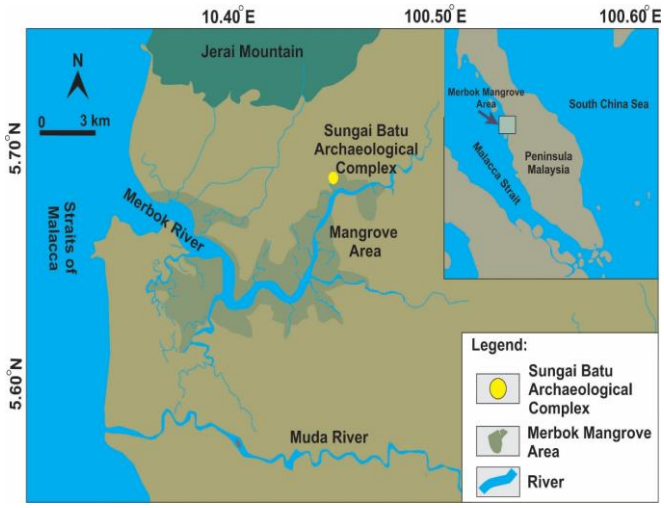

Figure 8. The abundance of mangrove trees along the Merbok River has been used as fuel for iron smelting at Sungai Batu Archaeological Complex (Source: Abidin et al., 2021 and illustrated by author, 2022)

SEM-EDX analysis was also conducted on charcoal samples found in the iron smelting workshop at the Sungai Batu Archaeological Complex to prove the results of the survey conducted. The results of the analysis have revealed a carbon element around 50.51-68.81% which shows the use of high quality mangrove fuel (Mokhtar, 2019). The interpretation of the use of mangroves as a fuel is also strengthened by photomicrographic analysis which shows that the charcoal has a dense and hollow structure (porosity) that almost matches the characteristics of mangrove wood (Mokhtar, 2019; Saidin, 2022).

Archaeological Excavations at the Ancient River Jetty

Archaeological excavations conducted at the SB2D river jetty site at the Sungai Batu Archaeological Complex were alternately in the dam technique (Figure 9). In addition, geophysical mapping using Ground Penetrating Radar (GPR) method is also applied to obtain magnetic anomaly data (Figure 10) which allows to suggest areas to be excavated in advance to be determined (Halim, 2019). The Mala Geoscience ProEx GPR equipment set using a 500MHz shielded antenna and an XV monitor display was used during the geophysical mapping. The determination of such excavation procedures allows the stratigraphic layer and the actual area of the site to be determined (Halim, 2019). The excavation process carried out especially at the SB2D site has been able to explain the structure of the monument which consists of

floors, walls, corridors and roof tiled as evidence that it is roofed structure. The architectural structure of this monument is still in-situ as it was originally which can illustrate the actual function inside the Sungai Batu Archaeological Complex. After the excavation was completed, the process of record a pictures of the site from a side view was carried out for the purpose of recording field data. After that, the process of producing the floor map plan, contour mapping and site cross section was also done which showed that the jetty site was built sloping towards the ancient river (Figure 11).

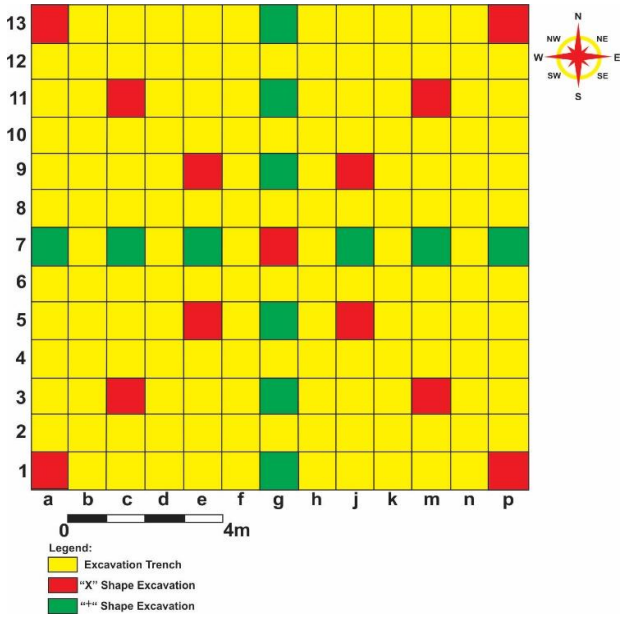

Figure 9. Excavations carried out alternately in the form of checkers either in the form of "X" or "+" for the purpose of data collection (Source: Research data analysis, 2022)

