

## Notes on two types of moated settlement in Northeast Thailand

### Introduction

Moated settlements are found in most regions of mainland South East Asia, but are especially common in Northern, Central, and Northeast Thailand. This paper defines and compares two types of moated settlement located in the Mun River basin of Northeast Thailand : the "water-harvesting" and the dissimilar or "territorial" sites. The two types can also be described using the terms "topographically controlled" and "non-topographically controlled" (Tiva Supajanya 1984). Moated settlements are often referred to in Thailand as *mu'ang*, a proto-Thai word which refers to a town, a city or a country (Moore : 1986 : 24).

The plan of the moats and earthworks of the water-harvesting sites is governed by the local terrain, but that of the territorial sites is not. Each new moat and earthwork of the water-harvesting settlements repeats the contours of the central mound which they encircle. The use of mounds for habitation is characteristic of the Northeast. The mounds rise 1-5 metres above the surrounding, generally flat landscape, visible on the ground and from the air. The mounds have been built up over centuries ; occupational debris overlies naturally occurring remnants of terraces formed by the action of rivers and streams, wind, and salt. As the water-harvesting settlements evolved, the mounds were surrounded by additional rings of water and land (see figures & plates). The final impression of form resembles that made when a pebble is dropped in a smooth pond and the disturbed water makes ripples around the place of entry.

The moats of the territorial sites tend to be fewer in number (often only one) and somewhat wider than those found surrounding the water-harvesting sites. Where moats have been added to the territorial sites, rather than the incremental expansion characteristic of the water-harvesting sites, each territorial development encloses a tract of land, often expanding in one direction only (see figure ).

Some of the territorial settlements began as and remained territorial sites, always non-topographically controlled and often with a larger size than the water-harvesting sites in the same area. They are a variable group which will require a case by case examination in the future. Other territorial sites began as water-harvesting sites and then changed in form. This alteration is correlated to functional changes and dated to the second half of the 1st millenium AD.

### **Previous study of water-harvesting settlement in the Mun basin**

The moated settlements in the Mun basin of Northeast Thailand are well known (e.g. Higham & Amphan Kijngam 1982 ; Srisakra Vallibhotatma 1982 ; Tiva Supajanya & Pongsri Vanasin 1982, Wales 1957 ; Welch 1985 ; Williams-Hunt 1950). However, their cultural identity and chronology have yet to be substantiated by a series of major excavations. A radiocarbon date of 820-415 BC has been obtained from the water-harvesting site of Ban Tamyae (15.14 n × 102.28 e), indicating prehistoric occupation of the mound (Welch 1985 : 224). However, no evidence was recovered at Ban Tamyae to date the construction of the moat and earthwork. Images dated to the 7-10th century AD have been recovered from both territorial and water-harvesting settlements (Bangkok Museum 1973, Srisakra Vallibhotama 1985). The custom of surrounding a site with moat(s) may thus span as much as 2000 years, from c.1000 BC to c. 1000 AD. A locational analysis and classification of 80 water-harvesting settlements in the Mun basin identified on the World War II Williams-Hunt Collection of aerial photographs yielded the following conclusions (Moore 1986a, b).

The water-harvesting settlements, when seen in cross-section, have a moat-mound-moat profile. The mound is surrounded by up to four moats, each averaging 30 metres. Each moat is bounded by earthworks, which today average 15 metres wide at the base and 3-6 metres high. When the area enclosed by the outermost earthwork was measured, the mean site size was 25 hectares.

The ecological prototype for the water-harvesting and the territorial sites may be "Naturally Moated Sites", slightly elevated mounds flanked by a permanent river on one side and intermittent rivers or marshy land on the other. Water pooling in the marshy area forms a natural moat. Water has shaped the landscape of the water-harvesting sites, and is the primary factor to be considered in relation to their survival. Sources of water include the Mun and its tributaries, rainfall, and the groundwater table.

