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Research Article

Ancient Kedah Kingdom: Interpretations Based on Archaeological Studies

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ABSTRACT

This manuscript is a summary of archaeological studies conducted in the ancient Kedah area, covering about 1,000 km². The conclusions of the study were identified by compiling data from written and navigational records as well as the archaeological record itself. The ancient Kedah Kingdom played an important role as a maritime kingdom in Southeast Asia since the 6th century BC. The jetty structure, port management, and the location of trade artifacts, which represent a trade area, provide evidence of ancient Kedah's involvement in trade activities. The iron smelting workshops at Sungai Batu Archaeological Complex and the bead and pottery manufacturing centers in Sungai Mas and Pengkalan Bujang provide evidence of the ancient Kedah industry. Moreover, the evidence of ritual structures, the Vimana-Mandapa (Hindu temple), the Buddhist temple, and sculptures clearly demonstrate the development of religion within this ancient Kedah civilization. This research clearly demonstrates that the ancient Kedah civilization conducted trade transactions with the early civilizations of the world, enabling foreign civilizations to recognize this kingdom as a major producer of iron ingot. This recognition was based on the nickname given to ancient Kedah by these civilizations, which means either iron or port. This indicates that foreign civilizations have recognized ancient Kedah as a port area that exports iron ingots of a global standard.

Keywords: Ancient Kedah Kingdom; Written and Navigational Records; Archaeological Evidence; Ancient Technology; Ancient Trade.

INTRODUCTION

Archaeological evidence internationally attests to the importance of the Strait of Malacca and the South China Sea as international trade routes since before the 1st century AD. It has also been studied and confirmed by Chaudhuri (1985), Kennet (2004), Rougeulle (2005), Sen (2006), Seland (2013), Zhang (2016), and Cobb (2018). The study's results have facilitated the interpretation of trade routes' potential to trigger the cultural, technological, and social evolution of early communities in coastal environments (Szigeti, Virág, Viktória, & Attila, 2017; Massimo & Scotti, 2017). As a result, cultures around trade routes evolved and developed, leading to a higher level of progress in the lives of early societies. Therefore, it is not surprising that the Southeast Asian region itself boasts a multitude of evidence-based trade interactions, including trade artifacts and architectural monuments that serve as markers of the trade process (Zhang, 2016). These are the basic components that symbolize the occurrence of technological, political, cultural, and social developments of early societies in the rapidly developing region as a result of the interactions that took place.

Studies conducted in the context of the ancient Kedah Kingdom from the 1840s (Low, 1848, 1849) to the present (Saidin, 2016, 2022, 2023, 2024) have found many important data points, including evidence of industry (Mohd Mokhtar, 2019; Saidin, 2016, 2022, 2023), trade (Abd Halim, 2019; Saidin, 2016, 2022, 2023), religion (Low, 1848, 1849; Hassan, 2018; Adam, 2021), and the sculpture (Rodziadi Khaw, Saidin, & Ramli, 2018). These findings suggest that the development of these kingdoms was a consequence of the social interactions that resulted from the trading activities that took place between the early kingdoms of the early civilizations of the world. All conducted studies, particularly on the ancient Kedah Kingdom, have yielded positive results. This

allows for extensive exposure and interpretation, ultimately identifying the local wisdom that the ancient Kedah used to strengthen their kingdom's economy.

Even the advancement of technology in research today, has enabled various disciplines, including science, geology, chronometric dating (OSL and radiocarbon), architecture, and history (Abd Halim, 2019), to take advantage of data and evidence from ancient Kedah archaeological sites. This will improve our understanding of the history of the ancient Kedah Kingdom. So the result of the combination of various disciplines has enabled important data on 1) geological and biological specialities (Abd Halim, Talib, Masnan, & Saidin, in press), 2) raw material resources (Abd Halim et al., 2023; Abd Halim, Talib, Jusoh, Masnan, & Saidin, 2024), 3) urbanization or land use processes (Abd Halim, et al., 2024), 4) industrial development (Mohd Mokhtar, 2019), 5) trade processes (Abd Halim, 2019), and 6) development of beliefs and religious systems (Wales, 1940; Allen, 1988; Hassan, 2018) to be recorded in a complete and accurate manner.

Therefore, this manuscript presents the results of academic studies that demonstrate the existence of the ancient Kedah Kingdom, supported by evidence from industry and trade. The Southeast Asian region also records evidence of the iron industry (Pryce, 2014; Petchey, Bellina, Pryce, & Innanchai, 2018; Hartatik, Surnarningsih, Fajari, & Sofian, 2023; Singtuen, Phajuy, Pongsaisri, & Pailopleee, 2024), but it does not record the discovery of jetty, port management, ritual, and Buddhist monument structures within the same area.

Since 2009, the research at Sungai Batu Archaeological Complex (SBAC) has facilitated the presentation of the unique location of the ancient Kedah Kingdom, the presence of iron smelting site, monuments and artefacts, and the written records pertaining to ancient Kedah. For ancient Kedah, studies at the Sungai Mas and Pengkalan Bujang sites also provide locations and industrial areas for bead and pottery making (Ramli et al., 2014; Ayob, 2017; Abu Bakar & Ramli, 2018; Ramli, 2020) based on the discovery of glass waste and the scientific analysis of brick materials in the area. This demonstrates that the port area of ancient Kedah boasts a variety of industries that can bolster the economy of the ancient Kedah Kingdom, thanks to the diverse range of commodities available for trade.

Academic studies also record Vimana-Mandapa monuments (Hindu) and Buddhist monuments and sculptures (Wales, 1940; Allen, 1988), which bear resemblance to temple architecture in South India, albeit on a smaller scale (Zainun & Rodziadi Khaw, 2017). This is in line with Wales's, Q.H.G., (1951), which states that the Malay Peninsula, Sumatra, Ceylon, and Myammar are considered areas of Indian settlement, which also serves as a center for the spread of Indian culture, especially in Southeast Asia.

ANCIENT KEDAH KINGDOM

Results of Low (1848, 1849), Irby (1905a, 1905b), Evans (1922, 1926, 1927, 1930, 1931), Sullivan (1958), Peacock (1958, 1974, 1980a,b), Lamb (1962, 1980a, 1980b, 1980c, 1980d), Leong (1973), Allen (1985, 1988), Nik Abd Rahman(1984), Nik Abd Rahman, Ramli, Z. and Sabtu, M. S. (2008), Taha (1983), Zakaria (1989) and Saidin, J. Abdullah, Osman, and Abdullah (2011) allow the definition of the location of the ancient Kedah civilization over 1,000 km², covering the boundaries of Bukit Choras in the north, Sungai Muda in the south, The Straits of Malacca in the west, and Jeniang-Sik in the east (Figure 1).