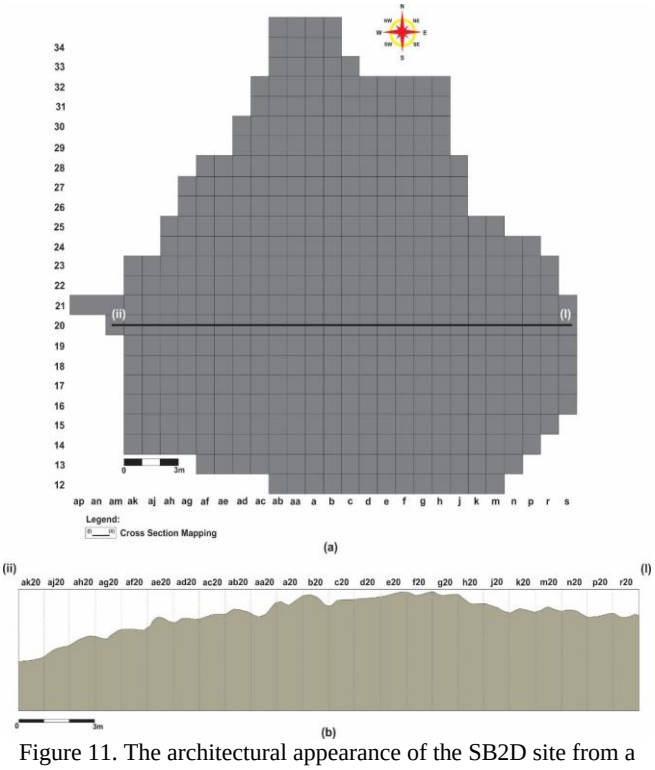

Figure 11. The architectural appearance of the SB2D site from a side view that allows the floor plan (a) of the site to be submitted. Cross-section (b) also show that monument was built sloping westward on an ancient river confirming its function as a jetty (Source: Research data analysis, 2022)

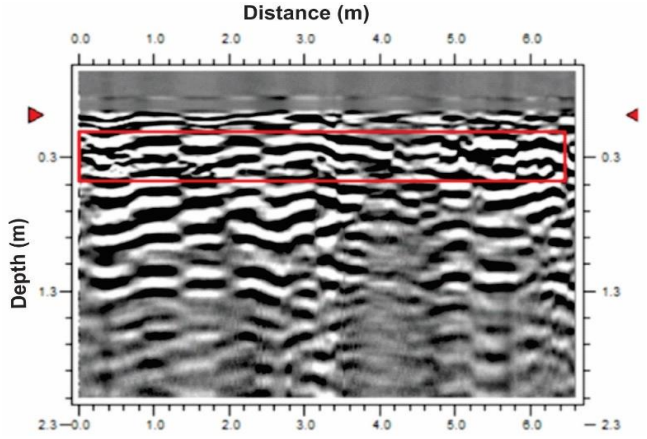

Figure 10. The results of geophysical anomaly analysis using GPR technique have revealed anomaly readings (red rectangles) which suggest the possibility of building structures buried below the ground surface (Source: Research data analysis, 2022)

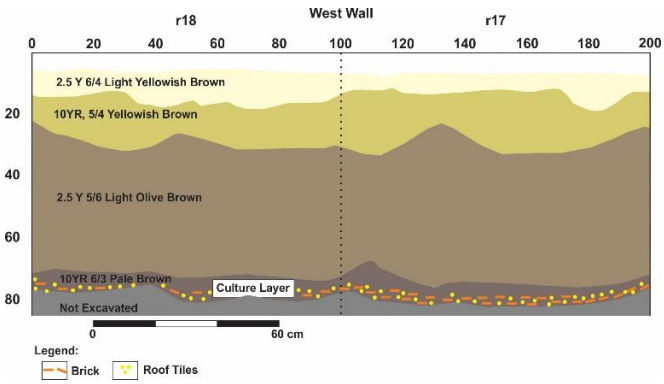

Figure 12. Stratigraphy of the SB2D site showing the structure of the monument is still in-situ embedded to a depth of 75 cm (Source: Research data analysis, 2022)

