

Prehistoric Settlement Patterns in Northeast Thailand: A Critical Review

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CONCERTED archaeological research over the last two decades has done much to illuminate the nature of prehistoric and protohistoric culture in Mainland Southeast Asia. The focus of most of this research has been on limited excavations designed to provide elements of Southeast Asian material culture and to sketch the region's "culture history." In contrast, relatively little attention has been given to investigation of Southeast Asian *societies* (or specific groups as organized in functioning communities) through the use of settlement pattern analysis.

In *Prehistoric Settlement Patterns in N.E. Thailand*, Amphan Kijngam, Charles Higham, and Warrachai Wiriyaromp (1980) provide one of the first serious attempts to apply settlement archaeology to data from Southeast Asia. This work signifies in part a potentially important shift in the strategies utilized in Southeast Asian archaeology. Regional site surveys are not new in Southeast Asia (for example, Williams-Hunt 1950; Solheim and Gorman 1966; Schauffler 1976; Higham 1977; Bayard 1980*b*; Coutts and Wesson 1978; Hutterer and Macdonald 1979). But at the time of its publication, this monograph represented only the second time survey data had actually been subjected to systematic settlement pattern analysis.¹

Over the years, through the use of the settlement archaeology approach, a wide range of methodologies has been developed to analyze and predict site patterning, social organization, and economic structure. These methodologies fall into two broad (but not mutually exclusive) approaches (Trigger 1968):

1. *Ecological*, where settlement patterns are analyzed in terms of environmental characteristics of site location; and
2. *Sociological*, where settlement patterns are analyzed in terms of social relationships, religious organization, economic structure, and political organization.

In their monograph, Kijngam, Higham, and Wiriyaromp utilize both approaches. An ecological approach is the focus for the analysis of site patterning of

data collected in two intensive site surveys conducted in Northeast Thailand's Sakhon Nakon and Khorat basins in early 1980. Here the researchers "seek to illuminate the settlement pattern of the area's small (ca. 0.6–4.2 hectare) burial and settlement sites in relation to the paleoenvironment" (1980:57). Subsequently, using statistical and spatial models, the authors employ a sociological framework to infer spatial organization and the existence of political hierarchy among a series of "moated" sites found along the Mun and Chi rivers on the Khorat Plateau. These sites are drawn from a recent review of known prehistoric/protohistoric "cities" in Northeast Thailand produced by the N.E. Thailand Archaeological Project of the Khon Kaen National Museum (Niti Saengwan 1979).

The bulk of the monograph encompasses a presentation of the results of the authors' regional site surveys. A catalog of prehistoric and historic sites is provided containing location, brief descriptions, and—in the case of prehistoric sites—some basic environmental data. This inventory is accompanied by a series of large-scale schematic soil maps locating surveyed sites. The appendices provide analyses of material collected from site surfaces, including a catalog and analysis of pottery collections, and a brief description of a test excavation conducted on a saltworks mound located northeast of the village of Ban Kho Noi, near Lake Kumphawapi.

While Kijngam, Higham, and Wiriayaromp are to be applauded for their use of the settlement archaeology approach, their application of its methodology leaves much to be desired, as, indeed, does their presentation of the material. Unfortunately, their monograph is flawed by a wide variety of problems that seriously undermines the authors' laudable intentions. These problems may be grouped into four areas:

1. Inadequate presentation of data;
2. Incorrect or suspect analytical procedures;
3. Failure to present alternative models;
4. Inadequate discussion of theoretical concerns.

SETTLEMENT ARCHAEOLOGY

Settlement archaeology has emerged since the early 1950s as a major research framework for analyzing prehistoric social, political, and economic structure. (For major theoretical views and models in settlement archaeology see Willey 1956; Chang 1958, 1968, 1972; Green 1967, 1970; Clarke 1968; Trigger 1968; Hodder 1972; Hodder and Orton 1976; Flannery 1978; Groube 1980; Steponaitis 1978, 1981.) The basic principle employed in this approach is the utilization of the sites themselves as artifacts, rather than as containers for portable artifacts (Green 1970). As Willey, a principal innovator of settlement archaeology, noted many years ago, "Settlements are a more direct reflection of social and economic activities than are most other aspects of material culture available to the archaeologist" (1951:1).

Ultimately, prehistory is the study of people, and not merely of their "culture." We are particularly interested in how people in the past were articulated with their environment and with other people. This is precisely the focus of settlement archaeology.

Fundamentally, settlement and spatial archaeology utilize the locations of past activities (represented by both portable and nonportable material remains), and the

characteristics of these locations, as basic units in reconstructing past social relationships. Functionally, various types of archaeological sites (cities, villages, houses, temporary camps, quarries, saltworks, religious shrines, and so on) may be viewed as preserved elements of a past community network. Through spatial analysis, these locations are used to provide description and characterization of various behaviors in the form of articulated networks of cultural relationships.

Such an approach can delineate and characterize many such networks, including economic systems (subsistence patterns, trade networks, "tribute" flow, craft specialization), social organization (degree of social segregation, number of social strata or classes), political organization (degree of centralization, number of decision-making levels), and religious organization. Moreover, it can potentially be applied to a variety of levels of society, from the household, to the household cluster, to the settlement unit, to political unit, to political units, to interregional political relations (cf. Flannery 1976).