Archaeological studies conducted from the 1840s by Low (1848) to the present day (Saidin, 2022, 2023, 2024) suggest that the ancient Kedah Kingdom existed from the 6th century BC until 17th century AD and played a significant role in trading activities, as evidenced by the discovery of iron smelting, bead and pottery workshops, ports, and port management. The development of the ancient Kedah Kingdom as a trading location was facilitated by the presence of Mount Jerai as a landmark, Sungai Merbok and Sungai Muda, and their tributary branches, which enabled traders to sail and reach the port area of ancient Kedah (Abd Halim et al., in press). Outside traders' visits to this trading area have sparked religious development, as evidenced by the presence of Hindu and Buddhist monuments (Adam, 2021).

Moreover, the ancient Kedah Kingdom has been referred to by a variety of names, including Chieh-cha, Hsieh-Ch'a, Ka-cha (China), Qaqullah, Kalai, Kalahi, Kalah (Arabic), Kalagam, Kidaram, Kataram, or Kadaram (India), Kala, Gedda (Persia), Queda, Kheddah (Europe), Kede, and Jere (Java), signifying port city or black ore "iron" (Abd Halim et al., 2023). This clearly shows that the ancient Kedah was an iron trade-oriented kingdom, with evidence of iron smelting workshops on a large scale found in SBAC (Mohd Mokhtar, 2019).

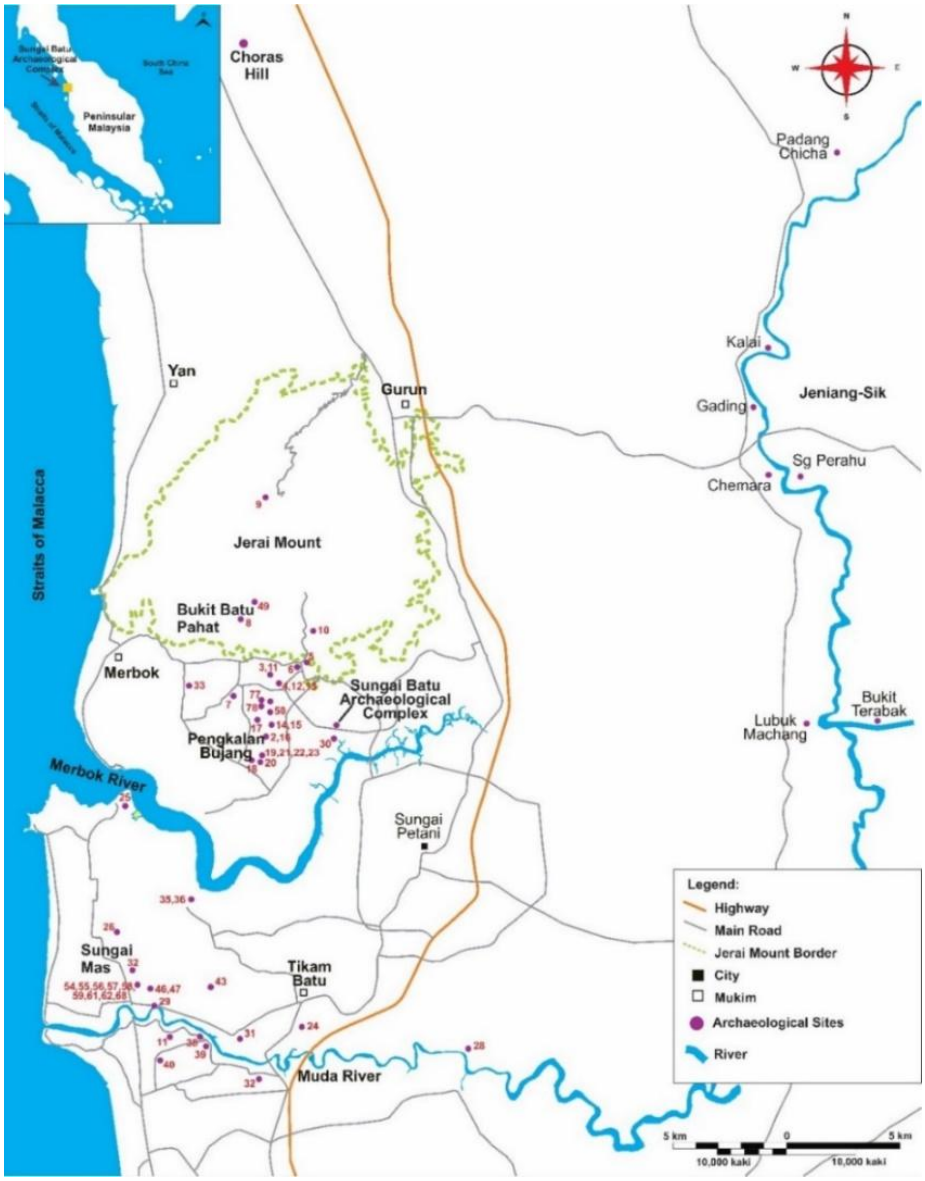

Figure 1. The location of the ancient Kedah Kingdom revealed archaeological sites scattered in an area of about 1,000 km² (Source: authors)

METHODOLOGY

Below is a general description of the methodology followed to address this approach:

This study employs a data collection method from archaeological studies of ancient Kedah, dating back to the 1840s, to analyze and interpret the recorded data. This means that archaeological studies by Low (1848, 1849) until 2024 (Saidin, 2024) are formulated to enable information related to technology, architecture, industry, religion, and trade to be recorded. In fact, researchers conducted academic studies on ancient Kedah through survey and mapping activities (Abd Halim et al., in press) and excavations (Abd Halim, M.H., 2024a; Mohd Mokhtar, 2019) to gather information about the unique features of ancient Kedah. The compilation of the data recorded ancient Kedah environment privileges, thereby catalyzing its development as the maritime kingdom of Southeast Asia.

In addition, early written and trade records related to the ancient Kedah Kingdom were also carefully collected and interpreted to corroborate the data obtained from the excavations of ancient Kedah. Therefore, this research enables a thorough determination of the ancient Kedah Kingdom's narrative through archaeological approaches, highlighting its significance in the early trading activities of Southeast Asia.

The Concept

Despite the initiation of archaeological studies at SBAC in 2009, scholars have been studying the historiography of ancient Kedah since 1800, following the recording of the Cherok Tokkun inscription in Penang (Figure 2) (Low, 1848, 1849; Allen, 1985). Subsequently, researchers began to conduct archaeological studies, as

documented by Wales (1940), Sullivan (1958), Evans (1922, 1926, 1927), Peacock (1958, 1974), Lamb (1962, 1980a, 1980b), Leong (1973), Mohd Yatim (1978), Shuhaimi (1984), Abd Halim et al. (2024b), and Saidin (2024). The results clearly show that the ancient Kedah Kingdom has existed and conducted industrial and trade activities. Therefore, studies conducted at SBAC have determined the origin of the development of technology, industry, and culture in ancient Kedah, particularly in the Southeast Asian region.

