



Loose change? Evaluating the roles of Chinese coins in the Angkorian Khmer Empire

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Abstract

Interactions with China and India played an important part in the development of the Angkorian Khmer Empire. Recent discovery of several Chinese coins at the regional centre of Preah Khan of Kompong Svay provides an opportunity to see how these objects were used in Angkor's moneyless economy. The broader distribution and function of Chinese coins in Southeast Asia is evaluated before examining why so few examples have been discovered in Cambodia. It is argued that coins served a plurality of functions ranging from deposit, cash, ingot, cure, and curio in the Angkorian world.

Keywords Angkor · China · Coins · Materiality · Preah Khan of Kompong Svay

1 Influences on Angkor: East and West

Angkor's rise and success in early historic mainland Southeast Asia was linked to the Khmers ability to integrate influences from powerful neighbouring polities based in India and China. From the west, local leaders adopted Brahmanical and Buddhist religious ideologies and socio-political codes rooted in the Arthasāstra to restructure their society beginning in the mid first millennium CE. Indic ideals were

applied as a veneer overtop of existing chthonic cults that enabled incorporation of larger territories of Pre-Angkorian and Angkorian kingdoms. Polities in India had little investment in the developments within Cambodia. Contact from the east was more direct, consistent, and markedly economic in nature. Han influence first appeared at the start of the first millennium, increased through the Angkor period (9th to 15th c.) and continues to the present day (see summary in Stark and Cremin 2023). While cultures in northern Vietnam in the first century AD were being incorporated under Sinitic influence (see Kim et al. 2010), China ultimately left little overt influence on the bureaucratic structure of Khmer civilisation. Smith (1999) intriguingly posited that Indic politico-religious mechanisms were chosen by the elites as they were too foreign for the Chinese to easily control. Economic exchanges of Cambodia's rich natural resources such as aromatic woods, resins, kingfisher feathers, and beeswax, for Chinese products including silks, ceramics, cast iron, and precious metals are frequently described in historical records on both sides from the Tang to Ming Dynasties (see Zhou 2016; Stark and Cremin 2023: 114–115). Of these goods the direct material evidence of Chinese products in Cambodia is derived from depictions of gongs, textiles and horses on temple bas-reliefs and the near-ubiquitous presence of Song Dynasty white porcelains and green celadons at all Angkorian sites. Beyond a few glass beads (Carter et al. 2019) and fragments of bronze mirrors (Guy 2010: 90–94), the only other archaeological marker of this trade relationship are Chinese coins.

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Copper cash used as a system of measures and payment was one of China's most important economic developments. Established between the Spring and Autumn and Warring States eras (8th to 3rd c. BC), copper alloy currency remained the primary form of money until the introduction of paper currency in the late Song Dynasty (von Glahn 1996: 25,43). The characteristic round coin with a square hole initially appeared in the Qin Dynasty (3rd c. BC) and this design facilitated transport of up to 1000 pieces on a 'string'. During the Tang Dynasty (617–908 AD), production reached 320,000 strings a year. In the early eleventh century, under the Song Dynasty, this figure rose significantly to a regular output of 1.2 million strings, peaking at 6 million by 1078 (Heng 2006: 183). The next five decades represented the largest export of Chinese coins until another embargo prohibited further movement. The dramatic increase in coin production depleted the available copper resources and led to an important recipe shift that saw higher amounts of lead being used compared to the traditional alloy.

Despite centuries of economic interaction between Angkor and China very few copper coins have been identified in Cambodia. Most cash findings recovered over the past century originated from what appear to be ritual contexts in the capital region. Recent discovery of several loose coins from a domestic residence at the regional centre of Preah Khan of Kompong Svay, 100 km east of Angkor, requires us to consider alternative interpretations. Here we examine the evidence of Chinese coins in Southeast Asia and then, following Appadurai (1986), assess their shifting value within the Angkorian world as forms of deposit, cash, ingots, or cure. This analysis follows recent work discussing the presence of Han Chinese coins more frequently appearing in poor – not elite – graves in 1st c. BC Yunnan (Allard 2015) and a Tang coin found in thirteenth century Corinth (Wu 2024). More broadly, our study provides a further example of how the Khmer actively incorporated foreign influences into their distinctive cultural milieu.

2 Chinese coins beyond China

The intentional exportation of Chinese coins dates at least to the seventh century and within a few hundred years copper cash was broadly distributed to sites in East, South and Southeast Asia and East Africa. The large-scale export of coins, particularly between the ninth and eleventh centuries, prompted rulers of the Tang and later the Song dynasties to prohibit their use in external trade in order to safeguard the empire's copper reserves (Twitchett 1963: 79; Chhen 1965; Golas 1999: 13:87, 2015: 180–82). It was not until the Song Dynasty (960–1279 AD) that the movement of metal cash intensified, especially from the second half of the eleventh century, when the embargo on the exportation of copper

coins was briefly lifted (Heng 2006; von Glahn 2014). Chinese coins have been recovered from multiple shipwrecks in Asian waters, such as the Nanhai No.1, Jeparu, Sinan, and Rang Kwien wrecks (Keith 1980; Kurniawan 2014; Ma et al. 2022). Coins recovered from terrestrial sites are also well documented, with a marked decline in quantity observed across regions, from hundreds of thousands in Japan, to thousands (Sri Lanka and South India), and fewer than one hundred (Iran, Bahrain, Saudi Arabia, and Somalia) (Cribb and Potts 1996). Most of these coins were minted during the peak of Chinese production in the Tang and Northern Song periods.

In Southeast Asia, Chinese coins are found in a range of different contexts and quantities over time. Late prehistoric and protohistoric Vietnamese burials at Dong Song, Sa Huynh and Lach-Truong contained *Wu Zhu* coins, which were initially minted during the emperor's reign and continued to be produced over the following centuries (118 BC – 621 AD) (Goloubew 1929; Jansé 1935; Dzung 2009). These coins often represent the lone Chinese import in the funerary assemblage and are viewed as important social markers and symbol of wealth. Access to coins in mainland and insular Southeast Asia increased with the expansion of maritime trade during the early historic period (Heng 2006). While the number of coin findings remain relatively low, higher quantities recovered at Kota Cina in Sumatra (1060 coins) and Temasik in Singapore (206 coins) could be attributed to the presence of Chinese populations in these centres and not a broad adoption of coinage for exchange (Heng 2006: 193–95). The most extensive use of Chinese coins was in Java, one of Angkor's main political and economic rivals. Elites there adopted copper cash, known as *picis*, as the base currency through the thirteenth century and later replicated Northern Song coins when exportation was banned during the Southern Song and Yuan Dynasties (Van Aelst 1995). Colonial records estimate coin numbers in the hundreds of thousands, yet only a few thousand have been recovered, likely due to local recycling or the collection practices of Dutch authorities. (Christie 1996: 270). Regardless, the Javanese example demonstrates that large numbers of Chinese coins were accessible in Southeast Asia during the time of Angkor.

3 Coins in premodern Cambodia

Despite the dynamic, long-term economic interactions between Angkor and China, very few coins have been recovered in Cambodia. The earliest known Chinese coin in Greater Angkor comes from an Iron Age funeral deposit at the site of Lovea, located 7 km northwest of the West Baray. The coin is associated with the post-Western Han Dynasty (206 BC–23 AD) and could be specifically linked to the Xin Dynasty or Wang Mang period (c.9–23 AD) (O'Reilly and Shewan 2016: 480–81). Its presence here testifies to a

continuity with Vietnamese funeral practices in Cambodia and the transfer of Chinese coins ritual/social value in this territory.

