Textile Technology in the Prehistory of Southeast Asia

Volume 1

Text

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Abstract

This thesis is the first systematic study of the archaeological evidence for cloth production in Southeast Asia and provides new insights into the origins and early history of textile technology and bark cloth production in the region. The study identifies an autonomous textile zone amongst Neolithic groups in the Yangzi Valley of South China. By mapping the distribution of diagnostic cloth production tools at prehistoric sites, the research shows the dispersal of the hand spindle with wet-rice groups from Southeast China into Taiwan, the Philippines, Hong Kong, Vietnam, Laos, Cambodia and Thailand at the beginning of the Bronze Age. At the broadest level, the documentation of items of material culture related to cloth production highlights women's significant economic contribution during the prehistoric period in Southeast Asia. The tools of production and extant remains of prehistoric cloth described in the study attest to considerable economic expenditure on fibre processing, spinning and weaving from the Neolithic period through to the Late Iron Age. An origin centre for the backstrap loom in the Yangzi Valley has also been identified. The study also shows that bark cloth was first produced 6000 years ago in Lingnan, long before the technology spread to Island Southeast Asia and the Pacific.

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Studying traditional objects in detail, not just admiring them, brings to light the ingenious ways in which their makers exploited the possibilities and overcame the limitations of both material and structure. Looking closer, I feel I may have made journeys which greatly increase my respect for them.

Peter Collingwood, The Maker's Hand, 1987.

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Introduction

The Research Problem and Purpose of the Study

Previous archaeological research in Southeast Asian prehistory has focused on lithic technology, pottery or metallurgy and reconstructions of cultural interaction in the region have been based primarily on these technologies. This thesis is the first systematic research into the archaeological evidence for cloth production from sites in Southeast Asia and commences the task of illuminating the origin(s) and early history of textile technology and bark cloth production in the region. At a general level, prehistoric cloth has received little attention in archaeology even though cloth production is as fundamental as agriculture in most societies. Few archaeologists can name the earliest textile sites or the different types of evidence for cloth production. There is a notable absence of entries for cloth in most archaeology texts. A perfect illustration of the problem is the Collins *Dictionary of Archaeology* (Bahn 1992) which does not have a single entry for spinning or weaving, nor any products of the loom, yet all other technologies of Neolithic antiquity are listed.

In her landmark study of prehistoric textiles, Barber (1991:4) stresses that balanced assessments of prehistoric economic systems need to consider evidence for this time-consuming activity. She argues that in many prehistoric and early historical societies, cloth production would have consumed more hours of labour than either pottery or food production. Prior to the Industrial Revolution in Europe, women spent much of their available time domesticating and gathering suitable fibres, processing them before spinning, weaving, and sewing them into cloths. Scholars of contemporary Southeast Asian textiles (Adams 1969; Barnes 1989; Fox 1980; Fraser-Lu 1988; Gittinger 1976, 1979, 1989; Gittinger & Lefferts 1992; Maxwell 1990) have clearly demonstrated that textile production is still extraordinarily complex and labour intensive in many traditional societies, with some ritual cloths requiring several years to complete. The cultural logic for the substantial economic investment in textile production lies not only in the role of cloth in the early trade of the historical period in Southeast Asia but in the significance of cloth in its cultural context. In many of these societies, socio-cultural relationships are articulated through cloth. Of these relationships, the usage of differentiated textiles in burials to indicate cultural affiliation and social status is very relevant to Southeast Asian prehistory.

Prehistoric Textiles

Wild (1988:7) has observed a common misconception amongst archaeologists that textiles do not survive at archaeological sites. He notes that many European archaeologists frequently express surprise that there *is* sufficient evidence to warrant systematic studies when told of research in progress on prehistoric textiles. Similar misconceptions are held by Southeast Asian textile scholars. At the 1979 Conference on Indonesian textiles held at the Washington Textile Museum, Woodward referred to the impermanence of textiles in Southeast Asia. Lamenting the absence of prehistoric forms, Woodward stated, "the textiles that survive belong to a shallow slice of time - little more than the past hundred years" (1980:15). According to Guy, "unlike ceramics, silk leaves no archaeological evidence of its presence [in Southeast Asia]..." (1986:5). Although the scarcity of textile remains at sites in Southeast Asia has obscured the importance of cloth production to prehistoric economies, fragments of prehistoric textiles (including silk), have survived, as this thesis will document.

Predictably, desert conditions are more conducive to textile preservation than wet environments. Aridity with salt inhibits the bacteria that destroy woven materials. Consequently, more fragments of prehistoric cloth have been recovered from sites in the dry deserts of Egypt, the Gobi Desert, and Peru where rainfall is virtually unknown and where burials are very deep. There, motifs are often discernible and colours intact. In Egypt, some excavations have produced fewer than one hundred specimens while others have produced thousands of fragments of prehistoric cloth. A single season at the settlement site of Qasr Ibrim in Nubia, for example, produced more than 20,000 fragments (Vogelsang-Eastward 1993:66).

Textiles have survived other extreme conditions through freezing, carbonization, metal oxidation and anaerobic water logging. At Pazyryk (Russia), wool carpets, felt, fur, leather and hemp textiles dated between 700 and 500 BC were preserved, frozen in ice (Rudenko

1970). In Denmark, 4,000 year old textiles woven from animal fibres were preserved in acid ground water (Glob 1970) but the acid ground water that preserved the animal materials destroyed the vegetable materials. In contrast, the muddy, airless, alkaline waters at the bottom of lakes in Switzerland destroyed animal materials but preserved cloth woven from linen *(Linum usitatissimum* perfectly. The earliest extant textiles from Çatal Hüyük (Anatolia) were preserved through carbonisation (Mellaart 1962, 1967:218), yet, ironically, the heavy carbonisation that preserved the 9000 year old fragments made fibre identification very difficult (Helbaek 1963, 1970; Ryder 1965; 1987) and contentious. The fibres originally identified by Mellaart as wool were later shown to be flax (Barber 1991:10). The palaeobotanist, Helbaek (1963:39), described the salvaging of Çatal Hüyük's prehistoric textiles as "a trying business". The aridity that inhibited potentially destructive bacteria and aided the preservation of the woven organic material made the fragments extraordinarily brittle and very delicate to handle. When archaeologists attempted to expose the whole burial in a conventional way, the surface would dry up in the heat, the textile remains would turn to powder and be blown away by the persistent wind.

Because prehistoric textiles gradually lose their original dyes and take on the colour of the surrounding soil, they can be lost during excavation unless they are anticipated at archaeological sites, Harrisson acknowledged that more than 50 burials had been excavated from the cemetery sector of the Great Cave at Niah (Sarawak) before prehistoric fragments of cloth were sighted. According to Harrisson, remains "were only recognised for the first time during the 1965 field season which concentrated the best workmen on slow burial exposure" (B. Harrisson 1967:154). For this reason, excavations of settlement sites in Middle Egypt, the Red Sea, and Nubia now include a textile archaeologist as an active member of the expedition team. Using a hand lens and ruler, specialists record the structural composition of fragments *in situ*, before samples are removed for laboratory analysis (Vogelsang-Eastwood 1993:85).

According to Barber, disinterest in prehistoric textiles has cost us dearly:

> For the most part, people untrained and uninterested in textiles (and in our culture, all sexism aside, this includes most men) have done the excavating and have ignored or even thrown out the artefacts that relate to cloth; nor did the museum curators of the past do better, when they scrubbed off the iron casts of textiles to present a handsome surface to the paying public (Barber 1991:xxiii).

Barber refers to a particular form of textile evidence found adhering to metal artefacts. This association that is not co-incidental as there is a relationship between metals and textile preservation: as metals corrode, the leaching salts preserve the cloth. Janaway's (1983:48-42) research into this process reveals several stages in textile mineralization. Archaeological textiles can be preserved in their original form simply through contact with corrosive metals. Or the corrosion of the metals can cause the formation of negative casts of cloth. Sometimes the textiles are incompletely replaced during the process. More frequently, the elemental minerals completely replace the cellulose and protein of the original fibres in the textile, the original composition disappears, and the cloth becomes completely fossilized (mineralized). Partially or completely mineralized fragments such as those shown in Fig.1.1 are called textile pseudomorphs, a term first coined by Vollmer (1979) to describe Chinese forms.

At archaeological sites where prehistoric fibres have not survived, impressions on pottery can also tell us a great deal about the technical knowledge of prehistoric spinners and weavers. Impressions are formed by pressing woven material (or cord) onto the outer surfaces of wet pottery prior to firing, creating negative impressions. For example, analysis of Neolithic pottery impressed with weaving structures found at the 7th millennium BC site of Jarmo (north-western Iraq) (Braidwood and Howe 1960:46) established that prehistoric weavers at the site had knowledge of two techniques: plain weave and basket weave (Adovasio 1983;figs. 169.9-10).

Cloth Production Tools

In Southeast Asia where conditions are not particularly conducive to the preservation of organic materials like cloth or wooden loom parts, pottery spindle whorls frequently provide the earliest extant remains of prehistoric cloth production. Spindle whorls are components of the hand spindle, a simple spinning device comprised of a spindle (shaft) and whorl (weight). The whorl keeps the spindle vertical and acts as a flywheel, prolonging rotation. Usually a single whorl is placed on the shaft (Fig. 1.2) but in some parts of the world more than one whorl is used. Regional differences have also been observed in the position of the whorl on a spindle: either at the top of the spindle (high whorl) or at the bottom (low whorl), depending on cultural preference (Crewe 1997). Twist is recorded directionally (S or Z spun), determined by ascertaining if the spiraling of fibres slants up to the left (S) or if it spirals up to the right (Z) (Forbes 1956). Scholars were once of the opinion that the direction of spin was culturally determined but recent research (Loughran-Delahunt 1996) has shown that direction of spin can result from left or right-handedness.

Space does not permit a detailed discussion of the development of spinning technology (see Wild 1988; Kuhn 1988; Barber 1991) but there are sufficient ethnographic examples of spinning in different stages of development to hypothesize about the development of the hand spindle. Before the invention of the hand spindle in the Neolithic, fibres would have been simply twisted under pressure between the palm of the hand or thigh, a technique still used by many non-textile producing groups. The next stage in the development of spinning is practiced by contemporary spinners in Scandinavia (Hochberg 1980:24) and the Sudan (Crowfoot 1931:10-14) who spin fibres using only a spindle. The hand spindle with a weight marks the next stage in the development of the technology. In terms of the evolution of spinning, the high whorl rolled along the thigh probably preceded the low whorl. While it is possible to weave unspun fibres, the main advantage of spinning is that spun fibres are longer, stronger, lighter and more pliable and better suited to loom weaving.

Although large numbers of prehistoric spindle whorls have been excavated from archaeological sites throughout the world, this class of artefact is often difficult to identify (Liu 1978; Barber 1991). Identification problems arise because the functional attributes of spindle whorls are not generally understood. In Southeast Asia, identification problems are compounded by a lack of ethnographic parallels. In most parts, the hand spindle has been superseded by the spinning wheel or commercially spun yarn. Consequently, spindle whorls, beads and weights (net and loom) are often clumped together in a miscellaneous category in the archaeological literature which can result in crucial evidence for cloth production being un-reported. For example, some of the earliest spindle whorls in Thailand have only recently been identified as spindle whorls, having previously been classified as net weights (Bayard pers. comm.). Identification problems are not unique to Southeast Asian archaeology. In Cyprus, where there is a long established spinning tradition dating back to the prehistoric period, scholars have recently advocated the taxonomic clustering of beads and spindle whorls because of their ambiguity (Crewe 1997). To overcome ambiguity in this study, criteria were developed to distinguish between different types of perforated discs. The following functional attributes of spindle whorls were identified: material composition, diameter, size of the central perforation, weight and morphology although positive identification is not always possible from a single attribute.

Material composition provides a simple means by which weights can be distinguished from beads. Because of the functional differences between tools of production (net weights, spindle whorls, loom weights) and ornament (beads), different materials are used for these different classes of artefacts. Spindle whorls, net and loom weights are usually made from common, locally available materials of little intrinsic value (wood, stone and pottery) whereas beads are usually made from exotic materials (gold, glass, jade and gems). Size is also an important functional attribute. Liu's (1978) study of ethnographic spindle whorls demonstrated that most whorls measure >3 cm in diameter and most beads measure <3 cm in diameter. However, Parsons (1972) has identified exceptional whorls measuring <2cm in diameter from archaeological sites in Mexico through ethnographic parallels.

The function of perforated discs can also be determined by the shape of central perforations. Diagnostic features include method of construction, size of the hole, and symmetry. Bead scholars (Francis pers. comm.) have observed that beads are generally drilled from both ends, producing an hourglass shaped perforation, presumably to prevent the breakage of exotic materials. Spindle whorls usually have straight-sided central perforations made from one end. The size of central perforations is also important. At the most fundamental level, the central perforation of a whorl needs to be sufficiently wide to take an upright spindle as shown in Fig. 1.2. Liu's (1978) study of ethnographic whorls showed that the central perforations of most ethnographic whorls ranged in size from 0.7 - 0.8 cm in diameter. A small number had large perforations measuring 1.0 cm in diameter and a few had very small central perforations measuring from 0.3 - 0.4 cm in diameter. McCafferty (1997) has shown that whorls from pre-Columbian sites with very large central perforations were used to spin split feathers into fibres. Symmetry is also diagnostic. Discs with off-centre perforations would be dysfunctional whorls (Barber 1991).

Weight is a significant attribute as it indicates the type of fibre that was spun yet few archaeologists record weight. Liu's (1978:90) study showed that the maximum weight of ethnographic whorls was 140-150 g (5 oz) and suggested that all perforated discs in excess of that weight ought to be classified as either net weights or loom weights. As Barber (1991) explains, tension is critical in spinning and more sensitive with shorter fibres. Heavy spindle whorls are suitable for spinning heavy thread of full-length flax and long stapled wool or for plying but quite useless for spinning short stapled wool, flax tow or cotton. During the spinning process, heavy whorls pull threads so fast that they break. Ryder (1968:81) has shown that in Afghanistan, whorls weighing around 8 g are used to spin short-stapled wool whereas whorls weighing 33 g are used to spin heavier, longer stapled fibres. Parsons (1972) has also shown that the lighter pottery spindle whorls from Post-Classical Aztec sites were used to spin cotton fibres (*Gossypium* sp.) whereas heavier pottery whorls were used to spin *maguey (Agave* sp.*)*.

Kuhn's (1988) ground-breaking research into Chinese spindle whorls established that the morphology of whorls is more diagnostic than might generally be appreciated. Using typologies, Kuhn demonstrated that while some Chinese spindle whorls are generic and commonly occur at archaeological sites, others were confined to certain provinces, with a few very atypical whorls confined to specific prehistoric cultures. His typologies of typical and atypical Chinese spindle whorls are shown in Figures 1.3 and 1.4. Kuhn's research is particularly relevant to Southeast Asian prehistory as this thesis will show that some of the atypical whorls in his typologies have also been found at Southeast Asian archaeological sites. Studies of spindle whorls from Cyprus have also demonstrated regional diversity (Astrom 1972; Crewe 1997). Crewe's investigations of Bronze Age whorls from the island showed a high degree of conservatism in spinning technology with culturally determined techniques static for millennia. Crewe saw the regional diversity evidenced at Bronze Age sites as inventiveness within the traditional repertoire. According to Crewe, this inventiveness indicates that the prehistoric spinners themselves were responsible for the manufacture of whorls.

Loughran-Delahunt's (1996) functional analysis of more than 100 Northwest Coast whorls from the Gulf of Georgia region has also contributed to our understanding of the functional attributes of prehistoric spindle whorls. Loughran-Delahunt was interested in the reasons behind variation and her study clearly showed a causal relationship between material composition and morphology. She showed that the physical principle of Moment of Inertia was a useful indicator of the performance of any whorl. Moment of Inertia is a formula, $I = 1/2\ MR^2$, used in physics to calculate the performance of any disc. I is the Moment of Inertia, M is mass and R is the radius of the disc (Tipler 1982:268). Moment of Inertia can also be used to distinguish net and loom weights from whorls, the former being designed to sink rather than spin.

Pottery bowls and woven baskets are also used during the spinning process to keep fibres clean and under control. Recently, so-called model boats from 6th millennium BP sites in Mesopotamia have been re-interpreted as spinning bowls (Strasser 1996:920-925) and pottery tripod bowls from 15th century sites belonging to the Aztecs (Mexico) have also been identified as spinning bowls used in cotton cloth production (Smith & Hirth 1988). Smith's identification is based on descriptions of spinning bowls in the *Codex Mendoza*. Pottery bowls distinguished by internal loops have also long been used in fibre processing. Use-wear analysis of looped bowls from Bronze Age sites in Palestine and Egypt has confirmed this function (Dothan 1963). Ethnographic parallels called "fibre wetting bowls" are also well documented in Japan (Tsuboi 1984).

In prehistoric Europe, specialized tools were used to process fibres prior to spinning and weaving. At flax production sites in the Swiss Lakes, archaeologists have identified tools called hackling boards. Distinguished by sharp points on one side, these tools were used to remove unwanted pieces of stem material from fibres after they had been retted (Barber 1991). Although pottery bowls have never been associated with prehistoric cloth production in Southeast Asia, this dissertation will highlight some bowls in the Southeast Asian archaeological record which may have had a role in textile production.

Occasionally, loom parts are excavated from archaeological sites. The loom is a wooden frame used in weaving to hold warp threads parallel in order to interlace the weft at right angles. Many different types of looms occur in the ethnographic record from very basic types made from bent sticks through to technologically advanced types such as jacquard looms. The different types and the development of the loom are described in detail elsewhere (Broudy 1979; Wild 1988). Irrespective of type, looms generally have the same fundamental components: a frame on which warps are arranged, two parallel rods, the warp beam and the breast beam between which the warp is stretched (Fig. 1.5). Most looms have a heddle that separates the odd and even sets of warps to create the shed, and a shuttle that carries the weft and passes it through the shed (Fig. 1.6). A beater (for beating down the warp) is also fundamental. All functional loom parts are made from wood but these archaeological tools are extremely difficult to identify because the basic wooden pieces that constitute the frame usually come apart over time and single parts are not easily distinguishable. There are exceptions. In South America, complete Chimu looms with unfinished textiles have been found in late prehistoric Peruvian burials. Notwithstanding this difficulty, a few prehistoric loom parts have been positively identified in the study region (see Chapter 2).

Loom weights made from pottery and stone have also been excavated from many prehistoric sites in Europe and the Mediterranean. Weights are the basic components of the warp-weighted loom. Loom weights are shaped differently to spindle whorls and, as with net weights, they have a lower Moment of Inertia than whorls. Generally though, identification of this class of artefact is based on conformity: irrespective of type, all loom weights excavated from a site will weigh approximately the same, to maintain consistent tension across the warp Wild (1988:32). Pottery loom weights are common at Neolithic sites in Hungary (Selmeczi 1969; Kalicz & Raczky pers. comm; Gimbutas 1982), Switzerland (Heierli 1887; Hoffmann 1964), Romania (Dumitrescu 1965), Bulgaria (Gaul 1948; Petkov 1965), and the Mediterranean. Fig. 1.7 shows Barber's (1991) reconstruction of the dispersal of the warp-weighted loom based on the distribution of loom weights at prehistoric sites. Although loom weights have never been positively identified at any Southeast Asian sites, artefacts that show strong affinities to Mediterranean types are described in Chapter 6.

Beaten barkcloth requires an entirely different assemblage of tools such as anvils, beaters, and stencils. While contemporary beaters are generally made from wood, only stone beaters, (distinguished by grooved surfaces), generally survive at archaeological sites. Tolstoy (1963) compared stone beaters from sites in Southeast Asia and Mesoamerica and concluded that the technology and paper making were derived from China. Since Tolstoy's findings, bark cloth beaters have been found at Neolithic sites in South China dating back more than 6,000 years. This study also examines evidence for this type of cloth production.

Dyes and Dye Vats

Dyeing as a chemical process dates back to the prehistoric period and evidence for dyes comes from coloured threads, piles of dyes (ochre, murex shells), dye vats, and depictions of the dyeing process on pottery artefacts. Although large numbers of Roman and Viking textiles retain traces of dyes (Wild 1988:59), the identification of prehistoric dyes in textiles is very difficult. As Barber (1991:223) points out, most of what has been written concerns possibility. For example, Mellaart (1967:219) believed he had found red dyed cord inside beads from burials at Çatal Hüyük, however, as Helbaek (1963:41, 43) states, the traces of red dye could have come from red dye on the bones. Unequivocal evidence for textile dyes in the form of dye vats has been found at Tell Beit Mirsim in Israel, dated to about 700 BC (Albright 1941-43) and purple stains inside pots at Nir David (Tel 'Amal) in Palestine (Levy & Edelstein 1972). While some scholars have suggested that the small pottery rollers excavated from several Metal Age sites in Southeast Asia were used in textile printing (Chapter 7), dyes have never been positively identified in Southeast Asian archaeology.

Pictorial Evidence

Depictions of fabric construction are extremely rare in the archaeological record although prehistoric examples have been found on pottery. The loom painted inside the 4000 year old pre-dynastic bowl (Fig. 1.8) from the Ngada I culture of southern Egypt appears to be the earliest known pictorial representation of a loom. A horizontal ground loom is depicted with two end beams fixed to the ground with wooden stakes. The three rods across the centre of the loom represent the heddle, shed stick, and beater. Eight warp threads are depicted, stretched out in parallel lines between the two end beams. The weaving process is indicated by three weft threads shown at right angles to the warp on the same plane. Some of our earliest impressions of Early Southeast Asians come from depictions of costumes on statuary and bas-reliefs from the Indianization period. While this specialized evidence has already been thoroughly analysed by art historians from a stylistic perspective, it is briefly described in Chapter 6.

Although textile history is not generally reconstructed from inscriptions, written records of cloth production sometimes provide details that cannot otherwise be interpreted from archaeological materials. In Egypt, inscriptions of laundry lists on pottery *ostracons* reveal that the ancient Egyptians possessed more underwear than any other type of clothing and that they changed these garments many times each day (Hall 1986). This not only indicates that the elites of this region had a predilection for freshly laundered underwear but that the professional laundry serving elite households existed as early as the Middle Kingdom (2040 - 1570 BC) in Egypt.

Gender Factors in Cloth Production

In Western societies, cloth production was women's work until the Industrial Revolution: women spun and wove cloth for all domestic needs as well as for trade and exchange.

Although men are known to have been involved in textile production in the Middle Kingdom in Egypt (Carroll 1985) and Classical Athens (Thompson 1982), such instances are exceptional. According to Barber (1991:291), men only became involved in weaving when a radically new component was added to the technology or when new prestige goods were developed and exploited quite rapidly.

In Southeast Asia there is an important relationship between women and cloth. Amongst traditional groups the cosmos is perceived in terms of dualism and as products of women, textiles are perceived as tangible elements of the female elements of the bipartite universe. The relationship is expressed at rites of passage ceremonies where textiles are given to represent the female element (Maxwell 1990:93, 156). Research into the anthropology of cloth reveals that textile tools are also used to express this notion. When an Iban child is in the womb, s/he is asked to determine their sex. If the unborn chooses a knife, he is born a male; if the unborn chooses a textile implement, she is borne a female (Vogelsang 1979). In Vietnam, the Tai also use textile tools to explain cosmic dualism. Three days after a child is born, a ceremony involving tools is conducted in close proximity to the house. Depending on the sex of the child, a weaving shuttle or a basket is prescribed for girls and a knife or a gun for boys. Prayers are offered to the gods and spirits in the hope that the boy would become a good hunter and the girl a good weaver (Tien Dung 1997).

Brown (1970:1073-1078) has explained this division of labour based on sex in terms of biological determinism. According to Brown, women restricted their production choices to activities compatible with child-minding. Brown based her argument on "one observable fact". Nowhere in the world, she argued, is child-minding primarily the responsibility of men and only in a few societies are women exempt from subsistence activities. Women choose economic subsistence activities that do not require rapt concentration, are repetitive, monotonous, easily interruptible, close to home and do not place children in danger.

Such subsistence activities include gathering, spinning, and weaving as opposed to hunting large game animals, deep-sea fishing, plough agriculture, mining, or metallurgy. Obviously, Brown's hypothesis is inconsistent with current Feminist thinking in archaeology that completely condemns stereotyping. At the Wenner Gren Foundation Conference on women in prehistory, Gero & Conkey (1991:8) proclaimed that contemporary gender roles cannot be translated into past prehistoric societies and recommended that biological determinism be replaced by acknowledging greater difference and diversity amongst women. Although women's involvement in Aztec (12^{th} – 16^{th} centuries) cloth production (Brumfiel 1991:224-254), cooking (Hastorf 1991:132-162), gardening (Watson & Kennedy 1991:255-275), shell fishing (Claassen 1991:276-300) and potting (Wright 1991:194-224) were discussed, no attempt has been made in the feminist literature to link textile production and women to the prehistoric period. Yet, women's economic investment in spinning and weaving is far greater than the energy invested in all other economic activities (Barber 1991). In Southeast Asia, textile production is extremely labour intensive and cloth production affords women economic power beyond the domestic sphere. When cash is required for family exigencies, products of the loom are sold and women usually control these commercial transactions. By not acknowledging gender stereotyping, feminist archaeologists have failed to appreciate the economic significance of spinning and weaving and *ipso facto*, women's substantial economic contribution in the prehistoric period.

