

# Excavation at Non Nok Tha, Northeastern Thailand, 1968

AN INTERIM REPORT

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## INTRODUCTION

THE 1968 excavation at Non Nok Tha represents a continuation of the three-year program of salvage archaeology in northeastern Thailand jointly sponsored by the Fine Arts Department of the Thai Government and the University of Hawaii. The site was located initially by Chester F. Gorman during the first season of the program in April 1964 while he was surveying the western end of the proposed Nam Phong Reservoir (Solheim 1966: 13-15; Solheim and Gorman 1966: 164-79) (see Fig. 1). At this time the site was designated Nam Phong 7. During the second year of the program, the site was extensively tested by Ernestine Green in January 1965 (Solheim, Parker, and Bayard 1966: 77-81). Materials from the seven test squares dug at this time were so promising that four months of the third and final season of the program (December 1965-April 1966) were devoted to a large-scale area excavation by R. H. Parker, assisted by me; as in the first two years of the program, Wilhelm G. Solheim II was general director. The preliminary report of this 1966 excavation appears in Solheim, Parker, and Bayard 1966 (see also Solheim 1968a: 40).

The 1968 excavation at Non Nok Tha (the local name for the site has since been adopted in place of Nam Phong 7) thus represents the fourth year of archaeological interest in the site and the second season of intensive area excavation. Such extended interest in a single site in an area still largely unexplored archaeologically may appear somewhat excessive; however, the results of the 1966 excavation raised so many interesting questions that a second area excavation at the same site seemed fully justified. The primary goals in this excavation were two: first, to locate a bronze-period occupation surface for comparison with the iron-period occupation levels excavated in 1966, with a view toward testing a possible adjustment in occupational and presumably social structure resulting from the shift from slash-and-burn agriculture to paddy cultivation of rice; we suspect this shift took place during the gap

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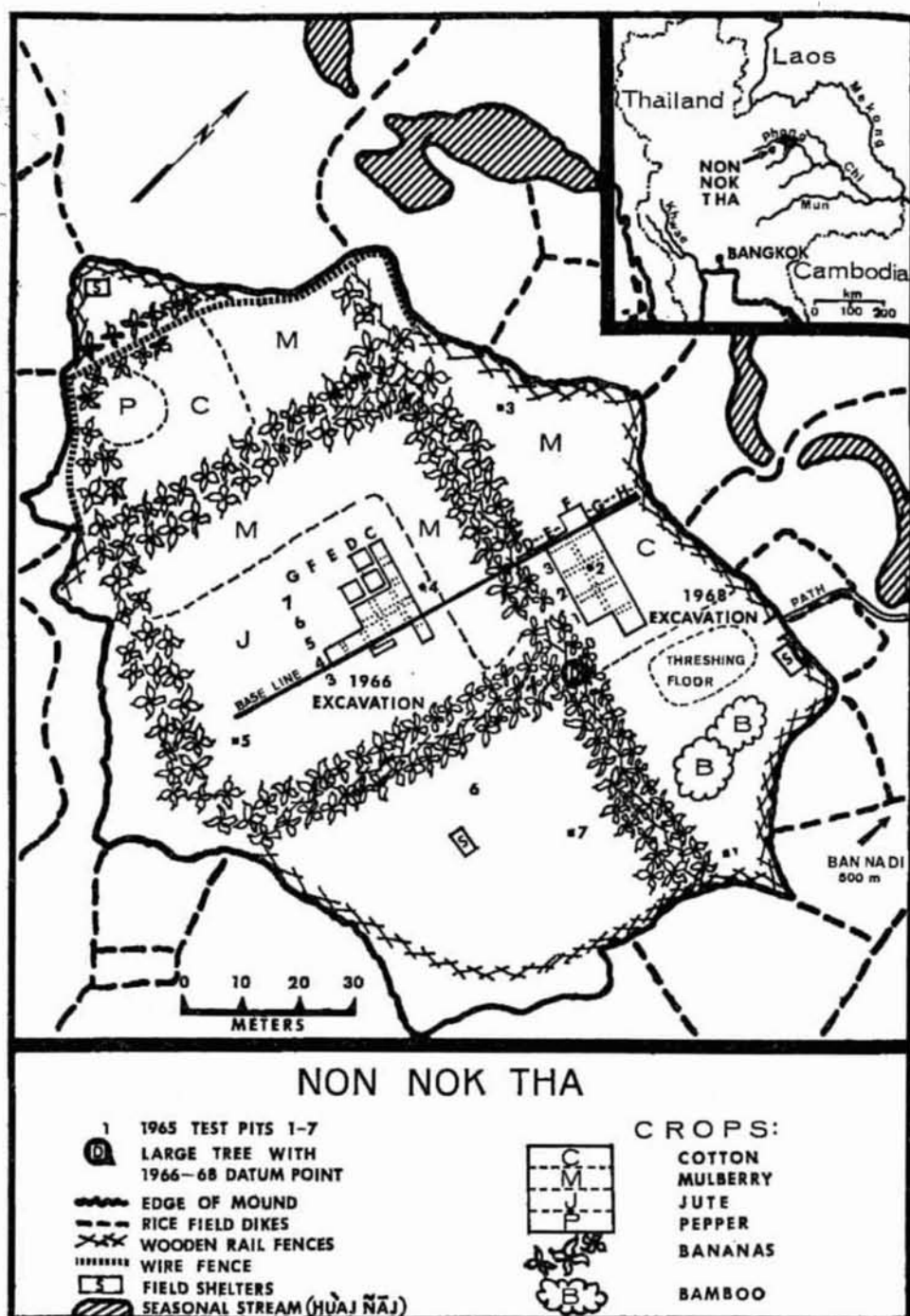


Fig. 1 Site map, Non Nok Tha.

between the bronze-period and iron-period occupations of the site. Second, we hoped to obtain further evidence in the form of additional carbon samples to test the sequence of dates from the 1966 excavation which seem to show the presence of a highly developed bronze technology prior to 2300 B.C. (Solheim 1968*b*).

Non Nok Tha means "Partridge Mound." The site is a low mound lying some 500 m south of the village of Ban Na Di in northwestern Phu Wiang district in the western end of Khon Kaen Province. It is located some 2.5 km north of the foot of the large, low sandstone mountain after which the district is named, which rises some 500 m above the level of a flat or gently rolling plain that extends north, east, and southeast to the Phong and Choen Rivers. This plain is largely paddy alternating with patches of scrub forest on the higher ground. The mound itself is located at lat. 16° 47' 57" N and long. 102° 18' 17" E (U.S. Army Map coordinates 48 QTD 2138-18592). Its approximate dimensions are 100 m north-south by 150 m east-west. The surface of the mound lies between 80 and 150 cm above the average level of the surrounding rice paddies. These paddies appear to have been cut into the mound; in many areas sherds are visible in the vertical edges of the mound. The general elevation of the paddies seems to be from 190 to 195 m above sea level according to Army Map Service maps.

At present the mound is divided by lines of banana trees into four plots owned by four families of Ban Na Di, who use the land for the cultivation of cotton, mulberry, jute, bananas, papayas, and red pepper. Three huts or field shelters are located on the mound, and a cow-dung threshing floor used during the harvest season lies between the northernmost of these field shelters and the area excavated in 1968 (see Fig. 1). The present pattern of use of the mound, like the rice paddies surrounding it, is almost certainly no older than the present village of Ban Na Di. According to one of the first settlers of Ban Na Di, the present Lao-speaking inhabitants of the village first came there in 1894 A.D. (112 Bangkok Era) from the large village of Ban Khok Na Fai some 4 km to the north. On their arrival, there were no traces of prior occupancy such as paddy dikes, cleared areas, houseposts and the like, so it seems safe to assume that the area had been uninhabited for at least several decades. However, people in the village estimated that without maintenance, dikes would vanish after about ten years. It seems likely from linguistic evidence (Brown 1965: 98-113) that the western Khon Kaen-Chaiyaphum-western Udorn area has been inhabited by a population similar to the present inhabitants for at least two hundred years, even if the area immediately in the vicinity of Non Nok Tha was uninhabited during this time.

#### EXCAVATION

The 1968 excavation at Non Nok Tha was opened on February 11, following three weeks of organization and assembling of equipment in Bangkok. I directed the excavation, with the assistance of Thawichai Uthaiwi of Maha Sarakham, Terry T. Marsh of Honolulu, and Khamporn Phithaksin and Buaphan Bunsom, both of Ban Na Di. During the month of May, the Fine Arts Department was represented in the field by Viraj Khunnamas of Unit No. 7, Khon Kaen.

The area excavated lies some 18 to 40 m north and 0 to 20 m east of the 1966 excavation. The choice of this area was largely dictated by indications uncovered in 1966 that the occupation areas of the bronze period lay to the north and east of that area (Solheim, Parker, and Bayard 1966: 39). The "4" line of the 1966 grid was selected as a base line for the 1968 grid

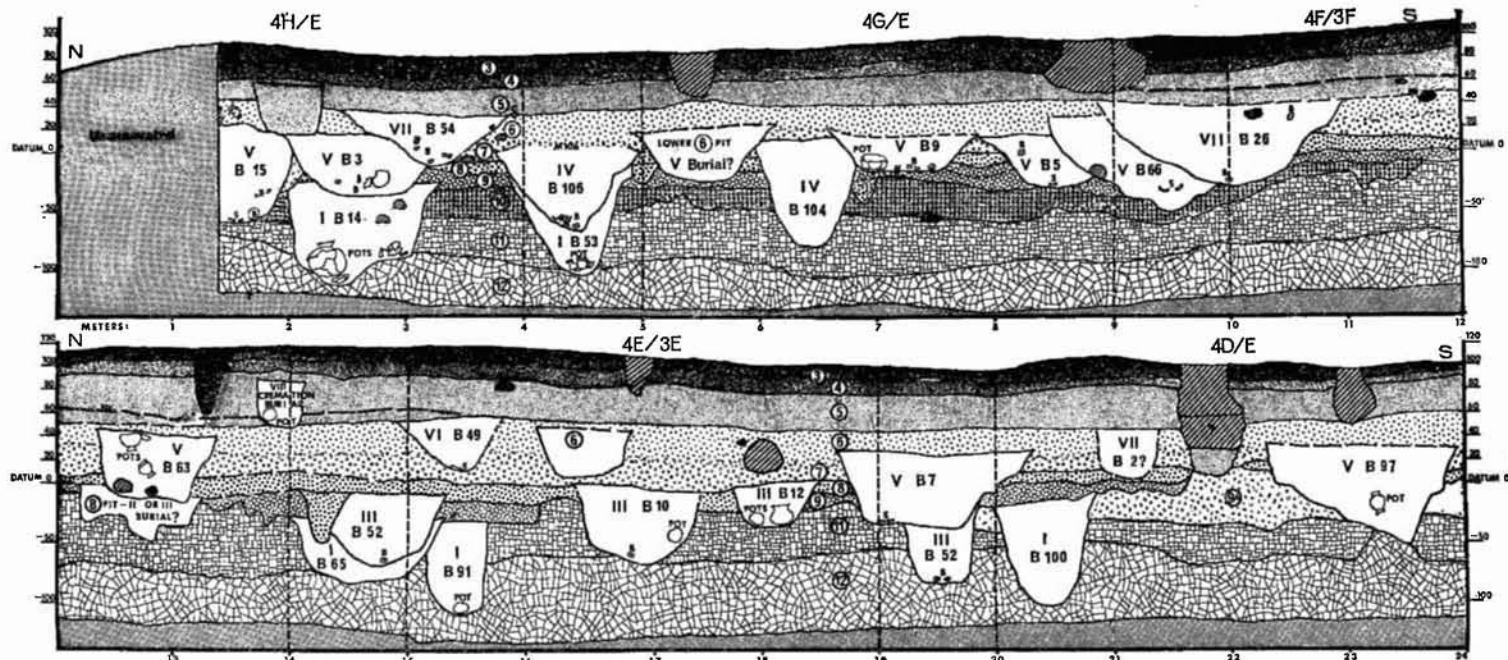


Fig. 2 Non Nok Tha 1968 excavation. Main north-south section (4 East). *B*, bone; *C*, burned clay; *P*, pot; *S*, sherd(s). Diagonally hatched areas are rootholes, termite nests, or wash-outs; solid black objects are large stones.

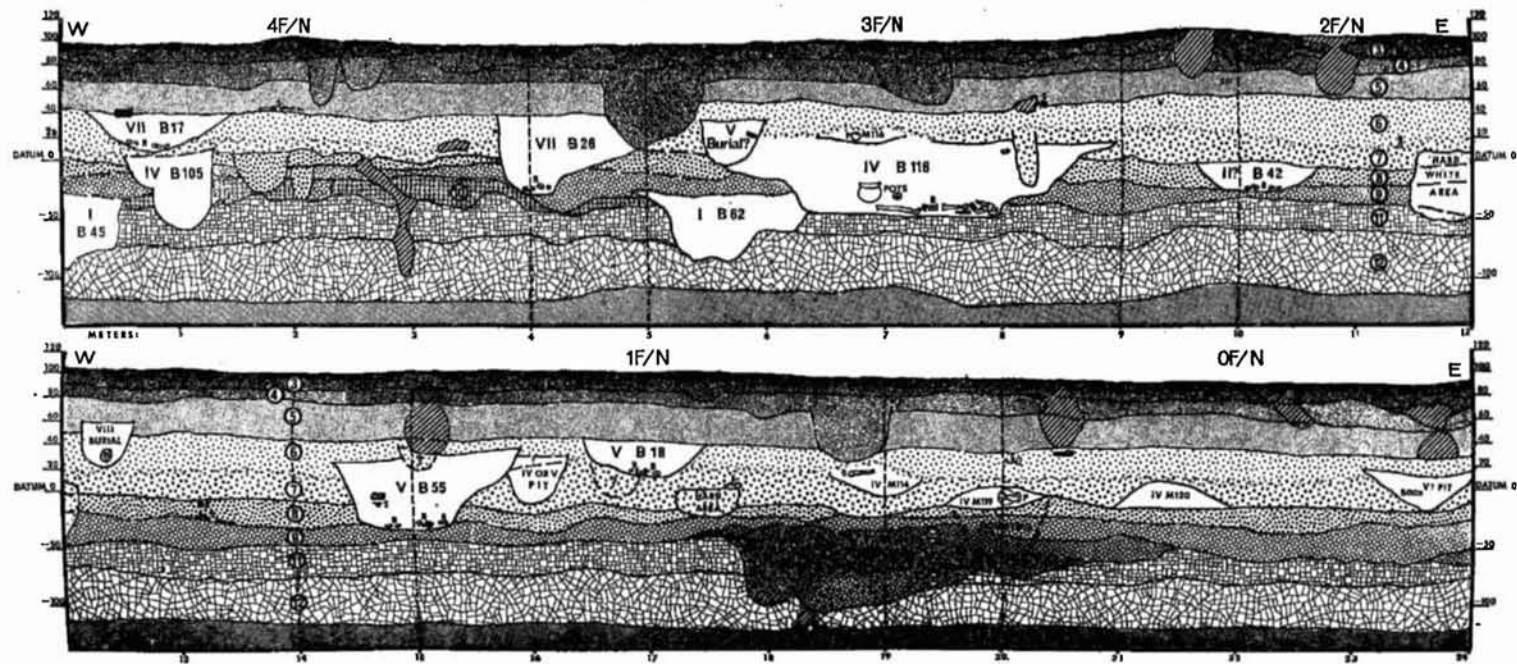


Fig. 3 Non Nok Tha 1968 excavation. Main east-west section (F North). (Key as for Fig. 2.)

that extended to the northern edge of the mound. The datum point for both excavations was identical: a large wild kapok tree to the southeast of the 1968 area. Four 4 m by 1 m trenches and a central 4 m by 4 m square were laid out to the west of the grid line, and an additional seven 4 m by 4 m squares were excavated to the east of this line. Excavation continued on a daily basis with few interruptions aided by 24 workmen from Ban Na Di, many with three seasons' experience. The work became quite difficult as we entered the rainy season. Erosion of the baulks necessitated trimming them 10 cm to 15 cm before drawing sections. Fortunately the weather cleared in early May, allowing completion of the excavation with removal of all baulks and the drawing of all sections except the western sides of the 4-line trenches (which closely duplicated the eastern sides). The excavation was finished and fill-in was begun on May 28 (see Pl. Ia and b).

