MORTIMER WHEELER ARCHAEOLOGICAL LECTURE

THE BAN CHIANG CULTURE IN WIDER PERSPECTIVE[1]

By C. F. W. HIGHAM

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I

THERE are in South-East Asia two lowland areas with a recent history of archaeological research. One is the Khorat Plateau of north-east Thailand and the other, the alluvial plain of the lower Red River in Vietnam (Fig. 1). During the past fifteen years, excavations at Non Nok Tha and Ban Chiang in the former area have led to claims of an indigenous and extremely early development of first bronze, and then iron metallurgy. These claims were made before the publication of evidence necessary for a judicious, independent appraisal. Given the portentous nature of metallurgy, it is not surprising that doubt and controversy prevail (Solheim, 1968; Gorman and Charoenwongsa, 1976).

Without an agreed chronological framework, more interesting matters cannot be considered. This is regrettable, because compared with the virtual *tabula rasa* which was prehistoric South-East Asia two decades ago, there is now some information of considerable interest. It discloses prehistoric metalworking as well as rice cultivation, exchange of exotic substances, and exposure to expansive state societies.

[1] This lecture could not have been prepared without support over the years from numerous friends and institutions. Foremost I must acknowledge the comradeship of the late Chester Gorman, who introduced me to South-East Asian prehistory. He and Pisit Charoenwongsa invited me to participate in their research programme at Ban Chiang in 1974–5. I have always received the utmost courtesy and co-operation from the Royal Thai Fine Arts Department through its successive Directors General, Dejo Savanananda and Khunying Aree Kultan. Amphan Kijngam, my co-director at Ban Nadi, deserves more than half the credit for his careful planning and flair for excavation. Financial support in the field and laboratory has been generously provided by the Ford Foundation, the British Academy through its Institute in South-East Asia, and the New Zealand government. I am most grateful to Professor P. J. Wilson and Dr D. T. Bayard for their comments on a draft of this paper.

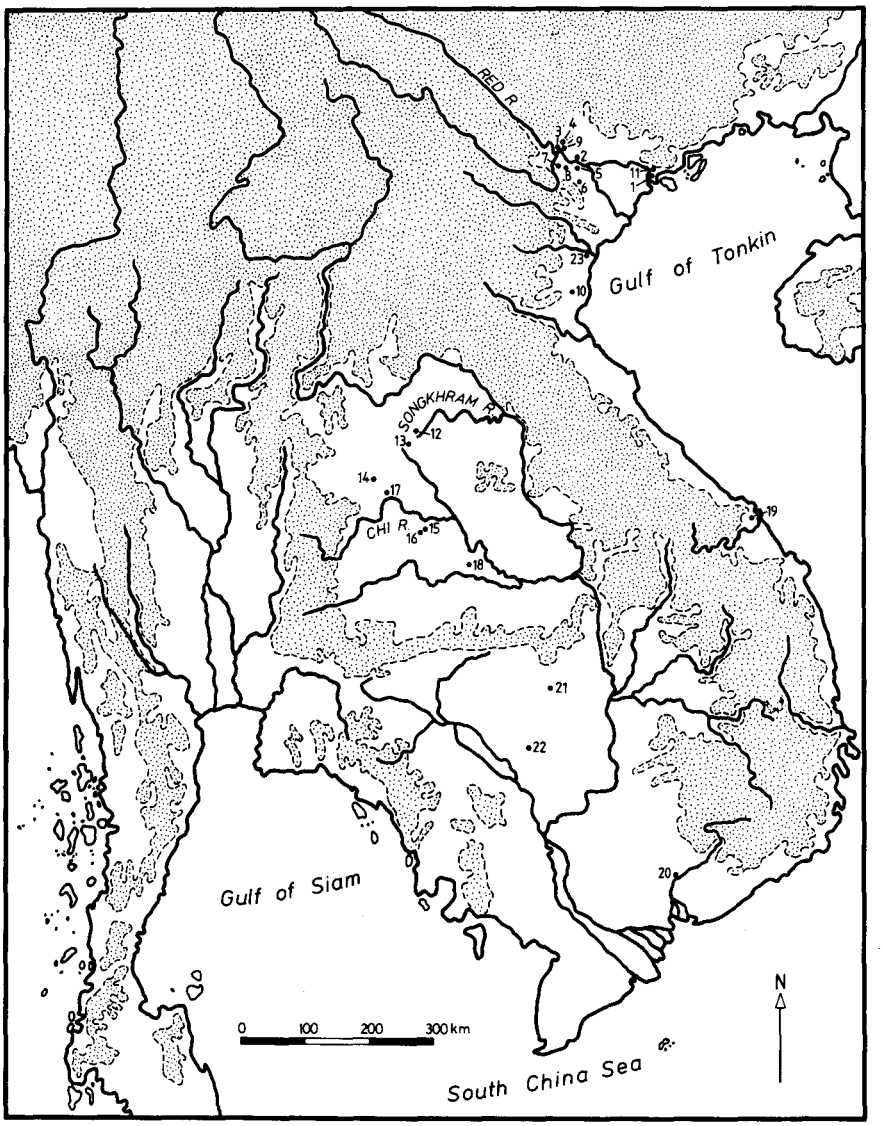


FIG. 1. Map of South-East Asia, showing sites mentioned in the text, as follows: 1. Trang Kenh, 2. Dong Dau, 3. Go Mun, 4. Doi Giam, 5. Go Vuon Chuoi, 6. Vinh Quang, 7. Chau Can, 8. Go Chien Vay, 9. Lang Ca, 10. Lang Vac, 11. Viet Khe, 12. Ban Chiang, 13. Ban Nadi, 14. Non Nok Tha, 15. Ban Chiang Hian, 16. Ban Kho Noi, 17. Non Chai, 18. Non Dua, 19. Binh Chau, 20. Doc Chua, 21. O Pie Can, 22. Samrong Sen, 23. Dong Son.

I would like then, to address two issues, one straightforward, the other complex. The former involves the chronology of later South-East Asian prehistory, and entails a judgement of what constitutes sufficient grounds for accepting a timetable based on

radio-carbon determinations.[1] The second considers the prehistory of two regions during the two millennia up to their exposure to expanding states of China and India. The establishment of a chronological framework must recognize certain stratigraphic problems. Prehistoric structures were raised above ground level on stilts, and there are no building levels. Moreover, digging graves, postholes, and pits relocated charcoal in prehistory. Some sites have also suffered serious bioturbation which has blurred if not destroyed stratigraphical distinctions. Clearly, then, all radio-carbon samples must come from *in situ* contexts such as hearths, charcoal from within bronze-casting furnaces, or wood cut from prehistoric coffins. Charcoal removed from the matrix of grave fill, or scattered charcoal collected from a given layer is valueless. The stratigraphic relationship of the sample to the event being dated must therefore be demonstrated and, if necessary, expressed as a *terminus ante* or *post quem*. The second principle demands that a chronological framework requires clusters of provenanced dates from a series of sites. While single dates from sites might fit a regional pattern, a set is preferable.

In 1968 Solheim concluded an initial report of the 1966 excavations at Non Nok Tha with the statement that: 'Carbon 14 dates from layer 19 would mean that bronze was being worked in north-eastern Thailand nearly one thousand years before it is now considered to have begun in Shang China' (Solheim, 1968, p. 62). Non Nok Tha is a prehistoric cemetery set within approximately a metre of deposit. The excavators recognized two periods of cemetery use. The earlier was subdivided into three phases, the later (called the Middle period) into eight. The burials both intercut and overlay each other, and during the Middle period, some interments were covered by mounds. Graves were cut to a depth of at least 50 to 60 cm. The earliest evidence for metal is a bronze axe-head found on the chest area of an Early period 3 grave. Evidence for bronze metallurgy during the Middle period includes artefacts in mortuary contexts, as well as moulds and crucibles.[2]

The excavators have never underestimated the problems of dating this site. When describing the 1966 campaign, Solheim

[1] All radio-carbon dates cited have undergone the correction published by Klein *et al.* (1982).

[2] Dr Bayard (pers. comm.) has also drawn my attention to two fragments of bronze corrosion in an Early period 1 funerary vessel. For early levels in mortuary sites, I am unwilling to accept evidence for metallurgy other than *in situ* artefacts or bronze-working facilities.

disclosed the absence of *in situ* hearths there. Radio-carbon samples were derived from grave fill and accumulated from layers recognized during excavation. None conforms with the stratigraphic principles set out above and there is no relationship between the dates and their stratigraphic contexts (Fig. 2).

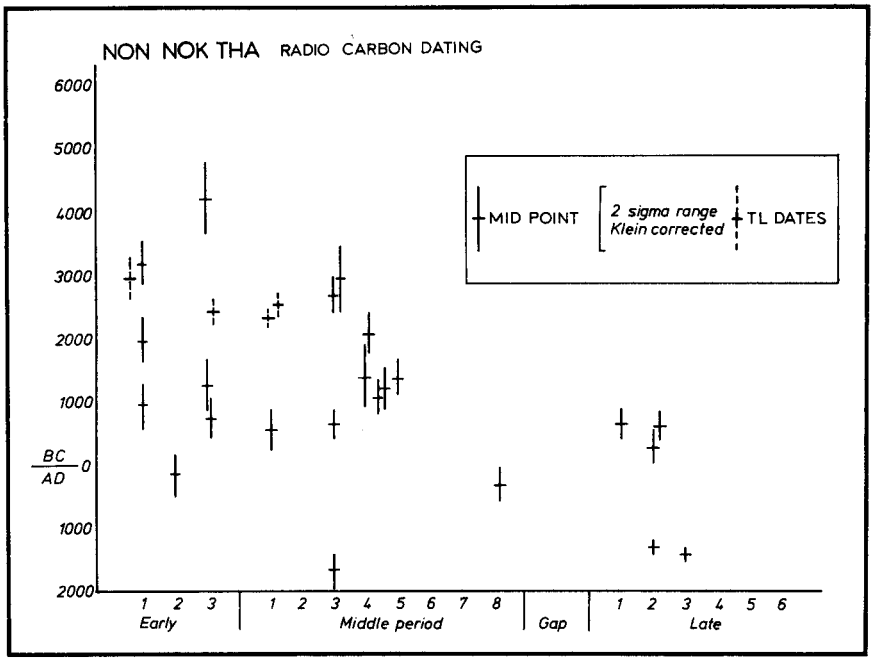


FIG. 2. The distribution of radio-carbon dates from Non Nok Tha, set against their level ascriptions.

Eighteen samples from the mortuary phases have been dated. Of these, four have been rejected by Bayard due to suspected contamination. Seven were based on bone apatite or collagen. Since no sample contained more than 0.8 per cent of collagen, Bayard also considers these unreliable. There remain three radio-carbon samples. One (GX 1611) weighed 2.2 g and was derived from burial fill. It dates Middle period 4 to 2200 ± 110 BC. The second (GX 1612) dates 2.6 g of charcoal from an Early period 1 pit to 940 ± 130 BC while the third (Y 2485) is a large sample (38.5 g) from under burial 95 but within the grave fill. It is held to date Middle period 5, and the result is 1380 ± 120 BC. Bayard has also obtained four thermoluminescence dates based on burial pottery. One dates Early period 1 to 2995 ± 320 BC. Burial 90 (Early period 3) has a date of 2420 ± 200 and there are two Middle period 1 dates of 2350 ± 150 and 2534 ± 200 BC.