Therefore, the conducted research should bolster the existing data. Although scholars may have different perspectives on the definition of civilization, according to Sulaiman (2016), civilization can be defined as a complex society that includes 1) settlements, 2) urban development and planning, 3) an organized agricultural system, 4) a clear writing system, and 5) the existence of a political order system capable of regulating society. 6) Specific activities, such as the division of labor, 7) a culture, 8) advanced or better technology, and 9) the presence of complex institutions, constitute civilization.

However, early civilizations did not necessarily have to develop all the features at the same time. Studies carried out by the Inca civilization, for example, found that it did not develop a writing system at an early stage, but it did carry out intensive cultivation activities. This indicates that an empire deserves to be considered a civilization if it meets any of the above characteristics (Sulaiman, 2016) such as settlements, town planning, agriculture, writing, politics, division of labor, culture, technology, and complex institutions.

Research on ancient Kedah's archaeology has so far demonstrated that this kingdom has attained the status of a civilized kingdom. This is because special archaeological studies in SBAC since 2009 have found iron smelting workshops that marked the economic activities of ancient Kedah at that time. The findings generally corroborate various data from navigation and trade records, which indicate that the ancient Kedah Kingdom engaged in iron ingot trading activities with global civilization (Hoyland & Gilmour, 2006; I-Tsing, 1886; Thilakavathy, 2019). Additionally, the discovery of the jetty structure, port management and Hindu-Buddha temples established a benchmark for the existence of various groups and systems of government in the port area of ancient Kedah. This is because the architectural evidence makes it possible to record as much information as possible about ancient Kedah construction, including details about its function, technology, and raw materials.

Ancient Kedah art is also recorded through the discovery of inscriptions and gold plates that reveal the establishment of Buddhist in SBAC after animism practices. In addition to the SBAC, researchers have also discovered stone inscriptions on Choras Hill (Dishong, 2022) and Sungai Mas (Rodziadi Khaw, Nik Abd Rahman, & Zainun, 2011), symbolizing the religious development of the ancient Kedah community following animism. Archaeological sites in ancient Kedah also record similar evidence, including the discovery of Vimana-Mandapa structures, Buddha (Wales, 1940; Allen, 1988), trade artifacts like ceramics, beads, and glass (Leong, 1973), and religious sculpture (Rodziadi Khaw et al., 2018) (Figure 3).

Figure 2. The discovery of the Cherok Tokun inscription has been the beginning of the study of the history of ancient Kedah since the 1,800s [Source: Murphy (2017)]

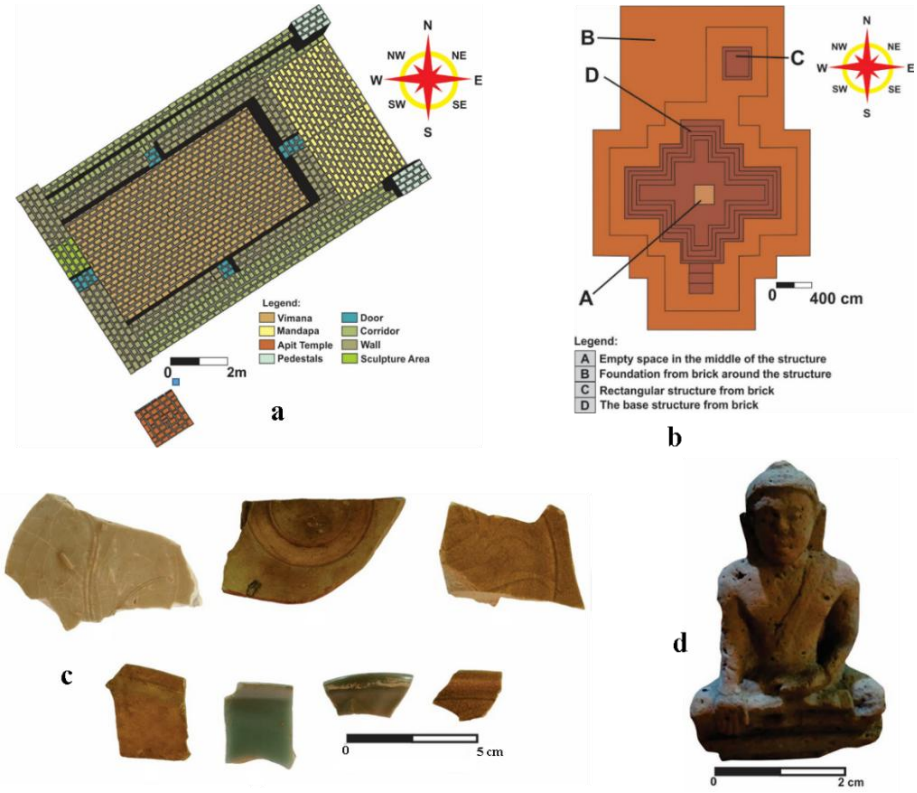

Figure 3. Archaeological evidence of ancient Kedah was identified with the discovery of Hindu (a), Buddha (b) monuments, trade artifacts (c), and sculpture (d) (Source: Authors)

The findings illustrate the evolution of the ancient Kedah community's art form, which learned manufacturing technology from outside traders. This is because the evidence of world civilization lasted earlier than ancient Kedah, which dates back to 8,000 in Mesopotamia (Butt, Pakeeza, & Farhat, 2023), 6,000 in the Indus civilization (Frenez, 2023) and 5,000 in China (Major & Cook, 2017), allowing the technology to be disseminated through trade activities. Furthermore, trade interactions between East and West civilizations (Rowlands & Fuller, 2018) have facilitated the widespread dissemination of this technology. The discovery of Chinese ceramics (Zhang, 2016), Indopacific beads from India (Xu, Wang, Han, & Yang, 2022), and glass from the Middle East (Henderson, Ma, & Evans, 2020) in the Southeast Asian region itself reinforces evidence of such trade interactions.

The study at ancient Kedah on SBAC sites also involved the analysis of raw materials for bricks, roof tiles, tuyere, and furnaces, which were used for the construction of monuments, as well as furnaces and tuyere for the iron smelting industry. Studies by Abd Halim (2014, 2019), Ramli, Nik Abd Rahman, Jusoh, Sauman, and Razman (2013), Zakaria (2014), Aminuddin (2015), Abdullah, Jusoh, Ramli, and Saidin(2018), Mohd Mokhtar (2019), and Mohd Rapi, Jusoh, and Saidin, (2020) have demonstrated that the SBAC river itself provided the raw materials for bricks, roof tiles, tuyere, and furnaces. This is due to the SBAC environment's high abundance of alluvium, which has been influenced by the evolution of sea level tides and precipitation since the Late Holocene (C. A. Ali, Mohamad, & Talib, 2019). The SBAC community subsequently transformed this alluvium into a material that facilitated the trade process in this region (Abd Halim, Talib et al., 2024). Analysis of iron ore and iron ingots in SBAC (Abd Halim et al., 2023) also showed that the raw material was obtained from a distance of between 1-11 km from this complex and has revealed evidence of smelting by the ancient Kedah community. Iron smelting sites around the world have also recorded similar evidence (Singtuen et al., 2024), in other words, the iron smelting workshop obtains the raw material in close proximity. The interpretation of Panagiotidis et al. (2024), which asserts that there is evidence of the community processing iron ore into iron ingots based on scientific analysis, supported this suggestion. This clearly demonstrates the community's high level of technological progress, as evidenced by the production of iron tools (Jung & Cho, 2022; Alemayehu Tegegn, D., 2024), which have the potential to develop a kingdom's economic system.