This shows that the site more clearly serves as a river jetty in the Sungai Batu Archaeological Complex. In addition, studies on stratigraphic layers also revealed that the site has four soil layers that are still in-situ (Figure 12). Layers one to three are layers that are on top of the culture layer that has a thickness of up to 75 cm. No artifact finds were recorded on this layer. The fourth layer is the cultural layer that has recorded the discovery of floors, corridors, walls and tiled roofs. This layer is expected to have a thickness of up to 10 cm.

Ancient River Jetty Architecture at SB2D Site

Excavations at the SB2D site revealed evidence of floors, walls, corridors and roof tiled (Figure 13) that proved the monumental structure at the site was roofed. The roof tiled were found in a scattered in the northern and southern parts of the SB2D site. In addition, a pillar base structure was found at the end of the main floor structure of the SB2D building which strengthened the use of the roofed structure at the site.

The main floor structure of the site was constructed north-south oriented and was built on clay with brick fragments and a roof tiled used as a foundation stabilizer. The floor structure of the main building is classified based on the remnants of 42 rows of in-situ brick stacks built measuring 20.6 meters long and 4.7 meters wide. The average brick size used for the floor structure at the SB2D site was 26x17x5 cm and between each stack of floor bricks is spaced about 15 cm per floor row with

an estimated length of each floor row around 4.10-4.15 cm. A floor architecture that has a distance between each floor row is proposed to function as one of the means of water outflow from the main building especially when the water level rises. In fact, bricks are also placed in the space of each row of bricks to prevent them from being eroded when the water level rises.

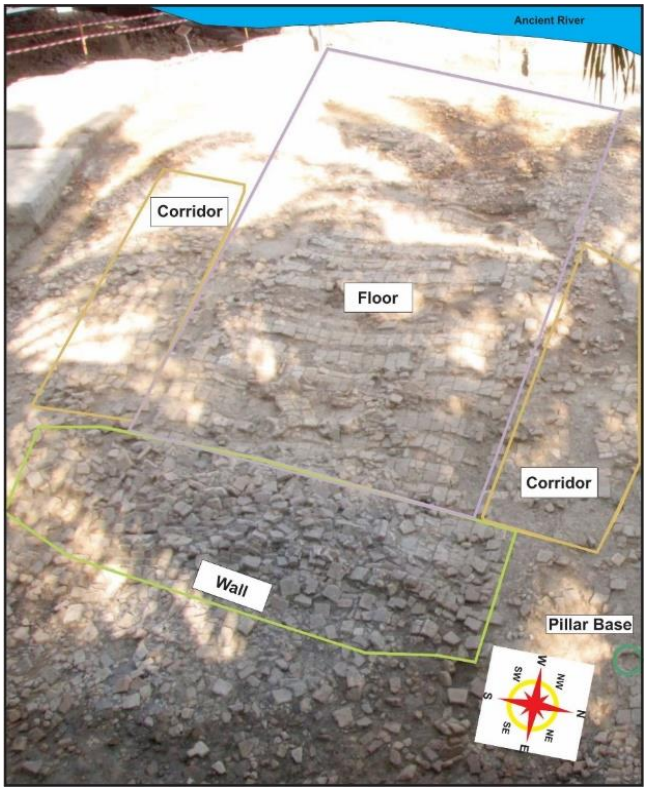

Figure 13. Architectural of the SB2D site
(Source: Research data analysis, 2022)

Figure 14. A mooring mast structure found near the river banks of ancient Sungai Batu (Source: Research data analysis, 2022)