When Non Nok Tha was still the only site in the area to have been excavated, the dates provided at least prima facie grounds for suspecting very early bronze working. But it is necessary to reaffirm Bayard's own hope, expressed in 1971, that further dates from other sites would settle the question (Bayard, 1971, p. 31).[1]

Excavations in 1974 and 1975 at Ban Chiang disclosed deeply stratified prehistoric burial, occupation, and industrial activity. Analysis has been delayed by the death in 1981 of Chester Gorman, and no published list of radio-carbon dates set against their provenance is yet available. The only sources of information are a brief report based on field impressions, an unpublished conference paper, and White's commentary in an exhibition catalogue. (Gorman and Pisit Charoenwongsa, 1976; Gorman, 1978; White, 1982*a*). Gorman and Pisit Charoenwongsa recognize six phases. An early burial contained a socketed bronze spearhead, and two phase 4 iron spearheads with cast on bronze hilts represent the earliest iron. Gorman (1978) dated the bronze spearhead to the early third millennium BC and the iron spearheads to between 1600 and 1000 BC.

A detailed commentary on the Ban Chiang radio-carbon dates is for the future. Since 1975, however, several other sites have been examined and the dates obtained may be compared with the general assertions made for Ban Chiang.

Ban Nadi is situated 22 km south-west of Ban Chiang. Amphan Kijṅgam and I excavated there in 1981. We encountered a clear stratigraphy comprising eight major layers. The bottom five relate to the Ban Chiang phases in the following manner: Layers 7 and 8 are the equivalent of Ban Chiang during mid and late phase 3, terminal Layers 7 and 6 to Ban Chiang phase 4, and Layer 5 to Ban Chiang phase 5.

All radio-carbon samples derive from *in situ* contexts[2] (Higham

[1] Dr Bayard and I have had numerous discussions on the chronology of prehistoric sites in north-east Thailand. Our positions differ on one key issue. He rightly points out that one-third of all dates at Non Nok Tha fall before 2000 BC and feels that the site was occupied during the third millennium BC. Without provenanced samples, I am not prepared to accept such a conclusion.

[2] It should be stressed that sample no. R9251/2 (see Appendix) comprises a large block of charcoal found, in association with a complete crucible, at the base of a posthole cut into Level 7 from Level 6. We submitted this for dating because it seemed possible that it was part of the post butt. Its placement in Fig. 3 may reflect that it comes from old wood.

Sample R9345/4 derives from charcoal found within a pit sealed by a sand lens laid by flood water. It is later than expected. Three further samples from the same pit were submitted and they match R9345/4.

and Kijngam, 1981, 1982). The pattern indicates initial occupation between 1500 and 1000 BC, the average mid-point for the two Level 8 dates being 1350 BC. The earliest iron artefacts in graves are dated between 400 and 100 BC, and the earliest iron slag to AD *c.* 100 (Fig. 3). These determinations are well over a thousand years later than the equivalent phases at Ban Chiang. There is a serious contradiction.

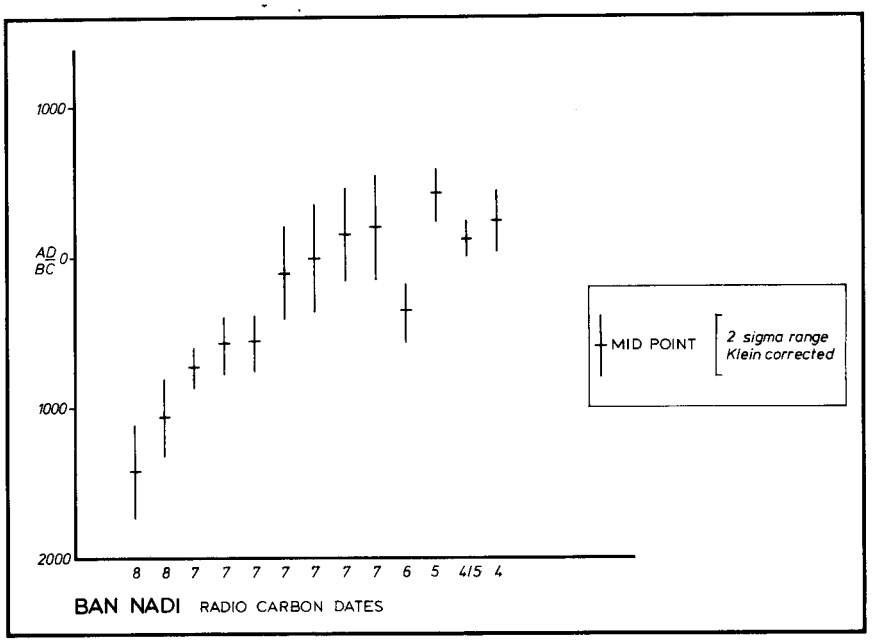


FIG. 3. The distribution of radio-carbon dates from Ban Nadi, set against their layer of origin.

Fortunately, it is possible to turn to three other recently dated sites. Ban Chiang Hian is a large moated settlement in the middle Chi Valley. Amphan Kijngam's excavations there encountered clearly stratified deposits 6.5 m thick. All but one of his six radio-carbon samples come from *in situ* hearths and, with that exception, conform with the stratigraphy. All layers in the site yielded bronze, the initial occupation falling towards the end of the second millennium BC. The first evidence for iron is bracketed between 600 and 300 BC. Two dates from Ban Kho Noi, 10 km west of Ban Chiang Hian, support the pattern there (Fig. 4).

The third site is Non Chai, where Pisit Charoenwongsa found iron from the initial occupation. The dated samples were collected from hearths and concentrations of charcoal (Pisit Charoenwongsa and Bayard, 1983), and the resulting pattern reveals occupation

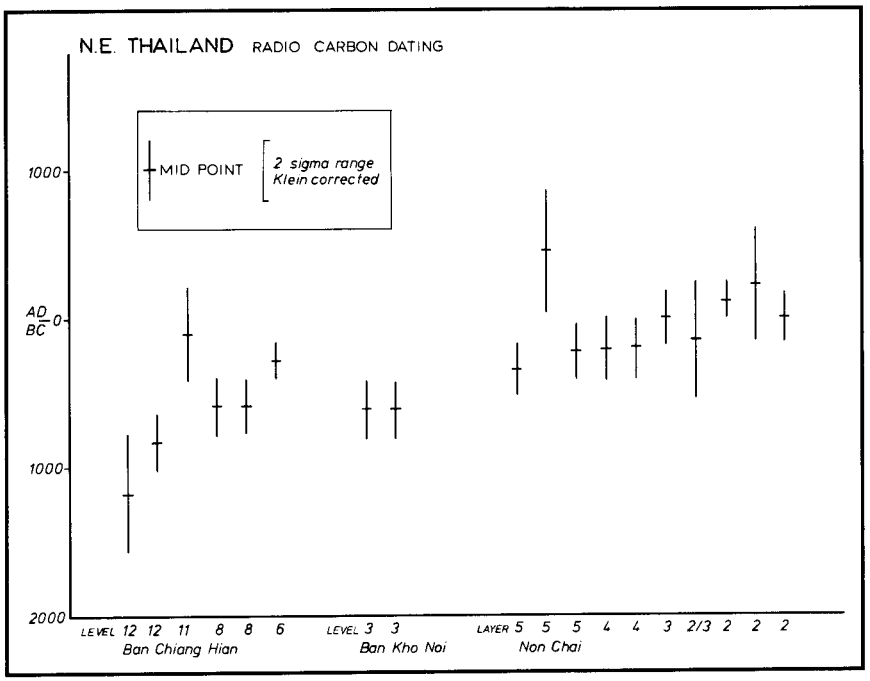


FIG. 4. The distribution of radio-carbon dates from Ban Chiang Hian, Ban Kho Noi, and Non Chai.

between 300 BC and AD 200 (Fig. 4).[1] Pottery from Non Chai parallels that from Ban Nadi Level 5. The fit is perfect.

During the last decade, research into the prehistory of Vietnam has greatly expanded.[2] A major achievement has been the identification, in the lower Red River Valley, of three phases which present an unbroken sequence leading to the well-known Dong Son culture. Several radio-carbon dates are now available for this sequence, though it is unfortunate that there is never more than one from any given site (Fig. 5). Nevertheless, Ha Van Tan (1980) has proposed that bronze technology is first apparent in the late Phung Nguyen[3] phase by *c.*1500 BC. Samples for Dong Son sites, which evidence the first iron artefacts, comprise wood taken from boat coffins. These disclose a pattern of dates with mid-points between 390 and 603 BC. Pham Minh Huyen (1983) has

[1] There is also one date from the basal layer of 1870±160 BC. This is completely at variance with all other dates and is difficult to accept.

[2] I am much indebted to my Vietnamese colleagues Hoan Xuan Chinh and Pham Minh Huyen for their helpful conversations on recent developments in Vietnamese prehistory.

[3] Diacritical marks for Vietnamese names are omitted for typographic convenience.

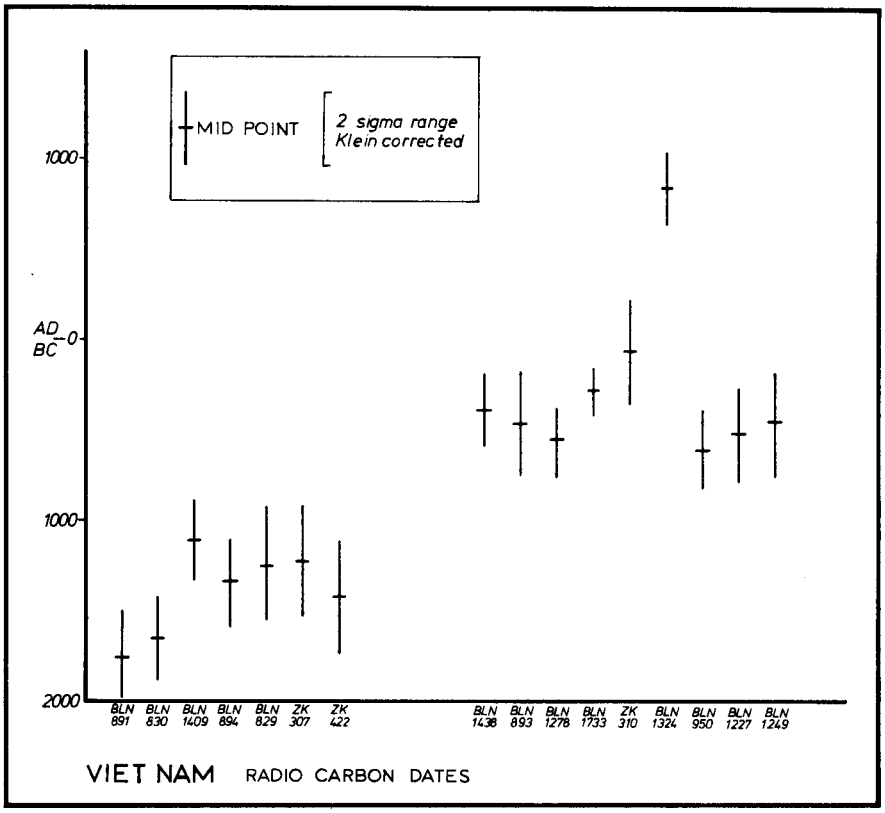


FIG. 5. The distribution of radio-carbon dates from Vietnam. For the key to sites, see appendix.

concluded that iron technology reached the Red River Valley by the fifth and sixth centuries BC.