Examples of Chinese copper cash are unknown throughout the early historic kingdoms of Funan (5th to 6th c. AD) and later Chenla or Pre-Angkor period (7th to 8th c. AD). Coins originating from or influenced by other polities have been discovered in the Mekong Delta during this period. An embossed gold pendant imitating a Roman coin was found at Oc Eo (Borell 2014: 10), while a locally produced golden medal resembling those of the Samatata kingdom in Bengal and a hoard of silver coins from the Pyu in Myanmar were recently recovered in the vicinity of Angkor Borei (Cribb

2013; Epinal 2013; Epinal and Ghosh 2016). These coins do not appear to have served as a form of currency but rather as symbols for the elite.

The corpus of coins found in association with Angkorian constructions currently consists of 56 whole or fragments from six locations (see Fig. 1; Table S1). Based on the minted dates, only six coins were incorporated during the Angkor Period, and almost all were found in association with the Royal Palace of Angkor Thom. The first set includes three coins found during the 1919 excavation of a stone structure south of the East gopura (Marchal 1919: 13–14, 22–23). The coins cannot be identified but were found in backfill alongside Angkorian sandstone statues,

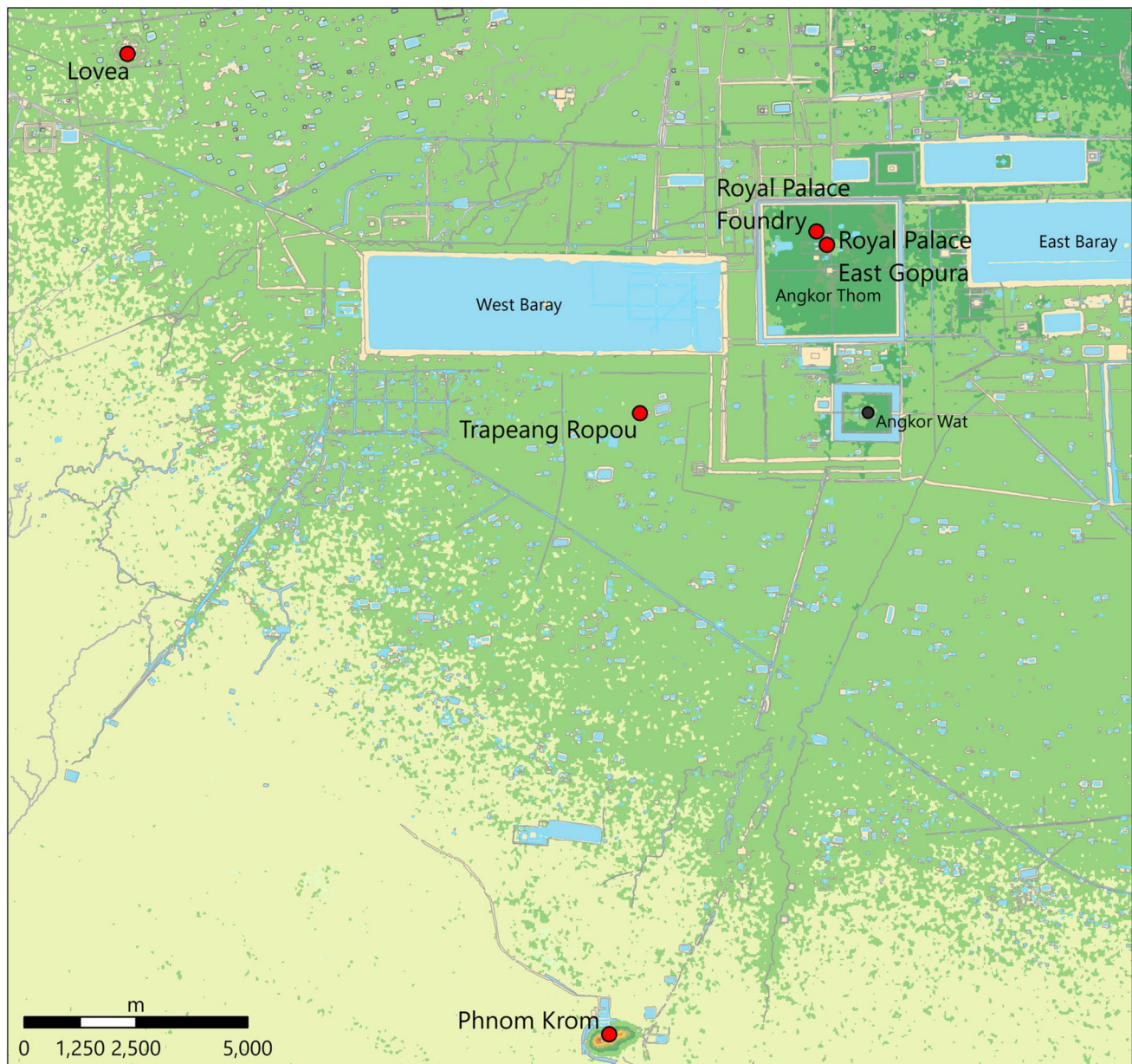


Fig. 1 Find locations of coins in Angkor (GIS data courtesy C. Pottier and D. Evans)

ceramics, and stone tools unearthed from a looting hole in the middle of the building, most likely associated with a foundation deposit. More recent discoveries include a *Xi Ning Zhong Bao* coin, minted between 1068–1077, found within the Royal Palace during a surface survey (pers. comm. Christophe Pottier, March 2024) and another excavated within the royal copper foundry located outside its northern enclosure wall (Vincent 2018:12). The inscription of the latter coin cannot be read but its archaeological context is definitively associated with Angkorian activities. A final corroded coin from Trapeang Ropou, a 11th to 13th c. village temple and settlement some 8 km from the Royal Palace, was found lying flat at the base of a post-hole (Bâty et al. 2014: 356–57).

Other known coins were recovered during clearance and restoration works made by the French architects and archaeologists of the *Conservation d'Angkor* during the first half of the twentieth century. The first set (Fig. 2a) consists of twelve coins and two fragments discovered at Phnom Krom, a temple site on top of a mountain south of Angkor initially consecrated by Yasovarman I in the ninth century. Closer inspection revealed the cache to be a mix of Vietnamese *Nguyên Phong Thông Bảo* (1251–1358), *Thánh Nguyên Thông Bảo* (c.1400) and *An Pháp Nguyên Bảo* (c.1736) coins included with other items as part of an early modern ritual deposit within the temple sanctuary. A second set (Fig. 2b) from an unrecorded location within the Angkor region includes two coins and 35 fragments, this



Fig. 2 Coins recovered from Phnom Krom (ga2840) and a collection of coins and crystals from an undisclosed location in Angkor (ga2837). (photos courtesy National Museum of Cambodia)

time associated with quartz fragments and a clay bead. All readable coins prove to be *Minh Mạng Thông Bảo* Vietnamese coins, minted in 1820–1840. As with the Phnom Krom cache, this set is a ritual deposit associated with a later reoccupation of Angkor. The general trend is that copper coins were used primarily as part of the long-term practice of sanctifying spaces in the Khmer world.

