The Palaeodemography of a Prehistoric Thai Population: Non Nok Tha

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ABSTRACT

COMPOSITE life tables are constructed from mortality data recorded on 139 inhumation burials from a prehistoric archaeological site, Non Nok Tha (NNT), in northeastern Thailand. The representativeness of the site's vital statistics, the methods used to determine the age and sex from skeletal remains, the possible sources of sampling error, and the method of life table construction used are discussed. Combining mortality data from all levels of the site shows the mean age-at-death for the entire sample to be 24.7 years, with very few individuals surviving to old age. The greatest number of deaths occur in the young and middle-aged adult intervals. In the subadult component, mortality is highest in young children (2 to 6 years of age). Life tables constructed from burials which were divided into an earlier and later group reveal a lower mean age-at-death, higher infant and early child mortality, and overall shorter life expectancy for the earlier inhabitants of this site. This changing demographic pattern of reduced mortality and higher life expectancy for the more recent inhabitants of the site generally coincides with advances in cultural development experienced at the site as interpreted from the archaeological record. Some limited comparisons are made between the site's demographic trends and the general state of health of the site's inhabitants as determined from a previous study of diseased bones found among these remains. Comparisons of the NNT life table with similar data drawn from one other prehistoric Thai site, Ban Kao, the prehistoric Jomon population from Japan, and several prehistoric and historic European populations are also made.

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Introduction

The use of life tables in palaeodemographic research on human skeletal populations is becoming increasingly common in the literature (see, e.g., Acsádi and Nemeskéri 1970; Swedlund and Armelagos 1969; Kobayashi 1967; Weiss 1973). In these and other accounts the problems associated with the methods of age determination and the general provenience of archaeological skeletal samples upon which demographic statements are based have been discussed. Worth mentioning here are questions that concern the nature of the site itself, such as the selective or discriminatory use of burial grounds for certain age groups or social classes of the population; whether the site was primarily utilized as a cemetery as opposed to an occupation area; the temporal continuity of the site and the representativeness of the skeletal remains of the original population. Other considerations concern the nature of burials themselves, such as the possible causes of death (i.e., natural, epidemic, or warfare) and the possibility that there were intrusions of populations from elsewhere. Despite these explicit reservations, there exists a consensus among researchers that application of modern demographic techniques to data collected on deceased populations can now serve as a useful and conventional means of comparing and describing mortality and length of life in prehistoric times.

The primary aim of this paper is to apply the techniques of life-table construction to mortality data recorded for prehistoric skeletal remains excavated at the site of Non Nok Tha in northeastern Thailand. An attempt will be made to demonstrate the presence of any temporal changes in the palaeodemographic pattern of the site and to discuss these trends in relation to the site's cultural sequence. Finally, limited comparisons will be made with several other skeletal populations reported in the literature.

The Site

Two seasons of excavation (1965–66 and 1968) at Non Nok Tha (formerly called Nam Phọng 7), near the hamlet of Ban Na Di in Khọn Kaen province, northeastern Thailand, have yielded approximately 188 inhumation burials. These excavations, which represent one of the first intensive archaeological investigations of a site in northeastern Thailand, were part of the Thai Fine Arts Department-University of Hawaii Salvage Program under the general direction of Wilhelm G. Solheim II. A preliminary report of the 1965–66 archaeological investigations has been given by Solheim, Bayard, and Parker (1968). Bayard (n.d.) has provided a report of the 1968 excavations.

Comparable sequences of development were obtained from both excavations, indicating the presence of three cultural periods: Early, Middle, and Late. The first two are prehistoric and represent premetal (Early Period) and bronzeworking (Middle Period) periods respectively. A third period (Late Period), following a gap during which the use of iron and the practice of cremation burial became common, is also evidenced at the site. All the information used in this paper comes from the inhumation burials of the earlier two periods. According to Bayard (1972), twenty-four radiocarbon and four recent thermoluminescence dates now accurately date the first use of the site during the Early Period in the fourth millennium B.C., lasting until about 2700 B.C., an estimated C-14 date for Level III of the Early

Period. (Throughout this paper, level designations will follow those adopted in the 1968 excavation.) The Middle Period extends this earlier occupation of the site to approximately A.D. 200, including eight additional levels. The Late Period, characterized by cremation rather than inhumation burial, began after the gap in the sequence at approximately A.D. 1000 and proceeded up to about 200 or 300 years ago. The site was used primarily as a cemetery during the first two periods, while occupational use of the area predominates during later levels of the site.

