

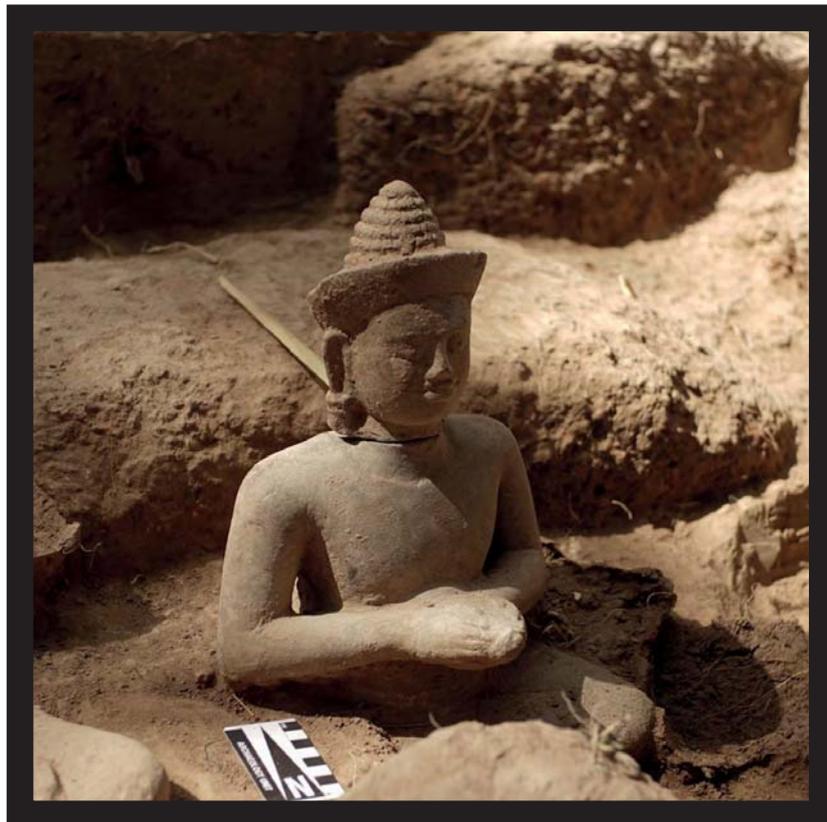
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Tonle Snguot: Preliminary Research Results from an Angkorian Hospital Site

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Tonle Snguot: Preliminary Research Results from an Angkorian Hospital Site

ABSTRACT

Tonle Snguot is an 11th/12th century CE hospital site at the northern gate of Angkor Thom, Siem Reap, Cambodia. It was partially excavated by an international team from the Nalanda-Sriwijaya Centre (NSC), APSARA Authority, and East Asia Summit (EAS) training participants in 2017. This was part of an EAS research and training mission supported by the Ministry of Foreign Affairs (MFA), Singapore, the NSC and the ISEAS- Yusof Ishak Institute. Statuary and habitation remains were recovered. cursory analysis is provided throughout the report – ranging from large-scale settlement concerns to smaller-scale “hospital-compound” and artifact-specific topics. The following report is intended to provide theoretical, methodological, and ‘ancient Angkorian medical industry’ data, information and speculations. Several sections are theory-method focused while other sections provide descriptive results. The overall intent was to explore and identify habitation sites related to the hospital compound. Historic and archaeological ‘narratives’ are often very different, but increasingly conceived as complementary.

Keywords: Archaeology, Tonle Snguot, Cambodia, Angkor, Medical Industry, Ancient Hospitals, Settlement Patterns

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1: INTRODUCTION

1.1 Background

Tonle Snguot is a late Angkorian hospital site associated with the reign of King Jayavarman VII (1181-1218 CE). Archaeological research was conducted at Tonle Snguot from 28 July to 07 August 2017 by the Nalanda – Sriwijaya Centre (NSC) and APSARA Authority as part of the NSC-EAS (East Asia Summit) Archaeological Field School. Preliminary research results provide insights concerning hospital complexes and ancient medical industries in Cambodia.

The Tonle Snguot site is located outside the northern gate at Angkor Thom, Siem Reap, Cambodia (Figures 1-5). **Angkor Thom is one of Cambodia's largest and most complex Angkorian capital cities.** Research is intended to elucidate the nature of the hospital compound as well as its relation to Angkor Thom, surrounding features, **and sites. The research team is also interested in the site's integration into urban planning, politics, and ancient state sponsored services – particularly public health and medical industries.**

The interdisciplinary Field School includes research and training components in archaeology, art history, anthropology and related fields. East Asia Summit (EAS) young professionals and research staff are trained in a multi-tiered experiential learning environment. The annual project is funded through the Singaporean Ministry of Foreign Affairs (MFA) with additional support from the APSARA Authority. Excavation and training teams were composed of staff from NSC, APSARA Authority, and other contributing organizations (e.g., the Hungarian archaeology team; Cambodian Development and Research Institute). Local community members, volunteers, and visitors were also key contributors.

This report is divided into a brief summary of the overall purpose (Section 2) followed by two primary overviews (Sections 3 and 4). The overviews in Sections 3 and 4 provide theory, models, methodologies, preliminary assessments, interpretations/speculations, and discussion points in addition to primary data. Section 5 provides a discussion on inscriptions by Hunter I. Watson. Section 6 discusses non-local influence related to hospitals, medicine and medical industries. Section 7 provides a recap, discussion, and additional topical subsections.

The first overview in Section 3 examines potential settlement histories and landscape transformations at the northern areas around Angkor Thom. The purpose is to better understand how the Tonle Snguot site was possibly articulated within urban planning and the larger urban system(s). We are interested in the big picture down to **the site specific details. For example, were hospital sites part of an urban “master plan”** or did they emerge separately? Were hospitals allocated to a specific number of communities, neighborhoods, or people? For example, was one hospital dedicated to village clusters (e.g., 5-10 proximate villages); 15 neighborhoods; or 10,000 people? Were hospitals strategically located to support military and economic logistics? Was the Tonle Snguot site built over pre-existing sites, residential neighborhoods,

agricultural lands, or empty space? What was the duration of hospital site operations? What, if anything, was subsequently built over or into the hospital compound after abandonment?

We also hope to help disentangle aspects of potentially larger-scale transformations through time and space. For example, can we visually distinguish different periods of construction, settlement, land-use, water system engineering, etc. – many of which may be partially superimposed in LIDAR, satellite, aerial photographic, topographic map imaging? Can this be determined by ground survey and feature identification? Does a 10th or 11th century configuration exhibit sufficient distinctive traits that can be recognized through extensive 13th century major landscape modification? Currently, algorithms for LIDAR analysis supported with input from GIS, ground surveys, subsurface testing and other factors are promising (e.g., the Hungarian team led by Dr. Károly Belényesy working at Koh Ker have made significant progress along these lines).

These goals, however, are not new to Angkorian archaeology. In fact, APSARA Authority, the Greater Angkor Project (GAP), Ecole Française d'Extrême Orient (EFEO), and many other international teams have made considerable progress and contributions. By comparison, our inputs are small and limited. Nevertheless, it remains an important step in revising models for understanding larger picture questions. Furthermore, the archaeological efforts are important for Field School training in addition to the research results.

Our principal methodologies are based on map, satellite, and LIDAR analysis (Evans 2015) followed by core sampling and controlled excavations in specifically targeted locations. First, we identified patterns, features, and known sites during the map and remote sensing analysis. Details are provided in Section 3. Findings were compared to excavation results and core samples. Excavation results are provided in Section 4. LIDAR, map and satellite image analyses were subsequently revisited for further comparative study. Ideally, a robust survey, mapping and ground-truthing campaign would be included in the overall methodology. However, only a limited amount of surface ground-truthing in the immediate Tonle Snguot area was possible during our research campaign. This needs to be rectified in future undertakings. Fortunately, the GAP and other teams previously surveyed large sections of proximate areas (e.g., Brotherson 2016 provided an overview lecture for the Field School). The GAP team also tested the canal at the eastern edge of Tonle Snguot site (Wilson 2017). Their results provide critically important comparative data.

The analysis in Section 3 also examines hospital sites in general followed by site-specific considerations at Tonle Snguot. In addition to testing for settlement and activity within the hospital compound, the team planned to test the canal, road, and an artificial reservoir to the east of Tonle Snguot as part of the original strategy. However, only the hospital compound and canal were tested during the 2017 season. The canal had been previously tested by a GAP team (Wilson 2017) resulting in: 1) evidence of proximate habitation; 2) post-hole features suggesting a previous wooden bridge spanning the canal; and 3) a valuable geo-morphology/geo-archaeology analysis of the

area, particularly the canal. The canal was further tested during current undertakings to gain more insights on the nature and dimensions of the bridge as part of Mr. Im Sokrithy's focused research on infrastructure, roads, and bridges.

Section 3 ends with a review and additional considerations of the larger picture. A basic hypothetical temporal-functional model is provided. The model provides a baseline for testing related questions. It is not intended as a life-history of Tonle Snguot; rather, what to think about when conducting archaeology in the area.

As stated, the second primary overview in Section 4 provides preliminary excavation results. Section 4 is descriptive, provides site and artifact visual data (numerous images), and is also infused with analytic and interpretative discussion points rather than entirely consigned to a separate section. Archaeological finds and their implications from each excavation unit are discussed in separate sub-sections. Statuary, pottery, other artifacts, and bas reliefs are also given attention.

Regrettably, we do not provide a comprehensive art historical assessment of statuary, architecture, reliefs, and related material culture in this report. This is reserved for a separate analysis. We do encourage others to use the images and data presented here for their own research pursuits. The project members will be happy to supply further information or imagery upon request.

Several near-complete Angkorian statues were identified and recovered from the onset of the Field School. This was unexpected – not that statues would be unusual at the site during the Angkorian period – rather, it is surprising that statues still exist at the site given a history of statuary removal from Cambodian sites; subsequent transference to museums and private collections; and the rampant looting that has occurred in Cambodia for decades with statuary being extremely high value targets.

Some of the recovered items from Tonle Snguot may be relatively “in situ” (i.e., close to their original location, but not likely their original position during its operational period). Some statues were assuredly displaced and perhaps broken inadvertently/naturally after the collapse and breakage of architectural features. Others may have been intentionally moved in antiquity. Some fragments may have been moved in modern times. Following the unexpected statuary discoveries, our field operations were adjusted accordingly. This resulted in deviations from the original plan.

Finally, we have yet to analyze the recovered artifacts, ecofacts, their spatial distributions, soil samples, the stratigraphy, and other possibilities in significant detail (e.g., phytoliths, pollen, residues, material compositions). These analyses will likely be conducted in 2018 or later pending funding and scheduling. Once completed, this

report will be augmented and adjusted. However, preliminary conclusions can be drawn which may be of immediate use to archaeologists, art historians, and historiansⁱ.

1.2: Settlement Area Dating, Urbanization, Abandonment, and Continuity Models

Most known sites and features in the surrounding area of Tonle Snguot are late **Angkorian**. They coincide with Jayavarman VII's reign (1181-1218 CE). Tonle Snguot is only a few hundred meters from Angkor Thom. Nevertheless, sites in the larger spatial context (i.e., extending several kilometers from Tonle Snguot in any direction) represent several Angkorian periods ranging from the 9th/10th – 14th centuries CE.

For example, the East Baray dates to the 10th century CE. The western bank of the East Baray is only 3.1 km from Tonle Snguot. Large labor crews would have worked in the area during its construction. They may have lived there, extracted resources, processed materials, etc. resulting in various temporary and permanent sites as well as environmental impacts. The same is true of the numerous major constructions within and outside of Angkor Thom. Finally, we must consider that there were undoubtedly rural villages, farming communities, and agricultural systems in the larger area; each with various histories. The latter are a consistently understudied aspect of Angkorian research with the partial exception of water control systems. LIDAR has recently illuminated settlement studies considerably (Evans 2016), but most concerns are related to latter urbanization – particularly the orthogonal patterns at Angkor Wat and Angkor Thom and population estimates – rather than discerning the process of urbanization.

Without speculating on all possibilities it is important to highlight that there is over half a millennium of major undertakings and settlement changes in the larger area. Thus, we need to carefully consider the possibility of multiple periods of use, activities, and settlement at all sites (temporary or permanent; small or large; functionally and/or symbolically similar or different). We need to avoid the bias of designating specific periodization and function of a particular site based solely on a few visible and prominent criteria (e.g., designating Tonle Snguot as only [emphasis added] consisting of a late Angkorian hospital complex because of the presence of a Bayon period shrine and associated architectural features). It may have multiple occupation and use periods. It is difficult to determine with ground surveys and LIDAR scans. Archaeologists are well aware of these pitfalls. Nevertheless, Cambodian archaeology and historical

ⁱ We also acknowledge that Tonle Snguot may not be the centrally important site or site type in the area. It is easy to become site-centric and inflate the significance of a site vis-à-vis a larger system of sites, features and settlement. For example, it is likely that the northern gate area at Angkor Thom was far busier, important, and populated than currently imagined. The hospital itself may have been one of many services, industries, activity areas, and settlements in the area. In fact, there are several hospital compounds around Angkor Thom. Likewise, the preeminence of the royal palace and other sites certainly eclipsed the hospital's prominence in many ways. However, it cannot be discounted that Tonle Snguot indeed was a critically important site – such as a medical supply restaging area, or an important component to a busy commercial and military gate because of its location and/or some yet unknown designation to serve a more specialized function.

research often continue to be plagued by essentializing site histories into compartmentalized time segments and functional categories defined by temporally and structurally diagnostic art and architectural styles and/or inscriptions associated with a particular site.

Although a single function and constricted use period for a site may be true in some cases, exploring the full potential archaeological history in the larger context is warranted. The Phum Lovea site (O'Reilly & Shewan 2016, 2015) provides a solid example of partially overlaid, truncated, proximate, and quite different sites that are clustered in a single area which represent numerous periods ranging from Iron Age cemeteries to Angkorian water control features. Likewise, sites such as Prei Khmeng and Koh Ta Meas that yield Iron Age settlement assemblages and burials in the Angkor capital region (often built into and over by pre-Angkorian and Angkorian features and sites) also warrant closer attention needed for research on earlier settlement histories, urbanization trajectories, and continuity models (O'Reilly & Shewan 2016, 2015; see also contributions to *Journal of Southeast Asian Studies* 2016 47[3] with introduction by Murphy & Stark 2016). Thus, we need to be cautious not to over-focus only on the Angkorian temples and architecture for defining temporal and spatial categories to address, for example, settlement and ecological impact questions. This is an increasingly cliché statement among researchers working in the region, but one that needs constant reminding.

As stated, Phum Lovea in particular merits a need to thoroughly examine possibilities of much earlier sites and settlements occurring in Angkor's urban and peri-urban landscapes; including research considerations related to settlement continuity, urbanization, and complex polity evolution mentioned above (O'Reilly & Shewan 2015). Phum Lovea is located west of the West Baray and contains an Iron Age circular settlement and cemetery site with moats and earthen embankments. The site is adjacent to large Angkorian features. The authors mention, "several probable prehistoric mounds, and indeed, other moated sties lie in proximity to Lovea" (O'Reilly & Shewan 2015:3). Test excavations, material remains, and topographic analysis (inclusive of LIDAR) indicate various manifestations of continuity through Iron Age, Angkorian, post-Angkorian, and historic periods including alterations and compromises to the site throughout its history (O'Reilly & Shewan 2016:480; also acknowledging Evans 'LIDAR Prospection at Lovea').

We have attempted to be comprehensive with our approach and questions regarding Tonle Snguot and the larger context. What are the diachronic natures of settlement, urbanization and landscape transformations in the larger urban and peri-urban area, particularly around northern Angkor Thom and Tonle Snguot? Also, what are the long-term anthropogenic histories, changes, and impacts in larger-scale areas? Pre-Angkorian, Angkorian and post-Angkorian sites and features are found from the Kulen Mountains (Phnom Kulen) to the Tonle Sap in the greater Angkorian capital area and its surroundings. Iron Age sites exist. It is speculated that sporadic Neolithic sites exist as well. Agricultural field systems and landscape features exist – many of which have unknown antiquities and development/use histories.

The point is that resource abundance due to diverse, predictable, and productive ecosystems as well as settlement potential in the area (biological, topographic, terrestrial, aquatic, environmental, spatial, geographic, etc.) was ideal for human populations throughout most of the Holocene. In fact, the eventual surplus production potential, geography/location, and other factors (e.g., water systems and waterways) were some of the most crucial factors for ancient complex polity formation in the area.

Thus, questions related to historical continuity are critically important. This was also emphasized by the authors in the recent *Journal of Southeast Asian Studies* (2016; issue 47[3]). We know Angkor was already emergent and urbanizing by at least the 9th century CE. The presence of pre-Angkorian (Chenla) material culture and sites suggests urbanization processes occurring from at least the 7th-8th centuries CE. As O'Reilly & Shewan (2015) emphasize, the roots probably extend to at least the Iron Age.

Nevertheless, at Tonle Snguot and the immediate surrounding area there are presently no prominent archaeological indicators that predate the Angkorian period. Thus, it is equally important to ask why earlier sites and features are not present at or near Tonle Snguot, or, why we're not identifying any. Perhaps it was merely a poor choice for settlement until massive urbanization measures were available and provided the necessary incentives. Many hypothetical models can be devised and we will continue to discuss several.

On the other hand, some of the pottery remains post-date the 14th century. This accords with the GAP surveys and evidence for continued settlement and use of the area in the centuries following the demise of Angkor (Brotherson 2016).

We also must consider questions of de-urbanization and associated settlement pattern, socio-political, economic, and environmental shifts for centuries related to and following the demise of Angkor. There are some post-Angkor settlement, some indicators of connections to long-distance value chains, and some evidence of visitation from travellers and pilgrims – but nothing as intensive as the mid to late Angkor period.

De-urbanization is not frequently studied in depth, although collapse models are prevalent. Processual or diachronic abandonment models addressing density decline, settlement dispersal, and long-term economic, political and environmental/ecological shifts have not been as abundantly considered as rapid collapse models in the past (e.g., war, political fragmentation, rapid economic decay/collapse, environmental catastrophe), although new paleoclimate data, for example, offer severe environmental fluctuations such as long-term drought and floods as prominent contributing factors (Buckley et al. 2010).

The distinctions we make between diachronic decline models and rapid collapse models are not necessarily mutually exclusive and exact. They are merely arbitrary points on multi-dimensional continuums. Our definition is relative. We define rapid collapse models as comparatively synchronic, such as an event (e.g., invasion, catastrophic natural disaster, hydraulic system failure) with a focus on major contributing factors within a single generational time span, for example, as a temporal division for major driving forces. Diachronic decline models necessitate multi-generation time spans and long-term forces that are frequently less evident to historians

(e.g., multi-generational forest resource degradation; sea level shifts affecting salt supplies; global warming). However, diachronic decline models may be heavily **“punctuated” at various times** – these punctuations, like major events, have varying overall cumulative impacts. When both forces are in operation, they sometimes synch in both very positive and very negative manners. It is important to recognize our considerations of these varying forces.

Of importance for the discussion, however, is that the Tonle Snguot hospital site construction, support, operations, and related activities are apparently restricted to the reign of Jayavarman VII (1181-1218 CE). Although some support and operations may have lingered with his immediate successors (e.g., Indravarman II; 1218-1243 CE), it seems more **likely that operations probably ceased shortly after Jayavarman VII’s death** and therefore a presumed lack of continued support for the state medical industry by his successors.

Thus, the hospital aspect of the urban socio-cultural and physical environment may fit a more rapid emergence and decline model. At a slightly greater scale, Jayavarman VII may have over-extended. There are arguments this assisted the decline of Angkor (i.e., he spent all the money and resources). Most of his sites remain unfinished.

Equally important to consider is the possibility of an Angkorian “business” culture of inward looking economic and socio-political conservatism whereas a culture of extra-local and extra-regional active entrepreneurship never developed, lending them to be readily outcompeted by neighboring polities beginning as early as the 13th/14th centuries and certainly by the 15th century onwards (Latinis 2017ⁱⁱ).

Returning to the major issues at hand, the greater urban, peri-urban and hinterland settlement area at Angkor has a lengthier history as previously indicated. The positive correlation unsurprisingly follows a pattern of increasing numbers of sites and temporal spans of settlement with an increase in geographic scale and research attention. However, the non-Angkorian long-term **“before and after” aspects in and** around the capital are only beginning to be the focus of increased attention (again, refer to continuity models mentioned above).

As a final note of interest and change of pace (the relevance is clarified below), B. P. Groslier (2006: 4) suggests that the Royal Palace (and whole city of Angkor Thom) seems to have been wholly abandoned by 1430 based on archaeological evidence of uppermost levels at the Palace, but that the rest of Angkor (e.g., Angkor Wat) was readily accessible, known, and still used by at least the 16th century onwards according to various documents and inscriptions – albeit certainly not to the urban intensity and **extensiveness it once was. In the early 1950s, most of Siem Reap’s Angkor area were, “inhabited and tilled”** (Groslier 2006:16) unlike Angkor Thom which was covered in dense jungle. Groslier continues to state (2006:16):

ⁱⁱ Latinis (2017) notes that both shipwreck data and terrestrial data have an abundance of Chinese, Thai and Vietnamese pottery throughout Southeast Asia, but hardly any Khmer ware.

It is difficult to see why only a part of Angkor, and one particular part, was invaded by the Jungle. One can realistically suppose urban life under the last Khmer kings was concentrated around Angkor Thom. It is in this part that we can find the greatest number of constructions after the thirteenth century. This therefore was the area which, more than any other, was sacked by the Siamese in the fourteenth and fifteenth centuries. The horrors of war, the systematic destruction of the water reservoirs and hydraulic works, led to the abandonment of the area, whereas the open countryside to the south and west remained inhabited and tilled by the Cambodians. When we speak of Angkor being abandoned about 1432, we mean that Angkor Thom as the royal capital was deserted, and not that the country was entirely depopulated.

This may relate to a pattern of palace and partial urban de-intensification of use and abandonment of the area for at least a few generations following the demise of a particular Prominent ruler. This is somewhat evident at the palace areas at Phnom Kulen (Banteay site; Jayavarman II) and Koh Ker (Jayavarman IV). Perhaps there was a strong social-symbolic, spiritual or psychological reason (e.g., ill fortune, ghosts, dangerous forces, *neak ta*) why those particular areas would become taboo for **continued settlement and intensive use of a “last great king”** of that particular area within multi-generational memory. Additionally, there may have been a negative event, set of conditions, or uneasy feeling associated with the place that became reinforced in myths, legends and other beliefs. Hence, reuse or continued use may not manifest in specific locales for long periods. Thus, the abandonment of Tonle Snguot (and other Angkor Thom hospitals) may be related to the abandonment of Angkor Thom in general. However, simultaneous hospital operations ceasing throughout the kingdom at sites located far away would better reinforce the hypothesis that economic, physical and human resource support ended as succeeding kings (and the state) may neither have had the desire nor the means to continue support.

2: PROJECT PURPOSE

2.1: General Concerns

The overarching purpose of the project is to further understand the nature of hospital sites during the late Angkor period – particularly related to Jayavarman VII. Jayavarman VII was the tantric Mahayana Buddhist King who reigned in the late 12th to early 13th centuries (1181-1218). Jayavarman VII is famed for the construction of massive urban complexes, temples, roads, water control features, infrastructure, and industry development. It remains difficult to discern if many industries were wholly or partially state/elite sponsored, controlled, and maintained (Latinis & Ea 2017). The lack of a cash economy, however, seems to support centralized control to a degree, but archaeological evidence is lacking and there are examples of semi-decentralization, federation, confederation and certainly internal conflict and competition at various periods. The hospital sites, however, appear to be state sanctioned and supported. Professional medical staff were appointed. Site complexes including shrines, statuary, walls, libraries (and texts), ponds, entryways, bridges, roads, paths, and other features were built. Other assets such as labor, land, and resources were provided. Special medicines and ingredients were evidently redistributed from the King's personal stores (Sharrock 2017; pers. comm.).

It is difficult to determine if the emergence of state sponsored medical industries and hospital construction could have been at least partially a response to public health concerns at the time (e.g., disease and epidemics in an increasingly populated area; Gundersen 2015); and/or, related to political, social, and economic maneuvering. Hunter I. Watson (pers comm; 2017; see also Gundersen 2015) noted that outbreaks of various diseases occurred in Thailand during similar periods. Perhaps Jayavarman VII **simply had the capital and empathy to “care for and take action” in order to benefit public health out of altruism**; but it cannot be ignored that public healthcare support would have enhanced charisma, popularity, and allegiance as well as productivity and efficiency through a healthier workforce and military. It also cannot be ignored that providing healthcare and welfare for his people, Jayavarman VII (a tantric Mahayana Buddhist) gained merit for himself and the kingdom (special thanks is extended to Hunter I. Watson for further elaborating this point during a recent seminar). It is equally important to emphasize that state support of the medical industry provided opportunities and jobs (e.g., construction workers to build hospital facilities, maintenance crews, producers and suppliers of medical goods, medical professionals, **healers, and hospital staff**). **In fact, Jayavarman VII's massive construction endeavors provided jobs and opportunities for a very extensive population both in the capital and throughout the empire.**

Inscriptions indicate Jayavarman VII ordered 102 hospitals to be built and staffed throughout the kingdom (Ta Prom inscription – see Cœdès 1940, 1941; Finot 1915a; Say Fong inscription - see Finot 1903; Briggs 1951) (refer also to Dagens 1991). Hospitals were to provide public welfare and medical treatment. This included physical,

spiritual and mental health. Medicine and medical treatments were almost certainly intertwined with religious and spiritual beliefs and practices. Importantly, the hospitals and medical services were available to the general population – elite, military, and commoners alike – possibly to include foreigners. However, it is unknown if patients had to pay, were partially subsidized, or, were provided free services through donations, state taxation, and good will.

