

PRELIMINARY REPORT ON ARCHAEOLOGICAL SURVEY AND EXCAVATIONS IN THE  
PHIMAI REGION, NORTHEAST THAILAND

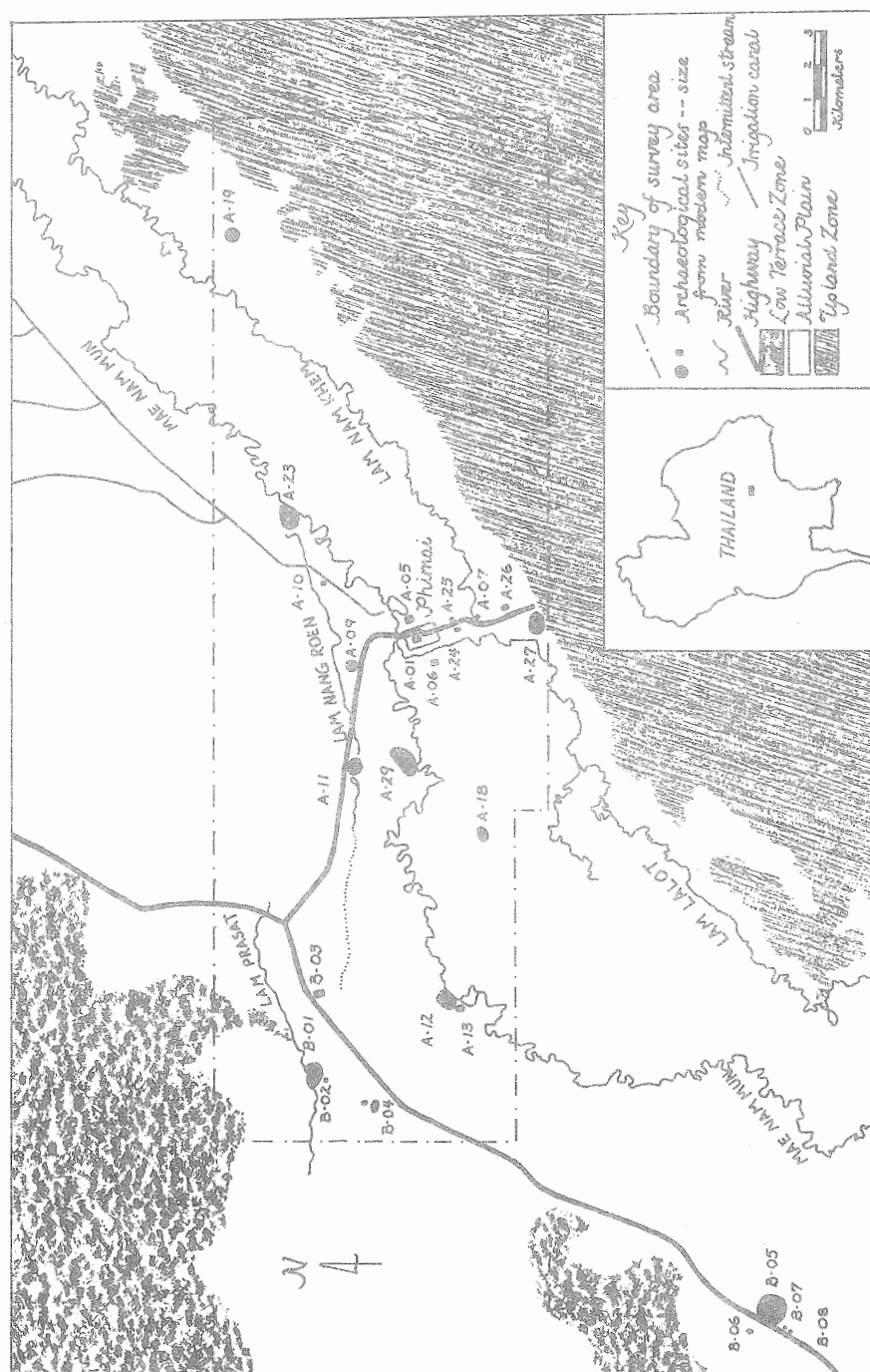
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PROJECT BACKGROUND