4 Chinese coins from Preah Khan of Kompong Svay: Context and analysis

The vast complex of Preah Khan of Kompong Svay (Preah Khan) is the single largest enclosure built by the Khmer outside of Angkor (Fig. 3). Located 100 km east of the capital,

the site experienced repeated building events between the 11th to thirteenth centuries resulting in a vast four-walled complex covering 22 km² (Mauger 1939; Hendrickson and Evans 2015). Preah Khan's size is directly linked to its status as an important trading center between the vast iron production landscape at Phnom Dek and Angkor, which accessed the regional centre directly by the East road (Hendrickson & Leroy 2020). Research by the Two Buddhist Towers Project inside the 3rd enclosure, known as Banteay Knong (Fig. 4), was directed towards understanding the nature of occupation and identifying shifts in material practices related to the transition from Mahāyāna to Theravāda Buddhism as the state religion after the thirteenth century. Extensive looting at Preah Khan between the late 1980s and late 1990s affected most of Banteay Knong with local villagers describing enormous quantities

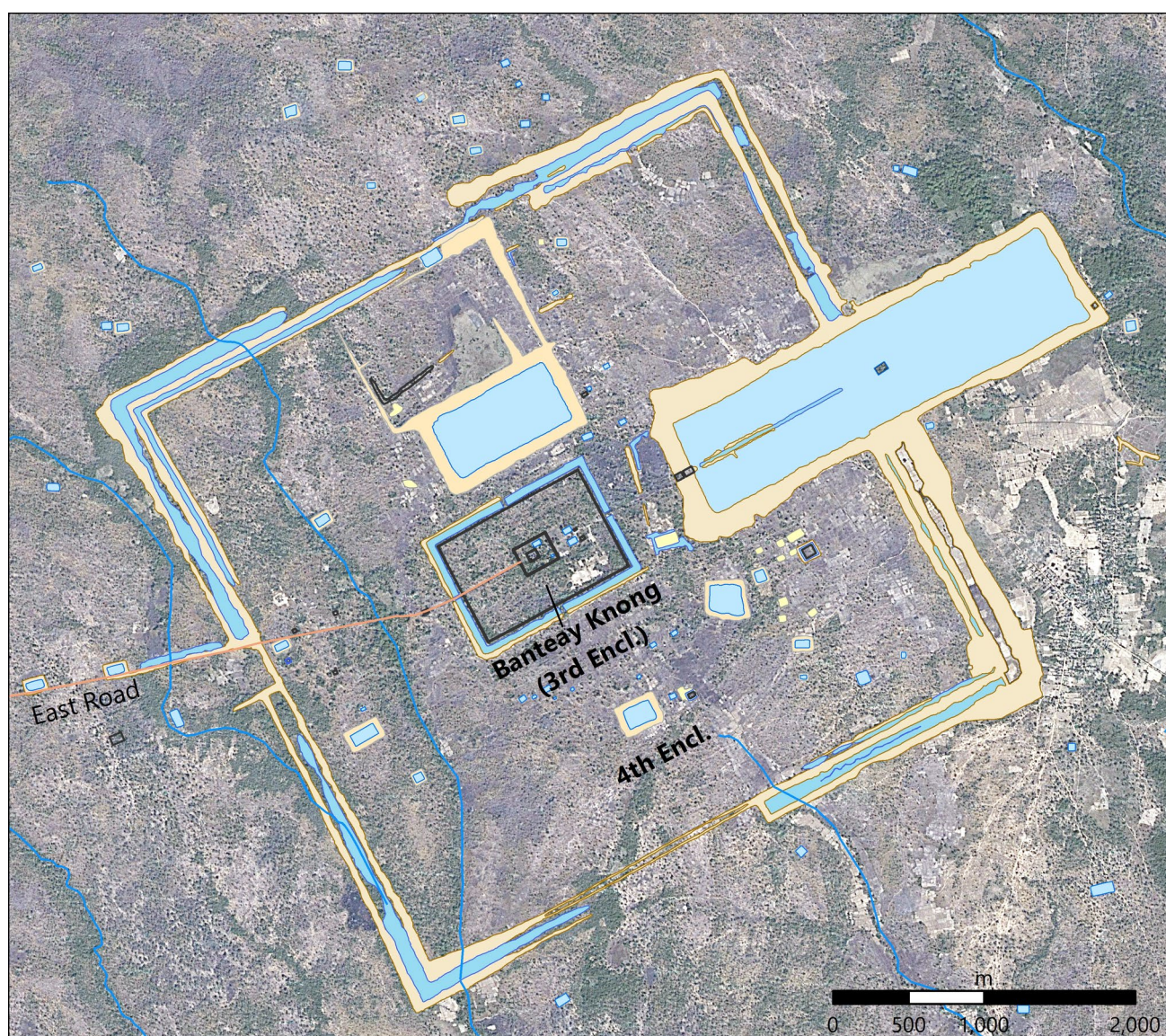


Fig. 3 Plan of Preah Khan of Kompong Svay

of bronze objects and statuary found across the enclosure. Excavations on the eastern side of the enclosure were found to be largely disturbed but produced local glazed stoneware and imported Chinese ceramics as well as a single Chinese style coin from Trench 1. The coin was recovered in the middle of a series of cultural layers containing a range of diagnostic local and imported trade wares from a range of periods. While Angkorian in nature, the context appears disturbed by looting.

Subsequent surveys and lidar acquisition revealed an orthogonal grid layout within Banteay Knong reminiscent of contemporary temples such as Angkor Wat, Ta Prohm and Beng Mealea within and beyond the Khmer capital (Evans 2016). Block 10 (see Fig. 4) was selected as one of the least disturbed blocks on the west side of the enclosure and four units (Trenches 5–8) were excavated to document the history and nature of occupation. Discovery of glazed Khmer ceramic types (green, lie de vin, brown) from all the main kiln regions and wide range of economic and food plants (Castillo 2023) demonstrated that the residents participated in the same economic network as the capital. Trench 7 (Fig. 5) revealed several occupation levels associated with a domestic area that showed remnants of a hearth and variability in ceramic breakage indicative of trampling around a house structure. The upper occupation layer (7004/7006) produced fragments of a large glazed ceramic vessel, stone, and small pieces of slag. Approximately 8–10 cm beneath

was a second occupation (7005) that contained animal bone, fragments of an earthenware brazier, a Khmer green glaze bowl and an earthenware jar. The lower level (7007/7015) contained traces of burning, animal bone and fewer ceramics. Coins were recovered from each of these cultural units. AMS Radiocarbon dates (Table 1), including a fragment of charcoal analysed from the hole of one coin, and associated local stoneware ceramics indicate that the coins were interred between the 10th to early thirteenth centuries and therefore were ‘in use’ during the Angkor Period.

4.1 Typology and composition

Identifying the coins involved delicate mechanical cleaning to remove dirt and part of the corrosion layers and photography using raking light techniques to enhance the characters. The results (Table 2; Fig. 6) showed the presence of one Tang and three Song coins that were associated with the following periods: *Kai Yuan Tong Bao* (621 ~ 907) (Fig. 6a), *Zhi Dao Yuan Bao* (995 ~ 997) (Fig. 6b), *Xi Ning Yuan Bao* (1068–1077) (Fig. 6c), and *Yuan Feng Tong Bao* (1078 ~ 1085) (Fig. 6d). The calligraphy on the coins appears fully consistent with standard Tang-Song specimens. *Kai Yuan Tong Bao*, *Xi Ning Yuan Bao*, and *Yuan Feng Tong Bao* coins are frequently found in overseas sites. Notably, these coins are among the top five