During 78 days of excavating we removed an average of 140 cm of cultural deposit over an area of 189.5 m<sup>2</sup> (the northern 1.5 m of trench 4H was not excavated because of the presence of a large ground termite nest); thus, the 1968 excavation was slightly larger than the 150 m<sup>2</sup> excavated in 1966. In addition, the narrow 4-line trenches and a strip 1 m wide along the north side of the F squares (see Fig. 1) were further excavated to at least 210 cm below the surface to insure that natural soil had indeed been reached in all areas (see Figs. 2 and 3).

In removal of both squares and baulks, excavation proceeded in all cases according to the natural stratigraphy of the site; in the case of layers thicker than 10 to 15 cm, spits of 10 cm were used to remove the layer. In a few cases, as with the thick layers 5 and 6 and in baulk removal, spits of 15 cm were removed. As the surface of each layer was reached, all detectable disturbances (pits, postholes, graves, etc.) were cleared, or at least carefully defined (in the case of deep burials), prior to beginning removal of the layer.

The 1968 excavation produced some 140 artifacts of stone, clay, bone, bronze, and iron, well over 400 whole or restorable pots, and a total of 115 burials from the neolithic and bronze periods. Of this total number of burials, no skeleton was located in 20 cases, the burial being represented by pits in section or grave goods in pits largely outside the excavation area. Of the remaining 95 burials, 14 were either fragmentary or mostly outside our area; thus substantial portions of 81 burials were lifted, with 34 of these being more or less complete and undisturbed by later burials and pits. Large amounts of sherds, faunal remains, soil samples, and many small carbon samples (some too small for accurate dating at present) were also recovered. Human skeletal material is currently being examined by S. Brooks of Nevada Southern University; faunal remains from both excavations are being analyzed by C. F. W. Higham of the University of Otago. C. Smith of the Massachusetts Institute of Technology is examining some of the bronze from the 1966 excavation.

#### A NOTE ON METHODS

The primary difficulties encountered in the 1966 excavation at Non Nok Tha were three: "(a) the linguistic problem of explaining to the labor force exactly what was required; (b) the difficulty of obtaining suitable tools; and (c) the character of the soils" (Solheim, Parker, and Bayard 1966: 6). During the 1968 season the first and last of these areas of difficulty saw improvement. The excavation was conducted almost wholly in Thai, and by this time an adequate and relatively precise vocabulary of archaeological terms in Thai had been evolved. In addition, the workmen were by that time quite well versed in the general prehistoric

sequence at Non Nok Tha, and as a result were conscious of the significance of what they were uncovering. Moreover, by good fortune the soils of the 1968 area proved considerably more amenable to stratigraphic interpretation than those of the 1966 area; this was particularly true of the northern and eastern portions of the 1968 area.

As in 1966, tools continued to be a problem; the extreme hardness of the clayey soils of the area preclude the use of locally available trowels and shovels for all but delicate tasks. Since the 1968 excavation was being conducted on a more limited budget than the 1966 one had been, importation of large quantities of high-quality tools was impossible. Thus, as in the first season's work, primary reliance was placed on local tools, principally the broad, flat-bladed hoe for gross removal of layers, and shovels and baskets for dirt removal. Inevitably, some amount of damage to pots and skeletal material was incurred under this system, but the workmen rarely removed more than 5 cm of the advancing face at a stroke, and in most cases would stop using the hoe at once on encountering something and switch to tools more suitable for fine work. These consisted of a small number of high-quality trowels from New Zealand, which effectively withstood the rigors of the hard-baked soils, and a large number of locally purchased, inexpensive knives, which did not. These tools were also used in clearing disturbances and defining the irregularities of layer surfaces as well as in preparing burials and other features for photography.

As in 1966, screening of deposits proved impossible; only with great difficulty can these soils be broken into particles smaller than 1 cm, and hydraulic sifting was even less feasible, as not only do the soils soften slowly, but the nearest supply of water lay some 150 m from the site and was needed for more important purposes (the area had suffered a two-year drought). It was apparent from viewing our spoil heaps that many small sherds were being lost by this lack of screening; however, the vast majority of sherds larger than 2 cm were recovered, along with fragments of metal less than 0.5 cm in diameter.

Although the methods used imposed limitations, I feel that we were able to follow stratigraphical distinctions with a high measure of success, considering the difficult soils of this region. I feel confident that owing both to our increased experience and to the sandier, more easily readable soils in the 1968 area, we were able to detect and follow down well over half of the disturbances present. However, I am also certain that a fair number of disturbances went undetected, perhaps about 30 percent; this is particularly true of the top two soils, where large pits, or indeed any disturbance larger than a large posthole, proved very hard to define.

#### STRATIGRAPHY

As mentioned earlier, the soils of this region are very difficult to interpret stratigraphically; the effects of cultural modification that are so often easy to observe in temperate or tropical volcanic soils are here submerged in the general soil profile, and considerable experience in looking at and handling the soil is required until the modifications produced by human activity begin to become apparent to the eye and trowel. The soils in the Phu Wiang area fall under the general descriptive name of Khorat Fine Sandy Loams (Pendleton and Montrakun 1960: 26-28). In the Ban Na Di area there seem to be two principal subtypes of this soil category, aside from the artificially modified soil of the rice fields: a reddish, sandy loam found in lower areas, and a more whitish, notably more clayey sandy loam found

in raised places. The soil at Non Nok Tha falls into the latter category. Both subtypes seem to have a horizon of laterite nodules occurring in the subsoil at a depth of about 50–100 cm in culturally unmodified areas, as judged from what few observations we could make. This again is characteristic of Khorat Fine Sandy Loams in general (Pendleton and Montrakun 1960: 27).

Recording a section at Non Nok Tha is usually a rather lengthy process. Some distinctions are relatively clear in a fresh-cut face, but vanish in a few hours' drying time; other distinctions become visible only after a day's drying. Within a week after exposure, however, when the entire section dries to an almost uniform yellow-brownish gray, only the most striking differences between layers remain visible; for example, those between Soil II and III, and IV and V. (There was unfortunately no chance to obtain a Munsell chart prior to departure for the field; hence color terms as applied to moist soil in the field are necessarily subjective. Munsell descriptions of each layer were made later in the laboratory by Mary Nelson, using dry soil samples.) In addition, the high clay content of the soil results in a section drying to extreme hardness, so that only the lower soils can be distinguished by feel. Light conditions also proved important in interpretation. In general, sections were clearest under diffuse light or early morning and late afternoon sunlight; midday sun, open shade, shadow and heavy overcast all made interpretation extremely difficult. All these factors tended to make section-drawing depend on subjective interpretation of the actual situation even more than it normally does; this was particularly true of sectioned disturbances. Nonetheless, matching up of separate sections as the baulks were removed proved to be an easy task; in a few cases layer distinctions were wrongly labelled, but the distinctions as observed seemed in almost all cases to match up with distinctions in adjoining parts of the section, although sections were drawn as much as six weeks apart.

As in 1966, five fairly distinct soils within the general profile were distinguished in 1968; however, as the soils of the two areas differ more than would be expected, the two sets of soils are not identical.

*Soil I* (layers 1–5; see Figs. 2 and 3) is a gray podzolic clayey loam containing considerable amounts of fine sand; it is hard, compact, and very lumpy from intensive root and insect penetration. Layer 5, which makes up the bottom 30 cm of this soil, is more brownish than the upper 20 cm (layers 1–4). This soil seems quite firmly equivalent to both Soil I and Soil II in the 1966 area (Solheim, Parker, and Bayard 1966: 15), but no fossil soil zone equivalent to 1966 Layer 7 was encountered in the present area. The water-deposited layers present on the western portion of the 1966 area are also absent here, with the probable exception of Layer 3 (see below).

*Soil II* (Layer 6) is a brown, clayey loam containing somewhat less sand than Soil I; like the latter, it is hard, compact, and root-broken. This soil is equivalent to Soil III in the 1966 scheme, and like it, gives a clear abrupt contrast when reached horizontally, but is very difficult to detect in vertical sections. In the 1968 area this soil has been truncated by erosion, particularly on the eastern part of the site. Its average thickness is about 25 cm, with considerable variation.

*Soil III* (layers 7 and 8) is a markedly softer sandy loam, with a fossil humus zone present at the II-III interface. At this interface Soil III is brownish gray with mottlings of Soil II penetrating into it, probably due to worm action. Soil III proper is brownish yellow on the southern part of the site, and brownish red on the northern third of the area; the average depth of this soil is about 20 cm, but like Soil II, the thickness is quite variable.



*Soil IV* (layers 9 and 10) is a modified version of the natural soil which forms the base of the mound. It is considerably harder than Soil III and contains more clay, as well as many small lumps of laterite in its lower portions. This soil varies from a moderately hard, rather loose reddish sandy clay on the northern part of the site to a very hard, compact whitish or yellowish clay with little sand and many dark brown or blackish laterite nodules over the southern two-thirds of the area. Once again, thickness is variable, ranging from 10 to 30 cm. Both Soil III and Soil IV seem to be derived primarily from weathering of the natural soil (probably aided by extensive gravedigging) rather than from human occupation as in Soil I, or from more extensive vegetation cover than exists at present; such cover is probably responsible for part of the formation of Soil II. Soil III and Soil IV together seem to be equivalent to 1966 Soil IV, but differ from the latter in their sandier texture and the greater relative ease with which the layers comprising them may be distinguished.

*Soil V* (layers 11 and 12) is the unmodified natural soil and seems essentially identical to 1966 Soil V. It is a moderately hard and lumpy clay interspersed with many laterite nodules, becoming even harder some 20 cm or more below its surface and continuing down to the excavation limit of the two deep trenches dug along the 4 and F lines (the sections portrayed in Figs. 2 and 3) at an absolute depth of 210 to 240 cm.

Within the above five soil divisions, twelve occupational or weathering layers or both were distinguished, extending over all or a significant part of the site (see Fig. 4). These are as follows:

1. A quite thin, loose, crumbly layer made up of humus and plant debris derived from the cotton and mulberry plants under cultivation prior to excavation. It is medium gray in color (East: 10 YR 4/2; West: 7.5 YR 4/2) and varies in thickness from 0 to not more than 2 cm except where it fills old planting holes.

2. The compact lighter gray humus underlying Layer 1 (color as for Layer 1). Like Layer 1, this layer is thoroughly mixed by yearly plowing of the garden to a depth of some 10 cm. Depth of the layer is from 3 to 6 cm; it contains some small amount of plowed-up sherds and little else.

3. This layer is more compact and sandier than 2 and is a dark brownish gray in color (E: 10 YR 4/2; W: 7.5 YR 4/2); this dark color is retained on drying, unlike Layer 2. Layer 3 is variable in thickness, ranging from 3 to 15 cm. In the lower portions of the site at present (squares 0F, 1F, 1E, and 4H), this layer contains many small, evenly worn sherds that may have been water-deposited, perhaps deriving from layers similar or identical to 1966 layers 2 through 6 to the south. No clear break in this layer exists between the lower and higher parts of the site; hence, it is treated as a single layer, although it is unlikely that the thick portions of the layer in squares 4F and 3F (which contain very few sherds) were water-deposited. No structural features aside from two or three possibly associated pits were found in this layer, perhaps owing to the fact that in places it lies in the bottom of the plow zone.

4. This layer is very similar to Layer 3, but somewhat more brownish and noticeably lighter on drying (E: 10 YR 5/1; W: 7.5 YR 4/2); it is also distinguished by many small red and yellow flecks of burned earth, larger pieces of yellowish burned earth, and many small pieces of charcoal. The 3/4 interface is marked by many sherds, pieces of animal bone, and some fairly heavy concentrations of charcoal. This layer varies in thickness from about 5 cm in southern 4D to about 15 cm in the lower areas of the site such as 4H and 0F; the average thickness is about 10 cm. A large number of sherds and many postholes and other features were encountered in this layer, as were many large rootholes on its surface.

1966 SEQUENCE			1968 SEQUENCE			PREDOMINANT TOOL MATERIAL	
Soil	Layer	Level	Level	Layer	Soil		
I	1	XIV	XI	1, 2	I	I R O N	
	2, 3	XIII	X?	3			
	4-6	X-XII	IX?	4			
II			VIII	5	II	B R O N Z E O N	
	7, 8	--	VIII?	5			
	9	IX	NOT PRESENT				
	10	--	OR				
III	11	VIII	ERODED		III	S T O N E	
	12	--					
	13	VII					
	14	--					
	15	VI					
	16	--					
	not present		VII	eroded 6			
	17	V	??	VI			6
	17-18	"IV-V"		V			lower 6
	18	IV					
19	III		NOT PRESENT				
IV	20	II			IV	COPPER	
	upper 21, "I" west		IV	7			
	upper 21, I east		III	upper 8			
	lower 21, I		II	lower 8			
			I	9			
	22	--	--	10			
		--	11-12	V			

Fig. 4 A tentative correlation of 1966 and 1968 sequences at Non Nok Tha, showing material predominant in tool manufacture.

5. A lighter brown layer somewhat more sandy and less lumpy than Layer 4, but also containing many red and yellow flecks (E: 10 YR 5/2; W: 7.5 YR 4/2). The layer varies from 15 to 40 cm in thickness, with many sherds and structural features present, probably representing a long period of frequent if not continuous occupation. Two particularly dense zones of occupation seem to be present at or near the surface of the layer and about two-thirds of the way down in the layer. However, neither of these zones seems to form clear living surfaces.

6. A dark, almost chocolate brown layer containing notably less sand and more clay than the layers above (E: 10 YR 6/2; W: 7.5 YR 4/2); on drying, this layer is even harder and lumpier than those above it. Three distinct cultural horizons seem to be present in this layer: the posthole butts and burials which derive from the eroded portion of the layer, referred to below as Level VII; features and burials derived from an occupation surface on or very close to the present top of Layer 6 (Level VI); and a few postholes and numerous burials derived from a cemetery level some 15 to 20 cm below the present surface of the layer (Level V). This last horizon is marked in places by discontinuous lenses of sherds. The layer as a whole averages from 15 to 40 cm in thickness, but is thinnest on the eastern part of the site, where erosion has been more marked.

7. This layer contains much more sand and much less clay than the above layers; it is also markedly looser in texture. The 6/7 interface is marked by the fossil soil zone mentioned above, whose thickness averages about 5 cm. Below this grayish brown mottled zone, Layer 7 ranges in color from a brown tinged with gray and yellow in the southwestern part of the site (Soil Zone C; see below) to a grayish yellow, more clayey version (E: 10 YR 6/2) containing large amounts of snail shells on the east (Zone B) and a reddish brown version (W: 7.5 YR 7/2), again sandy, on the northwestern quadrant of the site (Zone A). Thickness varies from 5 to 30 cm, averaging about 15 cm, but it is greater to the east. Many burials originate from this layer, but little in the way of structural features and occupational refuse was recovered.