The simplest water-harvesting sites are generally found on floodplain areas. Tributaries of the Mun such as the Lam Plai Mat and the Lam Thamen Chai have made the river basin a patchwork of floodplain and terrace formations or undulating upland areas (Tiva Supajanya, S. Hogcharoen, P. Chanhaw 1985). Soil maps of the region are correlated to terrace (Soil Map 1974, 1975, 1977). The floodplain/terrace combination is the typical location of the water-harvesting moated settlements.

Often a stream forms a natural moat around part of the habitation mound, particularly at the simple floodplain sites. Such sites tend to have less of the mound perimeter surrounded by an initial moat and fewer additional moats. Site complexity, measured by the number of moats and the degree of moat encirclement of the mound, increases as location moves from the floodplain onto the low and upper terraces (Moore 1986 a, b).

A majority (55%) of the water-harvesting sites examined were located on low terrace land at 130-180 metres altitude, and 86% were adjacent to a watercourse. The sample was randomly distributed, showing only a slight statistical clumping. The most likely explanation for the site clusters is water availability, but kin-based groups are another possibility to explore (see Bloch 1977, Friedman & Rowlands 1977, Keyes 1974, O'Connor 1983, Wolters 1982).

Many of the water-harvesting moats are now silted up and used for wet rice agriculture. However, large sections remain water filled, despite the lack of an obvious water source. Judging by the rate of change in the area, it is conceivable that a stream may have fed the moats at some point in the past, but has now changed course. Moats could also fill from underground springs, seepage, and/or collection of rainwater. The trees growing on the surrounding earthworks would also help to slow the rate of evaporation from the moats (B.Maloney, pers.comm., 1986).

Today, as may have been the case in the past, shallow margins and silted in moats are often used for nursery rice cultivation in the early part of the rainy season. A cultivation technique termed "farm-pond irrigation" or "bo" type rice culture may also be linked to the water-harvesting settlements (Takaya & Matsumoto 1974 : 509-10). The method, where small ponds are dug in the midst of rice fields, and the water lifted to the fields in bamboo baskets, is typically found on terrace type rice land, and is postulated to have originated on the terrace lands of the Khorat Plateau (ibid : 510).

### **Description of two water-harvesting sites**

Let me illustrate the above conclusions by describing two of the water-harvesting sites. Ban Nong Ta Na (15.13 n × 102.24 e) is located in Nakhon Ratchasima, to the south east of Phimai. Mu'ang Fang (14.49 n × 103 e) is in Buri Ram, south of Changwat Buri Ram (plates 1 & 2).

Ban Nong Ta Na is situated on a slightly elevated low-middle terrace remnant commanding lower land. The initial earthwork and moat hug the perimeter of the mound. The second and third moats are fed by the Huai Non Daeng, a stream which originates about two kilometres south of Ban Nong Ta Na. The stream flows down the one kilometre wide floodplain, and then turns west for about half a kilometre just to the north of the slight promontory where Ban Nong Ta Na is located. The site hangs like a round ornament along the east-west sector of the stream. The Huai Non Daeng then shifts to a north-south course, joins a second stream bordering Ban Nong Ta Na on the west, and continues its course north to the Mun River.

Surface sherds collected at Ban Nong Ta Na include several types of cord-impressed pottery, coarse ware tempered with laterite, burnished blackware ("Phimai black"?), and thin, hard, finely tempered white slipped ware.

Ban Nong Ta Na is one of a cluster of three triple-moated sites, averaging 26

hectares, with an inter-site distance of only 5-7 kilometres. The similarity between the three sites is striking. Ban Mu'ang Fang in Changwat Buri Ram is also stylistically paired, to the site of Ban Mu'ang Du located 5 kilometres to the south.