A particularly important feature of this approach is its ability to record systematically changes in various networks over time. This allows increasingly precise control over the occurrence of specific transformations of the entire sociopolitical system.

Understandably, chronological control and delineation of function (of activity areas) are two important emphases of the settlement pattern approach (cf. Parsons 1976). An important byproduct of these concerns is that establishment of chronological seriation allows the reconstruction of material culture and culture history concurrent with investigations of societal networks.

Note, however, that the reverse is not necessarily true: typical investigations focused only on material culture often do not provide data structured in accordance with the requirements of settlement archaeology. Thus, settlement archaeology provides a broader, more useful overall research strategy than do traditional narrow focus excavation-based strategies.²

The procedure for the application of the settlement archaeology approach follows this general pattern (cf. Flannery 1976; Steponaitis 1978, 1981):

1. Definition of (social) unit of study;
2. Development of theory for the relationship between material remains as the products of cultural behavior and actual behavior as manifestations of social relationships encompassed within the unit of study;
3. Design of research methodology to properly recover material remains;
4. Delineation of observed material patterns and their change over time;
5. Analysis of patterns to derive inferences about past societal networks and behavior.

Individual projects, of course, vary widely in the methodology developed for data retrieval and analysis depending on the specific units of analysis and the relationships under investigation. In fact, flexibility is one of the approach's distinguishing features.

In settlement archaeology, as in all empirical investigations, research design plays a critical role in determining the structure of the data that emerges. Thus, it is imperative for researchers to make explicit their paradigmatic assumptions about the phenomena they are investigating. Likewise they must discuss the ability of

their methodology to retrieve pertinent data from the field remains and the ability of their analyses to make valid statements about these data.

There is a conspicuous lack of such discussion in *Prehistoric Settlement Patterns in N.E. Thailand*. Particularly serious is the authors' failure to discuss the rationale behind their research strategy and to examine the principles behind their analytic procedures.

At this point it is best to postpone discussion of theoretical and methodological problems and begin first with the monograph's analytical problems. After a critical review of the authors' analytic procedures, the discussion will then return to theoretical and methodological concerns, the applicability of which extend beyond this critique.

Analysis of settlement pattern data in the monograph takes two forms: analysis of site locations and analysis of site size distributions. These analyses were designed to consider two problems: (1) the location of settlement and burial sites in relation to the paleoenvironment and (2) the investigation of potential hierarchy, among the aggregate of "moated" and "unmoated" sites (Kijngam, Higham, and Wiriyaromp 1980:57).

SITE LOCATION IN RELATION TO PALEOENVIRONMENT

The monograph begins with a straightforward investigation of the environmental characteristics of site locations identified in the authors' intensive site surveys. In this investigation data were recorded for eight environmental variables (altitude, percentage of four soil types in a "catchment" area, number of rivers, percentage of marsh and lake in the area, distance to nearest site, distance to first and second closest water sources, and for an index of soil quality). For their analysis the authors constructed a grid of 1 km squares over each survey area. They then recorded the values of each of the variables and the soil index for all squares.

For squares without sites the values of each variable were based on the center of the square. Soil distributions and other variables were measured within a 3 × 3 km "catchment" area. The procedure for recording values for squares with sites is not entirely clear. Initially the authors state that they record data based on the sites themselves for the distribution of soils within a 3 × 3 km "catchment" area.³ But subsequent statements only mention "squares with sites" and do not mention the sites themselves.

In their analysis the authors statistically compare the distribution of the environmental variables between squares with sites and squares without sites. However, it is not clear if variable values for squares with sites are calculated on the center of the square or if they are taken from the site itself. Furthermore, there is no mention of what procedure was followed where there was more than one site in a square.

Based on this analysis the authors conclude that for specific variables, squares with sites tend to have lower and less variable distributions than those for squares without sites (the specific variables that were statistically significant varied between survey areas). For example, in the Mahasarakham area, squares with sites tended to be associated with lower and less variable altitudes than squares without sites.

Subsequently the authors provide an analysis that attempts to assess the probability of a square possessing a site as a function of the variable measuring the

distance to the two nearest water sources and the soil index. According to the authors, "These are the only two variables that are comparable between the two areas studied and also seem to be related to the presence of a site" (1980:62). This assessment was carried out through use of the GLIM computer program and presented graphically through "equal probability contours."

Unfortunately, there is no discussion of the rationale behind use of this measure nor is any information provided on interpreting the equal probability contours. Further, probability percentages are not presented in the graphs nor is there discussion concerning the meaning of the shape of the contours, which vary between survey areas. The reader is left in a state of confusion, dependent on the authors for an interpretation of the results.

Based on this analysis, the authors conclude that in the Kumphawapi survey area,

The prehistoric sites have a significantly restricted distribution. They exhibit a preference for a combination of class III and IV soils. The sum of the distance to the nearest two water sources is never greater than 1.7 km. and there are no sites in the areas of poor rice soils. (1980:64-65)

For the Mahasarakham survey area they add that "The distribution of prehistoric sites reveals a lack of interest in the best (Phimai) and worst (Khorat) rice soils" (1980:65). Historic sites are seen to have a wider distribution according to the probability contours and this is used to assess changes in settlement patterns between the prehistoric and historic periods.

I am not familiar with equal probability contours and consequently am not in a position to criticize the authors' use of this method based on their presentation. However, it is clear that there are problems with the overall analysis, for the authors' conclusions are patently wrong.