There is, then, evidence for bronze metallurgy in coastal Vietnam and the Mekong Valley during the second millennium BC (Fig. 6). Similar bivalve sandstone moulds and small spouted crucibles for casting axes, spearheads, and arrowheads have been found in the lower Red River sites, central coastal Vietnam (Ngo Si Hong, 1980), the lower Mekong area (Le Xuan Diem, 1977), central Cambodia (Levy, 1943), and north-east Thailand. In the Red River area, they first appeared in an unbroken sequence, by 1300–1500 BC. There is one radio-carbon date of 1420 ± 130 BC for the material from Doc Chua, 25 km north-east of Ho Chi Minh City. Excavations there yielded sandstone moulds and artefacts paralleled precisely in north-east Thailand.

Spearheads are the earliest iron objects at Ban Chiang and Ban Nadi. The complete ones at the former site have cast-bronze hafts

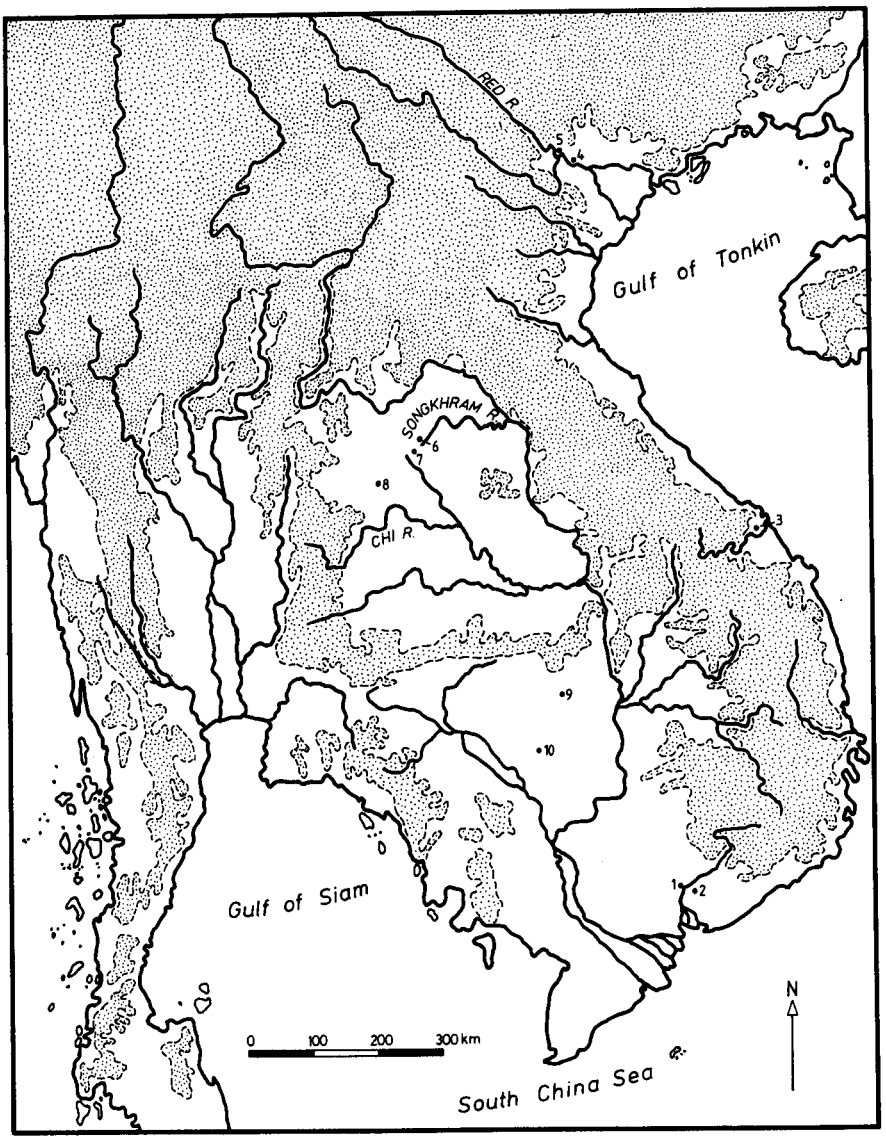


FIG. 6. South-East Asian sites of probably the 2nd millennium BC which have yielded crucibles or moulds for bronze casting: site 1. Doc Dua, 2. Hang Gon, 3. Binh Chau, 4. Dong Dau, 5. Go Mun, 6. Ban Chiang, 7. Ban Nadi, 8. Non Nok Tha, 9. O Pie Can, 10. Samrong Sen.

similar to that recovered in the Dong Son area. This bimetallic tradition was widespread in South-East Asia during the second half of the first millennium BC, particularly in areas offering easy contact with China. Thus, the aristocratic graves at Shizhai Shan in Yunnan have yielded bimetallic spearheads, swords, halberds, and axes (Pirazzoli-t'Serstevens, 1974).

There are at least two alternative interpretations for this dating evidence. One holds that bronze artefacts were cast at Ban Chiang 1,500 years or more earlier than practically identical pieces elsewhere in South-East Asia, and that the iron at Ban Chiang anticipated that in Yunnan and Red River area by over six centuries. The second alternative holds that bronze working was present in coastal Vietnam and the Mekong Valley by *c.* 1500 BC, and that the Ban Chiang bimetallic artefacts are probably imports dated no earlier than 300–500 BC. The corollary to the latter alternative, which I prefer and will follow, is that the final review of the Ban Chiang radio-carbon dates will reveal the same problems of provenance and association as were encountered at Non Nok Tha.

II

The proposed long chronology for the two north-east Thai sites started hares involving confusion and controversy. One was the need to seek origins for the precocious bronze- and iron-working traditions. The second was the proposition that metallurgy was present there for three millennia without concomitant changes in social complexity noted under similar conditions in the Aegean, Near East, or Shang China. Two models resulted. In one, Gorman (1978) linked bronze working, undertaken over three millennia at village level, with the dispersive nature of wet-swidden rice cultivation. This has recently been echoed by White (1982*a*), when she wrote:

> No complex, stratified social organisation appears to have been the cause or consequence of the development of metal technology. The types of metal artefacts manufactured by the people of the Ban Chiang tradition and elsewhere in southeast Asia reflect this nonurban, non military context. . . . In sum, we find a metallurgical tradition flourishing in peaceful agrarian village societies. (White, 1982, p. 48)

The shorter chronology proposed above dispenses with the need to explain the origins of metallurgy and its durability in simple village contexts. In its place, we can focus upon a particularly interesting change, from small autonomous communities to a hierarchic settlement pattern incorporating central places. This change occurred in both areas considered, and our perception of the processes involved is sharpened by comparison. Most prehistorians reviewing such data would seek interactions between environmental stimuli and aspects of behaviour involving change (Renfrew, 1972; Redman, 1978). First, however, we need to

identify changing values for the prehistoric environment and a wide range of cultural variables. These include the subsistence and settlement patterns, organization of exchange and production, social structure, and degree of exposure to the expanding states of India and China.

Marshalling the necessary information is a tall order in an area which still awaits a site report to rank alongside those of Verulamium or Maiden Castle (Wheeler, 1936, 1943). In fact, we are restricted to the northern part of the Khorat Plateau in northeast Thailand, and the lower reaches of the Red River Valley. Both abutt uplands rich in tin and copper ores. They are separated by the Annamite Range and contact involved crossing a mountain pass and the Mekong River. Whereas the Khorat Plateau is surrounded by uplands, the lower Red River Valley occupies a pivotal position for the control of movement along the Gulf of Tonkin and to the interior of Yunnan.

There are two distinct sub areas in the northern Khorat Plateau—the Chi and the Songkhram valleys. In both, there are sharp distinctions between the soils and vegetation of the lake and river margins, the low terrace and the older, higher river terraces. During the wet season (May to November), the lower reaches of the tributary streams and lake margins suffer prolonged flooding. White has contrasted this with the middle reaches, which tend to experience brief inundation. Such flooded land probably sustained vegetation 'with a very open character, with scattered trees and shrubs' (White, 1982*b*, p. 3). The slightly elevated terraces which surround the flood zone would have encouraged a dry deciduous forest. White has further suggested that such open areas prone to flooding were the foci of early prehistoric rice cultivation. Such land, however, is distributed as enclaves surrounded by drier soils on the higher terraces, or low-lying land prone to extensive flooding. Moreover, rainfall is variable. The area can experience a superabundance of rain, or drought, during the wet season. The dry season, however, sees very little if any rain, much sunlight, and high evaporation.

The Chi is a large river which cuts through several extensive tracts of broad flood plain, bordered by a mosaic of soil types matching those of the Songkhram area, and criss-crossed by a network of waterways. Van Liere (1980) has suggested that inundation on the flood plain was extensive but not deep enough to rule out rice cultivation. Moreover, such regular inundation would have encouraged, under climax conditions, a naturally open, grassy savannah.

In 1980 Amphan Kijngam and I undertook two site surveys. One investigated the area south-west of Ban Chiang, and was designed to illuminate the distribution and size of prehistoric sites as well as to identify changes in settlement patterns with time. The second survey took as its northern limit the Chi River. It crossed the extensive flood plain and then entered the area of low and middle terraces crossed by a network of tributary waterways.

The former identified numerous sites which displayed similar pottery styles and burial practices to those found at Ban Chiang. They showed a preference for the confluences of small streams commanding soils of the low terrace. It is very hard to estimate site sizes, but no evidence was found for a hierarchy on the basis of their area (Higham *et al.*, 1982).[1]

Ban Nadi was chosen for a major excavation. Two areas were opened, both near the centre of the mound and separated by about 25 m (Fig. 7). Each revealed a clear stratigraphy, incorporating features reflecting activity at ground level. Level 8, the lowest, comprised a diffused shell midden containing numerous small hearths, and large pits interspersed with lenses of sand lain down by flood water. This level yielded many fragments of bronze, a few bronze artefacts, and pieces of crucible to which dross still adheres.

During the build up of Level 7, parts of each excavated area were used as a cemetery. Inhumation burials were interred with whole pots, animal bone, and personal ornaments. These burials have been divided on stratigraphic grounds to phases 1, 2, and 3. One part of the excavation area revealed a clay furnace ringed with crucible fragments and pieces of bronze, which is interpreted as a facility for heating and casting.