Ban Mu'ang Fang, in Changwat Buri Ram, has an area of about 40 hectares. Ground survey finds include a *sema* stone, a stone bell of the type frequently found in the Central Plain in association with 7-11th century AD sites ("Dvaravati"), and numerous brown glazed pots dated to the 9-14th century AD period of Khmer influence on the Khorat Plateau (Sorajet Wonakamwichai 1985). Surface sherds include thick (1 cm) coarse black ware tempered with laterite and slipped on the outside, and thin (0.5 cm) hard finely tempered white ware. The range of objects suggest continued occupation over a period of at least 700 years. The Khmer finds indicate that habitation post-dates the construction of stone temples and water reservoirs or *baray* in the area. The *baray* supplemented the moats or served different, possibly ceremonial, purposes.

The Dvaravati art style had a unique variation in the Northeast, namely the practice of carving scenes on large (c.2 metres high) *sema* or boundary stones. Research to date on the distribution of *sema* stones indicates that they mainly occurred in the northern parts of the Khorat Plateau (Srisakra Vallibhotama 1985). However, a rough *sema* was found at Mu'ang Fang and at other Mun basin moated sites, evidence that the limits of the practice of erecting *sema* stones may yet to be documented.

In cross section, Mu'ang Fang is an elevated mound surrounded by earthworks and moats at its perimeter or base. The site is located on a slightly elevated middle terrace mound of undulating upland, and is surrounded by lower terrace land (Soil Map 1975). The elevational difference may be the result of the dissolution of underlying salt lenses. Salt lenses are characteristic of the Maha Sarakham and Khok Kruat Formations which make up the southern part of the Khorat Plateau (Wongsomsak 1986 : 135). Potential or actual salinity is also one of the major agricultural limitations of the Low Humic Gley soils, the soil group on which the water-harvesting settlements are most frequently located (Moore 1986 : 38).

### **Salinity and the water-harvesting sites**

Salt-induced alterations to the topography of the Northeast include not only subsidence from dissolved salt lenses, but the effects of anticline and syncline formation, as illustrated by the quotation below.

"Hite and Japakasetr (1979) have divided the Maha Sarakham Formation of Cretaceous age into Lower Salt, Middle Salt, and Upper Salt. Originally, they had concluded that the salt sequence was flat lying. However, a salt anticline was discovered near the city of Khorat in 1979 (Hite and Japakasetr, 1979). Since then they have been found over much of the Sakon Nakhon and Khorat basins. They are of

interest to us because they are very close to the present land surface in many places and topography reflects the core of the anticline and sometimes a ring syncline. Some ancient settlements are located directly over salt anticlines because the land surface is slightly higher there. Others are situated directly over the collapsed core of salt anticlines where the solution of the salt has produced a basin in the salt." (Supajanya & Rau 1986 : 136).

Another illustration of the topographical effect of salt is found in the hilly area to the west of the Nakhon Ratchasima-NonThai-Chaiyaphum road. Parts of the landscape in this area, when viewed in schematic section are composed of ridges and troughs. Between the ridges, weathering and cave-ins have created a "valley-like topography...occupied by paddy fields and swamps" (Wongsomsak 1986 : 140).

Thus the terrain in which the water-harvesting settlements originated was greatly influenced by underlying salt formations. Salt may also have been a factor in creating the Naturally Moated Sites defined earlier, as supported by the following quotation.

"This flowage of salt from the synclines into the anticlines probably explains the origin of the ring syncline or depression seen around many ancient settlements of the Khorat Plateau where they have filled with water. Thus, they are naturally formed moats which make ideal defensive positions for towns. Such moats show no rims indicating that they were not dug by hand. Moreover, they are too wide and deep in some settlements to have been dug by hand." (Supajanya & Rau 1986 : 136).

Salt affected the relationship of the mound to the moats encircling it. Domestic ponds dug on the top of the mound would tend to have less saline water fill from the ground table than moats dug at the base or perimeter of the mound (Wongsomsak 1986 : 144). Brine carried downward from the elevated mound either by surface or subsurface flow, tended to make water supplies more saline at the base of the hill (*ibid.*).