Based on the examination of aerial photographs, Williams-Hunt (1950) first noted the presence of over 200 archaeological sites apparently fortified by earth walls and moats along the Mun and Chi Rivers in the Khorat Basin of northeast Thailand. Since that time archaeological fieldwork has been conducted at only a few of these sites, namely Muang Sema and Muang Fa Daed by the Fine Arts Department of Thailand (Wales 1969, Subhadradis 1956), Ban Thamen Chai and Muang Phet by Wales (1957), and Non Dua by Higham and Parker (1970, Higham 1977). After mapping the location of over 400 fortified sites from aerial photographs, Thiva and Srisakra (1972) warned that many of them were in danger of destruction prior to archaeological field investigations. Therefore, the Khorat Basin Archaeological Project was organized to carry out archaeological survey and test excavation of fortified sites in the upper Mun River valley. The National Science Foundation provided funding through a dissertation research grant to the author, and the Fine Arts Department (FAD) of Thailand sponsored the research. Praphid Phongsmas, a FAD official, participated as co-researcher and a field supervisor, Professor Promsak Jermsawatdi supervised the work of three students from Chulalongkorn University during the Ban Tamyae excavations, and Judith McNeill acted as assistant project director.

The basic objectives of the project are to:

1. Determine the location of the fortified sites in the survey area, their size, present condition of the earthworks, and the type of archaeological remains associated with each site, and to prepare a map of each site.
2. Establish a local ceramic sequence for relative dating of the sites, and, if possible, to obtain radiocarbon dates from stratified deposits to provide calendrical dates for the sequence.
3. Ascertain the probable function of the earthworks and moats and the time at which they were constructed.
4. Test the hypothesis that an intensive agricultural system involving use of the plow and water control was used by the inhabitants of the fortified sites.



5. Test the hypothesis that the fortified towns were regional exchange centers for long distance trade.

The area selected for initial investigation centered around Phimai, a district administrative center and market town on the Mun river in Nakhon Ratchasima province. The rectangular survey area extended 15 km east and west and 5 km north and south of Phimai (Figure 1).

Three major environmental zones are present in the Phimai region: the alluvial plain, the low terraces, and the uplands. The broad, flat alluvial plain, covered by diked rice fields, is drained by numerous meandering seasonal and perennial streams. Rainfall, which averages 1200 mm a year, is just adequate to produce a single rice crop annually, but the Phimai and Kula Ronghai clay soils, which cover about 75% of the plain, are among the best in northeast Thailand for growing rice. West of Phimai farmers depend upon rainfall to water the fields, while northeast of Phimai, modern irrigation canals control the water supply to the fields. Farmers live in clustered villages of 70 to 300 households situated on mounds which rise 1 to 5 m above the alluvial plain. To the southeast the alluvial plain ends abruptly 3 to 5 km from the river where forested hills rise gradually to heights 70 to 100 m above the plain. Northwest of the river the alluvial plain is broader, extending 10 to 15 km from the river to the low, rolling plains of the low terrace zone. Except for hilly uplands in the southeast, the survey area falls within the alluvial plain zone.

Previous archaeological investigations in the survey area have been confined to Phimai and a few historic sites near Phimai. Phimai, formerly enclosed by a rectangular wall and moat, is the site of a large Khmer temple constructed during the tenth and eleventh centuries A.D. Between 1963 and 1968, UNESCO and FAD restored the main prang (sanctuary) and prepared a town map (Groslier 1963). Solheim (1965) reported the discovery by the FAD-University of Hawaii project of a new pottery type, Phimai black, beneath the foundations of the prang, and Parker (1966) excavated Ban Suai, a mound in the southeast part of the town, where he recovered Phimai black pottery and iron slag. A charcoal sample from Layer 6 (of eight layers) was radiocarbon dated  $1930 \pm 100$  B.P. (Gak-991); that is, about 20 B.C. to A.D. 160 (Solheim and Ayres 1979:68). Two excavations within the temple compound by Silpakorn University and by Peacock in 1969 uncovered several layers of structural fill containing "Dvaravati" pottery and burials containing Phimai black pottery, bronze, and iron (Bronson 1976:671, 709-712). FAD has conducted further, still unreported, excavations at Ban Suai in 1977 and at Tha Nang Sa Phom, a site previously surveyed by FAD (1959).