MATERIAL AND METHODS

Non Nok Tha Burials

Material consists of 188 individual human skeletons: 81 burials from the 1965–66 excavations at Non Nok Tha described in Pietrusewsky (1974), and 107 burials from the 1968 season of excavations at this site currently being studied by Professor Sheilagh Brooks of the University of Nevada.

Table 1 shows a breakdown according to age and sex of the burials from both seasons' excavations. Forty-nine of the original 188 burials (all of which were adult) whose exact age could not be determined were dropped from further analysis. While it was unavoidable, one possible consequence this latter decision may have had on the results of these analyses is an underestimation of adult life expectancies. However, some compensation is provided by the fact that subadult (especially infant) burials are typically underestimated in archaeological samples due to the relatively poorer chances juvenile skeletons have for surviving long periods of interment. Combining burials from several stratigraphic levels of the site further helps to alleviate the effects of any disproportionate age-group representation in these remains which may have arisen from variations in burial practices at the site over time.

TABLE 1. AGE AND SEX DISTRIBUTION FOR 188 BURIALS FROM 1966 AND 1968 EXCAVATIONS AT NON NOK THA, NORTHEASTERN THAILAND

AGE GROUP	MALE			FEMALE			SEX?			TOTAL
	I*	II†	T	I	II	T	I	II	T	(SEXES COMBINED)
Infant (0–1)							4	—	4	4
Child Early (2–6)							20	9	29	29
Child Late (7–11)							1	5	6	6
Adolescent (12–16)	—	2	2	1	—	1	—	5	5	8
Young Adult (17–31)	12	5	17	6	9	15	—	1	1	33
Middle-Aged Adult (32–46)	16	15	31	6	16	22	1	1	2	55
Old Adult (47–56)	—	2	2	—	2	2	—	—	—	4
Subtotal	28	24	52	13	27	40	26	21	47	139
Adult (exact age unknown)	12	14	26	4	9	13	3	7	10	49
Total	40	38	78	17	36	53	29	28	57	188

* I = Burials from EP1-2 and MP1.
† II = Burials from MP2–MP8.

Despite the omission of a substantial number of adults from these analyses, there is an apparent underrepresentation of infants in the site's remains, one which might feasibly create an inaccurate picture of life expectancy for this age segment of the NNT population. Weiss (1973: 26) has recently criticized the adjustment of these values on the basis of model life tables for modern populations or adult mortality statistics. He cites the extensive variance usually associated with infant and subadult mortality in both modern and prehistoric populations as a negating factor. In advance, the NNT infant and juvenile mortality data fall well within the range representative of living primitive (anthropological) populations surveyed in Weiss (1973). Furthermore, the NNT sample is considerably removed from the period of post-contact with western civilizations, making models based on recent populations of little use in adjusting these values. For these reasons no corrections based on either model life tables of recent populations or adult mortality values were applied to the infant segment of this sample to compensate for these apparent discrepancies in subadult mortality.

Roughly three-quarters of the burials are adult. There are slightly more male than female (52: 40) individuals. Although this difference in sex is not statistically significant ($p < 0.01$) when tested by the chi-square statistic, one of the basic assumptions in palaeodemographic research and life-table construction from censused modern populations is that samples be representative of the populations under consideration (Cook 1972: 4; Weiss 1973: 14) and, if possible, any deviation from the expected 1:1 ratio between sexes be corrected. While the NNT sample contains more male than female individuals, no correction was applied simply because sex-specific demography was not attempted in these analyses.

Determination of Age and Sex

Employing various dental and skeletal criteria presented in Krogman (1963), Anderson (1969), and Brothwell (1963), I have made estimates of age and sex of the burials used in this paper from the 1965–1966 excavations at Non Nok Tha. Similar methods were used by Brooks for estimating the age and sex of the skeletal material from the 1968 season of excavations. While these criteria are based largely on modern American and Western European skeletal series, they are the only extensive standards available for estimating age and sex of prehistoric skeletal remains. The accuracy of such skeletal aging and sexing methods has been discussed recently by Acsádi and Nemeskéri (1970) and Weiss (1973), among others. Admittedly, multivariate procedures would have provided the most objective means available for estimating the age and sex of these skeletal remains. However, because of the extremely fragmentary nature of the Non Nok Tha remains and the total lack (at the time of this writing) of any metrical data for the 1968 burials, reliance on the more traditional methods of aging and sexing of skeletal remains, utilizing as many criteria as possible, was the only direct means available for obtaining these estimates necessary for life-table construction.

The criteria of tooth eruption, suture and fontanelle closure, and the appearance and fusion of epiphyseal centers were used to determine the ages of subadult burials. Relative states of dental attrition, obliteration of cranial sutures, and the appearance of the symphyseal surface of the pubis bone were used to estimate the

ages of adults. Because of the extremely fragmentary nature of these remains, especially the symphysis pubes, a general categorizing of the adult remains into young, middle-aged, and old-aged intervals was adopted.