The hospitals undoubtedly served military and economic goals as well: supply chains, distribution, logistics, a healthy workforce, etc. The building of roads, other supporting travel infrastructure (e.g., water reservoirs, rest houses, hospitals), and urban complexes were related to settlement hubs and industry locations. That is, hospitals, infrastructure, and various services industries, for example, were located in population centers and industrial production locations (e.g., a hospital site is located proximate to the Torp Chey kilns (Ea 2015); Banteay Chhmar contains several hospital complexes; Phimai has a hospital structure including several hospitals on the road from Angkor to Phimai; Preah Khan at Kampong Svay has a neighboring hospital site (Hendrickson & Evans 2016); even the 10th century capital at Koh Ker contains a 12th/13th century hospital site). Besides hospitals and rest houses, many Angkorian kilns, quarries, and metal processing sites are located proximate to road networks. Traders, service communities, and agrarian support communities would have gravitated towards these areas.

Thus, roads may have been planned in accordance with existing population hubs and industries, and, may have also affected settlement shifts and industry development such that they relocated or developed closer to road networks (refer to **Mitch Hendrickson’s works on transport networks, roads, and infrastructure**). The point is that settlement shifts due to roads and other infrastructure may have resulted in the subsequent planning and placement of hospitals in addition to hospitals being placed in areas that were already populated, urbanized, or contained industries and infrastructure. Both cases may be valid: 1) a road was built to an existing hub and hospital placement was part of the design; 2) settlement and industry shifts occurred when roads were built and hospitals were then placed in response to those shifts. However, it is imperative to highlight that the spacing of hospitals and rest houses on key roads were consistent, suggesting most were likely part of advanced composite planning rather than the result of *post hoc* placements following settlement shifts that were a response to infrastructure and road development. Further contemplations of this “did the chicken or egg come first; or did both come together?” **scenario are beyond the scope of this introduction, but these are important points to consider.**

A spectrum of considerations have been introduced in the section above. Thus, it should be clear that we are not only concerned with the Tonle Snguot site as a closed-system and bounded physical phenomenon with a specific purpose, but the Tonle Snguot site in the context of larger considerations along multiple dimensions (physical, functional, social, symbolic, settlement, ecological, urban and infrastructural planning, etc.) and vice versa.

2.2: Specific Goals

Regarding the various physical components and features that comprised a hospital compound, the chapels (temples/shrines), libraries, walls, entryways, *gopura*, formal ponds, and other architectural and art historical elements are more well-documented (Im 2014 who refers to *Journal Muang Boran* 2004; Finot 1903; Coédès 1940; Chhem 2004, 2005). This is primarily because of their visibility, durability (often made with stone and laterite), and aesthetic value in addition to a past dominance of ancient art and architectural discourse vis-à-vis Cambodia's archaeological research history. Surprisingly, there are few comparative and holistic studies on hospitals. And, what about everything else, particularly the archaeology?

The Tonle Snguot site at Angkor Thom's northern gate was selected for archaeological soil-core testing and stratigraphic excavations related to settlement and site activities. The project aimed to address the nature of the following: a) site-complex layout (spatial organization), function and symbolism – inclusive of evidence for organic structures; such as, wooden houses, dormitories, processing structures, and bridges; specialized activity areas; gardens – possibly medicinal gardens; water features; etc.); b) the nature of specific site activities and site use; c) occupational and activity sequence(s) including possibilities of multiple period evolving settlement and site function; d) site ecology; and e) material culture. These aspects remain largely unknown and under-tested. Only one other hospital site has been systematically excavated: Prasat Tromoung located at Angkor Thom's western gate (Pottier & Chhem 2008). Prasat Tromoung yielded evidence of habitation and domestic activities, wooden structures in addition to the existing stone architecture, a necropolis, numerous pottery sherds and other artifacts, and 12th-13th century dates.

Lastly, research at the Tonle Snguot site also provided a platform to train East Asia Summit (EAS) participants and project staff through the Nalanda – Sriwijaya Centre's (NSC, ISEAS-Yusof Ishak Institute, Singapore) Archaeological Field School in partnership with APSARA Authority, Cambodia.

3: SETTLEMENT HISTORY, LANDSCAPE, HOSPITALS AND THE TONLE SNGUOT SITE

The following section provides a preliminary discussion of larger-scale geographic and temporal settlement, landscape, and ecological history among other phenomena. It is chiefly concerned with assessments and speculations based on pre-excavation and post-excavation background research and image analysis. We emphasize it is highly speculative. The intention is to facilitate further considerations for future modeling and testing at varying scales of analysis. We first considered large-scale geography, modified landscapes, settlement and ecology among other issues. The following sections will consistently narrow to smaller site-scale and finally specific test unit finds in Section 4. Finally, we will return to a more comprehensive “larger picture” summary at the end.

3.1: Large-Scale Settlement, Landscape Modification, Ecological, Economic and Social History

Before delving into a discussion of settlement, image, landscape, and topographic analysis, it is important to emphasize that this report is preliminary and cursoryⁱⁱⁱ. The contributions of numerous research projects over several decades from multiple nations and institutions have provided a wealth of knowledge, new interpretations, and innovative methodologies. Apologetically, these are impossible to summarize here. These studies have enhanced several aspects of our own efforts. We hope our modest contributions will assist others in building a more integrated, nuanced and larger comprehension of ancient Angkor.

The Angkorian region including areas in and around the capital was settled by Bronze and Iron Age communities in the first few millennia BCE to the early first millennium CE. The Phum Lovea site located in the Angkor area is the one of the most recently studied Iron Age examples (O’Reilly & Shewan 2016). Prei Khmeng and Koh Ta Meas (Western Baray) also contain Iron Age sites with burials beneath pre-Angkorian and Angkorian sites and features (Pottier 2006a, 2006b)(note: these sites are

ⁱⁱⁱ Needed are detailed understandings and dedicated research efforts related to: hydrology; overall regional settlement; modern and ancient agricultural field systems; modern and historic landscape and infrastructure modifications; modern and historic settlement and land-use changes; datable architectural and art historical features (there are many in the wider zone of analysis); results from previous archaeological studies in neighboring areas; dedicated inscriptional/epigraphic analysis related to project research questions; analysis of large project findings such as the Greater Angkor Project surveys (Fletcher 2011; Fletcher & Evans 2012; Fletcher et al 2008a, 2008b; Evans et al 2013); archival research and other related endeavors. Eventually, that is our long-term goal. We would also like to include species-genera analysis of the local ecology from micro to macro scales (i.e., biological as well as physical landscapes). This is part of our research interests in historical ecology. There are methods and data available (e.g., bas reliefs indicating numerous species of plants, animals and a variety of natural and artificial ecosystems; faunal, botanical, pollen, and phytolith studies; e.g., Penny (2014); Penny et al. (2005, 2006, 2007); Castillo (2016) who identified rice, pomelo and ginger at Angkor Wat). Similar analyses are proposed but are contingent upon sample availability and funds.

alternatively classified as protohistoric – see Heng 2016 for a more detailed discussion). There is a high possibility of Neolithic sites in the region, though few have been identified and studied in detail.^{iv}

Communities farmed rice, gardened, tree-cropped, fished, raised livestock, hunted, exploited wild forest resources, developed specialized craft industries, and traded. Over time, they developed increasingly larger settlements with increasingly larger, more sophisticated, and more transformative landscape modifications and water management systems. They buried their dead in cemeteries with grave goods. They were integrated in local and long-distance value chains. The exotic material culture ranged from distant regions in Southeast, South, and East Asia especially by the late Iron Age/early Funan periods. India and China were heavy influencers culturally and economically.

At a more regional and coarse-grained scale of analysis, there was a common culture of practice, ecology, socio-cultural-economic value chains (exchange), and communication (probably similar languages) across the riverine and floodplain region.^v by the late Bronze and early Iron Ages. Sites such as Laang Spean (Forrestier et al 2015) indicate early Holocene to Neolithic settlement. Whether or not the seeds of a common macro-culture were sewn in these periods remains unknown. On the other hand, imagining a purely homogenized culture over a broad area is dangerous and we would expect varying manifestations of meaningful diversity as well as continued diversification. It may seem contradictory to suggest a common connected macro-culture with a mosaic of diverse micro-cultures, but it can be argued as normative in certain circumstances. Where was the medical culture at this time? This is hard to imagine, but it was probably highly localized in practice (i.e., local practitioners), but maybe more widespread in medicines and medical treatments.

Beginning with the Bronze Age and especially by the mature Iron Age the situation was reflective of significantly increased interaction and more accentuated wealth differentiation, increasing social hierarchies, differential status, specialized production, long-distance exchange, and overall complexity (Higham 2016; refer also to other examples in *JSEAS* 2016 47[3] special issue). The period was characterized by more effective and efficient technology; surplus production; environmental engineering; access to exotic goods and wealth/prestige items; ability to engage in increased trade and larger value chains with greater variety of goods (staple products to high value prestige items and symbols of power); and more complex management structures. These aspects likely assisted emergent elites to incentivize, mobilize, and

^{iv} The Laang Spean site has been thoroughly reexamined; See Forrestier et al 2015.

^v It is possible to include coastal settlements. There are relevant reasons why coastal settlements could be included (e.g., obvious integration into long-distance socio-economic value chains) and equally relevant reasons why they may have quite separate and distinct trajectories (e.g., they had strand/maritime economies; possible seafaring and shipping capabilities; possibly more frequent interactions and stronger connections with much more ethnically diverse peoples as would be expected in port-like areas and among maritime traders – interestingly, the latter can be argued to have parallels with inland groups and ethnic hill tribes). These models will be explored elsewhere.

manage workgroups for increasingly larger-scale projects.^{vi} They could also consolidate and centralize power. As far as medical practices, specialists may have travelled or been sought after.

This trend consistently and at times dramatically and quickly increased in scale and complexity through time and space. For example, a) the transition to the Iron Age (ca. 500 BCE); b) incipient urbanization (ca. 1st century BCE – 1st century CE); and c) the mid-centuries CE changes that included shifts in mortuary practices (cessation of burial practices), monument construction, statuary production, dramatic primary settlement size increases, increased socio-political complexity, the introduction of writing (inscriptions, texts), and differing forms and intensities of outside influence (not ignoring reciprocal relations and local agency) may have been periods of highly accelerated changes – technological, socio-cultural, political, and economic among other dimensions. However, we do not know the true extents to which communities integrated, accommodated, transformed, impacted, managed, or mismanaged their

^{vi} In other words, time and energy needed for food production decreased while surplus increased. Surplus was capital. This could be converted to supporting larger projects and importing wealth. Jobs, wealth, and prestige provided incentives. Better management and group effort also increased efficiency. Opportunities to further develop industries and incentive-based communal projects became increasingly available. The larger and more complex the projects, the more jobs and job variability occurred. This also required more complex management hierarchies. Increasing complexity of differing levels of roles, power, authority, and wealth were inevitable. This continued to very large scales. However, the efficiency and manageability curve may have decreased (i.e., points of diminishing returns, even up to points of critical inefficiency and failure). Moving from one threshold to the next was both steady and punctuated. The Iron Age technology shift around 500 BCE; incipient urbanization around the first century CE; emergence of major architectural and statuary constructions with shifts in belief systems, burial practices, and political hierarchies around the late Funan period; shifts in the Chenla period and then again in the **Angkor period... these marked rather punctuated** changes in many sectors of society. Nevertheless, gradual changes and expansion continuously occurred. Very few places/settlements were likely static or frozen for long periods of time. These are certainly not a new considerations and models. Rather, they are grounded in basic economic, ecological, socio-political and evolutionary principals at the core.

Additionally, the model is not intended to ignore phenomena such as slavery and why and when slavery would occur (e.g., either more efficient labor; or, at the points of diminishing returns); or the need for force, threat, displays of power and negative incentives; cult/religion that emphasize non-material incentives, disincentives, reinforces the social and power order, and so forth. These notions can be readily incorporated.

The model also accommodates local continuity in evolving social complexity as well as multiple degrees and types of outside influence. This is not the venue for detailed discussion of these issues here. Rather, we want to highlight some of the theoretical underpinnings in our modeling. State health care, for example, might be one of the public incentives: providing services, jobs, spiritual and physical incentives, and so forth.

total resource environments^{vii}, social orders, and networks from local to regional scales. We also do not know the true diversity of communities that existed – from rural hinterland groups to emergent urban and possibly immigrant or diasporic communities. [Were certain medicines, medical treatments and medical knowledge being transshipped from highland areas to other settlements, for example?]

Nevertheless, we do know that most riverine and floodplain areas were more densely settled from Thailand through the lower Mekong. This is in contrast to the comparatively sparse Neolithic settlement evidence. Some Bronze and Iron Age settlements included areas in what would later become Funan, pre-Angkorian and Angkorian urban sites (Murphy & Stark 2016; O'Reilly & Shewan 2016; Heng 2016; see also Murphy 2016; and Rispoli et al 2013 for parallels in Thailand with proto-Dvaravati and Dvaravati models).

By the Funan period from the 1st- 6th centuries CE^{viii} urbanization, social complexity and larger-scale landscape impacts had significantly evolved (refer to examples in the *JSEAS* 2016 47[3] special issue). The Funan urban site at Angkor Borei (likely the capital), for example, demonstrates early urbanization and continuity from the Iron Age (e.g., Wat Kamnou; Phnom Borei) with large-scale landscape transformations. [We know almost nothing about the Funanese medical industry, but the potential is sufficiently high given the vast amount of diverse material culture and sites available for further study.]

Angkor Borei has a 20 meter wide, six kilometer long, amorphic wall with adjacent moats. The wall is mostly built of clay. Evidence of brick interiors occur in some places, although these may be architectural features embedded in the wall. Some areas contain evidence of settlement or activity areas on top of the wall as well. The wall, moats and other attached features primarily serve to manage water. Though large, the wall integrates with, rather than drastically redesigns, the local topography and ecology – Angkor Borei being an island during the wet seasons when the exterior landscape is

^{vii} Regarding ecology, what were the impacts of forest clearance for agricultural expansion, construction, fuel, and infrastructure expansion; introduction of exotic plant and animal species – some possibly being destructive invasives; domestication; agriculture; aquaculture; species-genera ratio transformations in forest plots and other ecosystems; wholesale ecosystem transformations; over-exploitation and depletion; etc.? It is also noted that numerous cumulative micro-transformations may have had larger regional impacts. It is also important to emphasize that ecosystems are not necessarily naturally stable and static. They constantly evolve with speciations, extinctions, introductions/invasions, changes (physically and biologically), etc. – including major and minor shifts; constant and punctuated. They have differing resiliencies and fragilities, however.

^{viii} The 1st- 6th centuries CE is a timeframe used by most historians, but not necessarily as clearly compartmentalized temporally in the archaeological record. Work at Angkor Borei clearly for example, clearly extends the timeframe to the early centuries BCE to the pre-Angkorian onwards (Stark et al 1999) – the archaeological overlap and divisions among Iron Age and Funan practices and material culture are quite different than the historical narratives imply.

significantly flooded^{ix}. It is possible that a topographic/environmental “integrative” approach as opposed to a major “transformative” approach for large-scale landscape modifications represents continuity from the Metal Ages. The size and scale of the wall and settlement, however, could be interpreted as intermediary (it is recognized that metal age moated sites and Neolithic *banteay kou* [circular earthwork sites], for example present problems and debate with this modeling: see below). There are also several notable artificial canals in the Angkor Borei region – some of which have direct connections to the site. These could be classified as more transformative in nature. The Oc Eo Funan site in Vietnam connected via canals to the Angkor Borei area some 90-100 km away is also geometrically designed in a manner that appears more transformative.

It is important to define and distinguish an “integrative” (or “accommodating”; also, the term “organic” may partially apply) versus a “transformative” approach vis-à-vis landscape, physical, biological, ecological, social, etc. modifications. Theoretically, both are merely arbitrary points on a continuum and can occur simultaneously depending on the scale and nature of analysis.

The integrative/accommodating approach operates with the existing environment, topography, hydrology, and ecology (e.g., many of the circular moated Bronze and Iron age sites in Thailand and Cambodia; see Boyd 2008; Evans et al 2016; Moore 1988a, 1988b; O’Reilly 2014; O’Reilly & Scott 2015; Scott & O’Reilly 2015; Stark & Bong 2001). That is, populations target desired areas for settlement and embellish them physically, ecologically, and socially. Impacts are initially not as pronounced and transformative at larger area scales of analysis (e.g., 10-50 km radius), but they may “stand out” archaeologically. As populations grow and split for whatever reasons, less desirable areas are frequently less available. It is possible these areas need enhanced embellishments. Fortification and moating may occur for competitive and defensive purposes as well as ecological-economic reasons (e.g., water storage in moats), cumulatively becoming more transformative at larger area scales of analysis.

Alternatively, the transformative approach is defined by significantly reworking landscapes at larger scales or entirely manufacturing new ones from an original master-plan design as a high-input large-scale undertaking (e.g., the West and East Barays at Angkor; the Rahal and massive dam at Koh Ker; Angkorian road networks and urban complexes; Angkorian mines; massive forest clearance for new agricultural and irrigation systems). Transformative approaches are defined as generally more artificial and larger scale. However, it is noted that artificiality if properly designed and managed

^{ix} This may also explain the deeply stratified cultural deposits compared to areas like Angkor or Sambor Prei Kuk where non-flooded land may have been more readily available during the wet seasons allowing settlement expansion rather than reuse of the same locations and density increase. Nevertheless, the deposits tested at Angkor Borei were generally at Wat Kamnou and closer to the river front (Stark et al 1999) – perhaps a much busier and densely inhabited area. Deposits further away from the river front, current market area, and Wat Kamnou appear less deeply stratified. Incidentally, Phon Kaseka (2004) excavated burial sites similar to those recovered from Wat Kamnou at a habitation and cemetery complex at the base of neighboring Phnom Borei. Further settlement testing is warranted.

does not necessarily indicate less diversity and increased fragility as is appropriately argued for some areas. In some cases it can create desired stability and predictability.

These concepts need not be restricted to only topography and/or hydrology. It is not necessarily the physical scale of earth and rock moved and reshaped. For example, the species-genera communities and their ratios may be slightly altered in the integrative model while entirely reworked in the transformative. An example of the former would be the introduction of a few new plant or animal species to a forested environment, or, the reduction of frequency of one or a few species and an increase in frequencies of others. Examples of heavily transformed biological environments might be the conversion of forest to grassland or rice paddies (note: this can also occur without changing the actual topography or main water flow systems dramatically), replacement of wild habitats and fauna with domesticated animals and their habitats such as conversion of forests and swamps to grazing ranges, or desertification in extreme cases.

Additionally, diachronically cumulative accommodating efforts may eventually become significantly transformative. For example, the expansion of a few simple farming and irrigation efforts by small rice growing communities through forest clearance and minor tapping of streams may have expanded over time resulting in major hydrological changes and large-scale forest clearance with increased wood-fuel consumption, agricultural expansion and intensification (also conversion of ecologically diverse communities to less diverse monocropping systems). They may have also continuously filled and expanded settlement and household mounds over time in parallel with population/settlement size increases. These combined diachronic efforts may have altered topography dramatically. In the case of mining, quarrying, leveling, and excavation (e.g., water storage features, canals, moats, and soil mining for mounds) a cumulative transformative effect was achieved. These concepts are actually quite common to considerations of landscape modifications. And, population size and density are factors to consider for obvious reasons. Nevertheless, it is important to clearly define them here.

During the subsequent period ca. 7th-8th centuries CE, more formalized, geometrically designed and symbolic centers with a boom in monumental architecture and major landscape modifications emerged (e.g., Sambor Prei Kuk – Isanapura). This included a scalar shift in environmental and landscape transformations to suit urban settlement needs. Large-scale topography and hydrology were increasingly redesigned and manipulated, if not outright manufactured; rather than being accommodated/integrated or less grandiosely re-worked at smaller scale segments. That is, there was more wholesale landscape transformation – an endeavor requiring much more labor and management effort including more sophisticated design, planning and engineering. Landscape integration and modification approaches did not necessarily disappear or diminish, however. The transformative approach at larger scales simply became more accentuated – especially around urban centers. Cumulative integrative approaches also evolved to be more transformative.

By the Angkorian period, the scale of environmental transformations and impacts were massive. These transformations were among the largest in the ancient

world along many dimensions: vast urban sites, immense and numerous water features, large complex canal systems, enormous architectural constructions, well developed road and bridge systems, giant quarries, increased agricultural systems, industrial production sites, etc. Did it come with a long-term cost? Did the massive transformations overstretch long-term sustainability? Did it create fragility rather than resiliency? Some of the leading models on the demise of Angkor incorporate environmental and resource degradation through over-exploitation, mismanagement, poor engineering, poor planning^x, although long-term environmental changes and natural catastrophes (e.g., droughts, floods) (Buckley et al 2010; Lieberman & Buckley 2012) are increasingly posited.

Although intriguing, we can neither review and synthesize all available **discourse on Angkor's rise and fall for now or the theoretical concepts introduced** above. The emphasis here is to present a general timeline with speculations and hypotheses pertaining to the Tonle Snguot site and how it fits within the larger picture of settlement. Whether or not one may consider the Tonle Snguot site itself as integrative or transformative, it is necessarily part of a larger transformative undertaking – that of Angkor. Additionally, hospital sites appear to be a late Angkorian phenomenon seemingly restricted to Jayavarman VII and are thus very transformative particularly as a social concept of state sponsored healthcare in addition to their role in the physical construction of infrastructure and monumental sites.

3.2: Surface Surveys and Hydrological Systems

Regarding Angkorian and post-Angkorian settlement and landscape modifications, the Greater Angkor Project (GAP) teams have provided considerable input into the area with large surface survey transects conducted from 2012-2014 (Brotherson 2016). The project complements methods previously employed by Christophe Pottier, EFEO, and APSARA Authority. The quadrant north of the East Baray running southwest to the Tonle Snguot area yielded very few post-Angkorian finds. The quadrant north of the West Baray running southeast to the Tonle Snguot area, however, yielded a greater abundance of post-Angkorian tradewares. Within Angkor Thom, there is evidence of post-Angkorian activity as well.

The discourse on hydrology research at Angkor is immense. Of relevance to our study, Evans & Kummu (2003) highlight the complexity of the Angkorian water management system(s) through airborne synthetic aperture radar (AIRSAR-TOPSAR) analysis. Areas immediately north of the Angkor Thom northern wall are dense with features and sites (see: Fletcher et al 2015; Fletcher 2011; Fletcher et al 2008a for an evolution of Angkorian large scale water systems). A series of research endeavors by the

^x Sarah Klassen notes in her current research that a move from multiple small water control features and systems to singular massive ones increases catastrophic risk. That is, if one small pond, dam or canal fails, it has low impact overall. However, if a single large reservoir, dam and main canal that supplies an entire city fails, the impact and negative consequence are immense.

GAP teams and others have led to a more nuanced understanding of the water system complexities and vulnerabilities. More recently, LIDAR imaging (Evans 2016) has further revolutionized our visibility, comprehension, methodological approaches, and research questions related to water systems and landscape features. LIDAR imaging has been central to our examinations of the Tonle Snguot area and research planning.

Prior to and during recent fieldwork at Tonle Snguot, preliminary walk-through surveys were conducted to assess the site compound and surrounding areas. We identified relevant features, assessed topography, and checked for artifact surface scatters. This was also useful for the coring and excavation unit planning. To be clear, walk-throughs were not systematic transect surveys and were mostly restricted to areas proximate to Tonle Snguot. They were opportunistic where less dense vegetative ground-cover allowed better inspection.

3.3: Large Landscape Features in the General Area

The following paragraphs discuss ideas and speculations during preliminary map and image analysis, walkthroughs, and cursory post-excavation considerations. LIDAR, in particular, has allowed us to consider larger landscape modification issues and different methodologies in a new light (Evans 2016; Evans 2010; Evans et al 2013), although ground truthing surveys and subsurface testing still remain necessary complements.

Tonle Snguot is located outside the North Gate of Angkor Thom abutting the eastern side of an ancient Angkorian north-south canal and road leading north to the Great Northern Canal (Figures 1 - 3). The Tonle Snguot temple (chapel, gopura and entryway) faces east towards a moderate sized defunct rectilinear artificial Angkorian reservoir (*trapeang* or *baray*). The reservoir is on the opposite side of the canal and road and is more likely an articulated hydrological feature with Preah Khan.

The reservoir measures approximately 800 m along the east-west axis and 400 m along north-south axis. A rectilinearly defined forested area to the north of the reservoir may have been part of a specific conjoined landscape feature (or pair of features) when it was constructed. It would then measure approximately 800 x 800 m. Similar sized embanked square features can be seen around the Tonle Snguot area to include a larger square embanked feature containing Tonle Snguot itself. The relation of these sites and features (if any) to Tonle Snguot is unknown. Testing the canal, road and reservoir were part of the initial project sampling plan although the team only managed to test the Tonle Snguot site during operations.

The area to the south of this reservoir contains several sites and features as well – most notably the unique Krol Romeas site: a large circular laterite-walled enclosure that is thought to have served as an elephant corral – the interior laterite wall having numerous sizeable grooves presumably for large tree-boll wooden pillars^{xi}. Several

^{xi} Of note, the ethnic Banong and Kue have a history for monopolizing elephant capture, training, use and trade in the ethnographic and ethnohistoric record. It would be interesting to postulate a dedicated ethnic community of elephant trainers and caretakers in the area.

water containment/control features and other unknown types of features are also clearly visible in the LIDAR images. Lastly, it is likely there exists remnant evidence for ancient settlement and land use in the vicinity.