Phase 3 graves were cut down from Level 6. Two contained iron artefacts, including a spear blade and an armlet. During the deposition of Level 5 there was a clear change in ceramic styles, and the excavated area had been used as a bronze foundry. Seven clay furnaces were found, together with crucibles and clay moulds for casting bracelets and bells (Pl. I*b*). Iron was also much more abundant and included the earliest pieces of iron slag.

[1] Sites take three forms: clear mounds set among rice fields, cultural material under modern villages, and cultural material identified in the open, but not deep enough to form a mound. It is self-evident that site sizes may have varied with time, and calculating the area of a mound will give a maximal rather than minimal value. The size/range of Ban Chiang-like sites in the survey area was 0.6–10.0 ha, with an average of 2.5 ha ($N = 17$). Ban Nadi probably covered about 2.0 ha, Non Nok Tha, 1.1 and Ban Chiang about 5.0 ha.

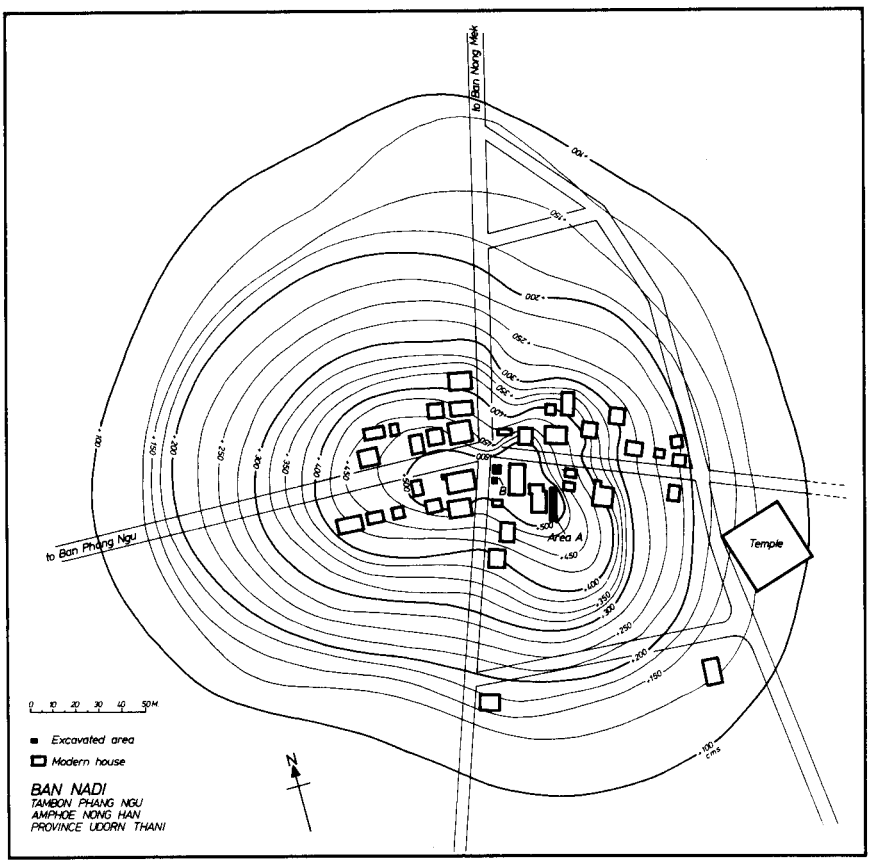


FIG. 7. Ban Nadi, showing the two areas excavated.

All archaeological deposits recovered at Ban Nadi were passed through 5 mm screens. Fifteen per cent were also screened through apertures of 250 μm. The latter provided micro-organic samples which have altered our perception of economic activities in such sites. A sample of rice grains was recovered, as well as the bones of very small aquatic species, particularly fish and frog. At Ban Nadi, the fine screening revealed a numerical predominance of small fish. These same species are still taken in large quantities today through a variety of nets and traps. The rainy season floods still bring fish to the very doorstep.

A combination of rice and fish, in addition to meat from domestic and wild stock and doubtless numerous other wild and cultivated plants, provided a sound nutritional base clearly revealed in the strong bone structure and evidence for robust musculature. Indeed, one seventeen-year-old female had already borne a child, indicating an early onset of menarche (Wiriyaromp, 1983).

The burials and their contents have been analysed in the light of the adhesions between mortuary behaviour and social structure (Binford, 1971; Saxe, 1971; Chapman, 1981). The extent to which certain burials were distinguished by relatively high energy expenditure, and recognition of special treatment reserved for individuals on the basis of sex or age, also require analysis.

The burial sample included males and females, and all age groups from foetal to over fifty years at death. They were found in both excavated areas. In each, there was an apparent edge to the burial area, within which individuals were buried in rows, and one on top of each other. On more than one occasion, two people were buried simultaneously in the same grave (Pl. II). The rite comprised extended inhumation with the head pointing either to the north or the south. The body was usually accompanied by the fore left limb of a juvenile cow or pig, and always by one or more complete pottery vessels containing food. The number and variety of vessels increased with time, and their sources became more variable (Vincent, 1983).[1] Other goods were, in the main, items of personal adornment. Stone[2] bracelets, some repaired with bronze wire, were found only in the early phase graves. Most jewellery was made of shell. The thirteen shell bracelets found in one grave were made from *Trochus*, a marine species (Pl. III). Shell disc beads and their spacers were common, and probably had a marine origin as well. A small group of graves incorporated clay figurines of cattle, deer, elephant, and human beings (Pl. I*a*).

The same burial rite was performed for adults and children. That for infants varied. One was buried in the arms of a forty-year-old female, two were placed in large pots without grave goods, another lay between two adult graves, while another still was found lying alone, with no associated material. In general, the objects buried with the dead cross-cut differences of age and sex. Children were buried with adults, and shared the same range of grave goods, including pots, burial ornaments, and shell jewellery.

Mortuary remains were found in both excavated areas (areas

[1] In an important analysis of the fabric of the Ban Nadi mortuary vessels, Vincent (1983) has shown that there are two or three types of fabric in mortuary phase 1 vessels, six in phase 2, and ten in phase 3. The new fabrics were often associated with unusual forms and decorative styles. Vincent is currently examining the possibility that these vessels used in mortuary sites derive from other settlements. This study clearly has considerable potential in identifying inter-site affiliations.

[2] The stone employed for making bracelets comprises marble, slate, and possibly travertine. All are exotic to the Khorat Plateau.

A and B). On stratigraphic grounds, burials in each belong to the same time-span. This situation permits a comparison between each area on the basis of wealth.

In this discussion, exotic artefacts are accorded higher energy value than local ones. Items in the former category include marble and slate bracelets, artefacts of bronze and iron, and shell jewellery of certain or probable marine origin. The stone bracelets are particularly interesting because, when broken or chipped, they were repaired by boring two holes adjacent to the fracture, and then joining them with bronze wire. This wire is the only metal found in the earliest burial-phase graves. One bracelet had such a small diameter that it must have been placed on the owner's wrist when he was young. All four stone bracelets come from Area B graves. Bronze artefacts were found in seven graves, four of which are in Area B (Pl. IV). While bronze was found in Area B in all phases, only the latest graves in Area A yielded metal ornaments. The man with thirteen *Trochus* shell bracelets was buried in Area B. Twenty burials contained shell disc beads, fifteen of which were found in Area B. Approximately 11,000 such beads were found, 96 per cent coming from Area B burials. Area B also contained several unique items. A ring, knife, and spear-blade of iron, a child buried under a crocodile skin shroud (Pl. V), and a large bone pendant made from a crocodile skull. Moreover, all clay figurines were found in Area B.

The many adhesions between mortuary behaviour and social systems make possible certain inferences. The first finding is that there was at Ban Nadi a cemetery with a structured disposition of the dead in rows and, with the passage of time, on top of each other. One part contained richer grave goods than the other, and they accompanied males, females, and children. Wright (1978) has argued that such a situation is compatible with a degree of social ranking and subgroup affiliation. Tainter (1978) also concluded that such gradations in energy expenditure applied to adults, and children involve a degree of ascribed status. We may proceed slightly further and suspect, in the light of Saxe and Gall's (1977) review of changing mortuary ritual among the Temuan of Malaysia, that certain lineages had preferred access to specific, limited resources. I don't want to press the evidence too far, given the restricted sample size, but for the moment at least, it is held that one group in the cemetery was richer than another. The distribution of wealth was greater in Area B over many centuries but in both areas the quantity of grave furniture increased with time.

Bayard's (1983) recent analysis of the mortuary data from Non Nok Tha has the advantage of covering the period before and after the introduction of bronze metallurgy. He has argued that there was ranking during the early period, but that this was moderate and increased perceptibly with the advent of metallurgy. Towards the end of the prehistoric use of the site, however, the distinctions between richer and poorer graves declined, and nearly all interments were accompanied by only a few grave goods.

Let us turn now to bronze-casting technology. The remains of a small furnace comprising blocks of partially fired clay with a central, charcoal-rich depression were found in Level 7. This feature was ringed by spreads of charcoal, crucible fragments, and flecks of bronze. The same level yielded a casting sprue made of lead (Seeley and Rajpitak, pers. comm.).

Examination of the dross found within the crucibles, as well as the absence of slag, indicates that copper and tin were converted to liquid form while contained in the small pouring crucibles. The two complete vessels have a maximum capacity of 80 ml. The lead-casting sprue was identified by Seeley and Rajpitak. They have suggested that initial castings were made in lead, since the low melting-point of this metal is less likely to crack the sandstone mould (Pl. VI*b*). The lead template would then have been surrounded by a more heat-resistant medium, such as clay, and then replaced by bronze. The same technique has been reported from Vietnam (Davidson, 1979). The occupants of Ban Nadi clearly obtained lead, copper, and tin and commanded the skills to cast a range of bronze artefacts.

Between *c.*400 and 200 BC the cemetery was abandoned. This event was associated with several other changes which, taken together, reveal a major discontinuity. With iron came the first evidence for the domestic water buffalo, an animal valued above all else today for pulling the plough. Laboratory studies are now revealing major changes in ceramics between Levels 5 and 7, both in form and fabric. Several novel artefact types appeared, while the shell and stone from mortuary contexts were no longer found. The area of the abandoned cemetery was used for the manufacture of bronze ornaments. Iron was abundant and pieces of iron slag were encountered.

Was this change at Ban Nadi a local or widespread phenomenon? At Ban Chiang there was also dislocation. White (1982*a*) has noted changes in burial rite, marked typological changes in pottery, and more abundant bronze jewellery commonly associated with child burials. This was the period of iron spear-

points and the first bones of the domestic water buffalo. Meanwhile, at Non Nok Tha, the cemetery was abandoned before iron became locally available.

Further relevant information comes from the Chi Valley. In 1978 Pisit Charoenwongsa excavated at Non Chai. This settlement covers *c.*18 ha. The radio-carbon dates reveal occupation there between *c.*300 BC and AD 200. Iron and water buffalo bones were found from the initial occupation. Some pottery forms from Non Chai match those from Ban Nadi Level 5. So, too, do the clay moulds for casting bronze jewellery.