I did not attempt to determine the sex of subadult remains. Diagnostic criteria of the skull, pelvis, and general size and robustness of long bones were used in determining the sex of the adult remains (Brothwell 1963: 51–57; Anderson 1969: 141–144; Krogman 1962: 112–152).

Life-Table Construction

For this paper, so-called composite-type life tables were constructed following procedures described in Swedlund and Armelagos (1969). Life tables of this sort utilize the age-at-death statistic of those individuals contained in a sample regardless of their exact year of birth or death. The appropriateness of this type of life-table construction for analysis of archaeological material, as opposed to those generally used in modern demographic analysis of living populations, has been discussed in considerable detail by various researchers (see, e.g., Swedlund and Armelagos 1969; Acsádi and Nemeskéri 1970; Weiss 1973).

The Key to Life Tables explains the kinds of information presented in the life tables constructed in this paper. While life-table construction traditionally requires large samples, these are rarely available in palaeodemographic research. Because some of the life tables—particularly Tables 3, 4, and 5—are based on an unusually small number of individuals, the results they show must be viewed with considerable caution. While the larger life table (Table 2) presented here may be regarded as a fairly accurate representation of the overall demographic pattern of NNT, those based on considerably fewer individuals may drastically misrepresent the populations from which they were sampled.

KEY TO LIFE TABLES

SYMBOL	EXPLANATION
x	age interval
n	width of age interval
$_nd'_x$	exact number of individuals dying at age x in completed years
$_nd_x$	number of individuals dying at age x expressed as a proportion of a cohort of 1000 individuals
1_x	number of individuals living at exact age x, obtained by subtracting the number of deaths from the number alive at the beginning of each age interval
$_nq_x$	mortality rate, or the number of those dying, expressed as a proportion of the living ($_nq_x = {}_nd_x / 1_x$)
$_nL_x$	number of individuals alive between x and $x + 1$ calculated as $_nL_x = (1_x + 1_{x+1}) / 2$ multiplied by the number of years in each age group
T_x	sum of $_nL_x$ values from the bottom of the column to the age interval being calculated
e^o_x	life expectancy or the mean life, expressed in years, remaining to those individuals attaining age x calculated by the method: $e^o_x = T_x / 1_x$

Results and Interpretations

Non Nok Tha Life Table

A life table (Table 2) was constructed using 139 individuals (sexes combined) positively assigned to one of the established age categories. These age categories, and the accompanying age intervals they express, were established partly because of the way in which the ages of individuals were initially recorded and partly because they allow comparison with similar data previously recorded by the author on other populations. Inspection of this table reveals that the highest mortality among the subadult population was experienced during early childhood (2 to 6 years). The highest percentage of deaths for the entire population occurred during young and middle-aged intervals. Very few individuals survived to old age. The mean age at death for the entire sample was 24.7 years. Life expectancy (e^o_x) sharply diminishes after young adulthood. Though not shown here, very similar trends were found when male and female segments of the adult population were compared separately. This latter finding stands as an exception to Acsádi and Nemeskéri's (1970: 184) observation that in prehistoric times life expectancy among males was longer than that for females.

TABLE 2. Life Table for Non Nok Tha, Northeastern Thailand (1966 and 1968 Excavations; Mean Age at Death = 24.7 Years)

x*	n	nd'x	ndx	lx	nqx	nLx	Tx	e^o_x
0	2	4	29	1000	29	1971	25242	25.2
2	5	29	208	971	214	4335	23247	23.9
7	5	6	43	763	56	3708	18887	24.8
12	5	8	58	720	81	3455	15158	21.1
17	15	33	237	662	358	8153	11703	17.7
32	15	55	396	425	932	3405	3550	8.4
47	10	4	29	29	1000	145	145	5.0
		139	1000					

* See Key to Life Tables for explanation of symbols.

Intrapopulation Comparisons

As a means of establishing the possible existence of any significant demographic trends at the site, two subpopulations were formed, consisting of (1) burials from the earliest levels of the site: Early Periods 1–3 and Middle Period 1, and (2) burials from the later levels: Middle Periods 2–8. While the major break in the pre-iron sequence is clearly between Early Period 3 and Middle Period 1, division of the skeletal sample at this point, although preferable, would have yielded highly uneven subpopulations and no representation of Early Period burials in some of the age categories of the life table. The proposed division made here gave samples of roughly equivalent size which could then be analyzed separately (Table 1). The chi-square statistic was used to test for possible sex and age-group differences between the two groups of burials. Although not significant at the 0.05 level, a more

disparate sex ratio is observed among the earlier burials: 28 males to 13 females in contrast to the nearly equal representation of sexes (24 males to 27 females) in the later group of burials. Again, although the chi-square results were not significant ($p < 0.05$), there is a slightly higher percentage of subadults in the earlier burials (38.8%) than in the later group (29.2%), utilizing only those burials for which an exact age estimate had been assigned.

