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Moated sites of the Iron Age in the Mun River Valley, Thailand: New discoveries using Google Earth

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ABSTRACT

Archeological sites that are surrounded by moats in Northeast Thailand were identified in the early 20th century and have generated interest ever since. Subsequent research has revealed that these sites fluoresced during the Iron Age (c. 500 B.C.–A.D. 600) but the purpose of the moats remains enigmatic. Pedestrian survey and aerial photographs have assisted in understanding the distribution of these sites across the landscape and has shown that they concentrate in the Mun and Chi Valleys of the Khorat Plateau. This paper presents the identification of 146 newly identified sites using Google Earth satellite imagery and identifies the presence of clusters of moated settlements in these regions through statistical analysis.

1. Introduction

The existence of morphologically distinct archeological sites in Northeast Thailand was first noted in 1906, when Prince Damrong Rajanubhab described a large, uninhabited mound in the upper Mun Valley of Northeast Thailand called Non Muang Kao (Damrong Rajanubhap, HRH Prince, 1995). Since then many more circular mounds surrounded by moats and embankments have been discovered. Excavation has revealed that, in at least one case (Ban Non Wat), occupation dates from the Neolithic (c. 17th century B.C.) until the Iron Age (c. 500 B.C.–A.D. 600), pre-dating the foundation of early Chenla states and the later Angkorian expansion into the region (Williams-Hunt, 1950; Vallibhotama, 1984; Higham, 1998b; Moore, 1988; Welch and McNeill, 1988–9; Talbot and Janthed, 2001; McGrath and Boyd, 2001; Higham, 2011). Excavations that have exposed stratigraphic relationships have provided relative dating and recovered samples have provided absolute dates. It is clear that the construction of the moats occurred from the mid- to late Iron Age, c. A.D. 1–600 (Boyd et al., 1999a, 1999b; Boyd and McGrath, 2001a; Boyd and Habberfield-Short, 2007). Sites typically have a mound up to five meters in height with between one and five surrounding moats and embankments. The moats surrounding these sites are substantial, some reaching over 100 m in width. Despite the research that has been undertaken thus far, the exact function and purpose of the moats is still debated. In the absence of strong evidence for one particular use, several theories have been put forth over time including defense (Vallibhotama, 1984; Nitta, 1991), agriculture (Higham, 1998a; Vallibhotama, 1984), symbology (O'Reilly, 2008), flood mitigation (McGrath et al., 2008; O'Reilly, 1999), or water storage (Higham, 1998a; O'Reilly, 2014). Sites surrounded by moats and embankments might well have been constructed for defensive purposes to slow an enemy's advance and indeed this was the interpretation offered by Williams-Hunt (1950) when he first published his report on such sites. An agricultural purpose would suggest that the moats were used to either grow rice or to irrigate surrounding fields. The symbological explanation draws on the idea that the moats represented a statement of power or perhaps a reflection of cosmological relationships as, for example, at Angkor where the moats are interpreted as a representation of the 'cosmic ocean' (Freeman and Jacques, 1999). Some have suggested the moats may have been constructed to mitigate seasonal flooding and the embankments were in place to protect the site from inundation. Lastly the water storage explanation refers to the use of moats to retain water in times of drought or through the dry-season for multi-purpose use by the site's inhabitants.

A large-scale survey of the Northeast of Thailand was undertaken by Moore (1988) who created the first catalogue of moated sites. Her efforts were laudable and relied on aerial photographs produced by Williams-Hunt to create a substantial database of sites. The advent of remote sensing technologies such as Google Earth has made desktop survey for archeological resources more practical, cost effective and in some cases, accurate due to improvements in image resolution.

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We present data that expand our understanding of the distribution of these morphologically distinct archeological sites. The new data, gathered using Google Earth, nearly doubles the 151 published moated sites in Northeast Thailand adding 146 further sites to this total.[1]

1.1. Geography of the Khorat Plateau

The Khorat Plateau of Northeast Thailand covers 170,226 km^2 and is bordered on the west by the Phetchabun mountain range and the south by the Dangrek mountains (Moore, 1988: 13). The former reach a maximum height of 1780 m, high enough to cause a rain shadow effect over the western parts of the Khorat Plateau (Supapoj, Naklang, and Konboon 1998, 162, Riethmuller, 1988, 78). The Plateau is divided into two regions, the Sakon Nakhon Basin in the north and the Khorat Basin to the south, where the vast majority of moated sites are found. The Mun and Chi rivers flow east through the Khorat Basin before joining the Mekong, which forms the eastern and northern boundaries of the Plateau. Rainfall records indicate an increase in precipitation from the west to east, ranging from an annual average of 1000–2400 mm. This is nearly all deposited during the "rainy" or "wet season", which occurs between May and September in two monsoon patterns peaking in June and September (Supapoj et al., 1998: 162). Annual fluctuations in the duration and intensity of the wet season can have significant impacts on crop yields (Parnwell, 1988; Fox and Ledgerwood, 1999; Bruins et al., 1986; Paul, 1984).

1.2. Northeast Thailand prior to the Iron Age

The earliest evidence for permanent occupation on the Khorat Plateau dates to the Neolithic (c. 1650–1050 B.C.) when rice farmers began to move into the area (Higham and Higham, 2009, 138). This is a relatively recent discovery as only a decade ago it was thought that the area had not been settled until the Bronze Age (Higham and Thosarat, 1998). Subsequent research has revealed Neolithic-period cemeteries at certain sites indicating a long period of occupation through the Bronze and Iron Ages and into the Historic periods of some sites (Higham and Kijngam, 2010).