Not only do spinners and weavers understand the physical properties of fibres (plant, animal and mineral) and filaments, they are also experts in the chemical processes involved in fibre preparation (retting, beating, dyeing), the physics of spinning as well as the mechanics of weaving. If textile technology can be linked archaeologically to women and pushed back to the prehistoric period, women's remarkable technological contribution to early societies can also be more fully appreciated.

Otis Mason (1894:59-60) once suggested that prehistoric women invented the wheel, an assertion based on women's association with spinning. Mason was very firmly of the opinion that the first continuous (rotary motion) was by the spindle, in the hands of women. In devising the hand spindle, he argued, ancient women not only introduced rotary motion but invented the flywheel for storing momentum; the spindle with its whorl was seen as a free wheel and axle with the principle of the flywheel fully developed. Yet in archaeology, the invention of the wheel is connected to the appearance of wheeled vehicles at 4000 BC sites in Mesopotamia (Piggott 1979, 1983). There is general consensus that the wheel then diffused rapidly from Mesopotamia into Anatolia, the Caucasus, Europe, and the Mediterranean in the third millennium BC. The potter's wheel, which is also an application of the principle of continuous rotary motion, was used in Mesopotamia (Uruk) as early as 4000 BC, during the Middle Bronze Age in Europe (after ca. 2250 BC), and around 2000 BC in China (Rice 1987:134). While it is not possible to determine the sex of inventors from archaeological materials, my research will demonstrate (Chapter 2) that in South China flywheels were already employed in spinning and weaving at least 4000 years before the appearance of wheeled vehicles in the Mesopotamian archaeological record.

The Origin(s) of Textile Technology

For more than a century, scholars have speculated about the origins of the loom in Southeast Asia, Melanesia and the Western Pacific (see Codrington 1891; Roth 1918; Heine-Geldern 1932, 1937; Beyer & de Veyra 1947; Riesenberg 1952; Solheim 1964; Chen 1968; Jocano 1975; Adams 1977; Kahlenberg 1977; Vollmer 1977; Blust 1976, 1984, 1995; Bellwood 1987, 1997; Fraser Lu 1988; Maxwell 1990; Yoshimoto 1990; Kirch *et al.* 1991; Intoh 1996; Howard & Sanggenafa 1999). While much has been advocated, little has been established and very little has been based on firm archaeological evidence. Most reconstructions are based on typologies of contemporary backstrap looms and the questionable proposition that the simplest looms were the earliest in the region, remainders from the prehistoric past. More advanced types in the ethnographic record have been interpreted as evidence for late introductions.

Ling Roth (1918) showed the widespread distribution of the backstrap loom throughout Asia and the Pacific, Northwest India, Tibet, China, Burma, Assam, Japan, Korea, Mexico, Borneo, the Philippines, Micronesia and Melanesia. In terms of technical complexity, Roth classified Dusun (Sabah) and Iban (Sarawak) looms as the most elementary; Igorot and Ilanun (Philippines) looms with warp-spacers as transitional and Malay and Cambodian vertical upright looms as advanced types, introduced into Southeast Asia during the historical period. Roth also proposed that Caroline Islands' looms derived from Melanesia (Fig. 1.9). According to Yoshimoto (1990:4), the simplest type of loom in the Indonesian ethnographic record is the backstrap loom used by the Sobei from Irian Jaya. The Sobei live along the northeast coast of the island of New Guinea. Howard and Sanggenafa (1999) have argued that the Sobei loom has survived from early Austronesian migrations into island Southeast Asia and the Pacific. The argument is based on the relative simplicity of the Sobei loom and the fact that the Sobei speak an Austronesian language.

Some Pacific archaeologists investigating the distribution of the backstrap loom in Oceania have adopted Ling Roth's approach, using loom typologies to reconstruct Pacific prehistory.

According to Kirch *et al.* (1991), distinctive features of Mussau Island looms indicate prehistoric contact between Melanesia and the Micronesian islands to the north. Using the same criteria, Reisenberg (1952) traced the Caroline Islands' backstrap loom with its continuous warp from "some Southeast Asian source" down through Indonesia into the Carolines and then into northern Melanesia. The Caroline Island loom is less developed than looms with discontinuous warps. However, as Broudy (1979:78) points out, the main problem with Reisenberg's reconstruction is that there may have been a third, simpler type in the prehistoric period from which both types evolved.

Intoh (1996) has focused on the distribution of the backstrap loom in the Caroline Islands (central and eastern), Micronesia, Melanesia, and a number of the Polynesian outliers. She noted strong affinities in the components of the looms and weaving methods in these islands which she doubts result from independent invention. While Intoh accepts Blust's (1995:492) hypothesis that the loom was brought to Oceania by Proto-Oceanic speakers, she does not accept Blust's proposition that it persisted only in the above-mentioned areas for several thousand years. Intoh suggests further linguistic research into the many different terms for weaving and loom parts is required before it is possible to know how this cultural complex was brought to the area: Melanesia to Micronesia, or vice versa, or both (1996:417).

When diffusionism was *de rigeur* in art history, Heine-Geldern (1932, 1937) proposed that the art of weaving was introduced into island Southeast Asia with metallurgy around 2500 years ago, during the Dongson expansionary phase in the Indo-Malaysian Archipelago. Heine-Geldern's hypothesis was based on several inter-related observations. First, an absence of archaeological evidence for weaving at early sites in Southeast Asia led him to conclude that weaving was not practiced in the region during the Neolithic period. He also recognized a congruence between certain dyeing techniques practiced by particular ethnic groups and certain design elements woven into their textiles. That is, Malays, Javanese, Balinese and Moslem groups from Lombok and northern Sulawesi dye cloth using the weft-ikat technique whereas groups from northern Sulawesi, Borneo and the Lesser Sundas dye cloth using the warp ikat technique. The two different groups also use different design elements. Heine-Geldern concluded that the weft ikat technique was introduced with Indian design elements into these islands by Hindu/Buddhists during the Indianization period, more than 2,000 years ago and the warp ikat technique and "old Indonesian" design elements were introduced by Dongson groups. Old Indonesian motifs included the S motif that occurs on Dongson bronzes and the "soul boat" motif, also known as the "ship of the dead" motif (Fig. 1.10), which he considered to be of either Dongson or Chinese (Late Zhou) origin.

Many textile scholars (Kahlenberg 1979; Fraser Lu 1988; Langewis & Wagner 1956) adopted Heine-Geldern's approach to textile history unquestioningly. However, as logical as it appears, the art archaeology approach to the history of textile technology in Southeast Asia is seriously flawed. It is based on two precepts:

(1) Dongson design elements occur on contemporary Southeast Asian textiles;

(2) Dongson drums (Fig. 1.11) have been found in the Indo-Malaysian Archipelago.

From this, scholars deduced that textile technology was introduced into island Southeast Asia by Dongson groups during the prehistoric period. The problem is that this is a syllogism. It does not establish that either textile technology or Dongson drums were introduced to the region in the prehistoric period. Apart from the obvious problems with population movements and cultural interaction in the historical period, Southeast Asian weavers have demonstrated a propensity to borrow "foreign" design elements. It is possible that the so-called "ship of the dead" motifs were introduced into the textile repertoire much later than the technology itself. Other Southeast Asian textile scholars (Vollmer 1977; Fraser Lu 1988) have drawn attention to archaeological evidence for the backstrap loom from the site of Shizhaishan in the former Dian Kingdom of Yunnan. Evidence takes the form of figurines in the round of spinners and weavers on bronze cowry containers (Fig. 1.12) dated to the Western Han dynasty (206 BC-AD 8). One weaver is depicted using a foot-braced body tension loom. Scholars cite this as the earliest evidence for looms in the Southeast Asian archaeological record and firm evidence for the origins of textiles in Southeast Asia.

The notable Southeast Asian textile scholar, Robyn Maxwell (1976, 1990), has put forward several different hypotheses for the origins of textiles in island Southeast Asia. First, J. Maxwell and R. Maxwell (1976) proposed a Dongson origin for Indonesian textiles. Later, R. Maxwell (1990) attributed the invention to Austronesian migrations into island Southeast Asia during the Neolithic. Maxwell cited the backstrap loom from Yunnan and extant remains of undated prehistoric textiles from Sarawak as evidence. However, there are two problems with this interpretation of the archaeological data. While the backstrap loom from Yunnan is of historical interest, it is far too late to be of consequence to the origin question and this dissertation will show that there is much earlier direct evidence for looms at Neolithic sites. Moreover, there is some confusion about the prehistoric cloths excavated from burials at Niah

Cave (1600 BC to 400 BC). Maxwell says "discoveries of twill weave vegetable-fibre fabric in the Niah Caves in Sarawak are the oldest woven fabric yet discovered in insular Southeast Asia" (1990:46). However, the twill basts (Fig. 1.13) to which she refers come from the Harrisson's excavations of wooden coffins at Lobang Tulang that belong to the Metal Age (B. Harrisson 1958). The earliest fragments of woven cloth in island Southeast Asia are fragments of 1/1 tabby weave excavated from the Cemetery sector of the Great Cave by the Harrisson team (B. Harrisson 1967; Cameron 1994).

Adams (1977) has drawn attention to a bronze sculpture of a weaver with a backstrap loom found on the small island of Flores in eastern Indonesia. The bronze (Fig. 1.14) was made using the lost wax technique and the loom is a foot-braced loom. As Adams recognized, the foot-braced loom is the most elementary type of backstrap loom with ethnographic parallels in northwest India, Vietnam, Taiwan, Hainan Island and Melanesia. However, the problem remains that the bronze is not securely provenienced and we have no way of knowing precisely when it arrived in Indonesia.

King (1979) maintained that the backstrap loom in Middle America originated from either Asia or Southeast Asia. King's hypothesis is an elaboration of the diffusionist argument put forward by Heine-Geldern and Elkholm (1951) based on strong parallels between Peruvian Mexican and Dusun looms. According to King, the backstrap loom was introduced into the Americas in Chavin-Olmec times during the Formative or Pre-classical period (post 3000 BP) when twining as a technique disappears from the archaeological record and woven cloth appears. King acknowledged that it is difficult to pinpoint origins from the distribution of contemporary looms but proceeds to do so because she firmly believed that the backstrap loom would be un-recognizable from the archaeological record and an accurate beginning date would be otherwise impossible to establish.

Beyer and de Veyra (1947:234) contended that textile technology was introduced into island Southeast Asia from Vietnam during the Metal Age and that the "the four great new industries (of the Iron Age) were metal working, pottery making, glass making and weaving". This contention was based primarily on cloth imprints on iron tools and weapons from Metal Age sites in the Central Philippines (see Jones 1964). Solheim (1964:20) also attributed textile technology to the Metal Age in the Philippines. According to Solheim, weaving belonged to groups called the Novaliches, trading people who came from the west of the Philippines and settled around Manila Bay, northern Palawan, and the Calamianes. The Novaliches introduced iron forging, bead technology, and the industries of cloth weaving into the Philippines between 400 BC and AD 1500. Jocano (1975) saw textile technology introduced to the Philippines along with iron and advanced pottery in the latter stages of the Incipient Period, around 2500 BP. Jocano's reconstruction was based on textile pseudomorphs on iron artefacts, spindle whorls, an undated textile fragment (ikat) from Banton Island and the presence of backstrap looms in the ethnographic record. Jocano concluded from this evidence that weaving replaced barkcloth production during the Iron Age in Island Southeast Asia.

A number of scholars have linked cloth production to language groups. Crawfurd (1820:176-178) proposed that cloth was first woven from bark fibres in Austronesian societies. Crawfurd's assertion was based on the usage of Sanskrit terms for cotton and silk with the Austronesian term for weaving in Southeast Asia. The linguist, Blust (1995:492) believes there is impeachable linguistic evidence for loom weaving by 6000 BP or earlier. This is based on the distribution of specialized words in the Austronesian languages spoken in Taiwan and island Southeast Asia (Bali, Borneo, Java, Flores, the Moluccas, Roti, Sumba, Sulawesi and Timor) as well as Madagascar. Blust identified reflexes of *tenun*, *tinequn* (to weave) (Taiwan, Philippines, Western Indonesia, Eastern Indonesia and *baRija* (Proto-Malayo-Polynesian) *balija* (batten of the loom) along with the Proto-Austronesian *gatip* and *gatip-an* (Taiwan, Philippines, Western Indonesia (breast beam) and *qaNi* (Taiwan, Western Indonesia) identified as a "weaving spindle". Blust's reconstruction is also based on ethnographic evidence for the backstrap loom on these islands as well as on its occurrence on several isolated islands in Melanesia (Banks Islands, Ontong Java, Santa Cruz) and the Pacific (the Carolines). Yet he has also noted that reflexes of *tenun* are absent on Pacific Islands where the backstrap loom has been reported. Blust considers the lack of cognate terminology in the Pacific leaves open the possibility of independent invention of the backstrap loom in Oceania. According to Blust, "Whether the horizontal backstrap loom is a sporadic retention or independent invention in the Pacific, the sparseness of its distribution in comparison with insular Southeast Asia is a striking fact that is in need of explanation" (1999:33). However, if linguistic evidence is to be used to reconstruct Southeast Asian textile history, the database needs to be improved. The lexicon pertaining to textile technology is more complicated and comprehensive than is currently held. The term weaving, for example, is too broad to be used for looms as basketry and netting are also woven. The term bark does not necessarily indicate beaten bark cloth as this research has found firm ethnographic evidence in Vietnam for bark fibres being spun and woven into vests. Moreover, historical documents discussed in Chapter 5 of the dissertation clearly indicate that bark was spun and woven into textiles in mainland Southeast Asia more than 2000 years ago. Many more different terms used in cloth production are necessary in the process of word excavation. Barber (1991) has provided a useful model by considering ancient textile terms in the order in which they are used by Aegean spinners and weavers. Terms include terms for specific fibres, verbs used to process them such as retting, combing, spinning and weaving as well as nouns for textile tools and dyes.

According to Bellwood (1987:151), the clothing of early Austronesians was of bark cloth whereas woven textiles were introduced into the Indo-Malaysian Archipelago later, by at least Western Malayo-Polynesian times (Fig. 1.15). Both Bellwood and Solheim noted the absence of prehistoric whorls south of Luzon in the Philippines and concluded that weaving was abandoned in this part of Island Southeast Asia during the prehistoric period. Bellwood proposed that, "weaving must have been replaced by bark cloth production in many areas (a conclusion also reached by Ngo (1985) to explain the shift away from cord-marked pottery to the south of Taiwan) but since weaving was so widespread ethnographically, an initial retraction followed much later by possible expansion, perhaps with more suitable fibres of mainland origin such as cotton may have occurred" (1985:226). This dissertation will demonstrate that an absence of whorls in the archaeological record does not necessarily preclude loom weaving.

More recently, Lu (1997-1998) proposed that textile technology originated in North China and diffused slowly to South China during the Neolithic period. According to Lu, spindle whorls first appear in the Yellow River Valley in the Peiligang assemblage, dated between 8000 and 7800 BP. Lu cites a re-worked square potsherd (Fig. 1.16) from the site as the earliest evidence for spinning in China and maintains that the usage of this re-worked sherd from Peiligang rather than an implement designed specifically for the task of spinning indicates that yarn manufacture was at an early stage of development. Lu argued that soon after the initial occurrence of the spindle whorl in the Middle Yellow River Valley, this implement made of fired clay was widely used in the Yellow and Yangzi Valleys, by 7000 BP. However, this study will show that there are earlier examples of basic whorl types with rice in an autonomous prehistoric textile zone in South China.

The Origins of Barkcloth Production

A number of scholars have examined the origins of barkcloth technology in Southeast Asia independently to that for textile technology. The dominant paradigm forty years ago was that barkcloth technology originated in China and diffused into Southeast Asia and the Pacific during the prehistoric period. Hunter (1957) first put forward the hypothesis in his history of paper based on his observations that the Malayo-Polynesian words for barkcloth, *tapa* and *kapa*, were used in ancient Chinese historical documents for locally produced bark cloth more than 2000 years ago. Ling (1961) discussed the historical evidence for Chinese barkcloth in considerable detail and pointed out that China's important role in this technology has been obscured by a lack of ethnographic parallels due to economic factors. He argued that bark cloth technology originated in the Huang and Huai Plains of North China, passed through the valleys of the Yangzi and Han rivers to south China, and then on to the islands of Taiwan and Hainan before moving onto Indonesia, via Vietnam, the Malay Peninsula and finally crossing the Indian Ocean to reach Africa, via Madagascar. Using dynastic records, Ling explained that barkcloth production was abandoned in China during the early dynastic period when greater economic returns could be obtained from processing bark into paper. In a second paper, Ling (1962) traced the movement of the technology from Mainland China to Taiwan, the Philippines, Malaysia and Indochina as well as Central America. This paper drew from linguistic, historical and archaeological evidence in the form of stone barkcloth beaters. Based on the distribution of stone barkcloth beaters in the archaeological record, Tolstoy (1963) has long been of the opinion that barkcloth technology and paper-making were transmitted from China to Meso-America via the Pacific Islands.

Bellwood (1976, 1980, 1985, 1997) and Blust (1979, 1995) link barkcloth production to the Austronesian language and prehistoric migrations. Both scholars believe the technology was known to ancestral Austronesian groups in Taiwan and introduced into the Indo-Malaysian Archipelago and the Pacific around 3000 years ago. Blust clearly states that although the linguistic evidence for bark cloth production and weaving is very sketchy, there are good archaeological and ethnographic reasons to show that the manufacture of bark cloth and co-existed with loom weaving from the earliest reconstructable period of Austronesian prehistory (Blust 1999:33). Bellwood has demonstrated this archaeologically by showing the distribution of bark cloth beaters at archaeological sites in Taiwan, Northern Luzon and the

Central Philippines. Bellwood has convincingly argued that the clothing of the Early Austronesians was of bark cloth, beaten from the inner bark of Manila hemp or abaca *(Musa textilis)*, paper mulberry *(Broussonetia papyrifera)* and breadfruit *(Artocarpus* sp.). According to Bellwood,

> ...one of the most significant points about bark cloth beaters is that they are generally only found in island Southeast Asia and its closest mainland fringes, particularly in Austronesian speaking areas, while most of the mainland sites produce spindle whorls instead. This may be clothing; a tradition which is of course of paramount importance in Oceania (Bellwood 1979:173).

Neither Bellwood nor Chang (1989) have interpreted the ungrooved stone implements from South China put forward by Ling (1962) as evidence for barkcloth production, notwithstanding the fact that Chang believed that "the barkcloth beater must be part of the cultural equipment of the whole region (Southeast China and Taiwan). According to Chang, so far it (the barkcloth beater) has not been identified in the mainland sites where spindle whorls and wooden shuttles for weaving looms (which are the oldest shuttles known) have been unearthed" (Chang 1989: 96, 97). Recently, however, Chinese archaeologists have recovered unambiguous stone bark cloth beaters from sites in the Pearl River region (see Chapter 4) which have necessitated a complete re-appraisal of bark cloth technology.

The Region Defined

Initially, the study area was confined to countries in mainland Southeast Asia (South China, Vietnam, Cambodia, Laos and Thailand). Myanmar was not included in the study because of a lack of archaeological materials from excavated sites. In 1999, the scope of the study was extended to include data previously identified from sites in Taiwan and island Southeast Asia.

The Hypothesis

The central thesis put forward in this dissertation is that textile technology developed independently in the Yangzi Valley of South China before 7000 BP amongst Neolithic groups with wet rice agriculture. Cloth production flourished in an autonomous textile zone for several millennia before the technology moved into mainland and island Southeast Asia during the prehistoric period. The process was the result of displacement when groups moved from the *zhongyuan* into the Yangzi Valley and Lingnan, a process of expansion that took several millennia.

Research Aims

- The principal aim of the study is to fully document the archaeological evidence for cloth production in the Southeast Asian archaeological record ;
- To map the distribution of cloth production tools throughout Southeast Asia;
- To produce a typology of prehistoric Southeast Asian spindle whorls;
- To produce a typology of prehistoric Southeast Asian bark cloth beaters;
- To provide new insights into the origin(s) of textile technology and barkcloth in mainland and island Southeast Asia;
- A primary, albeit ambitious aim is to engender Southeast Asian archaeology and demonstrate a relationship between women and spinning in the prehistoric period;
- Through the documentation of the archaeological evidence for cloth production at archaeological sites in Southeast Asia, the study aims to demonstrate women's important economic contribution in the prehistoric period.

The Data

The archaeological evidence for cloth production in Southeast Asia is small and fragmentary and located in many disparate sources. Much of the information comes from primary sources in Chinese, Vietnamese, Thai, and French. The artefactual evidence retrieved for the study included extant fragments of cloth, textile pseudomorphs, spindle whorls, loom parts, barkcloth beaters, loom weights, dyes, spinning bowls, textile stamps, rollers, depictions of clothing and textile production on cave walls, bronze artefacts, statuary and bas reliefs. However, it must be stressed that whorls are the main focus of the study.

Methodology

The dissertation is an exercise in culture history based on typologies. Typologies are analytical tools devised by archaeologists (and art historians) to show stylistic variation in material culture. They are based on the premise that variation in material culture is not an individual construct but culturally prescribed "ways of doing things" (see Conkey and Hastorf 1990). As Sackett (1977) pointed out, variation in material culture is a product of function *and* cultural (ethnic) preference. Sackett argued that stylistic variation in artefacts is diagnostic because choice is generally consistent. In his view, style can express different levels of ethnic resolution ranging from kinship groups to clans and great cultural history complexes. While reconstructions of prehistoric cultures have long been based on pottery typologies (see Rice 1987), typologies of Southeast Asian spindle whorls have not hitherto been developed for this purpose. Yet spindle whorls are no different from other pottery. Like other forms, choices are made as to material composition, size, shape and decoration. The variation articulated in spindle whorls should enable archaeologists to make inferences about the movement of the hand spindle and spinners and weavers in the prehistoric period.

Typologies are inherent in Chinese archaeology. As early as the Warring States period (ca. 450-221 BC), Chinese artefacts were classified in this way. As Chang (1986) points out, typologies of Chinese bronzes and jades attributed to the Yin (Shang) (1520 - 1030 BC) and Han dynasties (221 BC - 220 AD) are amongst the surviving texts of the Sung dynasty (960-1279). Notable examples are the *Gaogudu* compiled in 1092 and the *Bogudu* compiled between 1107 and 1110 (revised 1119-1125). These typologies were based on very large samples. For example, the latter described 939 different artefacts in imperial and private collections in terms of stylistic variation. Kuhn's (1988) typologies of atypical and typical Chinese spindle whorls discussed above appear to be the earliest typologies of Chinese spindle whorls. The typologies of Southeast Asian spindle whorls produced in this study are the first developed for this class of artefact.

Fieldwork

Several seasons of fieldwork were undertaken during the course of the candidature. In 1996, museum research was initially conducted in mainland Southeast Asia to ascertain if there was sufficient archaeological evidence for cloth production in several museum and archaeology collections for a PhD dissertation. Research at the National Museum of Cambodia (formerly *Musée Albert Saurraut)* failed to locate the whorls recovered during French excavations on the Tonle Sap Plains, so indirect evidence for cloth in statuary and bas-reliefs from the Indianization period was briefly examined. Unlike other Southeast Asian countries where textile traditions are well documented, little is published on Khmer textile technology. Master Weavers were located in the Royal Palace (Phnom Penh) and technical discussions were held with them. The weavers subsequently took me to their maternal villages in Takeo to show me ancient tools no longer in use. As tools survive in the archaeological record more often than prehistoric textiles, a detailed knowledge of the different types of tools used in this region at the cross-roads between India and China was essential. Another objective of this fieldwork was to ascertain if there were any parallels between contemporary Khmer, Indian or Chinese textile technology that might indicate technological transfer.

Some whorls from French excavations in Cambodia were located in the History Museums in Ho Chi Minh City and Hanoi (formerly *L'École Française d'Extrême Orient).* Although much archaeological research has been undertaken in Vietnam since the French colonial period in Indochina (1859-1954), most results are published in Vietnamese. For this reason I returned to Vietnam in 1997 to undertake 3 months intensive research into prehistoric crafts at the Institute of Archaeology in Hanoi under the supervision of Hà Văn Tấn and Nguyễn Kim Dung. During this period, archaeological materials relevant to the study in the Vinh Phu Museum, Ha Tay Museum, Quang Ninh Museum, Thanh Hoa Museum, Sa Huynh Museum, and the History Museum in Ho Chi Minh City were also investigated.

At the invitation of the co-directors of the Origins of Angkor Project (Charles Higham and Rachanie Thosarat) of the Otago Department of Anthropology and the Fine Arts Department of Thailand, I traveled to Phimai (Northeast Thailand) in 1997 to analyze spindle whorls from the sites of Ban Lum Khao, Noen U-Loke and Non Muang Kao. Each whorl was weighed, measured, drawn and its functional attributes recorded for comparative purposes. Pottery colour was measured using Munsell's Soil Chart and all decorated whorls were photographed.

In September 1998, a month was spent at Peking University on an official exchange between Peking University (Beijing) and the Australian National University. Lengthy discussions were held with Chinese archaeologists from the university and further information was retrieved from the library in the Archaeology Department. Evidence for cloth production housed in several Chinese museum collections was also examined. Discussions were also held with Professor Ma and Fan Dongqing from the Shanghai Museum. The textile tools from the open-air museum site of Hemudu in Zhejiang Province were also investigated. In addition, discussions were held with archaeologists from the Fujian Provincial Museum but it was not possible to analyze whorls from the collection as the Fujian Provincial Museum had been demolished and all artefacts were in storage, pending reconstruction.