An inventory of the study's prehistoric sites, with the percentage of each soil type and distance to the first and second water sources, derived from the authors' site inventory, is shown in Table 1. This tabulation shows that prehistoric sites do not exhibit a "preference" for class III and IV soils, but rather occur near class III and V soils. Very few sites are located near class IV soils, and indeed, in the Kumphawari survey area more sites are located near class II (Phimai) soils than class IV soils.

This tabulation clearly contradicts the authors' conclusions stated above. Not only are the preferences indicated incorrect, but also the sites are frequently located near class V soils, which in the authors' soil typology are noted as "unsuited to rice" and classed as Khorat type (1980:3, Table 1).

One problem here can be readily identified. Specifically, the index of soil quality employed in the analysis does not provide a meaningful measure of the distribution of soil types around a site. Instead this measure obscures the relationship between site location and the distribution of soil types. Functionally, this index, which is the sum of the proportion of each soil type in the area multiplied by its class number (II through V), serves to provide a weighted average of soil types.⁴ It does not indicate preferences.

A second problem is that the analysis compares grid squares rather than sites. Thus, the analysis yields the characteristics of the squares in which a site is located, but does not necessarily reflect specific site preferences. The difference will be

TABLE 1. PALEOENVIRONMENTAL DATA FOR PREHISTORIC SITES IN THE KUMPHAWAPI AND MAHASARAKHAM SURVEY AREAS

KUMPHAWAPI					WATER SOURCE	
SITE NO.	SOIL TYPE PERCENTAGE				DISTANCE	
	II	III	IV	V	1	1 & 2
53	30	70			0.1	0.3
54	15	85			0.9	1.9
58	20	25		55	0.3	1.9
59	30	70			0.1	1.0
62	30	70			0.1	0.3
65		90		10	0.4	2.0
68	10	80		10	1.2	1.4
69		90		10	0.2	0.4
77	10	90			0.2	0.9
78		85		15	0.3	0.8
79		70		30	0.2	0.3
86		65		35	0.6	0.8
88		60	15	25	1.1	1.2
89		75		25	0.2	0.3
90		80		20	0.2	0.2
92		85		15	0.2	1.0
93		60		40	0.1	1.0
94		50		50	0.4	1.4
96		80		20	0.1	0.6
97		85		15	0.1	0.2
121*	30	45		10	1.0	1.0
129		80		20	1.0	1.4
130		85		15	0.1	0.1
131		90		10	0.1	0.1
132		85		15	0.1	0.1
133		70		30	0.1	0.1
135		45		55	0.4	1.2
138		65		35	0.1	1.1
139		80		20	0.4	0.6
140		70		30	0.1	0.4
N=30	26.7%	100.0%	3.3%	83.3%		
	$\bar{X}=21.8\%$	$\bar{X}=72.7\%$	$\bar{X}=15.0\%$	$\bar{X}=24.6\%$		
	sd=9.23	sd=15.74	sd=0.0	sd=13.91		
	s ² =85.27	s ² =535.9	s ² =0.0	s ² =193.58		
	Range=20	Range=65		Range=45		

*NOTE: The catchment area of this site also includes some marsh/lake which is not included here.

MAHASARAKHAM

MAHASARAKHAM					WATER SOURCE	
SITE NO.	SOIL TYPE PERCENTAGE				DISTANCE	
	II	III	IV	V	1	1 & 2
142		80		20	2.5	2.8
143		70		30	1.7	1.7
144		75		25	2.0	2.0
145		75		25	2.0	2.0
146		65		35	2.0	2.0
150		60		40	0.1	0.3
151		65		35	0.1	0.5

154		40	30	30	0.3	0.6
158		80		20	0.8	2.3
159		80		20	1.2	2.5
160		80		20	0.4	2.3
161		70		30	0.2	0.4
162	30	60		10	0.2	0.9
164		50		50	0.7	1.5
174		78	2	20	0.2	0.2
182		80		20	0.3	1.2
183		80		20	0.5	0.5
186		55		45	1.1	1.6
190		60	20	20	0.2	0.4
194		80		20	0.1	0.3
195		80		20	0.1	0.5
202		55		45	0.2	0.3
204		70		30	1.1	1.2
205		70		30	1.2	1.3
206		70		30	0.2	0.8
209		50		50	0.3	0.3
210		60		40	1.6	.6
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N= 27	3.7%	100.0%	11.9%	100.0%		
	$\bar{X}=30.0\%$	$\bar{X}=68.1\%$	$\bar{X}=17.3\%$	$\bar{X}=28.9\%$		
	sd=0.0	sd=11.46	sd=14.19	sd=10.59		
	s ² =0.0	s ² =131.30	s ² =201.33	s ² =112.18		
		Range=40	Range=28	Range=40		

increasingly pronounced as the location of the site is farther from the center of the square (if the center is utilized as the data point).

Perhaps a more useful analysis would have been to compare the percentage of soil types associated with each site to the overall distribution of each type in each survey area as a whole. This method investigates whether the sites are distributed in a pattern significantly different from random with regard to soil types. In this way preferred or avoided soil types could be assessed (that is, if a soil type is found in greater proportion around a site than its general distribution in the area as a whole, then it is preferred; if it is found in a lesser proportion, it is being avoided). Unfortunately, because the percentage of each soil type in the survey area is not given, and these percentages are difficult to derive from their maps, no correction can be provided at this writing.