The introduction of iron smelting c. 500 B.C. marks the start of the Iron Age that is traditionally capped in the mid first millennium A.D. (Higham and Higham, 2009, 137, O'Reilly, 2007, 83, Vallibhotama, 1984). This technological advance coincides with morphological changes in site architecture in Northeast Thailand. AMS dating undertaken by McGrath and Boyd (2001, 359) places the construction of the moats and embankments surrounding occupation mounds from the mid to late Iron Age, c. A.D. 1 to 600. During the ensuing Historic Period the region saw the establishment of the Dvaravati polity c. A.D. 500–1000 (Moore, 1988, 141). This poorly understood Mon culture seems to have spread into the region from Central Thailand. Dvaravati is followed by the Khorat Khmer period which saw the expansion of the Angkorian civilization from Cambodia into Northeast Thailand c. post-A.D. 1000 (Welch, 1998, 208). During this time there is an apparent shift in site architecture, at least at some sites, from circular to rectilinear lay-outs, aligned along the cardinal points (Gaucher, 2002, 30). Despite these changes, the integration of hydrology, introduced during the Iron Age, continued to be an integral part of design with rectangular moats and reservoirs (*barays*) often incorporated.

[1] Higham (c.f., 1998b, 2011, 2014) has published a map illustrating moated sites in the Mun Valley. Higham's research was consulted and placed as an overlay in Google Earth and many sites confirmed while others seem to have disappeared in the intervening 15 years since the research was undertaken. No geo-location data exists for the sites mapped by Higham (pers. comm.) as the sites were transferred manually from aerial photographs to a map.

1.3. Previous research

Some forty-four years after Prince Rajanubhab's mention of Non Muang Kao, Williams-Hunt undertook an aerial survey of Northeast Thailand (Higham, 2011; Vallibhotama, 1984; Moore, 1988). Williams-Hunt (1950, 32) published a paper using his photographs and others compiled by the Royal Air Force that distinguished the circular, moated sites of Northeast Thailand from the later rectilinear, moated sites. Using aerial photographs, Williams-Hunt was able to differentiate the morphology of the two site types, leading him to hypothesize that the circular, moated sites pre-dated the Khmer dominance of the region. Since then more researchers have been drawn into the field and a plethora of theories have emerged to explain the function served by the moats surrounding these sites. The most plausible theories of defense, agriculture and water storage functions have been the focus of many of the studies conducted in the Khorat Plateau since the 1970s. Higham (1977a, Higham and Kijngam (1979, 1984b) and Moore (1988) conducted some of the first projects aimed at divining one particular purpose for the moats. Based on excavations of the site Ban Chiang in the Sakon Nakhon Basin, Higham and Kijngam published their findings for several cultural and palaeoenvironmental changes occurring in the region roughly corresponding with the onset of the Iron Age (Higham and Kijngam, 1979). The authors noted that the archeological record at Ban Chiang showed a marked decline in aquatic species and an absence of the previous evidence for permanent lakes contemporaneous with the onset of iron technology (settlement phase 3 at Ban Chiang). This supplied the first evidence for what has now become widely accepted, that of a drier climate and more pronounced dry-season during the Iron Age in the region (Higham and Kijngam, 1979; Welch, 1989; McGrath and Boyd, 2001; Higham and Kijngam, 1984a). It is interesting to note that the excavations also revealed the introduction of domesticated water buffalo at this stage considering that the species requires regular access to water (Higham and Kijngam, 1979: 224).

During the late 1980s and into the 1990s, work conducted in the Phimai region of the Khorat Basin provided more information on the subject through spatial analyses (Welch, 1989; McNeill and Welch, 1991). This research led to theories of a two-tiered economic system to explain differences in site structure and layout. More recent research on the moats has been conducted by Higham and his Thai colleagues Kijngam and Thosarat, work which focused on the excavation and dating of the moat features (c.f. Higham et al., 2007; Higham and Kijngam, 2009). Research undertaken by Boyd et al. in the late 1990s and early 2000s (Boyd et al., 1999a, 1999b; Boyd and McGrath, 2001a,b; McGrath et al., 2008) addressed many of the questions surrounding the structural morphology of the moats as well as advancing the current understanding of the hydrology and vegetation history of the Khorat Plateau.

In 1984, Vallibhotama (1984) published a paper in which he posited three potential functions for the moat and rampart system. Along with that of defense, the paper put forward the possibilities of the moats being used as an agricultural or water storage system.

Higham (1977b) conducted an analysis of site location in Roi Et province in the Chi Valley, Northeast Thailand. The focus of this project was soil type (permeability, water run-off, and slope), rainfall and access to perennial streams in order to discern whether sites were located to optimize agricultural potential. The results indicated that many of the moated sites were located in the more arid southern half of the province, leading him to suggest that the moats around these sites were developed as technology for controlling water as population pressure increased at the onset of the Iron Age, forcing people into the more arid areas of the Khorat Plateau (Higham, 1977a: 135). While the first spread of people into the southern Khorat Plateau at the start of the Iron Age has since been disproved by the discovery of pre-Iron Age cultural deposits at sites in the Chi Valley (Higham and Kijngam, 1984a), the use of moats for controlling water remains a valid hypothesis.