8. Somewhat lighter in color and more compact than Layer 7, Layer 8 varies in color and sand content in a similar fashion (E: 10 YR 6/2; W: 5 YR 6/2). This layer varies sharply in thickness; it averages 10 cm on the west and about 20 cm on the east. It appears to have been truncated by erosion on the eastern and extreme western parts of the site, although it remains thickest in the east, where it was apparently deposited over several low points in the Layer 9 surface. In this area Layer 8 also contains a fair amount of snail shells, but less than Layer 7. In both cases the presence of shell seems to be associated with the lower regions of the site during and after the formation of these layers. Aside from the burials associated with this layer (which are attributed to two cultural levels on typology alone, since no division of the layer is evident), only a few stray sherds were recovered, although a greater number of structural features were found than in Layer 7. Layer 8A, a more clayey version of 8, extends over part of square 1E below 8; this sublayer is about 15 cm thick.

9. The color and sand-to-clay ratios of this layer vary as with Layers 7 and 8; however, Layer 9 is always harder, somewhat lighter in color (E: 7.5 YR 6/2; W: 7.5 YR 5/4), and more like the natural soil than Layer 8, which allows relatively easy detection of 8 burial pits. Thickness varies from about 10 to 25 cm. Layer 9A, a very hard whitish yellow layer, lies between layers 9 and 11 in squares 4D, 4E, and 3E; it averages about 20 cm, but thickens to 40 in places. Layer 9B (E: 7.5 YR 6/2), a stickier, grayer version of 9, lies under 9 in square 0F; two additional lenses (9C and 9D—see Fig. 3) under the western end of 9B may represent a stream bed cut into Layer 11. Aside from the Level I burials derived from this layer and a few postholes, Layer 9 is almost sterile; the sublayers are sterile.

10. This is a fairly hard, red, lumpy layer (W: 7.5 YR 5/4) contrasting with Layer 9 above and Layer 11 below; it extends north from northern 3F and 4F. This layer does not appear to be of any more cultural significance than the sublayers of 9 described above; however, as it covers a fairly large portion of the site and was assigned a distinct number early in the excavation, it proved more convenient to retain it. Like Layer 9, this layer

contains a slight amount of small brownish black laterite nodules; like the Layer 9 sublayers, it is also sterile. Its thickness averages about 25 cm.

11. This is the top 20 to 60 cm of the natural soil; it is clayey, lumpy, and moderately hard, and contains many laterite nodules. It varies from reddish to yellowish brown in color depending on the area of the site in which it occurs (E: 7.5 YR 5/4; W: 5 YR 6/3), as with layers 7, 8, and 9.

12. This is a harder, more reddish version of the natural (E: 7.5 YR 6/2; W: 5 YR 6/3); its color when moist is affected very little if at all by the soil zones discussed below. It extends at least 30 cm below the bottom of Layer 11 over the entire site; like Layer 11, it contains large quantities of laterite nodules.

Late in the excavation, as we penetrated into Soil III in all squares, it began to be apparent that a sort of "vertical stratigraphy" was present at the site, as indicated by color, sand versus clay content of soils III and IV, and the relative ease of stratigraphic interpretation of these soils and Soil II. The 1968 area can be divided into three zones based on these criteria:

*Zone A* spreads over 4H, 4G, and the extreme northern margins of 4F and 3F; an isolated pocket of similar soils also occurs in 1E, extending over all but the southwest corner of the square. Within this zone, Soil III and Soil IV are soft, sandy, and generally reddish in color, and the sections are relatively easy to interpret.

*Zone B* occupies the remainder of 4F and 3F, except for the southeast and southwest corners of these squares respectively, as well as all of 2F, 1F, and 0F, plus the eastern third of 2E. Within this zone, soils II and IV become more yellowish and clayey, although they are still softer than these soils in *Zone C*; this condition is probably caused by higher moisture content. In addition, soils I and II in this zone become harder and more insect-penetrated (mainly by ants and termites); since the number of insects encountered in this zone did not seem to exceed that met within *Zone A*, I assume the effects of their work tend to last longer in the harder soils. In any event, interpretation of sections becomes a more difficult task.

*Zone C*, which extends over the remainder of the 1968 area (i.e., the southwest quadrant), is even worse from an archaeological point of view. Here soils III and IV are even more clayey and much harder and more compact than in *Zone B*; insect and root disturbance is even more marked. Soil conditions in general and the difficulty of reading sections approach the extremely refractory soils to the south in the 1966 area, which would seem to be wholly within *Zone C* with the exception of C7, D7, and western D6 and E6 (probably in *Zone B*).

At present I am uncertain as to the significance of these zones and the factors involved in their formation. One possibility which suggests itself is that these soil differences represent areas of different age within the mound, *Zone A* being relatively more recent than *B* or *C* (perhaps dating from the time of deposition of Layer 10 in the northwestern quadrant of the area). These distinctions may also relate to differences in drainage, permeability, or the relative proximity of the top of the water table. Judging from the pit left by our 1966 excavation, which is quite dry, although well below the level of the surrounding rice paddies, *Zone C* and probably *Zone B* are quite impermeable. From the evidence of color variability in Layer 11 and the distribution of Layer 10, it would seem that these distinctions developed prior to human occupation of the mound in the Layer 9 (Level I) period; nonetheless, they may well have had some effect on the human utilization of the mound. For example, Level III (upper Layer 8) burials are largely confined to *Zone C*, while Level IV (Layer 7) burials

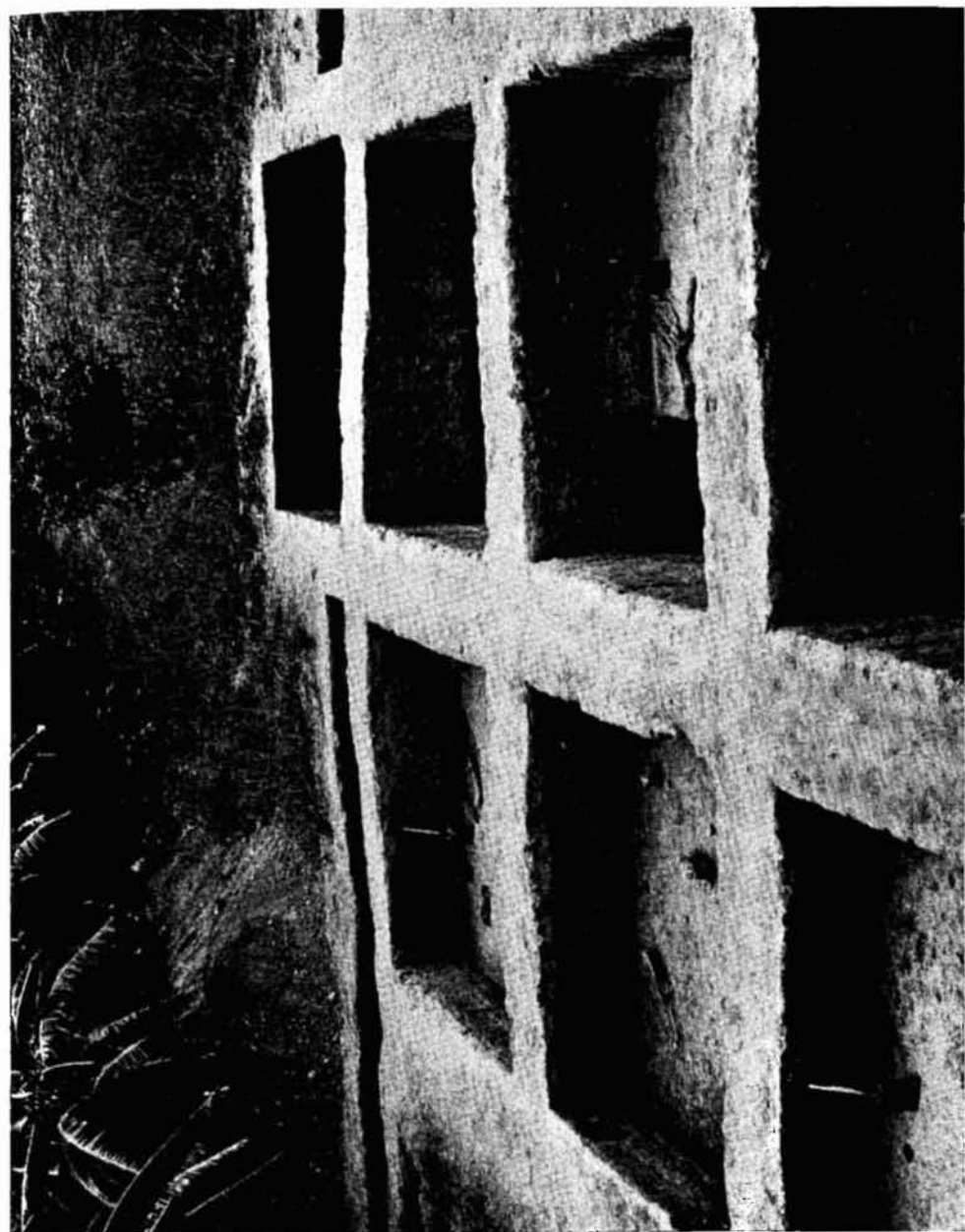


Plate Ia Non Nok Tha 1968 excavation half-completed—looking west.

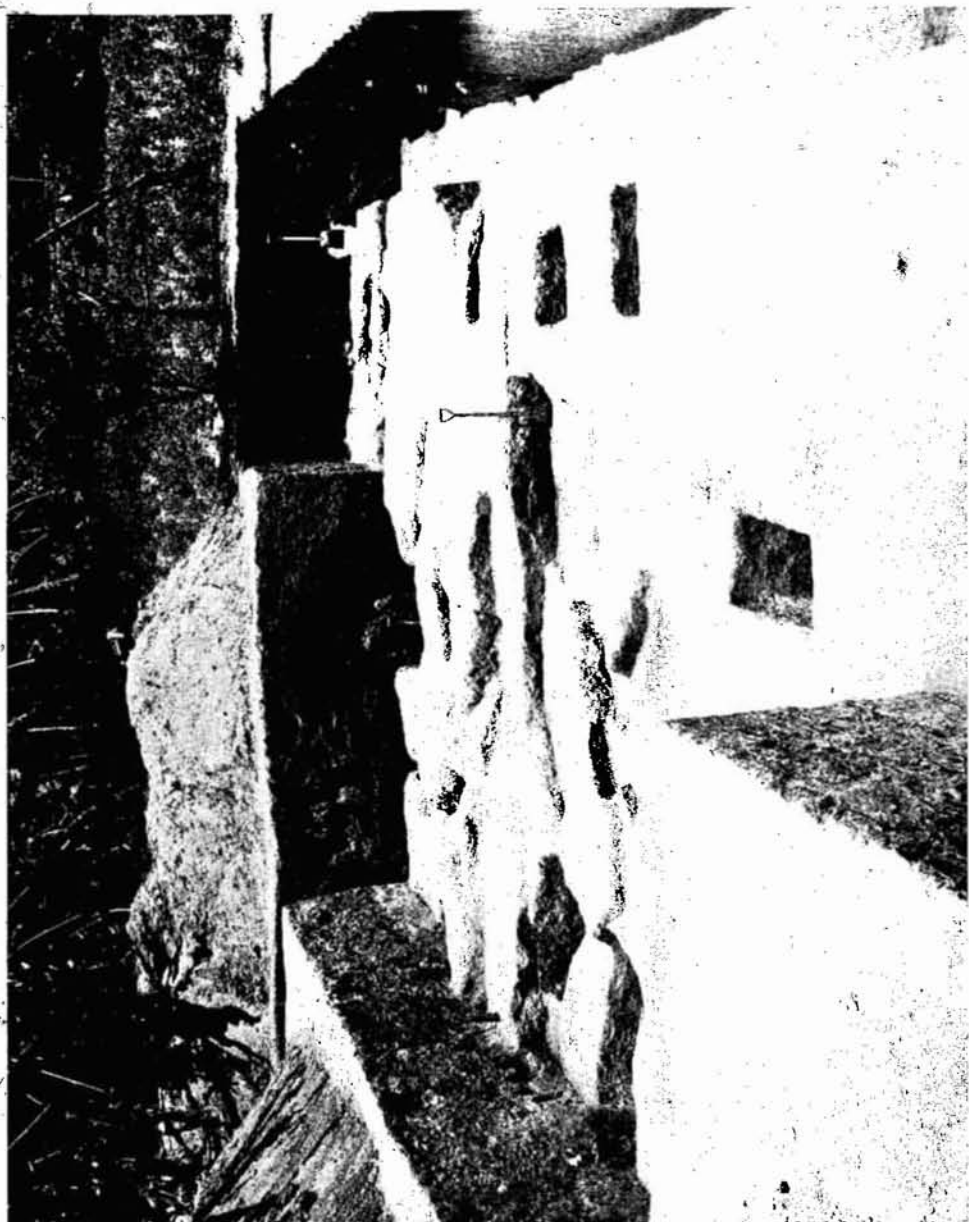


Plate 1b Completed excavation—looking west.

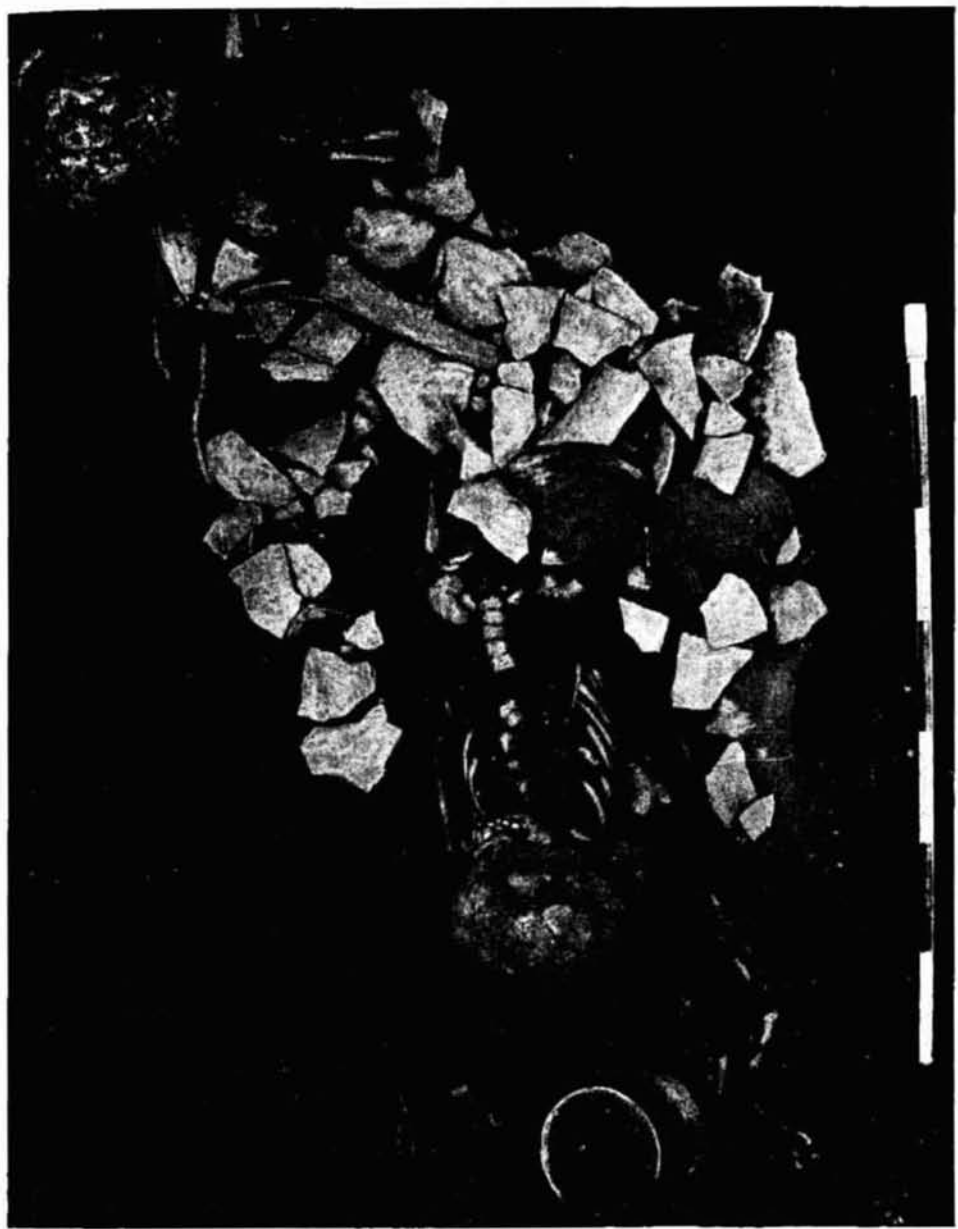


Plate IIa Level I Burial 14 with sherd sheet in place (from north).