Life tables were constructed for both subpopulations (Tables 3 and 4). The mean age at death for the earlier group of burials was somewhat lower (21 years) than that obtained for the later burials (approximately 28 years). A comparison of mortality curves (Fig. 1), or the percentage of individuals dying at each age interval, as derived from both life tables, reveals a conspicuously higher infant and early childhood mortality among the earlier interred burials. Mortality is highest in the middle-aged segments of both populations. The earlier group of burials contained no old-aged individuals while only four of the seventy-two later burials were determined to be old-aged. A comparison of survivorship curves (Fig. 2) reveals the percentage of individuals alive at each age interval of the earlier segment of population to be consistently below the level traced by the later burials. The slope of the latter is also more uniform than the one representing the earlier burials.

TABLE 3. LIFE TABLE FOR BURIALS FROM EP1-3 AND MP-1, NON NOK THA, NORTHEASTERN THAILAND (1966 AND 1968 EXCAVATIONS COMBINED; MEAN AGE AT DEATH = 21.4 YEARS)

x	n	$_nd'_x$	$_nd_x$	l_x	$_nq_x$	$_nL_x$	T_x	e^o_x
0	2	4	60	1000	60	1940	21984	22.0
2	5	20	298	940	317	3955	20022	21.3
7	5	1	15	642	23	3173	16042	25.0
12	5	1	15	627	24	3097	12849	20.5
17	15	18	269	612	440	7163	9736	15.9
32	15	23	343	343	1000	2573	2573	7.5
47	10	0	0	0	0	0	0	0
		67	1000					

TABLE 4. LIFE TABLE FOR BURIALS FROM MP-2 TO MP-8, NON NOK THA, NORTHEASTERN THAILAND (1966 AND 1968 EXCAVATIONS COMBINED; MEAN AGE AT DEATH = 27.7 YEARS)

x	n	$_nd'_x$	$_nd_x$	l_x	$_nq_x$	$_nL_x$	T_x	e^o_x
0	2	0	0	1000	0	2000	28317	28.3
2	5	9	125	1000	125	4688	26291	26.2
7	5	5	69	875	79	4203	21579	24.7
12	5	7	97	806	120	3788	17354	21.5
17	15	15	208	709	293	9075	13547	19.1
32	15	32	445	501	888	4178	4463	8.9
47	10	4	56	56	1000	280	280	5.0
		72	1000					

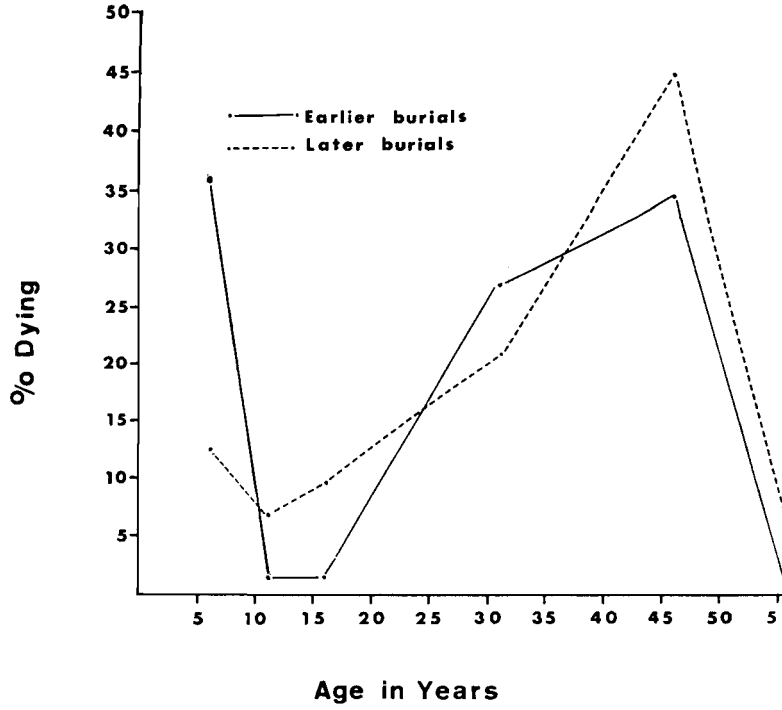

Fig. 1 Mortality curves.