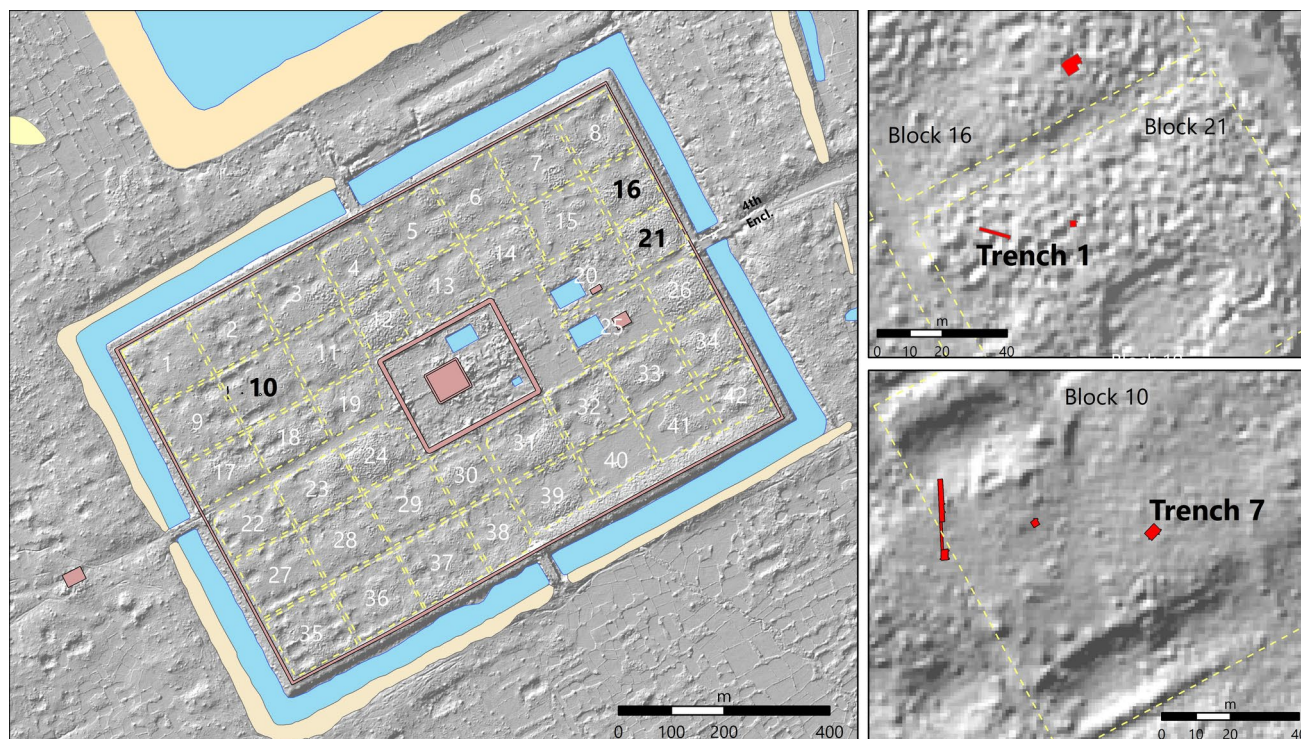


Fig. 4 Banteay Knong (3rd Enclosure) showing grid block layout and locations of coin finds in Trenches 1 and 7 (lidar background image courtesy CALI/Damian Evans)

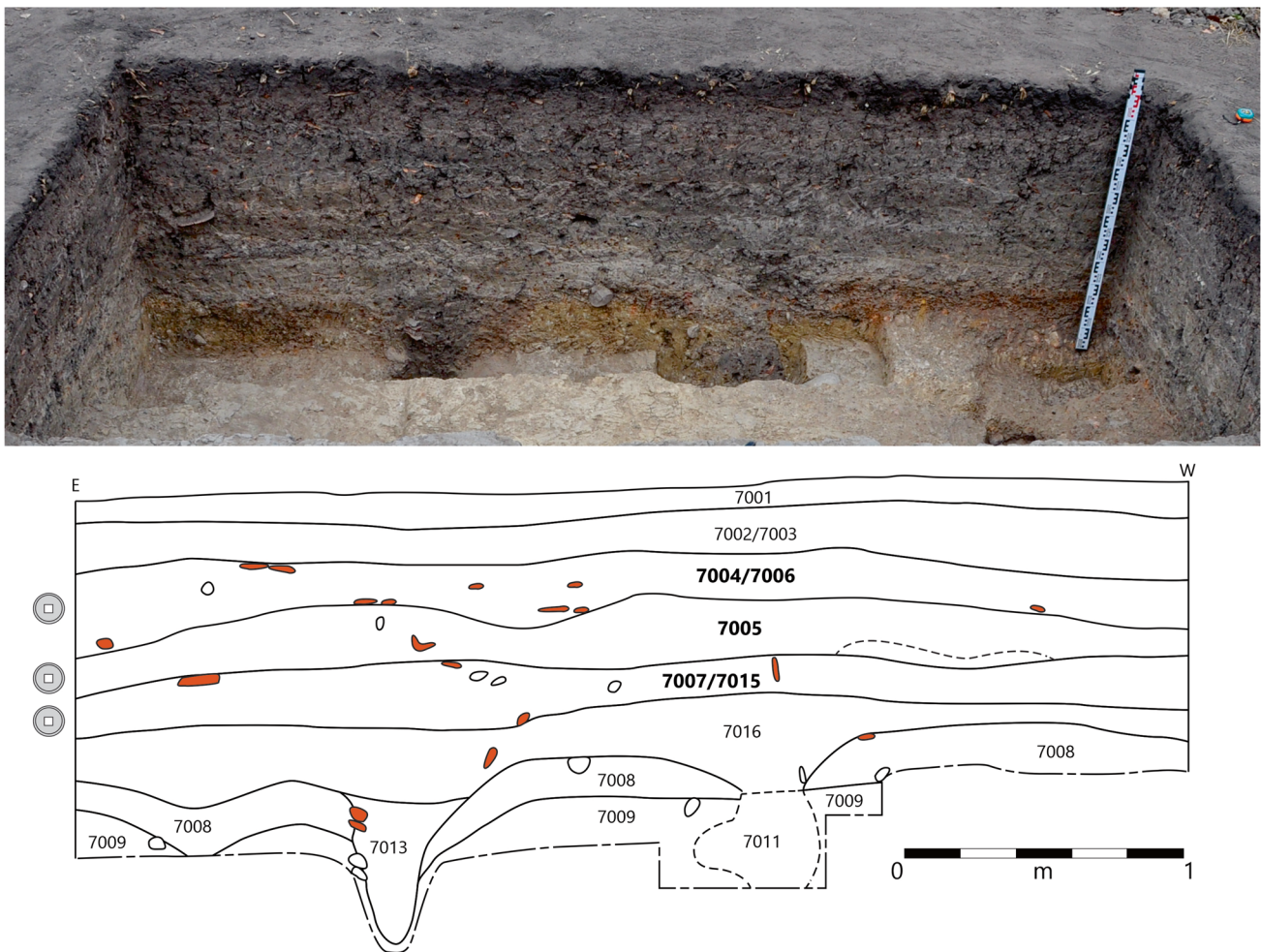


Fig. 5 Stratigraphic contexts of Chinese coins from South Section of Trench 7. Red are ceramics, hollow are fragments of stone. (photo Hendrickson)

types regularly found in Japanese hoards (Suzuki 1999). Both Xi Ning Yuan Bao and Yuan Feng Tong Bao were minted during the reign of Song Shenzong. Coin production reached an unprecedented peak during this period when, according to *Meng Xi Bi Tan* (Dream Pool Essays, published in 1088), more than 6 million strings of copper and iron coins—primarily copper—were produced annually during part of his reign (Dong & Gong 2014). The Yuan Feng Tong Bao coin is larger and heavier than the other three which suggests that it was a *Zhe'er* coin, valued at 2 cash (Sakuraki 2009). The Zhi Dao Yuan Bao was not a particularly common coin in China; it was minted in small quantities and rarely found overseas. The Kai Yuan Tong Bao represents the first Tang coin recovered anywhere in Cambodia, and its presence with later Song examples indicates collective transport to Preah Khan as part of one or more strings likely traded through Angkor.