Plate II*b* Level III Burial 90, with copper tool in place (from northwest).



with two or perhaps three marginal exceptions are located completely outside this zone. Moreover, these zones are significant and should be noted as far as the accuracy of stratigraphic interpretation is concerned. They may be one indication of the formation processes of mounds of this sort, thus suggesting useful clues to interpreting a site where such processes, rather than preceding the cultural sequence, might be incorporated into it.

#### CHANGES IN SHAPE OF THE MOUND THROUGH TIME

Since it seems obvious that changes in the contour of the site may well have affected its changing pattern of human use during the long time span of occupation, contour maps of the surface of each of the major layers were prepared from the section drawings, using an arbitrary base 100 cm below the datum zero already established for the surface measurements. The results seem to indicate that several interesting changes have taken place since pre-occupation times, although several features have persisted almost unchanged.

If the soil zones mentioned above are any guide, the high ground in the west central and southwest areas of the 1968 excavation is the oldest part of the site; the pattern of drainage to the southeast and northwest seems equally old, although a deep gully was present in square 2E through the early history of the area, filling only during Layer 7 and Layer 6 times. An even deeper depression, possibly an old stream bed, touches the northeast corner of square 1F, but extends only a short distance into the excavated area; this was filled prior to the deposition of Layer 9. In Layer 8 times, drainage begins to shift to the north and east, a pattern which continued during the deposition of subsequent layers (and the east-to-west erosion of Layer 6) and the gradual levelling out of the area, until by the Layer 5 period the area had assumed essentially modern contours.

When the foregoing changes are correlated with those observed in 1966 (Solheim, Parker, and Bayard 1966: 43-45), it seems apparent that during most of the period encompassing the formation of Layers 9 through 7 (levels I-IV or 1966 levels I and III) the mound, as it appears today, was divided into at least two and probably more small areas of higher ground separated by shallow, almost certainly intermittent watercourses. With respect to the areas already excavated, these high regions would seem to be (a) the eastern half of the 1966 area; (b) the 1968 area and land to the north of it; and (c) quite likely the western half of the 1966 area, which may well have been isolated from both of the other areas by a continuation of the gully to the south of the 1968 area or by a westward-draining gully meeting the first gully in the vicinity of square 4E.

#### ARCHAEOLOGICAL LEVELS

Layers 1 through 9 as described above may be divided into eleven more or less discrete archaeological levels; two of these levels are apparently premetal (I, II), five are bronze-period (III-VII), and the remaining four are iron-period (VIII-XI). With the exception of Level VI, all premetal and bronze-period levels are represented mainly by burials and debris from burials rather than by occupational refuse and extensive structural features. We suspect that the main occupation area associated with these cemetery levels lay about 500 to 1,000 m north of Non Nok Tha, to the west of the modern village of Ban Na Di. This site, called Døn Kha, seems to extend over an area of some 300 by 500 m and would undoubtedly

yield much valuable data, given the three or four seasons which would be necessary to excavate a significant portion of it. There are several other likely occupation sites in the vicinity as well, such as Nam Phong 6 and Nam Phong 8, which were located at the same time as Non Nok Tha (Solheim and Gorman 1966: 175-178).

The following brief description of the eleven levels encountered in the 1968 excavation is based primarily on burial typology, structural features, and subjective impressions of changes in pottery styles, faunal remains, and artifacts formed as they were being recovered in the field; additional information was also recovered by superposition of plans showing burials and structural features from each level over the contour plan of the associated layer. It should be remembered, of course, that analysis of the bulk of the material recovered from the 1968 excavation has yet to be completed; thus the conclusions presented below are quite tentative and may well be modified once analysis is completely finished.

*Level I.* During this earliest of the levels encountered in the 1968 excavation, most of the area was used as a cemetery; some 18 burial pits were found in the region east of squares 2F and 1E. Most (10) of the burials were of children, but remains of 3 adults and 1 adolescent were also present. (The remaining 4 pits were largely out of the excavation area.) The burials of this period have the following distinctive features: deep burial pits ranging from 40 to 90 cm, medium to large round-bottomed, cord-marked pots placed beyond head and feet, and in the more ornately furnished children's graves frequent offerings of whole or partial dogs, pigs, small deer, and one as yet unidentified carnivore or omnivore (Pl. IIa). Also common in the children's graves were strings of shell beads consisting of many small disks of about 5 mm in diameter worn about the pelvis and small stone adzes having a low-profile rectangular or trapezoidal cross section similar to those found in the lower layers (17-21) of the 1966 excavation. Four of the large, elaborately incised pots that were described as characteristic of this level in 1966 (Solheim, Parker, and Bayard 1966: 24; Solheim 1967b: 901) were recovered in the later excavation; as in 1966, they were far rarer than vessels decorated solely with cord-marking. As is the case with the following three levels, orientation does not seem to be significant, although Level I child burials tend to be oriented with head to the southeast or south, while the few adult burials are mainly oriented to the northwest. In contrast to the burials of 1966 Level I, only 3 possible burial mounds over the grave pits were located in 1968, and these were by no means as elaborate as those found in the first year's excavation. Structural evidence from this level was limited to a single possible rectangular building on the eastern part of the area (1F and 0F) outside the burial zone; its dimensions appear to have been about 6 m by 3 m, with the long axis running NW by SE.

*Level II.* Like Level I, no metal whatsoever was recovered from this level; small stone adzes are even more common in burials of this period than in Level I. During this period the entire area excavated was apparently used solely as a cemetery, with child burials located on the eastern portion of the site (8, including 2 doubtful) and adults buried on the western side (6, including 2 doubtful); a single child burial with notably more ornate furnishings was found in the adult area in square 4F. Graves of this level were very shallow, rarely extending more than 40 cm below the present surface of Layer 8; it would seem that in addition to the erosion of this layer which took place in post-Level III times the graves originally were considerably more shallow than those of levels I and III. Furnishings included the adzes mentioned previously, which were invariably found in the graves of children and frequently occurred in adult burials as well. The finely-made incised pots of Level I are absent, as is the wide variety of large undecorated cord-marked pots (40-60 cm diameter); however, ring

feet first make their appearance on small cord-marked pots (10–20 cm diameter) in this level. Animal offerings and strings of shell beads continue from Level I into this level, but are rarer. As in Level I, the more ornate graves feature sherd sheets formed by smashing a large cord-marked pot over the body (as in Pl. IIa), or, in the one clear-cut case of a mound over the grave found in this level, on the base of the mound itself. Two other low mounds without furniture appeared to be present over shallow child burials, but these seem to have been protective rather than ceremonial. This custom was reminiscent of the shallow child burials in Layer 21 burial mounds that we encountered in 1966; however, by probing beneath both of the 1968 mounds, we failed to uncover an adult burial below.

The only possible structural features that may be associated with this level more likely originated from Level III and are better discussed there.

*Level III.* Burials of this level were limited to the mid-southwestern portion of the excavation area (squares 4F, 4E, 3E, and 2E); in contrast to the earlier levels, adult burials are more common than those of children (5 adults, 2 children, 2 empty pits). Burial mounds are absent, although in one case offerings were placed in the fill of the grave. The graves are markedly deeper than Level II, averaging 60 cm. Offerings in general are simpler, with somewhat cruder cord-marked pottery prevailing; occasionally, as in Level II, these pots are decorated with two or three wavy lines incised over the cord-marked shoulder. Ring feet continue to be fairly rare. The most distinctive feature of Level III burials is the marked degree of disarticulation of the skeleton; while the bones of the body are in a more or less correct position, many of them were obviously not articulated at the time of burial, thus giving the impression that the body was allowed to partially decompose prior to final burial (see Pl. IIb). In one burial, the bones appeared to have been somewhat burned, as if the body had been partly cremated. As with Level II, orientation of the burials does not seem to have been significant; although a majority are oriented to the northwest, others are aligned to the southwest or southeast.

Possibly the most surprising result of the 1968 excavation was the discovery that limited quantities of metal apparently first appeared during this period. Since Level III seems to correlate quite closely with 1966 upper Layer 21 (Level I), which was presumed to be pre-metal at the time, this discovery would seem to make a reconsideration of the development of metallurgy in the entire region necessary. The major metal find from this level is a socketed axe or digging stick tip quite different in form from the axes found in 1966 levels II and III and 1968 levels IV–VII (see Pl. IIIa). A qualitative analysis by the Thai Department of Mineral Resources (Phuangsin n.d.) indicates that the metal is basically copper containing small amounts of aluminum, iron, and phosphorus, as well as traces of arsenic and mercury. At present it is uncertain whether the tool was cast or whether it was beaten around a form; there are, however, clear evidences of cold-working on the bit end of the tool. The patina of the object is a brilliant green and quite different from the soft bluish green of the later bronze implements.

The only other metal found relating to this level (two small fragments in an empty burial pit) features the same brilliant green patina. The burial in which the tool was found could be firmly assigned to Level III, in terms of both stratigraphy and typology; the burial was that of an old adult and featured extensive furniture in addition to the tool, indicating a person of some importance (Pl. IIb). When coupled with the complete absence of metal in the typologically very similar graves excavated in 1966, it would seem to be that metal was still quite rare at this time. As there are no evidences of metalworking present in this level,

the tool may well be an importation. The implications of this find will be discussed below.

Evidences of two possible large structures were recovered from this level—one of them possibly superimposed over a smaller building. As mentioned earlier, there is a slight chance these may be derived from Level II, but this seems unlikely. The first structure is located in the eastern portion of the area (squares 1F, 1E, and 0F) and measures at least 8 m by 7 m, with the long axis aligned WSW by ENE; this structure may in fact be larger and oriented NNW by SSE, in which case the dimensions would be 12 m by 8 m. Posthole spacings seem to average about 2.5 m. The second possible building is located to the west in 4G, 4F, 3F, 4E, and 3E; it is quite similar to the larger version of the first in size and orientation. A smaller (7 m by 5 m or 5 m by 5 m) building may have existed in the same location at a slightly earlier or later date; however, its presence is quite doubtful. Most of the burials of this level appear to be located between the two larger structures, although three are in fact underneath the western one.

*Level IV.* Use of the area as a cemetery continued during the formation of Layer 7 and spread to encompass a wider region of the site than in any previous level. This level is also distinguished by the variety in the types of burials and funerary features present. The 18 burials (3 tentative) and 10 mounds lacking burials (2 tentative) that are assigned to this level may be divided into four types, each more or less localized. In the northwestern quadrant of the area are located 6 more or less elaborately furnished burials featuring deep grave pits (averaging 65 cm) and mounds with offerings of pots and animal bones above them; 2 strings of shell disk beads were found around the waist of one of these skeletons. Located from northwest to southeast across the central portion of the site (3F to 1E) are 5 and possibly 6 quite shallow secondary burials with long bones, ribs, and pelvis arranged in more or less orderly fashion below the skull and accompanied by animal bones, many pots (some deliberately smashed), and in two cases an extra human skull. These seemed reminiscent of the elaborate mounds with frequent evidence of human sacrifice that were encountered in levels I and II of the 1966 excavation; however, test digging under the 1968 burials failed to turn up any trace of a primary burial below. To the east of these secondary burials there are 4 simply furnished extended burials lacking mounds; 2 of these are only tentatively ascribed to Level IV, however. Finally, 5 or 6 medium to large mounds containing pots, sherd sheets, and animal bones are located on the eastern margins of the excavation area (1F, 0F, and 1E). Again, probing below these mounds, we failed to locate any associated burials. These groups of offerings seem somewhat parallel to the "votive deposits" encountered in the Malayan neolithic site of Gua Cha (Sieveking 1955: 89-90). The southwestern portion of the site was lacking in Level IV features except for one elaborately furnished burial and a small "votive deposit" tentatively assigned to this level.

During this period bronze was apparently more available than in Level III times, and evidence that casting if not smelting of bronze was taking place in the immediate vicinity is afforded by the two pairs of sandstone axe molds found in this level. One of these was designed to cast a small, socketed axe with straight cutting edge unlike any yet encountered at the site; the second pair of molds were found with an axe possibly cast in them and are of a type similar to two recovered from Layer 20 in 1966 (Solheim 1967a: 88, Pl. I). However, finds of stone adzes in this level and levels V-VII above it seem to indicate a continuing although lesser dependence on stone tools.

The burial pottery of this level is quite distinct, although it is certainly related to the pottery of the earlier levels. Large round-bottomed cord-marked vessels are still common, but almost always feature carefully smoothed shoulders. The most notable change in pottery, however, is the first appearance in this level of the footed funerary vessels so common in levels V through VII. These occur in two forms: a globular or ovoid footed vessel with short vertical or slightly everted rim; and a shallow, footed "goblet" with a carinated, sharply inverted shoulder. The earliest forms of both types of vessel appear to have been much larger than the type common in the later levels, ranging up to about 30 cm in height; in addition, the large versions of the globular vessels often lack ring feet, having instead a sharply rounded conical base. The more standard small versions of both types also occur in this level, but seem to be somewhat later.

*Level V.* This level is associated with the lower horizon in Layer 6 and represents the period of most intensive use of the cemetery; 23 burials (3 tentative) were recovered in the 1968 excavation area; all but 2 of them were adults. The burials of this level occur over the entire site, excepting squares 0F and 1E, and are strongly standardized in comparison to those of earlier levels: they are almost invariably oriented to the southwest (a few cases vary to WSW and S by W) in graves averaging 55.6 cm in depth, have hands placed below the pelvis, and feature standardized furniture consisting of a group of four small footed vessels (two globular and two goblet types) placed beyond the head, usually accompanied by one or more large clam shells (Pl. III*b*). In many cases a similar group of pots was placed on top of the grave fill; animal bones and sherd sheets were also fairly common. The small, footed funerary vessels, which were also encountered frequently in burials in the 1966 area, apparently represent standardized descendants of the larger, more variable vessels of similar design mentioned above, which were not encountered in the burials of the nearly equivalent 1966 Level II. These small, standardized vessels continued to be used throughout levels VI and VII and were later exhumed by the iron-period inhabitants of the site for use as cinerary vessels. Several of these vessels contained a few very small fish vertebrae, possibly indicating the use of some sort of fermented fish product at this date (1800 B.C.).

One of the burials of this level contained a bronze axe of a type similar to that recovered from a Layer 19 (Level III) burial in 1966 (pictured in Solheim 1968*b*: 60, Pl. II*b*). The flat cutting edge with upcurved ends of this type of axe seems fairly distinct from the earlier curved-blade variety and was apparently introduced during the 1966 Level III period, which is not present in the 1968 area of excavation. Although no axe molds were recovered from 1968 Level V, evidence of bronze casting is offered by the presence of 2 earthenware crucibles bearing bronze stains that were found in a Level V burial pit.