## SITE SURVEY

Between December 6, 1979 and January 25, 1980 a four member team surveyed sites within the survey area and a few additional sites. A map by Thiva and Srisakra, identifying thirteen fortified sites in the Phimai area from aerial photographs, was generously provided by Srisakra and served as the original guide to site locations. The survey team surveyed these sites, all mounds, and other mounds within the survey area. While a few small mounds may have escaped attention, I feel that the survey has located the great majority of sites of this type within the project area. Intensive, reconnaissance surveys of a few non-mound areas found only concentrations of modern sherds, probably marking the site of recent field huts, and a few reservoir basins and embankments.

Villages are located on most of the mounds. At each inhabited site, the survey team interviewed the headman or his assistant and drew and photographed artifacts in local collections. Each site was mapped with tape and compass, and the elevation of the mound along two axes measured at 10 m intervals. At two sites, Ban Samrit and Ban Prasat, roads had been cut through the mound, making it possible to collect a stratified sample of artifacts from the exposed faces. At these sites and at Non Ban Kham and mound NR-A-08 subsurface samples were collected by coring with a soil auger.

Twenty-four sites, including a walled town, fifteen habitation mounds, and five religious shrines, were identified within the survey area. Three reservoirs near Phimai were assigned separate site numbers, but nine additional reservoirs are associated with various habitation mounds. Of the thirteen potential fortified mounds, twelve contain evidence of former human occupation and eight possess features that may be remnants of former earth embankments and moats. Most of the mounds, which are fairly clearly habitation sites, are located on the banks of the Mun river or other watercourses. Mounds may be circular, oval, rectangular, or square, and vary from 1 to 22 hectares in area. Within this range, sites appear to cluster into three size categories. Six sites are less than 5 hectares, five sites are between 13 and 17 hectares, and two sites are approximately 22 hectares. We were unable to measure the spatial extent of two sites. Two small sites may be the result of population expansion from nearby large sites.

Table 1 lists the sites identified during the survey, including sites outside the survey area; Ban Bing, a mound 22 km southwest from Phimai, small mounds near Ban Bing, and Ban Krabuang, a mound in the low terrace zone 32 km northeast of Phimai. Figure 1 shows the location of sites in the survey area.

Site No.	Name	Approx.	Ceramic				Earthwork	
		Size (Hectares)	Tradition				Remnant	
			T	P	EH	LH	Wall	Moat
Habitation Mounds								
NR-A-04	Ban Suai	15	-	X	X	X	-	-
NR-A-09	Ban Nang Roen	1.8	-	?	X	X	-	-
NR-A-10	Non Ban Kham	2.3	X	X	X	X	X	?
NR-A-11	Ban Tamyae	17	X	X	X	X	X	X
NR-A-12	Ban Samrit	22	-	X	X	X	X	X
NR-A-13	Ban Samrit Mai	4.5	-	X	X	X	-	-
NR-A-18	Ban Khla	1.5	-	?	X	X	-	-
NR-A-19	Noen Phaeng Phuai	16	-	?	X	X	X	X
NR-A-23	Ban Tha Luang	16	-	X	X	X	X	?
NR-A-27	Ban Wang Hin *	-						
NR-A-29	Ban Krabuang Yai	-	-	-	X	X	-	-
NR-B-01	Ban Prasat	22	X	X	X	X	X	?
NR-B-02	Non Prasat	1.2	-	X	X	X	-	-
NR-B-03	Ban Sa Si Liam	4.5	-	X	X	X	X	?
NR-B-04	Ban Ya Kha	13	-	?	X	X	X	X
Walled towns								
NR-A-03	Amphoe Phimai	60	-	X	X	X	X	X
Religious Shrines								
NR-A-01	Prasat Him Phimai	7	-	X	X	-		
NR-A-02	Meru Prahathat	0.3	-	-	X	-		
NR-A-07	Tha Nang Sa Phom	0.9	-	-	X	X		
NR-A-25	Tha Rusi	0.2	-	-	X	-		
NR-A-26	Wat Ko	1.4	-	-	-	X	-	X
Reservoirs								
NR-A-05	Sa Phleng	4.5	-	-	X	X		
NR-A-06		-	-	-	X	X		
NR-A-24	Pratu Chay	1.3	-	X	X	X		
Sites Outside Project Area								
NR-A-28	Ban Krabuang	3.1	-	X	X	X	X	X
NR-B-05	Ban Bing	25	-	X	X	X	X	?
NR-B-06		1	-	X	X	X	-	-
NR-B-07		0.2	-	?	X	X	-	-
NR-B-08		0.2	-	?	X	X	-	-

T = Tamyae  
P = Phimai

EH = Early Historic  
LH = Late Historic

\* = Unable to survey  
? = Probably present

Table 1. Sites of the Phimai Survey region.