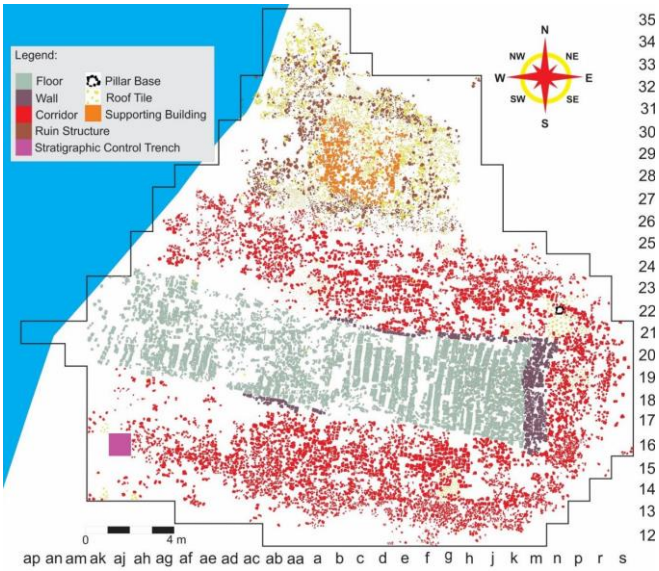

Figure 15. SB2D river jetty site reconstruction plan
(Source: Research data analysis, 2022)

Excavation of the SB2D site found a wall structure that is on the east side. The wall structure was built with a width of 4.7 meters and arranged with 12 rows of bricks that form a wall structure that is about one meter high. This wall structure serves as a space divider between the floor structure and the corridor at this site. The average brick size used to represent the wall structure was 17x14x5 cm. The corridor structure has been classified architecturally based on the arrangement of bricks arranged non-uniformly and has an estimated distance of 10 cm between each brick that exhibits differences in architectural appearance with the floor. The corridor structure is 14 meters long and four meters wide on the side of the main building while the corridor structure on the east side of the site is four meters long and three meters wide. Archaeological studies at the site also recorded the discovery of pillar base that were still in-situ at the end of the corridor structure. The discovery of the pillar base structure illustrates that the jetty monument at the SB2D site has a roofed structure. The base structure of the pillar is round in shape with an average size of about 15 cm. The discovery of the pillar base was also reinforced by the discovery of a dominant roof tiled distribution in the eastern and northern parts of the SB2D site. Furthermore, the findings of wooden structures (Figure 14) that are expected to be used as ship mooring mast (Zakaria, 2014) clearly strengthen the interpretation the existence of river jetty architecture at this site. The wooden structure is found in trench am21, an21 and ap21, which is on the river banks of the ancient Sungai Batu.

In addition, in the northern part of the SB2D site there is a horizontal structure was built in the rectangle shape. The structure is eight meters long and six meters wide. The structure was built with a single layer of brick arrangement without any reclamation with brick gravel or roof tiled. The average size of the bricks used to erect this structure has similarities with the main floor bricks which is 26x17x5 cm. Based on the appearance of this monument it is likely that this structure serves as a supporting monument to the jetty structure at the SB2D site. Based on the findings of floor, walls, corridors, pillar base structure and roof tiled that are still in-situ at the SB2D site, Figure 15 is a plan for the reconstruction of the river jetty structure at the site. The river jetty structure was built with an area of 28x27 square meters and slopes about 20^{o} towards the ancient river. However, the shape of the roof structure at this site could not be determined accurately due to the lack of evidence related to the location and the actual number of pillar base at this site. A comparative study conducted on the architecture of administrative (Figure 16) and rituals monument (Figure 17) clearly shows architectural differences that suggest their functions are not the same. This is because the architecture of the administrative monument is built horizontally with the presence of small room space (Ahmad, 2016 and Yusof, 2016) while the ritual monument is built with a circle structure at the base, a square in the middle and a small circle on it (Hassan, 2018). To determine when the SB2D jetty site was built exactly then some brick samples were taken and sent to the dating laboratory to get the absolute dating of

this site. Brick samples from floor and corridor structures were used to undergo the Optically Stimulated Luminescence (OSL) dating method at Korea Basic Science Lab, Korea to determine the absolute age of the site. The results of the dating have suggested that the SB2D site was built and used from 582 BCE to 420 AD at the Sungai Batu Archaeological Complex. This indicates that the SB2D jetty site has been used as an aid for the export of iron ingots in this area starting from 788 BCE.