The area to the west of Tonle Snguot and just north of the Angkor Thom wall and moat contains village houses and house gardens for about 1.5 km. Sporadic evidence of earlier settlement is present (e.g., ancient potsherds in surface scatters), but there is currently insufficient evidence to claim settlement existed prior to the mid to late Angkorian periods.

Prasat Prei is approximately 1.6 km due west of Tonle Snguot. Another major site, Prasat Banteay Thom, is approximately 1.5 km north and slightly east of Prasat Prei (Figure 4). Prasat Prei contains structures and layouts similar to a Jayavarman VII hospital site (which may have been its function) – perhaps servicing a different community and/or providing different types of services and functions. It is larger, has a formalized surrounding moat and enclosures, but otherwise contains the normative components: chapel, pond, library, entryway, and an enclosing wall. The nature of a large square reservoir (700 x 700 m) with a mound and foundation remnants in the center (Kagn Chan Ta Ourn) and the rectangular reservoir abutting the south (between Prasat Prei and Tonle Snguot) is unknown. It is possibly related to Prasat Prei – a water reservoir with a central island-temple. Both Prasat Prei and Prasat Banteay Thom sites are stated to be late Angkorian, although Prasat Banteay Thom contains brick architecture and is possibly reminiscent of earlier constructions.

Figure 4 highlights several of the large square, rectangular, and linear topographic features that are easily identified in the LIDAR imaging. Other dykes transect these features, some of which appear to intentionally subdivide or compartmentalize larger features. Alternatively, some patterns may reflect previous features being built over or modified in later periods. A somewhat orthogonal mound-pond settlement pattern is evident, although it is ambiguous and far less structured than what appears within Angkor Thom or Angkor Wat – Angkor Wat having the most clearly defined and ordered orthogonal urban settlement planning.

At a larger macro-scale (Figure 5), there appears to be various types of integration among large contiguous landscape features, water features, and sites along an east-west corridor (north of the Angkor Thom wall and moat). This may stretch several kilometers in length. Preah Khan and the massive Jayatataka reservoir (which houses the Neak Pean temple) fall within this belt – all contemporaneous with Tonle Snguot (Jayavarman VII period). [Incidentally, the Neak Pean is also associated with healing qualities.]

As stated, many features and sites in the larger swath are known to date to the late Angkor period – mostly associated with Jayavarman VII (e.g., Angkor Thom, Neak Pean, Preah Khan, Jayatataka, Prasat Prei, Prasat Banteay Thom). However, it is noted that the massive East Baray located just south of the Jayatataka dates to the 10th century. One would expect earlier settlements in the area; minimally for construction crews and support services. But, how much earlier?

The larger sprawling Angkorian urban landscape and settlement zone, especially following the later 9th century move to Yasodharapura (Angkor proper) has at least a 600 year history of increasing large-scale settlement, development, construction, industry, landscape modification, and hydrological engineering. Angkor Thom itself contains many earlier sites within and adjacent to Angkor Thom’s larger outer walls.

Figure 1: Location of Tonle Snguot (APSARA Map)

(note: all LIDAR base images below courtesy of APSARA Authority)



Figure 2: LIDAR image depicting Tonle Snguot and other major sites

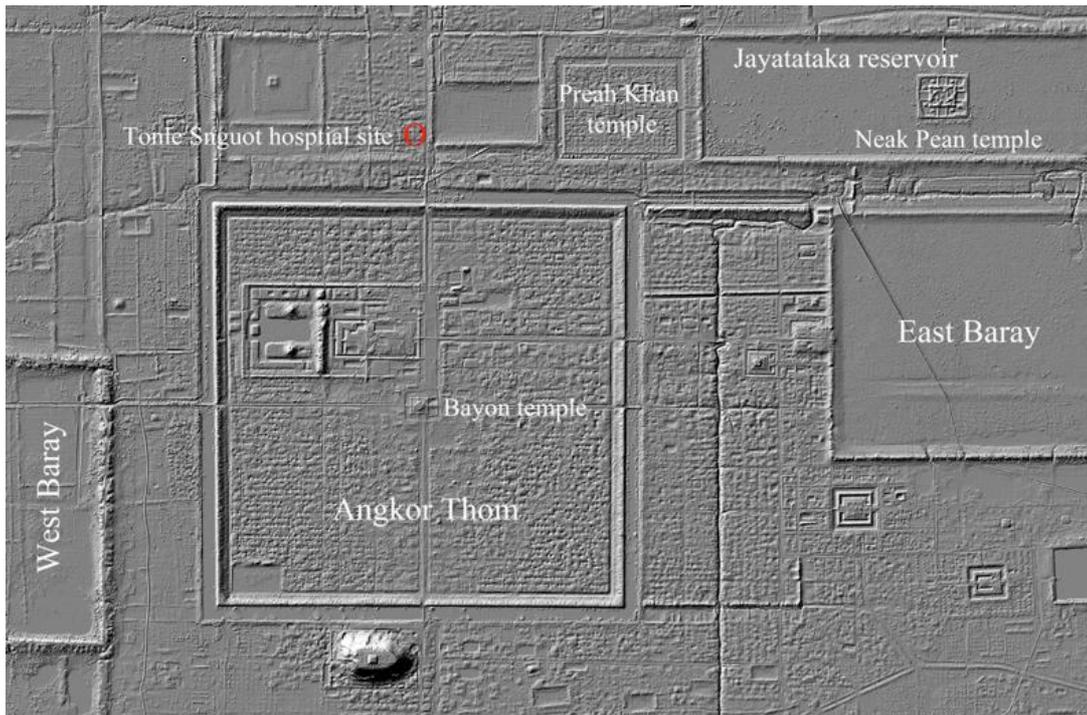


Figure 3: Google Earth Image of Tonle Snguot highlighting the eastern reservoir feature

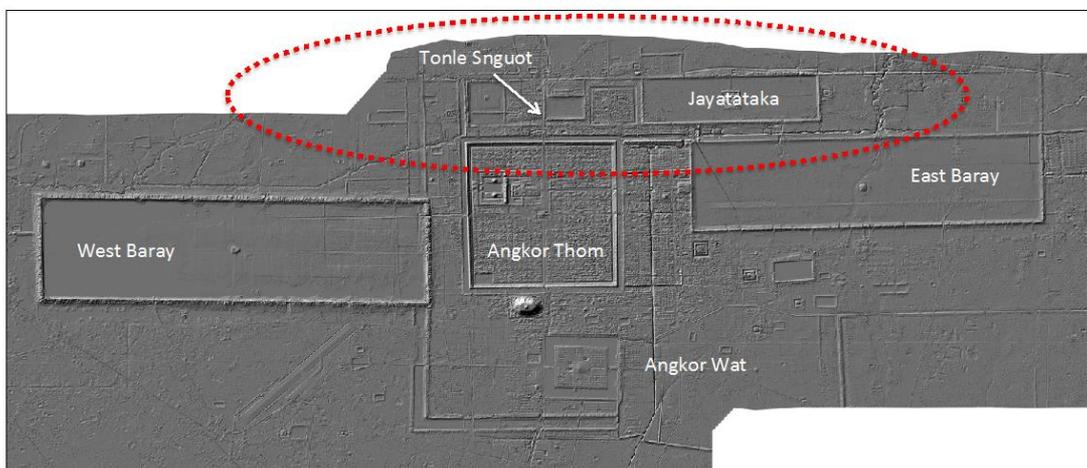


Figure 4: Prasat Prei, Prasat Banteay Thom, Krol Romeas and other features



(Note: the intent of this image is to cursorily demonstrate the intensity of landscape modifications, water features, possible settlement areas, etc. in the broader context; almost all the major sites and features in the area are late Angkorian)

Figure 5: East-West corridor of numerous large and transected rectilinear features



The dotted red circle highlights a “busy” (congested) corridor for large landscape modifications, architectural constructions, hydrological engineering, and agricultural sectors (field systems, plantations[?], etc.). The great north canal extends due north from from center (in line with Angkor Thom axis) to the Phnom Kulen (Kulen Mountains – canal ends at foothills). An east-west belt of large square and rectangular contiguous segments is seemingly visible - but it’s possibly wishful thinking if they were contemporaneous units in a much larger master-plan. Contemporaneity and/or variable construction sequences of many features remains unknown. Many, however, are associated with the 12th/13th centuries Jayavarman VII/Bayon period. It is possible that several large features may have been truncated or built over with the construction of Angkor Thom, the Jayatataka, etc. It is reminded that the East Baray was built 3-4 centuries prior to Angkor Thom.

(Note: it is unknown how many features and sites are contemporaneous, integrated, represent integrated planned sectors/units, have truncated or built over earlier sites, etc.: slide from 2017 NSC presentation by D. Kyle Latinis).

The lengthier history may include prehistoric and protohistoric sites, some of which later became pre-Angkorian sites (e.g., Prei Khmeng). Other prehistoric and protohistoric sites may have been absorbed while several were likely abandoned (Heng 2016) – perhaps the inhabitants being drawn into urban emigration. Several earlier settlements may have simply been outcompeted and subsequently abandoned. In turn, Pre-Angkorian settlements may have followed a similar path during the Angkorian periods. With the evidence thus far, however, it remains unclear. The northern swath of settlement interest depicted in Figure 5 may simply represent expansion into relatively uninhabited or marginally inhabited areas.

In summary, the repertoire of landscape features in the surrounding sectors at the scale of several kilometers (larger than depicted in Figures 1-5) include roads, canals, dykes, dams, reservoirs, ponds, *trapeang*, *baray*, terraces, mounds, structures, agricultural field systems (wet-rice *padi*/paddy fields; dry agricultural systems; house gardens; plantations; possible recreational and/or royal parks and gardens; etc.); possible aquacultural systems (?); neighborhood grids; quarries; industrial production areas (e.g., kilns, metal workshops); other forms of infrastructure; possible staging areas for construction activities; possible markets; and many unknown features (e.g., the maze/coil-like features south of Angkor visible in LIDAR imaging (Evans 2016; Evans et al 2013). Not all of these types of features have been identified or necessarily occur in the area surrounding Tonle Snguot, proximate sites, or the northern sections inside and outside Angkor Thom, but the list elucidates a realm of possibilities for further research.

The ‘bottom line’ is that massive landscape modifications were likely undertaken in the area for centuries or longer. The construction of the East Baray to the development of Angkor Thom already represents three centuries. Large-scale landscape modification, urbanization, and sophisticated water control engineering by the Khmer people began at least in the Funan period (1st – 6th centuries CE), and arguably had incipient roots in the Bronze and Metal ages. The scale and sophistication increased dramatically in the 7th-8th centuries (e.g., Sambor Prei Kuk), and then again in the 9th century – the dawn of Angkor – with a range of early Angkorian capital constructions and increased larger-scale urbanization ranging from Phnom Kulen to the Tonle Sap.

Evans et al (2013) break up various Angkorian periods to assess scalar shifts of greater construction intensity, systematic planning, and more formal geometric design imprinted on the landscape; particularly from the late 11th to 12th centuries and then again by the late 12th to 13th centuries. However, by the time Angkor Thom was built the rigid, formalized, redundant and orthogonal city block pattern witnessed at Angkor Wat seems to have given way to more haphazard patterning. Evans et al note (2013: 12597-12598):

“In the 11th to 12th centuries, we discern a marked shift in the patterning of urban space. Linear elements such as roadways and canals begin to appear within the moated precincts of temples and eventually form symmetrical rectilinear grids that define city blocks.”

“In the late 12th to early 13th centuries this “overflow” of the rectilinear grid into areas far beyond the space delimited by temple enclosures becomes well established. With the construction of Angkor Thom in this period, we see unambiguous evidence of the construction of a “city wall” as distinct from a temple enclosure; however, it is once again clear that the rectilinear grid encompasses both intramural and extramural areas, and transitions almost seamlessly in extramural areas into the surrounding low-density urban landscape. The organization of space within each of the city blocks has undergone a significant transformation by the 13th century, however, as the highly formalized spaces of the 11th to 12th centuries give way to a less rigid pattern, with ponds and mounds showing a significant degree of variability in placement, size, and morphology.”

“In terms of medieval urbanism, this is the end point of a trajectory that begins with the essentially open cities of the 9th to 10th centuries, progresses through a period of increasing urbanization and the formation of high-density nodes in the 11th and 12th centuries, and culminates in the 12th to 13th centuries when the high-density nodes in the central area of the settlement complex have expanded and coalesced.”

However, it is possible that the space in which Angkor Thom and surrounding areas were used had slightly earlier and/or later settlement modifications resulting in the less structured mound and pond orthogonal observed in the LIDAR images compared to Angkor Wat. That is, it is possible that the neighborhoods at Angkor Thom were resettled and repurposed multiple times. Residents may have settled there for lengthier durations. The material cultural density and settlement duration at Angkor Wat (Stark et al 2015) seem significantly less dense with briefer periods of use respectively than seen at Angkor Thom or elsewhere (e.g., Koh Ker, Latinis 2016). It is also plausible that Angkor Wat and Angkor Thom have different settlement and activity natures along at least a few variables of analysis (e.g., settlement and activity nature, duration and intensity). Stark et al (2015), for example, discuss periodic, intermittent and/or rotating settlement patterns at Angkor Wat that may have left a quite unique archaeological footprint at those particular sets of sites.

Without recourse to a lengthier discussion here, it is noted the Tonle Snguot area for several kilometers **in any direction is a very “busy and congested” area of landscape features, particularly water features.** This is not surprising given that this is the entry direction (north to south) of water systems (natural rivers and artificial canals such as the Great North Canal) from Phnom Kulen, through agricultural lands, into the Angkorian cities (also captured in many *baray*, *trapeang*, ponds, etc. at various locations), and ultimately draining into the Tonle Sap lake. Angkor is well-known for

its water engineering and large-scale hydraulic systems.^{xii} Additionally, Tonle Snguot is located near the gate of one of the largest Angkorian urban complexes – Angkor Thom. It is reminded that we are not arguing that Tonle Snguot is the pivotal feature. Rather, Tonle Snguot likely integrated into numerous features and may not have been in the original Angkor Thom planning. The hospitals could have easily been added features as supplements to original city design.

Meanwhile, debate continues around the function, symbolism, and overall purpose of many features. Discerning particular time periods for each landscape feature is also complicated and often ambiguous. Many are not well researched; some not researched at all.

For example, the period of construction for the reservoir opposite Tonle Snguot is unknown – as with several other abutting, “containing” (surrounding), and proximate landscape features. As logic and parsimony would dictate, however, many are likely contemporaneous with Angkor Thom, Preah Khan and Tonle Snguot (i.e., Bayon period - Jayavarman VII - late 12th/early 13th centuries CE). Additionally, we do not know if the managers and engineers of these separate undertakings were all that concerned about precise integration with the boundaries of proximate sites. Notwithstanding, we suspect some of the features may be older – dating to the middle to early Angkorian periods with perhaps some pre-Angkorian “footprints” of settlement and land use. LIDAR and topographic analysis is ongoing in our Tonle Snguot project (surface maps, satellite, LIDAR; and subsurface/geo-archaeological core and site stratigraphy analysis). Once thoroughly assessed and [hopefully] backed with robust ground truthing and subsurface testing, a better understanding will emerge^{xiii}.

To recap for emphasis: Tonle Snguot is built on an artificial mound. The site is enclosed by and adjacent to several larger rectilinear and linear earthen and water features (e.g., dykes, walls, terraces, berms, mounds, ponds, reservoirs, canals). A large north-south canal separates Tonle Snguot, the road, and the reservoir to the east. The reservoir is on the west side (back) of the Preah Khan temple (i.e., between Tonle Snguot and Preah Khan) and more likely relates to Preah Khan.

The remnants of semi-orthogonal mound and pond settlement features exist around Tonle Snguot. They are less formally organized than those witnessed at Angkor Wat – perhaps implicating less controlled settlement, less planning, and/or longer use and reuse; possibly even less enforcement of property boundaries. This more haphazard

^{xii} It is noted that since Funan and possibly pre-Funan times, the ancient Khmer have increasingly mastered techniques on how to store or obtain water when it’s needed; how to manage annual water level shifts advantageously; and how to get rid of excess water when there’s too much; although water system mismanagement and poor engineering have been factors in collapse models.

^{xiii} Regarding evidence of patterned features, termite mounds need consideration. Termite mound patterning may relate to past wooden pillar supports used for organic structures such as buildings and halls that are no longer preserved. **There may have been various termite “feeding frenzies” in the past.** It is possible that the termite mounds are quite ancient, having concretized and preserved over time. Wayne Johnson is highly thanked for providing these insights.

appearance is more common throughout Angkor Thom within and outside of the site. Natural processes is also a possibility worth testing.

Large water, earthen, and architectural features exist throughout the greater area abutting the northern wall of Angkor Thom. This occurs along a lengthy east-west corridor several kilometers long. The possible relationships, functions, symbolism, etc. [if any] of all sites and features in this broader area remain unknown. Some may represent different periods of construction, use, disuse/abandonment, and repurposing. However, most appear to be late Angkorian and at least somewhat adherent to large-scale planning. Field systems, however, may have been more organically emergent and it likely that modern field system construction may obscure many ancient field systems and features.

Different clusters of features may have articulated as various functional or symbolic systems. They may have even been parts of assorted master-plans during different periods – perhaps some preexisting structures were articulated into the planning by a successive engineer/architect working on different project during a later period.

Other than the Eastern Baray and related features with known construction dates, multiple time period construction is not clearly evident along the corridor in the LIDAR analysis except for a few possible locations where superimposition or unusual articulation of features may occur. Again, most pre-modern architecture sites and associated landscape features appear to be Bayon period. If earlier sites and features are represented, some may have been altered or augmented at later times (i.e., late Angkor, post-Angkor, etc.).

Specifically for Tonle Snguot we know that the post holes in the canal indicate **a wooden bridge connected Tonle Snguot to the road, further corroborating Wilson's** previous analysis (2017). This supports arguments for a contemporaneous integrated function of those particular features (bridge, canal, road); and/or, the hospital and bridge may have been built after the canal and road.

Regarding hospital sites in general, the only relatively clear speculation at present is that some of the hospitals (including Tonle Snguot) were intentionally placed outside the cardinal gates at Angkor Thom probably as part of a master urban design, or, were strategically emplaced shortly after when Jayavarman VII ordered the construction of numerous hospitals. A similar pattern of four hospital sites at the four cardinal midpoints/gates is replicated at Banteay Chhmar (Im 2014), for example. This is discussed further in the following sections.

3.4: Hospital Site Components and Features

Most known hospital sites compounds are comprised of relatively standard components (major site features) with fairly consistent spatial layouts (Im 2014) (Figures 6-9). Typically, they contain central stone and laterite shrines (chapels); libraries to the southeast; entrance gates, gopuras, and walkways to the east; enclosing walls (some made of stone or laterite); and 'sacred' ponds to the northeast (some

formalized or buttressed with stone or laterite and architectural embellishments). Many have larger square or rectangular ponds or water tanks to the northeast which are also frequently more formally constructed. There is some confusion as to whether the more proximate smaller 'sacred' ponds and larger less proximate water tanks to the northeast are synonymous. Some sites may have both. This needs validation. Interestingly, Zhou Dagan (Chou Ta Kuan) (Smithies 2001) notes that bathing practices were a frequent medicinal cure. Indian Hospitals also had medicinal bathing areas (Bhattacharya 2017:29; Prematilleke 2017: 307; Prematilleke & Aluwihare 1995; Aluwihare 2017; see also Chakravarti 1979). The pools may have functioned in similar manners. Architectural features are often ornately carved. An inventory of prominent architectural decorative elements, figures, and narratives as well as their spatial arrangements is beyond the scope of this study but would prove interesting.

This generic standard pattern is not clear at Tonle Snguot. The Tonle Snguot site contains a precariously cracked and collapsing central chapel, and highly degraded entryway, the possible ruins of a gopura (?) or entry hall to the east, the possible ruins of a library to the southeast, a semi formalized small pond to the immediate northeast, and no readily discernable formal enclosing walls^{xiv}. The site is in a mature state of ruin, continued degradation, attrition, and erosion. The central shrine requires numerous wooden supports and buttressing to prevent further collapse.

It is presumed that hospitals had diagnosis and treatment areas, living quarters (for staff, patients and families), and possibly medicinal gardens. They also may have had dedicated land, agricultural fields, animal pens, plantations, houses, and house garden plots associated with the compound or in nearby areas. We hope to conduct pollen, phytolith and residue analysis from Tonle Snguot to assist with understanding the local species-genera profiles and residue analysis to understand the nature of processed or stored items in jars, pots and cooking/preparation vessels.

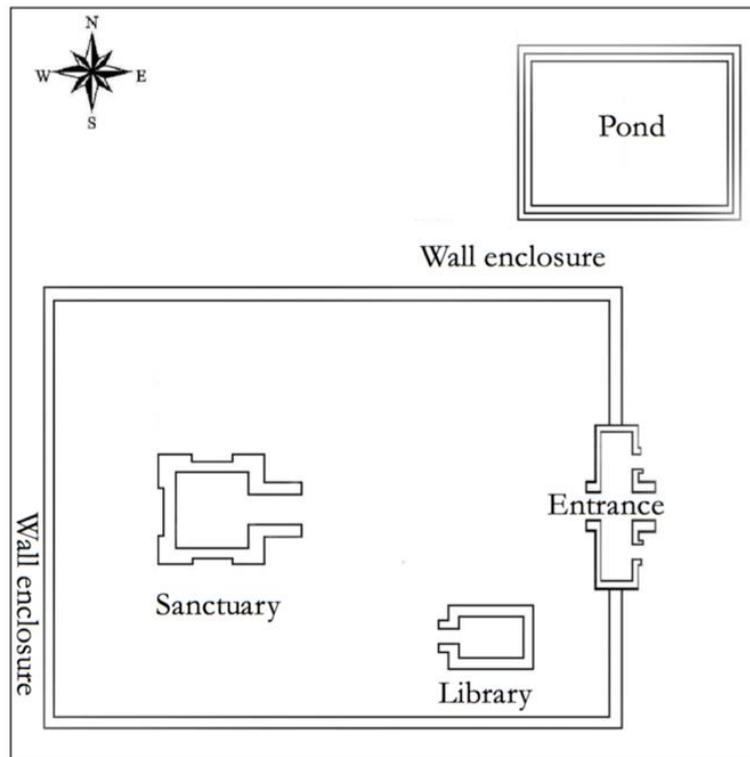
Treatment areas and living quarters were likely built of wood with possible stone foundations, floorings, alignments, drainages and/or post supports. If built on piles, formal floorings would not likely be present. Rather, compacted earth floors would be expected with a pattern of post holes, post hole supports, refuse, hearths and preparation areas. Roofs may have been thatch (e.g., grass or palm leaf), wood, or bamboo. Some roofs may have been tiled. Roof tiles are common at the site. Other structures may have been composed only from organic construction materials. Typical Khmer wooden structures are built on raised earth mounds with the main structure elevated on wooden posts/stilts/piles. The bases of wooden posts are generally supported by stones and rubble to provide firm support and prevent sinking.

The size of hospital site compounds may range from approximately 5000-10,000 m² (the Yeay Kom outer walled area is approximately 7000 m²); the chapel, library and

^{xiv} An enclosing wall may exist as defined by the edge of the fields to the north and south as well as the eastern embankment closer to the canal at edge of the site. The presence of walls was not tested or thoroughly surveyed due to the density of the secondary growth during the fieldwork and limited schedule. This also needs further testing and validation.

gopura structural areas are smaller, ranging from approximately 500-1000 m²; and the chapels themselves are around 20-30 m². The size of hospital complexes inclusive of habitation structures, activity areas, gardens and other features may be much larger (e.g., 1-3 hectares); and presumably much larger if dedicated agricultural plots, plantations, animal pens/corrals, and forest plots were included.