It is possible that additional moats were dug progressively further up the footslopes of the mounds, in an attempt to obtain fresh rather than saline water supplies (Tiva Supajanya, pers.comm. 1986). However, there are no remains of moats or earthworks on the mounds. Also, moats and earthworks of the water-harvesting sites clearly follow the contours of the mound perimeter, which would argue against an inward evolution of successive moats.

Alternatively, additional moats may have been dug as the water in the inner channels became too salty. Or the salinity may have been known and exploited. During

periods of flood, the salt in solution is brought to the surface. During the dry season the salt crystallizes on the ground as an efflorescence, which can then be scraped off in crusts and processed into an edible source of sodium to supplement the low sodium content of rice (Pendleton 1962 : 256). The manufacture and sale of salt may have been an important element in the economy of the water-harvesting sites.

#### **Territorial sites : increase in size**

Having described some of the factors influencing the water-harvesting sites, let me now return to those moated settlements which changed, from a water-harvesting to a territorial form. As mentioned earlier, these sites are often characterized by a greater increase in size with each moat addition than found at the water-harvesting sites. A comparison of Mu'ang Fang, a water-harvesting site, and Mu'ang Sema, a territorial site, illustrates this point (see figures & plates).

Mu'ang Fang has at least 4 moats. The area of the mound and the innermost earthwork/moat pair is about 23.7 hectares. When the second earthwork/moat set is included, the total area increases by 37% to about 32.5 hectares. In contrast is the territorial site of Mu'ang Sema. The original mound and moat on the southern part of the site measure about 37.5 hectares. The second moat encloses about 112.5 hectares, increasing the site area by four times, to about 150 hectares. A rectilinear enclosure is found at the centre of the new enclosure.

The second moat is not situated, as is the case at Mu'ang Fang, to bring water as close as possible to the inhabitants of the mound. At Mu'ang Sema, although the second moat is still a water and food source, it also reaches out to demarcate an uninterrupted tract of land. A further area of about 62 hectares may have been incorporated to the northeast, as evidenced by the remains of an earthwork beginning on the northwest corner and terminating in about two kilometres at an elevated site.

Mu'ang Sema is located on the western edge of the Khorat Plateau, in a favourable position for trade with the Central Plain. Some work has been carried out at the site, yielding several artefacts datable to the 7-11th century AD Dvaravati style, including a stone wheel of law and a large reclining Buddha (Fine Arts Department 1960 : 61). In addition, a Sanskrit inscription dating to the 7th century AD has been found at Bo Ika, near Mu'ang Sema (Coedès 1965 : 83). The stele commemorates donations to a Buddhist community by the ruler of Sri Canaca, a polity thought to have existed during the second half of the first millennium AD. Like the "kingdom" of Dvaravati, the location and extent of Sri Canaca is uncertain. The inscription is of interest here as it indicates that tracts of land may have been donated as a merit-making gesture in a Buddhist context.

At Ban Kong Rot (Nakhon Ratchasima) (figure 2), the area enclosed by the mound and the three moats totals about 50 hectares. With the addition of a non-

topographically governed rectilinear moat and earthwork, the area increased to about 94 hectares. The additional moat surrounded the former water-harvesting site and the new block of land. At Ban Prathai (Nakhon Ratchasima), a later squared-off moat also encloses the earlier oval moat, increasing the area from 37 hectares to 81 hectares (figure 3). None of the rectilinear additions bears the characteristic regularity of a Khmer temple enclosure.

As might be expected from such gains in site size, when all the moated settlements in one district (Changwat Buri Ram) were compared to the subgroup which changed from topographically to non-topographically controlled, the subgroup sites had a larger average size than the group as a whole. This comparison is detailed below. All data are from the Ancient Settlements from Aerial Photographs Research Project, Chulalongkorn University, courtesy of Tiva Supajanya (1987).