In Taiwan, cloth production tools displayed in the Archaeology Museum of the National University and the National Museum were investigated. While the data could not be weighed nor measured, some general observations were possible. The functional attributes of spindle whorls from Neolithic, Bronze and historical sites in the Philippines National Museum were also recorded.

Laboratory Analysis

Several different types of cloth production tools were forwarded to me at the Research School of Pacific and Asian Studies at the ANU for analyses. These included spindle whorls from Shutler's (1985) excavations at Andarayan (the Philippines), whorls and rollers from Karlstrom and Karlgren's (1999) excavations at Lao Pako (Laos) and an iron spearhead bearing traces of prehistoric textiles from Sayavongkhamdy and Bellwood's (1999) excavations at Tam Hua Pu (Laos). Fragments of prehistoric textiles from excavations in South Sulawesi undertaken by archaeologists involved in the Origins of Complex Society in Sulawesi (Bulbeck & Prasetyo 1999) were also analysed as part of the study but the results are not included because of dating problems. The tools from Laos were analysed with the Light Microscope and Digitizing Camera. Dye analysis was undertaken on the pottery rollers using an Ultra-Violet lamp of the long wave type, an experiment based on the principle that under ultra violet light, dyes fluoresce and the colour and intensity of the fluorescence is unique to each dye. The mineralized fragments of cloth on the spearhead from Tam Hua Pu were also analysed using the Scanning Electron Microscope (SEM) from the Electron Microscopy Unit (ANU). The material composition of the fibres in the archaeological textiles from Sulawesi was also identified using this technique. As minerals are the basic components of natural dyes and mordants, these were also measured using EDAX (Energy Dispersive X-Ray Analysis).

Arrangement of the Material

The dissertation consists of two separate volumes. Volume 1 is comprised of 10 chapters of text. To maintain clarity, the chapters are divided into discrete geographical zones. Each chapter focuses on a specific area of Southeast Asia and evidence for cloth production is discussed chronologically within each zone. The region known as South China is defined in Chapter 2 and the earliest evidence for cloth production is identified. In this chapter, an argument is advanced for the re-interpretation of some stone discs in the Chinese archaeological record as spindle whorls. Chapter 3 is concerned with regional variation in spinning technology and the movement of prehistoric groups from an autonomous prehistoric textile zone in Southeast China into Southeast Asia. It focuses on evidence for spinning in

Southeast China, Taiwan, Island Southeast Asia and parts of the Western Pacific. The chapter also attempts to explain the lack of whorls in parts of Island Southeast Asia and Oceania. In Chapter 4, the focus returns to South China where little known evidence for barkcloth production has been excavated. A possible depiction of a prehistoric loom from the Pearl River region is also discussed as well as data from Yunnan. Chapters 5, 6 and 7 are concerned with new evidence from Vietnam, Cambodia and Laos. Chapter 8 focuses on evidence from prehistoric sites in Thailand and presents the results of my analysis of the spindle whorls from the Bronze Age site of Ban Lum Khao (Northeast Thailand). Chapter 9 presents the results of my analyses of whorls from the Iron Age sites of Noen U-Loke and Non Muang Ko. Chapter 10 gives a final synthesis of the data and my reading of the evidence for cloth production in Southeast Asia. This concluding chapter also addresses unanswered questions raised during the research and proposes some new directions for further study. Volume 2 is comprised of figures that document the material evidence for cloth production and demonstrate the uniformity of the archaeological evidence.

Chapter 2

South China, Part 2

The Region Defined

For the purposes of this study, the geo-political region known as South China includes the prehistoric cultural complexes of the Yangzi Valley as well as those from Southeast China and part of the area known as Lingnan, immediately south of the Five-Mountain Ridge, along latitude 25°N. This is an integral part of Southeast Asian prehistory as South China was not influenced by the Han Chinese until the Qin (221-206 BC) and Han dynasties (206 BC - AD 220) and some ethnic groups in the region were never completely sinicized (N. Tapp. pers. comm.). As Higham (1996:1) points out, there is a logical case for including southern China in Southeast Asian prehistory, as the languages and customs of the many different ethnic groups in the region show greater affinities with the south than with the *zhongyuan* (the Chinese central plains).

Archaeologists have established the presence of prehistoric groups in the region before the terminal Pleistocene (20,000-10,000 BP) through the Neolithic to the historical period (see Lu 1999). Historical records from the second century BC indicate that during the first millennium BC, South China was occupied by numerous hierarchical groups with independent chiefs. Ancient Chinese documents also indicate that the lower Yangzi was under the jurisdiction of Yangzhou in the Xia Dynasty; the territory of the Yue State during the Spring and Autumn period (771-481 BC); and annexed to the Chu state during the Warring States period. Groups living along the southeast coast were known to the Chinese as the Yueh, or the "Hundred Yueh". According to Meacham (1999:123), the Yueh were noted for their navigational skills and their savagery in battle. The early state of Yueh (5th-4th centuries BC) centred in the Lower Yangzi practiced riziculture (wet rice) and engaged in trade along the coast.

For the purposes of this dissertation, South China has been sub-divided into several sections. This chapter is concerned with data from the Yangzi Valley sites shown in the Chinese chronology of Neolithic cultural traditions (Figure 2.4). Chapter 3 is concerned with data from coastal Southeast China, Taiwan and Island Southeast Asia. Chapter 4 focuses on data from Guangdong, Guangxi, Hong Kong (Lingnan) and Yunnan (Southwest China).

Origins Revisited

Lu (1997-1998) has followed the dominant paradigm in Chinese culture history and attributed the invention of spinning and weaving to Chinese from the Yellow River region. As stated in Chapter 1, Lu interpreted a re-worked pottery sherd (Figure 2.2) from the site of Peiligang as the earliest extant spindle whorl in China. The Peiligang assemblage dates from 8000-7800 BP. Lu's hypothesis is based entirely on the interpretation of this square-shaped sherd as a spindle whorl. She argued that modification of the sherd for spinning indicates that yarn manufacture was in an early stage of development and, by 7000 BP, the technology had diffused to the Yangzi region. However, there are problems with Lu's interpretation of the textile evidence, not the least being the spindle whorl on which her hypothesis is based. Square spindle whorls are not amongst the basic types in Kuhn's typologies of Chinese spindle whorls (Figure 2.3). The basic flywheel on which the spindle whorl is based has a high Moment of Inertia (Tipler 1982:268); this enables it to spin. Loughran-Delahunt's (1996) functional analysis of Northwest Coast spindle whorls shows that modifications of the basic round flat disc type simply improve Moment of Inertia. In contrast, the square-shaped pottery sherd from Peiligang has a low Moment of Inertia. The main problem is that while the re-worked pottery sherd from Peiligang could have functioned as a whorl, it is more likely to have been an improvisation rather than an autochthonous type from which spindle whorls derived. Otherwise, re-worked square pottery sherds would be found in the earliest layers of spindle whorl sites throughout China (North and South) and in other parts of the world. Moreover, this chapter will demonstrate that there are flat perforated discs from Early Neolithic sites in the Yangzi Valley (Figure 2.1) with the functional attributes of spindle whorls from which later forms are clearly derived. Along with other indirect evidence for cloth production, these unambiguous whorls suggest that spinning and weaving originated independently in the Middle Yangzi Valley before spreading to the lower Yangzi and Southeast China.

The Middle Yangzi Valley

This research clearly shows that three of the Early Neolithic cultural complexes with wet rice agriculture in South China (Figure 2.4) produced firm archaeological evidence for textile technology. These are Xianrendong, Chengbeixin and Hemudu (Chapter 3). It is significant that the earliest evidence for cloth production thus far comes from Early Neolithic sites in the Middle Yangzi with wet rice agriculture. The relationship between agriculture and cloth production is discussed more fully in the final chapter.

Xianrendong

From an origins perspective, the Early Neolithic site of Xianrendong is central. Xianrendong is located in the Dayuan Basin of Wan-Nian County in Jiangxi Province (PRC), less than 300m from the late Palaeolithic site of Diaotonghuan (Figure 2.1). As the chronology of Chinese Neolithic cultures shows, the Middle Yangzi Valley sites are the earliest Neolithic sites identified in the Yangzi region. Xianrendong was first excavated in the 1960's (Jiangxi Administration of Cultural Relics 1963; Jiangxi Provincial Museum 1976). Along with Diaotonghuan, the site was excavated again over two seasons between 1993 and 1995 by members of the Sino-American Jiangxi (PRC) Origin of Rice Project Team (SAJOR) (McNeish *et al.* 1995; 1997; 1998; Zhang Chi 1999) which included archaeologists from the Department of Archaeology at Peking University, the Jiangxi Institute of Archaeology, and the Andover Foundation for Archaeological Research. A third season was planned for SAJOR in 2001 and the author was invited to join the team to analyze the archaeological evidence for spinning but the program was postponed due to McNeish's untimely death. Consequently, this section is confined to my interpretation of the detailed descriptions of the cultural materials contained in the first preliminary report and two annual reports on the SAJOR excavations (McNeish *et al.* 1997; 1998), pending more thorough analysis when the program resumes.

Archaeologists estimate that Xianrendong was occupied between 20,000 and 8,000 BP. The earliest uncalibrated radiocarbon date is 19,770 ± 360 BP with most dates falling between 17,640 ± 60 and 12,430 ± 80 BP (Chen Xingcan 1999; Zhang Chi 1999). However, as Zhang Chi (1999) points out, the cultural phases at Xianrendong are very complicated. There are differing opinions concerning the cultural sequences and it is not possible to compare deposits produced from different excavations of Xianrendong. While there is a general consensus that four cultural phases are represented, Chinese archaeologists classify them as Neolithic 1 to Neolithic 4. McNeish saw the earliest phase (Neolithic 1) as Incipient Neolithic and designated it as the Xian Ren Phase. The following periods were classified by McNeish as the Initial Neolithic (Wang Dong Phase), the Early Neolithic (Jiangxi Phase) and the Middle Neolithic (Wan-Nian Phase).

Whorls were identified amongst the cultural materials at Xianrendong although archaeologists are not agreed about taxonomy. Figure 2.5 shows stone perforated discs called "pierced flat pebble discs" found in all sequences but opinion is divided in Chinese archaeology about the function of this class of artefact. All five examples shown in the figure were re-worked pebbles with their edges chipped to make them round. Each disc had a bifacially pecked central perforation. In the preliminary report of the Sino-American Jiangxi (PRC) Project, McNeish stated, "It has been suggested that the discs were large spindle whorls or digging stick weights but we have no evidence to support either opinion" (McNeish and Libby 1997:32). Identification problems have arisen because of traditional ideas about the material composition of spindle whorls in China. Most archaeologists believe that the earliest spindle whorls are made from pottery. The stone-perforated discs that occur in large numbers in the Chinese archaeological record are identified as either ritual discs or stone digging implements, the stone disc functioning as a club head. The dominant view put forward by Kuo Pao-chun (1948), Chou Nan-chuan (1985:82) and Willetts (1958:94, 1948:4-5) is that spindle whorls appear late in the archaeological record in China. More recently, Green (1993:105) has proposed that ceremonial stone discs known as bi *actually* provided the prototype for the spindle whorl. In contrast, archaeologists from the Jilin Museum (Zhang Ying and Jia Ling 1979) consider some of the stone perforated discs excavated from Neolithic and Metal Age sites in China to be spindle whorls and that *bi* might actually be derived from whorls. The prehistoric discs in question are made from many different types of stone (sandstone, basalt, andesite, slate, diorite and hornstone). As with pottery whorls, the earliest stone examples have rough surfaces and are crudely worked whereas whorls from Late Neolithic sites are better worked and frequently polished.

My own observations of Neolithic spindle whorls in Chinese museums showed a gradual trend towards greater diversity of shapes and more complex decorations over time. In 1979, Jia Ling and Zhang Ying from the Jilin Museum proposed that Chinese stone-perforated discs ought to be reclassified as spindle whorls. In a paper devoted to stone discs, the authors made a strong case for the re-interpretation of this class of artefact in Chinese archaeology as spindle whorls, based on archaeological data, physics and ancient Chinese inscriptions. Jia Ling and Zhang Ying recorded the functional attributes of an assemblage of stone perforated discs from Early Neolithic to the Late Bronze Age sites and observed a clear trend in the development of the spindle whorl over time which transcended material composition (Table 2.1).

Using these criteria (size of perforated disc and its central perforation), the authors re-defined the earliest stone discs in the assemblage as whorls and established technological continuity from the Early Neolithic period. Zhang Ying and Jia Ying were also influenced by the presence of stone perforated discs amongst pottery spindle whorls in female graves in Saodagou and in tombs belonging to the Middle Warring States period at Huangshantun in Huangdian. The central perforations of the stone discs measured slightly less than 2 cm in diameter. That is important for identification purposes as it militates against their identification as digging weights. As they point out, the wooden core that held the disc would have been too thin and flexible to have functioned as a digging tool without bending or breaking. The central perforations of the discs in Table 2.1 have a ratio of about 1:8 of the diameter of the disc. This, they argue, makes it "unimaginable to use stoneware of 17.8 cm (number 11) with a handle of 2 cm as with the Baicaogou disc" (Zhang Ying and Jia Ling 1979). The museum archaeologists further support their argument by quoting references to stone spindle whorls in oracle bone inscriptions from Shang sites.

Number	Site	Shape	Diameter (cm)	Central Perforation (m)	Reference
1	Zenpiyan, Guangxi	spherical	8	0.7	Wen Wu 3, 1976
2	Zengpiyan, Guangxi	spherical	8	1.1	Wen Wu 3, 1976
3	Tomb with bronze daggers in western Huangshantun, Huadin, Jilin, M5	spherical	5.4	0.6	Archaeology and History in Northeast China 1, 1982
4	Tomb with bronze daggers in western Huangshantun, Huadin, Jilin, M5	spherical	7.5	0.2	Archaeology and History in Northeast China 1, 1982
5	Jingu grave in Yanbian, Jilin	disc	12.5	1.8	Archaeology and History in Northeast China 1, 1982
6	East Tuanshan, Jilin	spherical	6.4	1.9	File Number 0934 Jilin Museum
7	Shanbo Yingzi, Zhemengnaiman	disc	9.5	1.8	File Number 3976 Jilin Museum
8	Baicaogou Wangqing, Jilin	disc	11.5	1.9	File Number 1333 Jilin Museum
9	Saodagou, Jilin	disc	4.2	1.94	File Number 0664 Jilin Museum
10	Xinhua Grave, Wangqing, Jilin	spherical	3.5	0.4	Museum Study 1 1984
11	Baicaogou Wangqing	disc	17.8	2.0	File Number 1401 Jilin Museum

Table 2.1 *Dimensions of stone discs from Chinese archaeological sites (Zhang Ying & Jia Ying 1979:170).*

Further research into Chinese site reports in the Archaeology Library at Peking University revealed that other scholars have also identified stone-perforated discs from Neolithic sites in other provinces as whorls. In Jiangxi Province, stone whorls (Figure 2.6) were identified amongst the cultural materials excavated from Neolithic sites in the dam area of the Three Gorges in the Middle Yangzi (Wang and Wang 1997:175). Eight flat stone discs from the earliest layers at Dadunzi in Jiangsu Province were also identified as whorls. Stone whorls were also identified at Banpocun (Chen Zhenyu 1997). In Hunan Province, fifteen stone whorls were identified at the site of Miaodigou (Anon. 1959a). In Zhejiang province, stone whorls were identified in the earliest assemblages at Hemudu (discussed below) and in the Pearl River region in Guangdong (Chapter 3). It is also worth noting that prehistoric stone discs have also been positively identified as spindle whorls in many other parts of the world. Manifold examples occur in the archaeological record of the Mediterranean, Europe, the Middle East, and North America (Barber 1991; Crewe 1997; Loughran-Delahunt 1996).

My research also shows that stone spindle whorls are still used by traditional groups in British Columbia (Kissel 1916; Vanderberg 1953; Marr 1979). Vanderberg (1953) has documented the use of stone spindle whorls amongst the Salish who live on the Northwest Coast of British Columbia. Vanderberg's research specifically shows that the Northern Salish, Nootka, Kwakiutl, Bella Coola and Tsminsian make stone spindle whorls from sandstone, balsaltic rock and steatite. Loughran-Delahunt's (1996), functional analysis of Salish whorls shows that stone whorls function as well as whorls made from other materials. The common nettle plant *(Urtica dioica)* is spun by the Salish with stone whorls of the type found at Xianrendong. It also seems of more than passing interest that this plant is thought to have originated in China (see Bray 1984). European textile studies show that Neolithic groups in northern Europe and Eurasia also spun the common nettle with stone whorls (Koie 1943:98-102; Manninen 1932:185, 352). According to Hald (cited in Kuhn 1988:30), nettle fibres spin well. As stated in the introduction, weight is the critical factor in the performance of any whorl. Barber's (1991) study of spindle whorls indicates that the weight of a whorl is related to the weight and length of fibres. Short stapled, light fibres cannot be spun with heavy whorls. Conversely, heavier long stapled fibres are better spun with whorls made from heavier materials such as stone. Nevertheless, while stone whorls spin more slowly than pottery whorls, they are still functional. The numbers and distribution of stone-perforated discs at Xianrendong is shown in Table 2.2. While stone discs occur in all Neolithic phases, only the discs from the Wan-Nian phase (Neolithic 4) were positively classified as whorls by McNeish, presumably because they occurred with sherds impressed with textiles. The criteria for identification are unclear and there are some inconsistencies in the report. One perforated stone disc (n) from the Wang phase, for example, was identified as a "flat pierced digging implement". An artefact with similar morphology from the Jiangxi phase was also identified as a digging implement yet it measured less than 4 cm in diameter. A stone disc from the Wan Nian phase was identified as a digging implement whereas a ground stone disc (h) from the same sequence was identified as a whorl (McNeish *et al.* 1999:47, 49). There is no mention of use-wear marks.

Phase	Provenience	Numbers
Neolithic 4 Wan Nian	WX surface 1A WWB WW F5 WX 1A –1B	2 0 0 1
Neolithic 3 Jiangxi Phase	WX 1B WX 2A WX 2B WX 2C WX C1 WX 3A WW Lower F, C2 WX 3B1	0 0 0 1 0 0 0 0
Neolithic 2 Wang Dong Phase	WX 3B2 WW D WX 3C1A	0 1 0
Neolithic 1 Xian Ren Phase	WX E WX 3C IB WW F WWG WWH WWI	0 0 0 0 0 0
Yangzi EPI Palaeolithic	WWJ WWK WWL WWM	0 0 0 0

Table 2.2 *Distribution of flat pebble discs at Xianrendong (after McNeish et al. 1997:25).*

The size of individual discs is not given in the report, simply an average diameter of 6.8 cm with central perforations averaging 1.2 cm (McNeish *et al.* 1999; McNeish and Libby 1997). The largest stone discs in the assemblage measuring 11.2 cm are within the accepted range of Chinese Neolithic spindle whorls shown by Kuhn (1988) to range in size from 2.6 cm to 11.2 cm with central perforations ranging from 0.35 cm to 1.2 cm (Table 2.3). If the largest discs are eliminated because of ambiguity, a number of discs from Xianrendong still fall well within Kuhn's established range for Neolithic whorls.

Whorls	Central perforations
Diameter (cm) 2.6 –11.2 **Thickness (cm)** 0.4-3.2 **Weight (g)** 12- 100.3	0.35-1.2

Table 2.3 *Measurements and weights of Chinese spindle whorls (Kuhn 1988:151).*

Figure 2.7 shows the different types of surface decoration on the Neolithic pottery from Xianrendong, which involved worked fibres: twine, cord, netting, spun thread and woven cloth. Table 2.4 shows the distribution of each of these categories identified by Hill and Vandiver (MacNeish *et al.* 1995) in all phases. However, as cloth production was not the primary focus of their pottery analysis, finer details pertinent to this study were secondary. Notwithstanding this, a few general observations can be made from descriptions. First, plant fibres were used to decorate much of the pottery in the assemblages with traces present on sherds from all four Neolithic phases. Of the 908 sherds recovered, 86% (781) were classified; of these, 61% (552) showed traces of plant fibres. The different categories described include Xian Grass Wiped, Xian Opposed, Wang Cordmarked, Dayan Net-Impressed, Xian Cordmarked, Xian Twine Impressed, Jiangxi Cordmarked, Wan-Nian Cord-marked, Wan-Nian Twine Impressed and Wan-Nian Textile Impressed. These different categories show developments in fibre manipulation over the Neolithic period but before the technical significance of certain types of impressions can be fully appreciated, a few basic principles about fibres need to be explained.

Fibres are the basic components of all types of fabric construction from netting and basketry through to matting and textiles. Plant fibres of sufficient length can be worked singly or doubly without twisting or spinning to produce a wide range of artefacts. They can be wound around each other between the palm of the hand, on the thigh, or spun. The main difference between twisting and spinning is that the twisting process does not draw out or extend the length of fibres. As stated previously, spinning is a more advanced technique of fibre preparation, requiring specialized tools (hand spindle or spinning wheel). Hand spinning differs from manual twisting in that it enables fibres to be drawn out more easily and the necessary twist given at a specific length (Braudel 1981:334). As Kuhn (1988:70) points out, the hand-spindle constituted an outstanding technological achievement of Neolithic times, a 'revolution' in textile production. While unprocessed and twisted fibres can be used for basketry, netting and matting, spinning produces produce long, continuous fibres that are well suited to loom weaving.

Table 2.4 shows Xian Grass Wiped sherds were found only in zone 3C1B. The interior and exterior surfaces of these sherds were marked by "parallel striations from smoothing using grass" (Hill 1995:36). The marks were formed when plant fibres were quickly wiped over wet clay before firing. Although McNeish first thought the sherds were cord-marked, plasticine impressions failed to show well twisted fibres and further analysis revealed that the fibres were not twisted or spliced or spun into cords but "the wrapping element seems to have just wrapped fibre" (McNeish 1997 *et al.* :15). Cord is first evidenced on sherds classified as Xian Opposed and Xian Cordmarked. Xian Opposed sherds are marked by two parallel 2 ply Z twist cord impressions applied to the exterior and interior of vessels. According to Hill, the cord size was around 1.2 mm. The smoothed nature of the impressions led Hill to conclude they were created during the forming or smoothing process.

Phase	Period	Evidence for fibre manipulation
Wan-Nian (Neolithic 4)	Middle Neolithic	spindle whorl? Wan-Nian twine impressed pottery Wan-Nian textile impressed pottery Wan-Nian cord impressed pottery
Jiangxi (Neolithic 3)	Early Neolithic	spindle whorl? Jiangxi cord impressed pottery Dayuan net impressed pottery Jiangxi textile impressed pottery
Wang Dong (Neolithic 2)	Initial Neolithic	spindle whorl? Wang net impressed pottery Wang twine impressed pottery Wang textile impressed pottery
Xian Ren (Neolithic 1)	Incipient Neolithic	Xian (Grass) wiped pottery Xian twine impressed pottery Xian opposed

Table 2.4 *Distribution of pottery with traces of twisting, spinning and weaving at Xianrendong.*

Plying is a process whereby twisted or spun threads are doubled. The fact that cord was plied at Xianrendong indicates that the Neolithic groups at the site understood how to manipulate fibres in order to give them greater length and tensile strength. The simplest way to ply thread is to catch it in the middle, bending one end back (still under tension) until it touches the other end before letting go of the middle. The thread twists quickly but briefly in the opposite direction to the original spin forming a double thread (Barber (1991). While spindle whorls are also used for plying, it is not clear from Hill's descriptions if the cord was spun or simply twisted.

Cord is defined here in the strictest sense as "a thread-like textile structure composed of one or more threads, either tightly twisted or corded together" (Kuhn: 1988:62). Chinese scholars have classified cord in this way since the *Shuo Wen Chieh Tzu* (Analytical Dictionary of Characters) compiled in AD 121. Cord marks were observed on 52 sherds from the earliest layers. The pottery had the same composition as the Xian Grass Wiped sherds but differed in that the cord impressions only occurred on the outer surface of the vessels. The cord widths were less than 3 mm. All of the impressions are of two-ply Z twist cords.

The sherds classified as Xian Twine Impressed are pertinent to the research. Twining involves the turning of two or more elements about each other to enclose other elements (Emery 1980:64). In technological terms, twining is significant as it indicates that the prehistoric groups invested time in fibre preparation, a process that is a precursor to spinning. Rather than simply obtaining a piece of vine to impress pottery, fibres were actually manipulated through twisting. Hill interprets the Xian Twine-Impressed sherds as evidence for matting. According to Hill, "the matting is made from 2-ply Z twist cordage. The cordage varied in width between 1-3 mm." and "...some sherds of Xian Twined fabric are cord impressions that overlap at 90°. Six sherds have twined fabric on their interiors..." (Hill 1995:38). Twined fibres continue in the archaeological record at Xianrendong throughout the Neolithic 3 phase and it is worth noting that twining disappears during the final stages of occupation (Neolithic 4) once spinning is well established. The exterior surfaces of the Wang Cord-marked sherds are impressed by a 2-ply Z twist cord-wrapped paddle or dowel. The cord impressions range from 2 to 3 mm in diameter. Unlike the impressions in the earlier phases, the Wang Cordmarked impressions extend vertically up the vessel and occasionally over the lip of the vessel.

The presence of Dayuan Net Impressed sherds in the Neolithic 2 suggests that the increased tensile strength given to the fibres through twisting in the earliest layers may have been required for netting. According to McNeish, the Dayuan Net Impressed pottery shows "that yarns and/or cords were tied together with a sheet-bend knot to make nets with a 1 cm mesh" (McNeish *et al.* 1997:43). Figure 2.9 gives an example of this particular technique. There can be little doubt that the bone needles with mid-point eyes in the Early Neolithic layers at both Xianrendong and Diaotonghuan were used for netting. It may not be coincidental that the Wang Phase is characterized by a reduction in refuse from large game and that nets are commonly used for small game and fishing.