#### EXCAVATIONS AT NON BAN KHAM AND BAN TAMYAE

From January 30 to February 15, 1980 a crew of eight laborers conducted test excavations at Non Ban Kham (NR-A-10), a 2.3 hectare, 1.6 m high, uninhabited and nearly square mound 4 km northeast of Phimai. Two 1 by 2 m test pits excavated near the center of the mound and two 1 by 1 m test pits on the south and east edges contained stratified deposits of pottery, animal bone, and shell to a depth approximately 2 m below the summit of the mound. A 1 by 1 m test pit excavated to a depth of 80 cm on a 70 cm high earth embankment on the site perimeter lacked cultural deposits.

From February 18 to May 2, 1980 a crew of eight laborers and three students from Chulalongkorn University conducted test excavations at Ban Tamyae (NR-A-11), a village 6 km west of Phimai. Ban Tamyae is a nearly circular mound, approximately 17 hectares in area (460 m in diameter), that rises 4.5 m above the surrounding plain. Most of the excavation was concentrated at the wat (monastery) on the south edge of the mound, at an elevation about 2.5 m below the summit, where surface survey had revealed heavy concentrations of sherds, including Phimai black sherds. Two 1 by 4 m trenches and a 1 by 1 m extension of one trench contained cultural deposits to 2.1 m below the surface, approximately level with the surface of the alluvial plain. On the west edge of the mound, a 1 by 4 m trench was excavated across what may be the remnants of a moat and embankment. Test pits 1 by 2 m were placed on the north and on the east side of the mound.

The first 1 by 1 m square in a trench was excavated in 10 cm arbitrary levels, except where natural or cultural layers were easily observable. Adjacent squares were opened in sequence and excavated in natural or cultural layers. All soil was screened through 6 mm screens. Soil samples for soil analysis and flotation were collected from all excavation units. A large quantity of potsherds, a few stone, bronze, iron, and non-pottery clay artifacts, animal bones, and shells of fresh water molluscs were recovered. Eight charcoal samples have been submitted for radiocarbon dating. The edges of two human burials were encountered.

Laboratory analysis continued for four months following excavation. All artifacts were examined, vessels were reconstructed, sherds from the survey and ten 1 by 1 m excavation units were analyzed, eighty 1 liter flotation samples were processed, and samples were selected for further analysis at the University of Hawaii.

The preliminary analysis of the ceramics from Non Ban Kham and Ban Tamyae suggests that four major traditions of manufacturing pottery succeeded one another chronologically from late prehistoric

to modern times. These are described below, with estimated dates for the duration of each tradition.

1. Tamyae tradition (1000-500 B.C.). These ceramics have hard, thin walls, grey, fine sand tempered paste, and gray to grayish-brown surfaces that may be plain and well smoothed, cord-marked, or decorated with impressions and fine incised straight lines or applique bands.
2. Phimai tradition (500 B.C.-A.D. 500). These ceramics, including Phimai black among other types, have a dark, gray paste tempered with rice chaff, and plain, cord-marked, or decorated surfaces. The most common decoration consists of thin polished lines burnished against a dull matte background, producing the streak polished pottery that is diagnostic of the Phimai tradition.
3. Late Historic tradition (A.D. 500-1300). These ceramics have a gray or brown paste tempered with fine to coarse sand and were almost certainly made on a wheel and kiln-fired. One ware group has orange-pink, pinkish-gray, or light brown surfaces, usually plain, occasionally incised, with a fine gritty texture, and corresponds with what is frequently termed Dvaravati pottery. A second ware group consists of the brown and green glazed stonewares and earthenwares that are called Khmer or Lopburi ceramics.
4. Recent Historic tradition (A.D. 1300-present). Modern ceramics have a brown to red paste tempered with sand or clay balls and red or yellowish-red surfaces that may be plain, cord-marked, or decorated with incised patterns. Today these are made by forming clay into rings, building the vessels from these rings, thinning the pots on a fast wheel turned by hand, and then firing the vessels in large brick kilns.