The elemental composition of the coins was determined with a Niton XL3 t GOLDD + handheld X-ray fluorescence spectrometer (pXRF) equipped with a silver anode tube and a large silicon drift detector (SDD) operating at maximum voltage of 50 kV and current of 200 μ A with a resolution better than 160 eV. Analysis was done using the ‘general metals’ mode with a collimated spot of 3 mm and an acquisition time of 60 s. Measurements were taken on the reverse side of the coins before and after sanding an area of about a square centimetre down to the bare metal. When using pXRF, only the analysis of the latter provides a good estimation of the concentration of the main elements composing the alloy (Orfanou & Rehren 2015) as shown by the differences in the results, notably the iron content which clearly affects the overall composition when measured on the corroded surface (Table 3). The coins contain primarily copper (Cu), lead (Pb) and tin (Sn) as well as some notable trace levels of

Table 1 AMS Radiocarbon dates on charcoal from Trench 1 and 7 and associations with coins and diagnostic Khmer and trade ceramics. Radiocarbon analyses were carried out at the Australian Nuclear Science and Technology Organisation (Fink et al. 2004). Age calibration was performed using OxCal program v.4.4 (Bronk Ramsey 2009) and a mixed calibration curve, 50% IntCal20 (Reimer et al. 2020) and 50% SHCal20 (Hogg et al. 2020), for the tropics (e.g., Cambodia). * - Assumed $\delta^{13}\text{C}$ value as measured value was not available

Lab ID	Sample ID	Strat Unit	Cultural Unit	$\delta^{13}\text{C}$ (‰)	Conventional ^{14}C Age (BP)		Calibrated Age (cal AD) **					Chinese Coin	Diagnostic Ceramics (n= num sherds)	
					Value	1 σ	68% confidence							
							95% confidence	95% confidence	median					
Trench 1	OZS744	PK15-T1-EW-56	1003	6	-27.4	915	20	1055	1205	1045	1220	1165	Kulen Gr. (19), Buriram Gr. (18), Torp Chei Gr. (349), Buriram Br. (69), Torp Chei Br. (9), Qingbai (83), Celadon (35)	
			1004	5									Zhi Dao Yuan Bao 995-997 (Song)	Kulen Gr. (14), Buriram Gr. (6), Buriram Br. (19), Torp Chei (54), Qingbai (69), Celadon (2)
	OZS742	PK15-T1-EW-165	1005	4	-26.9	1175	25	780	970	775	985	920	Kulen Gr. (8), Buriram Br. (5), Torp Chey Br. (7), Qingbai (17)	
	OZS743	PK15-T1-EW-159	1006	3	-27.2	1125	20	900	990	895	995	945	Cheung Ek (24), Kulen Gr. (11), Buriram Gr. (3), Qingbai (12)	
Trench 7	OZV112	TBT16-018	7004	7	-25.3	915	30	1055	1210	1045	1220	1160	Kulen Gr. (1), Buriram Gr. (10), Buriram Br. (8), Torp Chey Br. (20), Cheung Ek (8), Qingbai (14)	
													Xi Ning Yuan Bao 1068-1077 (Song)	
	OZV113	TBT16-024	7006		-26.6	865	30	1165	1230	1160	1265	1205	Kulen Gr. (4), Buriram Gr. (11), Buriram Br. (8), Torp Chey Br. (10), Cheung Ek (6), Qingbai (25)	
	OZV114	TBT16-021	7005	6	-27.1	920	25	1050	1205	1045	1215	1160	Buriram Gr. (1), Cheung Ek (16), Qingbai (2), Celadon (3)	
	OZV115	TBT16-027	7007	5	-26.0	1020	30	995	1125	990	1150	1040	Porcelain (3)	
	OZV116	TBT16-033	7016		-26.0	1000	30	1025	1135	1000	1155	1090		
	OZV117	TBT16-031	7013	4	-25.0*	1035	45	990	1130	900	1155	1030		

Table 2 Historical, calligraphic and physical characteristics of the four coins from Banteay Knong

Stratigraphic Unit	Inscription	Reading order	Meaning	Calligraphic Style	Minting period Dynasty (Emperor)	Value unit	Dimensions (mm) and weight (g)			
							Diameter	Square length	Rim thickness	Weight
PKKS16-7005 Trench 7	開元通寶 Kai Yuan Tong Bao	top-down-right-left	"Kai Yuan" means "start a new era"	Calligrapher Ouyang Xun's (557–641 CE) script	621–907 Tang (across dynasty)	1 cash	25.8	6.5	1.0	3.3
PKKS15-1004 Trench 1	至道元寶 Zhi Dao Yuan Bao	clockwise from the top	"Zhi Dao" is one of the era names of Song TaiZong (reign 976–997)	running script	995–997 Song (Taizong)	1 cash	23.0	5.5	1.0	3.5
PKKS16-7004 Trench 7	熙寧元寶 Xi Ning Yuan Bao	clockwise from the top	"Xi Ning" is one of the era names of Song ShenZong (reign 1067–1085)	regular script	1068–1077 Song (Shenzong)	1 cash	23.2	7.0	1.0	2.4
PKKS16-7007 Trench 7	元豐通寶 Yuan Feng Tong Bao	clockwise from the top	"Yuan Feng" is one of the era names of Song ShenZong (reign 1067–1085)	seal script	1078–1085 Song (Shenzong)	2 cash	28.2	6.2	1.6	6.2

antimony (Sb), bismuth (Bi), zinc (Zn) and nickel (Ni). The relative proportion of the three main elements in the alloy is consistent with the broad compositional ranges reported by various authors for genuine officially minted coins from the two dynasties (Zhou 2004; Zhao et al. 2009; Pollard & Liu 2021; Ma et al. 2022). As noted in the historical records, the Song coins contain more lead than the ones from the Tang Dynasty due to the increasing demand for cash and decreased availability of copper ores (Bowman et al. 2005).

5 The value(s) of Chinese coins in the Khmer Empire

The coins discovered at Preah Khan doubles the number of identifiable examples and their find locations raise some important questions about the value of Chinese copper cash in Khmer society. If coins were abundant in Cambodia, where did they go? If the coins were rare, why were the Preah Khan examples left behind? Here we evaluate the potential roles of Chinese coins as deposit, cash ingot, cure, or curio.

5.1 Deposit

Ritual deposits are an integral part of dedication and foundation of places in the Khmer world. From temples to houses to production sites, the need to propitiate local spirits and gods is shared by elites and commoners. Temple deposits are typically identified by the presence of a ceramic or stone vessel interred in the centre of a construction project and may include a range of objects including quartz crystals, fossils, precious metals and various 'organic 'fibres' (Pottier 1997). As noted above, nearly all the coins from Greater Angkor come from deposit contexts associated with an Angkorian temple. This trend likely reflects a historical research bias towards monumental sites but the coins from the base of a house pillar at Trapeang Ropou and within the bronze foundry near the Royal Palace supports the idea that coins were equally important in sanctifying different types of spaces and activities. The fact that most of the known coins were deposited after the Angkor period – and were from Vietnamese sources – illustrates a consistent practice dating back to the prehistoric occupation at Lovea. The Preah Khan coins however represent an obvious shift in our understanding of the role of Chinese copper cash. While the enclosure of Banteay Knong is undoubtedly interrelated with religious and likely elite activities, Block 10 is clearly a domestic space and the scattered nature of the coins in multiple residential