In addition to SBAC, Sites 17 (Bukit Pendiat Temple), 16, 18, 19, 21, 22, and 23 (Pengkalan Bujang Temple) (Figure 4) have also documented the use of local materials, primarily sourcing raw materials from the Bujang River area for brick making (Ramli, Nik Abd Rahman, Samian, Noor, & Yarmo, 2011; Nik Abd Rahman, Jusoh, & Sabin, 2012; Ramli, Z., Nik Abd Rahman, Samian et al., 2013; Ramli, Nik Abd Rahman, Jusoh, & Sauman, 2013; Ramli, Nik Abd Rahman, Samian et al., 2014). Sites 32/34 (Sungai Mas Temple) (Ramli, Nik Abd Rahman, Jusoh,

& Hussein, 2012) and the Kampung Baru Temple site (Ramli et al., 2018) also uncovered similar evidence, demonstrating that Sungai Muda served as the primary location for clay extraction for brick making. Meanwhile, Site 1 (Bukit Choras Temple) sourced its raw materials from the Choras Hill area (Dishong, 2022). This demonstrates that the ancient Kedah community typically relied on geological elements to procure easily accessible raw materials near the temple's construction site, with the aim of manufacturing bricks and building monument structures.

In terms of construction technology development in ancient Kedah, only the SBAC study until 2024 has been able to reveal evidence of jetty and port management architecture. Previous studies at ancient Kedah port sites such as Sungai Mas (Bakar, N.A. & Ramli, Z., 2018), Simpor Tambang, Kampung Sireh (Rodziadi Khaw et al., 2011), Permatang Pasir (Hasni, Ramli, & Ali, 2015), and Pengkalan Bujang (Leong, 1973) only revealed trade artefacts without classifying the appearance of the port architecture. A study of the ancient Kedah site additionally revealed the Vimana-Mandapa structure, Buddhist temple and sculpture (Wales, 1940). Therefore, the findings of the iron smelting workshops, the river jetty, port management, rituals, and Buddhist monuments structure at SBAC have bolstered previous studies on ancient Kedah's involvement in trade and industrial activities. Evidence at SBAC has also been found to have strengthened archaeological data at archaeological sites other than those of the ancient Kedah Kingdom, which also recorded findings of trade artifacts, Hindu-Buddhist monument structures, and religious sculptures.

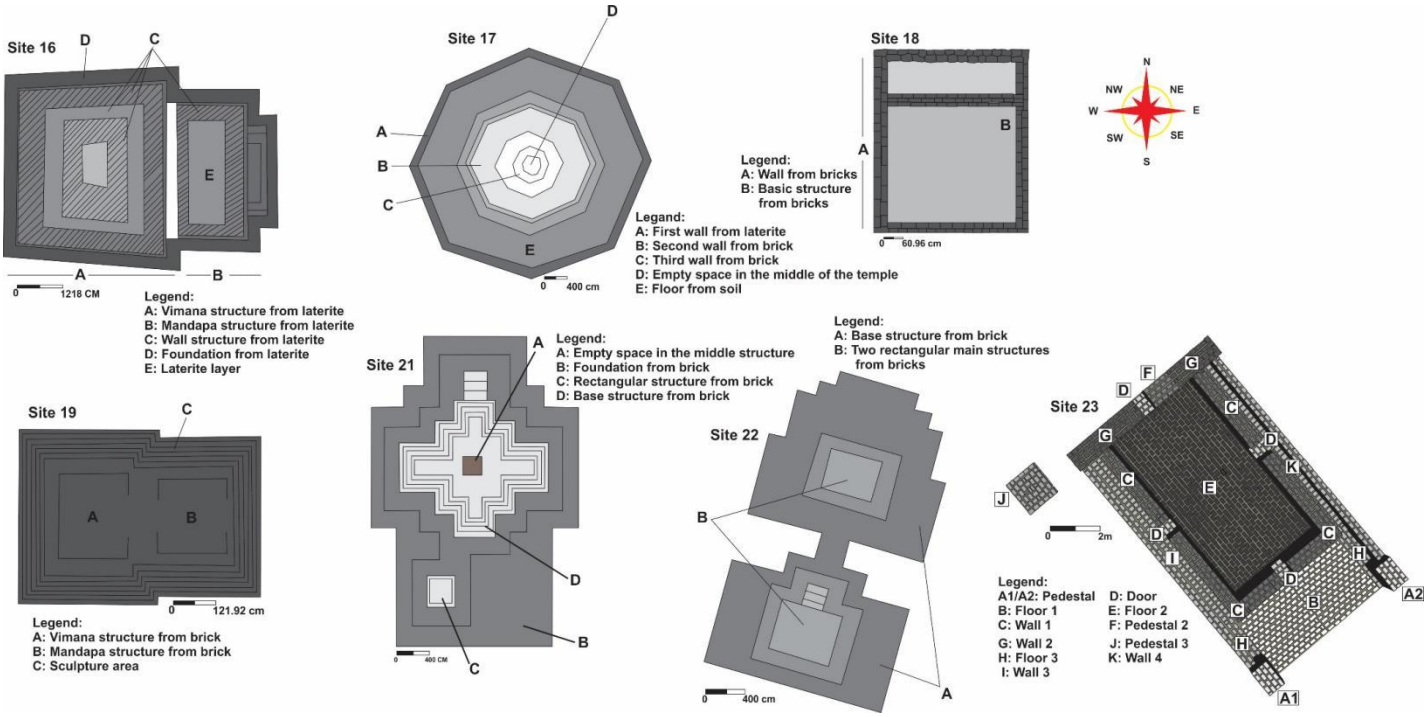

Figure 4. Archaeological studies have recorded the ancient temple architecture of Kedah [Source: the authors based on data from Adam (2021)]

The archaeological evidence, which includes trade artifacts, Hindu-Buddhist monuments, and religious sculpture, supports Wales's (1940) assertion that this kingdom was a significant hub for global trade. The strategic location of the ancient Kedah Kingdom in the middle of the world trade route, which connects the Bay of Bengal, the Strait of Malacca, and the South China Sea, has led to its development as one of the major trade centers in Southeast Asia (Hall, 2004; Evers & Gerke, 2006). In fact, Lamb (1961) stated that the location of ancient Kedah, situated on the coast and river valleys, enables its people to engage in rice planting activities (Mohamad, 2014) and forest product collection, thereby bolstering its economic system.