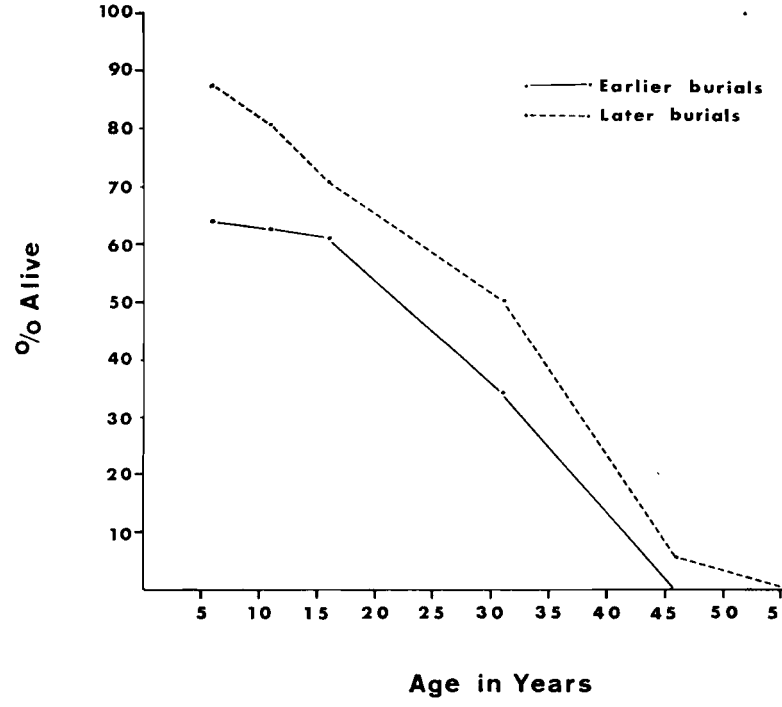

Fig. 2 Survivorship curves.

Finally, a comparison of life expectancy (Fig. 3) for both segments reveals, with the exception of late childhood, a consistently higher average number of years remaining for the site's more recent burials.

In summary, the demographic pattern of the earlier burials of the site when compared with the later burials is one which includes a lower mean age-at-death, higher infant and early child mortality, lower survivorship rates, shorter life expectancy, and the complete absence of old-aged individuals.

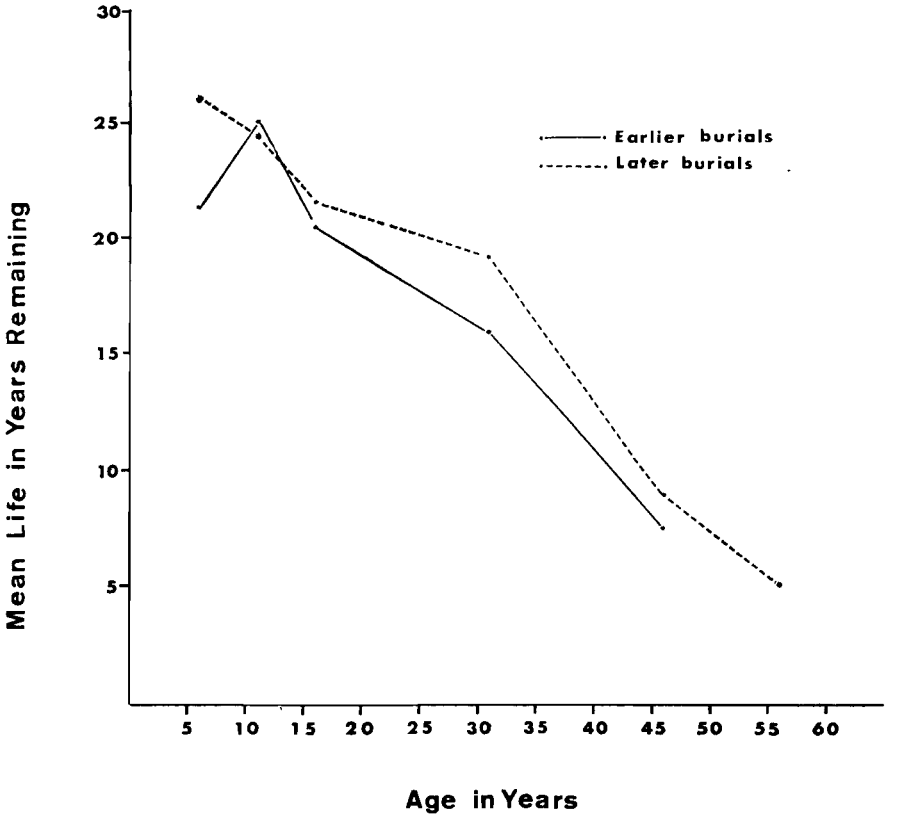

Fig. 3 Life expectancy curves.