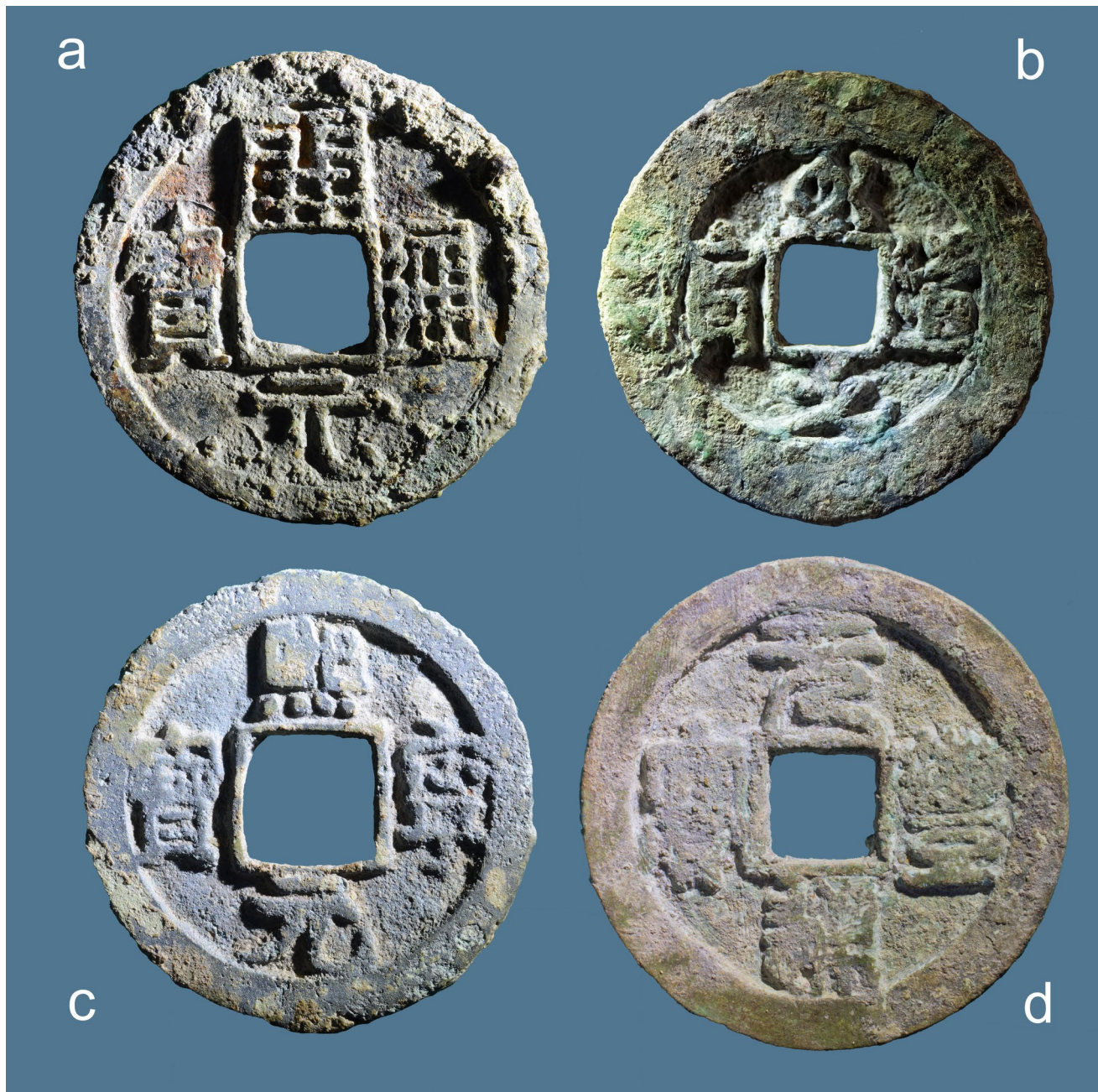


Fig. 6 Tang and Song Chinese coins from Banteay Knong under raking light: **a.** Kai Yuan Tong Bao, 621 ~907 (SU 7005); **b.** Zhi Dao Yuan Bao, 995 ~997 (SU 1004), **c.** Xi Ning Yuan Bao, 1068–1077

(SU 7004), **d.** Yuan Feng Tong Bao, 1078 ~1085 (SU 7007) (photo Hsieh and Fischer)

layers – perhaps like loose change – is clearly not part of an offering.

5.2 Cash

Drawing from epigraphic and documentary studies, Wicks (1992) highlights that Cambodia and Champa are unique among early historic mainland Southeast Asian economies in their

lack of established valuation systems. Whereas terms related to 'value' and 'price' emerged in eighth-century inscriptions, and rice, cloth and precious metals possibly served as standards of value, there is no evidence of a medium of exchange or a standardized measurement of value during the Angkorian period. Lustig (2009) further demonstrated that issues including production costs, lack of global trade connectivity, desire for centralised resource control, and lack of viable metal sources cannot be

Table 3 Chemical composition of the coins with concentration estimations for major and trace elements measured with pXRF

Coin Type	Stratigraphic Unit		Chemical composition (%)						
			Cu	Pb	Sn	Sb	Bi	Zn	Ni
開元通寶 Kai Yuan Tong Bao, Tang (621–907)	PKKS16-7005 Trench 7	before sanding	42.5	13.6	29.4				
		after sanding	76.5	5.3	15.0	0.01	0.02	0.04	0.29
		Zhou 2004	60.0 ~ 85.3	3.8 ~ 32.6	2.0 ~ 15.9				
		Bowman et al. 2005	52 ~ 94	1.4 ~ 29	0.2 ~ 29				
至道元寶 Zhi Dao Yuan Bao, Song (995–997)	PKKS15-1004 Trench 1	before sanding	14.0	40.0	34.0				
		after sanding	63.1	21.4	14.8	0.04	0.04	0.04	0.13
		Zhou 2004	55.0 ~ 83.2	10.3 ~ 35.6	1.1 ~ 12.6				
		Bowman et al. 2005	66 ~ 71	15 ~ 21	6.7 ~ 15				
熙寧元寶 Xi Ning Yuan Bao, Song (1068–1077)	PKKS16-7004 Trench 7	before sanding	18.5	40.7	35.8				
		after sanding	63.2	24.0	12.3	0.03	0.05	0.07	0.06
		Zhou 2004	58.7 ~ 78.2	12.6 ~ 31.5	0.4 ~ 10.7				
		Zhao et al. 2009	66.2	21.3	10.8				
		Bowman et al. 2005	59.0 ~ 77.0	11.2 ~ 26.5	7.9 ~ 12.7				
		Ma et al. 2022	68.3	24.6	6.6				
元豐通寶 Yuan Feng Tong Bao, Song (1078–1085)	PKKS16-7007 Trench 7	after sanding	76.5	19.2	3.9	0.01	0.03	0.03	0.03
		Zhou 2004	59.0 ~ 77.7	14.3 ~ 36.0	0.7 ~ 11.7				
		Zhao et al. 2009	62.2	21.8	14.7				
		Bowman et al. 2005	60.0 ~ 72.0	22.8 ~ 33.6	4.2 ~ 6.0				
		Ma et al. 2022	66.0	30.9	2.8				

*Elements at trace levels (Sb, Bi, Zn and Ni) are given for information purposes only

used to explain Angkor's lack of coinage. This indicates that the Khmer Empire functioned as a moneyless society and that it was a deliberate choice made by elites to regulate valuable commodities. Instead, the massive Angkorian economy operated via a complex barter system based on exchange of rice, cloth, and land. The late thirteenth century account of Zhou Daguan, a Chinese visitor to Angkor, importantly noted that copper cash was also utilized as a medium of exchange. Uk and Uk's recent translation of the original text notes that: "In small tradings, they pay with rice and Chinese goods. Next step up they pay with copper coins. For big businesses, the payment is with gold and silver" (Zhou 2016: 87). This remains the sole historical reference to Chinese coin usage in Cambodia and may not be representative of practices beyond the capital region. Evidence of Chinese traders and military figures depicted on twelfth century temple bas reliefs (Fig. 7) indicate residence in the capital, but unlike at Kota Cina and Temasik, any long-term presence does not appear to have supported local exchange in copper cash.

The presence at Preah Khan of local and Chinese ceramics as well as diverse food and economic crops (Castillo 2023) shows that its inhabitants were fully integrated with Angkor's broader trade networks. The residential context for the newly discovered coins opens the possibility for use in small-scale exchange, supporting the account of Zhou Daguan. The fact that we do not see small coin finds in Angkor is impacted by the lack of settlement excavation. Conversely, Preah Khan may have participated in different forms

of local exchange, extending the idea that regional centres develop local valuation systems as discovered recently at Roman Palmyra in Syria (Andrade and Raja 2022). Unfortunately, the small sample size precludes any conclusive argument for the use of Chinese coins as local cash.