Figure 6: Features and plans for typical hospital sites (Prasat Ta Nup; from Im 2014)



Prasat Ta Nup (Prasat Samrong), IK, 226.16

Figure 7: Plan view of chapel and hospital complexes from Thailand (from Im 2014)

Particular Structures of the chapels found in Thailand

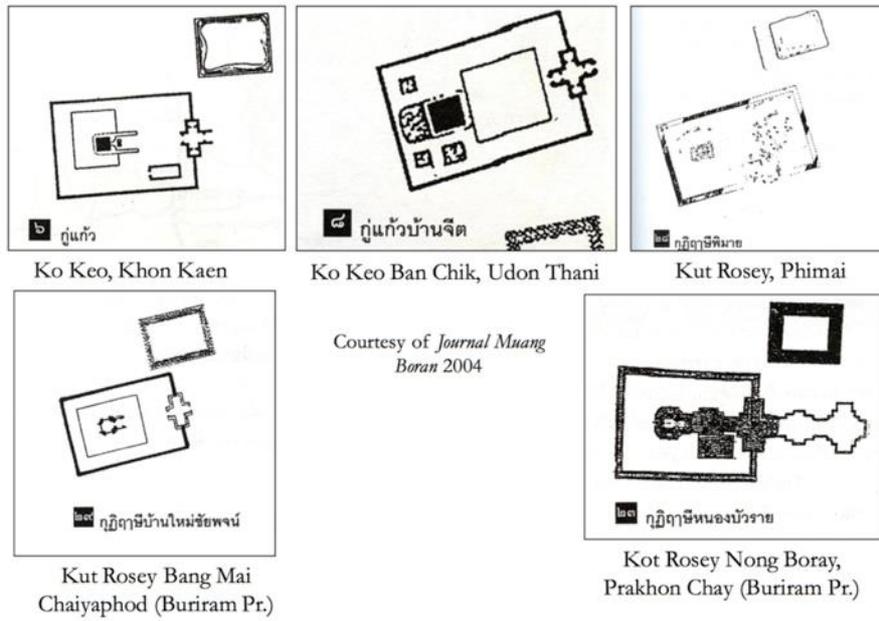
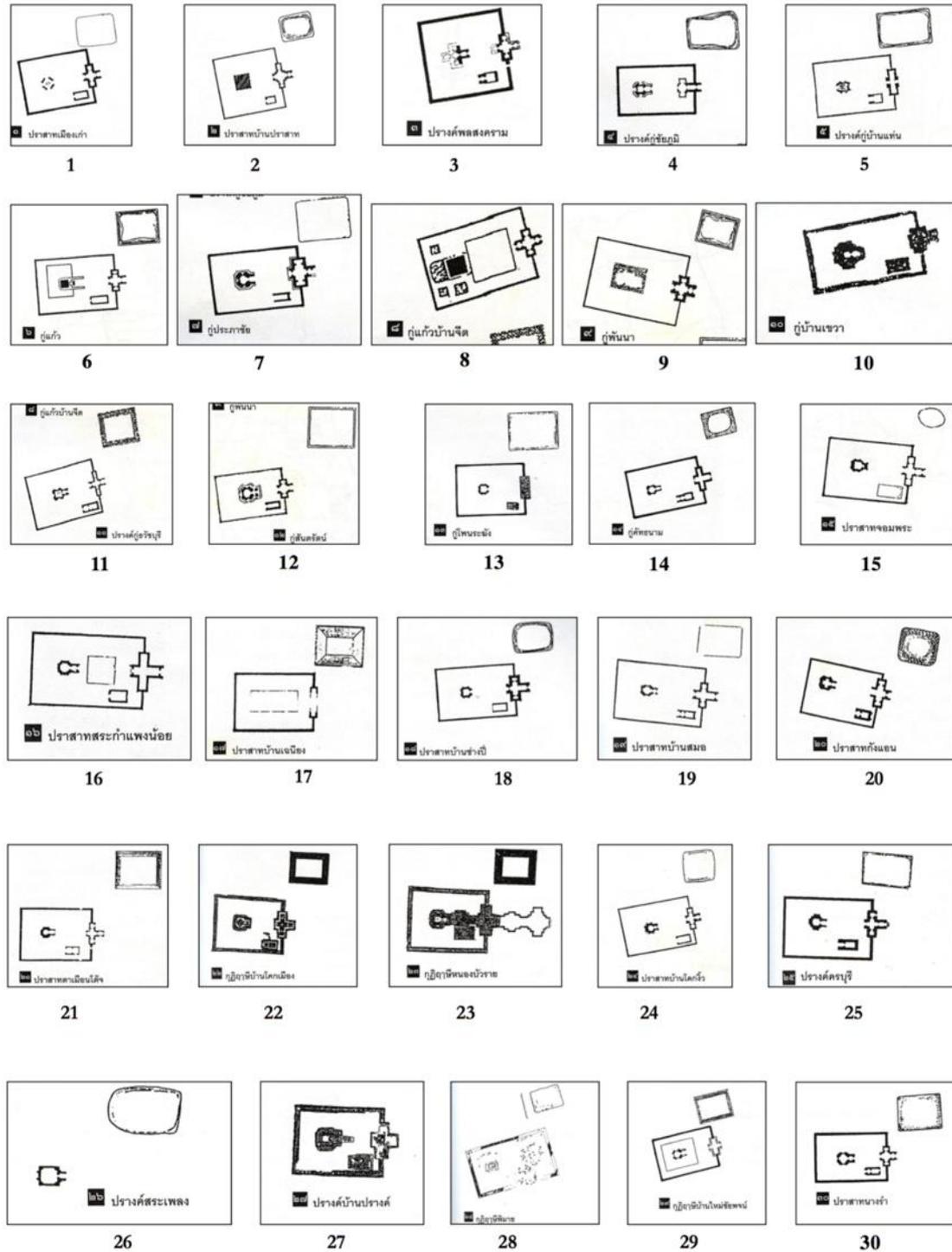


Figure 8: Plan view and site features for 30 comparable structures in Thailand

(from Im 2014)

30 various structural patterns of *Arogyasala* found in Thailand (*Journal Muang Boran*, 2004)



3.5: Tonle Snguot Name and Meaning

Prasat Tonle Snguot (Tonle Snguot): The full name roughly translates to “The temple or shrine [Prasat] of the dry [Snguot] stream/river [Tonle]; Dry River Temple”. This probably refers to the ancient artificial north-south canal [now dry] in front of the site to the east. The original site name is unknown to our knowledge, but was likely listed in an inscription at one point in time. Invocations, donations, assets, prominent people, and staff would have been included. For example, the Say Fong inscription (Finot 1903; Briggs 1951; Watson 2017) gives a detailed account of hospital staff (see below; also from Im and Ea, pers. comm.; Watson 2017). Given the recovery of in situ statuary during the recent campaign, it is possible an inscription still remains on site.

3.6: Hospital Staff

Beyond serving as spiritual, mental and physical healthcare facilities, the hospitals at the gates may have served as rest stops and checkpoints – also assuring healthy and sane people entered the city. The Say Fong inscription yields information on how the hospitals were staffed: 66 permanent staff to include: 2 doctors; 2 pharmacists (apothecaries); 8 nurses; 6 doctor assistants; 14 guards; 4 rice makers; 4 cooks; 4 secretaries; 6 servants; 2 *achar* (religious specialists/priests – who likely oversaw mental and spiritual diagnoses and treatments among serving the normative spiritual and religious needs of staff and visitors).

Briggs (1951: 233) calculated 101 staff from the Say Fong inscription (also referring to Finot 1903) including an astronomer and two sacrificers. Briggs (1951:233) further notes that Finot recognized nine hospital foundation stele by 1915 that, “extend from Say Fong, just below Vientiane in Laos, to the present southern boundary of Cambodia, but only two are east of the meridian of Angkor, while all except one in Battambang and the one at Say Fong are within the present limits of Siamese Laos.”

Most hospital sites have or had inscriptions. According to feedback from Hunter I. Watson (pers. comm.; 2017), several hospital inscriptions have been translated – or at least have been discussed by Thai and other archaeologists. Regrettably, we do not have access to all this information, but Watson (see Section 5) has provided information on other sites that have different staff lists and numbers – perhaps related to community size, specific needs or amount of state support provided. Watson indicates the preamble to the inscriptions are virtually identical. In fact, many of them may have been manufactured in a single workshop or set of centralized workshops possible located in the capital further lending credence to a heavily state supported and managed industry. They would have been augmented with additional information after delivery. The list, positions and total number of staff and additional information may vary considerably. Staff numbers and positions were apparently not standardized.

3.7: Tonle Snguot Site Dimensions

The total site dimensions for Tonle Snguot are not yet clear but estimated around 1-2 hectares maximum for the hospital compound and surrounding habitation, activity, and possible garden areas. Whether or not the hospital had designated agricultural fields (e.g., rice paddies) is unknown, but plausible – many inscriptions at various temples describe dedicated assets and donations, such as agricultural fields and staff.

The central elevated mound(s)/terrace(s) on which the Tonle Snguot chapel and main area rests is much smaller. As a coarse estimate, the main Tonle Snguot area is approximately 80 x 80 m to include the pond, library, temple, entryway and a few additional proximate features. If the western habitation and stretch of ponds are included, the site may measure at least 200 x 80 m. The maximum dimensions for the temple platform/mound are approximately 20 x 20 m with the walkway terrace and architecture extending east for another 20 m and approximately 5-10 m maximum width. The collapse and erosion make it appear much wider. The collapsed and eroded gopura or entry hall is expected to be wider than the walkway. Similarly, the scattered and collapsed surface remains also likely exaggerate the original width. The dimensions of these features were not mapped in detail during the field campaign. A GIS team was scheduled to assist, but unfortunately were tasked for other projects at the time.

The mound filled with ruined debris to the southeast is most likely the remains of the library structure (20 x 10 m; again, the actual size being amplified by collapse and erosion). Approximately five readily discernable ponds exist on the northern side of the compound. The ponds have approximately 20 m diameters. One is located to the northeast – the more formalized temple pond. The remaining ponds are located northwest and west. Several more possible ponds are located in surrounding areas. The mounds to the west are difficult to measure. They are not readily pronounced and dense secondary growth precluded sufficient mapping. It is estimated they are approximately 20-30 m in diameter. LIDAR images reveal squared plots ranging from approximately 20 x 20 m to 30 x 30 m in size. They are made of low earthen berms surrounding both mounds and ponds. It remains unknown if these are modern, historic or ancient (Figures 9 – 11).

Figure 9: LIDAR plan image of Tonle Snguot



3.8: Additional Features

Approximately 300-350 m east of the main shrine is a C-shaped (though squared/rectilinear) depression possibly opening to the east; Figure 10). This appears similar to various types of moat-mounds in which a small mound was augmented or artificially raised with fill to house a structure or shrine surrounded by a small partially enclosing moat. The fill for the mound was excavated from the perimeter which subsequently formed the surrounding moat. This feature needs further inspection and may be a component of a larger set of features articulating with the Tonle Snguot compound. If it is a related feature, it would extend the total site-complex size to at least three or four hectares. Another uniquely mounded feature is located between the chapel and the aforementioned C-shaped feature. These features were not formally mapped or tested during the 2017 campaign and deserve future attention. It is noted that there are at least four or five modern structures (houses/buildings) in this area including the noted features (Fig 10). Thus, they may be modern or historic.

Of interest, the immediate site area to the east of Tonle Snguot appears to be gridded by the aforementioned small low berms resulting in several square-like contiguous segments approximating lengths of 20 x 20 m to 30 x 30 m plots (Figures 11a-c). Some contain mounds while others contain ponds. These could be agricultural plots, but not typical wet-rice fields. These may represent remnants of a settlement system, such as gridded orthogonal neighborhoods typical of Angkor Wat and Angkor Thom mentioned above. Gridded neighborhoods are now understood to be common among many Angkorian urban sites. From the LIDAR analysis, there appear to be two

or three east-west rows with up to ten north-south columns. The fact that they are not as formally and geometrically placed as those seen at Angkor Wat would accord with the less precise patterns noted for Angkor Thom. If there was an intentional gridded design reflecting planned settlement neighborhoods, it is unknown if this was contemporaneous with the hospital complex, pre-existing, or a result of historic modifications. Habitation and late 12th and early 13th century contemporaneous dates, however, are largely supported with test unit and surface data (see below).

Either larger features may have had priority placement in the original design, or, the hospital was emplaced after the original landscape modifications. Some features may represent later augmentations – perhaps historic or modern. It can also be argued that the hospital complex was part of a larger design that contained kilometers of large delineated blocks of land from the east end of the Jayatataka extending west past Angkor Thom inclusive of water features, temple complexes, peri-urban neighborhoods, agricultural sectors, etc. However, we are inclined to take the position that all four of the cardinal gate hospitals were added contemporaneously or shortly after the original Angkor Thom wall, moat, and gate construction. However, it is unclear whether or not the walls, gates, hospitals and other features were all part of the same master plan. Thorough dating analysis of hospital or hospital-related inscriptions may help shed more light.

Figure 10: Possible moated mound features to the west of Tonle Snguot (not surveyed)

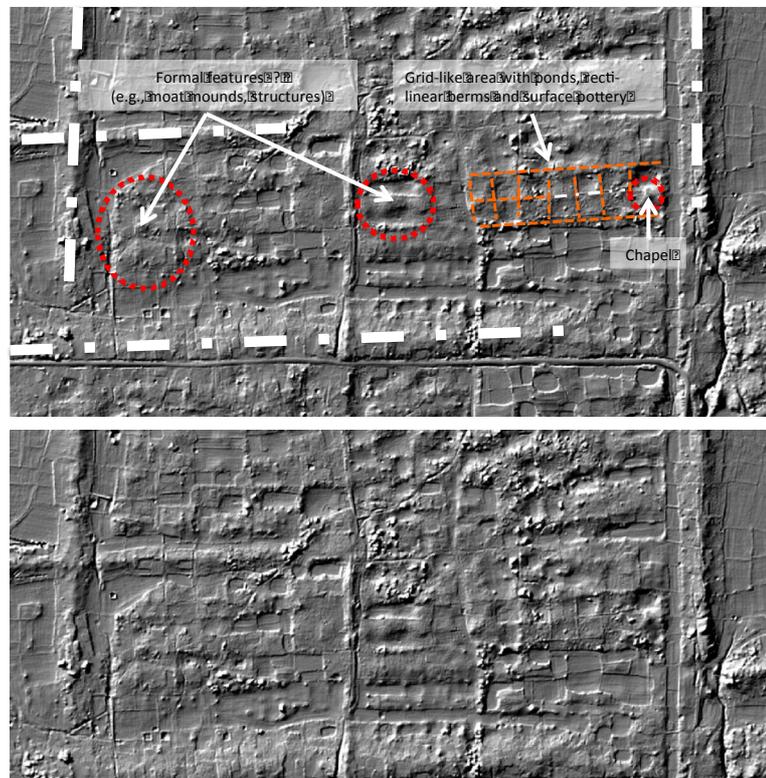
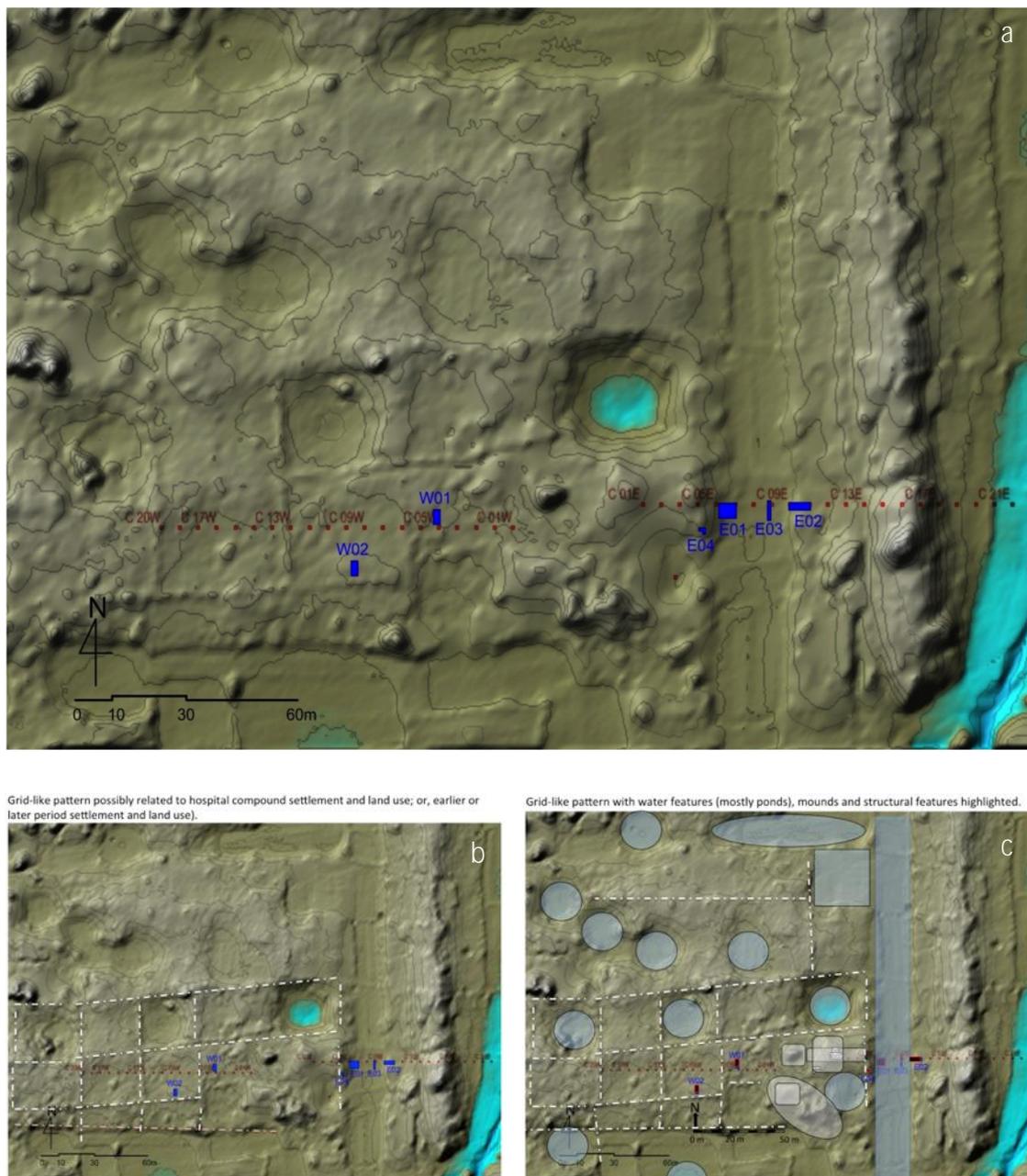


Figure 11: Plan image of Tonle Snguot depicting core and test unit locations (a); possible grid patterns (b); structural and water features highlighted (c).



3.9: Settlement and Dating Considerations (revisited)

The area around and inclusive of the Tonle Snguot site may have contained an earlier and possibly much larger habitation site, village or activity area. That is, there may have been a village-sized settlement prior to the construction of Angkor Thom and the hospital; perhaps prior to the Angkorian period. This seems less likely given the data, but it is possible.

During the topographic, satellite and LIDAR image analysis, a larger semi-circular area (possibly of slightly higher elevation) can be diffusely delineated (Figure 12). The current vegetation and land use may produce a misleading picture, although it cannot be wholesale rejected that the current vegetation and topographic patterns are resultant from past settlement, slightly higher topography, and differing soils. If this is the case, the visible pattern may represent 1/3-1/4 of a larger circular settlement site that was truncated by Angkor Thom's moat, wall, and other features to the south and east. Surface scatters of pottery remains, for example, are often low density but consistently occur throughout the area. Additionally, a strip of the current village settlement runs parallel to the north side of Angkor Thom's wall on the western side and then adjacent to Tonle Snguot closer to the gate where it then penetrates into the suggested area. The elevation, however, could have resulted from the construction of the moat and other features. Antiquity of the current or historic settlement area is unknown. Surface remains contain Angkorian to post-Angkorian artifacts, but nothing discernibly earlier. The GAP surveys (Brotherson 2017) also indicate sparse 11th century surface scatters, with larger frequencies of 12th-14th century datable tradewares. We do not know if earlier sites and assemblages were recorded in the immediate area.

Figure 12: Google Earth image depicting areas of current settlement and land use

Red circles indicate areas of current denser habitation and land use. Archaeological remains in surface scatters indicate older settlement in the same areas. Remains are primarily sporadic pottery sherds – some areas denser than others. No systematic survey was conducted. However, the GAP teams previously assessed, surveyed and tested some areas within the depicted zones as part of their systematic research endeavors.



(Note: surface remains in the area contain Angkorian and Song-Yuan Dynasty pottery sherds).

If there were pre-Angkorian or earlier settlements, they may not have occurred on the existing Tonle Snguot site itself. The mound(s) at Tonle Snguot were probably built up with fill specifically for the hospital. There may be earlier sites nearby, but current data from imaging is unable to reveal a possible earlier settlement pattern or site – especially without ground truthing and subsurface testing. None of the Tonle Snguot test units were deeply excavated. Although it is possible that more deeply buried cultural deposits lay beneath – perhaps separated by the relatively sterile and seemingly natural layers we encountered at basal levels – it seems unlikely.

Thus, we must reiterate with emphasis that no pre-Angkorian or earlier evidence was unearthed during excavations. The diagnostic glazed and unglazed stoneware (local Khmer and exotic) could date between the 9th to 15th centuries CE; but most probably date within the 12th-14th centuries – consistent with a late Angkorian occupation and use. Also, any earlier pottery may have been in circulation for quite some time. Most of the earthenware is temporally non-diagnostic, although detailed analysis of the ceramic assemblage is pending. There remains a chance that temporally diagnostic earthenware sherds will be identified, some of which may assist answering this question.

As stated, it is also emphasized that the 12th/13th century chapel mound and immediately surrounding areas were artificially constructed (raised, built-up) using soil and sand fill as evidenced by the geo-archaeological core testing. No earlier material culture was noted in the deposits – unlike some cases, such as Prei Khmeng and Koh Ta Meas (Heng 2016; Pottier 2006a).

The Prei Khmeng site, albeit a pre-Angkorian site, for example, supplies a case where metal age settlement and burial assemblages were excavated for fill to build a moat and mound for the pre-Angkor temple. The assemblages and stratigraphy are mirrored at the mid-point, with earlier Iron age remains in uppermost and lowermost levels as a result of excavating surrounding mound surfaces and piling up fill to build the mound. Heng (2016) also makes a strong argument for pre-Angkorian [and Angkorian] urban sites and temple clusters having deeper histories of continuity. Tala Borivat in Stung Treng and Angkor Borei (Wat Kamnou) in Takeo are noted examples (Heng 2016). Nevertheless, a similar case is not evident at Tonle Snguot. In addition, these sites generally have visible remains of earlier material culture at or nearby the sites – as surface scatters, road cuts, construction areas, erosion cuts, etc. This was not noted at Tonle Snguot or surrounding areas. A scenario depicted in Figure 12 may be pure wishful thinking.

The best dating methods we currently rely on are: a) art/architecture history – clearly within the late Angkor Bayon period; b) datable ceramics (exotic and local) – again, mostly late Angkor, Song-Yuan or later; and c) stratigraphic data – which do not indicate successive earlier occupations or activities at present.

Radiocarbon dates from the contemporaneous Prasat Tromoung site fall within the 11th-15th centuries, but mainly cluster in the 12th/13th centuries range (Pottier &

Chhem 2008). The material remains obtained from the east bank at Tonle Snguot (Unit E02) may be secondary older habitation deposits from a nearby pre-existing settlement that was mined for fill to build the dykes and road. However, the Khmer ceramics are mostly mid to late Angkorian.

At a smaller temporal scale, one can hypothesize workers, craftsmen and service communities living on or near the site during its construction; followed by hospital staff and a different service community after it was operational. It is also possible that a larger community organically developed near the Angkor Thom gate area, road, canal and Tonle Snguot hospital complex – perhaps parallel to the scenario just mentioned for the Tonle Snguot hospital complex, but a much larger scale: construction workers for Angkor Thom and other proximate sites, followed by settlers and service communities. In our repertoire of plausibilities, this is not unwarranted. There would likely have been lucrative social and economic benefits to the location – providing services and products for a busy funnel point. This might explain some of the artifact surface scatters in the area. These would add complexity to the settlement pattern. In fact, one hypothesis may be that the gates attracted larger settlements and thus may have required more medical services and staff. Minimally, these notional models provide hypotheses worthy of further exploration.

Current condition and use: Currently (Figures 13 and 14), the elevated portions of the site are covered in trees and secondary growth. Architectural remains are spread abundantly on the surface – especially near the chapel, gopura and library. Historic surface artifacts often consisting of 15th century and later local and exotic ceramic shards occasionally occur, though not in any currently discernable pattern, concentration, abundance.

The surrounding low areas are used for wet rice agriculture, gardens and grazing by locals. It is not a priority tourist location, although occasional small groups or individuals visit the site. The site is accessible by paths, with a nearby unpaved road. Village houses are located nearby (see satellite images; Figure 12).

3.10: Hypothetical Temporal and Functional Sequence

Thus, a possible sequence of occupation and site use can be proposed for further testing. The following sequence is not posited as the model that existed at Tonle Snguot; rather, it is proposed as a consideration for future research design.

- Pre- and Post-Angkor occupation and land use: No evidence thus far at Tonle Snguot other than limited surface scatters of post-Angkor ceramics implicating limited post-Angkor use. However, there are Iron Age, Funan, and pre-Angkor (Chenla) sites in the Angkorian area. Sites such as Prei Khmeng, Koh Ta Meas and Phum Lovea demonstrate continuity from the metal ages through pre-Angkorian and Angkorian periods. Also, many sites, including Angkor Wat, yield evidence of continued and/or periodic use through the post-Angkor, historic and colonial periods.

- Phase I: Farmstead, household and/or village settlement, house gardens, livestock and agricultural fields. Although there may be some evidence of earlier occupation and activities in the surrounding areas (e.g., features, ceramics and other remains), no current evidence clearly supports this at the Tonle Snguot site.
- Phase II: If earlier settlement existed, the site may have been truncated or modified by large Angkorian landscape features associated with accelerated and large-scale urban development (mostly earthen embankments, walls and dykes: artificial water features – ponds, lakes, canals). The evidence is unclear at present from topography, surface survey, and LIDAR analysis. However, lengthy earthen features transect the area and there are an abundance of water features.
- Phase III: Site repurposed as a hospital complex during the Angkor Thom master-plan and construction efforts ca. late 12th – early 13th centuries CE. Work crews were on-site during construction followed by a settlement shift with medical and support staff (also patients and visitors) when the hospital became operational. However, there is no current evidence the site was repurposed rather than simply built as an original undertaking. At present, we are unable to discern differences in: a) original site construction activities, b) subsequent hospital operations, and c) abandonment. We would expect differences but limited sample size and limited ability for appropriate fine grain analysis at this stage precludes any clear recognition.
- Phase IV: Hospital complex abandoned after dissipation of Angkorian Empire in 14th/15th centuries CE. There is no evidence of continued use, embellishments, or alterations of the temple or temple complex features, etc. after the 13th/14th centuries. The hospital complex was likely abandoned shortly after the demise of Jayavarman VII rather than the complete dissipation of the Angkorian Empire. Cessation of hospital operations and abandonment was probably related to termination (or lack) of support and funding.
- Phase V: Continued sporadic use for agricultural and proximate household or small village settlement. Occasional local and exotic ceramic surface sherds in the area indicate low-level post-Angkor presence and activity. Exotic sherds (Thai, Chinese, Vietnamese, others) also indicate they were connected to larger scale regional supply chains that imported exotic pottery and presumably other commodities. This is not an uncommon pattern in Angkor and elsewhere – i.e., low level settlement and activities continued into the historic and modern periods – possibly moderately fluctuating in density and intensity over the centuries.
- Current: The site continues to be minimally used for agricultural purposes by local villagers who respect the sacred integrity of the temple (chapel) ruins, architecture and artifacts. The site is marginally visited by tourists, although that will likely change given recent discoveries. Additionally, the site does not appear to have been looted – further evidenced by our ability to recover near-complete in situ statuary in shallow deposits. However, at least one local informant claims that some exposed statuary had been removed/looted in the past.