Textile scholars (Emery 1980:27) classify fabric structures in terms of the sets of elements interworked. Fabric structures are divided into four main categories: single element, two-single elements, one set of elements and two or more sets of element structures. The first category includes netting that is built up by repeated manipulation of a single continuous element interworked within itself. It is based on the formation of rows of interworked links or loops of varying types and degrees of complexity. In textile terms, netting differs from other single element manipulations in that instead of simply being linked or looped, netting is knotted. Xianrendong's Net Impressed sherds could possibly be amongst the earliest examples of netting in the archaeological record. In 'Prehistoric Textiles' (published prior to the excavations at Xianrendong), Barber (1991:41) attributed the earliest netting to Europe and the Middle East. The earliest recorded finds are from Mesolithic layers at Korpilaht in Finland, dated to the 8th millennium BC. As Barber points out, a netting bag was excavated at Nahal Hemar in Israel, along with netting needles. The site belongs to the Early Neolithic and is dated around 6500 BC. The net impressed pottery sherds from Xianrendong predate Western examples considerably.

Hill and Vandiver (Hill 1995) also identified textile impressions on many of the pottery sherds from this period. These were of two different types, classified as Wang Textile and Xian Textile; both were considered to have been woven on simple looms. According to McNeish, the earliest evidence for spinning and weaving at Xianrendong appears in the Wang Phase (Neolithic 2). As McNeish (McNeish *et al.* 1997:43-44) pointed out, "the Wang phase marks the introduction of a whole new industry, textile weaving, that will have a long and significant history in China". Although this research into the evidence for spinning at Xianrendong is still in its preliminary stages, the textile impressions on the sherds and the spindle whorls establish that fibres were spun and woven at Xianrendong sites before ca. 6000 BC (8000 BP).

Chengbeixin complex

The Chengbeixin cultural complex is the next cultural complex in the chronology (Fig. 2.4) that is relevant to the study. Two seasons of excavations (1983, 1984) at the site of Chengbeixi on the Yangzi River produced a single spindle whorl (Institute of Archaeology, Hubei Province 1996). From the three uncalibrated radiocarbon dates obtained for the Chengbeixin assemblages, the whorl has been dated between 9000 and 8400 BP. The whorl was found with distinctive pottery vessels *(dou* and *fu)* and bone needles. The pottery (cord-marked, incised, stamped, impressed) was tempered with rice although it is not clear from the evidence if wild or domesticated rice was used. The conical whorl from Chengbeixi was not made from stone but from pottery. Both its material composition and conical shape suggest that spinning was not in its initial stage of development at the site.

Salvage excavations in the Hubei section of the Three Gorges Dam Project organised by the National Cultural Relics Bureau (Wang Xiaotian and Wang Fengzhu 1997) also produced stone discs that have been positively identified as whorls. The Three Gorges Project covers almost 18 square kilometres in the middle of the Wide Valley. The sites are located in the first and second terraces of the river and are dated between 5000 and 4500 BP. These early rice sites also produced stone balls, grinding slabs and pottery (cord-marked, incised, impressed and painted). The stone whorls from Xiling Gorge (Figure 2.6) are all basic flat disc types ranging in diameter from 5.5 cm to 3.6 cm with central perforations of 0.9 cm in diameter. Those from the earliest layers were undecorated whereas those from later layers are decorated in a very specific way that strongly suggests relationships with lower Yangzi groups explained more fully below.

Daxi sites

Sites belonging to the Daxi culture (ca. 6500 - 5300 BP) are important to the study for their unusual use of pottery. Named after the site of Sichuan Wushan Daxi, Daxi sites are distributed across the entire Middle Yangzi basin from Sichuan in the west to Hubei and northern Honan in the east (Vainker 1991:23). The earliest sites, however, are concentrated around the shores of Lake Dongting. From marked differences in the number (and types) of goods in Daxi graves, archaeologists have concluded that Daxi societies were stratified. These sites are contemporaneous with the technologically advanced societies of the Yangzi delta region discussed below.

The Early Neolithic groups who occupied Daxi sites plastered the walls of their houses with grey pottery mixed with burnt clay fragments and potsherds. The exterior surfaces of houses were washed with yellow clay and the floors plastered with clay tempered with fine sand. Grey, black and red pottery vessels were also found. Most of the pottery was hand built, however, some curved cups were wheel formed and coated with red slip; some black pottery was burnished (Vainker 1991). The distinctive Chinese pedestals known as *dou* and tripods called *ding* discussed more fully below were also part of the material culture of the Daxi along with cylindrical bottles. Some vessels were painted (black on red, and red on black); others were cord-marked, incised, stamped and appliquéed (Chang 1986: 217, 223).

The large numbers of stone and pottery whorls excavated from Daxi sites indicate that the hand spindle was widely distributed in the Yangzi Valley by 6000 BP. The basic flat stone whorls evidenced at Xianrendong continue in the archaeological record at Daxi sites along with conical pottery forms. At the site of Liulin, elaborations of the two basic types appear in the form of slightly rounded stone whorls and truncated conical types (Kuhn 1988:118). Figure 2.10 shows examples decorated with small concentric circles, an artistic convention which also distinguishes whorls from the east coast. Daxi sites are pertinent to textile history as they have produced the earliest extant remains of prehistoric cloth found thus far for the Middle Yangzi. These came from excavations at the Daxi site of Chengtoushan (He Jiejun

1999:101) located in the village of Lanyue in the township of Chexi, in Li County, Hunan Province. The site was occupied from the Early Daxi period (earlier than 6,000 BP) through to the Qujialing Culture (5300-5000 BP) to the Middle or Late Shijiahe culture (4600-3800 BP). Chengtoushan also produced the earliest moat and wall structures yet found in China, constructed concurrently. The moat measured about 35 metres wide and lies some distance (10-20 metres) from the wall. A structure identified as a boat ramp was also found on one side of the moat, along with paddles, rudders and planks. Woven cloth made from bast was also recovered with bamboo basketry from mud deposits in the moat. While the moat has not hitherto been connected to textile production, the *Shi jing* clearly records that the Early Chinese retted both ramie and hemp in moats, an association discussed more fully in Chapter 9.

Qujialing sites

Excavations at sites belonging to the following Qujialing culture (ca. 5300-5000 BP) produced remarkable whorls with possible parallels in Southeast Asia. Whorls were found in all three layers at the type-site of Qujialing, made from red, black and buff pottery. Figure 2.11 shows that elaborations of the basic flat disc type described by Kuhn as "bow tie" types were represented, along with basic types. In terms of physics, the "bow tie" whorls indicate that the Neolithic spinners in this part of the Middle Yangzi were very efficient. Whorls of this shape have a very high Moment of Inertia which suggests that prehistoric spinners at these sites produced finer, lighter, more tightly spun fibres than their predecessors and neighbours. The arrangement of the design elements on the whorls is unusual; incised linear motifs and small impressed concentric circles are depicted around the outer edges of the whorls rather than their upper surfaces. Whorls from later sequences at Qujialing sites are distinguished by painted motifs whereas earliest forms are incised which suggests that there may have been interaction in the later period with Yangshao groups distinguished by painted pottery. Striking effects were achieved through the application of red paint on grey and buff coloured pottery. Kuhn believes that spindle whorls would have been amongst the most important artefacts owned by Qujialing groups. According to Kuhn,

> They indicate not only that the spindle whorl was one of the most essential implements in the culture, but also supply us with an impression of the imaginative craftsmanship of their makers in the design and colouring of the ornamentation. Indeed the repertoire of patterns created by Chhu-chia-ling [Qujialing] was never surpassed on Neolithic Chinese whorls and their powerful execution was never equaled in any other cultural region of China. They therefore represent far more than just the working utensils of daily life (Kuhn 1988:113).

Figures 2.12, 2.13, 2.14 show that the whorls in layers assigned to the end of the early period are monochrome whereas those from later periods are polychrome.

Shijiahe sites

The Shijiahe culture (ca. 4400-4000 BP) of the Middle Yangzi is characterised by a class of pottery that is unparalleled at prehistoric sites in the *zhongyuan*. The Jiangzhou Regional Museum houses an important collection of anthropomorphic and zoomorphic figurines of domesticated animals as well as elephants and turtle, all of which are depicted with lively expressions (Figure 2.15). The greatest concentration of these small figurines come from sites in Hubei Province. When figurines of this type were first discovered in the 1950s, archaeologists believed they were Han burial furniture whereas now they are known to have been produced by Neolithic potters from Shijiahe sites. The figurines have also been excavated from sites in Hunan and Henan provinces where they have been interpreted by archaeologists as trade goods (Rawson 1996:47). Small pottery figurines which compare favourably to those produced by Shijiahe groups have also been excavated from a number of Metal Age sites in Southeast Asia discussed in the following chapters but up until now, the origin of these figurines has been obscure (Cameron 2002).

The Lower Yangzi

Hemudu

The data on spinning and weaving discussed in the following section suggest that textile technology was also known to Middle Neolithic groups who occupied sites in the lower reaches of the Yangzi Valley. The earliest evidence for textile technology thus far for the lower Yangzi comes from the basal layers (Layer 4) at Hemudu, dated to about 5000 BC. Hemudu (Figure 2.1) is an open museum site in Dutou Village, Loujiang, immediately south of Hangzhou Bay in Zhejiang Province. Hemudu is significant in Southeast Asian archaeology for its possible proto-Austronesian connections. Chang (1989:91) observed that the material remains at Hemudu and later Majiabang sites are literal transcriptions of the material culture listed by linguists (Blust 1976; Pawley and Green 1984) in reconstructions of Proto-Austronesian.

Excavations at the site of Hemudu were extensive, covering a total area of 40,000 m^2 and it is fortuitous for textile history that the chemical environment at Hemudu was particularly conducive to the preservation of organic materials. Alternate layers of mildly acidic and alkaline soils produced a pH environment (between 6.5 and 7.5) which preserved many materials which are frequently lost through decay at semi-tropical sites. Because of these exceptional circumstances, the excavations at Hemudu produced the earliest wooden weaving implements found in either China or Southeast Asia. Moreover, the high proportion (22.38%) of textile tools excavated from layer 3 led archaeologists to conclude that "Hemudu was a flourishing place for many centuries... as far as textile crafts are concerned" (Liu Jun and Yao Zhong Yuan 1992:96). Because of the cultural, historical and technological significance of Hemudu's textile data, the following section is concerned with the minutiae of detail concerning each specific class of artefact from the site.

Evidence for weaving as a process independent of spinning and textiles comes from large fragments of matting recovered from Trench 33 in layer 4. This layer produced the remains of wooden pile dwellings of the type that characterise Southeast Asian architecture and the large size of the matting fragment suggests that it had a domestic function. One matting fragment from Trench 33 was woven using multiple warps and wefts, a simple weaving technique used throughout Southeast Asia and the Pacific for house walls, room dividers and flooring. The matting from Hemudu was a 2/2 tabby weave also known as basket or mat weave where paired warps and wefts are interwoven. The fibres were identified as *Phragmites* sp. (reeds). A second fragment was woven using a more advanced technique called twill. Twill weaves are float weaves for which a minimum of three warp groupings is essential (Emery 1980:75).

In Early China, twill matting was used for many different purposes, including sericulture. Kuhn's (1988:322) research clearly shows that wrappers woven from twill were used for silk cloth and silkworms were housed in trays manufactured from twill matting made from *Bambusa* sp. Although silk was not found at Hemudu, it has been suggested that the worm like designs depicted on an ivory cup are representations of silkworms (Chen Wei Chi 1984). Pollen from *Morus alba* (mulberry) was found at the site and fragments of very fine silk were found at the 5000 year-old Liangzhu site of Qianshanyang, nearby (Anon. 1960:73-93). Although tools associated with sericulture have never been identified at Hemudu, there is a remote possibility that the site produced an unidentified fibre preparation bowl. The bowl shown in Figure 2.16 is distinguished by a raised internal loop called a lug. While bowls of this type are not common at Chinese archaeological sites and are not shown in Kuhn's study of Chinese silk technology, they are still used in parts of Southeast Asia today. Lefferts and Cort's (2000) study of contemporary Tai textile techniques shows stoneware bowls called *toui i pe* with internal lugs that are used today for starching silk thread prior to reeling. I suggest that the bowl from Hemudu, which compares favourably with those recorded by Lefferts and Cort (Figure 2.17), may have had the same function, however, further research is needed to firmly establish this correlation.

Looms were evidenced at Hemudu by five ground and polished bone shuttles made from deer antlers (Figure 2.18). Shuttles are implements that hold weft threads and ultimately transport them through the open shed on a loom. One of the shuttles illustrated in the report on the site (Liu Jun and Yao Zhong Yuan 1992) measured 10.9 cm in diameter. The shuttle from the earliest layer has a reverse hook (Figure 2.19) in the mid-section around which thread would have been wound.

Sewing is also evidenced at Hemudu by needles (Figure 2.18) manufactured from animal bones polished to a fine point. The needles ranged in size from 15.7 cm to 6.3 cm in length with the size of the eyes of the needles consistently around 0.3 cm. The standard size of the eyes suggests that the same threads may have been used for different types of sewing. It is doubtful the needles would have been used to sew hide clothing as there is neither ethnographic nor archaeological evidence for this type of clothing in Southeast Asia. Although needles are also used for netting, the presence of textile tools at Hemudu suggests the needles were linked to textile production. We know from documents from the historical period that ceremonial dress was embroidered at least as early as the Shang dynasty. During the fierce political struggles of the Warring States period, the Prince of Zhao sent 1,000 reels of embroidered silk as campaign funds to establish an alliance amongst six states against the state of Qin. During the same period, mortuary rites prescribed embroidered silk for the burial clothing of feudal princes. The Baoiji City Museum houses an extraordinary example of embroidery from the Western Zhou period and both the Hunan and the Hubei Provincial Museums house magnificent early examples of this decorative technique from Chu graves with original threads intact, embroidered with birds (phoenix) and dragons (Huang Nengfu 1991:1). While these accounts are obviously for later periods, they do establish knowledge of embroidery from an early period in China.

Figure 2.19 also shows a number of other weaving tools identified amongst the wooden artefacts found at Hemudu. Beating knives were identified and archaeologists (CPAM 1978: 59-60) are of the opinion these tools were multi-functional: used for cooking and weaving. The handle of one bone dagger is carved with a double-headed bird in a distinctive style known as the bi-lateral split (Figures 2.21), a style that distinguishes traditional Southeast Asian art (see Chen 1968). The same bird motif executed using the same style (bi-lateral split) is woven into contemporary Southeast Asian textiles in the more remote parts of Indonesia. This critical evidence for looms from Hemudu has been overlooked in reconstructions of Southeast Asian textile history. According to textile scholars (Fraser-Lu 1988; Maxwell 1990; Vollmer 1979), the earliest archaeological evidence for looms occurs on bronzes from the Former Han dynasty (206 BC-AD 8) sites in Yunnan. While the Yunnan finds are of historical interest they are too recent to be of any consequence to the origin question whereas the weaving implements from Hemudu push the technology back a further 5000 years.

Several pieces of rope were also found at the site. The excavators (CPAM 1978:59-60) remarked that one piece (Figure 2.22) was barely distinguishable from modern rope. The fibre in the rope wrapped around the handle of a bone spade (T224) was positively identified as *Bambusa* sp. (bamboo). Another piece of cord plied from "native fibre" measured 2 mm in diameter. The fibres in the smaller piece of rope were positively identified as *Boehmeria nivea* (ramie).

A total of 206 whorls were found at Hemudu (CPAM 1978) and their distribution is given in Table 2.5. The presence of whorls in all layers indicates that spinning was carried out during the entire period of occupation at the site. Table 2.5 also suggests that the greatest economic expenditure in spinning and weaving took place when the site was first occupied (layers 3 and 4).

Layer	Number
1	8
2	7
3	121
4	70

Table 2.5 *Distribution of Spindle Whorls at Hemudu.*

The round flat types in the earliest layers at Hemudu measured between 6.5 cm and 5.8 cm in diameter whereas the same types were smaller in later sequences: between 5.3 cm and 5 cm in layer 2 and 4cm in diameter in layer 1 (see Kuhn 1988:93, 94). This is significant. When whorl numbers, size and distribution are considered, an interesting pattern emerges which suggests that the spinners in the final period of occupation at Hemudu did not produce the same yarns as spinners from the earliest period of occupation. Could the larger spindle whorls used by the earliest spinners at Hemudu have spun cords and ropes with greater tensile strength for maritime purposes? Could the earliest spinners with larger, heavier whorls have moved out from the Yangzi delta into other parts of Southeast Asia during the Late Neolithic?

The material composition of Hemudu's whorls is also significant in terms of population movements. While a wide range of materials was made into whorls at Hemudu, including wood, stone and pottery, the earliest whorls were made from stone and wood. The stone whorls link the spinners from Hemudu to spinners from Xianrendong and other Middle Yangzi sites discussed previously. Interaction with spinners from sites in the lower Yangzi is also suggested by the decoration on the outer rims of some of whorls from Hemudu. Some are impressed with the rows of small concentric circles that distinguished the outer edges of the whorls from the Qujialing cultural complex discussed below. The wooden whorls from Hemudu may also have implications for Austronesian migrations. In island Southeast Asia, where a few spinners still use spindle whorls, wooden types are used (see Hitchcock 1985:29). If textile technology diffused into Island Southeast Asia with the earliest colonisers as suggested (see Chapter 3), then it is conceivable that spinners with wooden whorls moved into the Indo-Malaysian Archipelago at an earlier date.

The range of weights of the whorls also indicates that different types of fibres were spun at the site. In Afghanistan, for example, very light whorls weighing around 8g are used to spin short stapled fine wools whereas whorls weighing 33g are used for heavier, longer stapled wools (Ryder 1968:81). The correlation between weight and fibre is important. As emphasised in Chapter 1, Parsons (1972) showed that smaller, lighter Aztec whorls were used to spin cotton whereas heavier pottery whorls were used to spin heavier, coarser bast *(maguey)* fibres. These correlations, validated by ethnographic research, are now widely accepted (Mason 1980; Smith and Hirth 1988). It can be concluded that wooden whorls and light pottery whorls from Hemudu spun light fibres and the stone and heavier pottery whorls spun basts with greater tensile strength.

Although the excavators (CPAM 1978) identified eight different types of whorls at Hemudu, Kuhn identified only 6 main types (Figures 2.23, 2.24). The discrepancy arises because Kuhn clumps all flat discs together whereas Chinese archaeologists split them according to whether they have straight, rounded or convex shaped rims. As argued in the introduction, whorl morphology is more diagnostic than commonly appreciated. In the following chapter, the proposition is put forward that certain Neolithic spindle whorls from Southeast China can be interpreted as cultural markers. The proposition is based on Kuhn's research on Chinese spindle whorls which found that while some are ubiquitous; other whorls are confined to certain provinces and a few are confined to specific prehistoric cultures. Seventy- one percent (50/70) of the whorls from Hemudu are basic types (type 1) and the basic type is represented in all materials: wood, stone and pottery. Seventy percent of the whorls in the earliest layers are basic types as are 71% in the middle layer (15/21) and 71% of the whorls in the upper layer (5/7) are simply elaborations of the basic type. The presence of truncated types (Type 4) in layer 3 is noteworthy as this elaboration of the conical whorl was recorded for Middle

Yangzi whorls. The more distinctive convex shaped whorl in the earliest layer appears to be peculiar to Hemudu (Kuhn 1988:154).

Although Hemudu whorls are described in Kuhn's (1988) study, their design elements were never analysed systematically. From data contained in Chinese site reports, published materials and whorls displayed in the open museum site at Hemudu, the main design elements shown in Table 2.6 were identified. The earliest design elements on the Hemudu whorls from Layer 4 were crudely applied, impressed with either a fingernail (?) or incised with a sharp pointed instrument while crude impressions are notably absent from later whorls. The whorls from later sequences were more carefully decorated and show greater control and emphasis on symmetry.

Motif	Arrangement	Technique	Layer	Type
concentric circle straight line	rows horizontal vertical square triangle	impressed incised	4, 3, 2 4,3	1,2,3 4
curved line	horizontal	incised impressed	4,3	1

Table 2.6 *Design Elements used to decorate Hemudu spindle whorls.*

The most frequently depicted motif on the whorls is the small concentric circle that occurs on three different types of whorls, rendered in different ways (Figure 2.25). The concentric circle is never depicted as a single element but designs are developed using multiples of concentric circles in various configurations. On some whorls, concentric circles are depicted randomly over the entire upper surfaces of the whorls; on others, rows of concentric circles are depicted on the outer circumference as shown in Figure 2.20. This convention was first described for whorls from Qujialing sites. On some whorls the concentric circles are strategically placed to form radiating patterns, a design element described in site reports as the bird's nest pattern. Concentric circles are interpreted by many Chinese archaeologists (Li pers. comm.) as bird's eggs which is interesting given the presence of the bilateral split motif of a bird on loom parts discussed earlier and the widespread distribution of bilateral split motifs of birds on traditional Southeast Asian textiles.

The second distinguishable motif on Hemudu whorls is the single straight line which first appears on the upper surfaces of basic flat disc types in the earliest layers. Small lines are incised horizontally and vertically on the surface of one whorl (Figure 2.24) and despite its seemingly random arrangement, the lines are carefully applied as none intersect. Could the lines be depictions of fibres of limited length before they were spun?

Sharp pointed instruments were also used to produce curved lines on a whorl in the lowest level. The motif, known to Chinese archaeologists as the "sun-god motif" (Lu 1998-1999) also appears on Lapita pottery although it has not previously been traced back to Hemudu. In his analysis of Lapita motifs, Spriggs (1990:110) identifies this motif as an earplug emblem [Samrong Sen] that occurs on Lapita pottery from Watom, Tongatapu and New Caledonia. The same motif (Figure 4.14) has also been found on an anthropomorphic figurine from Watom where it has been identified as a tattoo motif (Green 1979:Figs.1, 2). Early Chinese historical documents refer to the worship of a sun-god in pre-dynastic China and archaeologists do not consider any of the artefacts from Hemudu which bear the sun-god motif were intended for daily use but had a role in sun-worshipping rituals. In my view, the motifs could also be related to women's work and technologically inspired. In Figure 2.23, I have shown the motif in question and a number of silk reeling devices and a loom that are used in textile technology today.

Chengqiao site

Interaction between prehistoric groups along the Yangzi is reflected in the spindle whorls recovered during the 1989 excavations at Chengqiao. The site is located in Liuhe district, near Nanjing in Jiangsu Province. Most whorls are decorated with the same geometric and curvilinear motifs depicted on Hemudu whorls. However, two of the whorls from Chengqiao are extremely rare. In sharp contrast to the geometric motifs that appear on other Neolithic whorls, Chengqiao's whorls are decorated with figurative designs (Figure 2.26). Rawson describes the motifs as zoomorphic. One is described "as a star shaped decoration of five spirals which open out into the heads of birds or mythical creatures with long beaks possibly connected to the bird and sun cult" (1996:50). The same motif is depicted on a pottery bowl from Hemudu (Figure 2.27). Interestingly, in Chinese mythology, the Han are descended from birds.

Majiabang sites

Sites belonging to the Majiabang culture (Figure 2.1) cluster around the Lake Tai Hu region. Huang (1990) believes the Majiabang Culture developed from the Hemudu Culture parallel to the Dawenko and Qingliangang cultures north of the Yangzi River. Wu (1973) sees all of these cultures derived from the Hemudu whereas Chang (1986:192) was firmly of the opinion that future archaeological research in China will show that the Majiabang Culture actually predates Hemudu. Known Majiabang sites are dated between 7000 and 5000 BP and divided into two main phases (Anon. 1986:197).

Majiabang sites have a special place in textile history as they have produced very early examples of prehistoric textiles. Excavations at the site of Caoxieshan (Figure 2.1) in Wuxian, Jiangsu Province produced fragments of cloth. Caoxieshan is dated to around 6000 BP and the fragments came from layer 10. The three fragments of 1/1 tabby weave currently housed in the Nanjing Museum have been analysed by textile scholars in Shanghai and the findings challenge conventional opinion about early textile fibres. The Majiabang fragments were not made from *Cannabis sativa* (hemp) or *Boehmeria nivea* (ramie) as might be expected but were made from *Pueraria thunbergiania* (bean creeper). Botanical sources indicate that *P. thunbergiania* was an important multi-purpose crop in the Yangzi Valley. The beans were used for food, the roots for a kind of arrowroot, the green parts of the plant for animal fodder and the stems were spun and woven into cloth. As Kuhn (1988) stresses, the processing of bast fibres like the bean creeper for textile purposes was very labour intensive. When the creeper was more than 3 metres in length, the stems were cut, boiled, rinsed in running water at river banks, beaten and dried overnight in the open air to whiten the fibres. Dry spinning rather than wet spinning was preferred. The fibres were then ready for weaving, a process even more labour intensive than fibre processing. Sometimes the creeper was combined with silk to produce a cloth known to the Chinese as phoenix cloth which is interesting given the depiction of birds on weaving implements found at Hemudu and motifs identified as bird's eggs on the whorls.