5.3 Ingot

Metal coins, and particularly copper alloys, are inherently reusable as 'ingots' to produce new objects. During peak production and exportation periods in the Song Dynasty, copper coins were sold for two to five times their value to cast into Buddha statues, sacrificial offerings or bronze drums (Ding 2021: 208). In Southeast Asia, Cribb (2005: 1) suggests that Chinese coins were imported in certain foreign territories for alloy production, while Heng (2006: 185) argues that regions like the Malacca Strait did not need to recycle coins due to the immediate availability of local copper ores. Shipwrecks provide varying evidence for transshipment of coins and other metals, likely for recycling. The tenth century Intan wreck contained large quantities of scrap metal and a few Chinese bronze mirrors (Guy 2004: 177) while the cargo of the fifteenth century Rang Kwien shipwreck had 200 kg of coins (Flecker 2022:59; Brown 2004: 23–24).

Like stoneware and iron, bronze was an important pyrotechnological product in the Khmer world used to create an immense quantity and array of objects ranging from statues

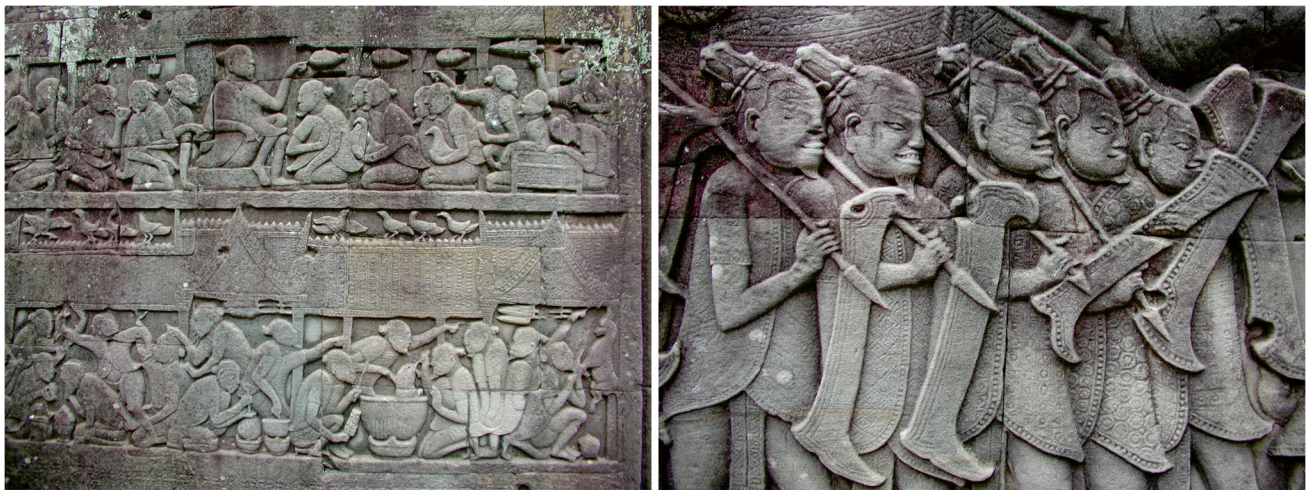


Fig. 7 Chinese traders and soldiers depicted on bas reliefs from the Bayon temple in Angkor Thom (photos Hendrickson)

to ornaments (Boisselier 1966: 1:323–46; Vincent 2012). Given the demand for copper alloys it is not surprising that metal recycling in Angkor is well documented and involved a range of different source materials (Malleret 1954a; Boisselier 1967). Despite having access to local copper sources (see Clouet 2023), Angkorian inscriptions record the frequent recasting of ancient religious images, or even the melting of “victory spoils” consisting of metallic items taken from the enemy in the wake of military campaign, to produce new statues (Cœdès 1937: 1:256, 258, 1942: 165, 175; Vincent 2012: 168). Scrap metal and looted objects were therefore important contributors to Angkor’s copper supply.

The question of whether Chinese coins were used as ingots to produce Khmer bronzes requires a few obvious caveats. It is highly unlikely that copper cash played a significant role in large-scale bronze production. Given their use in ritual deposits, coins are more likely linked to a particular practice of ritual offering to the crucible during bronze casting. Modern observations document the collective gift to the crucible of personal and sacralized items such as jewels, alongside the primary metal sources, for the casting of some parts of statue, notably Buddha heads (Malleret 1954a; Polkinghorne 2020: 138, 151). Malleret specifically noted the presence of coins, either Chinese or Vietnamese, within the ritual objects piled up for casting a Buddha statue in the Than-Quang pagoda of Hanoi in 1952 (1954b: 645). Griswold a year previously already noted the gift to the crucible of coins, among other precious metal items, by local devotees during the casting of a Buddha statue in Bangkok (1954: 638). Angkorian bronzes tend to confirm the long-standing nature of this practice through the punctual presence of especially high gold contents in the head of few statues when cast independently (Vincent 2012: 330–32). The presence of metal crafting inside Preah Khan, which is unique among all known Angkorian

sanctuaries, offer another reason to consider that the coins were linked to metallurgical activities, and perhaps shows a connection with the coin from the royal foundry of Angkor Thom.

Identification of copper alloy recycling is a complex process particularly in later historic periods where multiple sources of metal from new ores to old objects may be combined (see Bray et al. 2015; Pollard 2018:43–52). Analysis is based on linking chemical signatures of parent and object materials at scales ranging from alloy to trace elements and lead isotopes (Orfanou et al. 2020). Past research on Angkorian bronzes has demonstrated that during the Angkor Wat era (c. 1080–1175), most objects crafted by the Khmers were lead bronzes (Vincent 2012: 314–317). Their composition is relatively similar to the coins with, however, significantly higher tin contents in three of the latter. Even if this difference persists, the compositional match gets closer when considering a group of objects with high lead and tin found outside Angkor from the southeast and east provinces, including a Buddha statue (ga3378) from Preah Khan of Kompong Svay (Fig. 8; Supplementary Table 2; Vincent 2012: 318, 776–83). Despite the inherent limitations of pXRF analysis, specifically regarding sample size and shape, the composition of small bronze finds from Preah Khan of Kompong Svay shows a better correlation with the Chinese coins in Sn content but with lower Pb (Fig. 8, upper; Supplementary Table 1). More importantly, looking at trace elements, it appears that Sb levels are five to ten times higher in both the Angkor Wat bronze corpus and the small finds from Preah Khan of Kompong Svay compared to the coins (Fig. 8, lower) which points to a different source for the copper and lead ores. In fact, among all the high lead and tin objects analyzed in previous research only one shows a relatively low Sb content (ga357, Vincent 2012: 776). While