3.11: Additional Considerations Regarding Occupation and Dating

Some of the lower level structural remains at Tonle Snguot (e.g., quarried and shaped laterite blocks; see below), artifacts and stratigraphy do not necessarily indicate earlier occupation. Some of these may also represent unknown structures related to the hospital complex (e.g., staff or patient quarters), perhaps even a workshop – the western units containing multiple iron artifacts/tools.

Occurrences of numerous stoneware roof tiles indicate the present of wooden structures. Roof tiles are among the most numerous artifacts next to construction materials for structures (laterite and sandstone in particular). These mostly appear to be late Angkorian.

Post holes in the canal and banks indicate the presence of a bridge (likely built or upgraded when the hospital was erected). The canal and bridge are late Angkorian.

Datable glazed and plain stoneware ceramics range from the 9th – 15th centuries CE (some may be later; i.e., post 15th century). Though not particularly abundant, most stoneware sherds are comprised of Khmer green-glazed and brown-glazed wares as well as small amounts of Song-Yuan Dynasty Chinese wares (mostly celadon and Qingbai; both common in Angkorian sites). Most are probably late Angkorian.

The main temple area of the site was elevated by about four meters of fill (clayey sand). The fill was obtained from excavating nearby ponds, canals, etc. There is a more formalized main pond to the northeast of the temple that has laterite and sandstone buttressing (probably late Angkorian). Several additional ponds are located to the south – many of which may have been ponds related to households – possibly prior to the repurposing of the site to a hospital complex, contemporaneous with hospital use, and/or, after the hospital was abandoned. Several are a haphazardly placed – consistent with the less formalized pattern seen at Angkor Thom compared to the rigid grids at Angkor Wat.

Surface and subsurface cultural deposits are mostly sand with some clay/loam content. Sterile basal layers consist of more clayey lateritic soils. The depth of cultural deposits to the west (behind the temple site) is about 1.0 meter. There are indications of multiple layers but not necessarily multiple floors from different occupational periods.

4: EXCAVATION RESULTS

This section provides preliminary results from the 2017 excavations. The focus is primarily on the test units and material remains. Sampling was specific and targeted: a) stratigraphic test excavation units at mound edges to the west of the site to determine the nature of habitation and site activities; b) test units along the canal (banks and center) located to the east of the site to determine the nature of habitation, activities and further information on ancient bridge design. Core samples assisted determination of subsurface geomorphology and the extent of subsurface cultural deposits.

This site contains architectural structures of note (Figures 13 and 14). The architectural remains, however, were not targeted for archaeological or art historical assessment during this phase. The main temple (chapel) is precariously standing and highly degraded. Other structures are highly degraded as well (e.g., *gopura*, library, pond, walls, entryway).

Evidence of a formal walkway, halls, *gopura*, pillars and construction blocks are clearly visible but collapsed, eroded, partially buried and highly degraded. Sandstone and laterite are the most common visible materials. A considerable amount of the sandstone architectural remains are highly decorated. The presumed library is possibly the large southern mounded area with debris. It located in a normative library location. However, a discernable library structure and library features are not clearly evident. The pond to the northeast has evidence of more formalized construction and buttressing. It was not mapped or studied in detail although two core samples were taken from the pond. Fragments of construction material are scattered in a wide area around the site. Some of the blocks contain ornate carvings characteristic of late Angkorian/Bayon architecture and art. A few pedestal and statuary fragments are scattered throughout the surface of the site as well.

Mounded areas and ponds extend several hundred meters to the west. Dense secondary growth made it difficult to survey. The area around the chapel, however, had less ground cover and more trees. The canal to the east was dry and fairly clear of vegetation. The berm/road beyond was covered in trees and secondary growth. Further east is the large reservoir. It contains rice fields. They were dry on our first walk-through survey prior to initiating the Field School. The original plan was to retrieve core samples and excavate test units for comparative purposes from the reservoir area, although this was later scrapped due to the discovery of the statuary and time constraints.

4.1: Core and Test Excavation Synopsis

Testing began with 41 small cores spaced 5.0 m apart on linear axes (East [of the central chapel] 21; West 20)(Figure 11). Results indicate approximately four meters of fill was used to build up the mound near the chapel (i.e., temple to road surface). Erosion from the mound and temple as well as collapse of structural remains had covered proximate areas around the shrine and gateway/walkway. This buried statuary and masonry, but did not significantly infill the canal or ponds. The bank of the canal is in a state of partial

erosion. Almost all cores revealed cultural deposits. However, differentiating specific habitation/household sites versus activity areas or other land use from the core data remains speculative.

Figure 13: Tonle Snguot Chapel (photo by Ea Darith)



Figure 14: Tonle Snguot entryway (photo by Ea Darith)



(main temple/chapel in background; main pond in the depression to the far right)

On the second day of operations, the team discovered a 1.9 m near-complete sandstone *dvarapala* (guardian) statue dating to the 12th/ 13th centuries CE (Bayon period) at the entryway of the temple complex upslope from the canal. This disrupted normative operations. We had to spend substantial time conducting appropriate ceremonies and removing the statue for protection. We subsequently discovered several other statues (described in further detail below). Again, these were unexpected and altered our research operations significantly.

Six test units of variable size were then excavated totaling 61.5m² (E01, E02, E03, E04, W01 and W02): testing an estimated 0.1% of the site at most. Recovered cultural remains are described more thoroughly in the following subsection (Figure 13).

Sandy soils characterize the upper deposits until basal lateritic soils with more clay content were encountered. The ponds, however, generally have more clay content – presumably to allow better retention of water. Incidentally, three additional larger diameter auger cores were collected from pond locations for further soil and pollen testing – two from the formal northeast pond.

The eastern (E) units are at the entryway/walkway and *gopura* of the existing sandstone chapel to the north-south canal. The canal and canal banks were tested to further discern the nature of the bridge, sedimentation and geo-archaeology. Artifacts and ecofacts were recovered as well.

Post-holes were identified in the canal and proximate banks indicating a bridge structure made of wood. It is noted that this was previously tested during the GAP- Greater Angkor Project 2003 [U. Sydney](report by Andrew Wilson 2017). We simply found more post-hole evidence through further testing, but wanted to further define **dimensions**. Wilson’s (2017) geo-archaeology analysis is thorough. Our data corroborates his sequence.

Soils at the site were consistent with Wilson’s (2017) analysis (see also Appendix A):

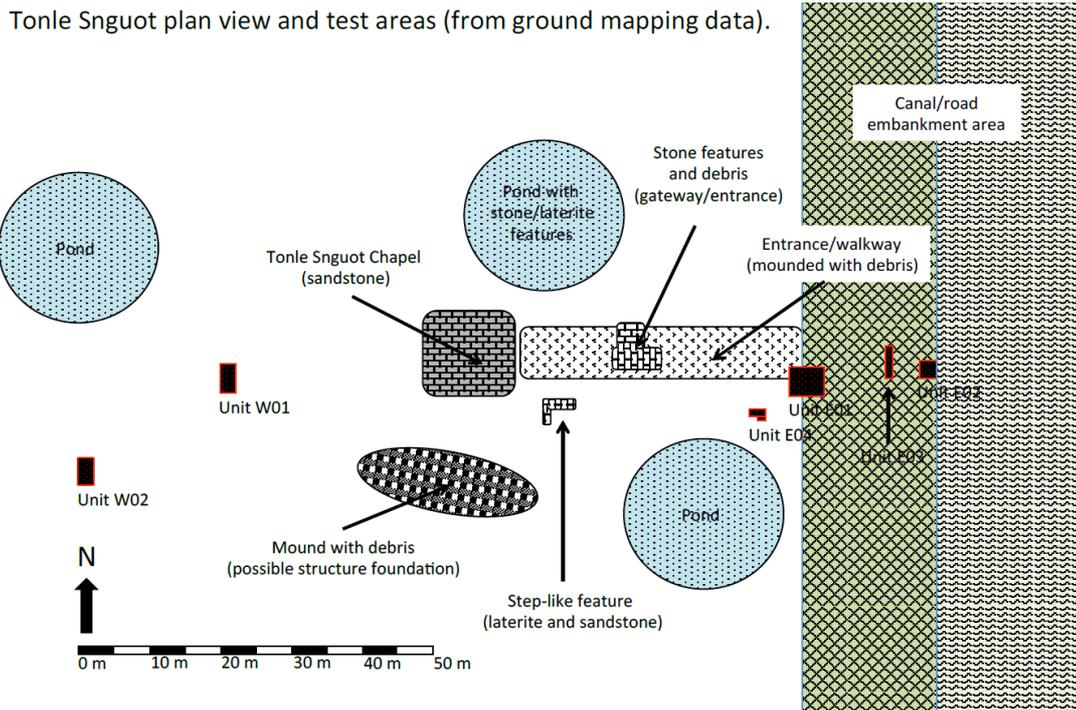
“Removal of unit 1 revealed two distinct deposits. Occupying the western 2m of the excavation area was a dark brown clayey sand with laterite inclusions [9]. This appeared to correspond with the bank of the canal. The remainder of the excavation area was taken up by a brown sandy loam soil deposit with charcoal flecks [2] containing a small number of ceramics.”

“light grey sandy clay mottled natural soil with black laterite [12] directly under the laterite block [10]. As excavation proceeded it became clear that these two deposits were mixed and so an interface unit [13] was defined.”

The eastern units from the 2017 NSC-APSARA campaign revealed approximately 1.0-1.5 m of cultural deposits. The units at the west side of the temple likewise had approximately 1.0-1.5 m of cultural deposits. Most remains were recovered in the upper 75-100 cm; the in situ statuary beginning just a few centimeters below surface. Artifact, ecofact, stratigraphic and soil analyses are ongoing. Thus, it remains

premature to indicate if there is more than one cultural deposit and if cultural deposits in different locations are contemporaneous. Generally, 3-5 layers were identified in most trenches with similar sandy soils, some charcoal flecking, and similar artifact remains. At present, the stratigraphy and cultural content seem restricted to the 12th/13th centuries – consistent with the architecture, art and epigraphic data, as well as Pottier & Chhem's (2008) results at Prasat Tromoung.

Figure 15: Plan view depicting test units and main features



4.2: Test Unit Finds

Unit E01: 5.0m X 5.0m; located on the east slope of canal. Five layers were noted. Cultural material recovered included:

- Large body and head of a sandstone Bayon period *dvarapala* (guardian) statue (Figures 14-17). It is broken at the lower legs: measuring 190-200cm (without feet) and approximately 58cm wide. Estimated total height would be approximately 2.5 m depending on the pedestal height. It was laying on its back – face facing upwards emerging only a few centimeters below surface deposits. **Although it's not in its original standing position, no signs of recent movement** were noted. The statue likely fell, broke, and may have been moved in antiquity. Parts of the arms and legs are missing, but otherwise it is near-complete and in good condition with intricate carved details. The nose is eroded, however. A broken piece of leg was also recovered. The statue was removed following ceremonies and subsequently taken to the museum and conservation area for protection and further analysis along with all other statuary at the site (all artifacts, ecofacts, and soil samples are now stored with APSARA Authority

following the end of the 2017 campaign – to be further studied during upcoming post-excavation analysis).

- A white oval crystal (1.0cm x 2.0cm) (Figure 18). The crystal is speculated to have been used as a decoration for the *dvarapala* (guardian) statue.
- A sandstone statue arm fragment – not related to the *dvarapala* (guardian) (Figure 19).
- A small palm-sized (15cm x 10cm maximum) sandstone statue of a kneeling elephant carved in the round (Figure 20).
- A foot fragment of sandstone statuary with base (Figure 21).
- A squared flat polished stone fragment (sandstone) with cut grooves (approximately 15cm x 12cm x 5cm) (Figure 22).
- Two highly oxidized iron tools (likely a short knife 15cm x 3cm and a nail 7cm x 1.5cm) (Figures 23 and 24).
- Numerous fragments of stoneware roof-tiles.
- A small amount of Song-Yuan Dynasty Chinese ceramic sherds.
- 90g of faunal remains.

Figure 16: Dvarapala statue in situ (photo by Ea Darith)



Figure 17: Dvarapala head in situ (photo by Chan Wai Peng)



Figure 18: Dvarapala statue at conservation storage area (photo by Chan Wai Peng)



Figure 19: Dvarapala removal ceremony (photo by Ea Darith)



Figure 20: Crystal (photo by Ea Darith)



Figure 21: Arm fragment from broken statue (photo by Ea Darith)



Figure 22: Carved elephant (photo by Ea Darith)



Figure 23: Feet and pedestal from broken statue (photo by Ea Darith)



Figure 24: Smoothed stone with grooves (photo by Ea Darith)



Figure 25: Iron object (knife) (photo by Ea Darith)



Figure 26: Iron object (nail) (photo by Ea Darith)



Unit E02: 6.0m x 2.0m; located on eastern bank of canal. Four layers were noted. Cultural material recovered included:

- Numerous faunal remains (fragmented; mostly food remains) (Figure 27), to include a mammalian long bone and possible skull fragments, teeth (large mammal - cow). There is a possibility that some human skeletal material may be present – the GAP teams having recovered a skull at the Thvea Dei Chnang site in 2006 (Johnson et al 2006). Faunal remains occurred in the soil deposits used to build the dyke, suggesting people may had lived there before the dyke was built.
- Wood recovered near the faunal and skeletal remains.
- Numerous Khmer ceramics sherds.
- Sandstones fragments.
- Laterite chips.

Figure 27: Skeletal and teeth remains from Unit E02 (photos by Ea Darith)



Unit E03: 1.0m x 6.0m; located in the middle of canal. Three layers were identified.

- A post hole 26cm in diameter and 70cm below surface was identified – likely part of a former wooden bridged (corroborates Wilson’s finding; 2017). No Findings (Figure 28).

Figure 28: Post-hole feature (photo by Ea Darith)



Unit E04: 1.0m X 2.0m with 0.5 mx 1.0m southeastern extension. Two layers were noted. Findings primarily consisted of statuary. There are six large statue pieces representing five figures (Buddhas/Bodhisattvas): two lower body halves and bases; three heads; and one complete body from neck to base. Only one head and body can be articulated forming a complete statue (probably a Candravairocana or Suryvairocana). All other pieces are from differing statues.

- Two pieces of a sandstone Buddha statuary seated on a nagas from the knees to the bases: One piece has a pointed foot under the naga body with a medicinal fruit (myrobolan?; possibly *Terminalia spp.*), covered box or jarlet representing a Bhaisajyaguru (Medicine Buddha). The other piece does not have a pointed foot. These are presumably Bayon-period styles. Bases have tenons for insertion into a larger pedestal.
- Two pieces of a carved sandstone Buddhas seated on nagas. One piece extends from the belly to naga head. The other piece is a head projecting outward with broken naga heads sheltering the back of the head.
- A seated Buddha resting on a lotus base. The head is broken off (two fragments), but otherwise the statue is complete from head to base. The hands are slightly extended in a praying-like position clasping a round elliptical object. The object may be a fruit or jar. There is a circular carved portion at the top of the object (i.e., the outward extended position just beyond the fingers) as if a protrusion,

knob, or lid but it is difficult to discern its true nature (e.g., top of a fruit, lid to a jar, etc.). It is the aforementioned Suryavairocana or Candravairocana.

- No other artifacts were mentioned in the initial field report, although it is likely that some were collected (unit notes were not available at the time this was written – notes are still with the stored material).
- 550g of ceramics.

Figure 29: Buddha/Bodhisattva statuary in situ during excavation (Photo by Chan Wai Peng)



Figure 30: Buddha/Bodhisattva statuary in situ during excavation (Photo by Chan Wai Peng)



Bhaisajyaguru Medicine Buddha on left holding a medicinal fruit, jarlet or covered box; Praying Buddha/Bodhisattva [Candravairocana or Suryavairocana] on right holding object in hands)

Figure 31: Buddha statuary in situ during excavation – head sheltered by naga (photo by Chan Wai Peng)



Figure 32: Buddha statuary after removal (photo by Ea Darith)



(left to right: Bhaisajyaguru legs, hands and pedestal; Buddha head and torso sheltered by naga; broken head and body with base of Buddha/Bodhisattva holding object in hands (Candravairocana/Suryavairocana); Head [upper] and lower body of possible Bhaisajyaguru Buddha [undetermined])

Figure 33: Buddha head backed by sheltering naga (photo by Ea Darith)



Figure 34: Buddha head and torso backed by sheltering naga (photo by Ea Darith)



Figure 35: Buddha/Bodhisattva head (Suryavairocana or Candravairocana); articulates with Figure 36 body (photo by Ea Darith)



Figure 36: Buddha/Bodhisattva (Suryavairocana or Candravairocana) body and pedestal; articulates with Figure 35 head (photo by Ea Darith)



(note: holding large round object such as pot or large fruit in hands)

Figure 37: Buddha legs, hands and pedestal (unknown if Bhaisajyaguru – possible object in hands is indeterminate) (photo by Ea Darith).



Figure 38: Bhaisajyaguru (Medicine/Healing Buddha) legs, hands, pedestal (note: fruit, jarlet of covered box in hands) (photo by Ea Darith)



Figure 39: Ceremony for group blessings, protection and removal of statuary (note: Buddhist statuary in background) (photo by Chan Wai Peng)



Figure 40: Ceremony for group blessings, protection and removal of statuary (note: Buddhist statuary in foreground) (photo by Chan Wai Peng)



Unit W01: 2.0m x 4.0m; located on the southeastern portion of an east-west mound to the west of the chapel.

- An ancient compacted floor was identified approximately 20cm below the northwest corner extending to southeast corner.
- Numerous Khmer and Song-Yuan Dynasty Chinese ceramics were identified.

Figure 41: Unit W01 – northwest view (photo by Sok Chanthida).



Figure 42: Unit W01 – south view (photo by Sok Chanthida).



Figure 43: Unit W01 – east view (photo by Sok Chanthida)



Unit W02: 2.0m x 4.0m; located 15m southwest of Unit W01 in a low mound.

- A compacted ancient floor was identified approximately 40-50cm below surface.
- Four laterite blocks near the eastern wall were identified – probably pillar/post bases. Three measure 25cm, 30cm, and 50cm in length with thicknesses between 15-20cm. The larger sandstone block is 106cm by 24cm and 20cm thick.
- A highly oxidized iron object was recovered – possibly the head of an undefined iron tool.
- Khmer and Song-Yuan Dynasty Chinese ceramics were recovered.
- There were no roof-tiles, possibly indicating that some house roofs were not tiled (i.e., perhaps made of wood, bamboo, thatch and other organic perishable material).

Figure 44: Iron tool from Unit W02 (photo by Ea Darith)



Figure 45: Unit W02 – south view (photo by Sok Chanthida)



Figure 46: Unit W02 – southwest view (photo by Sok Chanthida)



4.3: Artifact Discussion

Ceramics (Figures 47- 55), building materials and statuary were the dominant finds. Small amounts of metal (iron, to include slag), bone/teeth, and charcoal were also recovered. Most of the construction material at the site (large carved sandstone and laterite blocks) was left in situ. The statuary were removed and stored with the museum and conservation area. The chapel construction and ornamentation blocks contain many carvings and intricate designs. These remain at the site. Artifacts, ecofacts and soils recovered from test units and coring are stored with APSARA Authority awaiting further post-excavation analysis.

Table 1 gives a basic summary of recovered material per unit. Ceramics include eroded low-fired earthenware sherds (mostly red, yellow and orange in color), higher-fired earthenware sherds, unglazed stoneware, glazed stoneware (Khmer – Angkorian: green-glazed and mostly later period brown-glazed perhaps from Buriram; Chinese – Song-Yuan Dynasty: celadon and Qingbai), and a few pieces of white ware/porcelain (Chinese) and one blue and white (Chinese: probably mid-late Ming). Most of the non-roof tile ceramics represent utilitarian storage and cooking vessels. Most probably date to the late Angkor period along with the majority of the glazed stoneware. The earthenware sherds are predominantly undecorated. The Qingbai covered box and a few other high-fired glazed ceramics could be considered high-value items and may have been personal or ritual items as well. However, they are not unusual for a variety of Angkorian contexts (i.e., celadon and Qingbai are frequently recovered in Angkorian sites). In fact, Qingbai wares are noted as medicinal containers at contemporaneous Indian hospital sites (Prematilleke 2017:313).

Units W01 and W02 had comparatively high densities of ceramics (Table 2) – not unexpected as these units were placed on the outer edges of probable habitation mounds (perhaps structures) where household artifacts tend to be more abundant. Unit E01 and E02 had slightly lower densities. These may also represent some degree of habitation, although roof-tiles have not been separated yet and these densities may be misleading.

Table 1: Artifacts by mass from all material culture bearing units

Unit	Ceramic (g)	Bone (g)	Teeth (g)	Iron/metal (g)	Sandstone (g)	Laterite (g)	Soil (g)	Area (m²)
E01	31,390	90	-	134	26,595	2,630	1,620	25
E02	12,890	2,325	695	-	-	1,400	*	12
E04	550	-	-	-	3,665	-	810	2.5
W01	10,520	-	-	210 (slag)	1,160	1,280	*	8
W02	12,888	-	-	30	2,740	740	9,440	8
Total	68,238	2,415	695	374	34,160	6,050	11870	55.5

Grand total: 123,802g

* Sample masses have not yet been calculated

Table 2: Ceramic densities per unit

Unit	Ceramic densities (g/m²)
E01	1,256
E02	1,074
E04	220
W01	1,315
W02	1,611
Combined	1,230

Figure 47: Assorted ceramic remains (photo by Ea Darith)



Figure 48: Assorted ceramic remains 2 (photo by Ea Darith)



Figure 49: Khmer Angkorian brown-glazed (photo by Sok Chanthida)



Figure 50: Assorted stoneware (photo by Ea Darith)



Figure 51: Assorted green-glazed stoneware (photo by Ea Darith)



Figure 52: Green-glazed stoneware with iron firing stains (photo by Ea Darith)



Figure 53: Chinese glazed ware – Qingbai covered box and white ware sherds (Dehua-?) (photo by Ea Darith)



Figure 54: Chinese glazed ware – blue and white (mid-late Ming?) and Qingbai covered box (photo by Ea Darith)

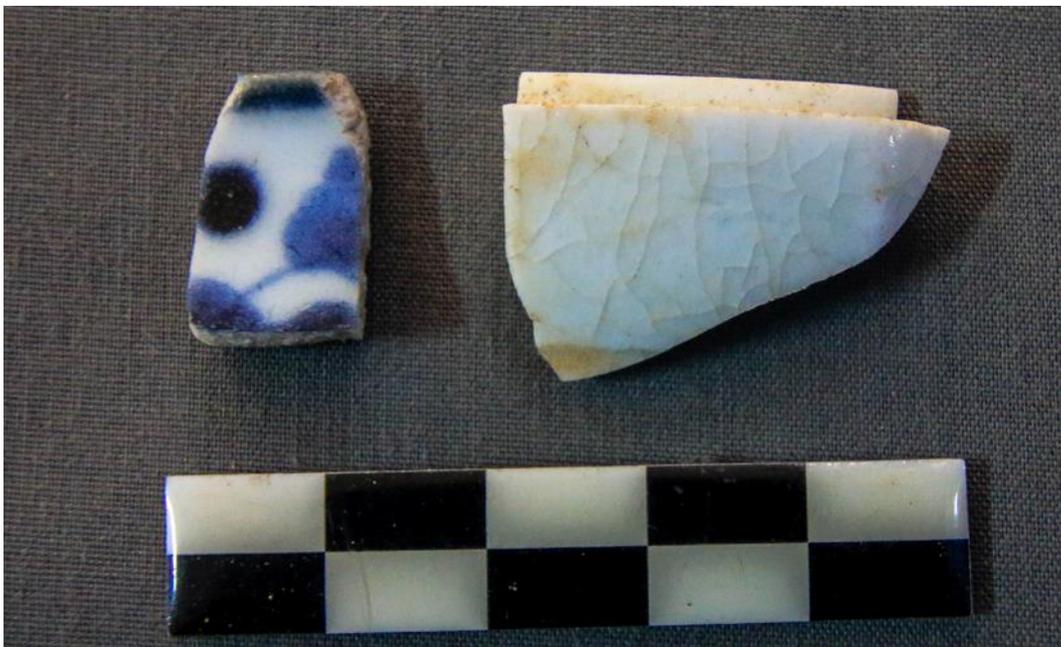


Figure 55: Assorted Chinese glazed ware (photo by Ea Darith)



The iron tools may represent work/activity areas other than habitation (e.g., stoneworking; perhaps for work crews who may have built the architecture; medical services; etc.), although no other data currently supports this interpretation. Furthermore, data is too sparse for any definitive conclusions on multiple occupations (e.g., earlier settlements and/or preliminary specialized work crews for temple construction). If they are a knife, a point and other related items, these may be typical household goods. Unit W01 yielded 210 g of iron including slag. Although this is not necessarily abundant by all means, it represents a much greater density than other units.