DISCUSSION

A comparison of the mortality statistics of the two stratigraphic groups of burials from Non Nok Tha reveals a relatively clear demographic pattern emerging from earlier to later levels; one which includes a higher average age-at-death, lower mortality, longer life expectancy, and more individuals surviving to advanced age.

These general improvements in life expectancy and longevity as interpreted from skeletal remains can be discussed in relation to the cultural sequence of the site. The earlier group of burials corresponds to the earliest levels of the site, which include all the premetal levels (Early Period 1 to 3) and the earliest level of the Middle Period. Bronze first appears at the site during the latter period, and there

is some limited evidence of copper* just prior to this level. Characteristic of most of this time period were the extensive use of stone tools, distinctive pottery types, evidence of domesticated animals and rice cultivation, with the suggestion of slash-and-burn agriculture (Bayard n.d.). The later group of burials representing Middle Period 2 through 8 corresponds with the presence of more intensive bronze casting, different pottery types, distinct changes in burial offerings, a decline in human sacrifice—or headhunting, as suggested by Bayard (personal communication)—accompanying burials, fewer animal remains, and some evidence suggesting that these inhabitants were producing fabrics. Burials of Middle Period 2 through 8 predate the use of iron, which prevails during the Later Period of the site. No inhumation burials exist for the Later Period (Bayard n.d.).

Some reservations should be stated as to the representativeness of the burials from each time-level period. The possibility cannot be ruled out that various portions of the site may have been used for burial of different age segments of the population, and seemingly more populous levels may reflect archaeological sampling or differential use of the cemetery rather than periods of increasing population density. The less frequent practice of sacrificial burial in the later levels may similarly misrepresent the demographic trends of the site. Although the site was primarily used as a cemetery throughout most of its history, evidence indicates the existence of an occasional structure in some levels and more extensive use as both an occupational and a burial ground during Middle Period 5, which may have likewise affected the demographic profile of these two subpopulations. Finally, the fragmentary nature of the remains and the generally small sample size, although not uncommon for prehistoric remains, should not be overlooked in interpreting the results given in these life tables. Aside from these reservations, the present series does provide the largest and most representative sample of a prehistoric population from this region of the world and as such does yield useful palaeodemographic information. A clear pattern emerges when the sequence of cultural changes is compared with demographic trends at the site. In this instance, general advancements in culture and technology run parallel to reduced mortality and higher life expectancy.

A preliminary summary of skeletal and dental pathology of the burials from the 1965–66 season of excavations at Non Nok Tha is given elsewhere (Pietrusewsky 1974). These observations and etiological interpretations were limited to macroscopic inspection of substantially incomplete and poorly preserved material and therefore may, at best, only partially represent the total skeletal pathology of the remains. Nevertheless, these preliminary findings, which include examples of degenerative changes at articular surfaces of the skeleton, evidence for infectious diseases, and conditions which may be attributable to anemias and other deficiency diseases, do provide a general indication of the range of pathology representative of this site's inhabitants. Only those categories of pathology which more directly reflect the general state of health of the site's inhabitants will be discussed here.

Over half of the adult crania (14/23) were found to show porotic hyperostosis or unusually thickened vault bones. This condition is common today among individuals who suffer from various hemoglobinopathies such as thalassemia and sicklemia. In addition to these causes, iron deficiency anemia, G-6PD deficiency, and various

* This has turned out to be bronze. Ed.

nutritional deficiencies have been found to produce similar lesions in bone. Hemoglobinopathies and relatively rare hemoglobin types may be largely responsible for the pathological conditions observed in these remains, considering the relatively high incidence of Hb E and thalassemia found in present-day inhabitants of Thailand (Chernoff 1959; Supa Na-Nakorn 1956; Wasi et al. 1967). This latter observation, in turn, may provide indirect evidence for the presence of falciparium malaria, which apparently acts to maintain these pathological conditions as balanced polymorphisms. Angel (1966, 1967) has suggested that the occurrence of such abnormal hemoglobins, being dependent upon the mosquito as their vector, is coincidental with agricultural practices which provide suitable habitats for their successful breeding (i.e., stagnant waters). The condition was found in burials of both the early and middle periods but was more prevalent in the latter, although this requires substantiation through studies of the pathology of the 1968 burials.