The 1980 site survey in the middle Chi Valley identified another large settlement at Ban Chiang Hian. It is now ringed by the remains of double moats and a reservoir, and covers an area of about 37 ha. Not only is it significantly larger than the other prehistoric sites found in the survey area, but it also controls access to an extensive tract of low terrace and floodplain land.

The site was first occupied between 1500 and 1000 BC. Early pottery bears no resemblance to that for the same period at Ban Nadi or Ban Chiang. Between 600 and 300 BC, there was a change in pottery forms and the first evidence for iron and the water buffalo. There is a third large moated settlement in the lower Chi, called Non Düa. This site controls both an area of river flood plain and an extensive deposit of salt. It was initially occupied in the first millenium BC and there is evidence for exploiting salt shortly thereafter.

There is, then, evidence for the foundation of settlements adjacent to the Chi flood plain which, in due course, grew differentially large. In the case of Non Chai, it attained 18 ha before it was abandoned early in the first millennium AD.[1] The same period saw dislocation in long-established mortuary practices and ceramic styles at Ban Nadi, Ban Chiang, and Non Nok Tha. We shall return to these variables.

Although the lower Red River Valley lies only 300 km northeast of Ban Chiang, its environment is in marked contrast. The middle region, that is the area above Ha Noi in which most

[1] Non Chai was an open site and measuring the area was straightforward. The area of Ban Chiang Hian is that within the moats. In each case, pottery remains are found over the entire surface of the site; but it remains an assumption that the area was all under occupation at any given period. About 0.04 per cent of Non Chai and 0.002 per cent of Ban Chiang Hian have been sampled by excavation. Corresponding figures for Ban Nadi, Ban Chiang, and Non Nok Tha are 0.33, 0.16, and 3.1 per cent.

prehistoric settlement was concentrated, contains soft and easily worked soil set within broad valleys. A combination of slight changes in altitude and the unique Tonkin climate are critical to any understanding of modern and prehistoric agriculture there (Gourou, 1955). At first sight, the raw climatic data reveal a monsoon regime of concentrated rainfall during the period May to November. Certainly, most rain falls then, but between January and April, moist winds from the South China Sea condense on reaching the cooler air above the delta, and bring mist and drizzle accompanied by very low evaporation. This singular phenomenon permits two or more rice crops to mature each year without need for irrigation, but by no means uniformly across the landscape. Land prone to flooding is only cultivated during the drizzle season, while slightly elevated terrain is restricted to a rainy season crop. It is not difficult to envisage that, during a period of population expansion, there would be a premium on access to areas which could sustain double cropping.

The three prehistoric phases ancestral to Dong Son are known as Phung Nguyen, Dong Dau, and Go Mun (Ha Van Tan, 1980). Meacham (1977) has included Phung Nguyen as one of several related groups which occupied favourable tracts of the south Chinese coast. Bronze is found only in terminal Phung Nguyen contexts. The ensuing Dong Dau phase has yielded clear evidence for rice cultivation and a range of bronze artefacts which includes spearheads, axes, and arrowheads as well as sandstone and clay moulds and small pottery crucibles (Nguyen Xuan Hien, 1980). This bronze-working tradition developed in terms of proficiency, scale, and range of artefacts during the Go Mun phase and culminated in the Dong Son manifestation. This trend is particularly marked in the Red River Valley, but is also recognizable in the valleys of the Ma and Ca rivers. Trinh Sinh and Ha Nguyen Diem (1977) have demonstrated a continuity of design motifs from Phung Nguyen pottery to Dong Son drums. It is important to note the greatly increased variety of Dong Son metal artefacts. In discussing the axes, axe-halberds, and daggers, Von Dewall (1979) has concluded that their design and proficiency indicate a local workshop tradition. The craftsmen also cast situlae, bowls, spearheads, ornamented body plaques, ploughshares, and, of course, the great ceremonial drums. It is worth recalling that the recently discovered Co Loa 1 drum weighs 72 kg and would have required the smelting of between 1 and 7 tonnes of ore (Nguyen Duy Hinh, 1983).

Most of these artefacts have been recovered from mortuary contexts. The recent excavations at Chau Can have revealed a row of eight boat coffins containing differentially wealthy grave goods (Luu Tran Tieu, 1977). Boat coffins up to 4.5 m long have been found at Viet Khe. The largest contained about 100 grave goods, including bronze daggers, a sword, and spearheads. There was also a drum, lacquered wooden boxes, and the remains of a hide shield with silver decoration. Three hundred and fourteen inhumation burials were excavated at Lang Ca. A few opulent ones were set apart from the rest, and distinguished by the richness of their bronze artefacts. One grave was particularly informative. It contained four clay moulds for making an axe, spearhead, dagger handle, and a bell. These were associated with a crucible large enough to pour 12 kg of bronze (Vu Thi Ngoc Thu and Nguyen Duy Ty, 1978).

There are other sources of information for this Dong Son culture. The decoration on the drums reveal scenes of conflict by high status individuals. Their distribution suggests a maritime exchange system amply confirmed by a review of the sources of Dong Son jewellery. Moreover, with Dong Son we enter the twilight period of protohistory. From about 200 BC, the area was exposed to imminent or actual Chinese military threat, culminating with its incorporation in the Chinese Empire in AD 43.

Nguyen Viet (1983) has recently considered the botanical and technological evidence for prehistoric rice cultivation in the Red River area, and has concluded that there was a considerable build up of population there, coupled during the first millennium BC with the adoption of plough cultivation, double cropping, and water control. This assessment finds confirmation in Chinese references to Lac Lords, the owners of the drums, who controlled the fields for rice cultivation. Wheatley (1979) has noted that, following the incorporation of the area as a Chinese protectorate in 111 BC, the 'Lac chieftains, in whose persons were institutionalised customary rights to land, were confirmed in their traditional authority'.

Recent archaeological research at Co Loa has identified what was formerly the principal centre of the Dong Son culture. This site, located about 15 km north-west of Ha Noi, comprises three sets of ramparts, their moats being supplied with water by a tributary of the Red River. The outermost defences enclose an area of about 600 ha. Excavations during the past year have uncovered a drum containing over 100 ploughshares and a cache of about 10,000 bronze crossbow bolts.

It is not possible fully to appreciate the Dong Son culture

without reference to contemporary events in Yunnan. Excavations at Shizhai Shan, an acropolis on the margin of Lake Tien, have revealed a society similar in many critical respects to Dong Son, though undeniably richer in terms of material goods. We find the same bimetallic tradition in metallurgy, though some of the forty-eight swords have golden scabbards. There are seventeen iron spearheads with bronze hafts, two halberds, and two axes. The upper echelon of Tien society also valued Chinese imports, such as mirrors, coins, and horse-trappings. Hundreds of thousands of cowrie shells have been found, stored in bronze containers in the richer graves. Indeed, one grave purported to be royal since it contained a gold seal inscribed 'Seal of the King of Tien'. To these rulers, iron had the value of scarcity. There are only 115 iron artefacts against over 2,000 in bronze, and most derive from the more richly endowed graves. This Tien society was contemporaneous with Dong Son and reveals increasing contact with Han China. Tien is linked to the Gulf of Tonkin by the Red River, up and down which there surely flowed goods and ideas.

III

There is evidence for a major cultural change in each area considered, occurring at approximately the same time. Before 500 BC or thereabouts, settlements were of about the same size, and I suspect, autonomous. After that date there were primate centres associated with craft specialization and intensified production. Let us refer to the earlier period as mode 1 and the later, mode 2 (Fig. 8). These resemble the entities recently identified on Melos and described in similar terms by Renfrew (1982).

During the currency of mode 1, bronze working was adopted within small village communities with a history of exchange in goods exotic to their region. Both the recurrent alloying of copper with tin in the earliest bronzes and growing evidence for open firing of early pottery vessels argue against an indigenous development of bronze technology. It has been noted that early bronzes were cast on site, were similar in shape over a very wide area, and were made using the same techniques. The recent discovery of copper and bronze working in Gansu by *c.*2700 BC, and establishment of bronze technology in the Geometric horizon along the south China coast during the second millennium BC, hint at the origin of this tradition (Zhang Xuecheng *et al.*, 1981).[1]

[1] The origins of South-East Asian bronze working are well beyond the scope of the present paper. Three points, however, must be made. The more

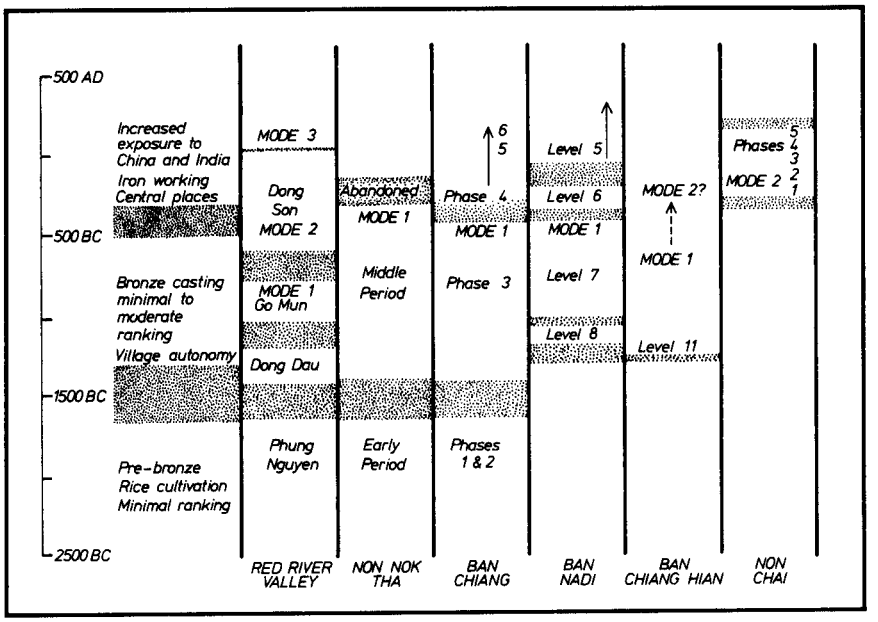


FIG. 8. A chart showing the chronological and cultural relationships between sites proposed in the text. Stippled areas depict periods of transition.

I suspect that mortuary and settlement data are important in understanding the characteristics of mode 1 prehistoric culture. My approach is stimulated by the presence at Ban Nadi and related sites, of grave goods made from exotic material, and calls upon Dalton's (1977) consideration of the role of 'primitive valuables' as a component in the maintenance of economic, social, and political relationships between small, independent communities. In a word, exchanges of valuables and establishment of affinal ties promote alliance. Imbalance or fluctuations in access to resources involves oscillations in rank. Within such a system, much devolves upon the leaders of dominant lineages. They had superior access to prestige valuables, could foster affinal relationships, and play an entrepreneurial role in the transfer of goods. Successful participation, however, necessitated access to valuables.

conservative chronological framework promulgated in this paper brings bronze working in South-East Asia later than that in north China. At the same time, the associations and dating of the Gansu copper and bronze artefacts are not by any means secure. I am much indebted to Dr N. Barnard of the Australian National University for his pertinent comments on the dating of material from the Majiayao, Machang, Qijia, and Huoshaogou culture sites in Gansu. Finally, there are problems in isolating links, in terms of technology, between South-East Asian and north Chinese material.