The studies of Bopearachchi, Disanayaka, and Perera (2011), Seland (2014), Zhang (2016), Cobb (2018), and Lischi et al. (2020) around the Indian Ocean further reinforce this, recording findings of trade artifacts that prove the existence of trade transactions between the world's early civilizations. Indeed, research on ancient ports (Abd Halim, 2019) and shipwreck (Carlson & Trethewey, 2013; Manguin, 2020) locations reinforces the understanding of sea routes as trade routes linking East and West. Ancient Kedah location in the middle of the world's major trade routes makes it an ideal trading area. Additionally, the suitability of paleoenvironment (Abd Halim et al., in press) has significantly contributed to ancient Kedah's ability to supply products for trade when foreign traders visit its ports.

Geological features in this area date back to 220 million years ago, following the occurrence of magma intrusion (C. A. Ali et al., 2019), which resulted in the abundance of iron ore (hematite, magnetite, and biotite) around Mount Jerai. This allowed the ancient Kedah community to mine, melt iron ore, shape it into ingots, and export it to outside civilizations. Its efficient management system, aided by the deep river flow along the Sungai Batu-Sungai Muda up to the coast of the South China Sea, also became the heart of the development of the ancient Kedah Kingdom iron-smelting-based economic system. This facilitates the transportation system for trade materials collected in the interior.

The study's results clearly demonstrate that the ancient Kedah Kingdom prioritized trade activities in developing its economic system, which aligns with its characteristics as a civilized kingdom. This kingdom underwent technological evolution and development, facilitated by the transfer of knowledge through social interactions during trade activities. Although studies at SBAC revealed that its economy was more focused on the iron industry, the kingdom also focused on bead and pottery (Ramli, Nik Abd Rahman, Hasan et al., 2014; Ramli, 2020) making in the Sungai Mas and Pengkalan Bujang port areas. Therefore, the ancient Kedah Kingdom's concept of forming its kingdom based on trade has influenced every artifact and architectural discovery, ultimately allowing for the detailed recording of location and contact routes.

RESULTS

Ancient Kedah Recorded Evidence

The study of the ancient Kedah Kingdom can be divided into two main parts: written and archaeological evidence. The written record, such as Kathasaritsagara, Kaumudimahotsava, Tamil literature, Chola inscriptions, and Chinese and Arabic sources, narrates the role of ancient Kedah in meeting the economic demands of external traders who traded in this area (Rodziadi Khaw, 2011). The archaeological record compiles a series of studies conducted on identifiable remnants of ancient Kedah, including monuments, sculptures, and trade artifacts.

Writing/Trade Records

The largest sources that record the description of the ancient Kedah Kingdom, either in the form of inscriptions or literary works, are Indian sources such as Tamil poetry, Sanskrit, and Chola inscriptions (Rodziadi Khaw, 2011). The record has detailed the natural beauty and richness of the locations visited, particularly the port cities and export commodities.

Indian Source

The sources of the Vayu Purana, the Ramayana, and the Sulawesi Buddhist statues are among the evidence of trade interactions between the Malay Archipelago and the Indian subcontinent. The Vayu Purana's evidence establishes this relationship, dating back to the 5th century BC. These records identified the Malay Peninsula's location through the names Yavadvipa, Yamadvipa, Jambudvipa, and Malayadvipa, providing insights into its landforms, biology, and export commodities. The Ramayana records (4th –3rd century BC) also mention Yavadvipa (Sumatra island, Java), which also reveals the existence of trade relations between the two areas (Rodziadi Khaw, 2011).

Tamil Poetry

The Sangam Period's Tamil poetry, which includes the Pattinappalai and Silappadikaram poems has documented the trade activities between the ancient Kedah Kingdom and South India. These records clearly reinforce the existence of trade lines between civilizations in Southeast Asia and South Asia (Wheatley, 1961).

Tamil poetry, such as Pattinappalai, also mentions that Kazhagam has the same meaning as Kadaram, which refers to ancient Kedah (Taha, 1991). Parunkathai also mentions the origin of iron from ancient Kedah, which served as the raw material for the construction of Princess Vacavathaththai's chariot (Rodziadi Khaw, 2011).

Sanskrit Literature

Sanskrit sources like Kathasaritsagara and Kaumudimahotsava are not only authentic historical sources but also works of historical literature. It represents the perception and outlook of Indian traders in ancient Kedah. Kathasaritsagara has noted that the ancient Kedah Kingdom had an important port called Kataha Dvipa. Kaumudimahotsava, a Sanskrit drama from the 8th century AD, refers to ancient Kedah as Katahanagara (Wheatley, 1961). The Puranic writings and Prakrit literature refer to ancient Kedah as Kadahadipa, a seaport with a trade relationship with the port of Tamralipti.

Arabic Source

Evidence of the existence of the ancient Kedah Kingdom is also known through Arabic sources such as the Akhbar Al-Sin W'al Hind. Arabic sources record several ports, including Zabaj, Qaqullah, Tiyumah, Fansur, Mul Jawa, Langabalus, and Kalah Bar. As for the Kalah-Bar itself, all its inhabitants, whether nobles or commoners,

wore futahs or sarongs as cloth, and they received water from wells (Tibbetts, 1979; Allen, 1988). Abu Dulaf notes that Kalah is the only coastal port in the Straits of Malacca with walls, beautiful gardens, and iron and tin mines (Tibbetts, 1979).

According to Aja'ib Al-Hind, the journey from Kalah to Shihr Luban in Western Asia took 41 days. The records of Sinbadh's voyage explain that Kalah (ancient Kedah) borders India, a country known for exporting commodities like camphor, tin, and bamboo (Dunn, 1975). Al-Idrisi (12th century AD) also noted that Kalah was the location of a large port that produced rattan, tin, and camphor (Tibbetts, 1979). Kalah produces high-quality tin or iron, which it exports to other outside civilizations (Tibbetts, 1979).

The writing likely refers to the iron commodity in ancient Kedah. Ancient Kedah played a significant role in exporting iron products, as evidenced by the exchange of two-finger-sized iron products from Chieh-Cha or Kha-Ca (ancient Kedah) for five to ten coconuts in the Nicobar Islands (I-Tsing, 1896). Even Al Kindi and Al Biruni records refer to Kalah as a center of the world's best iron exporters, along with Yamen and Hindi (Hoyland & Gilmour, 2006), which is also proof of this.

Inscription Source

Therefore, evidence from the inscription is also needed to strengthen the data from the writing record. This is because the inscription sources document the political legitimacy of the ancient Kedah, highlighting its significant role in the Indian kingdom. Therefore, the discovery of the large and small tablets, Leiden bronze, and Tanjore inscriptions directly links to the ancient Kedah.