Another example of pathology took the form of a fused portion of the thoracic vertebral column in one individual from the latest level of the Middle Period (Level 8). This finding has been interpreted as possible evidence for tuberculosis of the spine, which would imply an antiquity of at least A.D. 200 for this disease in this area of the world. No similar cases were found among the earlier burials from the 1965–66 season of excavations. Again, supportive evidence from other sources (Morse et al. 1964; Morse 1967) indicates that the evolution and presence of a bacillus such as the one responsible for tuberculosis was dependent upon population densities large enough to provide the necessary medium to maintain such highly communicable diseases.

These examples of the possible evidence of diseases from Non Nok Tha may further indirectly verify a general shift in subsistence patterns, moving toward an increased emphasis on agriculture and the ability to support heavier concentrations of people. Wet rice cultivation like that practiced in the surrounding area today may well have been introduced—perhaps on a small scale—at the beginning of the Middle Period, continuing and perhaps intensifying through this period and the succeeding Late Period at the site. Although such an introduction and intensification of the sort seemingly necessary for the spread of thalassemia to occur could well have taken place at Non Nok Tha, archaeological evidence for it is completely lacking (Bayard, personal communication).

External Relationships

Palaeodemographic information on populations contemporaneous with the Non Nok Tha (NNT) sample is virtually nonexistent. Of the numerous reports in the literature which include vital statistics of their samples, few are from Southeast Asia and none can be regarded as exact time or cultural equivalents to the Non Nok Tha burials (4000 B.C. to A.D. 200). One which approaches contemporaneity with NNT is a small series of skeletons recovered by the Thai-Danish Archaeological Expedition 1960–62 at the Bang site, Ban Kao, in western Thailand (Sørensen and Hatting 1967). An osteological-odontological study of these remains appears in Sood Sangvichien et al. (1969), from which the age estimates for 23 of the original 38 individuals were selected for comparison with the NNT sample. The remaining 15 skeletons were too fragmentary and incomplete (many being represented by a

few fragments of bone), hence were not assigned an age and sex by these authors in their original study. The cultural sequence of the site, which was originally described by Sørensen (op. cit.) to represent a neolithic settlement, has been revised by Parker (1968) to include an earlier occupation extending roughly from 1800 to 1300 B.C. and a later iron age period (500 B.C.–A.D. 500). Parker considers the Ban Kao burials to derive from the later period, during which time the site was used as a cemetery, placing them in a sequence overlapping and directly following the latter portion of the Non Nok Tha burials.

For comparison with the NNT table (Table 2), a life table (Table 5) was constructed using twenty-three Ban Kao burials which had been assigned a definite age by Sood Sangvichien et al. (1969). Inspection of the number of deaths which occur at each age interval in these two tables reveals fewer infant or child deaths among the Ban Kao burials. Non Nok Tha is particularly noteworthy for its high percentage of early childhood (2–6 years) deaths, and hence high child mortality, when compared with the Ban Kao sample, which completely lacks children of this age interval. Further comparison of the mortality statistics for these two groups implies a higher percentage of adolescent and young adult deaths among the Ban Kao sample. Non Nok Tha maintains only a slightly higher percentage of middle-aged deaths over Ban Kao. While the maximum number of deaths among the NNT sample occurred among middle-aged adults, the highest frequency of deaths occurred among the young adult segment of the Ban Kao population. Finally, a higher percentage of individuals who were of advanced age was found among the Ban Kao remains. In spite of a higher average age-at-death, due primarily to the relatively few child deaths among the Ban Kao sample, life expectancy values (e^{o}_{x}) were higher for all NNT age intervals except one. A slightly higher life expectancy was calculated for Ban Kao individuals reaching middle age. If survivorship curves were drawn (not shown) for the two samples, they would show a higher percentage of Ban Kao survivors during approximately the first two and one-half decades of life followed by similar curves during the remaining years of life.

Because of the extremely small samples, especially that from Ban Kao, and the many other reservations already mentioned which must be considered when dealing with archaeological skeletal samples, these observations are tentative. Disregarding differences in the size of the two samples, however, two general findings emerge

TABLE 5. LIFE TABLE FOR BAN KAO, WESTERN THAILAND
(MEAN AGE AT DEATH = 27.8 YEARS)

x	n	nd'x	ndx	lx	nqx	nLx	Tx	e^{o}_{x}
0	2	1	43	1000	43	1957	28146	28.1
2	5	0	0	957	0	4785	26189	27.4
7	5	1	43	957	45	4678	21381	22.3
12	5	4	174	914	190	4135	16685	18.3
17	15	8	348	740	470	8490	12533	16.9
32	15	7	305	392	778	3593	4033	10.3
47	10	2	87	87	1000	435	435	5.1
		23						

SOURCE: Data from Sood Sangvichien et al. (1969)

from a comparison of these two life tables. One is the total lack of early child burials and the relative scarcity of subadults in the Ban Kao sample. Another is the similar life expectancy values calculated for each age interval of the two sites. The first of these observations may be explained by the discriminatory use of the site by the earlier inhabitants, poor preservation, and inadequate sampling of the site. The latter finding suggests that the two sites were experiencing similar levels of life expectancy and in this respect were roughly contemporaneous or at least show a close antecedent-descendant relationship. Comparing the life tables of the earlier and later burials of the Non Nok Tha separately with the Ban Kao sample does not alter either of these two observations.