As is the case with Level IV, no structures were detected at this level. Features were limited to graves and a few scattered postholes, some of which form a dubious alignment in squares 1F and 0F.

*Level VI.* This is the earliest level in the 1968 sequence to provide significant structural evidence of occupation as well as cemetery use; this level is approximately aligned with the present (eroded) surface of Layer 6. A large rectangular building occupies most of the eastern and central portions of the area, extending southeast from square 3F to squares 0F and 1E. Its approximate dimensions are 12 m NW/SW by 6 m NE/NW; posthole spacing is apparently 3 m along the long axis of the building and 2.5 m-1.5 m-2.5 m along the short axis, indicating a 4 by 5 post pattern. This structure is notably larger than houses of the iron-period levels (VIII-X) and contemporary dwellings (Level XI). There are indications

that 2 possibly later structures were built in about the same area. One of these is about 9 m by 6 m with the long axis WNW/ESE with 2 m (?) posthole spacing; the second is also 9 m by 6 m with 2 m spacing, but is oriented only slightly N of W. What seems to be a long fence row extends in a slightly irregular line from square 4H to square 4D with small stakeholes at 1 to 3 m intervals. Three postholes in 4E and 4D indicate that a fourth possible structure may lie to the west of these trenches.

In addition to the above structures, some 12 adult burials (3 doubtful) were recovered from this level. These burials are sharply distinguished from those of both the preceding and following level by their orientation (N to NW), shallow graves (averaging 42.5 cm), and hand position (alongside or on the pelvis, rather than under it as with Level V burials; this trait is common to levels VI and VII, however). An additional contrast with both adjoining levels is the scattered spacing of Level VI burials: two are located under the large structure in the east-central area of the site, with the remaining burials irregularly dispersed to the west and south of the building. Six groups of large, round-bottomed, cord-marked pots nested together were also recovered in shallow pits originating from this level or Level VII. All but one pot were some distance from any burial of this or the next period, and hence may represent a later type of "votive deposit."

*Level VII.* During this period the site again returned to cemetery use, although the later erosion of the upper portion of Layer 6, with which this level is associated, may well have removed whatever structural evidence may have been present. We encountered 19 burials (4 doubtful) originating from Level VII; the skeletons, with the exception of 1 child and 1 adolescent, all appear to have been of adults. A fair amount of evidence supports the conclusion that the population using the site during this period was more closely related to the population of Level V than that of the intervening level: a return was made to more or less orderly spacing of burials over the areas used in Level V; orientation returned to the southwest, and graves deepened to an average of 52.5 cm below the present surface of Layer 6, cutting into the earlier Level VI burials in six cases. Differences in burial type between Level VII and Level V, which seem to indicate a considerable time span for the intervening level, are that in Level VII burials the hands were placed on top of the pelvis and the group of 4 standard pots was not found beyond the head; although these standard vessels appear singly in several graves of Level VII, the small, red-slipped, flat-bottomed jars that are apparently unique to this level are more common. Two pots in the forms of animals (an elephant and a frog (?)) bearing very similar red-slipped vessels on their backs are also tentatively assigned to Level VII (Pl. IVa). Also recovered from a burial of Level VII was a bronze axe with a thin blade some 16 cm wide by 5 cm long (excluding socket of 6 cm) and a plain bronze bracelet with circular cross section.

*Level VIII.* Evidence from the 1966 excavation indicates that a considerable period of time may have elapsed between the last bronze-period occupation of the site and the earliest iron-period settlement (Solheim, Parker, and Bayard 1966: 46). However, the erosion of Layer 6 over the 1968 area of the site has removed not only whatever evidence of 1966 levels VI and VII (layers 16-13) may have been present, but also any trace of an equivalent to 1966 sterile Layer 12. Hence the Layer 5 deposit resulting from this first iron-period occupation of the 1968 area lies directly above the Level VI deposit that thus has intrusive features from Level VII, as well as the much later Level VIII. The Layer 5 deposit may well represent two concentrations of dense occupation separated by a period of more sparse settlement; however, as neither extensive concentrated lenses of refuse nor sterile layers

separating them are present, this layer will be treated as a single extended occupation for the purposes of this interim report.

Judging from relative posthole depths and parallel alignment, I would say that two structures were present during early Level VIII times. The first of these was a square or rectangular building running SSW from squares 0F and 1F out of the excavation area; its dimensions were 6 m wide by at least 6 m long, with a probable 4 by 4 post pattern spaced from 2 m to 2.5 m apart. A second somewhat larger building stood on the higher but equally level ground to the west in squares 4F, 3F, 4E, and 3E; it measures about 9 m by 6 m, with the long axis running NW/SE and a possible 5 by 5 post pattern. Later in the Level VIII period, another building probably was constructed over this western one. This later structure seems to have been more square than rectangular and oriented more nearly N/S. Posts were arranged in a 4 by 4 pattern and were about 2 m apart. Both of the western structures had shallow pits containing ash and charcoal, implying that they were either ground-based buildings unlike those of the contemporary inhabitants or that they were raised off the ground to a considerable height; the present villagers do not build fires beneath their houses, although the houses may be elevated as much as 2 m. In the case of the earlier fire pit, there are indications that it was surrounded by a fence or enclosure of some sort. Dwellers in both buildings used the area to the southwest, which at that time was a shallow gully (squares 4D and southern 4E), as a refuse dump, although the concentration of bone and sherds is not so dense as to constitute a genuine midden.

As we found in the 1966 excavation, the iron-period occupants of Non Nok Tha had abandoned the practice of inhumation burial in favor of cremation and later burial of the ashes in cinerary vessels, most of which were apparently excavated from the earlier graves (Solheim, Parker, and Bayard 1966: 55). However, burials of cinerary vessels of the type described for 1966 levels VIII and IX were not encountered in 1968. The five burials excavated in 1968 Level VIII—one of them associated with the earlier period of dense occupation, four with the later—were all of the type described for 1966 levels X–XII. These utilized the standard globular and goblet funerary vessels so common in the middle Bronze period and a cubical pit roughly 40 cm on a side. Other empty pits assigned to 1968 Level VIII may well have been the result of later inhabitants' frequent and all too successful attempts to obtain a supply of pots from the underlying levels V, VI, and VII burials.

More than seemed to be the case in 1966, no sharp break in pottery types between the bronze and iron periods was encountered in 1968. What differences do occur seem to be primarily because of the predominance of funerary pottery in the earlier period; this is of course lacking in the iron period. The domestic pottery that was recovered from the Level VI occupation in 1968 seems to uphold this conclusion, as it bears a strong resemblance to the later domestic wares. Rather, the most distinctive feature of the later pottery is the addition of several new types to the common sand-tempered cord-marked ware that predominates throughout most of the history of the site. In Level VIII, pottery tempered with large amounts of chaff or chaff and sand begins to become prominent; a small amount of wheel-thrown pottery is also present. In addition, a limited quantity of stoneware and occasional sherds of celadon and crude porcelain make their appearance. All this plus the type of cinerary vessel burial present and the lack of any trace of widespread destruction of the type encountered in 1966 Level IX (Solheim, Parker, and Bayard 1966: 50) support the conclusion that 1968 Level VIII slightly postdates 1966 Level IX.

*Level IX.* The thinness of Layer 4, associated with this level, as compared to Layer 5,

would seem to suggest a shorter duration of occupation for Level IX. However, three post-hole alignments seem to indicate that the area was in fact occupied and not marginal to any settlement at this time. The structure suggested by these alignments occupied the west-central portion of the site (squares 4F, 3F, 2F, 4E, 3E, and 2E) and was oriented with its long axis due east and west. This building measured about 9 m by 6 m, with a 4 by 4 post pattern similar to one style of contemporary dwelling; posthole spacing was 2 m N/S by 3 m E/W. A 2 m by 3 m extension was present to the north of the northwest corner; the presence of scatters of charcoal and a lumpy, clayey patch alongside and under the place where this extension seems to have stood indicate that it may have served as the cooking and water-storage area of the house, similar to modern houses in the region. As with the Level VIII houses in the same area, the shallow gully to the southwest (which persisted into Level IX times) was used as a refuse area.

To the east of this building, two crude kilns for burning lime to be used with betel were discovered—one in square 1E, the other in 0F. Both were low mounds (probably old termite nests) of partially baked earth with a 50 cm hole in the center containing a quantity of charcoal and a lesser amount of lime. Signs of the lateral fueling hole present in contemporary kilns of this type were not in evidence. A probable fence row separating the building from the kilns runs ENE from 2E to 0F and seems to extend back toward the northeast corner of the building. No cremation pot burials were found associated with this level, but several empty pits were encountered that may have served to contain cinerary pots for burial elsewhere at the site.

*Level X.* During this period, the 1968 area was apparently quite marginal to whatever activities were taking place at Non Nok Tha; only two postholes and three pits were clearly assignable to this level. Of the relatively small quantity of sherds recovered from Layer 3, a fairly high proportion in the lower areas of the site show signs of wear, which suggests that they may have been deposited by erosion from earlier layers to the south. However, wear by annual plowing, which extends into the upper portion of Layer 3, may have accounted for some erosion.

*Level XI.* After a period of abandonment that probably lasted more than a century, the present villagers of Ban Na Di settled nearby and began gardening at the site, producing many planting holes, a few pits, and scattered postholes, but no signs of definite occupation; this theory is supported by the memories of the villagers as well. Oddly, it is at this level that the greatest break in overall pottery type appears: the earthenware in contemporary use in Ban Na Di (made in one of the several potting villages in the general region) is manufactured by a process similar to that used throughout the history of the site (paddle and anvil) but is never sand-tempered or cord-marked. The clay is instead tempered with fired fiber and clay balls which have been pulverized in a mortar; the vessel is shaped with a plain wooden paddle and is decorated with a carved wooden stamp in a single band around the neck (see Solheim 1964: 156-161). While the modern water storage and cooking pots bear a fair degree of resemblance to the prehistoric ones, the common high-profile round-bottomed pot used in steaming the glutinous rice that is the staple of the area is, as far as can be determined at present, strangely absent from Non Nok Tha.

Such is not the case with other items in current use at Ban Na Di, which often have very close counterparts in objects recovered at Non Nok Tha. For example, the socketed axes currently used are very similar to those of the bronze period, although they are formed of iron rather than bronze. The small, round clay pellets found in all levels of the site were at



once recognized by the workmen as ammunition for a two-stringed pellet bow. Lime-burning kilns formed by excavation of termite mounds such as the two found in Level IX are still in use today. Some degree of relationship may be seen as well between the contemporary house types and those described above. The modern houses are all elevated at least 1.5 m above the ground and are rectangular. Cooking is performed in either a separate elevated extension or on a corner of the veranda that almost invariably adjoins one side of the house. The traditional form of Lao house in the area consists of two houses of about 10 m by 6 m joined by a porch between them; each has a 3 by 4 or 4 by 4 post pattern, with spacing of about 2 m. Other smaller single houses have similar patterns and probably reflect an old style of building; a small, 4 by 4 m house with a 3 by 3 post pattern is becoming increasingly popular at present, and according to the villagers, represents an introduction from either central Thailand or the Khorat area.

Some degree of continuity in burial practices also exists, particularly as far as iron-period practices are concerned. At present, after cremation, selected bones are gathered up (usually from the region over the heart) and saved in jars. Rather than being buried, however, the jars are stored either in the family dwelling or in the village wat. Children under the age of eight and adults who have died violently are not cremated, but are buried at the cremation grounds in shallow, unmarked graves. Often, however, favorite possessions are buried with them, and both possessions and food offerings are frequently burned along with a cremation.

#### CORRELATION WITH 1966 SEQUENCE

Although it would of course have been desirable to excavate a trench connecting the 1966 and 1968 areas of the site to ensure accurate stratigraphic continuity, it proved to be an impossible task owing to time limitations and problems with multiple ownership of the land involved. Hence, the correlation presented here relies primarily on my impressions of soil distinctions in both areas, and even more on burial and pottery typologies. Despite the lack of direct continuity, however, the correlation presented here so far seems quite consistent in terms of both the radiocarbon chronology of the two areas of the site and the general trends in evolution of burial and pottery types distinguished in both excavations.

As may be observed by a comparison of the foregoing description of archaeological levels with that presented in the 1966 preliminary report, a greater degree of discrepancy exists between the two areas than would be expected, given their close physical proximity (see Fig. 4). The most noticeable difference is that caused by the erosion of the upper part of 1968 Soil II, which results in the absence in this area of layers corresponding to 1966 layers 12-16. Clear evidence of this erosion is present in the many shallow posthole butts encountered that were obviously not deep enough to have originated from Level VI on or near the present Layer 6 surface, as well as in badly eroded Level VII burials in those parts of the 1968 area where erosion was apparently most severe (the eastern and northern edges of the excavation). It is of course not possible to say with certainty that layers equivalent to 9 through 16 of 1966 were in fact ever formed over the eroded portion of 1968 Layer 6, but the former presence of at least part of this series seems likely given the lack of any significant degree of variation in elevation between the two areas and the absence of a correspondingly thicker Soil I in the 1966 area. In fact, Soil I in the 1968 area is markedly thinner than soils I and II in the 1966 area, and the surface of 1968 Soil II, although eroded, is noticeably

higher than the corresponding surface of 1966 Soil III to the south, implying a still higher surface for 1968 Soil II prior to erosion.

In addition to this major discrepancy, other significant differences may be noted. For example, the lower part of the Level VIII occupation (1968 Layer 5) seems to be slightly later in time than 1966 Level IX, based on the differences in sherd types encountered; the 1968 Level VIII features a significant amount of fiber-and-sand-tempered sherds quite similar to those encountered in the nearby site of Nam Phong 6 and the Lam Pao 3 site at Ban Sao Lao, Kalasin, some 125 km ESE of Non Nok Tha (Solheim and Gorman 1966: 132-135, 174-178; Solheim, Parker, and Bayard 1966: 85-88). Sherds of these types are very rare in 1966 Level IX. A second lack of correspondence is the apparent absence of any exact equivalent of 1968 Level VII in the 1966 sequence: although burials typologically similar to 1968 Level V are succeeded by 1966 Layer 17 burials similar to 1968 Level VI, the subsequent return to strict southwest orientation and other features of 1968 Level VII are not present to the south.

A larger gap in the 1968 sequence is represented by the absence of an equivalent to the south or southeast-oriented Layer 18 (Level IV) burials on the eastern portion of the 1966 area. The deep, narrow graves with bovine limbs of 1966 Layer 19 are also completely absent in the 1968 area, and Level IV in the 1968 sequence seems slightly earlier than the majority of Layer 20 (Level II) material encountered in 1966. The only features in this latter area that might be ascribed to 1968 Level IV are limited to the western quarter of the 1966 excavation (squares D6, D7, and C7), where several secondary burials with pottery very similar to 1968 Level IV pottery were found. These burials were tentatively assigned to either Layer 21 or Layer 20 in 1966, but seemed typologically distinct from either layer. With the evidence from the 1968 excavation, it now seems fairly certain they are indeed intermediate between 1966 Levels I and II and closely equivalent to 1968 Level IV, while the Level II material over the major portion of the 1966 area is somewhat later still and absent from the 1968 area.