There are three points which require comment when reviewing South-East Asian material within such a framework. The first is that the exotic goods we find at Ban Nadi come from considerable distances and different directions. I suspect that there were clusters of interlinked exchange networks focused in, for example, the margins of the Bangkok Plain, the Lower Mekong, and doubtless in the vicinity of major ore sources. These supplied the marine shell, exotic stone, and rare bronzes which we find in mortuary contexts. The second point is that it is exactly through such a system that the knowledge and practice of bronze working itself could have spread. The third, and perhaps most critical, is that the system is internally flexible with regard to permanence of rank. It is worth pausing to review such flexibility, because it will sharpen our understanding of the changes which heralded the transition to mode 2. The model I am proposing incorporates independent communities of differing size, location, and importance. I have made much of the location of sites in north-east Thailand, and found that some were situated in small enclaves of riceland while others commanded extensive areas of the Chi flood plain. The technique of rice cultivation probably involved the exploitation of flat terrain which experienced a gentle flood regime. Climatic unpredictability involving drought and flood prejudiced successful cultivation. The broad-ranging subsistence activities would then have buffered the effects of climatic extremes. At the same time, however, intensifying production to permit participation in a prestige-goods exchange system and all that that involves would have come more readily to those commanding the best tracts of riceland. Indeed the settlements of the Khorat Plateau had no direct access to marine shell, metal ore, or fine-grained stone. Good land was their major resource. There are, then, conditions under which certain groups may prosper unduly. Among these may be numbered access to a circumscribed source of a valued substance, be it copper or good land, control of a strategic position such as a mountain pass or river crossing, or monopoly, through the fortunes of geography, over access to prestige goods, such as glass beads or bimetallic spearheads, provided by an expanding state.

Mode 1 settlement and mortuary data are consistent with a system of flexible lineage ranking, of which the unequal and restricted distribution of valuables in cemetery contexts are the archaeological embodiment. Documenting affinal ties and fluctuating success by participating lineages is more difficult, but not impossible. Archaeology reveals that this situation changed

swiftly, and we can date the inception of change to the period 500–200 BC. We find different consequences in each area considered.

The transition to mode 2 involves fixing of rank underwritten by intensified production and exchange. In the Red River Valley, there are several variables which display intensification (Fig. 9). In terms of agriculture, there was the advent of ploughing using animal traction and double cropping. The creation of fixed fields expands the area wherein aquatic resources may be obtained. There was a major intensification in the production of bronze objects and in exchange. The development of plough cultivation in fixed fields associated with double cropping and private land tenure is particularly interesting, since adhesions between plough cultivation and social systems are well documented (Goody, 1976). Indeed, the application of ploughing to rice cultivation is a particularly clear example of agricultural intensification and its implications bear comment.

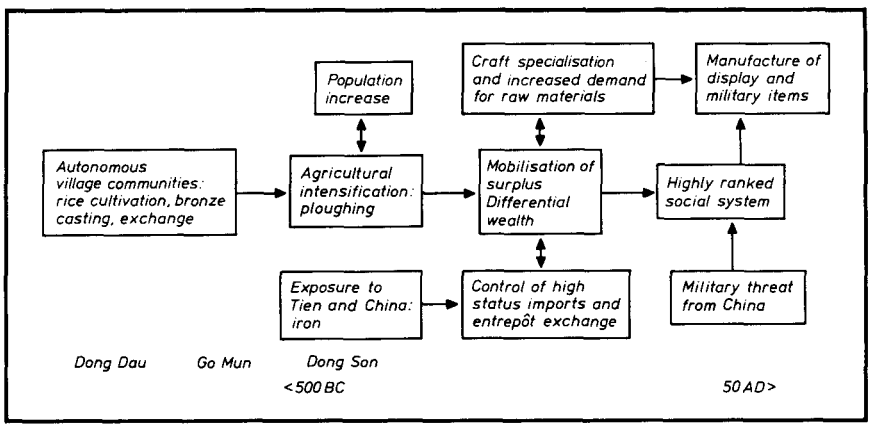


FIG. 9. A scheme suggesting relationships between cultural variables underlying the development of the Dong Son culture in the Red River Valley.

The creation of fixed fields by bunding permits the retention of rain-water. By opening and closing culverts between fields, water flow can be regulated. This technique makes it possible to create replicas of natural swampland. In Geertz's (1963) terms, rice fields are a managed swamp. Animal traction provides the energy for cultivating a greatly expanded area: Gourou has shown that a male water buffalo at the critical and brief period of ploughing between two crops in the Tonkin delta, can work 2.5 ha. Such ploughing aerates the soil and removes competing weeds. These, decaying under anaerobic conditions, release elements which feed the growing rice. So too do the blue-green nitrogen-fixing algae

which percolate past the growing rice under conditions of water management. This system is extraordinarily productive because crops can be taken annually even on poor soils.

Goody (1976) has noted that fixed fields created by bunding and improved with regular ploughing and dressings of manure become inheritable wealth and an individual equipped with a plough, draught animal, and (preferably) workers, can produce more rice than his immediate requirements. Rice may be stored for long periods without deterioration, and is a source of wealth. In a word, then, there are adhesions between plough agriculture and the unequal distribution and accumulation of wealth.

The transition from rice cultivation in naturally marshy areas to the creation of fixed fields by bunding is not technically demanding. Yet it has the potential for greatly increased production. Seavoy (1973) has, in fact, observed that this transition in Kalimantan occurred within small, autonomous villages and created a demand for more tools and draught animals.

There is, then, a close link between the establishment of fixed fields, regular rice production, and the accumulation of wealth. A rice surplus can be used to attract followers and sustain retainers, thereby concentrating people. It may also be converted into visible status objects. This period witnessed a proliferation of metal artefact types, the range of which is intriguing. There are the massive ritual drums, as well as situlae, bowls, ornamental body plaques, daggers, spearheads, and axe-halberds. A few weapons were made of iron. The bronze objects were found in rich graves and most, if not all, were concerned with ritual, display, or war. In this context, it is interesting to recall that Gourou (1955) has emphasized that the Tonkin peasant of the 1930s had very little use for metal objects other than an iron tip for his plough and an iron hoe. Indeed, the delta soils are so soft that the tips of the ploughshares were made of cast iron.

Again, the Dong Son mortuary data reveal a superordinate group, distinguished by the quantity and variety of prestigious metal objects as well as their location and manner of interment. Von Dewall's analysis of the foundry traditions noted that their establishment and maintenance entailed a 'socio-political agglomeration of sufficient weight to sustain it economically' (Von Dewall, 1979; p. 165). To this must be added the great proliferation in the skills of casting and the amount of metal employed. It is self-evident that the organization and purpose of casting was qualitatively distinct from that characterized during mode 1, involving as it did the maintenance of permanent ateliers

and importation of greatly increased supplies of raw materials. In this manner, permanent ranking, craft specialization, and private ownership of land present a triad of linked variables.

Nor must it be forgotten that the emergent Dong Son aristocrats commanded maritime and riverine routes of communication. Their territory was also exposed to contact with Tien and Chinese civilizations. The effect of such contacts has recently received wide attention (Bloch, 1977; Ekholm, 1977). Under a similar set of circumstances, Haselgrove (1982) has applied a prestige-goods exchange model to the institution of political centralization in south-east England following direct contact with Imperial Rome. This model supposes that, where a particular lineage or group is able to control production through a monopoly over raw materials or new sources of prestige goods, it will achieve a dominant position over its former peers. Haselgrove anticipates that such prestige goods will include those requiring 'rare materials, considerable technical skills, high labour investment or availability from outside the local system' (Haselgrove, 1982; pp. 81–2).

Durable prestige goods of Chinese origin are a feature of opulent Tien graves. They include horse-trappings, iron swords, coins, and crossbow fittings (Chang, 1977). There is evidence too for direct Chinese contact in the Dong Son graves. Iron swords and the axe-halberds are of Chinese origin or inspiration. At Lang Vac, Chinese bronze imports dated between 415 and 220 BC have been found in an opulent Dong Son grave (Trinh Minh Hien, 1974). Indeed, the earliest iron artefacts there probably fall into the same category. The proximity to China, however, brought with it the threat of subjugation. The provision of suitable weapons and organization of defensive structures are further aspects of intensification.

Let me try to distil the essence of this model. Mode 1 involved flexibility in ranking which depended on at least a given community's access to land and valuables. If we could peer into Leach's black box of social variables, we would probably also perceive circumscribed access to ancestral spirits and individual aspirations expressed in feasting or power-play (Leach, 1973). The transition to mode 2 was rapid, and involved the elevation of a few lineages to permanently high rank. The stimulus to such a restructuring is seen in restricted access to a new source of prestige goods and the enormous capacity of plough cultivation to generate the rice surplus required to intensify production. As archaeologists we can recognize the physical residues of this change in richly furnished boat coffins, ritual drums, and large central places. I suspect that population increases reflect the

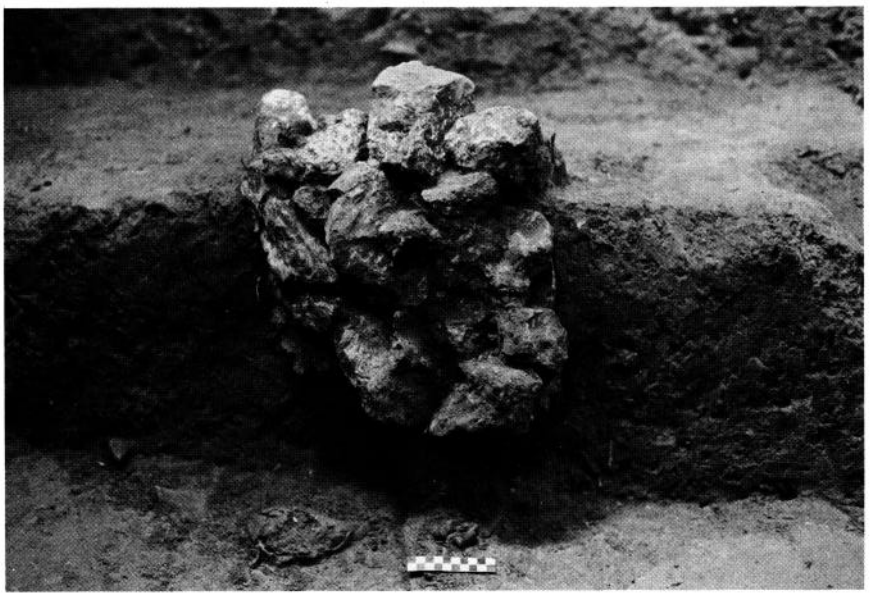
attraction or coercion of people to a rising polity to fulfil the labour demands attendant on intensification. The Red River Valley is stage set for such a change given its strategic position, advantageous climate and circumscribed area of good, well-aspected rice land. The processes identified were truncated by the area's incorporation in the Chinese Empire (mode 3).