The problems that are apparent with regard to the prehistoric sites are also likely to pertain to the historic sites. Unfortunately, the authors provide only probability contours and their conclusions, but no raw data on environmental parameters for historic sites (as was provided for prehistoric sites). Thus, it is not possible to reanalyze the soil distributions of historic sites, although the reanalysis for prehistoric sites suggests that the conclusions provided for historic sites will be wrong.

These problems undermine the authors' attempts to characterize changes in soil preferences, since the preferences are incorrectly derived. This comparative analysis is also plagued by problems emerging from their sampling strategy. Specifically, except in random cases it is not known for sure if the historic sites are exclusively historic or if they contain prehistoric occupations. Thus, the sample used to compare changes in environmental preferences is incomplete and no real diachronic conclusions can be drawn.

ANALYSIS OF SOCIOPOLITICAL COMPLEXITY

Following their analysis of site locations in relation to environmental parameters, the authors attempt to investigate the existence of complex sociopolitical societies associated with "moated" sites found in the basins of the Mun and Chi rivers. The authors are specifically concerned with identifying state-level organization among sites of the protohistoric period in Northeast Thailand.

Their approach focuses on the use of site size to determine patterns of site hierarchy. Site hierarchy is in turn utilized as an indicator of sociopolitical complexity. In addition to testing for complexity by examining site hierarchy, the authors compare the settlement pattern of the "moated" sites to an "early state module" model proposed by Renfrew (1972).

Site Hierarchy

Site hierarchy is analyzed here through the use of a model of exponential distributions based on a "broken stick" model derived from ecology (Pielou 1977) and a new model derived by a colleague of the authors, Brian Manly, which is described in an appendix. Their approach is based on the premise that

the sites in an area may consist of two types: the "ordinary" sites for which the distribution follows some simple law, and "major" centres for which the size is determined by a number of factors that do not apply to "ordinary" ones. In general the major centres will be larger than the ordinary sites so that there should be no difficulty in recognizing them. (1980:67)

The basic procedure involves determining if the largest site in a distribution of site sizes is significantly greater than all the remaining sites (the actual mathematical procedure is moderately elaborate and cannot be easily presented here). Significantly large sites are then removed from the distribution and the next largest site is tested. This determination continues until no site appears to be significantly larger than the rest. The remaining group is fitted to the exponential "broken stick" model (no explanation is given, but presumably this step indicates a continuous distribution and/or random variability of site sizes).

This model is applied to subsamples of the prehistoric sites (those for which size could be estimated) from each survey area, the moated sites from the Khorat Basin, and three samples drawn from the literature (as test cases). A major center was found to be present in the Mahasarakham survey area while the Kumphawapi area and the moated site sample yielded no such center. The authors conclude from this analysis that the former encompasses a site hierarchy while the latter do not. Some effort is made to attribute the lack of hierarchy among the moated sites to sampling bias: The authors believe the current site inventory may be biased in favor of the larger sites, which would tend to undermine their statistical analysis.

The hierarchy identified in the Kumphawapi survey area was taken to be indicative of the presence of a state level of social complexity (1980:79).

However, several problems may be identified in their analysis:

1. The statistical analysis does not clearly test for functional hierarchy within a settlement size distribution, but rather tests for statistical discontinuities in site size;
2. Absolute site size alone is not necessarily a good indicator of the hierarchal relationship between sites in a political system;

3. The assumptions underlying the settlement hierarchy model are exceedingly, and unrealistically, simplistic; and
4. The hierarchal pattern observed (if it is valid) indicates only a two-tiered pattern. In most models of sociopolitical complexity based on organizational hierarchy such a pattern does not indicate state level organization.

The first problem makes it difficult to assess multilevel site hierarchy where it exists embedded within a site size distribution. Such multitiered discontinuities often appear as clusters of sites around modal sizes (reflecting the character of the particular political organization). Such distributions that appear statistically continuous, may, in fact, not be so; the moated sites fall into this category. According to the authors, the moated sites fit an exponential distribution and possess no major sites (indicating a continuous distribution). Impressionistically, however, these sites appear to be highly clustered, an observation that is implicitly acknowledged by the authors when they qualitatively divide the distribution into four groups based on clustering in a histogram of site size (1980:75, Fig. 23).

According to Manly, in the appendix describing the method, "The model is suspect if this [the test for major sites] results in the classification of more than a small number of sites as major centres" (1980:123). Thus, this method, by limitations inherent in its design, cannot identify hierarchies of sites clustered around modal sizes and cannot be utilized to test for clustered hierarchal patterns.

The second problem entails a mistake common to many settlement-pattern analyses. As Steponaitis (1981) points out, absolute size is not necessarily a good measure of site interrelationships and site position in a hierarchy. For example, he suggests that relative site size, based on the number of "non-producers" estimated to have been supported in a site, is a more realistic measure. Thus, a small site inhabited by administrative "non-producers" may be significantly more important in a politically organized settlement system than a larger site containing only farmers.

The third problem entails the authors' characterization of settlement organization. The authors state that they "have found that this type of model [the two-tiered model with exponential distribution] does seem to be appropriate for many site size distributions, with the distribution of the size of ordinary sites being of the exponential form" (1980:67).