China appears to have been the origin centre for the bean creeper. The *Nung Cheng Chuan Shu* (Complete Treatise on Agriculture) composed in 1639 specifically states that the wild species, *P. lombata* (Wild.) *Ohuru* and *P. thunbergiania*, grew abundantly throughout China while the domesticates, *P. montana* and *P. thomsonii* were grown in the southeast coastal provinces (Chhen Tzu-Lung 1843). Textiles made from bean creeper were highly esteemed in the first millennium BC. The *Shi jing* (Book of Odes), compiled between the 11th and 7th centuries BC, attests to this:

> How the bean-creeper spreads, it reaches the middle of the valley; its leaves are rich;
> I cut it, I boil it; I make fine cloth *(hsi)*; I shall never grow weary of them"...
> " In the south, there are trees with down curving branches, the bean and the *lei* creepers cling around them" (Karlgren 1974).

During the Han dynasty, groups from the Yangzi delta paid tribute to the Han Emperor in cloth made from the bean creeper. While the fibre is not a major textile fibre today, a remainder of its earlier cultural significance can be seen in contemporary Chinese marriage rituals where a groom presents his intended with shoes made from spun but unwoven strands of bean creeper.

The differential distribution of whorls at Majiabang sites suggests that textile production may have been concentrated in one or two main centres around Hangzhou Bay. The earliest layers at the type-site of Majiabang (Figure 2.1), for example, produced only a single whorl (radiocarbon dated to 5860 ± 140 BP). This was a basic flat disc type made from red pottery (M48: 6), measuring 6.6 cm in diameter. The following layers belonging to the Songze phase (radiocarbon dated to 5180 ± 140 BP) produced two grey pottery forms. In sharp contrast, the Neolithic layers at the site of Beiyinyangying (Nanjing Museum 1993) mentioned above produced 95 spindle whorls; 45 of stone and 30 of pottery. Beiyinyangying is located in the Hangzhou region, not far from Hemudu. Phase I is dated to ca. 4000 BC, phase II to ca. 3500 BP, phase III to ca. 3000 BC and phase IV to ca. 2500 BC. The region in which Beiyinyangying is located continues to be one of the principal textile centres of China.

In this context, it is worth noting that crafts were kinship based during the early dynastic period in the *zhongyuan*. According to Chang (1974:463), each settlement group had a number of craft centres at the service of the aristocracy (Shang) to provide for the whole settlement. Chinese dynastic records also indicate that in the early dynastic period, some of the lineages specialized in particular branches of handicrafts. Skills were passed down from generation to generation within kin groups and as a consequence, the members of these early kinship groups were wealthier and had more privileges than farmers. In some instances, the craft was a supplement to agriculture; often they were full-time, specialist occupations. The data at Majiabang sites described above, raises the possibility that the craft specialisation recorded for the Shang dynasty was practiced in the Yangzi Valley during the prehistoric period.

Different types of whorls are found at Majiabang sites. The site of Qingdun (Figure 2.1) produced small round abacus whorls of the type found at Hemudu that suggests technological continuity from the Middle Neolithic to the Late Neolithic in the Yangzi delta. Artistic continuity is also discernible in the design elements on Majiabang whorls that are also paralleled at Hemudu.

Songze sites

As with Majiabang sites, there are greater concentrations of whorls at a few Songze sites which suggests specialized craft villages. At Songze (outside Shanghai), the earliest Majiabang layer produced only a single whorl, a basic flat disc type (6.6 cm in diameter); the following Songze layer produced only two whorls of similar type (7.4 cm and 5.5 cm in diameter). In contrast, the Songze layers at the site of Xuejiazhang in Anhui Province, produced 46. Not only were the numbers greater, they were also more differentiated with some decorated with the "needle stitch pattern" (Kuhn 1988:97, 98). This development can also been seen in whorls from the Neolithic layers at Beiyinyangying located near Nanjing. The Songze layers at Beiyinyangyin produced whorls with simple decorations (Fig. 2.30) whereas those from the Majiabang layers have different motifs, a trend that continues from the Shang and Western Zhou dynasties to the period of the Warring States period when fewer examples of this class of artefact occur in the archaeological record. According to Kuhn (1988), whorls were replaced by the spinning wheel during the Han period.

Liangzhu sites

The textile evidence at Liangzhu sites differs to that described for earlier wet rice sites in the Yangzi and reflects the increased wealth and stratification of the Yangzi groups. The Liangzhu culture, dated between 4900 and 3900 BP (Shanghai Museum & Hong Kong Museum of History 1992), developed from the Hemudu, Majiabang and Songze cultures within the same geographical area extending over Jiangsu and Zhejiang provinces and the city of Shanghai. Although the Liangzhu culture is better known in Chinese archaeology for its exquisite black pottery and remarkable jades, it has a special place in textile history for its prehistoric textiles. Consideration should also be given to the proposition that the increased wealth evidenced at Liangzhu sites may have been partly derived from cloth production.

The earliest archaeological silks yet found anywhere in China come from the Liangzhu site of Qianshanyang in Zhejiang Province (Anon. 1960b:86; Chang 1986:180-181; Anon. 1980b: 205). At Qianshanyang, silk fragments were found inside small baskets in the earliest layers, radiocarbon dated between 2850-2650 BC. Some fragments were too carbonized to reveal original colours but sufficient quantities of uncarbonized brownish-yellow cloth remained to indicate material composition. Fibre analysis revealed that the filaments were made from *Bombyx mori*, i.e. domesticated rather than wild silk (Tussah). The filaments were Z and S spun and were all 1/1 tabby weaves. One small piece had a thread count of 72 warps to 64 wefts per cm. The largest fragment (2 x 1 cm) had a thread count of 48 warps to 48 wefts per cm. Another, finer piece had a thread count of 52 warps to 48 wefts per cm. A silk belt made from 10 strands of silk was also recovered.

The cultural and economic significance of silk textiles to the development of early societies in China would be difficult to overestimate. While silkworm cocoons and ancient inscriptions indicate that silk cloth was woven during the Shang dynasty, evidence from Liangzhu clearly shows that silk was the cloth of the elites in the Yangzi Valley more than 4000 years ago. During the Zhou period (1100 -770 BC), sericulture was an established cottage industry in China with Imperial workshops and mulberry nurseries attached to the palace to oversee production and to control quality. Silk was so important to the Imperial coffers 3000 years ago that those proficient in sericulture and capable of disease prevention were rewarded with one *jin* of gold and eight *shi* of grain, as well as exemption from military service (Kuhn 1988: 19). A silk robe found in one of the tombs at Mawangdui (Han dynasty) was so fine that it weighed a mere 49 grams even though it was 128 cm long with sleeves of 190 cm (Chung Chien 1973:48).

Jade burial clothing has also been found at Liangzhu sites. Jade had a role in mortuary rituals because of its perceived supernatural properties that supposedly lengthened the life of the corpse. Some elites were buried in jade suits, sewn together with silk cord (discussed more fully in Chapter 4). At some Liangzhu sites, high status burials were also found covered with silk "face-cloths" embellished with jade. The Archaeology Museum (Arthur M. Sackler) at Peking University displays an example of a silk and jade cloth (Figure 2.28) from the site of Yingpanshan, in Pukou District, Jiangsu Province. Thinly cut jade pieces of varying shapes had been sewn onto the silk cloth through tiny holes to form a mask on the cloth that then covered the face.

Qianshanyang (Anon. 1960:86) also produced the earliest identified ramie cloth yet found in China. One fragment was made from coarse fibres with a thread count of 23 wefts to 23 warps per cm. A second fragment had a thread count of 16 warps to 16 wefts per cm. A third S spun fragment had a finer weave, with a thread count of 30 warps to 20 wefts per cm. An even finer fragment had a thread count of 48 warps to 48 wefts per cm.

Qianshanyang also produced pieces of rope made from ramie and bamboo, the coarsest of which measured 2.5 cm in diameter. The presence of oars at Liangzhu sites suggests that the ropes may have been used for maritime purposes.

All three layers at Qianshanyang produced whorls. As Table 2.7 shows, the largest numbers came from the upper layer of the site. They measured from 2.6 cm to 4.4 cm in diameter. Both basic flat discs and conical types were represented. It is interesting to note that the whorls were decorated with the same concentric circles that embellished whorls from earlier Neolithic sites throughout the Yangzi Valley where wet rice was the subsistence base. Another whorl was decorated with the motif resembling a silk reeling machine of the type first identified in the study at Hemudu.

Layer	Number
1	29
2	15
3	15

Table 2.7 *Distribution of spindle whorls at Qianshanyang.*

Whereas the above-mentioned fragments of silk indicate the high status of a few Neolithic individuals buried at Liangzhu sites, the spinning tools indicate the status of spinners and weavers in the Yangzi delta during this period. In 1957, archaeologists reported finding a jade spindle whorl (Figure 2.29) in a woman's tomb at a Liangzhu site (Anon.1957a:77-80, Plates 11,6,8). Observations of the jade disc stored in the Shanghai Museum confirmed the original description. As Huang Xuanpe (pers. comm.) from the Shanghai Museum explained, the function of the jade disc is unambiguous, supported by the presence of the jade spindle inserted in the whorl. This provides indisputable evidence that cloth production was a means by which Late Neolithic women in the Yangzi Valley could achieve high status and presumably considerable wealth.

In summary, this chapter has identified an autonomous textile zone in the Yangzi Valley belonging to Neolithic groups with wet rice which is independent from the northern agricultural zone of the Yellow River. The hand spindle was traced from its early development in the Yangzi Valley in the Middle Neolithic through the Late Neolithic to the beginning of the dynastic period. The data also demonstrated a relationship between cloth production and the emergence of elites at the end of the prehistoric period in the Yangzi delta.

Chapter 3

South China, Part 2

Southeast China and Island Southeast Asia

This chapter is concerned with evidence for cloth production from wet rice sites immediately south of the Yangzi Valley in Southeast China, Taiwan and parts of island Southeast Asia. The earliest data of concern here belong to two Neolithic cultures: Tanshishan and Tapenkeng. Data from these sites are crucial to our understanding of textile history as well as the movement of prehistoric spinners and weavers into other parts of Southeast Asia towards the end of the Neolithic period and provide further insights into Austronesian dispersals. Bellwood (1985:232) links the Austronesian language to prehistoric migrations and has long held that Neolithic groups from southeast coastal China (probably Zhejiang or Fujian Province) settled Taiwan before other parts of island Southeast Asia. He described the pattern of An expansion shown in Fig. 1.16 as a "geographical expansion beginning in Taiwan then encompassing the Philippines, Borneo and Sulawesi; and finally bifurcating, one branch moving west to Java, Sumatra and Malaya, the other moving east to Oceania" (1995:99). Solheim (1975a, 1984-1985), on the other hand, places An origins with maritime traders from Indonesia with secondary movements up to the South China coast and reverse movements of Malays and Chams from South China into the Indo-Malaysian Archipelago. Meacham (1984-1985) also rejects a South China origin as quite improbable. Meacham (1977, 1983) sees the island of Taiwan as culturally distinct for more than 6000 years with cultural interaction from the Philippines into Taiwan. Meacham sees Lungshanoid traits in southern Taiwan resultant from one-way accidental crossings (Pearson 1989:113).

The Austronesian homeland is pertinent to this study because weaving is one of the technologies attributed to PAN speakers. Blust identified reflexes of *tenun* (weave cloth) in the Austronesian languages spoken in Taiwan, island Southeast Asia (Bali, Borneo, Java, Flores and the Moluccas, Roti, Sumba, Sulawesi and Timor) and Madagascar. Blust's reconstructions are also based on ethnographic evidence for the backstrap loom on these islands and several isolated locations in the Pacific (Banks Islands, Ontong Java, Santa Cruz Islands, Truk, Ponape and the Carolines). He also found that reflexes of *tenun* were absent on

Pacific islands where the backstrap loom had been reported. He considers the lack of cognate terminology in the Pacific leaves open the possibility of independent invention for the backstrap loom in Oceania. To recapitulate, "Whether the horizontal backstrap loom is a sporadic retention or an independent invention in the Pacific, the sparseness of its distribution in comparison with insular Southeast Asia is a striking fact that is in need of explanation" (Blust 1999:33).

Bellwood (1979, 1985) has examined the archaeological evidence for weaving in island Southeast Asia and observed that like reaping knives, whorls do not occur in the region until after 2500 BC. Bellwood noted that whorls occurred at Neolithic sites in Taiwan and some parts of the Philippines but were not represented at sites south of Luzon. From this he concluded:

> Weaving may have been replaced by barkcloth production in many areas (a conclusion also reached by Ngo T. P. to explain the shift away from cord-marked pottery to the south of Taiwan) but since weaving was so widespread ethnographically an initial retraction followed much later by an expansion, perhaps with more suitable fibres of mainland origin such as cotton, may have occurred (Bellwood 1985:226).

The principal argument put forward in this chapter is that regional differences in spindle whorl morphology first appear in South China at wet rice sites belonging to the Tanshishan culture of the southeast coast. When combined with surface decoration, this permits us to trace the movement of spinners with early rice from Tanshishan sites in southeast China, across the straits of Taiwan into the islands of Taiwan, down the coast to sites on the southern-most tip of the island before moving onto northern Luzon. The central point is that Late Neolithic whorls from Tanshishan sites are diagnostic whereas those from wet rice sites discussed in the previous chapter are generic (basic types). This chapter also elucidates correlations between boat burials with textile shrouds from Fujian province and boat burials with textile shrouds from sites in Island Southeast Asia. The absence of data south of Luzon is also explained.

Tanshishan sites

Fig. 2.1 shows the position of the Tanshishan cultural complex in the Chinese chronology of prehistoric cultures displayed at the Peking University. The Tanshishan is one of the well-defined regional cultures of South China that sprang up around 3,500 BC (Chang 1986:107, 108), parallel to the wet rice cultural complexes of Songze and Liangzhu (from the lower Yangzi), Qujialing and Shijiahe (from the middle Yangzi), and Shixia (from Guangdong). With the exception of the shell mound at Fugoudun (ca. 5200 and 4200 BC) where "potsherds decorated with incised lines, impressed rows of semi-circles, and zoned patterns with incisions made by dentate stamping with the toothed edge of an Andara shell" (Bellwood 1985:213) were found, the Tanshishan remains the earliest prehistoric cultural complex identified in Fujian province (Huang 1989:67). Tanshishan sites (Fig. 3.1) cluster along the banks of rivers and on the narrow coastal strip of Fujian Province where rice could be cultivated. According to Chang, there was considerable interaction between Neolithic groups belonging to the Tanshishan culture and Neolithic groups from the Middle and Lower Yangzi (Fig. 3.2).

All Tanshishan sites shown in Fig. 3.1 produced large numbers of whorls. Moreover, archaeologists from the Fujian Provincial Museum (Lin Gong Wu pers. comm.) have observed that the majority of whorls from Tanshishan sites come from female burials.

The type site of Tanshishan is located near the Min River. The lowest layer has an uncalibrated radiocarbon date of 1945 BC and 1324 BC for the middle layer (Kuang-Chou Li 1989). It is worth noting that a high proportion of the artefacts recovered from Tanshishan were cloth production tools. During a single season of excavations (Anon. 1976:83-119) at the site, 117 whorls were recovered.

Layer	Number of whorls
1	66
2	40
3	11

Table 3.1 *Distribution of spindle whorls at Tanshishan.*

Table 3.1 shows that whorls were present in all layers of the site. Eleven were found in layer 3, a thin layer containing two ash pits, fifteen graves and red slipped pottery. The spinning artefacts were associated with round clay pellets and two round unperforated pottery discs. Forty whorls were found in the middle layer (layer 2) made up of shell deposits. This layer contained 41 ash pits, 17 graves and large numbers of artefacts including stone adzes and incised pottery, along with pig and dog bones. Although the upper layer (layer 1) was badly disturbed and contained few artefacts, this layer produced the largest number of spinning tools with a total of 66 whorls recovered. The whorls from layer 3 (Fig. 3.3) were made from fine red and grey clay and measured between 5.2 and 3.7 cm in diameter. However, morphology is the most important functional attribute of these whorls. Whorls from these sites are biconical and as Kuhn's (1988) research into Chinese spindle whorls has demonstrated, whorls of this type are not found at other Chinese archaeological sites. Kuhn's typology (Fig. 1.3) shows that biconical whorls are atypical and unique to the Tanshishan culture. Whereas earlier types in the prehistoric textile zone identified in Chapter 2 are generic, the biconical whorl is culturally specific.

Some of the biconical whorls from Tanshishan were decorated with incised and impressed motifs. The outer circumference of one whorl (Fig. 3.3) is impressed with what Fujian archaeologists (Anon. 1978: 91) call the "fingernail pattern", a decorative technique first observed on basic types from Hemudu. Layer 2 at Tanshishan produced 40 whorls, none of which were biconical. Instead, new types with sharper features appear. These occur with flat discs with both straight and annular ends and an elaboration of the basic disc with raised lower surfaces, and a high-bodied trapezium whorl with parallels at Hemudu. Whorls from layer 2 are also decorated; the upper surfaces of some are incised with the "needle-stitch" pattern (discussed further below). The upper surface of one whorl (Fig. 3.4) was further sub-divided by a large concentric circle to create a narrow band infilled with fingernail impressions. The general configuration of three other examples is consistent with this, the outer rim subdivided into 20 smaller segments with 2 or 3 fingernail impressions within each of the segments. The same impressions divide another example into 6 segments, creating a motif resembling the spokes of a silk reeling machine, a motif first witnessed at Hemudu (Chapter 2). Layer 1 produced 66 whorls that are smaller in diameter (3.1 - 4.3 cm) than earlier forms. Most are elaborations of the basic flat disc. They compare favourably in material composition with those from earlier layers but differ morphologically and stylistically, which suggests exogenic influences during the later period of occupation at the site.

As can be seen from Fig. 3.5, there are also changes in decorative style. Although some whorls from layer 1 are impressed and incised like earlier Tanshishan whorls, others are painted with geometric motifs that compare favourably with painted geometric whorls from Middle Yangzi sites belonging to the Daxi culture discussed in the previous chapter. Chinese archaeologists interpret Daxi sites as mixed sites primarily because of the painted pottery which is connected to the painted pottery tradition of the Yellow River Valley. Chang has already established zones of interaction in the late prehistoric period (Fig.3.2). The distribution of whorls with the angular wheel motif first recognised on whorls from Hemudu and painted on the whorls in the upper layer at Tanshishan also corresponds with Chang's zones of interaction.

Layers 2 and 3 at Tanshishan also produced pottery stamps and small pottery artefacts classified by Chinese archaeologists as net sinkers (Anon. 1979:108). They are made from grey pottery and measure between 2.4 and 3.4 cm in length. These rollers first occur at Majiabang and Liangzhu sites. The Fujian examples differ from rollers found at Metal Age sites in Southeast Asia discussed more fully in Chapters 5, 6, 7, 8 and 9 in that they do not have worked surfaces.

Fig. 3.6 and 3.7 show several unusual pottery artefacts from Tanshishan sites that Fujian archaeologists have identified as bark cloth beaters because of their longitudinal grooved surfaces. Attempts were made during fieldwork to locate these tools but the Fujian Provincial Museum was closed for rebuilding and its collections were unavailable. Nevertheless, a few general observations can be made about them. While these artefacts could have been used to decorate pottery, none of the motifs on the beaters from the site occur on the pottery. Given the presence of bark cloth beaters at Guangdong sites (Chapter 4) and the interaction between prehistoric groups in these regions, it seems reasonable to conclude that Tanshishan groups had knowledge of bark cloth production. The identification of these artefacts as *bark cloth beaters*, however, suggests "something was lost in the translation". In my view, it seems far more likely that these artefacts were used to impress designs on barkcloth in the manner wooden stamps are used in Pacific barkcloth production to create precisely the same patterns.

The site of Dongzhang (Anon. 1965) produced sufficiently large numbers of whorls to suggest craft specialisation. At Dongzhang, 334 examples were found, the largest number of whorls found at any Tanshishan site (Kuhn 1988). The wide range of spindle whorl types at Dongzhang (Fig. 3.8) suggests that a wider range of fibres were in the spinner's repertoire at Dongzhang. While specific whorl types cannot at this satge be linked to specific fibres, the presence of both light and heavy whorls within the same assemblage indicates that both light and heavy fibres were spun at the site. Technological continuity is indicated by the usage of the same small concentric circles and incised radiating spirals on the whorls that were documented at Hemudu. As shown in Fig. 3.9, some Tanshishan sites have also produced other atypical whorls relevant to the study.

Excavations (Fujian Provincial Museum 1998:227) at Zhuangbianshan in Minhou County, Fujian Province, also yielded a wide range of whorls. The site lies on the southern bank of the lower Minjiang River. There are no radiocarbon dates for the site. The lowest of the four layers has been assigned to the Tanshishan culture, the upper layer assigned to a new cultural complex called the "Upper Zhuangbianshan Culture". Figures 3.10 and 3.11 show that some of the whorls are incised with the same concentric circles noted previously on Hemudu and

Tanshishan whorls. More importantly, an elaboration of the biconical type with stepped edges which occurs elsewhere in Laos (Chapter 7) makes an appearance in the Zhuangbianshan layer. Also, re-worked sherds of the type found in the Yellow River (Chapter 2) make an appearance at Zhuangbianshan.

Space does not permit a detailed discussion of all Tanshishan sites. The most important point is that Tanshishan sites produced diagnostic whorls with parallels at early rice sites in both mainland and island Southeast Asia. In addition, the study shows reduced spinning activity at Tanshishan sites around the same time that painted whorls with Daxi and Yellow River Valley parallels appear.

Wuyi sites

Mention should also be made of data from cliff burial sites in the Wuyi Mountains area of southeast China that are particularly relevant to Southeast Asian prehistory. Although distinctive boat shaped wooden coffins have been found at several archaeological sites in Taiwan (Huang 1989), Vietnam, the Philippines (Fox 1970) and Sarawak (B. Harrisson 1967; T. Harrisson 1975), parallels from Fujian Province have not been previously reported. Chinese historical documents indicate that cave burial was practiced in the regions watered by the Min and its tributaries with wooden coffins deliberately placed on limestone cliffs, hundreds of metres above ground level (de Groot 1912; Liu *et al.* 1980). Cliff burials were practiced by the Yueh people of Zhejiang and Fujian provinces during the Three Kingdoms period (AD 221-265) and probably date back to the Bronze Age (Huang 1989:77). Excavations of cliff burial sites in Fujian province have confirmed this.

Fig. 3.12 shows the hazardous excavation posed by the location of "death ships" on a cliff at the site of Wu Yi in Ching An (Anon. 1980). The site is dated to about 3200 bp (Lin pers. comm.). Fig. 3.13 shows the morphology of the coffins. One coffin was lined with bamboo matting as well as fragments of cloth woven from a number of different fibres (Fig. 3.14). Using Scanning Electron Microscopy (Fig. 3.15, 3.16, 3.17), Chinese scholars identified cotton, silk, ramie and hemp fibres in the long-sections and cross-sections shown in the photomicrographs.

There is sufficient archaeological and historical evidence to indicate that cotton was known in China during the first millennium BC (Kuhn 1987:59). Archaeological textiles woven from cotton and seeds of *G. herbaceum* have been found at sites belonging to the Later Han (AD 25-

the Later Han dynasty) mentions locally grown cotton (known as Szechuan cloth) from Yunnan and Szechuan. The *Shiji* (Record of the Historian) states that by the dynastic period, cotton growing had spread from Yunnan to Guangxi and Indo-China, Guangdong and Fujian Province (1988:59). However, the long sections of "bush cotton" in the photomicrographs of the cotton from the Wu Yi coffins lack the distinctive striations of *Gossypium*. It seems more likely that the spun fibre was *kapok* used to stuff pillows that were placed in coffins.

Taiwan

Some scholars (Kano 1952; Chang *et al.* 1969; Huang 1989) see Taiwan's Neolithic cultures originating from mainland southeast China, either Fujian (Xitou, Keqiutou or early Tanshishan) or Guangdong and have recognized general parallels in the pottery from sites in Taiwan and that from Liangzhu, Tanshishan, Guangdong, Zhongzhou and Shenwan sites. Huang (1989: 79-81) has clearly demonstrated parallels between the prehistoric pottery from sites along the southwest coast of Taiwan and prehistoric pottery from several regional cultures from Southeast China, including Tanshishan, but spindle whorls were not included in any of these pottery studies. Nor did Kuhn (1988) include the island of Taiwan in his study of Chinese spindle whorls.

Tapenkeng

Fig. 3.18 shows a chronology of Taiwanese prehistoric cultures. The oldest Neolithic assemblages on the island belong to the Tapenkeng cultural complex, named after the site of the same name (Fig. 3.19), located near the Tamsui River, which flows directly into the Taiwan Straits. Tapenkeng was first discovered in 1956 by Sheng Ch'ing-ch'i from the Commission for Historic Research. The following excavations at the site in 1959 by staff from the Department of Archaeology and Anthropology (Taita) and the Yale-Taita Expedition in 1964-65 (Chang 1986) produced copious quantities of cord-marked vessels and sherds. The newest Tapenkeng sites are located in the Tainan Science-Based Industrial Park. It is generally accepted that the Tapenkeng dates after 3500 BC.

Cord marks occurred over the entire surface of vessels, presumably applied with a cord wrapped stick or paddle. There is no evidence that the cord was spun with whorls. Spindle whorls first appear on the island of Taiwan in layers assigned to the Yuanshan culture (ca. 2500 - 1000 BC) which is characterized by globular vessels with ring feet decorated with incised and impressed motifs, and red slipped pottery. The Yuanshan layers also produced quadrangular adzes, stone projectile points and chipped stone hoes. Altogether, 20 pottery spindle whorls (Fig. 3.20) were recovered from the Yuanshan shell mound. Dimensions of individual whorls are not contained in the report, simply an average dimension of 4cm (Chang 1969:181). In keeping with the conventional Chinese approach to stone discs, Chang did not identify any of them as whorls although some have the same functional attributes as stone whorls from Middle Yangzi sites discussed in Chapter 2.