North-east Thailand was shielded from Chinese expansion by the Annamite Mountains. Characteristic Dong Son artefacts are either absent or rare. The transition to mode 2 there requires us to draw a sharp distinction between events in the Songkhram and Chi valleys. In the latter, there are three changes of note. In a favourable area of good riceland, Non Chai grew to cover an area of 18 ha. This differentially large site has yielded evidence for the smelting of iron and importing of glass beads. The similar, but as yet undated, large sites command the extensive areas of flood plain down the entire Chi Valley.

These changes are consistent with a breakdown in the proposed long-standing affinal alliance and exchange system between independent villages, but for different reasons in each valley. Occupants of the Chi area had three advantages. They had access to larger tracts of good land and iron-ore, and controlled the northward flow of marine resources, ideas, and rare objects now reaching the communities of the Bangkok Plain from India. Several interacting variables may be identified. Population growth and agricultural intensification in the Chi flood plain are noted and were doubtless contributory factors. But the social change was critical in that it involved the growth of a few large central places as foci of population. There is some archaeological evidence that these centres also controlled the distribution of salt, exotic artefacts, and locally produced craft goods. Seminal variables are held to reflect the flexibility and opportunism inherent in the mode 1 social system, in conjunction with the best agricultural land and preferred access to the ideas and prestige goods of an expansive, but in this case Indian, state society.

As it happens, those living in the upper Chi area used red slipped and painted pots. In the Songkhram area and at Non Nok Tha, plain or cord-marked vessels were preferred. The model for expansion to mode 2 in the Chi Valley envisages stress on its margins. This stress reflects the breakdown there of a long-standing system of approximate equivalence due to severance of the Songkhram area from supplies of foreign valuables by the emergent and expansive Chi Valley polities. Moreover, their available agricultural land was always the more restricted. We see

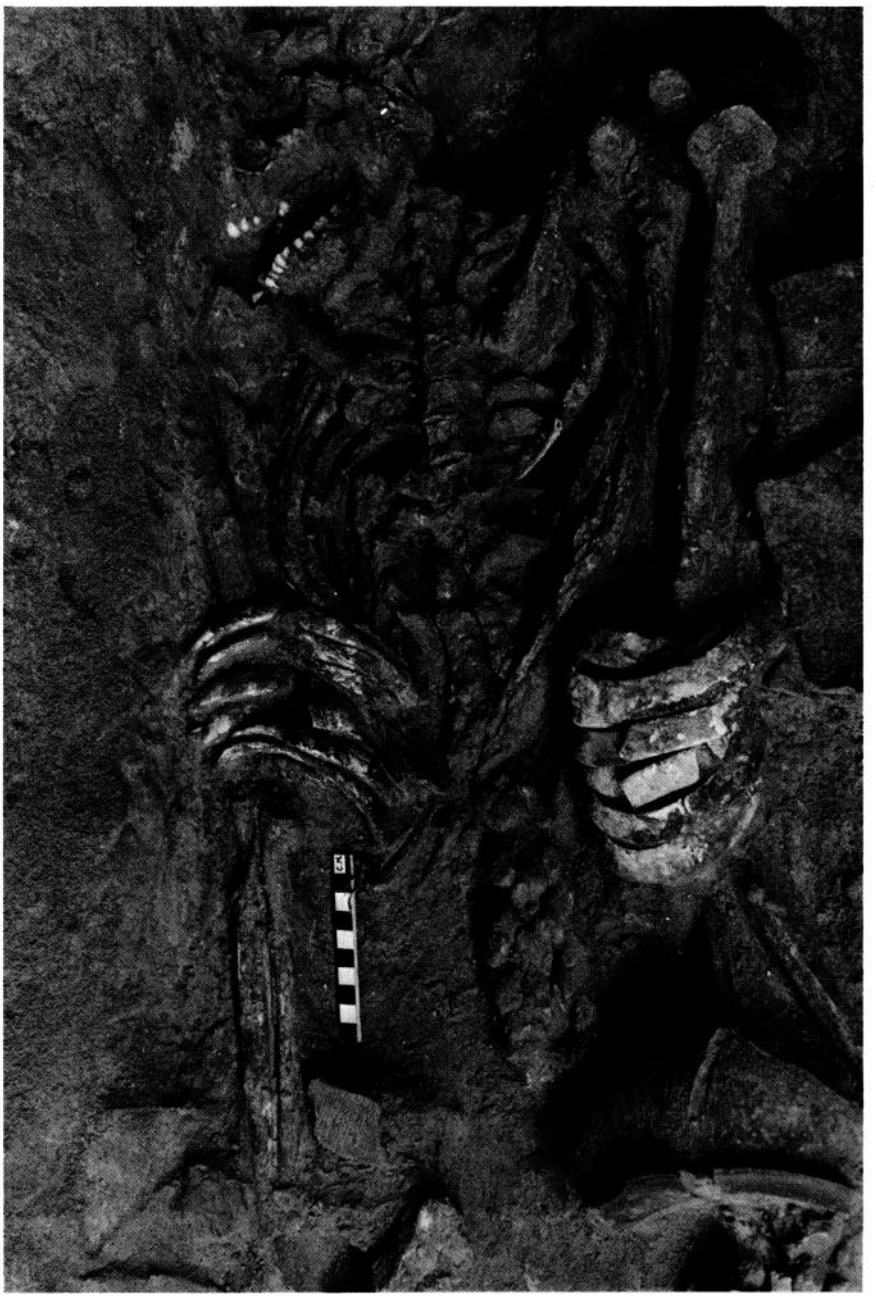
(*a*) Clay figurines of cattle were interred in some Area B graves. Burial 47 contained eight specimens. Figurines of humans, deer, and elephant were more rare. This specimen is 75.0 mm tall at the shoulder.



(*b*) Level 5 yielded the remains of seven small clay furnaces. They were surrounded by bronze detritus, and fragments of clay crucibles and moulds, and are interpreted as furnaces used to raise bronze to melting-point.

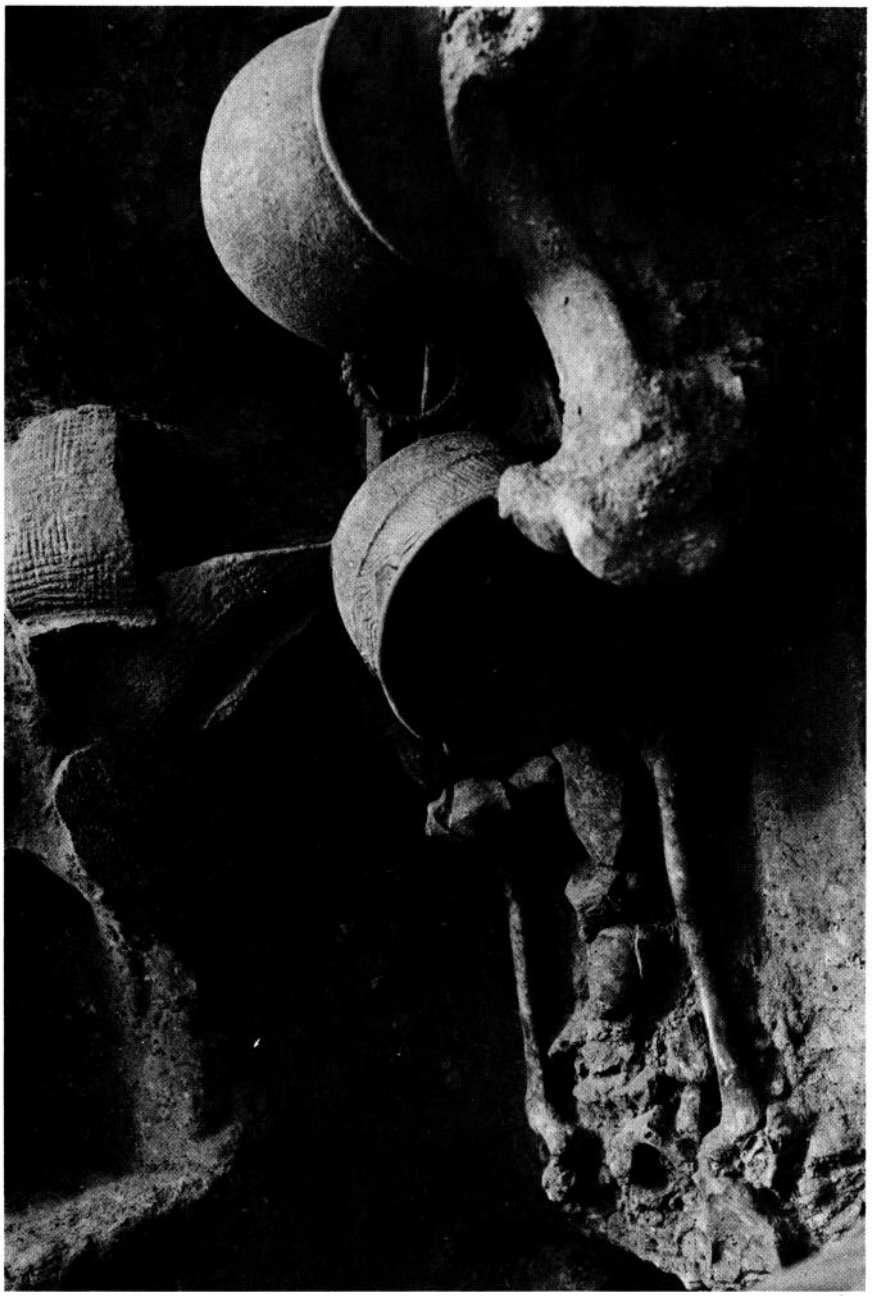
PLATE VIII

Burials at Ban Nadi were laid out in rows. These examples are from Area B. That on the far right contains two bodies.



This adult male (burial 32, Area B) was interred wearing thirteen armlets cut from *trochus* shell. This is a marine species, and the most likely origin is peninsula Thailand, *c.* 1000 km to the south of Ban Nadi.