Rajaraja I issued the Leiden tablet inscription (Nilakantha, 1949) as an official document, symbolizing the close relationship between the Chola empires and the port of ancient Kedah, founded on the construction of a Buddhist temple. The Tanjore inscription also tells of Rajendra Chola's military expedition that attacked the Malay Archipelago. The Tanjore inscription states that Rajendra Chola attacked and captured Raja Kadaram (ancient Kedah). King of Kadaram actually refers to the King of Suvarnabhumi. The Small Leiden tablet documents King Kadaram's request to extend the land grant for the Culamanivarmavihara temple and to secure a village for temple construction (Nilakantha, 1949). This demonstrates that there was contact between the Indian and ancient Kedah Kingdoms before the 1st century AD.

Archaeological Records

Since the 1800s, archaeological studies have recorded several archaeological sites in an area of about 1,000 km² (Saidin, 2024). Despite the archaeological record revealing nearly 190 sites, only five retain evidence of monument architecture, making them accessible for study and visitation until 2024. The locations are: i) 97 sites in SBAC; ii) six sites in Jeniang-Sik Archaeological Complex; iii) three sites in Pengkalan Bujang archaeological complex; iv) four sites in Bukit Batu Pahat archaeological complex; and v) one site in Bukit Choras (Dishong, 2022; M. A. Ali, Abd Halim, Masnan, Saidin, & Narayanen, 2023).

Archaeological excavations dating back to 1800 clearly show that as many as 21 sites served as Hindu temples, five as Buddhist temples, and one as a temple or palace monument. However, the ruins of these 45 sites leave their status uncertain. The archaeological research of ancient Kedah also recorded a total of 11 jettys, 17 port management, one complex for ritual and Buddhist monuments, and 17 iron smelting workshops. Archaeological research at ancient Kedah also documented 18 sites, all of which contained trade artifacts such as Chinese ceramics, beads, glass, and pottery, indicating their importance as a trading area. In fact, ancient Kedah research documented the structure of the largest Hindu temple at Site 8 (Bukit Batu Pahat) and the largest Buddhist temple at Site 1 (Bukit Choras). Therefore, the conducted archaeological studies record detailed information on technology, dating, architecture, raw materials, and evidence of ancient Kedah Kingdom trade.

Based on archaeological research, ancient Kedah Kingdom civilization, as a whole, started as early as the 6th century BC and focused on the iron-smelting industry (Abd Halim, Mokhtar et al., 2024). To date, the results of archaeological studies at SBAC, which document iron smelting workshops, jetties, port management, rituals, and Buddhist monuments (Figure 5), are the only ones globally to reveal such evidence. This is because archaeological studies at the international level until now have not revealed areas that have evidence of the iron smelting industry and also have a jetty, port management, rituals, and Buddhist monuments in the same area.

The location of the site is also close to the river flow system, which is the main source of trade relations. This allows classification of the construction technology according to the size and orientation of the monument, which corresponds to the construction specifications of Manasara-Silpasastra (Kramrisch, 1976). The raw materials used in the construction of the temple, whether brick, river stone, laterite, or granite blocks, were in line with the foundation of the monument. This shows that the ancient Kedah people already had geological knowledge, which they used for the construction of temples in this area.

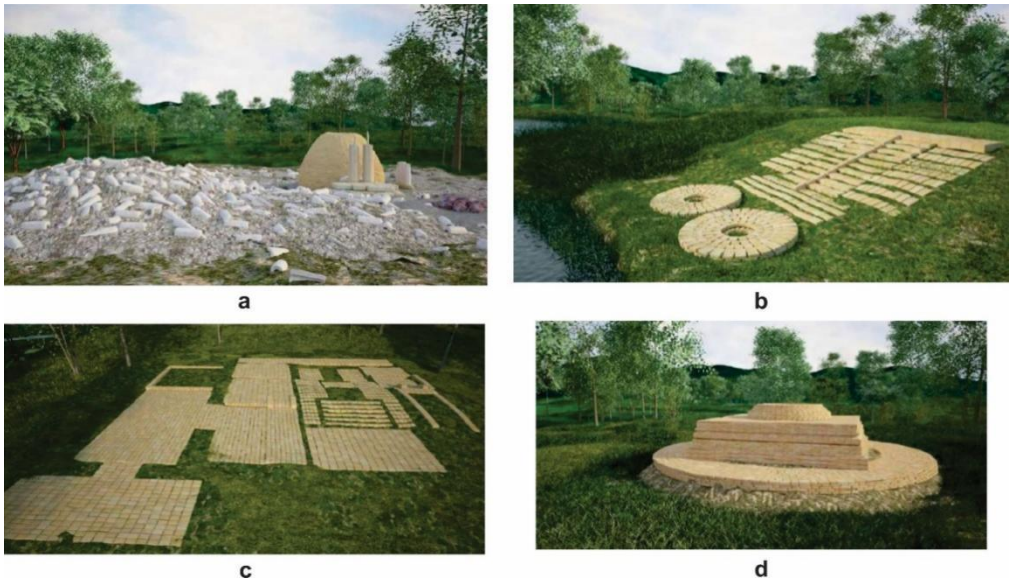

Figure 5. Archaeological evidence of ancient Kedah at SBAC records an iron smelting workshop (a), river jetty (b), port management (c), a ritual, and a Buddhist monument (d) (Source: authors)

Even in the vicinity of SBAC, the abundance of iron ore, the mangroves surrounding the Sungai Merbok, and the use of clay (alluvium) all contribute to the area's uniqueness as an industrial center. This is because the iron ore has been used as the main material in iron smelting activities in SBAC (Mohd Mokhtar, 2019), while mangrove trees, especially from corky stilt mangrove (Rhizophora apiculate blume) species, have been used as fuel in iron smelting activities in SBAC (Mohd Mokhtar, 2019; M. A. Ali, Abd Halim, Masnan, & Saidin, 2021), and clay has been used as the main raw material for the construction of monuments, roof tiles, furnaces, and tuyere (Abd Halim, 2019), which develop the urbanization process and trade economy in SBAC.

The construction technology also uses raw materials that are around the temple (Ramli, Nik Abd Rahman, Jusoh, & Sauman, 2012). For example, due to the environment of Site 1, Choras Hill revealed laterite geology (Dishong, 2022), so it has been used as the raw material of the temple on the site. Similarly, at Site 8, Bukit Batu Pahat geology is granite, while Pengkalan Bujang, Sungai Mas, and the SBAC geology are clay, so it has been used as the main raw material for temple construction in the area. Brick building technology has also used clay mixed with paddy husk, dried, and baked at a temperature of 550°C to 900°C (Abd Halim, 2019), while roof tiles, tuyeres, and furnaces are burned to a temperature up to 1,200°C based on the presence of cristobalite and mullite minerals (Abd Halim, 2019; Mohd Mokhtar, 2019).

Furthermore, the local wisdom regarding the construction technology of ancient Kedah temples indicates that the community adapted it to suit their local architecture. This is because most ancient Kedah temples are recorded to have pillar and door sill cladding structures (Figure 6 and Figure 7) (Wales, 1940; Ramli, Nik Abd Rahman, Jusoh, Sauman et al., 2013), which are synonymous with local architecture. In addition, the finding of roof tiles (Figure 8) in SBAC also reinforces the interpretation of the application of roof structures at the monument site for the ancient Kedah Kingdom itself (Abd Halim, 2019). The roof tiles are made of clay, baked in a furnace at temperatures as high as 1,400°C, and shaped either zigzag or wave (Abd Halim, & Saidin, 2022).