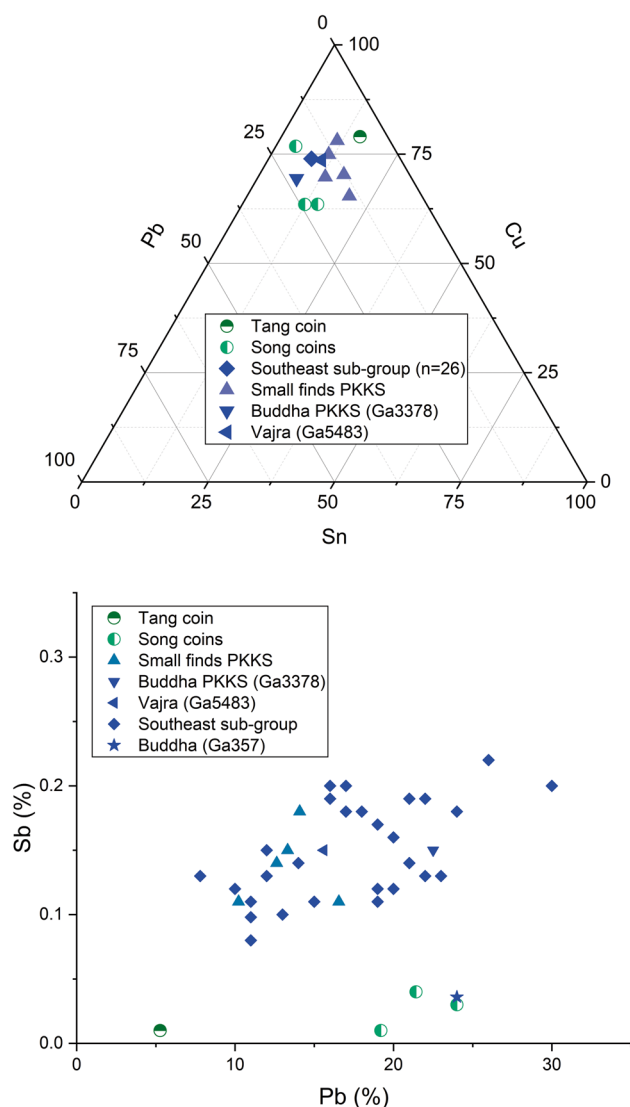


Fig. 8 Comparative compositions of Chinese coins and selected Angkorian copper alloy objects: upper—Ternary diagram showing relative proportions of copper, lead, and tin in ledged bronze artifacts from the Angkor Wat period. Data for Chinese coins and small finds from Preah Khan of Kompong Svay (PKKS) were obtained with pXRF, other with ICP-AES (Vincent 2012); lower—Pb-Sb bivariate plot of ledged bronze artifacts from the Angkor Wat period

it is highly probable that none of these objects were derived in part or majority from Chinese coins, further study of lead isotopic signatures might provide more solid evidence.

5.4 Cure...or curio?

A more intangible value of Chinese coins in Angkorian society is their potential use within local wellness practices. Medical and health care treatises such as Ayurveda and sutras from India (see Filiozat 1964) were available to the Khmers for centuries and were adapted alongside local practices during the Angkor

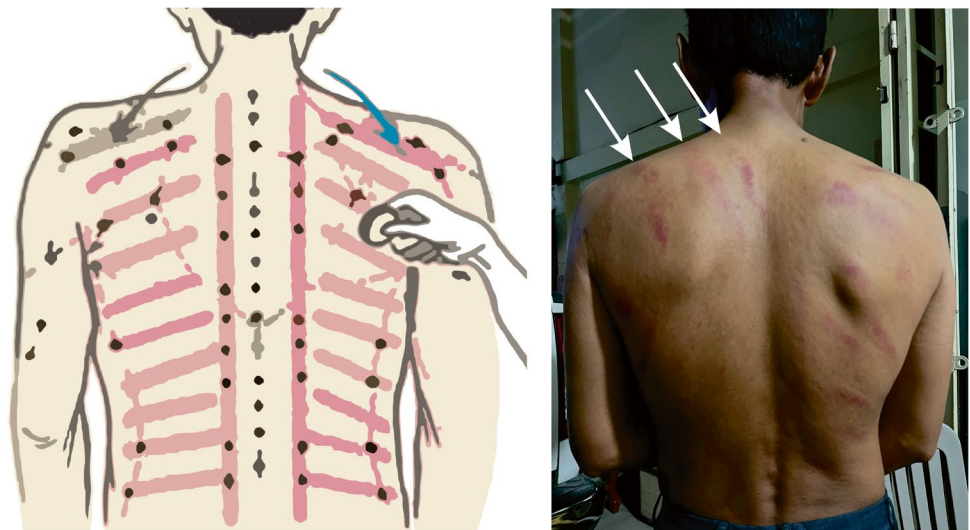
period (Chhem et al. 2023). Jayavarman VII, the famed king responsible for shifting the state religion from Śaivism to Mahāyāna Buddhism in the late twelfth century, intentionally expanded institutions related to health care in Khmer society. In 1186, the king erected 102 hospital chapels dedicated to *Bhaiṣajyaguru*, the Medicine Buddha, to provide populations with medical services and integrate new regions within his territory (Chhem 2005; Lowman et al. 2023). The associated hospital inscriptions, combined with the contemporary Indic sources describe over 400 illnesses diagnosed through studies of urine, skin and body heat (Chhem et al. 2023: 293). Chinese medical influence in Cambodia dates back at least to the seventh century with the account of the visiting monk Punyodaya who sought local herbs for the Tang Court. The request for Punyodaya to return to Cambodia is related to the medical knowledge passed onto the Khmer physicians (ibid.:294). The practice of rubbing the skin with an implement such as a spoon or coin is rooted in practices from the *Shang Han Lun* (On Cold Damage) text (~ 220 AD) (see Mitchell et al. 1997) and became formalized as *gua sha* in medical practices treatises of the Ming and Qing Dynasties (Yue 2023). Today, coin rubbing is a common counteraction treatment found in Cambodia and the Khmer diaspora (*kos khyol*) as well as Vietnam (*cao gio*), Laos (*khoud lam*) and Indonesia (*kerok*) (Nielsen 2013: 39). Coins, often older and of Chinese origin, are rubbed along the back to alleviate ‘wind illness’ (Fig. 9) symptoms such as chronic pain, fever and respiratory infections (Graham and Chitnaron 1997; Darsha & Cohen 2020). The unique context of the Preah Khan coins – each isolated in a domestic space – merits consideration of intangible medical practices at work in the Angkor period. Future Chinese coin finds must therefore consider new and refined approaches to recognize edge polish or recover potential buildup of human residues (see Green & Speller 2017; Bonsu et al. 2020; Caricola et al. 2022) as a means of determining their use to heal in the past.

Finally, we cannot discount that the scattered distribution of the Preah Khan coins merely represents misplaced keepsakes or curios. Foreign objects, as Helms (1988) aptly points out in her study of power and distance, typically have an inherent value for those who received them. Chinese ceramic imports to Cambodia were valued both for their contents, wax or scents, and the containers became status symbols or heirlooms (Wong 2010: 257–58). If Chinese coins were not used regularly for money or needed for ritual, then their value may have been more personal in nature.

6 Conclusion

The extensive, long-standing economic exchanges between Angkor and China described in the historical records stand in stark juxtaposition to the quantity of

Fig. 9 Coining therapy diagram and use in Cambodia today (schematic adapted from <https://pktivkaltim.com/hati-hati-kerok-an-penyebab-stroke/>; photo Phon)



Chinese coins found in Cambodia. Today, numbers of Tang and Song Dynasty copper cash are comparable with archaeological finds in far distant places such as Iran or Somalia. Explaining the lack of coins, however, is not clear cut. Barring the unlikely option that coins were not imported into Angkor, it instead appears that these objects were absorbed into Khmer society in different ways that reflect varying values of the objects themselves. The discovery of four coins in Preah Khan further highlights the need to recognize how material and purpose may shift over time, across space and within a community. Whether deposit, cash, ingot, cure or curio, the study of Chinese coins provides another example of how the Khmers adopted and modified foreign influence into their cultural milieu and how metal coins can be examined in global contexts.

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Author contributions Mitch Hendrickson. obtained funding, initiated the project, conducted fieldwork, artifact analysis. Sébastien Clouet. conducted archival analysis. Ellen Hsieh. conducted fieldwork, data analysis of coins. Christian Fischer. obtained funding, conducted fieldwork, data analysis of coins. Kaseka Phon. conducted fieldwork, ethnographic work on coin use. Dominique Soutif. conducted fieldwork. Quan Hua. analysis of radiocarbon samples. Julia Estève. conducted fieldwork. Cristina Castillo Cobo. conducted fieldwork, analyzed botanical remains. Mitch Hendrickson wrote the main text

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Declarations

Conflict of interest The authors have no conflicts of interest.

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