The mean area of a sample of 101 topographic, non-topographic, and topographic to non-topographic moated settlements was 32 hectares. Non-topographic sites whose form did not change had a slightly higher mean, 36 hectares. The topographically controlled water-harvesting settlements (65% of the total) were slightly smaller, averaging 26 hectares. In contrast, the mean for the sites which changed from topographically to non-topographically controlled (8% of the total), was 89 hectares. The point of the comparison is that sites whose form changed from water-harvesting to territorial, by enclosing large tracts of land with each moat addition, are greater in overall size than other types of moated settlement.

### **Central Plain comparison**

• Impetus for the construction of territorial sites in the Northeast, both new ones and modified water-harvesting types, may have come from the Central Plain of Thailand. The plan of moated settlements such as U Thong, Ku Bua and Nakhon Pathom in the Central Plain closely resembles that of the Northeast territorial sites. None of the moated settlements in the Central Plain have yielded artefacts earlier than the 7-11th century AD Dvaravati period. (Phuthorn Bhummadhon, pers. comm. 1986). Both the Northeast territorial sites and moated settlements in the Central Plain are typically encircled by a single non-topographically controlled moat with one of five main forms: free-form, circular, oval, rounded corner, or angular corner (Tiva Supajanya 1984).

At Nakhon Pathom, the perimeter of the old town is a free-form moat. There is also a canal running from north to south. Both moat and canals were undoubtedly used for transportation as well as territorial demarcation. Excavations at Nakhon Pathom have uncovered the foundations of buildings which appear to have been rebuilt several times between the 7th and 11th centuries AD, indicating contemporaneous occupation with sites such as Mu'ang Sema.

This is also supported by images of the Buddha in a similar Dvarvati art style from Central Thailand and the Northeast. Finds have come from both water-harvesting and territorial moated settlements, suggesting that Buddhist influence was not restricted to the territorial sites. While the range of images from each region is distinct they are stylistically related. Inscriptional evidence of Indian or Ceylon-based religious influence also indicates a west-to-east flow of ideas from the Central Plain to the Northeast at this time. For example, in addition to the Bo Ika inscription mentioned earlier, two 8th century AD Sanskrit and Khmer (with Mon influence) inscriptions found 35 miles south of Khorat, at Hin Khon, commemorate benefactions to the Buddhist religion (Coedès 1965 : 73).

The case for heightened exchange between the Khorat Plateau and Central Thailand during the late first millennium AD is further strengthened by evidence that the shoreline of the Gulf of Thailand was far to the north of its present position during this period. This was noted a number of years ago (Seidenfaden 1927 : 2) and has recently been substantiated by geographical and remote sensing analysis of the Central Plain (Tiva Supajanya and Pongsri Vanasin 1981). If the shoreline of the Gulf of Thailand was further north, port access from the Northeast would have been easier, placing towns such as Saraburi close to the Gulf. Goods sent from Nakhon Ratchasima to Saraburi for shipment had only to be transported 108 kilometres, less than half the distance from Nakhon Ratchasima to Bangkok today. The possibility that Saraburi served as a collection point for products from the Northeast is supported by Saraburi's role as the nearest *suai* or tax collection point for Nakhon Ratchasima during the 19th century (Wilson 1987).

### Summary and future investigations

To summarize, moated settlements found in Northeast Thailand can be divided into two types, the water-harvesting and territorial sites. The majority, the water-harvesting sites, have a moat-mound-moat profile with the shape of the moats and earthworks derived from the shape of the mound. Successive moats increased to as many as four. The form of the territorial sites is not governed by the topography. They tend to be larger and have fewer moats. Some of the water-harvesting sites became territorial settlements. Additional moats no longer followed the contours of the mound, but demarcated a new continuous zone of land potentially suitable for settlement or agriculture. The change from the water-harvesting to territorial type may date to the second half of the 1st millennium AD, having been generated by economic and cultural trade with Dvaravati moated towns in the Central Plain.