The authors suggest in this model that "ordinary" sites should fit an exponential distribution, and the size of these sites is randomly determined. But there does not appear to be any *a priori* reason to assume that this is so. They provide three cases which they claim support use of this model: sites from the Late Uruk Period of the Warka and the Susiana areas of Mesopotamia, and Iron Age hill forts in Wales. After removal of major sites, the ordinary sites do fit an exponential distribution. But these cases are not discussed in relation to the model and no information is provided regarding their context.

The authors provide no discussion of why the exponential model should apply to site size distributions. More importantly, they provide no justification why this model should apply cross-culturally, so that their test cases provide empirical support.

The fourth point suggests that the authors provide a conclusion that is at variance with the prevailing definition of states. The prominent models of political

complexity based on hierarchal organization characterize states as possessing at least three hierarchal levels (cf. Wright 1969, 1977; Wright and Johnson 1975; Steponaitis 1981).⁵ This is assumed to be true in state level societies for decision-making hierarchies, as well as class stratification. No real justification is given for the two-tiered models as an indication of state level organization. (This problem is discussed further below.)

Thus, the authors' analysis, if correct, either does not indicate state level organization or some factors other than decision-making hierarchy or class stratification were responsible for producing the hierarchal settlement pattern. Alternatively, as I have suggested, the results of their analysis could be wrong.

It should also be noted that in the case of the site survey areas, the analysis is conducted on a significantly incomplete sample. In the case of the Kumphawapi area the sample is 17 sites out of 24, 30, or 27 sites, depending on which record of the number of prehistoric sites is used. (The monograph's inconsistent reporting is discussed below.) The sample utilized is thus 71 percent, 57 percent, or 63 percent. For the Mahasarakham area the sample is 15 out of 38, 42, or 30 total prehistoric sites (40 percent, 36 percent, or 50 percent respectively). Remember also that these prehistoric sites are only a subsample (of unknown proportions) of potential prehistoric sites in the survey area (not all historic sites produced immediate surface or emergent evidence of prehistoric sites).

The problem of sampling seriously undermines the statistical reliability of the analysis and limits generalization of the results to the area as a whole. Although statistical analysis may be applicable if certain statistically rigorous sampling conditions are met, there is little discussion of the impact of using such a sample of sites and the authors' research methods do not appear to indicate such rigorous designs.

SPATIAL ORGANIZATION

Kijngam, Higham, and Wiriyaromp attempt to support their conclusion concerning the presence of states in Northeast Thailand between 1000 B.C. and A.D. 1000 through additional spatial analysis of the moated sites. After qualitatively dividing the moated sites into four groups based on size (less than 10 ha., 10-20 ha., 20-30 ha., and greater than 35 ha. [*sic*]) the authors construct unmodified Thiessen polygons around sites in the largest size category (greater than 35 ha). Two spatial relationships are then measured: the distance between these major centers, and the area encompassed within the "service" area of these sites as determined by the Thiessen polygons.

The resulting measurements (which are not provided) are said to fit an "early state module" model proposed by Colin Renfrew (1972) (which is also omitted). This analysis, along with a scant review of fragmentary, unproven data on political developments in adjacent areas, such as the Chao Phraya basin and the Lower Mekong/Central Plain region of Kampuchea, is used to support the association of moated sites with state organization in Northeast Thailand.

This analysis also has several problems:

1. Uncritical use of Thiessen polygons;
2. Use of absolute site size versus relative site size; and
3. Uncritical use of Renfrew's "early state module."

Thiessen polygons are a fairly simple type of spatial model. They are created by drawing the perpendicular bisect between contemporaneous centers of approximately equal rank.

Given the observed distribution of points, these polygons can be seen as defining the areas which could most efficiently be served by its center, if factors such as ease of access were uniform and assuming that movement minimization was an important factor. In doing this, they allow suggestions as to the shape and size of service areas. (Hodder and Orton 1976:59-60)

Although simple, Thiessen polygons are useful for defining theoretical "service" or "attraction" areas for sites. As a model of settlement organization, such polygons encompass several permutations, each of which is based on different structural assumptions. Each form of the model must be critically evaluated for its applicability to a specific settlement pattern. This, of course, is also true for the utilization of the model itself in the first place. Unfortunately, the authors fail to discuss the assumptions of the model or to examine more than its simplest form.

Underlying the use of Thiessen polygons in this way is the assumption that there is free access to competing centers. While this may often be the case in modern market economies, and may have been the case in many societies in the past, there is no *a priori* reason to assume that this was so during this period in Thai prehistory. In chiefdoms, for example, centers are often not in competition; rather, commerce within a territory is controlled by fiat and operates under a tributary administration (cf. Steponaitis 1978; Peebles and Kus 1977; Cordy 1981). Such factors may significantly alter site location and spatial organization of political territory.

Where applicable, Thiessen polygons have typically been constructed around sites without taking site size into account. However, it is reasonable to assume that service areas may be determined by the size of the central site. In this case perpendiculars are drawn at a point proportional to the difference in the sizes of adjacent centers. This also will generally produce a significantly different pattern of polygons and potentially will alter the amount of area enclosed per polygon.

Unfortunately, reanalysis of the settlement pattern and its fit to Renfrew's model is limited by lack of data. The authors do not provide the specific sizes of individual moated sites as they appear on the map (although their size class is indicated symbolically). This is a major omission, particularly since specific site sizes are indicated in their histogram of site sizes.