This is due to the absence of records of Indian temples using pillar bases to support their roof structures. This is due to the construction of Hindu temple structures in India, which use blocks of stones to span from the monument to the roof. Proof of this manner is seen in the temple architecture of Parsurameswara (Meister, 1985) and Konark (Chatrath, 2019) in India, Prambanan (Pratomo & Herwindo, 2018) in Indonesia, Angkor Wat (Bhagentsang et al., 2021) in Cambodia, Phnom Wan (Freeman, 1998) in Thailand, and My Son (Binda, Condoleo, Cuarzi, Le, & Hoang, 2006) in Vietnam, whose buildings essentially use blocks of stones arranged so that they peak upwards into a roof structure. The architecture of the Parsurameswara temple (Meister, 1985) and Konark (Chatrath, 2019) in India, Prambanan (Pratomo & Herwindo, 2018) in Indonesia, Angkor Wat (Bhagentsang, et al., 2021) in Cambodia, Phnom Wan (Freeman, 1998) in Thailand, and My Son (Binda et al., 2006) in Vietnam clearly demonstrate the differences in architecture between these temples and those in Kedah. This demonstrates the local wisdom of the ancient Kedah communities, who adapt foreign technology to the local architecture they learn through trade activities.

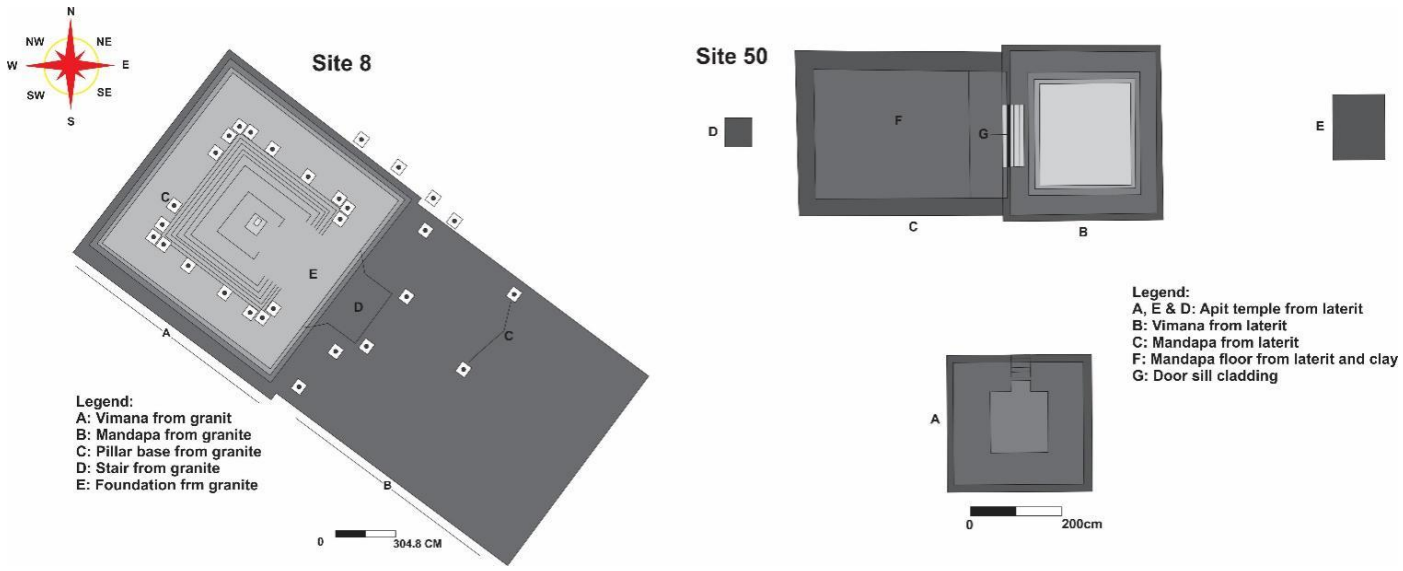

Figure 6. The architecture of sites 8 and 50, which reveal the structure of the pillar cladding and door sill cladding, suggests that it represents the local architecture of the ancient Kedah community [Source: the authors based on data from Wales (1940)]

Figure 7. The pillar base (a) and door sill cladding structures (b) at the ancient Kedah temple site demonstrate the influence of local architecture during the temple's construction (Source: authors)

Figure 8. The discovery of roof tiles indicates that the ancient Kedah Kingdom utilized local construction technology during the construction of the temple in this area (Source: authors)

Studies conducted by Lamb (1961), Hergoualc'h (1992) and Degroot (2014) on the architecture of temples Si Topayan in Padang Lawas, Indonesia, have demonstrated the use of pillar bases, suggesting the possibility of roofed architecture in some of these temples. This is because the Degroot (2014) study, which documents the architectural structure of the Padang Lawas area and arranges rock blocks to form the temple's top, has demonstrated that not all temples in the Padang Lawas area feature a roofed structure (Figure 9a). Yet a study by

Bonazt, Neidel, and Widiatmoko (2009) at the temple site in Muaro Jambi (Figure 9b) (Marhaeni, 2010), Muara Takus Complex (Figure 9c) has shown almost the same architecture as the ancient Kedah temple, which has an open space on each side. Archaeological studies conducted in Kota Kapur for the Srivijaya Kingdom also revealed the same architecture as Muara Jambi, Si Topayan, and ancient Kedah temples (Figure 10). The most important point of the study at the site is the discovery of temple bricks carved with monument architecture, as well as pillars and roof structures (Figure 11). This suggests that there are architectural similarities between the ancient Kedah temple and the Muaro Jambi and Kota Kapur temple of the Srivijaya Kingdom, which represent the maritime kingdom architecture of the Southeast Asian region during that period.