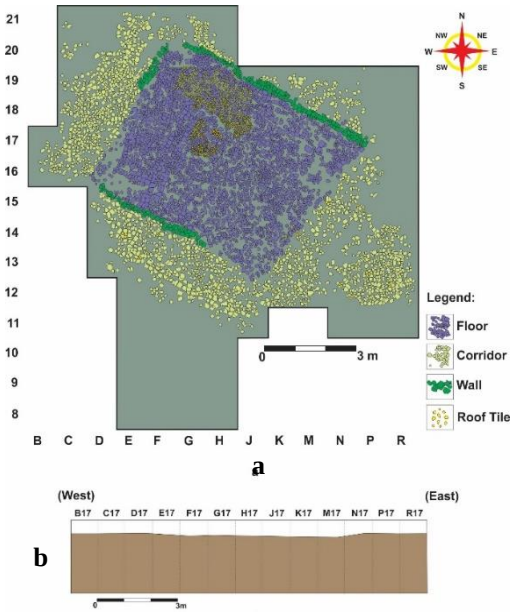

Figure 16. Architecture of river jetty administrative monument (a) built horizontally based on cross section mapping (b) (Source: Research data analysis, 2022)

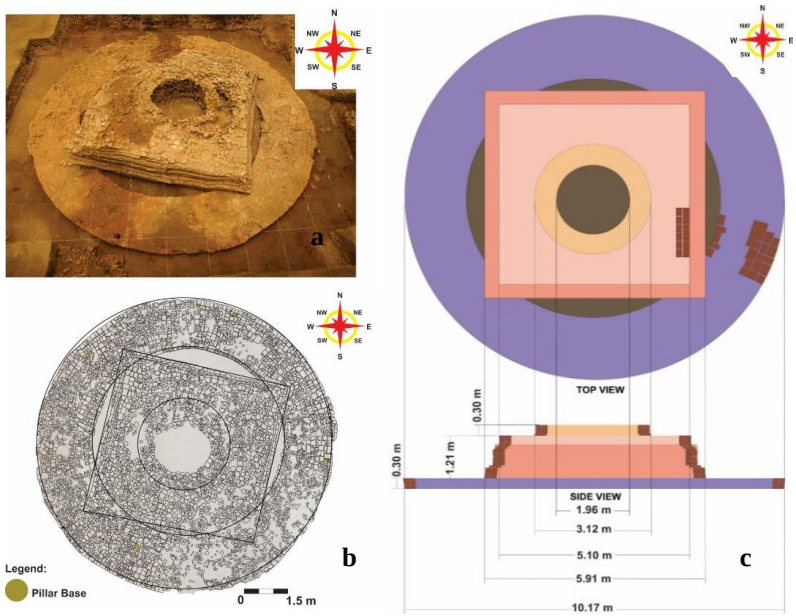

Figure 17. SB1B ritual site architecture (a), sketch (b) and reconstruction plan (c) showing architectural differences with SB2D ancient river jetty site (Source: Research data analysis, 2022)

Outstanding Universal Value (OUV) of Ancient River Jetty Site

To date, archaeological research at the ancient river jetty, administrative, ritual sites and iron smelting workshop at Sungai Batu Archaeological Complex have been able to reveal the Outstanding Universal Value (OUV) by the site which qualifies it to be nominated as a World Heritage Site (WHS) category. Among the Outstanding Universal Value (OUV) found at the ancient river jetty structure at the Sungai Batu Archaeological Complex are (1) for the first time found the most complete jetty architectural in the world, (2) reveals evidence of a river jetty built since the sixth century BCE representing the world iron trade and (3) the only area in the world that reveals the most jetties close to each other in the vicinity of a river. The Outstanding Universal Value (OUV) data for the river jetty site in the ancient port of Kedah Tua which qualifies it to be developed as a UNESCO world heritage site and as an iconic tourism product.

The Most Complete Ancient River Jetty Architecture

In general, the academic study conducted at the Sungai Batu Archaeological Complex has been able to record the discovery of a complete river jetty structure. The structure of the river jetty is classified by the presence of floor structures, walls, corridors, pillar base and roof tiled that are built sloping towards the ancient river. Current archaeological studies clearly reveal evidence of early world jetties and ports recorded only based on the discovery of ruins of rig structures (Tripati and Gaur, 2009), wooden poles (Lobell and Merola, 2008), walls (Guderjan, 1988: 2012) and breakwaters (Graauw, 2016) embedded in the bottom of a river or sea.