With the exception of a single conical whorl, 19 of the 20 pottery whorls from the Yuanshan layers at Tapenkeng were biconical (Chang 1969: Plate 100). The concentration of biconical whorls in the shell mound link the Neolithic spinners from Taiwan to spinners from Tanshishan sites on the mainland discussed above. It is highly unlikely that these specialized tools would have been trade goods. Chang (1969) has established that the pottery at the site was locally made and there is no ethnographic evidence anywhere for a trade in spindle whorls. Moreover, biconical whorls spin faster than flat types and would have required high levels of technical competence to use. Relationships between the Yangzi delta and Taiwan are further articulated by the decoration of the whorls, particularly the parallel rows of small concentric circles on the upper surfaces that characterize whorls from layers 2 and 3 at both Tanshishan and Dongzhang. This specific arrangement of small concentric circles on whorls was observed on whorls from Hemudu. The same motif has also been observed on other pottery from sites along the southwest coast of Taiwan to the southern tip of the island.

In his report, Chang (1969:181) raised an interesting proposition relevant to textile history in Taiwan. Chang suggested that some of the grooved sandstone pebbles in the Yuanshan sequences might have functioned as loom weights. However, the artefacts in question seem more like artefacts identified as net weights at Tanshishan sites.

Chang also recovered a stone barkcloth beater from the Yuanshan layers but its significance for Pacific Archaeology was not appreciated at the time. Chang (1989:88) acknowledged that the beater had not been published and all that appeared was a passing reference to the beater in a small article on the Yuanshan in a Taiwanese Journal (see Chang 1954:37). The beater measured 5.5 cm by 2.8 cm. It was a horned type (Ling 1962) with its protuberance broken off (Fig. 3.20a). Beaters of this type are not widely distributed throughout Southeast Asia but appear to be confined to Taiwan and island Southeast Asia. The term "horned type" was first coined by Beyer (1948), who found large numbers at archaeological sites in the Philippines (in Rizal, Bulakan, Cavite, South Cebu, Misamistukidnon and Cotabato). An undated horned beater was also amongst the original surface finds from Minanga Sippako in south Sulawesi

(Stein Callenfels (1951:pl. XIII). Most horned types are devoid of grooves but a horned type with deep longitudinal grooves on its upper face was recovered during the excavations of Ampah, on the island of Borneo (van de Hoop 1935: 468-70; van Heekeren 1972: 125).

Chihshanyen

Excavations carried out in 1983 (Huang 1984) at the site of Chihshanyen in the Taipei Basin (Taipei City), not far from Yuanshan, also produced the biconical whorls that are the focus of this study. Three uncalibrated radiocarbon dates on shell *(Corbicula sp.)* have been obtained for the site: 3640 ± 100 bp, 3145 ± 110 bp, 3080 ± 100 bp as well as a radiocarbon date of 3170 ± 125 bp calibrated to 3475 ± 125 BP. However, there are problems with dates on fresh water shells throughout Island Southeast Asia (see Spriggs 1989:600). The whorls shown in Fig. 3.21 made from red and grey pottery compare favourably with whorls from Tapenkeng and Yuanshan. Both biconical and conical forms are represented. In terms of size, they cluster into 2 main groups: 3.4 - 4.6 cm and 5-7 cm, which suggests that two different fibres were probably spun at the site. The site report also features wooden shafts described as "digging sticks" which may have functioned as spindles.

Oluanpi

Biconical whorls (Fig. 3.22) were also amongst the cultural materials recovered during excavations at Oluanpi (Huang 1989). The site of Oluanpi is located on the southern tip of the island of Taiwan and is significant for its early evidence for rice. Spinning tools were not in the earliest layers (OLP I and OLP II), dated between 5000 and 4000 BP, but make an appearance in Layer III (OLP III), dated around 3000 BP with painted pottery, stone tools and shell fish-hooks.

Fengpitou

Spinning tools appear in the earliest layers at Fengpitou with cord-marked pottery impressed with spun fibres. The site is located towards the southern tip of the island and dated between 4500 and 2600 BP (Chang 1969). The Yale-Taita Expedition team recovered whorls from all layers; more were found in the lower layers but precise numbers are not provided. The report contains a diagram of whorl shapes (Fig. 3.23) but the biconical shape is more easily distinguishable from actual photographs (Fig. 3.24) (Chang 1969:Plate 63, A-D) 69). The "silk reeling motif" is again represented, incised into the surface of conical whorl with a sharp instrument. It is also possible that some of the shell discs from Fengpitou were whorls of the type used by the Yami.

In his report on the site, Chang says "there is no evidence to indicate the kinds of plants used for fabrics but cord marks on the pottery suggest the cultivation of hemp and a cloth impression on pottery shows a fabric of fine strands, presumably woven on a loom" (1969:80). It is not immediately clear from the report how Chang identified hemp from the pottery impressions particularly as *Cannabis sativa* is not listed in Kawakani's comprehensive 'List of Plants of Formosa' (1910). Perhaps the term hemp was used in the generic sense? If cord was spun at the site it seems more likely to have been made from one of the known fibre-producing plants shown in Table 3.2.

Pueraria thunbergiania and *Boehmeria sp.* have been identified in prehistoric textiles found at Neolithic sites in the Yangzi delta (Chapter 2). In South China, two types of ramie were known. *B. nivea forma chinensis*, a yellowish, hairy ramie and *B. nivea forma indica*, a green ramie found only in the southernmost parts of Fujian and Guangdong (Kuhn 1988:30). Up until the 1960s, the Yami spun both wild and domesticated ramie with pottery whorls (Shih & Chen 1950; plates 1-2). It is also worth noting that contemporary Yami whorls are decorated with the same motif (Fig. 3.25) featured on archaeological whorls. Fig. 3.26 shows the Yami backstrap loom used to weave ramie fibres which is similar in type to the body-tension loom evidenced at Hemudu. The clothing of the Yami from Botel Tobago also bears the same "needle-stitch pattern" (Fig. 3.27) depicted on the whorls. The motif is not stitched but produced on a loom using the supplementary weft technique with different coloured warps and wefts.

Botanical name	Common name
Abutilon asiaticum, A. indicum	kenaf
Artocarpus incisa, A. integrifola	breadfruit
Boehmeria frutescens Thunb. Var. concolour (Makino) Nakai, B. nivea forma indica, B. nivea forma chinensis	ramie
Bombax malabricum	kapok
Broussonetia papyrifera	paper mulberry
Dolichos Lablab. L.D. tribolus	
Ficus elastica, F. retusa, F. roxburgi, F. spetica, F. sieboldi, F. swinhoei, F. vacinoides, F. vasulosa, F. wightiania	fig
Gossypium herbaceum	cotton
Hibiscus mutiabilis, H. rosa sinensism H. surrattans, H. syriacus, H. titiacus	hibiscus
Musa textilis	abaca
Maoutia setosa Wedd.	aramie (wild ramie)
Pueraria thunbergiania	bean creeper, *kudzu*

Table 3.2 *Fibre producing plants used for cloth production in Taiwan.*

Peinan

Large numbers of pottery whorls (Fig. 3.28) have been excavated from sites attributed to the Peinan culture of Taiwan. Peinan sites are concentrated along the south-east coast of the island and are considered to be contemporaneous with the Yuanshan (Sung & Lien 1983, 1984). Peinan was occupied between 1500 and 80 BC. The Peinan culture is distinguished by its slab graves, many of which contained multiple burials and large quantities of jade. Not only have spindle whorls been found in sexed female Peinan burials but they occur with precious materials. This not only suggests that spinning was women's work amongst the Peinan but the presence of jade with spinning tools also suggests that cloth production may have been economically significant on the island of Taiwan 3000 years ago.

Peinan whorls are of three main types: conical, biconical and an elaboration of the biconical whorl unique to the Peinan culture which is described by Taiwanese archaeologists as "mushroom shaped" (Fig. 3.29). Biconical types predominate and they are decorated with the small concentric circles that characterize Tanshishan spindle whorls (Fig. 3. 30) as well as incised lines that have been interpreted as potter's marks (Lien & Sung 1997). Peinan also produced large numbers of stone-perforated discs that *could* have spun nettle fibres. Some of the whorls show clear relationships with Tanshishan spinners but the "mushroom shaped" type seems to be a local development as has not been noted at other sites in South China nor is it amongst the Chinese spindle whorls in Kuhn's typologies.

The presence of stone barkcloth beaters at Peinan sites indicates that these late prehistoric groups produced more than one type of cloth. Fig. 3.31 shows the different types of bark cloth beaters excavated from Peinan. As well as the type with longitudinal grooves found at Tapenkeng, hafted types with cross- hatched grooves are also represented. These beaters are paralleled at sites in the southern part of Vietnam (Chapter 5). The latter were probably used to beat very tough bark from undomesticated plants such as *Ficus* sp. rather than soft fibres from the paper mulberry. Some of the pottery vessels from Peinan sites (Fig. 3.32) could also have had a role in cloth production. Vessels with lugs in their inner surfaces may be silk processing bowls of the type used today by the Tai discussed more fully in Chapters 2 and 9. As with other Taiwanese Neolithic sites, Peinan sites produced large numbers of stone perforated discs that could also have functioned as whorls (Fig. 3.33) as well as hafted, ungrooved beaters of Liangzhu type which could also have been used to pound bark.

Lan Fen Shen

Whorls were also found in the middle layers at Lan Fan Shen, a site located about 6k from Peinan. The site predates 3000 BP (Huang 1989:14). The whorls from Lan Fe Shan (and Fengpitou) are larger than whorls from the northeast, measuring between 8.7 and 5.0 cm. My observations of Taiwanese prehistoric whorls displayed in the old National Museum in Taiwan revealed a trend in the size of prehistoric whorls in Taiwan. The earliest Neolithic forms are appreciably larger than later whorls; this would be consistent with the initial usage of heavy fibres for cords and ropes for maritime technology and later usage of finer, lighter fibres for clothing as the technology developed and groups became more stratified.

The Philippines

As stated in the introduction, the question concerning the origins of spinning and weaving in the Philippines was considered by Henry Otley Beyer who hypothesized that the "art of weaving" did not reach the Philippines until the Iron Age. According to Beyer (Beyer & de Veyra 1947), the islands of the Philippines were first settled during the Palaeolithic by groups from the coastal areas of South China and Vietnam. A second wave of migration was postulated for the Neolithic period followed by a final wave of Iron Age migrants from the southwest, around 2500 BP. According to Beyer, the "Malay peoples" from the southwest were the first "who knew how to manufacture cloth and to weave". Since Beyer's research, large numbers of Neolithic spindle whorls have been excavated from sites in the Philippines. The data base now spans the Neolithic, Metal Age through to the historic period. Many of these spinning tools are housed in the National Museum of the Philippines and some of them were analysed as part of this research. The earliest and greatest concentration of whorls found thus far come from the Cagayan Valley, on the island of Luzon. From an origins perspective, this is significant. The earliest spindle whorl sites (Andarayan and Arku Cave) are also amongst the earliest rice sites in Luzon. The only whorl south of Luzon came from a cave site in the Calamianes Islands, just north of Palawan (Solheim 1964:147, plate 35). Solheim (Solheim in Casal *et al.* 1981:56) is puzzled by the absence of whorls at Metal Age sites. He said, "one rather curious thing is the apparent lack of spindle whorls, and thus an indication of the weaving of textiles, at sites with Sa-huynh-Kalanay pottery in the Philippines". This problem is addressed below.

Andarayan

Shutler's (Snow & Shutler 1985; Snow *et al.* 1986) test excavations at the Andarayan site produced a small number of whorls. Andarayan is a large open-air site near Solana in the

Cagayan Valley, not far from the Cagayan River. Luzon lies around 100k from the island of Taiwan and Shutler (pers. comm.) has pointed out that the Cagayan River is navigable by watercraft and during typhoons, the Cagayan Valley is protected by high mountains. The Andarayan site has two radiocarbon dates on charcoal: a radiocarbon date of 3240 ± 160 bp calibrated to 3883(3468) 3278 (SFU-86) and 3400 ± 125 bp, calibrated to 3829 (3682), 3670, 3646) 3479 BP. The site produced 6 pottery whorls, associated with red slipped pottery (tempered with rice chaff), chert flakes, a ground stone adze and distinctive earrings *(lingling-o)*. All came from burials. The whorls are grey, buff and red pottery, made at the site from coarse low-fired clay, tempered with mica and hornblende. As with Tanshishan sites, small un-perforated flat discs were also found with the whorls. The 4 whorls housed in the National Museum were analysed along with 2 whorls forwarded by Shutler to the Australian National University for analysis. Their functional attributes are shown in Table 3.3.

Weights range from 27 g to 47 g. However, the central perforation of the heaviest whorl (47g) was filled with soil, which suggests that it actually weighs closer to 35g, a weight comparable with whorl 78R-1B(2). Three of the whorls from the burials were asymmetrical with off-centre perforations. This is of functional significance as off-centre whorls would have wobbled on their spindles. This disfunctional whorl suggests that whorls may have been produced specifically for burial as symbolic grave goods, either as gender or status symbols. Three different types are represented in the assemblage: biconical, conical and the basic flat disc (Fig. 3.34). The presence of biconical whorls at Andarayan links the third millennium spinners at the site to third millennium spinners from Yuanshan sites in Taiwan and Tanshishan sites in Fujian.

Number	Material	Shape	Diameter (cm)	Central perforation (cm)	Weight (g)	Decoration
78-R11	pottery	flat disc	4.5	1.00	34	-
78-R38-2	pottery	biconical	2.3	1.00	27	-
78-R51	pottery	conical	3.2	0.75	47	-
78-R1	pottery	flat disc	2.9	0.75	7	-
78-R11	pottery	biconical	4.5	1.00	34	-
78-R38	pottery	biconical	2.3	1.00	27	-
78-R13	pottery	biconical	3.1	1.00	38	-
78-R112	pottery	biconical	1.9	0.75	33	-

Table 3.3 *Functional Attributes of whorls from Andarayan.*

Arku Cave

Thiel's (1986-1987) excavations of Arku Cave in 1976 also produced 12 pottery whorls. The cave is located on a cliff overhanging the Pinacanuan de Tuguerarao River, a tributary of the Cagayan River. According to Thiel, the cave was used for burial between 2200 BC and 50 BC although this early date has been questioned (see Spriggs 1989:198). Whorls were recovered from squares J1 (layer 1), H4/5 (layer 1), H8 (layer III) and the backdirt in large pothole 2. Table 3.4 gives their distribution.

Square	*Layer*	*Number*
J1	1	1
H4/5	1	3
H8	3	1
Pothole 2	1	1

Table 3.4 *Distribution of spindle whorls at Arku Cave.*

Fig. 3.35 shows the tools described in Thiel's report (1986-1987:244). Again, the distinctive biconical whorl is represented and, again, the tool is decorated with the "needle-stitch" pattern. A ground sandstone beater distinguished by two working sides was associated with the single whorl in H4/5. As Thiel points out, bark cloth beaters with one or two working sides have also been found in Cebu (Beyer 1948). However, Arku's beater is further distinguished by a projection for hafting which links it to beaters in Taiwan and Vietnam. A small piece of knotted rope made from an unidentified fibre was also found at the site.

Hill Top site, Magapit

Excavations by members of the Lal-lo Archaeology Project (Aoyogi *et al.* 1993) at the Hill Top Site of Magapit Shell Midden produced an isolated whorl. The site is one of 21 shell middens along the Cagayan River about ten metres above sea level. Two radiocarbon dates have been obtained for the midden: 2800 ± 140 bp and 2760 ± 125 bp (uncalibrated) although these are seen as problematic (see Spriggs 1989). The isolated find came from a 4 X 4 metre square, in association with red-slipped pottery, a quadrangular adze, clay earrings and tools and ornaments made from bone and stone. Fig. 3.36 shows the biconical (?) whorl which measured 5 cm in diameter with a central perforation of about 1 cm.

Laurente Cave

Two whorls from Laurente Cave (Hansen: unpublished MA thesis) in the National Museum of the Philippines were analysed and their functional attributes are given in Table 3.5. Laurente Cave is a Neolithic site located in the main valley and tributary of the Cagayan River. The radiocarbon date of 8600 bp reported by Meacham (1988) has been completely rejected by Spriggs (1989:593) who is of the view that Rabel and Laurente Cave might be as early as 4800 BP.

Number	Material	Shape	Diameter (cm)	Central Perforation (cm)	Weight (g)	Decoration
1	pottery	conical	3	0.05	14.6	-
2	pottery	conical	3.5	0.05	18.9	-

Table 3.5 *Functional Attributes of spindle whorls from Laurente Cave.*

Site C64, Calamianes

Whorls occur south of the island of Luzon but only as isolated finds. Solheim found a single whorl (Fig. 3.37) at Site C64, a cave site near Banuningdan in the Calamianes, on the northwest coast of Renon de Coron, Central Philippines. He described it as "C64-67. Earthenware artifact: pottery spindle whorl (?) with a flat top and curved bottom, circular in cross section, 4.1 cm in diameter, 1 off-centre hole 7 mm in diameter, side of artifact incised in alternating triangular motif" (1964:147, Plate 34). The diameter of the disc (4 cm) is slightly larger than beads (usually <3cm). The diameter of its central perforation (7 mm) is also too large for a bead but large enough for a spindle. Its function as a spinning tool is confirmed by fabric attrition on one section of the central perforation which is consistent with its position on the spindle. The whorl is incised with three parallel lines: the so-called "Kalanay design". This distinctive motif occurs on an ivory cup from layer 3 (6500-6000 BP) at Hemudu as well as on Dong Dau pottery from Vietnam (see Chapter 5).

Number	Material	Shape	Diameter (cm)	Central perforation (cm)	Weight (g)	Decoration
1	pottery	oval	4.1	0.70	-	incised parallel lines

Table 3.6 *Functional Attributes of whorl from Site 64.*

Calatagan

The Calatagan Collection in the National Museum houses 194 whorls (Fig. 3.38) recovered during several excavations of historical sites (12^{th} – 14^{th} century) on the Calatagan peninsular. The excavations at Calatagan produced 505 graves buried with 521 pottery and porcelain vessels from China, Vietnam and Thailand as well as hundreds of other artefacts. The Calatagan sites were first excavated by Olav Janse in the 1940s who incorrectly attributed the burials to the post-Spanish period (16^{th} century). The pottery was subsequently dated on stylistic grounds to the late Yuan dynasty (1280-1368) (Main & Fox 1982). The distribution of whorls at the Calatagan sites is shown in Table 3.7.

Type	Number
A, B	81
C, D	21
E	21
F, G	31
H	1
I	1
J	3
K	5
L, M	7
N	12
O	1
V	1
W	1
X	1

Table 3.7 *Calatagan whorl types and numbers (Main and Fox 1982:59).*

Examples in the National Museum from Pinagpatayan, Punta Sunog, Talisay and Santa Ana were analysed and their functional attributes are given in Table 3.8. The most striking difference between the historical and prehistoric whorls is their finish. As with Neolithic forms, Calatagan whorls are made from red and grey pottery but instead of being rough and coarse (with a lot of temper), they are smooth and symmetrical and 8 of the 194 are polished. They are also much more uniform in shape, reflecting advanced pottery technology. Technical continuity is indicated by the continued usage of conical, biconical and oval shaped whorls. Artistic continuity is indicated by the continued usage of the same design elements (Fig. 3.39) first observed on whorls from southeast China.

Number	Material	Shape	Diameter (cm)	Central perforation (cm)	Weight (g)
T239	pottery	conical	2.7	0.40	18
T243	pottery	oval	3.0	0.40	13
T380	pottery	oval	2.5	0.40	13
T250	pottery	biconical	2.5	0.40	13
T236	pottery	oval	2.5	0.50	15
SA 19	pottery	conical	3.0	0.40	18
SA 123	pottery	truncated conical	2.8	0.40	19
SA 83	pottery	conical	2.8	0.50	14
SA 185	pottery	conical	2.0	0.50	17
SA 163	pottery	conical	3.5	0.50	18
SA 185	pottery	conical	2.8	0.50	20
SA 39	pottery	conical	2.6	0.40	14
P1	pottery	conical	2.8	0.40	14
PS 105	pottery	round	2.6	0.40	14
PS 129	pottery	round	2.5	0.40	11
PS 250	pottery	biconical	2.9	0.40	24

Table 3.8 *Functional attributes of spindle whorls from Pinagpatayan, Punta Sunog, Talisay and Santa Ana.*

Bolinao

The historical site of Bolinao in Pangasinan produced 10 whorls from 10 burials (8, 9, 12, 14, 15, 17, 18, 28, 35, 36) in association with shell ornaments, copper and bronze, beads and Chinese trade wares. According to Fox (Main & Fox 1982:115), the pottery from Bolinao was indistinguishable from Batangas pottery. Three of the whorls came from the upper layer. None is biconical. The most striking whorl (BLG 64-F-154) in the assemblage, currently on display in the National Museum, was not only decorated with the same parallel lines found on the whorl from Site 64 but was glazed. Glazed whorls are very unusual although they have been found at Harappan sites in India (Ghosh 1989) and Vietnam (Chapter 5).

Number	Material	Shape	Diameter (cm)	Central Perforation (cm)	Weight (g)	Decoration
64-F-154	pottery	truncated conical	4.2	0.50	23	incised parallel lines
64-F-91	pottery	trapezium	4.2	0.30	16.6	incised circles
BLG-GR-9 64F-35	pottery	trapezium	4.5	0.50	-	incised lines

Table 3.9 *Functional attributes of spindle whorls from Bolinao, Pangasin.*

Site C11 and Site C55

The Guthe Collection at the University of Michigan houses an assemblage of textile pseudomorphs from several Metal Age sites around the Mindanao Sea which appear to be the earliest extant textiles in the Philippines. The fragments come from several different Iron Age sites: Site B23, on the island of Siquijor, Surigao (northern Mindanao), Site C11 on Bohol, and Site C55, a cave located in a limestone cliff in Sitio Ilihan, Barrio Santa Fe, Municipio de Carascal, Surigao, Mindanao (Solheim 1964). Fig. 3.40 shows these textile pseudomorphs analysed by Volney Jones from the Museum of Anthropology (University of Michigan). Jones identified three different examples of worked fibres in the assemblage: matting, cord and textiles. He described the matting as follows:

> The elements are almost incredibly small, usually about 1/2 a millimeter wide, and varying from 1/3 to 3/4 millimeter. This would result in a semi-flexible textile. In no instance is the form evident, but such weave might be found in flexible baskets, bags, hats or matting. Probably these represent mats used in wrapping burials (Jones 1964:125, 126).

Jones also described a small piece of cord measuring 2 mm in diameter wrapped around a barbed point from Site B23. His analysis revealed that the cord was not spun but simply twisted. According to Jones, "cordage of this type is generally manufactured by laying two parallel fibre bundles on the thigh, rolling them separately under the palm in one reverse direction to form the individual strands, and then reversing the direction of rolling to unite them into two-strand cord" (1964:125). The fibres preserved on metal artefacts from C55 in Surigao were identified as 1/1 tabby weaves. Impressions of cloth woven from "checker-weave" were also identified at C11 on Bohol. This particular weaving technique using multiple warps and wefts is also well represented on textile pseudomorphs from Dongson sites discussed in Chapter 5. Jones did not positively identify any of the fibres in the assemblage.

It is clear from a display prepared by the Philippines Textile Research Institute at the National Museum of the Philippines that a wide range of bast fibres are used by traditional groups on these islands. These fibres and filaments are summarized in Table 3.10. *Maguey (Agave* sp.*)* as one of the fibres woven in these islands. Could *maguey* have been spun during the prehistoric period? *Agave larida* is indigenous to Mexico where it is still spun with the hand spindle to make rope and cordage. *A. fourcroyoides (henequen)* has also been identified at archaeological sites in Yucatan. Several species of the same genus are also used in South America to spin lighter fibres. These include *A. sisalana* (sisal), which is highly regarded for its great tenacity and *A. cantala* (Manila *maguey)* (Simmons 1971:2). It is possible that *maguey* was spun on the small, round pottery whorls found at historical sites in the Philippines as these particular whorl types have been found with *maguey* at South American archaeological sites.

Species	Common Name
Agave sp.	sisal
Boehmeria comosus	pineapple
Boehmeria nivea, B. multiflora	ramie
Ceiba pentandra	kapok
Corchorus olitorius L.	jute
Gosspyium barbadense, G. herbaceum, G. hirsutum, G. nanking	cotton
Hibiscus cannabinus	kenaf
Musa sapientum, M. textilis	sajing, abaca

Table 3.10 *Principal fibres and filaments used for spinning and weaving in the Philippines.*

It is unlikely that either abaca *(Musa textilis)* or *Corchorus* sp. were spun with prehistoric whorls. Even though *Musa sp.* appears to be indigenous to Southeast Asia, there is no ethnographic evidence of *abaca* ever being spun. Long fibres are simply stripped from trees then tied into continuous threads and wound onto reels. *Corchorus* is in the same category. Soft diaphanous fabrics known as *pina* are also woven from the leaves of the pineapple plant *(Ananos comosus)* in the Philippines and Borneo. Although cloths woven from pineapple in Dutch museums attest to the fibre's economic importance to textile production during the 17th century, it is unlikely to have been spun by prehistoric groups in the Philippines, as the plant is indigenous to South America and is more likely to have been introduced by the Spanish during the historical period. Although *G. barbadense* grows wild in the Philippines and Borneo, it is also indigenous to South America (Johnson & Decker 1989). Yet cotton must have reached the Philippines before the 12th century as cotton cloths produced in the Philippines are mentioned in Chinese historical records. According to Chao Ju-kua (Hirth and Rockhill 1911) 12th century islanders from Calamianes, Busuanga and Palawan (San-su) exchanged woven cotton cloths (and native cloths) for silk, black damask, beads, porcelain, lead and tin. Chau Ju-kua also refers to cotton and *yu-ta* cloth from Luzon (Mai-ti). *Yu-ta* is probably *Musa textilis* although *Musa sapientum* is also used for cloth production in the Philippines.