The use of Renfrew's model as a mode of analysis for the determination of state level organization in this study is quite uncritical. No discussion is provided reviewing the model's applicability, nor is the model itself even presented. Yet Renfrew's model is not without its shortcomings.

Renfrew himself provides no real theoretical support for the model and notes that it has not even been systematically tested (1972:18). Further, it was derived without taking into account either absolute or relative site size. Finally, there is no reason to believe that the distance between major centers, and the areas encompassed within the service areas of the centers are definitive characteristics of states. Renfrew derived the model inductively from patterns he believed to be associated with state level societies in the northern Mediterranean. It was not derived from any principles of social organization that might apply cross-culturally.

TABLE 2. THIESSEN POLYGON MEASUREMENTS FOR MOATED SITES

POLYGON AREAS OF LARGE MOATED SITES	
WITHOUT TRUNCATED POLYGONS	WITH TRUNCATED POLYGONS
N = 13	N = 15
\bar{X} = 1319.5	\bar{X} = 1400.4
sd = 478.15	sd = 679.38
s^2 = 228,627.59	s^2 = 461,558.81
Range = 1208.22	Range = 2482.19
$\pm 1 \sigma$ = (841.35-1797.65km ²)	$\pm 1 \sigma$ = (721.02-2079.78km ²) 52%-149%
DISTANCES BETWEEN LARGE MOATED SITES	
N = 52	
\bar{X} = 40.62	
sd = 18.88	
s^2 = 356.59	
Range = 75.5	
$\pm 1 \sigma$ = (21.74-59.50 km ²)	

Renfrew proposed 1500 km² for polygon areas and 40 km for the distance between centers. Kijngam, Higham, and Wiriyaromp do not provide their data on the distances between sites or on the areas encompassed within the polygons, but I have made the appropriate measurements, shown in Table 2. Note that only whole polygons should be measured, but I have also added two that are fractionally incomplete. While the mean area for both samples (with and without incomplete areas) is somewhat less than Renfrew's figure, they are probably in the acceptable range. Renfrew does not provide any range guidelines, but notes that it is the modular arrangement of areas that is the concern, rather than a specific size (Renfrew 1972:17). This, of course, begs the question of a specific 1500 km² criterion.

The variance of polygon areas in the moated site sample is substantial, indicating that the modules are not very regular (Table 2). The distance between sites also fits the criteria, but the variance and range here are also substantial. Again regularity is not indicated. Thus, while these measurements fit the criteria statistically, they appear to violate the general principle behind the model.

The authors conclude from these analyses that "There are then, strong archaeological and historic grounds for concluding that the hierarchic settlement pattern in the Mur and Chi valleys reflects state formation." However, in this reviewer's opinion the evidence presented is not strong and is actually quite inferential and open to questioning.

METHODOLOGICAL AND THEORETICAL PROBLEMS

The inadequate analyses in this monograph are symptomatic of more substantial problems underlying the authors' approach as a whole. In general they fail to discuss their assumptions, to delineate the reasons behind their methods, or to explore alternative techniques and models. Such discussions and presentations of alternative models would have greatly enhanced their monograph.

The most significant area where this inadequacy emerges is in the treatment of sociopolitical complexity. The authors present an analysis that purports to test for site hierarchy and relate this hierarchy to state level political organization. Yet nowhere do the authors define or characterize state level organization; nor do they reference any definitions provided by other authors. In areas such as these, where there is little agreement among scholars, a common definition cannot be assumed. Finally, they provide no discussion of why a two-tiered hierarchy should reflect state level organization.

To employ a settlement pattern approach profitably it is essential that the social units under investigation be defined. This definition then provides guidelines for developing theory that relates the behavioral attributes of a sociopolitical form to archaeologically recognizable material remains. Only after these two steps are taken can we adequately investigate the sociopolitical nature of past societies through archaeological methods.

Further, if we are interested in social change we must also focus on developing evolutionary models of sociopolitical development and identify attributes useful for archaeological investigations.

The authors' failure to develop basic sociopolitical definitions and evolutionary models for prehistoric and protohistoric Thailand limits their ability to investigate these past societies adequately. At the same time I must stress that this failure is not theirs alone: no one has yet adequately addressed these elements for any part of Southeast Asia. This is a major problem area of concern for archaeologists investigating sociopolitical complexity in the region.

Increasing archaeological evidence of heretofore unsuspected sophistication in Southeast Asian subsistence technology, metallurgy, and ceramics, occurring at potentially quite early dates, has directed attention to possible indigenous development of complex societies in the region prior to contact with complex societies in India and China (for example, Bronson 1979; Bayard 1980a). Unfortunately, the subject of sociopolitical complexity in the region, either as an indigenous, introduced, or externally stimulated development, has rarely been addressed systematically by archaeologists. Particularly dismaying is a universal lack of the use of definitions of sociopolitical forms and the failure of most to utilize a systematic approach to documenting changes in sociopolitical entities in the evolution of sociopolitical complexity in the region.

Historians have been somewhat more active in exploring the nature of sociopolitical forms in early Southeast Asia (for example, Hall 1976; Wheatley 1975). However, their reconstructions tend to be tied together largely by suppositions that remain untested. Here archaeologists and historians can profitably work together to devise testable hypotheses and to effect applicable research programs.