Additional provenienced skeletal samples from this immediate region are unavailable. One of the most comprehensive documentations of the sequence of palaeodemographic trends among prehistoric Asian populations, that by Kobayashi (1967) for Japanese populations, includes skeletal remains of the Jomon period. These remains are generally regarded as representing the Neolithic period of Japan and approach most nearly the temporal association of the NNT and Ban Kao burials. Unfortunately, only life tables for the adult segments of these populations are reported. Life expectancy for skeletal remains representative of early to latest Jomon period of Japan (6000–300 B.C.), sexes combined, is compared with the Thai material in Table 6. While the selected age-intervals are not identical, the average number of years remaining for each of the post-adolescent age intervals is relatively higher for the Thai samples.

Perhaps the best documented palaeodemographic data on skeletal remains is that compiled by Acsádi and Nemeskéri (1970) for Paleolithic to more modern historical times, which the authors illustrate primarily by material from European sites. Life expectancy data were selected from this larger compilation to represent populations extending from late Paleolithic to early Roman times. In Table 6 these data are added to those of the populations previously discussed.

Interestingly, life expectancy figures for NNT fall somewhere between those given for Volni, a European Neolithic site which spans a period of approximately

TABLE 6. COMPARISON OF LIFE EXPECTANCY

SITE	N	AGE INTERVAL 0–1	2–6	7–11	12–16	17–31	32–46	47–56
Non Nok Tha (Pre-metal-bronze)	139	25.2	23.9	24.7	21.1	17.7	8.4	5.2
Ban Kao (Iron)	23	28.1	27.3	22.3	18.2	16.9	10.3	5.1
Jomon (Neolithic 6000–300 B.C.)	235	—	—	—	16.8*	10.1†	6.3‡	5.5§
Maghreb-type (Late Palaeolithic)		26.3	32.7	30.6	27.1	19.4	13.8	9.7
Vassilievka III (Mesolithic)	31	—	—	—	22.8‖	19.9	13.3	12.1
Volni (European Neolithic)	45	24.1	22.5	22.0	18.8	10.5	7.1	7.8
Alsonemedi (European Copper)	42	32.1	35.1	31.9	28.5	18.1	10.7	7.8
Mezöcscát (European Bronze)	37	29.4	27.8	26.1	23.8	19.2†	12.9‡	8.5§
Mezöcscát (Early Iron)	45	43.0	38.9	37.0	33.9	24.9	15.8	12.2
Intercisa and Brigetic (Early Roman)	233	34.0	31.8	29.6	26.0	22.0	16.6	15.3

* Age 19 † Age 34 ‡ Age 49 § Age 59 ‖ Age 20

3500–2500 B.C., and Mezöscát, a European Bronze Age site. While the life expectancies for the subadult ages of the intervening copper age site of Alsonemedi are all too high, the calculated values for the adult intervals more nearly approach the Non Nok Tha expectancies. Life expectancies of an early European Iron Age site, also from Mezöscát, are all much higher than those of the prehistoric Thai samples. Acsádi and Nemeskéri refer to a changing demographic pattern which presumably corresponds to the economic revolution of the European Neolithic; one which was characterized by a higher fertility and generally more favorable conditions which ultimately led to reduced mortality and population expansion. (Although Boserup's interesting thesis [1965] maintains that, in general, population expansion precedes agricultural intensification and development.) These trends are evident in the Neolithic through more advanced stages which are correlated with metal technology and agricultural subsistence. Accompanying these more dense and permanent settlements was the increasing susceptibility of the populations to communicable diseases and large-scale homicides. According to the authors, these factors account for the regional and temporal differences observed in later stages of the European Neolithic. While the examples provided by the two prehistoric Thai samples do not deviate appreciably from this European model, parallel archaeological evidence which would account for these demographic trends is lacking in the two Thai sites. The explanations postulated here for the demographic changes evidenced by the material from Non Nok Tha and Ban Kao must remain speculative until additional archaeological evidence becomes available. One hopes that further work and cooperation between prehistorians and physical anthropologists in investigating other sites will soon produce an explanatory demographic model for Southeast Asia similar to the one that has been developed for Europe.

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