The architectural structure is not clear and most of the jetty and port sites could not be included in the reconstruction plan of the appearance of the building because it has been destroyed. Therefore, only the findings at the Sungai Batu Archaeological Complex to date are able to reveal the most complete architectural form of the river jetty for the early world civilization that can be accompanied by a plan to rebuild the evidence of the port as shown in Figure 18.

Early Iron Ingot Export River Jetty

The chronometric dating of OSL performed on brick samples of river jetty structures is also reinforced by radiocarbon dating of the iron smelting site which gives it its involvement in iron smelting activities since 788 BCE. Based on the chronometric dating data, it is clear that the structure of the Sungai Batu jetty was built for the purpose of exporting Kedah Tua iron ingots, especially since the sixth century AD. In addition, a comparative study of world iron smelting sites also did not reveal the existence of evidence of river jetty sites, jetty administration and rituals in the same area which shows the uniqueness and importance of findings in the Sungai Batu Archaeological Complex in the development of early world civilization. Archaeological studies at iron smelting sites in Southeast Asia by Pryce (2014) at Khao Sam Kaeo sites and Phu Khao Thong (Biggs et al., 2013), Thailand, Preah Khan (Angkor) (Hendrickson et al., 2013), in East Asia at the sites of Hongfengshuiku, Maochengnao, Mianyangdi, Wangyuecun, Xiyuqiao, Cangxiawu, Lidegui and Yanwopu (Garcia, 2017) also did not find jetty architectural structures built specifically for the purpose of exporting iron ingots. Archaeological studies in South Asia such as at the Dhatwa site (Hegde, 1973) and Khasi Hills

(Prokop and Suliga, 2013), West Asia such as at the Ed Dur site (Delrue, 2008), Salut, Oman (Esposti et al., 2016) and Europeans such as the Lecci site, Italy (Giardino and Quercia, 2008) also did not find finds as recorded in the Sungai Batu Archaeological Complex. This suggests that until 2022, only archaeological studies at the Sungai Batu Archaeological Complex will be able to reveal the architecture of the iron ingot export jetty for early world civilizations.

Port Complex

Based on the survey and mapping carried out on the sites located on the left and right river banks of Sungai Batu revealed at least 11 sites that have the potential to reveal the jetty monument that has been buried. It is proposed based on the discovery fragments of brick and roof tiled on the ground surface. To confirm the potential of the site, archaeological studies were conducted at the site. Excavations carried out at the site found that all the main building structures were constructed directed and sloping towards the ancient river which suggested its function as a river jetty. Due to the number of close sites which is between three to 15 meters each jetty site suggests it as a port complex in this area. Archaeological studies of river jetty and port sites until 2022 did not reveal areas with so many jetties and ports in a river and sea environment (Table 2). To date, only the findings at the Sungai Batu archeological site are the only ones in the world that can reveal 11 evidence of river jetties, 17 jetty administrative, 17 iron smelting sites and six ritual monument that represent the high civilization of the Old Kedah Kingdom.