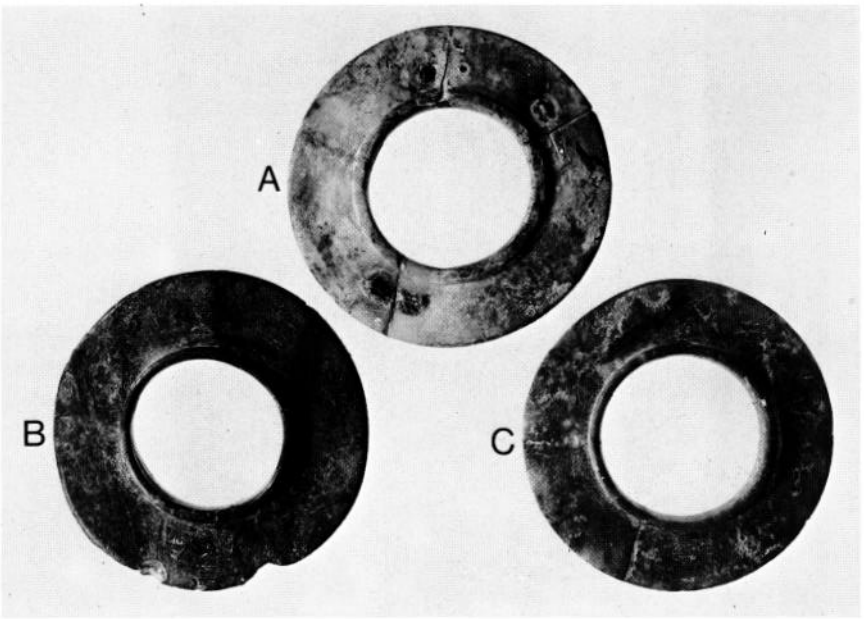
PLATE X



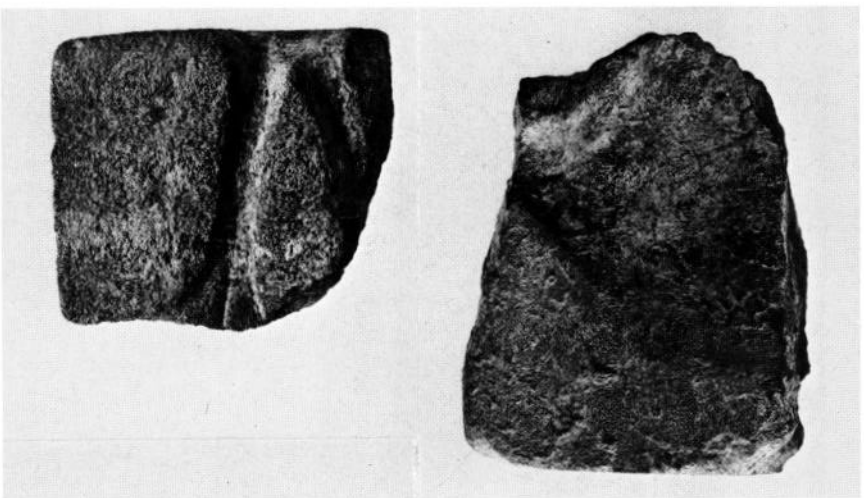
Bronze artefacts were very rare in Ban Nadi mortuary contexts. This bracelet was found in association with a three to ten-year-old child (grave 38). It has a diameter of 90 mm.

This three- to ten-year-old child (Burial 19) was interred under a crocodile skin shroud. The bony scutes of the crocodile are seen overlying the child's legs.

PLATE XII



(*a*) These three stone bracelets were all found in Area B. The uppermost is made of marble, and has holes bored for repair with bronze wire. A, marble; B, slate, C, travertine. Specimen A has an outer diameter of 116 mm.



(*b*) Several broken pieces from sandstone moulds were found at Ban Nadi. That on the right was used for an axe (Level 6), that on the left was probably for a tanged projectile point (Level 7). The latter is 42 mm. high.

the reduction in prestige goods at Non Nok Tha and ultimately the abandonment of cemeteries which had been in use for a thousand years or more. When Ban Nadi was reoccupied, it was by people who used red-painted pottery in the Chi Valley tradition, who smelted iron, and who imported blue glass rather than shell beads. It is proposed that events in each area are related. The rise to power of centrally based Chi Valley aristocrats attracted followers. But in the Songkhram area there was depopulation followed by intrusive settlement. Those who intruded were responsible for the now famous Ban Chiang painted pottery (Fig. 10).

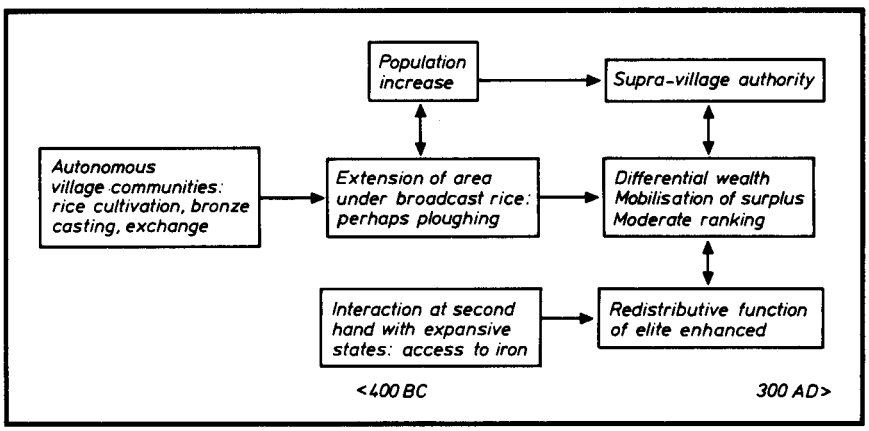


FIG. 10. A scheme suggesting relationships between cultural variables underlying the development of central places in the Chi Valley, north-east Thailand.

I hope I have made one point clear. South-East Asia is and was a place of great environmental and cultural diversity. The transition from mode 1 to 2 in each area has to be considered both within its own terms and as part of a wider system.

In each, I have either concluded or hinted that the development of mode 2 centralized polities reflects access to the means to generate a surplus and preferred exposure to expansive states. One of the unanswered questions still shrouding South-East Asia in prehistory, is the extent to which initial trends to mode 2 preceded Chinese or Indian contact. My own expectation is that the transition was latent in indigenous societies, and occurred first, and most intensely, in the Red River Valley and among littoral communities whose locations combined ownership of extensive riceland and direct contact with Indian entrepreneurs.

Doubtless some of you will feel I have strayed beyond reasonable bounds in attempting to model prehistoric changes in

such an unexplored region, let alone in predicting the results of future research. I am unrepentant. Our aim is to understand the processes which led to the development of the early and indeed modern states of South-East Asia, and this requires a blend of solid archaeology and the generation of explanatory models. Sir Mortimer Wheeler, in whose memory we are assembled, would have particularly relished this combination.

APPENDIX

Radio-Carbon Determinations from Vietnam and north-east Thailand

Site and no.	Context	Date BP (5570 half life)	Sigma range (Klein corrected: BC unless otherwise stated)	Mid-point (BC unless otherwise stated)
Trang Kenh BLN-891	Charred wood mixed with loam, late Neolithic/early Bronze Age	3405 ± 100	1975–1545	1760
Dong Dau BLN-830	Charred wood, late Phung Nguyen	3330 ± 100	1885–1415	1650
Doi Giam BLN-1409	Charred wood and organic matter, Phung Nguyen	2900 ± 60	1330–885	1108
Go Vuon Chuoi BLN-894	Charred wood, Dong Dau	3070 ± 100	1585–1100	1340
Vinh-Quang BLN-829	Charred wood, late Go Mun	3045 ± 120	1565–925	1245
Doc Chua ZK-422	Bronze period	3145 ± 130	1735–1105	1420
Trang Kenh ZK-307	Bronze period	3005 ± 90	1540–905	1222
Chau Can BLN-1438	Wood from coffin, late Dong Son	2325 ± 60	585–195	390
Go Chien Vay BLN-893	Powdered charcoal, Dong Son	2350 ± 100	770–180	475
Go Mun BLN-1278	Powdered charcoal, probably Dong Son	2384 ± 60	760–390	575
Lang Ca BLN-1733	Charred wood from grave pit, Dong Son	2235 ± 40	410–160	285
Lang Vac ZK-310	Charcoal from stone bordered grave pit, Dong Son	1990 ± 85	360 BC–AD 225	68

Site and no.	Context	Date BP (5570 half life)	Sigma range (Klein corrected: BC unless otherwise stated)	Mid-point (BC unless otherwise stated)
BLN-1324	Charcoal from stone bordered grave pit, Dong Son	1140±80	AD 635–1045	AD 840
Viet Khe BLN-950	Coffin wood, Dong Son	2480±100	395–810	603
BLN-1227	Coffin wood, Dong Son	2415±100	260–790	525
BLN-1249	Coffin wood, Dong Son	2320±100	170–760	465
For further details on Vietnamese dates, see Kohl and Quitta (1978)				
Ban Nadi R9345/5	Charcoal from small hearth, Level 8	3150±180	1735–1105	1420
R9251/5	Concentration of charcoal within shell midden, Level 8	2840±80	1330–805	1065
R9345/6	Charcoal from clay furnace, Level 7	2600±60	850–605	730
R9251/4	Charcoal from within clay bronze-working furnace, Level 7	2420±60	775–395	585
R9251/3	From thick layer of charcoal sealing A pit, Level 7	2370±70	760–385	572
R9251/2	A large piece of charcoal at base of posthole cut from Level 6	2300±70	565–185	375
R9251/1	Charcoal from bronze-working furnace, Level 4/5	1865±55	AD 0–240	AD 120
R9345/2	Charcoal from pit cut within Level 4	1755±120	35 BC–AD 455	AD 245
R9345/3	Charcoal from bronze-working furnace in Level 5	1610±75	AD 240–585	AD 415
R9345/4	Charcoal from pit cut within Level 7	1810±135	150 BC–AD 530	AD 200
R9452/6	Charcoal from pit cut within Level 7	2130±170	420 BC–AD 205	108
R9452/7	Charcoal from pit cut within Level 7	1830±145	155 BC–AD 450	AD 150

Site and no.	Context	Date BP (5570 half life)	Sigma range (Klein corrected: BC unless otherwise stated)	Mid-point (BC unless otherwise stated)
R9452/8	Charcoal from pit cut within Level 7	1930±145	370 BC–AD 360	5
Ban Chiang Hian R9345/1	Hearth 80 cm above sterile Level 12	2910±180	1570–780	1175
R9452/4	Hearth at same level as 9345/1, Level 12	2670±60	1020–640	830
R9452/5	Charcoal scattered in Level 11	2100±160	410 BC–AD 215	98
R9452/3	Charcoal-rich hearth, Level 8	2430±60	780–400	590
R9452/2	Thick spread of charcoal, basal Level 8	2460±60	785–405	595
R9452/1	Charcoal from pit cut from basal Level 5 into Level 6	2230±60	410–160	285
Ban Kho Noi R9178/3	Concentration of charcoal, Level 3	2520±70	420–805	615
R9178/4	Concentration of charcoal, Level 3	2540±70	430–810	620
Non Chai NZ4814	Charcoal concentration in Layer 6, phase 1	3490±160	2185–1555	1870
NZ4819	Hearth in Layer 5, phase 1	2270±70	525–175	350
Ned 2	Hearth in Layer 5, phase 1	1520±235	AD 70–865	AD 465
NZ4815	Concentration in Layer 5, phase 1	2200±70	405–45	225
NZ4818	Charcoal in shell midden, Layer 4, phase 3	2190±100	415–0	207
NZ4816	Ash lens, Layer 3, phase 4	2140±70	390–5	197
NZ4812	Concentration in Layer 3, phase 4	2040±70	AD 185–185	0
NZ4815	Hearth in Layer 2/3, phase 5	2080±200	550 BC–AD 240	155
NZ4813	Concentration in Layer 2, phase 5	1850±65	AD 5–245	AD 125

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