What was referred to as Layer 21 or Level I in the 1966 sequence seems at present to be represented by three distinct levels in the 1968 area, validating the estimate made by R. H. Parker at the time of the 1966 excavation (Solheim, Parker, and Bayard 1966: 13). Although it is possible to state that the more elaborate, deeper burials of 1966 "lower" Level I are equivalent to the 1968 Level I burials originating in Layer 9, I was unable to draw a stratigraphic distinction between Level III and Level II as represented in 1968 Layer 8, although the typological differences between burials of the two levels seem quite clear-cut. Based on this typology, 1966 burials 26 and 81 are almost certainly equivalent to the 1968 Level III burials, which share their marked disarticulation. However, the correspondence of 1968 Level II with the remaining Layer 21 features in the 1966 area is far more tentative. A further difference between the burials of 1968 levels I-III and 1966 Level I is the apparent paucity of burial mounds in the case of the former levels: only four mounds or traces of possible mounds were encountered in association with 1968 Level I and Level II burials.

#### CHRONOLOGY

As of this writing (August 1969), we have received 25 radiocarbon dates on charcoal from Non Nok Tha from five laboratories: Gakushuin University (GaK), Tata Institute (TF), Yale University (Y), Florida State University (FSU), and Geochron Laboratories (GX).

TABLE 1  
NON NOK THA RADIOCARBON DATES, 1966 AND 1968

LABORATORY SAMPLE NUMBER	PROVENANCE	B.P. DATE	CORRECTED TO 5730 HALF-LIFE	2 SIGMA RANGE
1966 DATES				
GaK 908	Layer 9	710 ± 90	1220 ± 90 A.D.	1020-1420 A.D.
GaK 956	Layer 19	4120 ± 90	2290 ± 90 B.C.	2490-2090 B.C.
GaK 957	Layer 13	1720 ± 80	180 ± 80 A.D.	20 B.C.-380 A.D.
GaK 958	Layer 9	2220 ± 110	340 ± 110 B.C.	560-120 B.C.
GaK 959	Layer 21	1860 ± 140	30 ± 140 A.D.	250 B.C.-310 A.D.
GaK 1027	Layer 9	2480 ± 80	600 ± 80 B.C.	800-400 B.C.
GaK 1028	Layer 11	2560 ± 100	690 ± 100 B.C.	890-490 B.C.
GaK 1029	Layer 17 or 17-18	2830 ± 100	960 ± 100 B.C.	1160-760 B.C.
	Burial 48			
GaK 1030	Layer 18	Less than 250 B.P.		1700-1950 A.D.
GaK 1031	Layer 18	2530 ± 120	660 ± 120 B.C.	900-420 B.C.
GaK 1032	Layer 20	8100 ± 250	6390 ± 250 B.C.	6890-5890 B.C.
	Burial 69			
GaK 1033	Layer 17	2990 ± 110	1130 ± 110 B.C.	1350-910 B.C.
	Burial 10 or Layer 17-18			
	Burial 9?			
GaK 1034	Layer 21	5370 ± 320	3590 ± 320 B.C.	4230-2950 B.C.
	Burial 26			
TF 651	Layer 19	4275 ± 200	2325 ± 200 B.C.	2720-1920 B.C.
Y 1851	Layer 17-18	3170 ± 200	1310 ± 200 B.C.	1710-910 B.C.
	Burial 78?			
1968 DATES				
FSU 339	Level VIII pit	Modern plus 0.07 counts per min. per gram		
FSU 340	Level 0 (Layer 11)	4435 ± 130	2620 ± 130 B.C.	2880-2360 B.C.
FSU 341	Level IV	2470 ± 140	590 ± 140 B.C.	870-310 B.C.
FSU 342	Level III	3055 ± 130	1200 ± 130 B.C.	1460-940 B.C.
FSU 343	Level IX kiln	Modern plus 0.2 CPM/g		
FSU 345	Level I	3560 ± 130	1720 ± 130 B.C.	1980-1460 B.C.
	Burial 125			
GX 1609	Level VIII pit	500 ± 85	1430 ± 85 A.D.	1230-1630 A.D.
GX 1611	Level V	3685 ± 110	1840 ± 110 B.C.	2060-1620 B.C.
	Burial 15			
GX 1612	Level I pit	2750 ± 130	880 ± 130 B.C.	1140-630 B.C.
Y 2485	Level VI	3090 ± 120	1230 ± 120 B.C.	1470-990 B.C.
	Burial 95			

Of the samples dated 15 were derived from the 1966 excavation, and 10 were 1968 samples; a complete list is presented in Table 1 and Figure 5.

The 25 dates listed in Table 1 were plotted against the integrated 1966 and 1968 sequence (see Fig. 4); correction procedures used are those used by Solheim (1968b: 61). Obviously, the radiocarbon chronology of Non Nok Tha presents a number of problems. Resolution of these problems seems of particular importance in view of the possibility that a well-developed tradition of double-mold bronze casting may have been present in northeastern Thailand

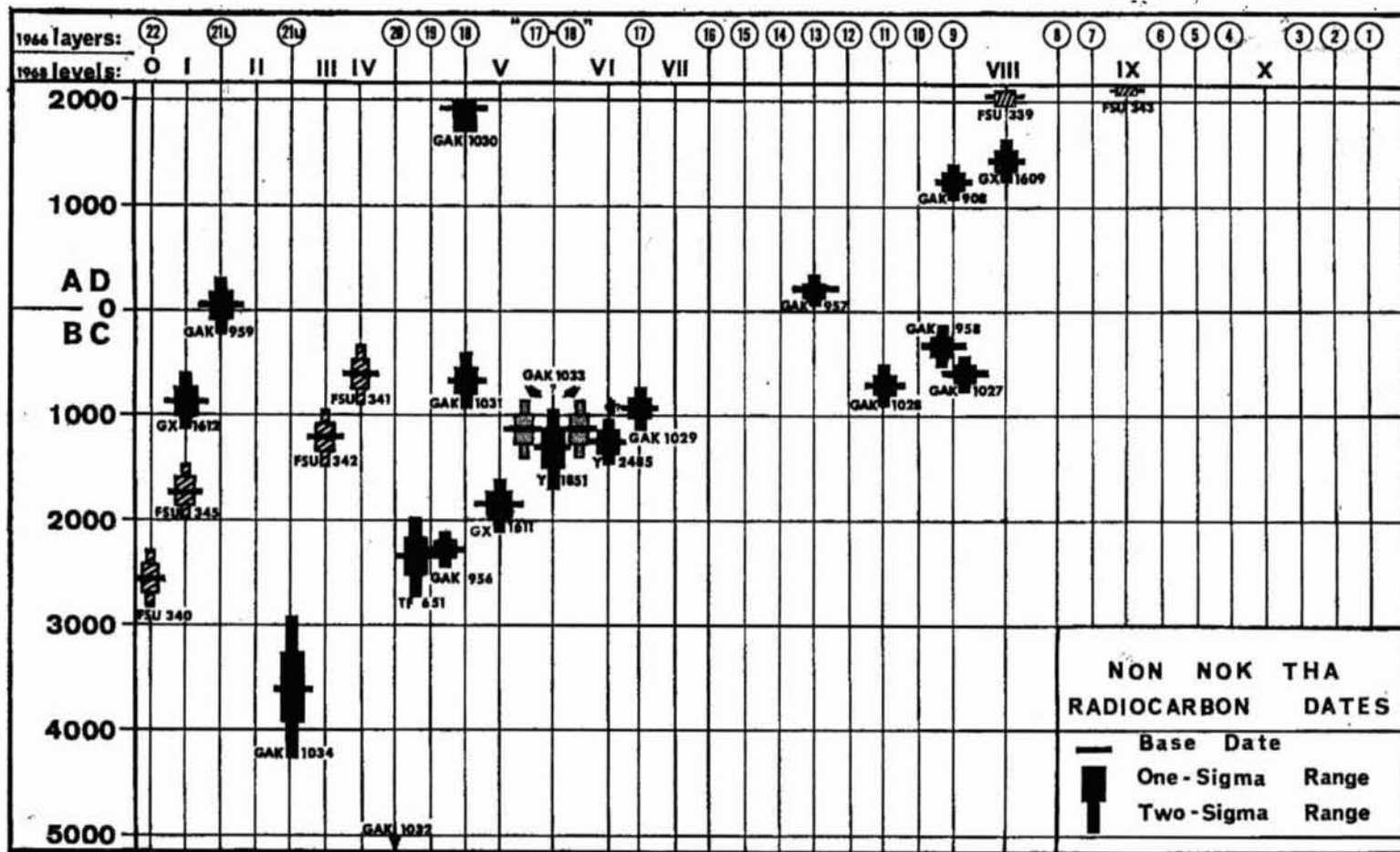


Fig. 5 Radiocarbon dates, 1966 and 1968 excavations. FSU dates suspected to have been contaminated are diagonally hatched.

well before 2300 B.C. Unfortunately, no final resolution can be offered at this time; however, some explanation of the individual dates may help support or negate the validity of the early bronze dates.

Ten of the dates from the 1966 excavation have already been presented and discussed by Solheim (1968*b*); however, some additional comments on two of these ten dates should be mentioned here. Although the sample that produced the Y 1851 date was originally ascribed to Layer 20, we later concluded that it was in fact derived from a second burial (No. 78) cut into Layer 20 Burial 62 (Solheim 1968*b*: 61). Examination of final section drawings and photographs of this burial indicate that both stratigraphically and typologically the burial belongs to the group of Layer 17-18 burials, which seem to be intermediate between the south-oriented burials of Layer 18 and the north-oriented burials of Layer 17 (although it was erroneously listed as Level III in the 1966 report). It should also be noted that Burial 48, which provided the sample for GaK 1029, may derive from a somewhat earlier point in the layer 18-"17-18"-17 continuum than the upper end of this series; typologically, the burial appears to be intermediate between 1968 Level V and Level VI. Hence its position (Fig. 4) should be regarded as tentative.

Since the publication of these dates, five additional samples from the 1966 excavation have been dated by Gakushuin University. One of these (GaK 1028) seems to have been affected by the same factors which distorted GaK 958 and 1027; a second also seems much too early in relation to the remaining dates (GaK 1032). Two of the remaining dates fit the published sequence quite well: GaK 1034 and GaK 1033. The later date almost certainly derives from one of two graves dug into the grave of Layer 21 Burial 6, and thus may serve to date either Layer 17 or Layer 17-18. The last date (GaK 1031) is considerably later than the published sequence would seem to imply.

A single sample from the 1968 excavation was dated by Yale; this date (Y 2485) was on a particularly secure, large charcoal sample from Level VI Burial 95 and fits the 1966 sequence quite well. However, in April of this year, six additional samples from the 1968 excavation were dated by Florida State University (diagonally hachured in Fig. 4); these dates form an internally consistent sequence considerably later than that formed by the 1966 dates. Indeed, the two upper samples (from Level VIII and Level IV) contained more Carbon-14 than contemporary organic material, which produced a "date" some years in the future. The crucial question is, of course, whether all six samples have been affected equally by some modern source of radioactivity, or whether only the two upper samples were so affected. If the latter is the case, then the four earlier samples, combined with GaK 1031 and less probably with GaK 959, would tend to support the more traditional dating of the first appearance of metallurgy in Southeast Asia at about 600 B.C. for double-mold casting, although the 1200 B.C. date for Level III and the first appearance of metal at the site is still surprisingly early.

In an attempt to resolve this question, we submitted three more samples to Geochron Laboratories. A sample from the same Level VIII fire pit dated by Florida State University as modern was dated by Geochron at  $500 \pm 85$  B.P. (GX 1609); a secure sample from a Level V burial pit (containing bronze bracelets) was dated at  $3685 \pm 100$  B.P. Both of these dates strongly support the early sequence and imply that the samples submitted to Florida State were somehow contaminated in shipment. However, a sample from what I feel is an equally secure Level I context was dated at  $880 \pm 130$  B.C., which of course tends to support the later sequence, although I believe it seems too late even for that.

Thus at present we have 11 dates forming a relatively straightforward sequence supporting a very early development of metallurgy in Southeast Asia, 5 or 6 dates supporting the more traditional later arrival of metal-working, and 8 dates that support neither sequence. Our difficulties in obtaining consistent dates seem to stem from two factors: the extensive disturbance present at the site during its long history as a cemetery, and later as a source of cinerary urns, compounded by the very difficult soil conditions; and contamination of the samples, either *in situ* (possibly from rootlet penetration sometime after deposition but long before excavation) or in transit to the laboratory, as I believe to have been the case with the six Florida State dates.

In conclusion, I believe at present that the early sequence is the correct one based on the internal evidence from the site that is available to date, although I am certain that many will arrive at alternative conclusions from the data presented. However, additional support for the early sequence is available in the form of two dates from other sites in mainland Southeast Asia. The Hàng Gòn 1 site some 60 km ENE of Saigon has produced bronze and double molds dated at  $3950 \pm 250$  B.C. or  $2120 \pm 250$  B.C. with corrected half-life (Saurin 1968: 3). Sherds from the site of Ban Chiang, Udorn Province, Thailand, have been dated by the University of Pennsylvania at  $4630 \pm 520$  B.C. (thermoluminescence date PT-104; Chin You-di, personal communication). The pottery dated is a very distinctive (and handsome) red-on-white ware similar to a vessel from 1966 Burial 26 (dated by GaK 1034 at  $3590 \pm 320$  B.C.) at Non Nok Tha; in addition to this vessel (illustrated in Solheim 1967b: 901), several other sherds of this type have been recovered from this site. While the association of the 4630 B.C. date with the bronze artifacts encountered in burials at Ban Chiang is uncertain in the opinion of the excavator (Vidya Intakosai, personal communication), Burial 26 in the 1966 excavation at Non Nok Tha is typologically almost identical with 1968 Burial 90—this burial contained the copper tool mentioned above that at present seems to be the earliest metal at the site. Thus, while the evidence for the presence of metallurgy in Southeast Asia at a date of 3000 B.C. or earlier is at present not conclusive, it seems quite probable. We hope that further dates from other bronze-period sites will settle the question conclusively in the near future.\*

#### NON NOK THA 1968: A PRELIMINARY INTERPRETATION

Although analysis of materials from both of the excavations at Non Nok Tha is still incomplete at this writing, it is possible to summarize and update the conclusions published elsewhere (Solheim, Parker, and Bayard 1966; Solheim 1968a). The evidence for the sequence of development at Non Nok Tha obtained during 1968 closely parallels that from the 1966 excavation and indicates that the history of the site may be divided into two distinct periods of occupation. These are: an early period characterized by stone and later copper and bronze tools, large quantities of sand-tempered, cord-marked earthenware apparently

\* [added in proof] Since August 1969 five additional dates have been received; four of these (kindly processed by the University of Pennsylvania) are thermoluminescence dates on pottery from Non Nok Tha burials, while the fifth is a collagen date on bone from 1968 Burial 90 (processed by Isotopes, Inc.). While the collagen date seems too late even for the late sequence, the four thermoluminescence dates lend unequivocal support to the early sequence, although implying a somewhat later date for Level I than estimated above. The dates and their implications are discussed in my revised and updated account of the 1968 excavation (*Non Nok Tha: The 1968 Excavation. Procedure, Stratigraphy, and A Summary of the Evidence*. University of Otago Studies in Prehistoric Anthropology, vol. 4. Dunedin, New Zealand).

intended primarily for funerary use, and inhumation burials featuring more or less elaborate offerings of large animal bones, stone, bone, and metal tools, and numerous pots; secondly, a period characterized by mainly occupational rather than cemetery use of the area, the replacement of inhumation burial with cremation and burial of the ashes in specialized vessels, and the introduction of iron tools. The first of these periods extends from 1966-1968 Level I through 1966 Level VII; the second begins after a hiatus of some 600 to 800 years with 1966 Level VIII and extends to the abandonment of the site some two to three hundred years ago.