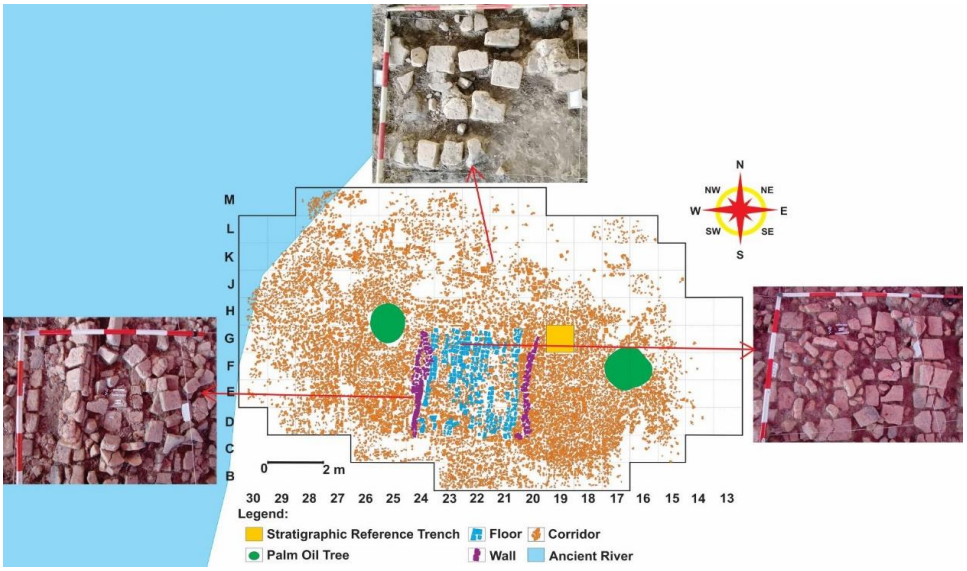

Figure 18. Evidence of floor, wall and corridor structures classified at one of the river jetty sites other than the SB2D site at the Sungai Batu Archaeological Complex (Source: Research data analysis, 2022)

Table 2. Evidence of structures and constructions at ancient jetty and port sites exceeding one structure at each location for early world civilizations (Source: Compiled by Authors, 2022)

CIVILIZATION	LOCATION	COUNTRY	CLASSIFICATION	REFERENCE
Southeast Asia	Yarang	Thailand	30 moat structures, canals and temple buildings	Linehan, 1948 & Sidhu, 2021
	Karang Anyar	Indonesia	Seven canal structures, three ponds and a shipwreck	Manguin, 1992 & Wiyanarti, 2018
South Asia	Porbandar	India	Reveals four jetty structures built using limestone blocks	Gaur et al., 2004 & Tripati, 2015
East Asia	Naniwa	Japan	Platform and warehouse structure	Sakaehara, 2009 & Pearson, 2016a
	Sakai	Japan	Platform and warehouse structure	Pearson, 2016b; 2020
West Asia	Pharos (Alexandria)	Egypt	Breakwater and lighthouse structures	Jondet, 1912; 1921: Salem, 1991: Doris, 2006: Vrettos, 2010 & Amr, 2021
	Marea/Philoxenite	Egypt	Four platform from brick structures	Emad Khalil, 2010 & Derda et al., 2021
	Magdala	Israel	Two platform-shaped structures were built on the north and south sides	Sarti et al., 2013 & Galili et al., 2018
Europe	Marseille	France	Wooden pillar structure, building walls of stone blocks	Morhange et al., 1996; 2001
	Narbonne	France	Building structures of stone blocks and warehouses	Kyprouli, 2012
	Pisa	Italy	Two jetty structures of pine wood, stone blocks	Graauw, 2016
	Vounari Tou Kambiou	United Kingdom	Building and warehouse wall structures	Leidwanger, 2005
	Elaia	Turkey	Reveals three ancient port that it closed port, open port and breakwater structure	Seeliger et al., 2013

SB2D Ancient River Jetty Site as a Iconic Tourism Product

Once the archaeological study at the Sungai Batu Archaeological Complex especially at the river jetty site is able to reveal the most complete jetty architecture in the world, then it should be developed as an iconic tourism product. To achieve this goal, several tour packages have been designed and offered to interested tourists. Among the tour packages offered include a guided tour package that will expose tourists to information and evidence of river jetty sites, jetty administrative, rituals and iron smelting workshops available in the area. In addition, for tourists who are interested in taking the full tour package then the tourists will be exposed to a tour of the entire archeological site in this complex as well as exposed to the experience of iron smelting experiments, brick making and simulation of archaeological excavations (Figure 19). Apart from that, to centralize tourism activities at the Kuala Muda district level, an area has been gazetted as the Kuala Muda Tourism Interpretation Center (Figure 20) to manage large-scale tourism packages at the district level. To attract tourists, several tourism products such as geosite Jerai Geopark, Sungai Merbok mangrove biology and Sungai Batu Archaeological Complex have been made the district's iconic tourism products to maximize the offer of global tourism packages to tourists.