Faunal remains were comparatively abundant in Unit E02 (near the canal) and absent in the western W01 and W02 units. It is possible that most are food remains but it remains unclear. They may have been secondarily deposited during the canal construction as well.

It is unfortunate we do not have data for comparative artifact and ecofact densities at Angkor Wat (Stark et al 2015) or Prasat Tromoung (Pottier & Chhem 2008). Stark et al (2015) discuss low intensity and perhaps rotational, intermittent or periodic habitation in mound sites at Angkor Wat. They mention a fairly simple stratigraphy (three main layers) with radiocarbon dating placing most occupation during Angkor Wat's use – perhaps some earlier work crew presence and later period sporadic use. Artifact density appears fairly low in their description.

Densities at Tonle Snguot range between 0-2.7 kg/m³ depending on variable calculations. Compared with habitation mounds at Koh Ker (approximate average of 7.5 kg/m³), this is fairly low. Occupation at Tonle Snguot, like Angkor Wat, may have been restricted to Tonle Snguot's heyday as a hospital in the late Angkorian period. Koh

Ker habitation likely was longer in duration (7th – 14th centuries, but probably heaviest in the 10th century when massive construction projects were underway and it served as the Angkorian capital under Jayavarman IV). Soils are quite different (clay at Koh Ker; sand at Angkor Wat and Tonle Snguot) which may be a factor affecting comparative density or volumetric analysis. Nevertheless, the densities may reflect on the nature and density of habitation as well as frequency and intensity of activities. Comparative volumetric studies can be quite useful, especially with fine-grained artifact and ecofact typologies. Nevertheless, this data is not often reported and adequate sample sizes for Angkorian habitation/household sites are not readily available because only a few sites of this nature have been tested.

4.4: Further Considerations of the Statuary

It is not surprising that statuary and ornate carvings were components of the chapel and hospital complex. However, it is rather shocking that they still exist in situ given the shallow depositional context (only a few dozen cm below the surface) vis-à-vis the rampant looting that has occurred over the decades. These are extremely high value items and frequently end up for sale on the black market. Therefore, there was a need to recover and move the statuary to official Cambodian conservation and museum facilities for protection, conservation and further study.

In addition to the *dvarapala* (guardian), the six large statuary fragments indicate the presence of five Buddha effigies. All are broken, but appear in situ from ancient deposition. Whether or not they were moved in antiquity remains unknown. Their location along the entryway to the shrine at the southern side may have been intentional for visitor access – perhaps sheltered in a corridor. However, the lugged (tenoned) bases indicate insertion into larger pedestals. The base housings were not identified in the excavation units.

Pedestal fragments occur on nearby site surfaces and among the collapsed architectural ruins. In fact, one pedestal with broken feet was thought to be the base of the *dvarapala* (Figures 56 and 57). It was located several meters from where the *dvarapala* was unearthed. Diameter measurements suggested otherwise. Whether this indicates the pedestal or the *dvarapala* or other statues and parts were moved in antiquity (post-depositionally) or even more recently is unknown, but highly likely.

One Buddha fragment is an exceptionally rare find in this context. It is a Bhaisajyaguru – the Medicine or Healing Buddha. The statue was broken in half just below the stomach. The legs, hands, pedestal and base remain. The Buddha is seated atop a coiled naga on a tenoned (lugged) pedestal for insertion into a larger separate pedestal. Buddhas seated on coiled naga bodies with naga heads shielding the back and head of the Buddha are common to Angkorian iconography – especially Bayon period given the Mahayana Buddhist state/royal religion of the time. The Bhaisajyaguru Buddha is holding either a medicinal fruit or medicine jar (covered box) in his lap. Although several Bhaisajyaguru statues were recovered at the Bayon-period Banteay Kdei site, this is the first Bhaisajyaguru recovered from an actual hospital complex.

Another Bodhisattva statue is complete, although the head is broken. It is seated atop a lotus. The hands are positioned in a mid-chest/belly praying position, but are slightly outstretched and appear to be holding a moderately large round object – perhaps a jar, large fruit or cylinder. It is likely a Candravairocana or Suryavairocana Bodhisattva – almost identical to the one described by Sharrock (2011). Sharrock and Jacques (2017) mention:

The dedication stela [Khmer no. 273; see Coedès 1906:44-81] of Jayavarman's first major temple, Ta Prom, announced the creation of the whole hospital network four years after he took the throne. The stone informed the public about its centralized organization, with state doctors and local carers, and with triannual shipments of precise quantities of herbs, spices, and minerals used in medicine, including some precious items from the king's own central warehouse. Each hospital had a walled compound, a stone and laterite sanctuary, a stone-lined pool, and a "library" building. In the sanctuary, a ritual platform was raised for Bhaisajyaguru and his bodhisattva assistants, Sunlight and Moonlight. This is the first inscription to mention the Buddha of healing.

It is unknown if some of the statues form the typical trilogy associated with Baisajyaguru - Bhaisajyaguru is often depicted in the middle with two Bodhisattvas, Suryavairocanacanda [Suryaprabha] and Candravairocanarohinica [Candraprabha] (sun and moon Bodhisattvas respectively), on either side (Finot 1903: 29). Other trilogies with Bhaisajyaguru depict Shakyamuni in the centre, Bhaisajyaguru on the right and Amitabha to the left (this trilogy is more common in China and Japan). Flanking entities frequently hold similar objects such as a fruit, bowl or jarlet. However, the Suryavairocana or Candravairocana statue found adjacent to the Bhaisajyaguru would suggest the trilogy was present. Whether or not this means one of the other statues forms the trilogy is more likely, but it is unknown. Earlier, we described at least one statue that may be a second Bhaisajyaguru (however we were unable to determine if this was the case as only a broken pedestal and lower limbs are present). However, this second statue may be a member of the trilogy or some other Buddha or Bodhisattva entirely.

Lastly, a small stone statue of a kneeling elephant was recovered along with fragments of anthropomorphic statuary unaffiliated with those listed above. This includes a pedestal with the broken feet of a standing figure (see Figures 55 and 56). The possibility of more statuary being buried at the site remains high. Protective measures have been put in place by APSARA Authority.

The discovery of the *dvarapala*, although a highly newsworthy astonishing find, is not particularly unusual as they commonly occur as statues or carvings at Angkorian temple and shrine entry points for protection. The Buddhist statuary near the chapel undoubtedly served religious and spiritual healing purposes. The Bhaisajyaguru probably had a psychological or psychosomatic effect as well. Thus, the spatial

context/function of that particular area could be considered specialized with both religious/spiritual and medical/practical purpose.

Figure 56: Tonle Snguot chapel with pedestal/base and broken feet in background (photo by Foo Shu Tieng)



Example of post-depositional statuary movement? (originally thought to belong to *dvarapala*)

Figure 57: Pedestal with broken feet on surface (photo by Foo Shu Tieng)



4.5: Bas Reliefs

One final data set observed during the Field School included comparative assessments of bas reliefs – particularly a scene carved in one of the panels at the contemporaneous Bayon Temple. Clues to various practices can be discerned (e.g., pulse taking, head/temperature examination, medicine preparation). Message therapy, childbirth

assistance, and other practices are not evident, however. What we do not see may be equally important, perhaps indicating that certain practices occurred at different locations (e.g., childbirth and pregnancy matters may have been performed at residents' homes).

Structures, site furniture and a small variety of tools and containers are depicted, but they may be fairly generic. Surgical tools, however, are known in Indian hospitals of that period – particularly the 12th century Polonnaruwu site (Aluwihare 2017). The structures may represent buildings that have long disappeared. Pillared open structures **with ceramic finials and tiled roofs are common in the scene's backdrop.** Various examination and treatment areas, practices, tools and other objects are depicted. Further analysis may yield more specific clues. Fruit bearing palms and other trees are depicted in upper sections, but these may be generic floral backdrops rather than depictions of medical plants grown and used at the facilities. Staff, patients and common people are depicted. One person appears to be writing (perhaps a prescription), while others possibly prepping medicines or equipment/supplies in boxes. It would be interesting to assess gender, age, ethnicity and any visual clues to specific ailments or disorders. All faces are smiling. Thus it appears they must be receiving/providing good treatment and the staff are enjoying their work.

Sharrock and Jacques (2017) describe a carved relief at Banteay Chhmar (while also noting the site's importance in the medical industry):

“in one unique carved relief at Banteay Chhmar, the king, dressed in high ceremonial regalia, makes a symbolic offering in a temple in front of a pile of sacks that people are venerating seen in the bottom register of the relief... having seen medicinal herb blessing ceremonies in Tibet today that involve similar piles of sacks, it appears more likely that the Banteay Chhmar scene presents a medicine blessing ceremony.”

Although we visited Banteay Chhmar for art history training, we did not focus on the reliefs that would depict medical industry related information. Banteay Chhmar certainly deserves further attention. Sharrock and Jacques (2017) make a strong argument for its importance in the overall industry, especially the links to the Dangrek Mountains—a source of **‘medicinal herbs, animal parts, and minerals used in medicine (perhaps remedies using gold...’**, noting that the site was **“a strategically important temple, may have played a special role in the hospital system.”**

Figure 58: Bas relief at the Bayon temple – medical/hospital scene (photo by D. Kyle Latinis)



5: INSCRIPTIONAL ANALYSIS

Hunter I. Watson

Hospital Inscriptions: During the reign of Jayavarman VII numerous construction projects were undertaken, including the rest houses and hospitals outside urban centers and along the roads between them. Some information regarding the establishments of Jayavarman VII has been gained from the study of epigraphy. From Jayavarman VII's reign there are multiple inscriptions which provide glimpses into this period; most notable are the two large inscriptions found at Ta Prohm and Preah Khan, in the region around Angkor. There are also numerous smaller inscriptions found scattered across a wide region known collectively as the Hospital Inscriptions. The inscriptions from Ta Prohm and Preah Khan share some similarities but are not wholly identical. Similar in shape and size, both are four-sided stele nearly two meters tall and just over half a meter wide on each side. Both are composed in Sanskrit and comprise of 72 lines on each side, except the fourth side of the Ta Prohm stele, which has 74 lines. The first 18 stanzas are identical on both, but afterwards, the subjects of the two inscriptions diverge (Cœdès 1941: 255).

The Ta Prohm inscription mentions that the Rājavihāra temple, or Ta Prohm, was founded after the war. This was a reference to the great battle between the Khmers and the Chams, supposedly in the year 1177 CE, also depicted on the carved murals of the Bayon and Banteay Chhmar temples. This might also imply that Preah Khan temple, consecrated in 1191 CE, was established on the location of the final battle (Cœdès 1941: 258). The Ta Prohm inscription also mentions the establishment of /ārogyaśālā/, or hospitals. The inscription states that there were 102 hospitals and lists the total budget of items distributed among them (Ta Prohm stele, Side D, Lines 17-62 (Stanzas CXVII-CXXXIX); Cœdès 1906: 66-69, 80-81). Ta Prohm was effectively the headquarters of all the outlying hospitals (Cœdès 1941: 265).

The Preah Khan inscription mentions another type of structure built along the roadways under the reign of Jayavarman VII. Cœdès translated these as "gîtes d'étape avec du feu" (Cœdès 1941: 296-297), or lodges with fire. Finot later assigned these structures with the label /dharmaśālā/, which he translates as "maisons de charité" (Finot 1925: 422), or houses of charity. In English these are often referred to as rest houses. The Preah Khan inscription enumerates 121 of these structures and lists the numbers constructed along the roads to various cities (Preah Khan stele, Side D, Lines 2-6 (Stanzas CXXII-CXXVI); Cœdès 1941: 280, 296-297). It seems there was both a rest house and a hospital located outside of Preah Khan (Cœdès 1941: 263).

The Preah Khan inscription mentions the establishment of 430 divinities at Preah Khan. Among the divinities enumerated are four statues in the rest house and three in the hospital (Cœdès 1941: 262, 275, 288-289). This corresponds precisely with the record engraved on the Hospital Inscriptions, which all begin with an invocation to three deities: Bhaiṣajyaguru Vaiḍūryaprabharāja (Hospital Inscriptions, Side A, Line 3

(Stanza II)), the Buddha of Medicine, accompanied by Sūryavairocana Caṇḍarocis and Candravairocana Rohiṇīśa (Hospital Inscriptions, Side A, Line 5 (Stanza III)), both of which are Bodhisattvas (Finot 1903: 19). The statues recovered in 2016 to the north of Angkor Thom by the NSC field school are arguably examples of these deities. Chhem stated that no description of these statues were given in the inscription and that none of them had yet been found (Chhem 2005: 10). However, Lorrillard drew attention to the fact that the Say Fong inscription was found together with a statue, photographed in 1902, suggesting that it might represent one of the bodhisattvas (Lorrillard 2014 : 77, 79). In Thailand, a complete statue of the Buddha of Medicine was discovered at Ku Kaew in Khon Kaen Province (Phiset et al 2000: 41).

Regarding the Hospital Inscriptions, several have been found at various locations. Based on a preliminary review, it would appear that as many as 43 different Hospital Inscriptions have been discovered (for a review of structures in Thailand attributed to Jayavarman VII, see O’Naghten 2014). These are primarily in Cambodia and northeastern Thailand, as well as one in central Laos and one in southern Vietnam. However, these numbers and locations need to be reconfirmed, a matter complicated by the fact that some boundaries have shifted since information regarding these inscriptions was published (in some cases many decades ago).

The first Hospital Inscription was discovered in Cambodia by Étienne Aymonier. It was studied by Abel Bergaigne and published in 1882. The stone was broken into several pieces, but was identified as relating to a hospital providing services for people of every social class. The fragmentary inscription mentioned doctors and medicine, as well as staff of different sorts, and made clear **reference to /Kambujarāja/,** or the king of Cambodia (Bergaigne 1882: 143). In the year 1900, Aymonier described an inscription found in Cambodia which was not very legible. It was in fact another Hospital Inscription, although at the time Aymonier had yet to make this connection (Aymonier 1900: 378). In 1901, another publication of Aymonier (1901: 110, 116-117, 130-131, 191, 297)) included six more Hospital Inscriptions, but the similarities between them had yet to be recognized.

An entire, unbroken inscription was discovered at Say Fong, along the Mekong River in central Laos. This excellent specimen was featured in a number of articles in 1903 (Maspero 1903: 1-17; Finot 1903: 18-33; Pelliot 1903: 33-37; Barth 1903: 460-466). By then the connection between the various inscriptions was realized, and it was noted that the shape, size and style was remarkably similar between them (Maspero 1903: 4, Finot 1903: 21-22; Barth 1903: 460). In a later publication, Finot (1915b: 1-135) further analyzed textual differences between the inscriptions. The Say Fong inscription bears the name of Jayavarman VII, as well as dates which correspond to 1182 and 1186 CE (Barth 1903: 462). Finot transcribed and translated the inscription, explaining that the content is divided into four sections. It begins with an invocation to the Buddha, followed by a eulogy of Jayavarman VII, then a description of the various personnel and supplies of the hospital, and ends with a final clause (Finot 1903: 19). The average measurement of each side of the Say Fong inscription is 50 cm high by 20 cm wide; the

first three sides bear 24 lines of writing each while the fourth side bears 26 lines (Finot 1903: 22).

Some of the Hospital Inscriptions found in northeastern Thailand are in relatively good condition. Four of these were published in Thai in 1985 and again in 1986 (Kaeoklay 1985; Wiraprachak 1986). Although not all are exact replicas, they have similar sizes and numbers of lines. In 2015, Sombat Mangmeesukhsiri (2015) reanalyzed these inscriptions, comparing the one from Say Fong with one from Surin Province, in Thailand, along the border with Cambodia. He explained that the inscription from Surin is slightly shorter than the one from Say Fong, and stated that out of 48 verses, 20 verses show slight differences, while the rest are the same. He further explains that verses 1-3 are the invocation, verses 4-8 are the eulogy to Jayavarman VII, and verses 9-12 described the misery of the Khmer people after facing a civil war and a war with the Chams. Then verses 13-18 described the establishment of the hospitals by Jayavarman VII for the benefit of his subjects. Verses 19-24 describe the various staff who worked at the hospital and their responsibilities. The Say Fong inscription reportedly had 98 people on the registry, while the hospital at Surin had only 50, an indication that the community at Say Fong was much larger. Verses 25-36 described the plants and some aquatic animals used in the production of various types of medicines. Verses 37-46 mention other products used at the hospital, such as tin and rice, as well as the religious personnel for performing rituals and an astrologer or mathematician. The final part is Jayavarman VII's wish that his subjects would be well; he compared himself to a beggar seeking happiness to all sentient beings, and stated that he would give all of his possession, including his throne, for their benefit. The inscription ends with Jayavarman VII's blessing for the hospital personnel, who he hoped would achieve salvation and go to heaven (Mangmeesukhsiri 2015: 2-3).

6: HOSPITALS, JAYAVARMAN VII AND NON-LOCAL INFLUENCE

The Tonle Snguot site and other hospital compounds, as with Jayavarman VII in general, at first appear to break considerably from several normative Angkorian historical and cultural trends. Most prominent among these changes were Jayavarman VII's **significant shift in royal/state religion to tantric Mahayana Buddhism and the massive construction efforts and infrastructural developments over broad territories – vastly outbuilding any predecessor. Although Jayavarman VII's art and architectural styles were quite unique in many regards, it can be argued that many basic elements of engineering, architecture, symbolism, design and art as well as various overall trends were actually quite consistent with Khmer traditions – including the tradition of new kings and subsequent eras defined by evolving stylistic variation among key elements (e.g., lintels, pediments, statuary, and so forth) as well as general increases in magnitude and abundance of architecture and major landscape features. That is, changes along some dimensions were a dynamic norm of Khmer culture^{xv} among the royalty, elite, designers, architects, artisans, etc. Some types of changes were consistent or even expected. Other factors remained very conservative. This is normative of any culture, although the particular things (social or physical) that are expected to change, evolve, or remain conservative vary from culture to culture; as well as the variance within each category/phenomena.**

It is also reminded that Jayavarman VII may not have been the only Buddhist king (or king who strongly supported tantric Mahayana Buddhism) in ancient Khmer history. However, his emphasis on tantric Mahayana Buddhism at that particular **moment was a redefining shift. In fact, Sharrock (2013:13) sufficiently argues, “From c. 600-1080 [CE] Khmer Buddhism survived as a secondary creed... in 1080 the Mahidhara dynasty established Buddhism as the power behind the throne and in 1182 Jayavarman VII made it the state religion... the Buddhism of the Khmers was mostly tantric from 600-1300 [CE].”**

Importantly, what seems prominently different in the urban and infrastructural **planning of Jayavarman VII's era is precisely the emphasis on hospitals, rest houses, and state supported medical industries.** Although the size of the gates and walls around Angkor Thom^{xvi}, new art/architectural elements, and the sheer volume and scale of sites were seemingly unique, these endeavors may not have actually been quite as unique as the hospital and medical industry efforts. No other Khmer king appears to have endorsed such a campaign.

Did Jayavarman VII or his advisors at some point spontaneously realize **hospitals were a good idea and “dreamed up” their own versions, or, was this concept partially influenced from non-local sources such as India or China?**

^{xv} Notwithstanding changes in technology and engineering which may have evolved for a variety of different reasons.

^{xvi} Most Angkorian urban sites rarely had city walls, although walled compounds for shrines and temples were common (Evans 2013). Evans also noted that the low density settlement occurred outside the walls at Angkor Thom.

Zysk (2000:44) noted that, “[in South Asia] medicine and healing were integral parts of Buddhist monasticism from its inception.” Bhattacharya (2017:28-38) further describes the history of Buddhist medicine and hospitals in India from perhaps as early as the 3rd century BCE (though according to Zysk (2000:44), this was “in no way proven”) and that the Nagarjunkoda inscription from the 3rd century CE clearly indicates ‘health houses’ at the eponymous Buddhist Monastery. Bhattacharya (2017:32) also noted that, “a 6th century CE inscription from Duddavihara in Gujarat states the use of medicines and remedies was for all those who are sick, not only for the monks [see also Zysk 2000:44],” thus indicating that [state/elite/monastic supported] public medical attention for all classes was a concept in practice by that time. Bhattacharya (2017:32) further discussed the records of Xuanzang (690 CE) noting,

“in all the highways of the towns and villages throughout India he [?] erected hospices, provided with food and drink, and stationed there physicians, with medicines for travelers and poor persons round about, to be given without any stint (Beal, vol I, 1884:214)... the nobles and householders of this country have founded hospitals within the city, to which the poor of all countries, the destitute, cripples, and the diseased may repair.”

Although the inception of medical industries, hospitals, health related merit making, and so forth are strongly associated with early Buddhism in South Asia, it was not restricted to only Buddhist institutions, support, management and implementation by later centuries. Zysk (2000:46) emphasized, “when Buddhism was submerged in Indian after 1200, these Hindu institutions seem to have assumed the responsibilities for medical services previously provided by the Buddhist monasteries.” Bhattacharya (2017:33) also highlighted, “the provision of medical facilities was made in the Brahmanical religious institutions of Northern India during the early medieval period [referring to King Sricandra c 925-975 CE],” and that, “... medical personnel, very often despised by Brahminic culture, begin to be adopted by the culture itself... through this adoption, [the] secular nature of Buddhist medicine begins to crystallize into orthodox Brahminic tradition.”

Wujastyk (2012) discussed hospitals in Bengal and Kashmir during the 12th century CE noting that, “the hospitals he [King Vallala] was proposing to fund were to be substantial (“made of bricks”) and well-equipped and staffed... these institutions seem to be hospitals in a recognizable and formal sense, rather than mere dormitories or religious shelters.” Thus, by Jayavarman VII’s reign, the concepts of state supported public medical industries, hospitals, and treatments were well established in South Asia having transcended any exclusivity to Buddhism, although it did have a long Buddhist history. South Asian connections and influence from the early centuries BCE to the Angkorian era are quite clear in archaeological and other data sets (material culture, writing, language, inscriptions, architecture, epic stories and characters, religions, historic documents, etc.), although this does not imply we support earlier interpretations of “Indianization” models (i.e., diffused complex polity formation from

India stamped out on a blank slate of a socio-politically undeveloped Cambodia) that have grown passé in the modern discourse. It would seem hard to imagine that various Southeast Asian polities, especially Angkorian and pre-Angkorian, would be unaware of South Asian medical institutions and practices for a long time. In fact, it may be a more interesting question to ask why state/elite supported medical industries and hospitals were only implemented by Jayavarman VII rather than earlier kings and polities.

Returning to state religion in Cambodia, Jayavarman VII's ascension and emphasis on tantric Mahayana Buddhism does not imply that all subjects converted and that all non-Buddhist religious institutions were abolished. In fact, quite the contrary. Though significant, how much of a societal change in the religious and belief system sectors were there? In fact, Brahmanism (particularly Saivism) continued to have significant representation and roles. It was the dominant formal large-scale belief system since the Funan period although Buddhism had prominent representation and was supported by many Khmer royalty^{xvii}. Archaeological and historic evidence indicated Buddhist influences existed since the Funan and early Chenla periods. For example, Goonatilake (2003; also referring to Demiéville et al 1978) suggested that Mandrasena and Sanghabhara, Funanese monks, couriered Buddhist texts to China in the 5th and 6th centuries CE, and earlier, “the King of Funan, Kaundiya Jayavarman (478-415 CE) sent in 484 CE, an Indian Buddhist monk, Nagasena, a resident of Funan as ambassador to the Court of the Chinese Emperor Wu-ti taking ivory stupas with him... [and] the same king sent another envoy to China in 503 CE with gifts including a coral statue of the Buddha (Hazra 1981:73).” Nancy Dowling (2000) noted that standing Buddhas at the National Museum in Cambodia likely date to the early 7th century CE and were recovered from the Funan heartland near Angkor Borei. Incidentally, Suryavarman I [reigned 1006-1050 CE] was once thought to be a Buddhist King although Vickery (1985:227) strongly put that idea to rest – “even though none of the above theories is now tenable, it is worth noting that the most recent research on Suryavarman agrees that in fact he was no more Buddhist than other Angkor rulers of his time, and that in particular his posthumous name, ‘Nirvanapada’, may also be associated with Sivaism.”

Additionally, traditional belief systems (e.g., ancestor worship, *neak ta* placation, animism) undoubtedly continued to be infused throughout daily life and periodic rituals as was the case throughout, from historic to modern times. Sharrock (2013:13) noted, “there is abundant evidence today in Cambodia of central government routinely establishing formal links with past *neak ta* when officials are installed in the provinces (Ang Choulean 1986:217),” and continued to give several prominent modern

^{xvii} Peter Sharrock argued that Tribhuvanadityavarman [reigned 1149-1177 CE] was a Buddhist King; Jayavarman II [reigned 802-835 CE] had at least two Buddhist communities next to his Phnom Kulen royal residence as evidenced by the Don Meas and Peam Kre sema stone sites (Latinis 2018), Jayavarman V [reigned 968-1001 CE], and Udayadityavarman II [reigned 1050-1066 CE] and several other kings, though generally Saivite, strongly supported Buddhism and integrated Buddhist practices.

and historic examples of the power of *neak ta* and the associated belief system. Anyone familiar with Cambodia can attest to the fact that *neak ta* beliefs are infused in folklore and daily life practices at all levels including official, private sector, and religious institutions. Importantly, *neak ta* are associated with good fortune and bad fortune – including good health, bad health, and recovery – being causal factors in many cases.