#### SETTLEMENT SEQUENCE IN THE PHIMAI REGION

Ceramics of the Tamyae tradition were found in the lowest cultural layers at Ban Tamyae and Non Ban Kham and in the Ban Prasat core. If earlier sites are present, the evidence is probably buried beneath the rice fields and will be difficult to discover. The makers of the Tamyae pottery appear to be the earliest inhabitants of sites that would remain as permanent settlements until the present. Because the pottery was not found on the surface at any site, the number of sites occupied at that time is uncertain.

Streak polished Phimai tradition sherds were found at Phimai and nine of the fifteen habitation mounds, and rice chaff tempered sherds without polish streaks that probably belong to this tradition were found at four other mounds. At Ban Samrit, Ban

Tamyae, Ban Prasat, and Ban Bing, Phimai tradition pottery was seen over nearly the entire extent of the mounds with deposits 1.5 to 3.0 m thick. The evidence suggests widespread occupation of the alluvial plain and intensive use of the inhabited sites for a relatively long period of time. Within the 300 km<sup>2</sup> survey area, at least three sites over 20 hectares (Phimai, Samrit, and Prasat), at least two sites of 13 to 17 hectares (Tamyae and Tha Luang), and five sites of 1 to 4 hectares were occupied. Probably an additional two medium-sized sites and two small sites were also occupied at this time. At Phimai the settlement expanded beyond what was probably the initial occupation on Ban Suai mound to include the area on which the temple now stands, a 30 to 40 hectare settlement.

Pottery of the early historic tradition has been found at twelve habitation sites, four of the religious shrines, the three reservoirs near Phimai, and probably at three other habitation sites. At the small sites early historic sherds are more common than Phimai sherds, and at Non Ban Kham were found in several layers. At many of the larger sites these sherds are rare and occur in only thin deposits overlying the deep Phimai tradition deposits. Whether this indicates a redistribution of the population is as yet unclear. Phimai grew into a 60 hectare town enclosed within a rectangular moat and laterite wall, at which an impressive Khmer temple was constructed. The town was far larger than any other site in the area and could have easily contained a population of 2000 to 3000 inhabitants.

There is no evidence of a discontinuity following the withdrawal of Khmer influence, and sherds of the recent historic period are found at all sites. The two uninhabited sites were abandoned during this century according to local informants, and Non Ban Kham contained several layers with recent historic sherds. A few new sites appear to have grown up along highways during this century.

#### SITE FORTIFICATION

The survey revealed that eight of the thirteen potential fortified mounds have earth embankments 0.4 to 1.5 m high parallel to the edges of the mounds. Four of these sites possess canals or a series of ponds along their edges, and at the other four sites rice fields, lower than the surrounding fields, are located at the mound edges. At no site did these earthworks extend beyond half the circumference of the mound, although at Ban Samrit, Ban Prasat, and Ban Tha Luang the Mun river flowed along one side of each site, and combined with canals and ponds to surround most of their circumferences.

The excavations proved of little value for interpreting the function or dating the construction of these features. The earth embankment at Non Ban Kham contained no cultural or other dateable



materials. The possible moat at Ban Tamyae was underlain by at least an 80 cm deposit of seasonally saturated gleyed clay, containing very worn, chaff tempered sherds, probably of the Phimai tradition. How they became deposited in the clay is unclear.

Re-examination of the 1954 aerial photographs, used by Thiva and Srisakra, indicated that while landscape modification has destroyed some features since then, even at that time evidence for fortification of the sites was rather uncertain. Several alternative explanations may account for this lack of clear evidence of site fortification.

First, natural erosion and human activities may have levelled the landscape around the edges of the mounds, destroying evidence of former fortifications and leaving only the present remnants. The extensive landscape modifications observed during the one year of fieldwork, evidence of change since the 1954 photographs, and the descriptions of changes, including the recent filling of canals, provided by village headmen, lend support to this hypothesis.