One of the chief deficiencies in the chronology of the site is the lack of an accurate date for its earliest occupation; however, based on the amount of change in burial and pottery types between the lowest level of the site and that of 1968 levels III and IV, the first occupation may well date from the fifth millennium B.C. Levels I and II, extending up to an estimated 3500 B.C. date for Level III, show a close relationship with each other and with the following level; while levels IV-VII are quite clearly continuations of the same culture, the appearance of several new pottery types in Level IV tends to subdivide the early period into two units. During the first of these (equivalent to 1966 Level I) the evidence from both excavations suggests a culture relying on tools of stone (largely imported phyllite, diorite, and fine-grained quartzite), antler, and bone, with copper making a very limited appearance only toward the end of this period during the latter half of the fourth millennium B.C. Stone adzes in use during this period, like those used in levels IV-VII, are uniformly small (rarely over 5 cm in length) with a low rectangular cross section; shouldered adzes are lacking completely. Double-pointed narrow cylinders of bone ranging from 5 to 10 cm in length have been tentatively identified as fish gorges, an identification supported by occasional finds of jaw bones from moderately large fish, presumably from the nearby Nam Phong. However, cattle, pigs, and cervids seem to have been a more important protein source, judging by the frequency with which bones of these animals occur in the burials of levels I-III. At least some of the cattle bones examined thus far seem to be those of domesticated animals (C. F. W. Higham, personal communication).

As was the case in 1966, no direct evidence of agriculture was recovered from this portion of the early period at the site; but since the writing of the 1966 report we have discovered that the distinctive globular and goblet-shaped funeral vessels popular from Level IV through Level VII quite often contain tiny pieces of silicified vegetable remains, which in many cases are clearly identifiable as rice chaff. Moreover, a single pot was discovered in a Level I pit (absolute depth 215 cm) that contained a small amount of carbonized rice chaff temper (Pl. IVb), thus indicating the probable presence of rice agriculture in the area prior to 3500 B.C. and perhaps extending back as far as the beginning of the fifth millennium B.C. In any event this would seem to be the oldest dated (pre-3500 B.C.) remains of rice yet encountered. Chaff-tempered sherds also occur sporadically in Level III and are relatively common from Level IV (ca. 2600 B.C.) upwards. Whether the agricultural technique involved slash-and-burn or wet cultivation remains unknown at present; it is hoped that expert examination of the rice remains and palynological analysis of three series of soil samples collected at and near the site will settle the question. The discovery of a number of multiple postholes in levels III, IV, and VI and alignments that seem to suggest superimposed structures in these levels tends to imply a migratory cycle of settlement, abandonment, and re-settlement that may be connected with slash-and-burn agriculture, but this of course remains a highly speculative interpretation.

The latter part of the Level I-III period saw the first introduction of metal at the site, apparently in very small quantities. The copper tool found in Burial 90 and two additional tiny fragments represent the only traces of metal encountered in this level, as none was recovered from upper Layer 21 in the 1966 excavation. The nearest source for this copper and that used in bronze manufacture during Level IV and later would seem to be the deposits in the valley of the Lam Pa Sak some 130 km to the west of Non Nok Tha (see report of R. Pittioni in this volume). This general area may also be the source of some of the stone for adze manufacture, although any evidence of the actual presence of established trade routes will have to await investigation of the Pa Sak Valley in Phetchabun Province; at present the area is completely unknown archaeologically.

The beginning of the latter half of the early period at Non Nok Tha (1968 Level IV through 1966 Layer 13-Level VII) saw the introduction of several new pottery types to the funerary inventory. The footed globular and goblet pots appear for the first time, as do pedestaled shallow bowls generally resembling Chinese *tou*. The incised scroll-and-triangle and batwing designs found on some of the Level I vessels and the apparently later versions of these designs impressed or painted on the very rare Level II or Level III vessels are completely absent from Level IV upward. Even more significant is the evidence for fairly intensive casting of bronze rather than copper at the site. While we have found no evidence of ore smelting, which was presumably done at the mining site, all of the six pairs of double molds and additional mold fragments found to date are manufactured of local sandstone (Phra Wihan Formation in most cases, although a few pieces seem to be more representative of the Phu Kradung Formation; Haworth et al. 1964). Other evidence for casting includes the presence of several crucibles with bronze fragments adhering in Level IV and V graves and frequent finds of tiny round nodules of bronze that appear to be casting spillage.

From the increased concentration of the burials of these levels it might be assumed that the area was somewhat more densely populated than in the Level I-III period, but this condition may merely reflect a more concentrated use of a single portion of the mound. Similarly, the sharp decline in burials of infants and children may simply be a result of a separate burial area for them elsewhere on the mound, as was apparently the case with Level II. Another burial difference is the seeming decline of human sacrifices as accompaniment to burial, particularly after Level IV, although it should be noted that evidence from the 1968 excavation indicates that this practice was apparently less common than the evidence from the 1966 area alone would indicate. Grave offerings in general tended to become increasingly simplified during levels V through VII, culminating in the very simply furnished burials of 1966 levels VI and VII that were not encountered during the 1968 excavation. Animal remains are also quite rare during this latter period and are mainly limited to large clam shells placed near the head.

Level VI produced the only relatively intensive occupational evidence from the early period recovered to date from Non Nok Tha. In addition to the structural evidence of the three house alignments mentioned earlier, a large amount of sherds that seem to be domestic rather than funerary ware was found in this level. In contrast to the predominantly sand-tempered, almost always cord-marked funerary wares of the earlier levels, Level VI pottery on preliminary analysis seems to be nearly one-quarter fiber or fiber-and-sand tempered; a much larger proportion of the sherds are plain, although cord-marked sherds continue to predominate. Whether this distinction between domestic and funerary vessels is characteristic of the entire Level IV-VII subdivision or is limited to Level VI is at present not known.



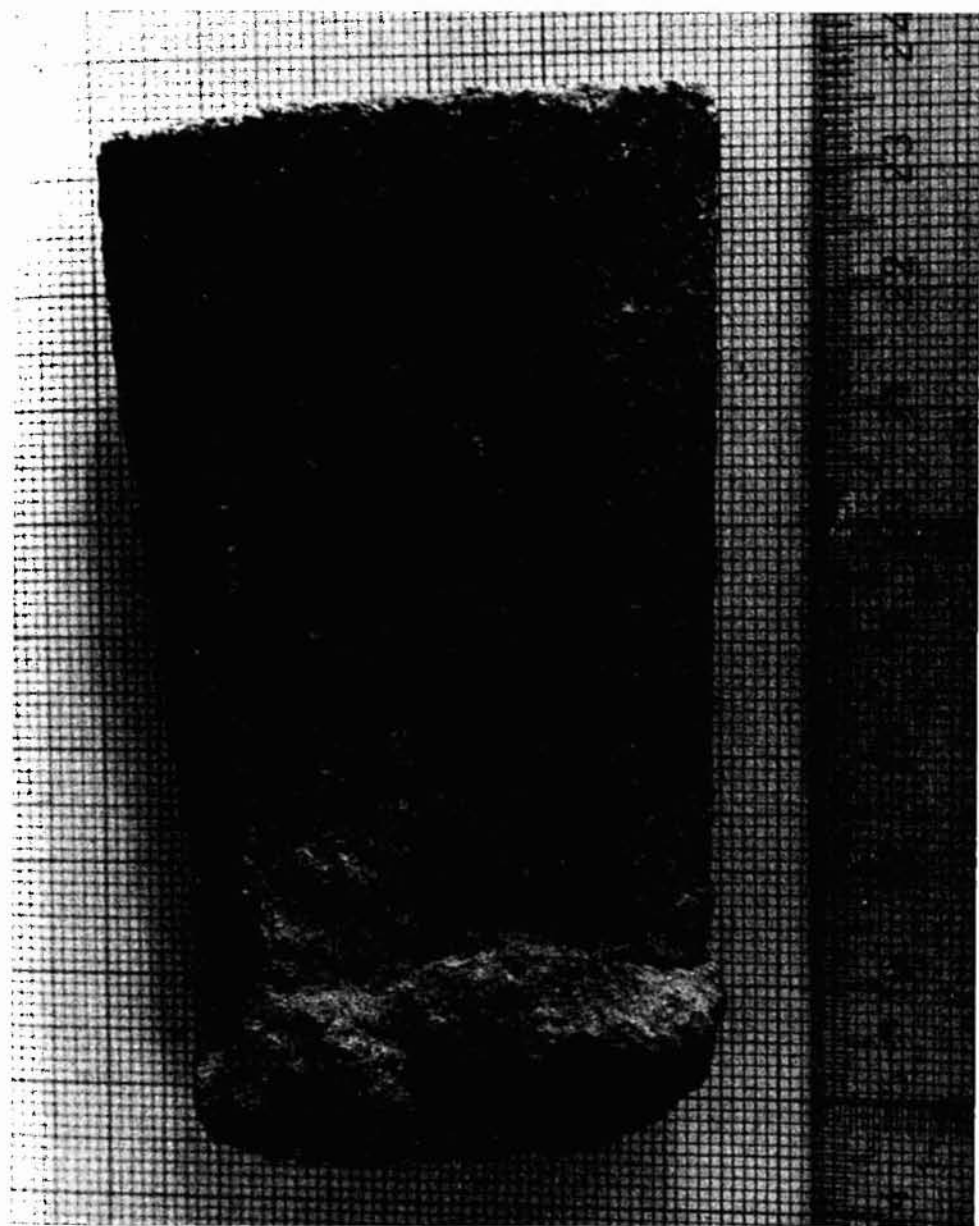


Plate IIIa Copper tool found in Burial 90, scale in cm.

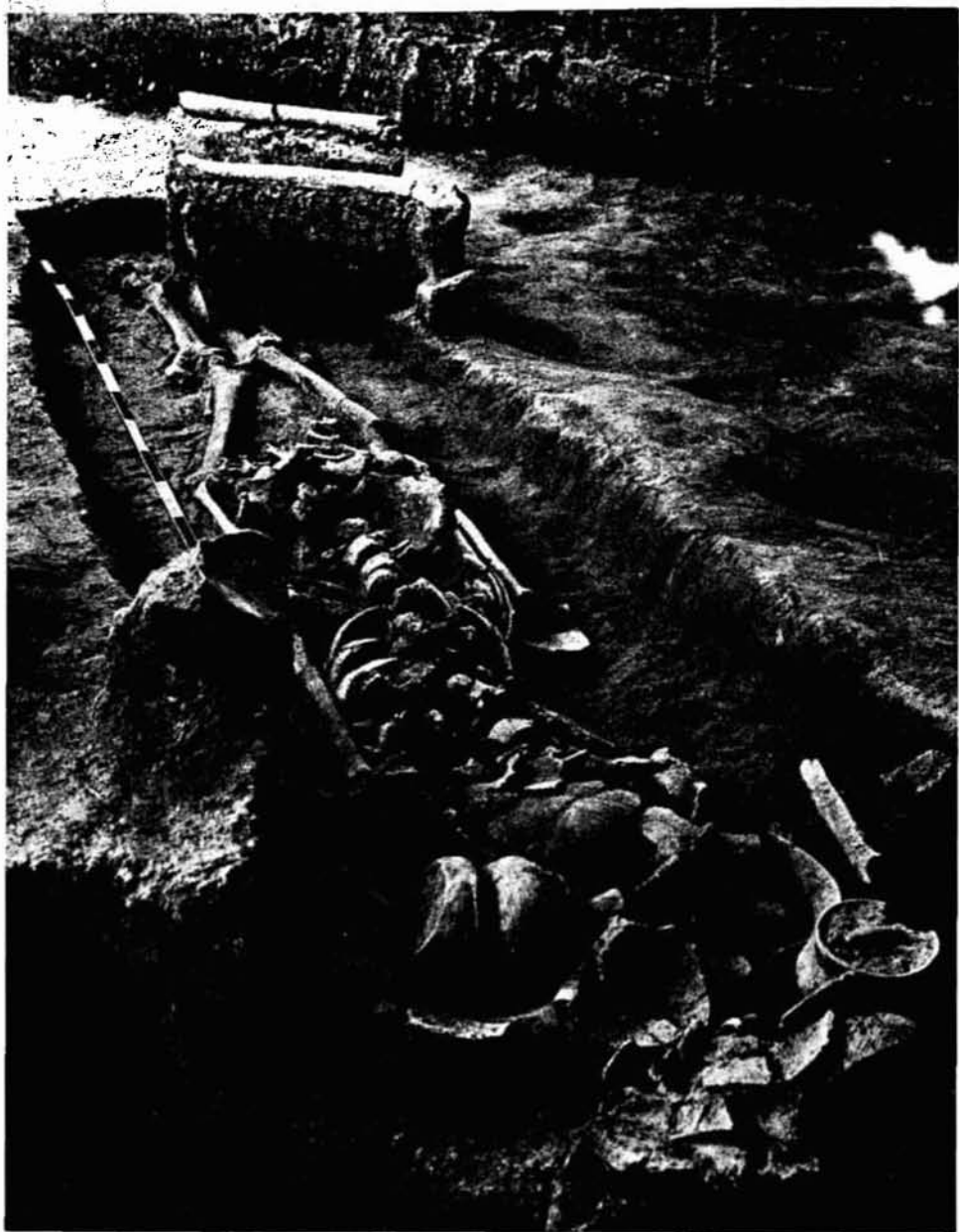


Plate III*b* Level V Burial 33, showing funerary vessels beyond head (from southwest).

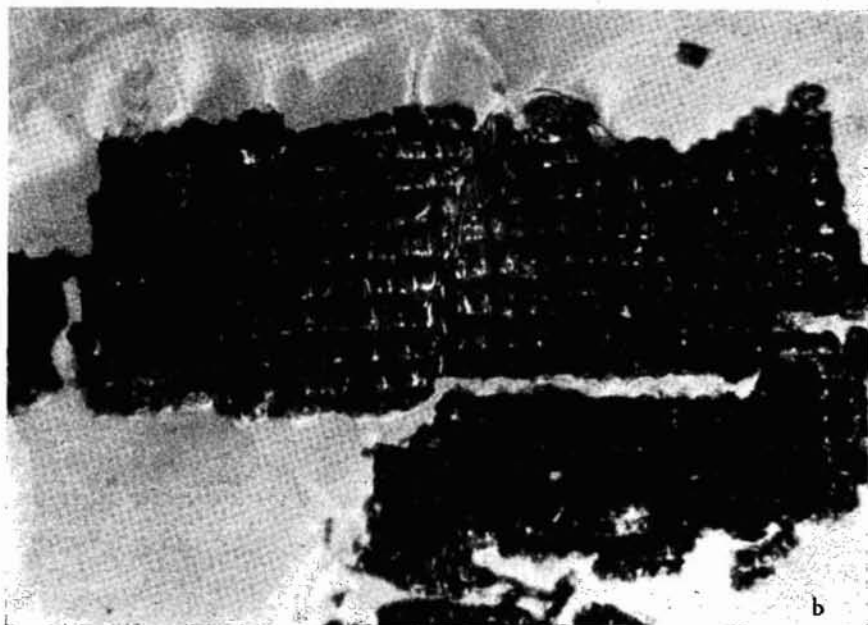


Plate IV *a* Elephant and frog (?) effigy vessels, probably from Level VII; *b*, top, potsherd with imprint of rice husk (NNT 629, Layer 7); bottom, enlargement of carbonized lemma of *Oryza* species removed from sherd (NNT 467, Layer 9 [1968], before 3600 B.C.; picture from Hitoshi Kihara, Kihara Institute for Biological Research, Yokohama, Japan).

A feature that does serve to distinguish the Level IV-VII period from the earlier three levels is the common presence of axially pierced biconical objects of fired clay thought to be either net weights or spindle whorls—more probably the latter. Their presence may indicate the introduction of cotton cultivation during Level IV times; however, this interpretation is naturally extremely speculative.