The concept of a single exclusive religion or belief system seems to have never existed in practice. Quite the contrary, multiple belief systems were not only tolerated but often promoted, used, fused and reinvented. Religious syncretism in Cambodia since ancient times is quite well known though not frequently well defined, analyzed and explored in depth. Nevertheless, the shift to tantric Mahayana Buddhism with the need to promote health, prosperity, well being, and merit making for the king, kingdom and people at state expense [emphasis intended] represented a significant departure at that particular time and set of social conditions.

Again, we stress that various forms of Buddhism were practiced in the region and in Cambodia for centuries. However, was the form of tantric Mayahana Buddhism characterized and practiced by Jayavarman VII comparatively unique? How purely Mahayana and/or tantric was Jayavarman VII and did he and/or the practicing populations make sharp distinctions (again, we emphasize that various researchers have differing opinions)? Was this a result of distant or more local/regional influence, and/or, completely localized and reinvented by Jayavarman VII? Were the massive construction campaigns including the erection and staffing of public hospitals and promotion of tantric medicine a personal innovation of Jayavarman VII, or, was there an influential concept from neighboring or distant polities? As we shall continue to argue, the idea of non-local direct or indirect influence from South Asia as well as active borrowing by the Khmer (in cultural packages) are more plausible explanations.

Nonetheless, implementing state supported hospital concepts “in Cambodia” was a purely unique injection by Jayavarman despite tantric medical practices introduced to the ancient Khmer as early as the mid-7th century CE when Punyodaya, an Indian monk [tantric master] visiting the Tang to translate Sanskrit texts was sent on an imperial mission to Chenla to study medicinal herbs and share knowledge with local masters (Sharrock 2013: 4; Lin 1935: 89, 86; see also Chhem 2005:8). Sharrock (2013:5; also referring to Lin 1935) further noted,

“when he arrived in the southern seas, the kings paid homage to him and built **religious foundations especially for him.**’ His teachings and skills made such an impact that after he returned to China a Zhenla delegation of Buddhists arrived in the Tang capital in 663 and pleaded for his return. The emperor permitted his departure by decree and the Indian master spent the rest of his days in Zhenla. However, his work to establish early tantric Buddhism in Zhenla suffered a rapid reversal in the suppression usually attributed to Jayavarman I...”

By contrast, as evidenced by Zhou Dagan's (Smithies 2001) statements about health, medicine and medical practices in the late 13th century CE, the Chinese had very little notable influence on the Angkorian medical world despite being well represented in other economic and cultural areas for several centuries. In fact, as seen in the Punyodaya example above, the Chinese (at least in the earlier Tang courts) seemed more interested in learning about medicine from the Chenla Khmer rather than imparting their [Chinese] knowledge and practices.

An important ecological and historical consideration is also relevant. Cambodians would likely be far more familiar with South Asian plants, animals, spices, products, etc. (i.e., medical ingredients common to India and Southeast Asia) than they would Chinese. Furthermore, the late Angkorian medical experts likely knew the South Asian writing systems, texts and experts that dealt with medical practices more thoroughly – having been exposed to these for centuries. It is reemphasized, however, **we are by no means supporting earlier concepts of wholesale “Indianization” but we do recognize active reciprocal influence and interaction – Cambodia being part of an equally important region of agency.**

Thus, it is emphatically restated that the prolific hospital construction campaign appears to be completely unique to Jayavarman VII in Cambodia, but may have some forms of outside influence. Undoubtedly local medical practices (physical, mental, spiritual) existed in Cambodia well before Jayavarman VII – presumably since prehistoric times – but little is known about the possibility of state or royal supported hospitals in previous Angkorian, pre-Angkorian/Chenla, or Funanese periods. If hospitals and state medical industries did exist in Cambodia prior to Jayavarman VII, researching the possibilities with Suryavarman I would be a good start – especially tantric medical practices. Suryavarman I promoted large-scale projects. In the early 11th century CE (1012-?) (Coedès 1968), Suryavarman I allied with the Chola Kingdom to fight Tambralinga – specifically requesting support from King Rajendra Chola (1014-1044 CE), one of the most successful and powerful kings who had also expanded power to the Ganges and Sri Lanka. Sriwijaya eventually joined Tambralinga with subsequent defeat of both circa 1025 CE from a Chola invasion. This actually resulted in widening trade and influence dominated by Tamil merchants for the next century.

The Chola at that time had a public state supported medical industry with hospitals, including medical schools and hostels for students. Physicians and staff were paid in various “*kalam* of paddy per year...” and, “... the names of twenty different medicines that were kept in the store of the hospital were also mentioned in that inscription [1067 CE inscription ‘inscribed on the walls of the inner sanctuary of the temple of Venkateshwar’]” (Agrawal & Goyal 2011:18-19; Jaggi 2000; Bhattacharya 2017:35). Bhattacharya (2017:35) more clearly elaborates on King Virajendra and the inscription (placing the date at 1069 CE):

“... [The] Visnu temple of Venkatesa-Perumal at Tirumukkudal in the Madhurantakam taluk (area) of the Chingleput district... The inscription

consists of 55 lines... The last item of expenditure was for the maintenance of a hospital wherein were treated students living in the hostel, and temple servants that were sick [Subrahmanya Ayaar 1931-32/1984: 220-250]”

“... A clear distinction between a physician (Savarnan Kodandaraman Asvatthama Bhattan) and a surgeon (Calliyakkiriyai Pannuva) becomes evident. The hospital had fifteen beds. Twenty different types of medicines were stored in the hospital. Some of the medicines were of animal origin, most were of vegetable origin. One item seems to be mineral in nature [Subrahmanya Ayaar 1931-32/1984: 224].”

“... According to this epigraphic record, the physician in charge of the hospital was paid annually 90 kalam (old South Indian unit measuring weight, which varied from area to area) of paddy of 8 kasu (equivalent to 30 grains) in addition to a grant of land. Contrarily, the surgeon of the hospital received 30 kalam of paddy. Two persons for fetching medicinal herbs were paid 60 kalam of paddy and 2 kasu. A barber performed minor operations in addition to his professional duties received 15 kalam of paddy [Subrahmanya Ayaar 1931-32/1984: 223-224].”

The latter ‘position and payment’ aspects of Bhattacharya’s discussion are interesting vis-à-vis Angkor. Angkor was cashless. Payments in paddy, land and other non-cash items/benefits would likely have occurred as seems to be the case at Venkatesa-Perumal.

The temple was erected by Rajendra Chola’s third son, Veera Rajendra Deva (Virarajendra Chola [reigned 1063-1070 following his two brothers]) who also strengthened power over Sri Lanka. He built the temple at Thirumukkudal which contains the hospital inscription listing staff, facilities and medicines, some of which Vijaya Raghavan et al. (2014:202) suggest were also used to treat insanity and mental

illnesses^{xviii}. Again, did the multiple public hospital concepts evolve independently, have origins further away, emerge rather abruptly, or steadily build to their more formalized manifestations during Jayavarman VII's rise to power?

In summary, it is significant that Sri Lanka and India have a long history of institutionally supported hospitals – perhaps the oldest in the world beginning as early as the first few centuries BCE. Institutionally supported Hindu and Buddhist hospitals continued to develop through time in India including 12th century CE Buddhist hospitals. This is highly relevant to considerations of influence on Cambodia and Jayavarman VII. South Asian direct and/or indirect influence and interaction were prominent since the early centuries BCE onwards, with periodic waves of more intensive influence and interaction: commerce and trade in commodities; language, writing, inscriptions, titles; epic narratives (e.g., Mahabharata, Ramayana), temple construction, and most importantly for the discussion here, religious and medical institutions. Medical and specific religious practices would have been intimately entwined – quite evident in the Angkorian hospitals, especially with their chapels/shrines being central and prominent in overall hospital compound designs.

In contrast, Chinese medical influence seems somewhat surprisingly absent. Though a few Chinese missions and travellers had been sent and received since the Funan period, Chinese influence is far less prevalent in non-commercial/economic spheres. By the 11th-13th centuries a prolific amount of Song-Yuan Dynasty ceramics are consistently found in many Angkorian sites (particularly celadon and Qingbai wares) suggesting strong economic value-chain connections with China. Whether goods were shipped directly and/or indirectly is not entirely clear, but transshipment through various maritime routes, ports, and overland segments through intermediaries remains

^{xviii} According to Vijaya Raghavan et al. (2014: 202), the temple inscription at Thirumukkudal was probably the first of its kind to give the composition of a small hospital with 15 beds and its staff. The hospital (named Veera Cholesvara) functioned in the *Jananatha Mandapam* in this temple. The hospital staff were comprised of: A doctor, a surgeon, 2 male nurses who brought herbs and firewood, and prepared medicines, 2 female nurses who administered doses of medicines, fed the patients, and attended to the cooking, a barber, a washer man, a potter, and a gatekeeper. Provisions were made for a lamp to be lit all night. Drugs were prepared in the form of medicated ghee (*ghritham*), medicated oil (*thailam*), and medicated water (made by mixing cardamom and lemon). The oil was applied to the body or only to the head and was thought to reduce the heat (*anal*) in one's body. Medicines were applied externally (*tuvalai*), by fumigation (*vatu pitita*), the oral route (*ullukku kottudal*), by nasal application (*nasiyam*), and through ocular application (*kallikam*). The various drugs mentioned as being in use were: *Brahmyam kadumburi*, *Vasa-haritaki*, *Dasamula-haritaki*, *Bhallataka-haritaki*, *Gandiram*, *Balakeranda tailam*, *Panchaka tailam*, *Lasunaka eranda tailam*, *Uttama karnadi tailam*, *Bilvadi ghritham*, *Mandukara vatakam*, *Travatti*, *Vimalat*, *Sunerri*, *Tamrathi*, *Vajrakalpam*, *Kalyana lavanam*. The indications for the use of these drugs were not mentioned in the epigraph, but can be found in the Ayurvedic text, *Charaka Samhita*. *Brahmi* is a popular Ayurvedic and Siddha drug even today, used to improve memory and intelligence. *Kalyana lavanam* is used to treat insanity in general, as well as epilepsy and stammering. The list consists of drugs like yellow myrobalan (*haritaki* in Sanskrit, *kadukkai* in Tamil) and castor oil which are popular purgatives (thought to reduce the excess bile, *pittham*, in one's body). They were used since antiquity to treat mental illness in India and in other parts of the world. *Dasamula-haritaki* is used to treat mental illness in general.

the most likely scenario based on our current models. The influence of Chinese medical industries including clinics, medical halls, hospitals complexes, medical practices, medical practitioners, and various medicines (with possible exceptions such as mercury) are absent and may have been excluded. Differing environments may account for differences in availability and choices of medicinal plants, animals, and other products, for example, but well-established local traditions in Cambodia by that time may have precluded local demand for Chinese influence, products, and practices.

Interestingly, Zhou Dagan, the Chinese diplomat residing in Angkor during the late 13th century, mentions (Smithies 2001: 51 – *Sickness and Leprosy*; see also Zhou 1312?/2007; refer to Un (2010)’s references for J. Gilman d’Arcy Paul 1992; Ly Theam Teng n.d.; Paul Pelliot 1902,1951), “as with us, medicines are sold in the markets, but they are very different from those in China, and I do not know any of them.” This statement is important for two reasons. First, it appears Chinese medical influence, medicines, and practices were not prevalent in Cambodia. Second, there is no mention of hospital use; rather, medicines were available in markets (i.e., public hospitals had fallen into disuse). He continues to state in the same passage that, “there are also some sorts of sorcerers who practice their arts on people... this is completely ridiculous.” Again, there is neither descriptions of formal professional doctors and related staff nor hospitals. He also mentions that, “the people of this country spontaneously recover from many of their common illnesses by going to plunge into water and repeatedly washing their heads.” This tradition may relate to the consistent formal pools found at hospital complexes (i.e., the pools may have served as healing pools). Lastly, Un (2010:157) notes a ‘striking difference’ between Ly’s and others’ interpretations of leprosy, highlighting, “what Harris [in Zhou 1312?/2007], Gilman d’Arcy Paul and Smithies refer to as leprosy, for example, Ly calls ‘ringworm’”. If indeed the referenced illness noted by Zhou Dagan is dominated by ringworm cases rather than leprosy, this may have significant implications on how we further interpret and explore the medical industry and health conditions at that time, treatments of that particular illness (i.e., ringworm rather than leprosy), and the social relations of those afflicted by ringworm with the rest of the population. Zhou Dagan noted that ‘lepers would eat and sleep among the healthy population’. Some may argue that this is the cause of a high percentage of leprosy. However, if it were ringworm, leprosy may not have been as prevalent and the general population less fearful of interaction.

7: SUMMARY AND DISCUSSION

Archaeological investigations were conducted at the 12th/13th century Tonle Snguot hospital complex in 2017 as part of the NSC-APSARA Field School. The site is located outside the northern gate of Angkor Thom. Tonle Snguot is a late Angkorian hospital site associated with Jayavarman VII (1125-1218; he reigned as King from 1181-1218). **Currently, the Tonle Snguot site is composed of several former “hospital-compound” structures in ruins and a partially collapsed temple-shrine.** It is clearly Buddhist and late Angkorian-Khmer (Bayon period) in nature based on architecture and art historical evidence. Archaeological testing included six excavation units (61.5 m² total) and 44 core samples (41 small diameter; 3 large diameter).

The main purpose of the project was to determine the nature of subsurface deposits, habitation/settlement, and site activities in addition to a greater understanding of ancient medical industries in Cambodia. During the Angkorian period, a state supported public hospital campaign appears to be unique to Jayavarman VII's reign but may have been influenced from the long-term existence of similar institutions in South Asia.

Regarding the statuary discoveries (which received considerable media attention), a two meter *dvarapala* sandstone statue was recovered near the entryway of the site (east side). The lower legs and pedestal are broken and missing. The complete statue would exceed 2.0 meters. An additional broken pedestal with human feet belonging to an unknown standing figure was also recovered from the same unit. It represents a smaller separate statue.

More importantly, six sandstone Buddha statue fragments were recovered in a separate test unit. These include two heads, one head with torso, and three lower body and pedestal fragments. The six large fragments represent five individual statues. All were in situ and buried in shallow deposits (approximately 10-75 cmbs). The statue fragments were buried naturally through erosion and re-deposition of soils and debris from the chapel, entryway architecture, and artificial mound. Base pedestals with tenons are included with two of the lower body fragments (a Bhaisajyaguru and Surya/Candra Vairocana) indicating they would have been placed on a larger pedestal or support structure. The Bhaisajyaguru and Candra/Suryavairocana statues may be related to tantric/Mahayana Buddhist medical ideology and practice. Tantric medicine has a long history in Cambodia dating to at least the Chenla period in the 7th century CE. **Of note, the ‘medical specific’ statues are the first of their kind to be excavated in situ from an Angkorian hospital site.** Bhaisajyaguru statues have been excavated from other sites (e.g., Banteay Kdei), but not hospitals per se.

It remains unknown if the statues are close to their original locations while the hospital was active, or, were relocated in antiquity. Much of the central shrine and proximate architectural features in the hospital compound are collapsed and scattered throughout the area. This may account for some of the breakage and movement. As stated, statuary fragments such as the aforementioned pedestal with feet were found several meters away on the surface (i.e., not buried). Thus, some surface artifacts,

missing statue parts, and other remains indicate some objects or their parts were possibly moved in the past to include historic and modern times.

The cause of statuary breakage is unknown. Perhaps breakage occurred during the post-abandonment collapse and degradation of architectural features. Although there are post-Jayavarman VII incidents of vandalism to Buddhist representations in architecture and art, there is no present evidence indicating intentional breakage or disfigurement. It also seems very unlikely the statues were intentionally buried for protection or discard. Fortunately, the site has eluded intensive looting. There is a high probability that additional buried statues exist at the site.

Two pieces (a head and a body with attached base; approximately 50-60 cm tall) can be articulated into a complete statue. It is a Suryavairocana or Candravairocana (Sunlight or Moonlight Bodhisattva; Sharrock 2011; Sharrock & Jacques 2017; Sharrock pers. comm.; see cover photo; refer also to Salguero 2017). This is very similar to the statue described by Sharrock (2011; pers. comm.) from the Berlin Museum of Asian Art. Likewise, the statue is seated on a lotus with hands extended near the chest (*virasana* posture) holding a large round object – probably a cylinder, jar, or fruit (see Boisselier 1966:301; Sharrock 2011; and Chhem 2005). The cylinder/jar may represent a vessel containing medicinal ingredients. It would be interesting if the cylinder were related to the Chinese mercury jar, but it seems unlikely at this point given the shape (more ovoid). Lastly, the base of the statue includes a tenon which means it was set into a separate pedestal (possibly for multiple statues) which was not identified.

One lower body and pedestal fragment with a tenon base recovered in the same unit represents a Bhaisajyaguru (Medicine/Healing Buddha) with both hands folded in the lap. The hands are cupping a small spherical object; perhaps a medicinal fruit (e.g., *myrobalan*), jarlet, or covered box. Other objects such as a bowl, jewelry, flower (lotus), miniature stupa are possibilities (Chhem 2005). The torso and head are missing. Another lower body and base fragment with a tenon may also represent a Bhaisajyaguru or other Bodhisattva. However, this particular piece is fragmented and difficult to accurately interpret at this stage of analysis. Both are seated atop a coiled naga.

As mentioned, Bhaisajyaguru statues have been recovered at sites such as Banteay Kdei. Bhaisajyaguru and Moonlight/Sunlight Bodhisattva statues are also noted in other sites and collections (Sharrock 2011; Sharrock & Jacques 2017; see also Woodward 2011). Sharrock (2011:7) discusses similar statuary described in situ by Goloubew at Banteay Chhmar, and, a headless ‘Vajradhara’ (now thought to be more representative of the Bhaisajyaguru) at the east chapel hospital located west of the Takeo temple as also described by Goloubew (1937). However, the Tonle Snguot finds may be the first confirmed in-situ archaeological discoveries at an Angkorian hospital site in the capital. This may have further implications concerning the redistribution of medical supplies from the capital and the king’s personal stores of medical supplies (i.e., possibly a redistribution facility as well; Sharrock pers. comm.).

Briggs (1951:233) in reference to Finot’s (1903) interpretation of the Sai Fong [Sayfong; Say Fong] inscription (hereafter, Say Fong) implies that all hospitals were dedicated to Bhaisajyaguru. Sharrock (2011, 2017; see also Chhem 2005) provides more

comprehensive details. Bhaisajyaguru and Surya/Candra-Vairocana Bodhisattvas are often depicted in trios. Thus, to discover two of the three adjacent to each other in an archaeological context is quite rare and critically important.

Evidence of habitation and various activities were identified in the material culture and deposits of several units – particularly to the west of the main chapel. A semi-orthogonal pattern of mounds and ponds was noted in the LIDAR analysis. The archaeological remains and spatial distributions (as well as types and densities) at this point are too to determine absolutely, but the mounds in this area were possible households, specialized buildings, or activity/processing areas.

Two units west of the chapel were excavated at mound perimeters. They contained floorings and domestic artifacts. Artifacts include ceramics, iron, and blocks of sandstone and laterite. Some ceramics may have been specialized containers, preparation vessels, and tools. The Song-Yuan covered boxes from China (Qing Bai ware) may have been medicine containers. Interestingly, these are also found at Indian hospital sites.

Nonetheless, most of the remains cursorily indicate domestic/habitation activities. The laterite blocks may relate to past structures which may have supported wooden houses/buildings. Additional, they may represent parts of floorings, pavements, drainages and walkways. Specialized activity or processing areas have not yet been identified from the test unit data other than the religious nature of units yielding statuary.

More refined analysis of the iron tools and pottery from specific units will yield further details. Radiographs (X-rays) or proper cleaning of the iron tools, for example, may indicate they were specialized medical tools. However, at present we can only speculate that two of the iron artifacts consisted of a possible blade and nail-like implement. Grinding stones, balances, medicinal vessels/container, and specialized medical tools (including surgical tools) have been documented at the ancient Buddhist monastic Alahana Parivena hospital complex at Polonnaruva founded by Parakramabahu in the 12th century (Aluwihare 2017; Prematilleke 2017). This may have further implications for understanding medical tools and practices if South Asian influence was a factor in late Angkorian medical industries.

Data indicate habitation and activity dating to the 12th/13th centuries and later – contemporaneous with the artistic styles, architecture, epigraphic references, and overall construction and settlement nature of Tonle Snguot and surrounding areas associated with Jayavarman VII (Bayon period). None of the excavation data robustly indicate site settlement or other activities prior to the 12th century. Local Khmer stoneware and exotic Song-Yuan Dynasty high-fired ceramics (mostly glazed) support mid to late Angkorian period dates. This also accords with research results from the **Prasat Tromoung hospital Site at Angkor Thom's western gate** (Pottier & Chhem 2008).

Some evidence, such as post-Angkor exotic ceramics, may indicate lower intensity site use after the 13th century. This is expected given the GAP and other project results indicating the presence of 14th century and later exotic pottery in assemblages

and surface scatters throughout Angkor (Brotherson 2016; see also Stark et al 2015 with similar evidence at household sites within the Angkor Wat complex).

Evidence from the east bank of the canal may indicate earlier settlement (pottery, bone, faunal remains). However, the material culture may consist of secondary remains that were excavated in antiquity to build the embankments. Nevertheless, the **temporal nature may closely coincide with Tonle Snguot's construction period (i.e., not significantly predating the 12th/13th centuries).**

Stratigraphic analysis of all test units do not indicate long-term or multiple/successive period floorings, activities and use. Testing for deeply buried cultural deposits separated by sterile layers was not conducted. The possibility of earlier deposits needs further investigation. Also, if the site were repurposed, it may have destroyed evidence of earlier occupation. On the other hand, if this were the case, **material remains from previous periods would be expected in the mixed "repurposed" deposits such as is seen in Prei Khmeng, Koh Ta Meas and Lovea.**

A bridge-support post-hole was identified in the canal. This further supports **Wilson's (2017) conclusion that a bridge built on wooden piles connected the hospital site to the road on the opposite side of the canal.** In fact, this was the most expected result of test excavations in the area. However, we wanted to determine size and consistency in order to better understand the bridge design.

Jayavarman VII orchestrated and supported a state-level holistic medical industry (physical, mental and spiritual). Public hospital construction seems unique to **Jayavarman VII's reign, although a long-term Buddhist and subsequently Hindu practice of elite and monastic supported hospitals existed in South Asia.**

Inscriptional data for Jayavarman VII indicate 102 hospitals were built along major arteries and urban centers. Many of these have been archaeologically identified. The inscriptional data from modern-day Thailand are more prolific, but there are few translations in English (see Watson above).

It is stated that hospitals were available to all classes of people (perhaps also including travelers and foreigners). Hospitals provided physical, mental and spiritual healthcare. Again, this corresponds to the preexisting South Asian tradition – Buddhist and Hindu. Some hospitals were apparently more heavily staffed than others (Watson 2017). This may correlate with local community population sizes and needs, and/or, may correlate to the frequency of use including travelers/non-residents (Watson 2017).

Hospital construction occurred only a few years after Jayavarman VII's ascendency as a [tantric] Mahayana Buddhist king. The differentiation between tantric and Mahayana Buddhism at that time in ancient Cambodia is obscure. In fact, Cambodian tantric or Mahayana practices may be quite unique. However, Buddhist merit-making and related ideological concepts are significantly important. The king, kingdom and followers would have gained substantial merit as well as physical and economic benefits from the medical industry.

The fact that the undertakings followed a period of conflict and strife is also important (i.e., post-war conditions following the Cham conflicts). Additionally,

possible plagues or epidemics in the region may have been additional factors in the prolific hospital and public healthcare campaign.

Hospitals were periodically provisioned with medical supplies and products from the King's royal stores and private warehouses (Sharrock & Jacques 2017; Sharrock pers. comm. suggests 'quarterly supplies of precious herbs, spices and minerals to possibly include mercury from the King's personal dispensaries'). Some of these included rare and exotic products, such as clove from eastern Indonesia. Mercury is commonly mentioned as a medicinal ingredient and important for medical practices in addition to processing gold. Unique Chinese mercury jars (cylindrical/conical small mouthed jars) from the 13th-14th centuries are found at many contemporaneous sites in Cambodia and throughout the region. However, these unique vessels were not identified in the Tonle Sngout assemblage (although detailed ceramic analysis is pending). As suggested earlier, it is possible that some of the objects held by statuary (i.e., cylinders) may be related. Ultimately, the presence and use of exotic, rare, and precious items that were redistributed by the King (i.e., state) have implications for understanding long-distance value chains as well as redistributive state-level supply chains and other socio-economic phenomena. The model of state created and supported medical industries has implications for understanding other industries.

The placement of hospitals had strategic economic supply/value-chain, logistic, and military advantages. They also ensured a healthier and more productive population and may have also been a partial response to epidemics and health concerns in the region. Some hospitals may have served as checkpoints in various urban hubs such as Angkor Thom and Banteay Chhmar. The consistent spacing of hospitals along key roads and around/within key urban hubs signify the concept was part of an infrastructural master plan. Additionally, many of the inscriptions are systematically consistent in their introductions/invocations, although staff listings and a few other details vary. The inscriptions may have been produced in one locale with standard inscriptional pre-inscribed to be augmented when shipped to their final destination (again, possibly signifying a state organized, controlled and planned approach).

Hospital construction, maintenance, staffing, and related aspects to the medical industries provided jobs. Additionally, the King (Mahayana and/or tantric Buddhist) and other contributors ultimately gained merit. It was the King's duty to promote the health and well-being of his people. Finally, hospitals and the architecture served as a Khmer/Jayavarman VII symbol to the public, essentially making a statement of beneficence, socio-political inclusion, territory, control, etc.

Again, it is reasonably assumed from archaeological, architectural, art historical and epigraphic data that hospital construction, maintenance, and staffing were supported and controlled by the state during Jayavarman VII's reign. After his demise, hospital support and operations appear to have dwindled or ceased entirely.