Second, the earthworks may never have been intended as fortifications, but may have been constructed primarily for village water supplies, as first suggested by Srisakra (1970:36) and later by van Liere (1980:269). The problem of retaining water for use during the dry season is a critical one, and today ponds and reservoirs located along the edges of the village mounds are an important means for retaining water. The possible remnant fortifications may always have been canals, ponds, and reservoirs with embankments and may never have formed continuous encircling earthworks. One must also question the value of moats for defense during the dry season, the most likely time for warfare, in such a seasonally arid environment.

Finally, two different functional types of structures may, because of similarities of form, have been classified into a single category of earthwork fortifications. Many of the earthworks may have been multi-functional, but the evidence suggests a difference between sites in the alluvial plain and those in the low terrace zone and upland river valleys. Sites in the alluvial plain, except Phimai and perhaps a few other large sites, may have simply possessed tanks and canals for water supplies, and these have been mistaken for defensive earthworks. Sites in the low terrace zone and upland river valleys, where rice land is scarce, settlements isolated, and defense perhaps more necessary, have more massive and complete earthworks and may have been true fortified sites. These hypotheses can be tested with further research.

### PREHISTORIC AGRICULTURE

The relative stability of the settlement pattern from the time of the Phimai and perhaps the Tamyae tradition until the present, when rice agriculture is the primary occupation of all villagers, may be an indication of continuity in subsistence practices. The use of rice chaff as the primary temper in Phimai tradition pottery also suggests that rice was being cultivated at that time as the major food crop. The distribution of sites is clearly correlated with the availability of land suitable for rice cultivation. Within the survey area, most of the land is of this type, and sites are distributed fairly evenly across the floodplain. No sites have been found in the uplands, but intensive survey has not yet been undertaken. Within a 30 km radius of Phimai, all probable prehistoric and early historic sites identifiable from aerial photographs have at least 500 hectares (about 40% of the total land area) within a 2 km radius suitable for rice cultivation. Where land suitable for rice agriculture is rare, most sites are located on non-cultivable land adjacent to rice fields.

No agricultural tools were recovered in the excavations. Fragments of iron tools were recovered from a layer transitional between the Tamyae and Phimai traditions at Ban Tamyae, so iron would have at least been available for plowshares by that time. The only floral remains recovered, even after flotation, were wood charcoal, the rice chaff used for tempering pottery, and occasional rice grain impressions on potsherds. Reservoirs are almost always located adjacent to habitation sites and probably served mainly as tanks for domestic water supplies. There is no evidence of canal systems associated with them, and, if former canal systems did exist, these have been obscured by more recent agricultural field systems and could not be identified.

### INTERREGIONAL EXCHANGE

The ceramic remains provide evidence of a growing volume of trade over time with areas outside the Phimai region and increasing distances over which trade was conducted. The Tamyae tradition represents a unique cluster of elements and appears, on present evidence, to be confined to the Phimai region itself. The Phimai tradition is a widespread regional tradition, found throughout the upper Mun river valley, but not in the middle Mun river basin or the upper Chi river valley. The presence of a few sherds at Chansen (Bronson 1976:389-391) suggests trade contacts between central Thailand and the Phimai region. A few sherds of a thin, white ware found at Ban Tamyae and Non Ban Kham may be related to the white wares from Non Nok Tha and the Roi Et sites. The gritty, sand tempered wares of the early historic tradition are very

similar to the "Se type complex" from phases V and VI at Chansen (Bronson 1976) and to the "Dvaravati pottery" found at sites throughout central and northeast Thailand. This similarity over a wide area suggests manufacture in a limited number of specialized centers sharing basic manufacturing techniques and distribution from these centers. The Lopburi wares were probably manufactured at a few kiln sites and then traded throughout the area under Khmer control. During the recent historic period, ceramic manufacture probably became more localized again, but certain wares were imported into the Phimai region from even greater distances than previously. Sukothai style celadons, probably from north Thailand, and Chinese porcelains are found at numerous sites. During the present century local production of pottery ceased and pottery is manufactured at a few specialized centers in villages southeast of Khorat.