The National Museum of the Philippines houses contemporary whorls used by contemporary groups from Luzon, including the Ifugao, Kalinga, Apayao and Tinguan. The Ifugao use conical wooden types (E1295B, E1295F) to spin cotton and bast fibres *(bahug* and *saluyot)* (Santiago 1985: unpublished fieldnotes). The Tinguan use pottery biconical whorls with bamboo spindles to spin bast fibres called *ginisgis* (Cole 1922); the botanical name of this plant is not clear from the vocabularies consulted (Pawley pers. comm.).

Banton Island

The National Museum of the Philippines also houses the earliest ikat textile found to date in Southeast Asia. The fragment is not the earliest extant ikat in Asia as the Hōryū-ji temple at Nara (Japan) houses an ikat fragment dated to the reign of Empress Suiko (AD 593-629) (Tokyo National Museum 1989: 46-5). The prehistoric textile of concern here (Fig. 3.41) was found in a burial inside a wooden coffin on Banton Island, Romblem Province, where it functioned as a shroud. The tiny island of Banton lies north of the Visayan Islands, separated from Mindoro by the Tablas Strait. The textile has been dated between the 13th and 14th centuries on the basis of Chinese blue and white (Ming) pottery within the coffin (Solheim in Casal *et al.* 1981). The fibres in the shroud have since been identified as *Musa sp.* (abaca) (Ocampo 1999). There are two important points about the Banton Island cloth which reflect its origin. The fragment is warp ikat rather than weft ikat. The warp ikat technique is a decorative technique generally associated with Southeast Asia whereas the weft ikat technique is generally associated with India (see Chapter 1). Secondly, it is decorated using the **S** motif, a Dongson motif discussed in more detail in Chapter 5.

Borneo
Niah Cave

The Harrisson team (B. Harrisson 1967; T. Harrisson 1975) also found prehistoric cloth and matting during excavations at the Great Cave at Niah in Sarawak. The fragments were recovered from wooden coffins in two different sectors of the cave: the Cemetery sector and Lobang Tulang. Many of the burials were placed in matting shrouds. In his report on the matting from Niah, Tom Harrisson pointed out that "the term matting is rather loosely used here to describe layers of strips of vegetable material arranged, sometimes carefully interwoven, as a cover or wrapper, occurring under skeletons or even coffins, part or whole" (1975:162). One matting fragment from the Cemetery has a single uncalibrated radiocarbon date of 3410 ± 100 BP (Physics Laboratory, Groningen). According to Tom Harrisson,

> It has not yet been possible scientifically to identify the parts (matting) involved. But most appear to be either a long-leafed riverine bull-rush or the common Pandanus ("screw palm" or "pandan") of sub coastal zones, still extensively used in native matting today. Pandan can be rendered soft but durable, and its rather easily worked. Of the cemetery mats provisionally identified as pandan, 15 are with wood coffins, 10 with bamboo. More elaborately meshed material including (?) netting has been found in 2 of the wood coffins but not in sufficient separation or quantity for C-14 analysis. Similar fragmentary pieces also occur, apparently as wrappers with Niah cremations, an osiery, and on a multiple burial (n. 60 B-D) already provisionally radiocarbon dated at 2500 BP which was hitherto the earliest such mat date for the region. The present result runs back nearly a millennium earlier. In addition, some sort of leaf is used for "pillows" under the head of (6) extended burials" (Harrisson 1975:162).

However, it must be said that Harrisson's excavation techniques have been seriously questioned and his dates appear to have been confused (see Spriggs 1989:587).

Woven cloth was also recovered from two wooden coffins in the cemetery sector. Barbara Harrisson reported,

> Only two of the coffin burials (59; 113/4) had an additional wrapper of textile to the described pandan mats. This textile of spun cotton seems to resemble the basic structure of Iban Dyak ikat textiles. Unfortunately, the Niah material is too fragmentary and poorly preserved to allow analysis of previous colours or designs (B. Harrisson 1967:154).

Regrettably, we will never know how many of the 167 burials in the cemetery sector were originally buried with cloth, as most of the fragments were lost during the excavations. As Barbara Harrisson points out, these artefacts were never anticipated at the site and "were only recognised for the first time during the 1965 field season which concentrated the best workmen on slow burial exposure. It is thus possible that some of this extremely difficult material was missed during earlier seasons" (B. Harrisson 1967:154). The prehistoric fragments of cloth provisionally identified by Barbara Harrisson as cotton were not left with the Sarawak Museum. However, samples of woven cloth from the historical site of Lobang Tulang, dated to about 800 AD (B. Harrisson 1958; 1959), were located for this investigation. The shrouds from Lobang Tulang shown in Figures 3.42 and 3.43 were woven from bast fibres similar to *Pueraria thunbergiania* using a distinctive weaving technique called diamond twill. As reported in Chapters 2 and 3, twill was woven in Southeast China during the Late Neolithic period. Chapter 3 also showed that prehistoric groups from the Wuyi Mountains of Fujian Province buried their dead wrapped in twill shrouds in coffins like those found at Lobang Tulang (and other sites in the Philippines).

The Earl of Cranbrook (a zoologist with a long association with the site) and staff from the Sarawak Museum located some fragments left *in situ* in the cemetery sector. Minuscule fragments of fine cloth were removed from the median side of the right femur of burial 169 (Fig. 3.44). The minute fragments were analysed using the Scanning Electron Microscope but none of the fibres showed the characteristic convolutions of cotton. The photomicrographs of the very fine fibres that came from burial 169 matched photomicrographs of coconut palm (*Cocos nucifera*) (Fig. 3.45). The edges of coconut fibres are distinguishable from the wavy lines (Textile Institute 1985:20). A phytolith of the same was also identified.

While the Harrissons did not identify any cloth production tools amongst the material remains from Niah, artefacts in the Sarawak Museum described as "earthenware beads" could be relevant to the study. The beads (?) came from burial 7 and burial 21. Barbara Harrisson described them as "heavy tubular beads of clay, unpolished 32-37 mm long, 25-39 mm in diameter, 30.4 to 50.2 g in weight similar to others found in Iron Age contexts in the Sarawak River delta excavations of the northwest" (B. Harrisson 1967:180). Fig. 3.46 shows a number of perforated discs from the Niah excavations that were located in the Sarawak Museum. Two of the discs are paralleled at sites in Taiwan and the Philippines. The disc on the left with two perforations is paralleled at Arku Cave, Magapit and Fengpitou (Fig. 3.47). The shell disc in the figure resembles small shell discs used to spin kapok floss from *Ceiba petandra* in East Timor (O'Connor pers. comm.) but is almost certainly decorative, perhaps sewn onto fabric. The central perforation seems too small for a spindle.

Kota Batu

It is not generally known that loom parts have been found at an archaeological site in island Southeast Asia. These components were amongst a large number of wooden artefacts excavated from Kota Batu, a waterlogged site along a river bank in Brunei (T. Harrisson 1956:306). The single radiocarbon date of 2045 ± 110 bp obtained for the site has, however, been completely rejected (Spriggs 1989:574). Chinese coins excavated from the site cover the period between 723 and 1425 AD (Pre-Islamic period).

Of the 75 wooden objects recovered, 16 were identified as spinning and weaving tools. Given the basic structure of many components, it is highly likely that more remain to be identified. Loom parts occurred in all layers with the greatest concentration found at a depth of 24-48". Harrisson's classification of the tools is shown in Table 3.11.

Types	***0-24***	***25-48***	***48+***	***Total***
bowls	-	8	-	16
tools (for splitting wood, hammers, nails)	1	6	1	8
spinning and weaving apparatus	6	8	2	17
fishing apparatus	-	6	-	6
kitchen utensils	1	6	4	11
discs or wheels	2	2	2	6
tops	3	-	-	3
comb	-	2	-	2
coconut cups	1	5	2	8
Total	18	44	13	75

Table 3.11 *Typology of wooden artefacts from Kota Batu (after T. Harrisson 1956:306).*

Harrisson identified several different parts of looms, 1 measuring 4 1/2" long (Figs. 3.48, 3.49) and 2 sticks measuring 6 1/4" and 5 1/4" long with incised linear motifs. The wood was identified as ironwood and local timbers *(merbau, selangan bafu, kempas).* In his report on the site, Tom Harrisson compared the loom parts to upright Malay looms of the type subsequently reconstructed in the Brunei Museum (Fig. 3.50). However, the loom parts do not correspond with the reconstructed loom. In my view, the loom parts from Kota Batu more closely resemble loom parts from the Biman backstrap loom still used on the island of Sumbawa. The Biman loom has a discontinuous warp and is used to weave supplementary weft cloths using seried ranks of heddles (Hitchcock 1985:2). As Fig. 3.51 shows, the Biman loom is characterized by the turned wooden components that also characterize the proto-historic loom parts from Kota Batu.

Many wooden pieces from spinning devices (12-18 2R1, 24-30 2L11X30; 24-30 2Q1, 30-36 2L10X20, 48-54 W4 were also identified. Some artefacts identified as discs or wheels (18-24 2L10X10; 18-24 2L10X20) measured between 2 ¼ and 3 ¾ inches in diameter, which is within the range of whorls. The Kayan, for example, use wooden whorls to spin bast fibres (Tillema 1938: Plate 105). Tillema observed parallels between Kayan and Ifugao whorls noting that whereas the Ifugao spin cotton with wooden whorls, in Borneo, pineapple *(Ananos comosus)* was spun with tools of this material composition. Fig. 3.52 also shows a number of small unambiguous dye pots found amongst the assemblages at Kota Batu. The pots do not appear to have been analysed for traces of dye. There can be little doubt that Kota Batu was an important cloth production site during its period of occupation.

Sumba
Melolo

Van Heekeren also found whorls at Melolo, a jar burial site on the island of Sumba. According to van Heekeren,

> Nothing is known about an absolute date [for the site]. We are not even sure if it [Melolo] belongs to the Bronze or the Neolithic Age. The situation is comparable in a way with Kalumpang, with the difference that the Melolo people knew the art of weaving as attested by the finds of spindle whorls (van Heekeren 1972:197-198).

In his work on the Bronze Age, van Heekeren (1958) also refers to weaving shuttles but neither the shuttles nor the whorls could be re-located for this study.

One of the puzzling aspects of this research is the absence of whorls at archaeological sites in the Pacific. As Bellwood says, "It is hard to know why knowledge of weaving was lost given the wide range of fibre-producing plants in Southeast Asia and Oceania, but the fact remains that the spread of loom weaving into eastern Indonesia and parts of western Oceania (Riesenberg & Gayton 1952) may have been a quite recent event" (Bellwood 1979: 63). Although whorls have never been positively identified at any Pacific sites, there are stone, shell and pottery discs in the Pacific archaeological record that warrant closer attention. One disc in question (Fig. 3.53) was found during excavations at Objan on Saipan in the Mariana Islands (Spoehr 1957). The Marianas were settled about 1500 BC (Kurashina and Clayshulte 1983) by groups using the thin-walled red slipped pottery called "Marianas Red Pottery". Bellwood (1995:236) has already noted strong parallels in Marianas Redware (Tarague Phase pottery) and Red pottery from the Philippines. As Bellwood says, all Micronesian archaeologists agree that the Marianas were settled by a separate, earlier movement than that indicated by the Lapita of more southerly latitudes. In 'Marianas Prehistory', Spoehr described the disc in question as a "worked sherd of Marianas Plain pottery with perforation in centre" (Spoehr 1957:130, Fig. 132). It measured 3.5 cm in diameter. A similar sherd was found during excavations of the Nomna Bay site on the island of Guam in the Carolines. The disc (Fig. 3.53) was found 15-30 cm beneath the surface in stratum I, Test Pit 9-1-6. It is featured in 'Archaeological Survey and Preliminary Test Excavations on the Island of Guam, Mariana Islands, 1965-1966' (Reinman 1977). According to Reinman, the pottery disc from Nomna Bay resembled the disc from Objan. Re-worked sherds have also been excavated from Lapita sites in Fiji. These discs ought to be re-examined for use-wear marks as they could have been functioned as improvised whorls.

In summary, the textile data discussed in this chapter shows the movement of spinners and weavers with diagnostic whorls from Tanshishan sites in Southeast China to Taiwan before moving onto the island of Luzon. Furthermore, the textile data in Taiwan also suggests the movement of spinners and weavers from the Yangzi delta into the island. Elsewhere (Cameron 2001), I have argued that the absence of whorls at sites in other parts of Island Southeast Asia (apart from Sumba) may not be "loss of textile technology" but negative evidence which can be nterpreted as evidence that prehistoric groups from other parts of Island Southeast Asia wove unspun bast fibres on looms.

Chapter 4

South China, Part 3

Lingnan and Yunnan

This chapter focuses on data from archaeological sites in the southeastern provinces of South China, a region once known as Lingnan and data from the southwestern province of Yunnan. Lingnan was the term coined by Early Chinese to denote the land 'south of the mountains' (Nan Ling Mountains) that was occupied by the ancient Yueh. The geographical zone incorporates Hong Kong and its environs as well as the Chinese provinces of Guangdong and Guangxi. Although northern Vietnam was also part of Lingnan, sites from both northern and southern Vietnam are discussed together in the following chapter. The first part of the chapter draws attention to little known evidence for bark cloth production from Early Neolithic sites in coastal Guangdong which challenges the dominant paradigm (Blust 1995:493; Bellwood 1979, 1987, 1995, 1997) that bark cloth technology originated with Proto-Austronesian speaking groups from Taiwan and dispersed into Southeast Asia and the Pacific from the island with An speakers during the prehistoric period. The second part of the chapter describes spindle whorls from Late Neolithic sites in Lingnan and discusses their relationship to whorls from Late Neolithic sites in Southeast China. This relationship is of consequence to the prehistory of the region. As Meacham points out, the relationship between the prehistoric cultures of Hong Kong and coastal groups from mainland China is "far from settled" (1979:288). Some scholars (Chang 1968) attribute Hong Kong's Neolithic cultures to the Lungshanoid Cultures of the Yangzi basin whereas others (Meacham 1983-4) perceive them as distinctively South Chinese. The study contributes to the debate by showing a correlation between the textile data from a number of prehistoric sites in the Pearl River delta and data from sites in southeast China discussed in previous chapters. The final section of the chapter focuses on some very unusual textile evidence from the province of Yunnan. An unexpected outcome of the research has been the discovery of what *might possibly be* a very early depiction of fabric construction on rock art.

Xiantouling

It is not widely known that stone bark cloth beaters have been recovered from early Neolithic sites in the Pearl River region (Guangdong Province). Archaeologists from the Shenzhen Museum (1990a, 1990b) found 14 stone bark cloth beaters at the site of Xiantouling (Fig. 4.1), in association with stone axes, adzes, chisels, rings and grinding stones. The site was excavated over three seasons in 1985, 1989 and 1997. As Table 4.1 shows, Xaintouling belongs to Phase I in the Pearl River delta, dated between 4500-3700 BC. Not only have the museum archaeologists recovered the largest assemblage of prehistoric stone beaters from any prehistoric site but they have also recovered the earliest prehistoric bark cloth beaters yet found, anywhere in the world.

Phase	Date	Sites
I	4500-3700 BC	Xiantouling, Yung Long, Chung Hom Wan, Tai Wan, Dahuangsha, Dameisha, Hac Sa, Housha, Longxue, Xianqiaozhou
II	3700-2900 BC	Fu Tei Wan, Yung Long, Kwo Lo Wan, Sham Wan, Tung Wan, Sai Wan, Tung Kwu, Sha Chau, Dahuangsha, Hac Sa, Caotangwan
III	2900-2200 BC	Yung Long, Sha Lo Wan, Chiwan, Hedishan, Houshan
IV	2200-1500 BC	Hai Dei Wan, Sham Wan, Tung Wan, Po Yueh Wan, Sha Lau Tong Wan, Caotangwan, Donggao, Hedang, Zaogang, Maogang
V	1500-100 BC	Sham Wan, Tai Wan, Hai Dai Wan, Man Kok Tsui, Sha Po Tsuen, Tai Long, Lo So Shing, Deishaishan, Dameisha

Table 4.1 *Chronology of Prehistoric Cultures from the Pearl River delta (Chau Hing-wah 1993:54).*

The stone beaters from Xiantouling in Fig. 4.2 measured between 4.5 cm and 21 cm in length and between 2 cm and 6 cm in width. In terms of morphology, they are described as square, rectangular and round. One rectangular beater is further distinguished by four small holes in each corner. In Taiwan and Sulawesi, bark cloth beaters of this type are attached to wooden handles by threading twine through small holes in the tools (Fig. 4.3). The upper surfaces of all examples from the Xiantouling assemblage are characterized by longitudinal grooves, measuring from 1-2 cm in diameter. This feature enabled archaeologists from Shenzhen Museum to positively identity the beaters as bark cloth beaters. Previously, only ungrooved pounders from Tanshishan sites (Fig. 4.4) had been excavated on the mainland.

Xiantouling also produced discs that resemble stone whorls. These were found amongst the cultural materials in layers belonging to phase III (2900 - 2200 BC). The whorls are paralleled at Middle Yangzi sites discussed in Chapter 2. The discs in question indicate interaction between spinners from Lingnan and spinners from the Yangzi Valley much earlier than that proposed in Chang's zones of interaction shown in Fig. 3.4 (Chang 1986).

Dahuangsha and Dameisha

Xiantouling's beaters were not isolated finds. Archaeologists from Shenzhen Museum (1991:114) also found similar stone bark cloth beaters at the nearby site of Dahuangsha. The beaters (Fig. 4.2) were found in the basal layers, dated between 4500 and 3700 BC. The largest of them measured 10.2 cm x 5 cm. One broken piece measured 6.7 cm x 5.5 cm. Another small round beater measured 5.4 cm x 5.4 cm. Dameisha also produced a rectangular beater (Fig. 4.2) of the type found at Xiantouling. The site also belongs to phase I, dated between 4500 and 3700 BC. Stone whorls of the basic type found at Xiantouling were also found in the upper layers at Dameisha, which indicates that Neolithic groups in the Pearl River region had knowledge of both textile technology and bark cloth.

Fu Tei Wan

Stone bark cloth beaters continue in the archaeological record of the Pearl River region for several millennia. Similar types were found with stamped pottery, shouldered and stepped adzes at Fu Tei Wan on Chek Lap Kok Island (Meacham 1994) and at Man Kok Tsui on Lantau Island (Chiu and Ward 1979:98). Both Fu Tei Wan and Man Kok Tsui belong to Phase II, dated from 3700-2900 BC. The bark cloth beaters (Fig. 4.6) from these Hong Kong islands show close affinities to the above-mentioned beaters from the mainland coastal sites and undoubtedly belong to the same cultural tradition.

Chinese historical documents attest to the production of bark cloth in Lingnan for trade and tribute during the first millennium BC (Ling 1960). The *Houhanshu* (History of the Later Han) refers to bark cloth tributes from barbarian tribes in Lingnan to the Chinese court. *The Nan Fang Tshao Mu Chuang* (A Prospect of the Plants and Trees of the Southern Regions) written by Hsia Han in AD 305 mentions bark cloth missions from Guangdong and Guangxi in AD 284. The document describes the presentation of thousands of strips of bark cloth to the Han Emperor, who subsequently bestowed a further ten thousand strips to Tu Yu (Generalisimo of the Southern Garrison) who led the Han expeditionary force that conquered the Wu kingdom. The bark cloth was described as brownish in colour with markings resembling fish spawn. It was very fragrant as well as strong and pliable and, when soaked in water, did not disintegrate (important for maritime technology) (Needham *et al.* 1986:447). Hui Lin Li (1979:105-108), a qualified botanist and translator of the *Nan Fang Tshao Mu Chuang*, identified the bark described in the ancient document as *Aquilaria agallocha*. The most valued product of this tree is its pathologically diseased, fragrant wood called gharuwood that was an important commodity in the early maritime trade in Southeast Asia (Hirth & Rockhill 1911:272). A Han dynasty (202 BC - AD 200) painting (TH.2.OC) in the collection of the National Palace Museum in Taiwan depicts the early gharuwood trade (Fig. 4.7). It is clear from the costume of the men carrying gharuwood and other precious commodities in the painting that they are neither Chinese, Middle Eastern, nor Indian.

Excavations on Chek Lap Kok Island conducted by the Hong Kong Archaeological Society in 1991 produced an artefact described as the first example of portable art (apart from pottery) from the prehistoric period in Hong Kong (Meacham *et al.* 1994:85). Fig. 4.8 shows a figure incised on the upper surface of a small, smooth pebble recovered from the Middle Neolithic deposit at the site called Fu Tei, located on the south-west coast of Chep Lap Kok Island (Fig. 4. 1). The pebble was amongst pottery vessels and polished stone tools at the main site on a plateau overlooking the beach. From four radiocarbon dates on charcoal, Meacham places the period of occupation at Fu Tei between 3900 and 3600 BC. Analysis of the material composition of the stone showed that it was exotic: fine-grained felsite, not found in Hong Kong. The artefact was identified as a pebble grinder and in the report on the site, 'Archaeological Investigations on Chek Lap Kok Island', Meacham describes the pattern on the surface of the pebble as "unlike anything seen on pottery" and concludes that "its meaning will probably remain unknown" (1994:85). I suggest that textile technology *might be* incised on the upper surface of the pebble from Chek Lap Kok Island and that the artefact *could possibly* be an instructional diagram of sprang, a simple method of fabric construction generally considered to be a pre-cursor to true weaving.

Depictions of fabric construction are extremely rare in the archaeological record although some early example have been found on other mediums. Fig. 1.8 shows a painting of a loom inside a prehistoric pottery bowl from Nagada I in Egypt which appears to be the earliest known pictorial representation of a loom. The artist has depicted a horizontal ground loom with two end beams fixed to the ground with wooden stakes. Eight warp threads are depicted, stretched out in parallel lines between the two end beams. The weaving process is indicated by the three weft threads depicted at right angles to the warp on the same plane. The three rods painted across the centre of the loom represent the heddle, shed stick and beater.

Fig. 1.6 shows the basic principles of the true weaving illustrated on the pottery bowl. The odd (1,3,5) warp threads are attached to the heddle by a series of looped threads; when the heddle is raised the odd warps are automatically raised, thereby creating a space between the odd and even warp threads. This space is called the shed. To create woven cloth, the weft thread that is usually attached to a spool, is passed through the shed, straightened and beaten down with a sword shaped implement called a beater. The set of even warp threads (2, 4, 6...) is then taken up to create a countershed through which the shed stick is placed before the weft thread passes through the shed. The process is continued until the woven cloth attains the required length. The depiction of true weaving on the bowl indicates that the prehistoric groups in pre-dynastic Egypt had attained a high level of technical knowledge and skill 5000 years ago.

An entirely different technique of fabric construction is shown on the 6000 year-old diagram on the Chek Lap Kok Island pebble. The Hong Kong diagram shows a technique known as sprang which differs from the true weaving described above in that it uses only a single set of elements. In textile terminology, sprang is weft-less and the warp is active. Sprang is indicated by the absence of any weft in the diagram and the diagonal alignment of the warp. While the three rods across the centre of the diagram resemble the header, shed stick and beater that are an integral part of true weaving, similar rods are also used in sprang to prevent the fabric structures from unraveling.

Fig. 4.9 shows how parallel rows of warp threads are fixed between two points to make sprang. Using the fingers, the warps are interworked, either interlaced or intertwined (Fig. 4.10). The process begins at one end and is automatically replicated at the other end. When the elements become too short to be interworked they are simply tied off. Sprang can be produced without a frame. Small children use the technique to play a game called 'cat's cradle'. In some parts of the world, sprang is still produced on wooden frames. In his detailed study, *The Techniques of Sprang*, Collingwood (1974) shows sprang worked on backstrap looms in Mexico, on makeshift frames where the warp is stretched between two poles, one of which is a limb of a tree, in Romania and on standing frames in both Pakistan and Moravia. Small portable frames are also used for sprang.

The earliest indirect evidence for sprang in Europe takes the form of pottery impressions from Neolithic sites in Germany where the greatest concentration has been reported (Schlabow in Barber 1991:123). Extant sprang has also been excavated from sites in Peru (Fig. 4.11). Barber (1999) has also identified headwear made from sprang on the Mummies of Urumchi in

Chinese Turkestan but sprang has not been identified at archaeological sites in either north or south China. However, impressions on pottery found at the Neolithic site of Yuchan Cave in the Yangzi Valley described by Chinese archaeologists as "knitted patterns" (Yuan 1996; CASS 1997; Lu 1997-1998) *could be* sprang. In the absence of either ethnographic or historical evidence for knitting in China, sprang remains a possibility. Three radiocarbon dates for the cave have been published which range from 8000 to 6000 BC. The site contained stone tools, pottery and rice. It is also worth noting that Hong Kong archaeologists have linked the Middle Yangzi sites to the Pearl River delta by a series of reconstructed routes discussed more fully below. Furthermore, sprang has been found at other archaeological sites in Lingnan mentioned below. Sprang is also widely used throughout the Melanesian world for *bilims* which are worn on the head. All of this adds credence to the possibility that the pebble from Fu Tei on Chek Lap Island is an instructional diagram of sprang. The diagram could be interpreted as a small portable frame with handle and intertwined warps consistent with sprang constructions. The circle around the centre of the frame could be showing the interlacing process. Further research into pottery impressions in the Middle Yangzi and Pearl River delta are clearly indicated. Although the origins of Chep Lap Kok pebble remains unclear at this stage, it *might be* significant to textile history. The diagram *might be* amongst the earliest depictions of fabric construction on prehistoric art, anywhere.