There is a strong history of medical practices in South Asia with some of the world's oldest known hospitals and formal/royal/state supported medical industries. Prematilleke (2017:305) states, "[the] Ancient Indian medical system known as Ayurveda was absorbed into Sri Lanka's indigenous healing art from the foundation of

the city of Anuradhapura in the fourth century BC... since then, the long line of rulers were responsible for the perpetual organization of health institutions for the well-being of the people.” Additionally, ancient Buddhist institutions such as Nalanda (5th-13th centuries CE) in Bihar, India had significant influence in Southeast Asia. Nalanda provided medical instruction and texts. Travellers such as Xuanzang (biographer Hwui-Li; see also Sen 2006) visited Nalanda in the mid-7th century and noted students studied Chikitsavidya (medicine) as well as urban planning (see Dutt (1962/1988) and Frazier (2011) respectively). However, it is unknown if the urban planning included hospitals; particularly the location, design, facilities, and services of hospital compounds. Yijing (I Ching; I Tseng; originally Zhang Wenming), a Chinese Buddhist monk and scholar, also studied at Nalanda and Sriwijaya (Swrivijaya; probably Palembang) in the 7th century noting similarities, differences and influences between South and Southeast Asia in several of the traditions (Takakusu 2005; Sen 2006).

It is quite possible that the continual evolution of South Asian medical institutions directly and/or indirectly influenced Jayavarman VII's hospital construction concepts and campaign. The 12th century Polonnaruva period medical sites and history deserve greater comparative analysis. Furthermore, Prematilleke (2017:306) intimates that, “in the twelfth century Polonnaruva period, Parakramabahu I [a Buddhist reformer and also known for massive unification, expansion, construction, and renovation campaigns] played a major role in the sphere of health service. In addition to his political leadership, Parakramabahu was a reputed medical practitioner and a teacher of medical lore.” Hema Goonatilake (2003) notes, “the Sri Lanka chronicle, *Culavamsa*, records that Cambodia and Sri Lanka had close political and cultural contacts in the 12th century,” and “... the Burmese [in a Sri Lankan trade rivalry with Cambodia] captured a Sinhalese princess sent to Cambodia by the Sri Lankan king... [probably] responding to a request made by the Cambodian king Dharanindravarman II (who was probably a Buddhist) by sending a princess as a bride to his son Jayavarman VII.” Goonatilake (2003) also notes several other indicators (direct and indirect) of strong Cambodia-Sri Lankan connections and influence during Jayavaman VII's reign, although South Asian polities had varying types and intensities of influence and interaction – probably reciprocal in cases – over the centuries since the late first millennium BCE (e.g., economic, political, religious, language/writing, epic stories, titles, art, architecture, monument construction, etc.).

In contrast, Chinese medical influence seems surprisingly absent despite a robust history (and industry) of TCM (traditional Chinese Medicine) for 2-3 millennia in China. Though a few Chinese missions and travellers had been sent and received since the Funan period (c. 1st-6th centuries CE), Chinese influence is far less prevalent in non-commercial/economic spheres.

Sen (2006:26) notes of Chinese travelers that, “... Buddhist monasteries provided accommodation and health care to the long-distance traders, many of whom reciprocated by giving donations to the monastic communities.” Thus, health and medical industries may have economically [and socially] benefitted from foreign visitors.

By the 11th-13th centuries a prolific amount of Song-Yuan Dynasty ceramics are consistently found in many Angkorian sites (particularly celadon and Qingbai wares) suggesting strong economic value-chain connections with China. Whether goods were shipped direct and/or indirect is not entirely clear, but transshipment through various maritime routes, ports, and overland segments through intermediaries remains the most likely scenario based on our current models. The influence of Chinese medical industries including clinics, medical halls, hospitals complexes, medical practices, medical practitioners, and various medicines (with possible exceptions such as mercury) are absent and may have been excluded. Differing environments may account for differences in availability and choices of medicinal plants, animals, and other products, for example, but well-established local traditions in Cambodia by that time may have precluded local demand for Chinese influence, products, and practices. Interestingly, Zhou Daguan, a Chinese diplomat residing in Angkor during the late 13th century, mentions (Smithies 2001: 51 – *Sickness and Leprosy*), “as with us, medicines are sold in the markets, but they are very different from those in China, and I do not know any of them.” This statement is important for two reasons. First, it appears Chinese medical influence, medicines, and practices were not prevalent in Cambodia. Second, there is no mention of hospital use; rather, medicines were available in markets (i.e., public hospitals had fallen into disuse). He continues to state in the same passage that, “there are also some sorts of sorcerers who practice their arts on people... this is completely ridiculous.” Again, there is neither descriptions of formal professional doctors and related staff nor hospitals. He also mentions that, “the people of this country spontaneously recover from many of their common illnesses by going to plunge into water and repeatedly washing their heads.” This tradition may relate to the consistent formal pools found at hospital complexes (i.e., the pools may have served as healing pools).

Most of the discussion points, theory, hypotheses, methodology, etc. are provided in sections above. In summary, we are only beginning to truly understand the ancient Angkorian medical institutions, industries and related cultural phenomena. Much work remains. However, baselines for further study have been set. It is reminded that the historic narratives (largely based on epigraphy) and archaeological narratives are very different. They do not necessarily negate or support each other, however. That is not the intent. Rather, they complement. The archaeological narrative resulting from systematic investigations is small by comparison. We hope our contributions in this working paper will lead to further research and understanding.

8: CONCLUSION

Most discussion points have been provided throughout the report. The project began with map, satellite and LIDAR analysis (light distance and ranging) in addition to normative background archival research. The GAP and other large-scale efforts have increased our understanding significantly. Their surveys, LIDAR and art/architectural historical endeavors reveal a very complex history of large landscape modifications, urban planning and water engineering in the area. Most sites and features around Tonle Snguot are late Angkorian, however. Likewise Tonle Snguot is a late Angkorian hospital site associated with the construction boom of Jayavarman VII's reign. Site art, architecture, stratigraphy and material culture likewise appear to be mostly late-Angkorian.

Perhaps the site was part of a pre-existing village or agricultural community nearby, successively repurposed as a hospital in the late 12th century with work crews occupying the area during its construction followed by the hospital staff and service communities. Donated land and other assets would have been included. The larger area – adjacent to the road, canal, gate, and hospital – presented an ideal opportunity for various service entrepreneurs. Finally, the hospital and surrounding area returned to its current agricultural nature following site abandonment after the demise of Jayavarman VII's. **That might have coincided with the time when funding and other subsidies for hospitals ceased.** This makes sense if hospitals were reliant on state support to maintain normative operations. Nevertheless, it remains unknown if the medical industries also included private for-profit aspects, although the state decree for ordering hospitals to be constructed throughout the region strongly indicates at least a significant amount of state sponsorship and support for facilities, staff and supplies. Despite abandonment, the temple compound itself essentially remained a sacred space as it does today. No evidence currently supports the hypothetical history other than site occupation and use during the late Angkor period and a return to an agrarian low-density proximate community during the post-Angkor period. We provide our interpretations as speculations to be tested through further fieldwork, analyses and interpretations.

The mounds to the west of the chapel are likely the remains of occupation and **domestic activities (households, dorms, living quarters)**. **One mound's subsurface deposits contained possible structural remains that may have supported a more formal house or building.** Other than the chapel, library, pond, *gopura* and the religious zone defined by units where statuary was recovered, no specialized activity areas are readily identifiable. Further analysis is pending and we may be able to refine our interpretations later. Some evidence of low-level post-Angkorian settlement occurs in the area (e.g., low representation of post-Angkor pottery).

Units in the canal and canal banks re-confirmed a wooded bridge once existed (similar post-hole and similar material remains were analyzed by Wilson 2017). The material remains on either bank indicate domestic/habitation activities as well. It is unknown if they may be secondary deposits from canal and road construction in the late 12th century.

Local and non-local pottery occur in most units. Earthenware, glazed stoneware and some porcelain were identified. Most of the pottery consists of utilitarian jars, containers and cooking pots typical of a domestic context. Some (e.g., covered boxes) are less utilitarian in a sense and may be high-value prestige items, but perhaps were used to store important personal items, medicines, etc.

Non-local pottery (almost entirely Chinese) as well as Khmer glazed ceramics indicate that Tonle Snguot residents were connected to long-distance and medium-distanced value chains. Some ceramics may be high-value items (e.g., Qingbai covered boxes), but these are not uncommon at many Angkorian sites and no residential economic or status differences were noted.

Iron tools and other fragments (including small pieces of slag) were recovered. A knife, possible nail and the head of an undefined iron tool were the only ones that provided plausible functional attributes to be identified. They are highly oxidized. Faunal remains were recovered and likely represent food items. Some may have occurred naturally. Others may have occurred from secondary deposition.

The statuary included a two meter near complete dvarapala uncovered at the entrance of the site, and five Buddha images in six large pieces, one of which is complete. These high-value finds are unexpected given the history of intensive looting in the area, but probably normative of ancient hospital site architecture. At least one of the Buddhas represents Bhaisajyaguru – the Medicine/Healing Buddha. Although Bhaisajyaguru have been recovered from sites such as Banteay Kdei, this is the first recovered in situ from an Angkorian hospital. It accords with the medical function of the hospital complex to include practical/applied, mental and spiritual holistic medical services.

We are looking forward to continued work and post-excavation analysis in the coming months. It is our plan to seek additional funding for further research and preservation at Tonle Snguot.

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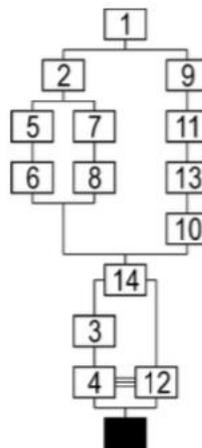
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APPENDIX A: Wilson (2017) Soil Analysis Summary

GREATER ANGKOR PROJECT
THE UNIVERSITY OF SYDNEYPRASAT TOMLE SNGOUT EXCAVATIONS - INTERIM REPORT
PAGE 7**Stratigraphic Unit List****Area 1**

1	Topsoil	Light grey clayey sand excavated over the whole area
2	Soil	Brown sandy loam excavated over the south-eastern 5 by 5 m area
3	Natural soil	Pinkish grey clayey sand excavated over the south-eastern 5 by 5 m area
4	Natural soil	Brown sandy loam excavated over the south-eastern 5 by 5 m area
5	Fill	Brown sandy loam with sandstone chips fill of posthole Unit 6
6	Negative interface	Cutting of posthole in southeast of area, filled with Unit 5
7	Fill	Brown sandy loam fill of posthole Unit 8
8	Negative interface	Cutting of posthole in southern section, filled with Unit 7
9	Fill	Dark brown clayey sand with laterite inclusions in western 2m of area
10	Structure	Laterite block below Unit 14 probably in situ
11	Fill	Strong brown clayey sand with laterite and sandstone chip inclusions, west section
12	Natural soil	Light grey sandy clay mottled natural soil with black laterite, as Units 3 & 4.
13	Interface	Zone of mix of Units 11 & 12 50-100mm wide, includes REW artefacts
14	Negative interface	Cut for canal construction



Stratigraphic sequence matrix of Area 1.

Area 2

15	Topsoil	Light grey clayey sand excavated over the whole area [as Unit 1?]
16	Soil	Brown sandy loam over western part of area [as Unit 2?]
17	Fill	Dark brown clayey sand with laterite inclusions in eastern part of area [as Unit 9?]
18	Natural soil	Pinkish grey clayey sand [as Unit 3?]

APPENDIX B: Background and Original Research Agenda (from 2017 Field School Booklet)

Ancient Hospitals and the Tonle Snguot Research Plan:

Jayavarman VII is famed for launching some of the largest and most numerous construction projects of any Angkorian King. He reigned from 1181-1218. His projects have the broadest geographic distribution – in many ways defining the vast extent and accomplishments of the Khmer empire by the early 13th century. Unlike many of his Hindu predecessors, Jayavarman VII was a Buddhist king. Buddhist designs, iconography and statuary are found in many of the monuments. Unfortunately, many of the projects were not fully completed. Also, numerous temples, statuary and carvings were vandalized during the ensuing Hindu resurgence period. Regretfully, several sites have also witnessed intensive looting – both historic and modern. Despite these problems, there still remains immense opportunities for art historical and archaeological research to increase our understanding of ancient Khmer civilization and their connections to others.

Jayavarman VII's massively walled and moated city is called Angkor Thom. The famed Bayon temple is located at the center. In addition to constructing numerous temples, Jayavarman VII supported the expansion of road networks, canals, reservoirs, bridges, rest houses, services, the economy, etc.

Of importance for the NSC-APSARA Field School research, Jayavarman VII also ordained the construction of 102 hospitals (Arogyashala). These were located across the main transportation arteries and urban hubs. We know of the hospitals from inscriptions, carved stone bas reliefs, and the archaeological remains of hospital sites and chapels. Incidentally, one of our site tours and training areas will include roads, bridges and sites leading to the famed Jayavarman VII period Banteay Chhmar temple complex which also contains hospital sites and features.

The ancient Khmer hospital sites have similar layouts. Generally, there is a gate/entrance, walled compound, walkway, pond, central shrine, and a library. The central shrine or sanctuary is also referred to as a chapel. The chapel is thought to have been used for praying, offerings, spiritual treatments, and housing sacred objects. Library structures may have contained palm leaf books – some of which may have been medical texts.

Many of the structures in hospital compounds exhibit stone, laterite or brick pavements, alignments and other embellishments. These are non-perishable, enduring, inorganic materials. They can break, and some can slowly erode or dissolve, but they can last thousands of years. Organic materials such as wood, bamboo and thatch are perishable. They rot, burn and are eaten by insects. Thus, they quickly disappear over time.

The central shrines' foundations, floors, walls and roofs were built of enduring materials (stone, laterite, bricks), although wooden beams, ceilings and other organic additions would have been included. The shrines likely contained religious statuary and

other sacred objects. Many objects may have specifically functioned to assist with spiritual and physical healing practices.

Other structures may have had stone, laterite or brick foundations, floorings, alignments, or hard supports for wooden posts. However, walls and roofs were predominantly made of wood and other perishable materials, unlike shrines and temples. Khmer houses, storage structures, etc. were often raised above ground on wooden piles/posts as they are today. Walls, floors and roofs were typically made of organic material. Some roofs had ceramic roof tiles. Even the royal palaces were made mostly of wood. Generally, structures for deities and ancestors were made almost entirely of hard enduring materials (stone, laterite, brick), while structures for human habitation were predominantly made of wood.

Different activities occurred in different areas of the site. Some spaces were sacred; others more functional, practical and mundane. Some spaces and material culture may have been related to vocational specialty, status, title or rank. Various structures in the hospital compound may represent treatment areas, rest areas, and even residential areas for doctors, nurses, other specialists, and servants. The Say Fong inscription from Laos indicates each hospital should have 66 permanent staff to include: 2 doctors; 2 pharmacists (apothecaries); 8 nurses; 6 doctor assistants; 14 guards; 4 rice makers; 4 cooks; 4 secretaries; 6 servants; 2 achars (religious specialists) and others. Particular archaeological remains may indicate storage and preparation areas for medicines – a type of pharmacy perhaps. Other areas may have included kitchens, medicinal plant gardens, isolation areas for the sick, specialized disposal areas, and so forth - although this remains speculative at present. Additional features may have been connected to the compound. For example, at the Tonle Snguot site, there is a north-south road and canal at the eastern end of the compound. There may have been a bridge crossing the canal linking to the hospital to the main road.

Tonle Snguot is the northern hospital at Angkor Thom. It is one of four hospitals associated with four of the five main entry gates at the city of Angkor Thom. The western hospital, Prasat Tromoung, was test excavated under the direction of Christophe Pottier and Rethy Chhem in 2006. Besides adding to our structural and spatial knowledge of hospital compounds, they recovered an abundance of artifacts such as numerous jars – many of which may have used for medicine preparation and storage. Dr. Chhem researchers ancient Khmer medical traditions, noting that court doctors were common since at least the 7th century. Historic records also mention a Chinese Buddhist monk visiting Cambodia for two years in the 7th century to study Khmer herbal medicines. Incidentally, our site visits and training incorporate a trip to the 7th-8th century Champa (pre-Angkorian) capital city at Sambor Prei Kuk (also known as Isanapura). This will assist with the overarching research theme revolving around the evolution of ancient complex polities, urban dynamics, and multi-scalar socio-economic networks (domestic and foreign; proximate and long-distance).

The Field School personnel will assist test excavations at several locations within and outside of the hospital compound at Tonle Snguot. We will use mixed methods for research and training. Controlled stratigraphic excavations will be

conducted at locations thought to contain habitation and specialized activity remains. Larger, structural excavations will be conducted at key locations to expose the true extent and nature of partially buried stone and brick features. Test trenches placed to the east of the chapel near the canal will help us explore the possibility of a bridge and yield further details about the entryway to the east. Coring will allow soil samples to be collected from a broad area. Surface highlight mapping will help us ground-truth features noted in LiDAR imaging, identify exposed surface remains not detectable through remote sensing, and create a detailed archaeological map.

Primary Research Questions:

- What are the types and spatial layouts of surface remains and features; what are the implications?
- What is the nature of material remains (surface and subsurface), as well as activities reflected in the material culture (surface and subsurface)?
- What do basic analyses of artifacts, ecofacts, soils, stratigraphy, and spatial relations reveal?
- Do material remains, such as pottery types and faunal remains, reflect specialized use or activities?
- Can we conduct residue analysis to further our understanding of pottery contents; likewise, can we conduct pollen and phytolith analysis to understand botanical representation in the hospital vicinity?
- Is there evidence of specialized activities performed at the site; particularly activities related to the medical industry?
- Is there evidence of temporary, periodic, or permanent habitation; what kind of habitation; how big; how long; how dense; how busy?
- Was the site occupied and used prior to and after the hospital period in the 12th/13th centuries?
- If so, did the nature of site function and settlement change or remain consistent?
- Do spatial distributions reflect different activity areas, sacred areas, living quarters, etc.?
- What is the nature of subsurface structural remains?
- Are there additional features, such as a bridge connecting the site to the main road (which may only be indicated through geoarchaeological, subsurface remains such as post hole evidence, and stratigraphic analysis)?
- How do our research results at the hospital/chapel site relate to larger questions of urbanisation, industries, economics, networks and social complexity?

These are only a few of the many questions we can ask. Some have obvious overlap and mutual implications. The important point is to start with basic, relevant and answerable questions. Our methodologies are designed to answer some of these questions as best as possible within the limitations of our available toolkit of methods, budget and time constraints. Methods begin with background research and continue with excavations, post-excavation analysis, creation of meaningful typologies and databases, various

forms of specialized analyses, statistical analysis, comparative analysis, and so forth. It is important to remember that understanding research design is central to the programme. This starts with asking relevant research questions (which can be formed into hypotheses) and designing an appropriate methodology (how we answer those questions).

APPENDIX C: Field School Objective for East Asia Summit Participants and Staff
(from the 2017 Field School Booklet)

The Nalanda–Sriwijaya Centre Archaeology Unit, ISEAS – Yusof Ishak Institute:
Welcome Letter and Background:

Dear Participants, Collaborators, and Staff,

On behalf of the ISEAS – Yusof Ishak Institute and the Nalanda–Sriwijaya Centre (NSC) I take pleasure in welcoming you as members of the 2017 NSC Field School. This year, fourteen participants have been selected from the East Asia Summit (EAS) countries. Cambodia and Singapore are the host countries for fieldwork, site visits, and lectures. Funding for the project is provided by the Singapore Ministry of Foreign Affairs.

In 2009, the Institute of Southeast Asian Studies (Singapore) established the NSC as a nexus for cultural research and knowledge exchange. Among several interdisciplinary initiatives focusing on Asia, the NSC created an archaeological field training programme in line with EAS and Singapore support of the Nalanda University project. The archaeology programme is designed to recruit international students to actively engage in dynamic on-site lectures, enhance field skills, and conduct interdisciplinary research in Southeast Asia. Experienced, high caliber, international instructors will guide them through the process.

This programme is designed to contribute to an increased understanding of the ancient and intimate links that have connected Asian countries; to emphasize the history of intra-Asian interactions over the past 2,000 years; and create a community of EAS scholars. Primary goals include: building networks; strengthening enduring partnerships; sharing knowledge, skills and experience among participants; and expanding the community of experts.

Field research and experiential learning will concentrate in Cambodia with hands-on activities related to archaeology art/architecture history, history, ethnography, and environmental studies. In 2015 and 2016 we excavated sites at the ancient city of Koh Ker - the famed 10th century Angkorian capital associated with Jayavarman IV. This year, we will excavate Tonle Snguot - a hospital/chapel site associated with Jayavarman VII. It is located near the northern gate of the 12th/13th century Angkorian capital city at Angkor Thom in Siem Reap. Tonle Snguot will be a key training and research area. Additional site visits include Sambor Prei Kuk, Banteay Chhmar, and numerous sites in the Angkor Park. Training and lectures will cover early civilization and cultural dynamism in Southeast Asia including extra-regional influence and interaction.

Together with our host partner, APSARA National Authority, the fifth session of the field school will be held in July and August 2017. The curriculum will include site visits, lectures, field work, and training. Training covers research design, basic survey and

excavation skills, art/architecture history, analysis, and cultural resource management. Research design and project management are critical components of the training. Lectures will incorporate broad topics in archaeology, history, art/architectural history, ethnography, economics, ecology, environmental studies, and cultural interaction.

The field school is intensive, high energy, and densely packed. Field conditions will range considerably. You will be more closely linked to local life, stakeholder communities, and each other. There is no comparable experience. We sincerely hope you will enjoy the programme, the training, the instruction and most of all, the new friends and partners you will make during our journey.

Yours Sincerely,

Dr D. Kyle Latinis,
Field School Director,
The Nalanda–Sriwijaya Centre

Field School Objectives:

Our strategic objectives are to build enduring partnerships among the EAS community of young professionals; enhance skills in critical thinking and research design; train basic field methods in archaeology, anthropology, art history and related disciplines; promote lateral learning and sharing of knowledge among participants and staff; and provide research results to the communities of interest. The following list includes some of our many objectives. We also intend to have fun while working hard. The following list contains several of our special c objectives. Our field school schedule/itinerary also lists specialized training sessions, lectures, etc.

- Immerse international participants in lectures, site visits, on-site interactive discussions, and on-site training sessions.
- Enhance critical thinking skills; expand knowledge; and increase awareness.
- Provide basic introductions to the multi-disciplinary nature of archaeology and related fields.
- Develop skills in: research design, methodology, implementation, management, analysis, and reporting.
- Mentorship and training in: multi-disciplinary research design, methodology, analysis and cultural resource management.
- Train basic survey, mapping, drawing, excavation, sampling, and artefact analysis skills.
- Enable participants to design and conduct expedient group/team projects; present preliminary results.
- Build enduring partnerships among EAS participants and host-country staff.
- Promote lateral learning and knowledge sharing among participants and staff.
- Strengthen regional cooperation and networks.
- Introduce a variety of topics to include:

- Current historic and archaeological knowledge
- Method and theory
- Cultural resource management and historic preservation (to include mitigation/salvage)
- Art and architectural history
- Anthropology, ethnography, ethnohistory, ethnoarchaeology
- Traditional industries
- Historical ecology, environmental studies, environmental archaeology
- Landscape archaeology
- Remote sensing to include LiDAR, aerial photography, and satellite imagery
- Structural and architectural archaeology
- Intercultural engagement and influence through space and time
- The nature of cultural and economic networks
- Multi-scalar social complexity related to the Funan, Chenla, Angkor, and post-Angkor periods (i.e., the evolution of complex polities with consideration of local and extra-local variables)
- Museums, Tourism, and related topics

List of members for Tonle Snguot project to be acknowledged in an interim report.

APSARA National Authority:

- HE Dr. Sum Map, Director General
- HE Dr. Tan Boun Suy (Deputy Director General): Institutional Senior Advisor and Oversight Coordinator
- HE Sok Sangvar (Deputy Director General), Senior Advisor in charge of Tourism (TMP)
- HE Hang Peou (Deputy Director General)
- HE Chau Sun Kerya (Advisor)
- Dr. Ea Darith: Field School Director and Principal Investigator
- Dr. Ly Vanna: Senior Archaeologist and Advisor
- Mr. Im Sokrithy: Senior Archaeologist and Advisor
- Mr. Tann Sophal: Site lecturer
- Mr. Khieu Chan: Site/Operations Managers
- Mr. Chhay Rachna: Site/Operations Managers
- Mr. Huon Yav: technical staff
- Mr. Po Nimol: technical staff
- Ms. Soeng Sreytouch: technical staff
- Ms. Seang Sophany: technical staff

ITC/J7 Heritage Science Team (Institute of Technology, Cambodia) Staff:

- Dr. Rethy Chhem (CDRI): Senior Advisor and Subject Matter Expert: ancient Angkorian hospitals, medical practices, and services
- Dr. Kri Nallis, Dean, Faculty of Geo-resources and Geotechnical Engineering

- Dr. Bun Kim Ngun, Vice Dean, Faculty of Geo-resources and Geotechnical Engineering
- Ms. Sio Srey Mean, Lecturer, Faculty of Geo-resources and Geotechnical Engineering
- Mr. Kang Sang Long, Lecturer, Faculty of Geo-resources and Geotechnical Engineering
- Dr. Yos Phanny, Lecturer and Researcher, Faculty of Geo-resources and Geotechnical Engineering

Royal University of Fine Arts (RUFA, Department of Archaeology)

- Ms. Seng Sonetra: Dean of faculty of archaeology