Given our hopes of uncovering the occupational and bronze-working areas that indications in 1966 led us to believe lay to the north of that excavation, it was disappointing to discover that these areas had been eroded in the 1968 portion of the mound. Thus the more recent excavation produced no additional information on the period represented by 1966 layers 12-16 (levels VI and VII). Moreover, any trace of the long gap between the bronze-period and iron-period occupations of the site represented by Layer 12 in the 1966 excavation was also either eroded as well or was not laid down. However, the evidence from the 1966 excavation indicates a long period of abandonment of the site, extending from perhaps 100 to 300 A.D. up to about 1000 A.D., although the possibility of utilization of other portions of the mound during this period cannot be ruled out.

In viewing the material from Level VIII, and from the whole of this latter division of the history of the site, it is obvious that, as was stated in the 1966 report, "... a profound and pervasive cultural change in its character has taken place" (Solheim, Parker, and Bayard 1966: 46). The chief examples of this change are: the abandonment of inhumation burials in favor of cremation mentioned previously, which quite likely reflects the introduction of brahmanistic concepts to the area; the common occurrence of iron tools, many of them tanged in contrast to the universally socketed tools of the earlier period; the rarity of remains of large meat animals and their apparent replacement by fowl and pig in the diet; and the reduction in size of the housepost alignments encountered in levels VIII and IX to dimensions closely approximating modern houses in the area. One interesting result of the 1968 excavation is the possibility that the domestic pottery of the two periods had more in common than the 1966 evidence indicated, as suggested by the Level VI pottery mentioned above. The pottery of the latter period also gives evidence of considerably more trade than was the case in the earlier period, based on the greater percentage of sherds present that seem to be non-local. The bulk of the pottery, however, continues in the same general tradition that prevails throughout the site: cord-marked, usually round-bottomed ware with sand and fiber-and-sand as the predominant temper. Indeed, the pottery of Level IX in many ways has more in common with that of Level VI or even Level I than with the contemporary pottery of the area. This may be due to the fact that pottery manufacture in the region today is confined to specialized villages, most of which seem to be Thai Khorat-speaking and composed of relatively recent migrants from the south.

In summary, the evidence from both excavations supports the presence at Non Nok Tha of a generally similar cultural tradition over a time span of as much as 7,000 years. The occupation was not a continuous one, however, and the tradition was far from static or unchanging. New elements appear frequently in the history of the site, and often one population seems to have been replaced by a related but distinct group showing marked differences from the earlier one. This seems to have been the case with Level III in the 1966 excavation (absent in the 1968 sequence), as well as with 1968 Level IV and the new features accompanying it. The replacement of stereotyped Level V burials by those of Level VI and the later return of the earlier form in Level VII is an even clearer example of this phenomenon. The gap between the earlier and later periods of occupation of the site obviously saw

important but undocumented changes taking place. These changes included the introduction of cremation, presumably as part of a complex of brahmanistic or Buddhist beliefs, and the introduction of iron tools and technology. The evidence afforded by the sharp drop in large animal remains, and their replacement by remains of those animals that currently form the second major source of protein after fermented fish, might also lead to the speculation that slash-and-burn cultivation of rice was replaced by the paddy system (or at least an economic system more closely approximating the present one) during this gap. However, we have no direct evidence for this interpretation at present.

#### EXTERNAL RELATIONSHIPS

Since the Thai-Danish Expedition of 1960-1962 initiated prehistoric archaeological excavation in Thailand, interest in the prehistory of the area has grown yearly, and the amount of available data is following suit, although it is still sparse. Excavation of Spirit Cave in extreme northwestern Thailand has provided details of the food-collecting to food-producing transition in Southeast Asia and has yielded the oldest possible plant domesticates yet discovered in the world (Gorman 1969, 1970). In addition to the Thai-Danish investigation of Hoabinhian and later neolithic sites at Sai Yok, Ban Kao and other sites in western Thailand (van Heekeren and Knuth 1967; Sørensen 1967*a*, 1967*b*), the Thai-British Expeditions of 1965-1969 have excavated a neolithic-early bronze-period site near Chai Badan at the northeastern edge of the central plain and a protohistoric (i.e., pre-Dvāravati) site at Tha Muang near U Thong (Watson and Loofs 1967, Watson 1968). The Thai Fine Arts Department has excavated an early iron period site at Lop Buri (Chin 1965), while the University of Pennsylvania has devoted two seasons of excavation to a protohistoric and Dvāravati site at Čhan Sen (Dales 1968; Siwali 1969; Bronson, in press).

In the more immediate area of Non Nok Tha, the Khorat Plateau, the Fine Arts Department has excavated at the site of Ban Chiang, eastern Udōn Province (Vidya Intakosai, personal communication); and at the iron-period site of Non Hang, Maha Sarakham Province (Viraj Khunnamas, personal communication). The Fine Arts Department-University of Hawaii Salvage Program conducted excavations at the protohistoric and historic sites of Phimai, Nakhon Ratchasima and Ban Sao Lao, Kalasin (also reported in Solheim, Parker, and Bayard 1966), as well as at Non Nok Tha; the University of Hawaii Thailand Archaeology Program currently has surveys underway in the Pha Mōng reservoir region in western Udōn Province (Marsh 1969). Although publication of data from these excavations is far from complete, enough has appeared to allow some comparison of the material from Non Nok Tha to that of other sites in Thailand, as well as to earlier excavations in neighboring areas.

The site which to date seems to offer the closest parallels to the lower levels of the Non Nok Tha early period is that of Khok Čharoen near Chai Badan, Lop Buri Province. As pointed out by Watson (1968: 304), the closest resemblances of the Khok Čharoen pottery seem to be with that of NNT (Non Nok Tha) 1966 layers 19 and 20 (1968 levels IV-V); particularly noteworthy are the slipped, pedestaled bowls very similar to those of NNT Level IV and the globular cord-marked vessels with smooth shoulders that are found throughout NNT levels I-V (Watson and Loofs 1967: 252-253). Other parallels between the two sites are evident in the small, low-profile rectangular adzes and shell beads en-

countered at Khok Charoen; one should note, however, that no bronze was found at this site (Watson 1968: 303-304).

Other more distant relationships with NNT levels I-IV may be present at the Ban Chiang site—which contained burials with bronze implements and a large quantity of red-on-white ware (not definitely associated with the burials) similar to rare sherds and a single pot excavated from NNT Level III—and at a recently discovered site near Ban Na Di, western Udorn Province, called Non Ban Kho or Na Klang 3 (Marsh 1969: 4). Here the lowest of three levels encountered in test excavations (60-150 cm) contains some amount of thin, red-slipped sherds similar to a relatively common type in NNT Level IV. However, the excavator would hesitate in drawing any conclusions from this general similarity.

By far the most interesting (and to date least successful) external relationship to be sought in these lower levels is in the area of metal technology. Even if the indirect date of 3500 B.C. on the copper tool recovered from Level III is not considered, the amount of cultural change taking place between Level III and Level IV, including the considerable development in metalworking, would seem to indicate a minimum age of about 2700 B.C. if our main dates are at all correct. This date is about 850 years earlier than the estimated beginnings of metallurgy in the Chinese Nuclear Area (Chang 1968: 231), and the technology involved in both the Level III tool and the more numerous tools, crucibles, and molds from levels V-VII seems to bear little or no resemblance to the Chinese material (Noel Barnard, personal communication). Moreover, the Non Nok Tha technology also seems completely unrelated to that of the Indus Valley civilizations in that it totally lacks flat-mold casting and any sign of tanged or shaft-hole hafting. Non Nok Tha casting metallurgy would also seem to have antedated that of the Indus region by 200 years at the very least (Solheim 1968*b*: 62).

At present the method of manufacture of the Level III tool is still uncertain, but the presence of traces of arsenic and phosphorus, as well as large amounts of copper oxide, would seem to rule out cold-working of native copper (Barnard, personal communication; Thompson 1958: 1). The presence of smelted or at least remelted copper at this early date is even more surprising. The relationship of the early tool to those of Level IV and later at Non Nok Tha seems quite clear, but obvious external relationships for both levels are completely lacking. The closest parallels seem to be the socketed celts of eastern Russia and Siberia at the end of the third millennium B.C. (Loehr 1956: 86-96), and hence later than those of Level IV. In short, at present it appears to be quite possible that a separate invention of metalworking based on a socketed hafting technology and the use of double molds may have developed in Southeast Asia independently of stimulus from either China or the Indus and earlier than both areas. This hypothesis can only be tested by further research in the area.

A search for close parallels in pottery and bronze technology with the latter portion of the early period at Non Nok Tha (1968 Level V through 1966 Level VII) is also difficult. The Non Ban Kho site mentioned earlier has produced sherds in the middle level of the site (20-50 cm) which bear similarities to those of NNT 1968 Layer 6 (levels V-VII), although they may be somewhat later in time; several bronze ornament fragments were also present (Marsh 1969: 5). General relationships seem to be present between the NNT material and some of the artifacts from the Mlu Prei sites in northern Cambodia; these include similar socketed bronze axes, sandstone double molds, and some general resemblances in pottery (cf. Lévy 1943: Pls. 22; 23; 37, no. 22; 32, nos. 1-4, 6, 7, and 10). However, considerable

differences are present in the pottery, as well as in the predominance of high-rectangular or trapezoidal-sectioned adzes over low-rectangular ones. Some parallels are also present at the bronze-period sites of Hàng Gòn 1, 2, and 3 near Saigon, including an axe mold fragment quite similar to those of NNT levels IV-VII and grooved pieces of green sandstone very similar to several recovered from NNT Levels III and IV (Saurin 1968: 2-6, Pl. 2, nos. 5a, 5b, and 7).

Relationships between the NNT material and that from the Bang Site at Ban Kao, the most extensive excavation to date in the general area, are rather more difficult to define. I would not agree with Sørensen's statement that "...the Ban Kao culture is an independent culture in Southeast Asia, i.e. without any significant relations to or connections with the Corded Ware culture" (Sørensen 1967b: 20), which would presumably include Non Nok Tha along with Mlu Prei and Samrong Sen. After examining burial pottery from the Bang site, from the early iron-period Artillery Site at Lop Buri, from Khok Charoen, and that from Non Nok Tha at the National Museum in Bangkok, I was left with the strong impression that considerably more relationship was evident between the Non Nok Tha, Khok Charoen, Lop Buri, and Ban Kao burial pottery than exists between the last and any material from north Chinese Lungshanoid sites. One of the problems in establishing closer relationships would seem to be temporal. I accept Parker's revision of the Ban Kao sequence (Parker 1968) which describes the site as an earlier occupation area (ca. 1800-1300 B.C.) later used as an iron-period cemetery from about 500 B.C. to 500 A.D. This latter estimate is substantiated by a thermoluminescence date on black pottery from these burials by the University of Pennsylvania of  $290 \pm 255$  B.C. (PT 102). Given this late date, one would expect greater resemblance of the Ban Kao pottery to the Artillery Site, thermoluminescence dated at  $700 \pm 166$  B.C. (PT 103), and to such protohistoric sites as Tha Muang (cf. pot shown in Watson 1968: 305) than to the earlier sites at Khok Charoen and NNT I-VII. With the publication of the occupational refuse from the Bang Site in the near future, parallels with the middle bronze period at Non Nok Tha (levels V-VII) should become more evident. Even at present, Sørensen's pottery types 2, 18, 20, and 22 (Sørensen 1967a: Pls. 90-91, 111, 112, 114-115) have reasonably close parallels with the middle bronze period at Non Nok Tha, although only type 2 is distinctive enough to be said to be diagnostic. In addition, the strings of shell disk beads and tubular stone beads (with beveled ends) found with Bang Site Burial 11 (Sørensen 1967a: Pl. 25) are identical with ones recovered from Levels I-IV at Non Nok Tha.

Relationships to the protohistoric central plains sites of Tha Muang and Chan Sen, the latter dated from about the first century A.D. (Siwali 1969: 76; Bronson, personal communication), are apparently absent at Non Nok Tha. This may reflect the beginning of the large gap in the occupation of the site mentioned above, but more probably the failure of influences from the central plains to reach the relatively isolated area at this early date. Evidence of contact, if any, would probably be found in the apparently later early iron-period sites of NP 6 and Døn Kha near Non Nok Tha. Any connections with the controversial site of Samrong Sen would also quite likely be found on these other sites, since in the light of the recent excavations in Thailand already discussed I have the impression, based largely on the pottery from the site (Mansuy 1902: Pls. 4-12), that the material is quite possibly late bronze period or early iron period in date, rather than Neolithic. While numerous stone adzes were recovered (as with the Bang Site burials), it should be remembered that at Non Nok Tha, stone adzes apparently continued to predominate over metal tools for a period of as long as

four thousand years (i.e., from 1968 Level III through 1966 Level VII, Layer 13). This also seems to have been the case at Tha Muang (Watson and Loofs 1967: 247).

With the reoccupation of Non Nok Tha during 1966 levels VIII and IX (layers 11 and 9) and particularly with 1968 Level VIII, connections immediately become apparent with other protohistoric sites in northeastern Thailand. While most of the pottery recovered from this upper period continues in the same general tradition as the earlier material, one particular type (thick, black, sand-and-fiber tempered ware with whitish or pinkish surface) is very close to the predominant ware of the middle levels of the Ban Sao Lao site (LP 3) in Kalasin Province (Solheim, Parker, and Bayard 1966: 87). In addition, the percentage of apparently imported sherds of earthenware, as well as occasional sherds of stoneware and porcelain, rises markedly in comparison with the early period, where imported earthenware was quite rare. Noteworthy here is a white-slipped ware with a distinctively bulbous, heavy rim, painted in red or dark brown, very similar in form and design if not in temper to much of the pottery I observed at the iron and bronze-working site of Non Hang in Maha Sarakham Province. Interestingly, there are few if any similarities with the protohistoric pottery excavated at Phimai (Solheim, Parker, and Bayard 1966: 89-98). I suspect this is because the protohistoric levels at Phimai were very probably earlier than all but the very beginning of the upper period of occupation at Non Nok Tha, which seems to have begun in the eleventh century at the earliest. Pottery similar to contemporary ware in the area occurs at Non Nok Tha only on the surface or slightly below it (probably owing to planting holes and plowing).

In summary, the picture that emerges at present for Non Nok Tha and central and northeastern Thailand as a whole is, in my opinion, one of semiisolated but generally related cultures possessing a hitherto unguessed sophistication of technology (Solheim 1967*b*: 902; Gorman 1969: 673) but an apparently low level of political organization. These cultures persisted from the Neolithic through the period of development of bronze technology and coalesced into larger entities only upon the introduction of Indian concepts, both religious and political, which helped to trigger the development of historic kingdoms in the area. No sharp cultural divisions appear to be present prior to this influx of concepts. On the contrary, the Neolithic and Bronze period cultures of the Khorat Plateau seem to form a continuum of relationship with their immediate neighbors to the west of the Khorat Range (Khok Charoen) and to the south of the Dang Raek Mountains (Mlu Prei). Relations are more distant but still apparent to the neolithic sites excavated by the Danish expeditions in western Thailand and with sites to the east and south, such as Hång Gòn 1, 2, and 3.

The more or less steady development of a culturally related series of populations at Non Nok Tha during the late Neolithic and Bronze periods does not seem to have been radically affected by the introduction of new items of technology (chief among them metallurgy). This specific area thus seems to have been a backwater of the formative or "crystallitic" period extending well into the era of general expansion or "extension" outward from Mainland Southeast Asia, to use terms recently proposed by Solheim (1969: 137). The area was and to some extent still is isolated, and it seems that not until considerably after the formation of the first Indianized kingdoms to the south (Fu Nan), southeast (Chenla), and southwest (Dvāravatī) did the influences of political and cultural centralization reach the area.\*

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