Bennet Bronson's (1979) discussion of the late prehistoric and early protohistoric periods of Central Thailand reflects the confusion that currently exists in Southeast Asian studies of sociopolitical complexity. In the first portion of his paper, Bronson refers to "proto-states" and the Dvaravati state. But by the end of the paper the same entities are being described as chiefdoms and kingdoms. Like most Southeast Asian scholars, Bronson skirts the problem of defining state organization or chiefdoms (1979:315). This approach creates considerable confusion.

Discussion of specific sociopolitical forms is beyond the scope of this paper, but a few initial points are in order.

Definition of sociopolitical structures and application of associated theories through settlement archaeology revolve around developing a systematic model of the interaction of the various components that characterize a community's networks. Thus, we must identify or posit the extent of political centralization and the extensiveness of the power of leadership, the role of markets and "tribute" in the socioeconomic network, the influence of religious organization, and so forth, for various sociopolitical forms as they existed in past mainland societies.⁶

Most critical here is the nature of sociopolitical development from "tribal" organization to "chiefdoms" and "states." In the period of Thailand's prehistory from 4000 B.P. to 1000 B.P. encompassed within Kijngam, Higham, and Wiriya-romp's analysis, of particular concern is the transition from "complex chiefdoms" to "states." Each type of sociopolitical organization (as well as forms within general types) has a special impact on settlement patterns. These in turn require specific analytic models and methods. In periods of transition it is especially important to have a clear idea of the type of structure being investigated, if we are to be capable of discerning various forms of a society.

The moated sites are a particularly good case in point. There is some possibility that for at least part of this period, there existed some type of "complex chiefdom" rather than a "simple state" prior to extensive Khmer influence (cf. Wolters 1979).⁷ In a complex chiefdom, tribute systems and alliance political organization have significant influence on settlement patterns while in a simple state, market economies and administrative organization may be more influential (cf. Peebles and Kus 1977; Steponaitis 1978, 1981).

In investigating settlement patterns during this period it would be profitable to apply several alternative models in the analysis and interpretation of sociopolitical organization. Kijngam, Higham, and Wiriya-romp's monograph is particularly limited in providing such alternative analyses.

In this review it had been my desire to provide a demonstration of alternative analyses that could be utilized to examine the settlement pattern data presented in the work under consideration. However, in most models utilizing hierarchal organization as a criterion of analysis, site size in relation to location is a critical component for analysis. These data are not presented for the moated sites. An effort was made to obtain these data from the authors, but circumstances prevented their transmission. Thus no alternative analysis can be presented at this time.

The methodology utilized for intensive site survey by the authors is also an area of concern. While they briefly outline their field procedures (1980:10-11, 58-59), there is little discussion of the impact of their approach on the survey results.

In the survey, sites were located in three ways: examination of aerial photos (Kumphawapi area only), interviews with local residents, and land rover/foot survey. The authors note that "It is probable that further sites will be recovered. It is hoped, however, that the 95 sites discovered are a reasonable basis for the discussion which follows" (1980:10).⁸

While the authors suggest their survey has provided a "reasonable" data base for their analysis, the inventory produced by their field methodology may not ultimately provide an adequate data base for statistical analysis of settlement patterns. Specifically, their survey has little structure to the sampling procedures. Sampling is ad hoc and open to bias from many sources. Most importantly their survey

implicitly focuses only on mound sites of substantial visibility and does not systematically test the assumption that sites of different morphology exist within the area. Further, the method has no means of systematically investigating the presence of prehistoric sites under modern habitations (such identification being accomplished through interviews with villagers who have found inhumation burials or diagnostic pottery sherds in wells or other pits and from survey of available road cuts and other surface collections).

It may turn out that the authors' assumptions concerning the ability of local villagers to identify most prehistoric sites (cf. 1980:10) is correct and that the project managed to identify most of the sites. This is not the issue. What we are concerned with is being able to rely on the recovered sample as statistically valid. This can only be accomplished through statistically structured sampling procedures and inclusive field survey methods (the most reliable being ground coverage on foot aided with aerial photos).

The procedures employed in this project in reality reflect the relatively simple research designs that have been typical of past archaeological research in Southeast Asia. While the quality of excavations and surveys has indeed taken a significant step forward since the days of Colani, the overall research that is being done still leaves much to be desired. As of this writing only a few projects have made significant inroads in applying advanced methodologies, utilized relatively successfully in other regions of the world (particularly Mesoamerica), to Southeast Asian archaeology (cf. Hutterer 1982). However, Southeast Asia has only relatively recently begun to attract the interest and resources for extensive research to build on the few data points that have emerged and earlier researchers often operated under severe constraints. There is a clear need to face the past realistically and strive toward better work in the future. There is certainly no lack of models to draw from. Of course, we must learn to be critical of the methodological models we adopt and be willing to adapt them to the particular exigencies of archaeological investigations of past societies in Southeast Asia.

Miscellaneous Errata

This review has largely concentrated on substantive issues. But there are some serious procedural problems with the presentation of the monograph of which the reader should be aware. For example, several instances were noted above where data used in an analysis were omitted. These include environmental data for historic sites, size of moated sites in relation to site location, and areas encompassed within the Thiessen polygons constructed around the large moated sites and distances between these sites. Such omissions hamper reanalysis of the authors' work and restrict use of the data base in other projects.