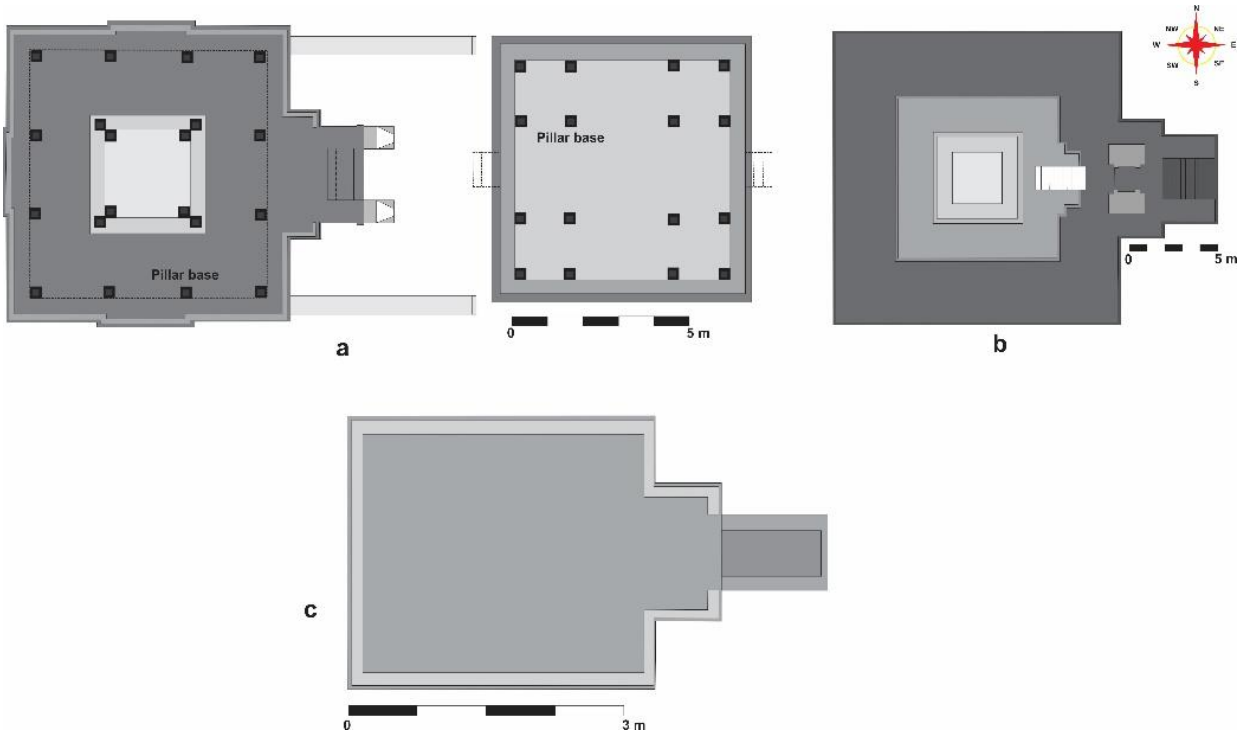

Figure 9. The architecture of the Si Topayan temple in Padang Lawas (a), Tinggi temple in Muara Jambi (b), and Palangka temple in Muara Takus (c) reveals the architecture of the pillar base, which shares architectural similarities with the ancient Kedah temple [Source: Degroot (2014); Siswanto and Ardiansyah (2020)]

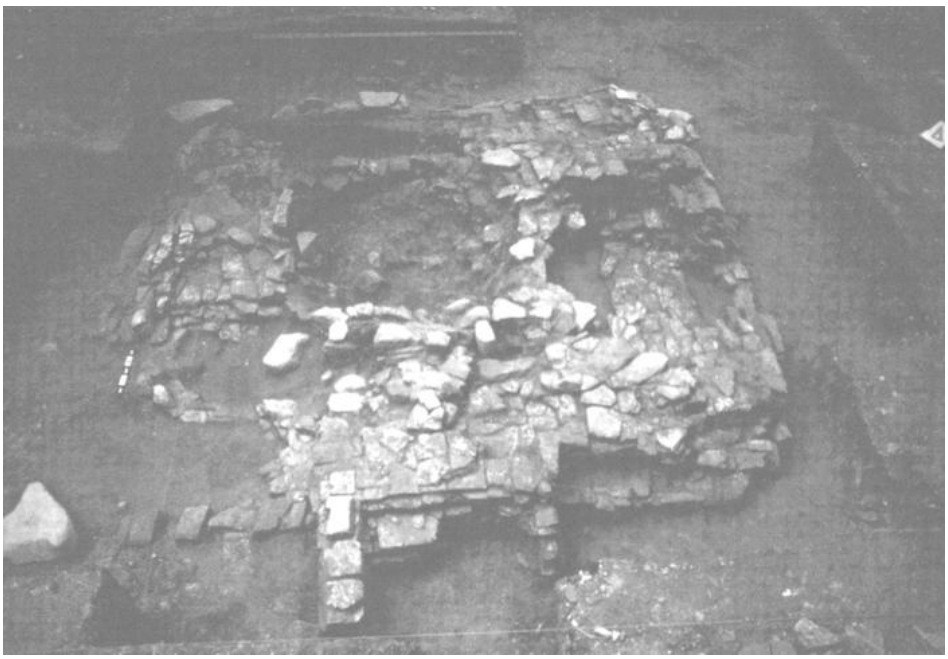

Figure 10. Ancient Kedah and the Kota Kapur temple, both built with open spaces on each side of the monument, share architectural similarities [Source: Dalsheimer and Manguin (1998)]

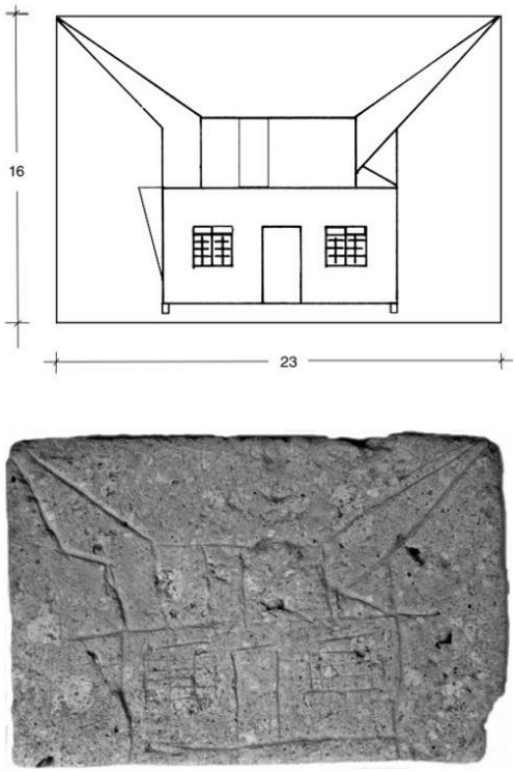

Figure 11. Sketch of the Muaro Jambi temple with pillars and a roof on the brick [Source: Bonazt et al. (2009)]

CONCLUSION

A compilation of studies from 1840 to 2024 on the ancient Kedah Kingdom has shown the ancient Kedah Kingdom to have begun as early as the 6th century BC. In addition to producing beads and pottery, the kingdom played an important role as an iron ingot exporter. Despite the abundance of natural resources such as iron ore and clay (geology), as well as mangroves and forest products (biology), the ancient Kedah area played a significant role in its development as a maritime kingdom in Southeast Asia. This study has also contributed to the understanding that the ancient Kedah community had knowledge in the field of geology, which allowed them to engage in trading activities. This trade interaction facilitated the acquisition and mastery of iron smelting technology and architecture, which in turn enabled ancient Kedah to construct port management jetty structures and temples. The Archaeological Survey's data formulation has made ancient Kedah the only place in the world to reveal evidence of an iron smelting industry and trade area spanning 1,000 km^2.

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