The few bronze bracelets and fragmentary pieces found in Phimai tradition and later layers indicate that the Phimai region was part of the network for the exchange of bronze and the metals used in its manufacture. The iron slag at Phimai is evidence of local iron working, perhaps of iron from laterite sources in the uplands. Salt is currently being mined from the Kula Ronghai and Phimai soils. Salt and iron may have been exported from the Phimai region during prehistoric times, but there is as yet no archaeological evidence to verify this.

#### PRELIMINARY INTERPRETATIONS

At the time of the Tamyae tradition, settlements were established in the alluvial plain of the Phimai region, probably supported by rice agriculture, with local production of ceramics and exploitation of local shell resources. During the period of the Phimai tradition, settlements were present throughout the alluvial plain in a pattern that has remained essentially the same throughout the historic period. Rice was cultivated as the primary subsistence crop, iron tools were manufactured, and bronze and other items were traded in an interregional exchange network. A distinctive regional ceramic style characterized the pottery of the upper Mun river valley, and Phimai black wares were probably being manufactured in a few specialised centers. The presence of three settlements over 20 hectares and of size ranking of sites may indicate a hierarchical political structure. While requiring more substantiation, it is plausible to hypothesize that during the period of the Phimai ceramic tradition a complex political and economic system became established in the Phimai region. Specialized production of some goods, intraregional and interregional exchange systems, and a hierarchical political structure for which there is clear evidence during the early historic period probably already existed during the late prehistoric period.

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#### REFERENCES

- Bronson, Bennet. 1976. Excavations at Chansen and the cultural chronology of protohistoric central Thailand. Unpublished Ph.D. Dissertation, University of Pennsylvania.
- FAD. See Thailand Fine Arts Department.
- Groslier, Bernard P. 1963. Karn Sorm Prasat Hin Phimai. (The reconstruction of the Phimai Temple.) Translated into Thai by Subhadradis Diskul. Fine Arts Department, Bangkok.
- Higham, Charles F.W. 1977. The prehistory of the southern Khorat Plateau, North East Thailand, with particular reference to Roi Et Province. In Modern Quaternary Research in Southeast Asia. 3:103-142.
- Higham, Charles F.W. and R.H. Parker. 1970. Prehistoric investigations in N.E. Thailand 1969-1970: preliminary report. University of Otago, Dunedin.
- Liere, W.J. van. 1980. Traditional water management in the Lower Mekong Basin. World Archaeology. 11:265-280.
- Parker, R.H. 1966. Excavations at Pimai: preliminary report. In Preliminary reports on excavations at Ban Nadi, Ban Sao Lao, Pimai No. 1 (ed. W.G. Solheim II). Mimeographed, University of Hawaii, Honolulu.

- Solheim II, Wilhelm G. 1965. A preliminary report on a new pottery complex in northeastern Thailand. In Felicitations volumes of Southeast Asian studies II, p. 249-254. The Siam Society, Bangkok.
- Solheim II, Wilhelm G. and Marti Ayres. 1979. The late prehistoric and early historic pottery of the Khorat Plateau, with special reference to Phimai. In Early South East Asia (eds R.B. Smith and W. Watson), p. 63-74. Oxford University Press, London.
- Srisakra Vallibhotama. 1970. Review of Dvaravati: the earliest kingdom of Siam by H.G. Quaritch Wales. Journal of the Siam Society. 58, Part 1:126-136.
- Subhadradis Diskul. 1956. Muang Fa Daed, an ancient town in N.E. Thailand. Artibus Asiae. 19:362-367.
- Thailand Fine Arts Department. 1959. Plan and report of the survey and excavations of ancient monuments in Northeastern Thailand. Fine Arts Department, Bangkok.
- Thiva Supajanya and Srisakra Vallibhotama. 1972. The need for an inventory of ancient sites for anthropological research in Northeastern Thailand. Tonan Ajia Kenkyu (Southeast Asian Studies). 10:284-297.
- Wales, H.G. Quaritch. 1957. An early Buddhist civilization in Eastern Siam. Antiquity. 31:42-50.
- 1969. Dvaravati: the earliest kingdom of Siam. Bernard Quaritch, London.
- Williams-Hunt, P.D.R. 1950. Irregular earthworks in eastern Siam: an air survey. Antiquity. 24:30-36.