Figure 19. Full tour package offered at Sungai Batu Archaeological Complex consisting of site visit (a), excavation (b), iron smelting (c) and brick making (d) experiment (Source: Research data analysis, 2022)

Figure 20. Kuala Muda Tourism Interpretation Center (PIPKM) which is used as a one stop center for tourism in Kuala Muda district (Source: Drone Mapping, 2022)

Therefore, seven tourism packages at the district level (Table 3) have been created with a combination of several iconic and byproduct tourism (history, agro, recreation and eco, culture and heritage) that clearly highlight the identity of Kuala Muda district in the tourism sector. The scope of tourism offered to tourists is a package of day trips to tourist sites.

This allows tourists to minimize tourism time as well as to maximize the experience with the beauty of the natural panorama and the validity of the research facts of the tourism product. The unique experience gained through the visit session is expected to generate identity building related to nation building through historical values adapted from the experience of the visit.

CONCLUSION

Archaeological research that has been conducted at the river jetty site has been able to reveal the most complete architectural of the river jetty for the early world civilization built using bricks since 582 BCE. As the archaeological study revealed world-impact OUV data such as 1) the most complete architectural evidence of the river jetty built since 582 BCE, 2) the earliest Kedah Tua iron ingot export jetty and 3) the only area in the world to reveal a total of 11 river jetty sites in the vicinity of the river allows it to be an iconic tourism product in the Kuala Muda district. Based on the privileges that have been recorded, seven tour packages have been offered in the Kuala Muda district to introduce the iconic tourism product to the general public. This allows all the findings that have been recorded during the archaeological study to be interpreted and disseminated to tourists through the available tour packages.

Table 3. Kuala Muda dustrict tourism packages combining iconic tourism products and byproduct tourism (Source: Research data analysis, 2022)

No.	Package	Product
1	Package 1: Kuala Muda Tourism Interpretation Center (PIPKM)	Visit around PIPKM to see the scenery of various species of mangrove forest, Sungai Merbok and the distant view of Mount Jerai. After that, a visit to the PIPKM gallery and batik Merbok kiosk was also held to complete this package.
2	Package 2: Jerai Peak	Visit around PIPKM, former Gurun quarry, Sungai Layar fort, Wan Mat Saman Canal, Forestry Museum, see beautiful scenery of four types of Gunung Jerai forest, Padang Tok Syeikh, Padang Tok Syeikh tower, Tok Syeikh well and Batu Kapal. While on top of Gunung Jerai tourists have the opportunity to enjoy the beautiful scenery with cool temperatures around the hotel The Jerai Hill Resort, beautiful views of Yan and the Botanical Park.
3	Package 3: Kuala Muda Waterfall Recreation	Visit around PIPKM and after that the tour continued by visiting Sungai Batu Archaeological Complex, Semeling historical building, Sungai Layar fort, former Gurun quarry, see the beautiful scenery of lowland tropical forests before reaching Sungai Badak or Sungai Kunyit for recreation.
4	Package 4: Kuala Muda Minerals	Visiting around PIPKM and after that the tour continued by visiting Semeling and Tok Pawang mines, Sungai Batu Archaeological Complex, Sultan Muzaffar Shah 1 Tomb, Besta Gold mine mineralization zone, Tupah, Bukit Batu Pahat Archaeological Complex and Merbok town.
5	Package 5: Kedah Tua	Visit around PIPKM and after that visit Sungai Batu Archaeological Complex, Tomb of Sultan Muzaffar Shah 1, Semeling mangrove charcoal manufacturing center, Pengkalan Bujang Archaeological Complex, Pengkalan Kakap Mosque, Bukit Batu Pahat Archaeological Complex, kelulut honey farm, nira nipah Merbok and enjoy the panorama of the Tanjung Dawai.
6	Package 6: Sungai Merbok Mangrove	Visit around PIPKM and after that see the beautiful scenery of Merbok mangroves, Pulau Tiga palace, Semeling charcoal manufacturing center, Lubuk Pusing palace, Sungai Merbok oyster breeding center, Pantai Merdeka, Pulau Sayak and enjoy the panoramic beauty of Tanjung Dawai .
7	Package 7: Tsunami Gallery and Whisper Market	Visit around PIPKM and after that see the beautiful scenery around Sungai Petani town, Merdeka Bridge, Guar Kepah Neolithic site, Kuala Muda fort, Sungai Muda fort, whisper market, Tsunami gallery, Sayak Island, Mahang Formation red mudstone, Bukit Penjara fort and beautiful views of Merdeka Beach.

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