There is also some inconsistency in reporting the number of prehistoric sites located in the intensive site surveys. These sites are noted in at least three places, two maps, and the site inventory, but none of the sources agree as to the total number of sites. For instance, the site distribution map for the Mahasarakham survey area (1980:9, Fig. 3b) shows 24 sites while the large scale "site relocation" maps (1980:52-56, Figs. 13-17) list 30 sites, and the site inventory 27 sites. In the Kumphawapi area the numbers for prehistoric sites are 38, 42, and 30 respectively. Also in one case (1980:65) reference is made to site numbers that do not appear on the map.

TABLE 3. INCONSISTENCIES IN REPORTS OF NUMBER OF SITES WITHIN SIZE CLASSES

SIZE CLASS	HISTOGRAM	MAP
< 10 ha	24	33
10-20 ha	17	8
20-30 ha	8	11
> 35 ha	13	25

TABLE 4. CONFLICTING SOIL KEYS USED IN PREHISTORIC SETTLEMENT PATTERNS IN NORTHEAST THAILAND

REGIONAL MAP OF KUMPHAWAPI	REGIONAL MAP OF MAHASARAKHAM	SITE RELOCATION MAP
1) Soils of Type II: well-suited to rice cultivation	1) Well-suited	1) Low Terrace—suited
2) Soils of Type III: moderately suited to rice cultivation	2) Suited	2) Middle Terrace—unsuited
3) Soils of Type IV: poorly suited to rice cultivation	3) Moderately suited	3) Low Terrace—well-suited
4) Middle Terrace Soils of Type V: poorly suited to rice cultivation	4) Unsuited	4) High Terrace—moderately suited
5) High Terrace Soils of Type V: unsuited to rice cultivation		5) High Terrace—unsuited

Another problem occurs in the delineation of the moated sites. The authors' histogram of site sizes (1980:75, Fig. 23) lists 62 moated sites, but the accompanying map shows 77 (1980:76, Fig. 24). There is also a discrepancy in the number of sites within a particular size class (see Table 3).

Further inconsistency is found in the monograph's soil maps. In all three soil maps are presented, a regional map for each survey area and a set of large-scale "site relocation" maps. Unfortunately, each map uses a different key to soil types. These keys are shown in Table 4. Note that the differences make it difficult to compare soil types from one map to the next.

A few such errors are to be expected in any monograph, but the extensiveness of those found here requires that they be noted. Ultimately, such omissions and inconsistencies can seriously undermine the effectiveness of the monograph.

CONCLUSION

While there are major gaps in our knowledge of past societies in Southeast Asia, parts of the region, Thailand in particular, are no longer really "terra incognita." Accordingly prehistoric research in the region is entering a more sophisticated phase of investigation. *Prehistoric Settlement Patterns in N.E. Thailand* represents in part a significant contribution to the opening of this new phase; but like many first efforts this work has room for improvement.

Settlement archaeology has much to offer to the study of prehistoric and proto-historic societies in Southeast Asia. In applying this approach we have much to draw on from several decades of theoretical and methodological development on the subject. Settlement studies in Mesoamerica particularly provide useful models for our region (cf. Parsons 1971, 1974; Flannery 1976; Blanton 1972, 1978; Sanders, Parsons, and Santley 1979). But we must be ready to adapt and refine such models to the particular nature of Southeast Asia, its history, and present field conditions.

This paper has attempted to acknowledge the contribution of Kijngam, Higham, and Wiriyaromp in forging new paths in archaeological research in Southeast Asia while at the same time pointing out the problems encompassed in their specific project. These criticisms are offered with the hope of stimulating ever more rigorous methodological and analytical procedures.

In the final analysis, I must question the conclusions of Kijngam, Higham, and Wiriyaromp concerning the extent of political hierarchy, the nature of state level political organization, and environmental preferences of prehistoric and protohistoric sites in Northeast Thailand. While some of their conclusions may prove to be correct as the result of future research, their analysis as presented in this monograph does not provide adequate support for such conclusions.

Much more work remains to be done before any conclusions of this type can be reliably advanced from existing archaeological evidence. But the authors are on the right road and we can only hope that future work from their project will shed additional light on the subject.

NOTES

1. A settlement pattern approach was concurrently being employed for a site survey project in the southern Philippines directed by K. Hutterer and W. Macdonald beginning in 1979.
2. Note that settlement archaeology does not exclude excavation from its method. In this approach, however, excavations are generally not ends in themselves (as they tend to be in traditional culture history approaches), but rather part of a larger methodology.
3. These values appear to be those recorded in the site inventory.
4. $I = \%II(2) + \%III(3) + \%IV(4) + \%V(5)$.
5. Some recent Marxist models do employ a two-tier hierarchal model (William Macdonald, personal communication), but their relationship to the present study is unclear.
6. Note that in developing a systematic evolutionary model of social change we are not limited to traditional rigid categories such as states or chiefdoms.
7. I would include here perhaps certain forms of "despotic" kingdoms where control is highly centralized and alliance between local rules provides political structure within a region.
8. It is not clear which 95 sites are being referred to here. There are 57 prehistoric sites listed in the site inventory. The other two sources list 52 and 72 prehistoric sites. The site inventory lists 63 historic sites.

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