Why did the builders of the territorial sites not conform to the pre-existing mode of moat construction, and place the additional moats just outside the first? To do so would have, as was the case in the water-harvesting sites, had the following



benefits. The water storage capacity, and the amount of plant and animal protein that could be harvested from the water, was increased. The building of another earthwork doubled the defensive capabilities and created new and accessible habitats for small game. Potential salt manufacturing locales were added. Instead, at the territorial sites, the inhabitants chose to dig the second moat to enclose more territory. The addition usually formed a large tract rather than a narrow belt of new land. The change in form may mark a change in function, reflecting a later period of construction for the territorial than for the water-harvesting settlements of Northeast Thailand.

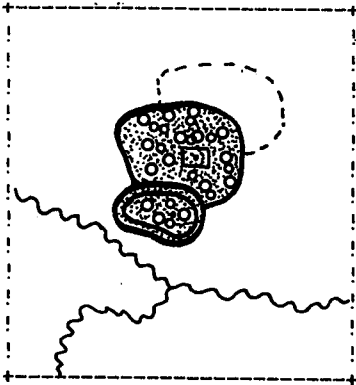
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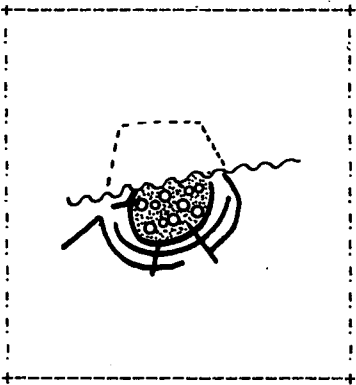
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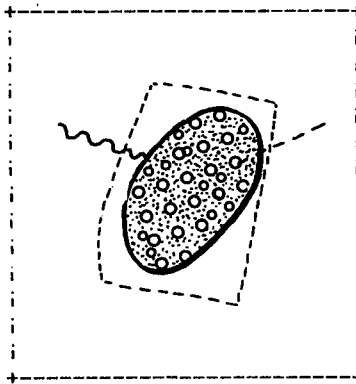
## Figures



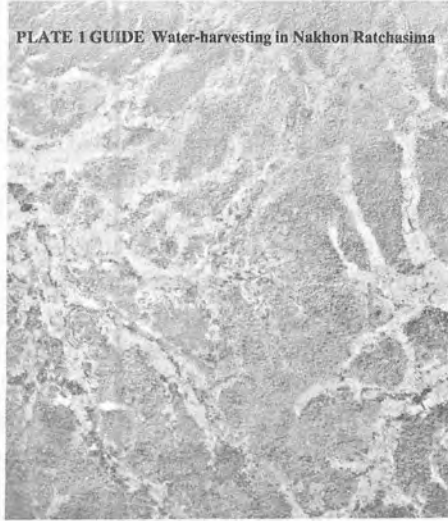
**Figure 1**  
 Mu'ang Sema  
 Amphoe Sung Noen  
 Changwat Nakhon Ratchasima  
 14.55  $\mu$  × 101.48  $\mu$



**Figure 2**  
 Ban Kong Rot  
 Amphoe Huai Thalaeng  
 Changwat Nakhon Ratchasima  
 15.02  $\mu$  × 102.44  $\mu$



**Figure 3**  
 Ban prathai  
 Amphoe prathai  
 Nakhon Ratchasima  
 15.31  $\mu$  × 102.48  $\mu$

**Plates****PLATE 1 GUIDE** Water-harvesting in Nakhon Ratchasima**Plate 1**

Ban Nong Ta Na, in the lower left portion of the photograph, is one of three moated settlements on this photograph (annotated by Williams-Hunt). From the Williams-Hunt Collection.

**PLATE 2 GUIDE** Water-harvesting in Burirath**Plate 2**

Mu'ang Fang (to the north) is seen just to the left of the centre of the photograph. Mu'ang Du is to the south on the lower left hand corner. From the Williams-Hunt Collection.