Zengpiyan

A perforated stone disc was found at the site of Zengpiyan (Fig. 4.1). Zengpiyan is an early cave site occupied during the warm phase in South China (Higham 1996:15). The Zengpiyan assemblage is dated between 8000 and 6000 BP (Institute of Archaeology CASS 1984). The disc (Fig. 4.12) *may have* functioned as a whorl as it compares favourably with the stone-perforated discs identified as whorls from the Middle Yangzi sites discussed in Chapter 2. Zengpiyan also produced one stone bark cloth beater that may have been used in cloth production. In addition, Zengpiyan also yielded a number of needles of the type linked to netting at Xianrendong.

Yung Long

Different relationships are suggested by the pottery whorls found at Yung Long (Fig. 4.1) on Hong Kong Island. The site spans three phases: Phase I (4500-3700 BC), Phase II (3700-2900) and Phase III (2900-2200 BC). The whorls from the site belong to Phase III that is marked by the sudden appearance of pottery decorated with stamped leaf-vein designs and stone *yue* (polished green stones) considered to be ritual symbols of the ancient Yueh (Chau Hing-wah 1993:54). Yung Long's pottery whorls measured between 3.3 cm and 4.2 cm in diameter. The design elements incised on the upper surfaces of the whorls (Fig. 4.13) are paralleled at Hemudu and Tanshishan. The whorls do not appear to be biconical in shape but are linked to the Yangzi delta by the reeling device motif depicted on the whorls from Phase III that characterized whorls from Hemudu. Lapita pottery (Fig.4.14) has the same motif.

Shixia

The data from the Late Neolithic site of Shixia indicates quite different relationships. Shixia (Anon. 1978:1-22) is a large Neolithic mound located near the Wushi River, a tributary of the Xiangjing. The site is dated between 2800 and 3500 BC and contains evidence for rice (Higham & Lu 1998:874). Details concerning the shape of the mound are worth noting. As de Groot (1912:1094), points out, grave mounds in Fujian are conical whereas large numbers of grave mounds in the central and northern provinces were semi-globular. All three layers at Shixia produced whorls (Fig. 4.15). Table 4.2 shows that the greatest numbers were found in layer 2.

Layer	Number of whorls
1	1
2	93
3	1

Table 4.2 *Distribution of spindle whorls at Shixia.*

Layer 3 produced a single pottery whorl associated with fine polished pottery (Kuhn 1988:136). This truncated conical whorl (trapezium) type measured 3.1 cm in diameter. This type of whorl occurs at Middle Yangzi and Shang dynasty sites. Fig. 4.16 shows Shixia's strategic location in reconstructed migration routes southward from the Yangzi Valley developed by Hong Kong archaeologists. The route passes down the Xianjiang to Shixia, then into the Pearl River delta, via Lake Dongting. Layer 2 at Shixia produced 93 whorls. Shixia's connection to the *zhongyuan* is emphasized by the decoration on the whorls. Scholars (see Kuhn 1988:136) have observed that two of the designs impressed into the whorls (M27: 1 and M29: 28) resemble the Chinese characters *mi* and *shih*.

Hedang

A group of sites known collectively as Hedang (Fig. 4.1) also produced textile data along with unequivocal archaeological evidence for division of labour based on gender. Excavations of 77 graves at Hedang (Zhu Feisu 1984; Li Guo 1994) produced large numbers of stone needles, spindle whorls and weaving shuttles. The whorls were confined to female graves, the earliest of which is dated to about 2200 BC. The same burial pattern was demonstrated in female burials in Phase I at Beiyinyangying from the same period in the Lower Yangzi (Nanjing Museum 1993).

Man Kok Tsui

The morphology of whorls from Late Neolithic sites in Hong Kong (Fig. 4.17) links the earliest spinners from these islands to Tanshishan sites. Biconical types were found at Man Kok Tsui (Site 30) on Lamma Island, K'ei Lun Wai at Castle Peak and several other sites in the region. Man Kok Tsui also produced a bark cloth beater. Davis and Tregear (1960:211) also found a stone point with a biconical whorl that they believed may have functioned as a spindle. The context of the artefact in question is not clear from the report, however, it is conceivable that the two artefacts are components of the hand spindle. Stone (jade) spindles with whorls still attached excavated from a Liangzhu site in the Yangzi delta were discussed in Chapter 2. Almost certainly, these were ritual paraphernalia of a high status spinner. The same symbolic meaning could also be attributed to the glazed biconical whorl from Sham Wan Tsuen that was found in burials from the Tang period (AD 618-906).

Kwo Lo Wan

The earliest extant textiles found to date in the Pearl River delta were recovered by Meacham (Meacham *et al.* 1994) during excavations at the Bronze Age site of Kwo Lo Wan. The fragment (Fig. 4.18) was found adhering to a bronze projectile point (KLU 148) in burial 2. Three radiocarbon dates were obtained for the Bronze Age layer: 1253-847 BC, 1430-1040 BC and 1677-1311 BC. The fibres in the fragment were analysed by the Hong Kong Government Forensic Laboratory using Scanning Electron Microscopy and while the fibres were not positively identified, the photomicrographs (Fig. 4.19) showed that they resembled hemp. The fragment was a 2/1 tabby weave. According to textile experts from the Hong Kong Polytechnic, the fragment was not a "primitive textile" but a tabby weave which compared favourably with examples of Han cloth. The relationship between cloth and weapons is discussed more fully in Chapter 7.

Xianggang

Excavations (Guangxi Museum 1978; Guangzhou City 1981) of the stone-chambered tomb of the Nanyueh king at Xianggang (Jiefang Beilu Street, Guangzhou), yielded copious quantities of textiles which tell us a great deal about the role of elites in cloth production in Lingnan towards the latter part of the first millennium BC, as well as the profound influence of Chinese culture in Lingnan. The royal tombs contained the remains of the second king of Nanyueh, Zhao Mo, his 4 wives and 7 slaves. The tomb dates to 122 BC (Zhao Mo reigned between

137-122 BCE). The important role Lingnan played in the early maritime trade is reflected by the large quantities of prestige goods in the king's chamber, including well-preserved exotic cloths.

The king was buried in two coffins placed in a stone-chambered tomb. He had been dressed in a jade shroud comprised of small platelets (Figs. 4.20, 4.21. 4.22). The very high status of the king of Yueh is indicated by his burial suit; it is one of only 40 jade burial suits excavated thus far in China. As already stated, the Early Chinese associated jade with longevity and believed that jade placed in burials prolonged the life of a corpse. Because jade is quarried from mountains, it was (and still is) thought to contain the essence of mountains and capable of acting as an intermediary between earthly and spiritual spheres (Rawson 1996:170). In Han China, jade platelets of high status princes were sewn together with silk, gold, silver or bronze wire *(Hanshu* cited in Rawson 1996:171). Although jade platelets have never been found outside China (North and South China), the *Rijsmuseum voor Volkerkunde* in Leiden contains the burial costume of a Tahitian chief (Fig. 4.23) of the same structural composition. While the two burial suits appear quite different because of their different material composition, the method of construction of the jade and shell is virtually the same. The shell platelets from Tahiti are sewn together with twine rather than spun silk threads.

The royal burials at Xianggang were distinguished by large quantities of prestige goods, including jade *bi*, lacquer, elephant tusks, gold, iron, wood, bronzes (Dongson and Chu), mirrors and bells. A large proportion of the weapons in the tomb (80% of the bronzes, 78% of the jades and 30% of the iron artefacts) was wrapped in layers of silk (Lu 1991; Wang and Lu 1999). This practice was observed in the royal burials at Anyang. Textile pseudomorphs remained on some of the bronzes. Lu (1997-1998) observed that the colour remaining in some fabrics resembled cinnabar. Fig. 4.25 shows the remarkable good condition of the cloths found in the west chamber. Because of their state of preservation, Wang and Lu (1991) identified 23 different types, including 2 different types of embroidered cloths, 4 types of gauze, 3 types of brocade, 2 types of ribbon as well as unspun silk for quilting (Figs. 4.24 – 4.28). It is not surprising that large quantities of embroidered silks were found in the tombs as embroidery was highly fashionable amongst the elites of the early dynastic period. The prince of Chu so loved his horse that he put an embroidered dress on the animal. Moreover, embroidered cloths were prescribed at royal funerals, not only as burial furniture but ancient Chinese mortuary rites of the period prescribed that coffins of feudal princes be wrapped in embroidered cloths (Huang Nengfu 1991:5).

The structural composition of many of the cloths from the king's tomb are readily discernible. Amongst the wide range of fabric structures are examples of interlacing (S24), interlooping (S41A, S41B), looping (S34), warp facing (S38) with a horizontal cut (S29) and tabby weave. One of the most interesting fragments in the assemblage is S38 (Fig. 4.26) which has a mistake in the weave. Either one yarn was removed, or, alternatively, it was not woven correctly. Warp faced weaves would be quick to produce because of the diameter of the threads; the mistake in the example suggests that the spinners and weavers who produced the cloth for the king's tomb were more intent on speed than accuracy.

The tomb of the Nanyueh king at Xianggang also produced a number of exotic textiles of unknown provenience. The first was a very loosely woven lacquered silk cloth (15 warps x 14 wefts per cm) shown in Fig. 4.28. The gaps are readily discernible in the figures. Lacquered hats of this type of cloth were also found at Luobowan, discussed below. In the *zhongyuan*, both matting and textiles were painted. As Huang Nengfu (1991) points out, there is epistemological evidence to link painted cloths to embroidery cloth in Early China. The same character in ancient Chinese is used to denote embroidery and polychrome pictures on fabric (Huang Nengfu 1991).

A second type of rare cloth recovered from the Nanyueh king's tomb was painted with a very dark, black/blue oily substance. According to Lu (1991), Chinese silks were painted with vegetable oil during the Western Han period. The same technique is also linked to South China (Chen 1984). However, there are Southeast Asian parallels also worthy of consideration. During fieldwork in Vietnam, a very unusual glazed cloth was purchased for the author's collection (Fig. 4.29). It is woven from hemp dyed with dark blue/black *Indigofera suffruticosa* in dye vats cut out of the limestone cliffs in Guangxi. Wax paste was applied to cloth before it was pounded with a mallet. Guangdong Province has long been a commercial producer of this glazed cloth using rocking stones and rollers for calendaring. The cloth was placed on a tray under a small cylinder; it was glazed when the stone pounder moved backwards and forwards with great power (Hommell 1937). The presence of early examples of the technique at Xianggang also suggests that Lingnan might be included in the history of chintz.

A third type of exotic cloth in the Nanyueh King's tomb was plainly woven silk coated with a mineral powder (Wang & Lu 1991) provisionally identified as mica. The analysts reconstructed the manufacturing process as follows. The woven fabric was first soaked in vegetable oil, then mica powder was applied to the surface before the cloth was rolled to fix the mica to the surface. The lack of Chinese parallels led Lu (1997-1998:67) to conclude that this unusual type of cloth was locally produced. Certainly, there are reports of local deposits of the mineral near Canton as early as the Qin dynasty. However, there are also reports of the usage of mica for decorative purposes in India in early Chinese records. As Wheatley points out, references to mica are very rare in Chinese documents but there is a reference pertinent to this discussion. "There is a mineral resembling mica, but of purplish tinge, which splits into plates as thin as a cicada's wing. Put together these laminae resemble silk gauze" (Wheatley 1959:119, 120). Contemporary Indian textiles are still decorated with mica.

Textile tools were also found at Xianggang. These include 2 bronze printing plates (Fig. 4.30). Lu (1989) has demonstrated that the designs on the bronze printing plates from the king's chamber also feature on some of the silk fabrics in the tomb as well as on cloths recovered from the royal tomb at Mawangdui, an important Chu textile site of the Han period. The printing plates are similar to bronze batik printing stamps called *caps* that are widely used throughout Indonesia for making batik. Batik is also produced by Chinese Minorities. According to Lu, the printing plates provide evidence for a printing workshop (probably a royal one) in Guangzhou around 2100 BP. Lu also points out that local needlework production is indicated by the presence of hundreds of iron needles in the tomb (1997:1998). It is possible that the King of Yueh owned textile workshops that included skilled batik producers and decorators of mica cloth.

Before discussing further evidence for workshop production, some of the fragments from Xianggang illustrated in the report should be mentioned. Some fragments were not woven and appear to be sprang. The fragments shown in S 29 and S 38 are woven, warp faced with a horizontal cut. These would have been faster to weave than weft faced cloths. Although it is not possible to determine fibre from photographs, it seems likely that the warps would have been silk as silk is finer and stronger than the wefts shown in the figures.

Luobowan

Excavations of tombs at Luobowan in Guixian County also produced very interesting evidence for craft specialization and loom technology in Lingnan at the end of the prehistoric period. Archaeologists from the Museum of the Guangxi Zhuang Nationality Autonomous Region (1977, 1988) attribute the site of Luobowan to the Western Han Dynasty (206 BC- AD 6), when Zhao Cha ruled over the kingdom of Lingnan, immediately following the incorporation of the region into the Han Empire. The tombs of concern here contained the remains of two

Prefecture governors and their spouses of corresponding rank. The tombs were superimposed above pits containing sacrificial victims buried beneath the floor of the upper chambers.

Amongst the burial furniture at Luobowan were 14 pottery biconical whorls, placed in the grave of the Governor's spouses (Fig. 4.31). The presence of biconical types shows a degree of technological continuity; the techniques and fibres used by Tanshishan spinners in the prehistoric period were used in the weaving workshops at Luobowan. The whorls were not found in the tombs of sacrificial slaves but were found in Tombs M1 and M2 containing the remains of high status sacrificial females buried with copious quantities of high status prestige goods. One of the lacquer bowls in the tomb was inscribed with *bushan* (Made by the Municipal Government). According to Gernet (1996), one of the peculiarities of the Han dynasty was the existence of very rich families who combined agricultural enterprises with industrial undertakings such as cloth mills, foundries and lacquer factories. The presence of the textile tools in high ranking burials at Luobowan suggests that textile production remained in the hands of women in the historical period with high status women supervising spinners and weavers in textile workshops producing exotic textiles for the emerging elites.

Fig. 4.32 shows depictions of characteristic Han robes with wide-sleeves on the bronzes in the tomb. Although grave robbers removed many of the cloths originally placed in the graves, scholars have been able to reconstruct the burial clothing from a list of the burial furniture that had originally been placed in the tomb. The list records 50 garments, including hemp shoes and 63 bolts of silk, plain weave hemp, gauze and brocade (Guangxi Museum 1978).

Fig. 4.33 shows a number of loom parts found in the tombs at Luobowan. According to Lu (1990), a dozen flat sticks were also found with the looms which indicates that more complex looms than the backstrap loom were used. However, the loom parts featured in the final report on the site (Museum of the Guangxi Zhuang Nationality Autonomous Region 1988), do have ethnographic parallels. The flat sticks from Luobowan could be patterns sticks used to weave brocade. Moreover, pattern sticks are used with backstrap looms. For example, 54 pattern sticks are used on Badja backstrap looms. More importantly, pattern sticks are used on Balinese looms which also have the same slotted warp posts and flattened wooden end beams found at Luobowan. Artefacts 10, 11 and 12 in Fig. 4.33 may also have been used in tapestry. Other end beams from Luobowan also compare favourably with Yami end beams (Fig. 4.34).

Yunnan

Although Yunnan is landlocked, its southwestern borderlands are linked to the *zhongyuan* through the Yangzi and to other parts of mainland Southeast Asia through the Red, Salween and Mekong Rivers. As Higham points out, in an area where river transport remains critical in exchange, "Yunnan is nodal" (1996:136). Archaeologists have reported pronounced differences in the wealth displayed in Bronze and Iron Age burials in Yunnan and these differences are generally attributed to the development of bronze and iron. There is also a strong possibility that cloth played a central role in the development of societies in this area but the absence of data has obscured its significance.

Shizhaishan

The royal cemetery at Shizhaishan (Yunnan Provincial Museum 1956, 1959) produced some of the most striking archaeological evidence for textile production yet found. The site is located on the shores of Lake Dian (Fig. 4.1) and is dated to the last few centuries of the first millennium BC. Shizhaishan has been identified as the cemetery of the King of Dian from the presence of a seal bearing the inscription "seal of the King of Dian". Ancient Chinese texts record the submission of the local Dian chief to Chinese control in 109 BC (Watson 1951:290-296). Excavations of high-ranking burials at the site produced large bronze drums showing scenes of the economy, religious rituals and the daily lives of the Dian, amongst which was a bronze showing a weaving scene. A basic division of labour based on sex is depicted on the Shizhaishan drums. Only male figures are depicted in the battle scenes on one drum (Fig. 4.36) and only female figures are depicted in the weaving scenes (Fig. 4.37). While this division of labour is implied in Neolithic burials in South China, it is unambiguous on the drums. Craft specialization is also shown on the drum from M1.

The weaving workshop depicted on the surface of the drum also indicates the usage of slave labour in the southwest. The central figure in the composition is a Dian slave owner, surrounded by smaller slave figure distinguished by different hairstyles and traditional costumes. The very high status of the slave owner is articulated by the use of another precious metal: she is the only gilded figure on the drum. She also sits on a raised platform whereas the slaves are depicted seated on the ground. The slave-owner has been identified as Dian although Han influence is discernible in her costume and hairstyle, described as like "Chinese silver ingot" falling to her shoulders (Huang Ti & Wang Dadao 1983:199). Her wide-sleeved robe with its central opening is typical of Han robes. Almost half (7/18) of the slaves in the workshop scene have been identified as ethnic Dian through their distinctive hairstyles, body decoration and costumes. Amongst the non-Dian textile workers is a slave with a topknot, bead necklace and knee length skirt belted at the waist. She holds a parasol above the slave owner to shield her from the sun and signal her high status. Parasols were amongst the ritual paraphernalia of elites throughout Asia in the historical period and this class of artefact has also been found in other high-ranking burials at Shizhaishan and Lijiashan, discussed below. Another slave is dressed in a sarong touching the ground at 2 points and fastened at the waist with a broad belt.

According to the *Hanshu* (History of the Former Han Dynasty), the people of Ba and Shu (Sichuan) frequently travelled south to traffic in slave children with the Dian. The *Huang Guozhi* (History of Huanyang) records that "certain men of Shu owned as many as six-hundred slave children plundered from Dian" (Huang Ti & Wang Dadao 1983). We also know from the *Man shu* (History of the Man Peoples) that skilled weavers were captured for their skills and set up in weaving workshops and that weavers from Sichuan with knowledge of satin weave were stolen specifically for their expertise.

Several figures on the surface of the drum are depicted weaving on foot-braced backstrap looms with continuous warps. The weaver is an integral part of the loom: tension is created when she places her feet on the warp beam. While this type of loom is more portable than other types, it has one major limitation: it can only produce textiles of very limited length (twice the length of the weaver's body). Foot-braced looms rely on friction of the warp to hold moveable parts into position. The shed stick occupies a vulnerable position in these looms, subject to torsion caused by the weaver failing to keep uniform tension. To overcome this problem, the Yunnan loom has bow shaped bars to lock the shed stick in place. Vollmer (1977, 1989:78-89) points out that this feature only survives in Taiwan in Atayal looms. Foot-braced looms are still used by Chinese Minorities and the Montagnards of Vietnam (Fig. 4.38).

Each of the 6 weavers on the bronze drum from Shizhaishan is depicted holding a sword beater. Four are depicted with both hands on the sword beater, beating up the weft. Another weaver is shown with a sword beater held sideways, opening the shed. Another is depicted removing the sword beater before feeding in the warp (Fig. 4.41). The same weaving tools were found in Tomb 17 at Shizhaishan along with a cloth beam with prolonged ends, a warp beam and a shed stick (Fig. 4.40). Two slaves are depicted spinning with hand spindles. One holds an unidentified object in her right hand and a drop spindle in her left. The object might be a gourd. Gourds are mentioned in relation to spinning in the *Dianhai Yuheng Zhi* (Official History of the Dian):

> The Man barbarian weavers set up their wooden looms anywhere...their looms do not occupy as much space as those used by the Han. They use a small gourd in the shape of a bell known as a *duo* from which they suspend a small weight. The thread is spun as the gourd turns. The method is less complicated than that used by Han weavers (Huang Ti & Wang Dadao 1983:219-220).

Textile technology was far more advanced in the Middle Kingdom during the first millennium BC than that depicted on the drum. Han stone engravings show that the Chinese had developed mechanized horizontal looms with treadles. The treadles, operated by the feet, were used to change the heddles thus freeing the hands for more complicated weaving techniques. Fabrics stored in the tomb at Mawangdui show that when Shizhaishan was used for burial, Chinese weavers produced very complicated types of weaves: *sha* and *luo* (gauze), *qi* (figured damask), *jin* (brocades) as well as *rong* (pile-looped weaves that were fore-runners of jacquard weaves) (Anon. 1973).

Lijiashan

At Lijiashan, the high status of cloth producers is marked by the presence of bronze weaving tools in high-ranking graves. Lijiashan (Fig. 4.1) is a cemetery site south of Shizhaishan near Lake Fuxian, dated between 830-400 BC. Yun Kuen Lee's (1994) analysis of the cultural materials in 22 of the burials shows that the Bronze Age groups buried at the site were appreciably richer than those buried on the Yunnan plains at Tainzimao, Shibeicun, Taijishan, Wutaishan or Pujuhe. The analysis also showed a concentration of bronze weaving tools in A1 burials, which was interpreted as evidence that access to woven products was restricted to elites. As with Shizhaishan, the textile evidence at Lijiashan shows gender differences; tombs 21 and 24 contained only bronze weapons and buckles whereas tombs 11, 17, 18, 22 and 23 contained only textile tools. The bronze loom parts from Lijiashan (Fig. 4.40) clearly indicate that while the weavers or workshop owners in the graves were richer than those buried at the above-mentioned sites, the burials with bronze loom parts were not as rich as those represented at Shizhaishan. Whereas the loom parts from Shizhaishan were made entirely of bronze, the beams from Lijiashan were wooden with only the socketed end pieces made of bronze. Four separate pairs of beams of this type were found in tombs 11, 17, 22 and 23. Vollmer (1979) compared the textile tools excavated from Lijiashan with the textile tools excavated from Shizhaishan and found them to be similar in length (44.0 cm and 48.4 cm) and concluded that the same tools were buried in each of the two cemeteries. He also concluded that the occupants of the graves containing bronze loom parts at Shizhaishan were elite craftspersons. Vollmer (1979) also observed that the double pointed sword-beater excavated from tomb 17 at Lijiashan is of the type used by Minorities in Yunnan today.

The whorls from Lijiashan were basic flat discs (Fig. 4.43), not diagnostic. The site also produced a class of artefact known in the West as a "niddy noddy" (Fig. 4.42), measuring between 5.7 cm and 22.1 cm in length and 2.4 cm and 21.4 cm in width. These tools are still used in many parts of the world including Southeast Asia to wrap spun yarn straight from the spindle. The niddy noddy is basically a shaft with a crossbar at each end. One crossbar is rotated at 90° degrees from the other. The end of the thread is held against the back of the centre shaft. With the left hand, the thread is carried up and over the crossbar and then down and behind the lower crossbar before being carried up the front and over the crossbar, then down again in front of the crossbar. The cycle is complete when the thread is carried up again behind the shaft. When the thread has been completely drawn out, a skein is produced. Vollmer has also identified two other tools excavated from the site as weaving implements. He considers a "knife" to be a weaving tool and an object identified as a "pointed chisel" to be a beater, of the type depicted on the bronze cowry container from Shizhaishan. Several bronze boxes from the site also contained bobbins holding unidentified fibres. A needle case containing "eye-less" bamboo needles (6-11 cm in length) was also reported. A rectangular plaque measuring 16 cm in length with four holes in it may have functioned as a backrest of a backstrap loom. Fig. 4.44 shows tools called spoon scrapers in the Yunnan Provincial Museum reports (1959) which Needham and Ohta Eizo have re-defined as scrapers used for retting hemp (Vollmer 1979:80). This class of artefact is discussed more fully in the following chapter.

At Tianzimao, whorls were found in burials belonging to commoners and elites (Hu Shaojin 1984). Some were associated with pottery (burials 11, 12, 19, 21); others were the only grave goods in the poorest graves. The largest, richest grave at Tianzimao (burial 41) contained the remains of an adult male and a child. This very large isolated grave (6.3 m x 4 m) is distinguished by large numbers of bronze swords, axes and daggers. A single whorl was also found in the grave. It is dated between 300 and 100 BC. As Higham (1996:165) points out, the presence of pottery spindle whorls in this male burial is not in keeping with evidence from other Dian sites where there is a sharp distinction between males with bronze weapons and females with pottery spindle whorls. There is a possible explanation for this discrepancy. We know from the 'Records of the Historian' that slave children were engaged in textile production in Yunnan and that the people from Sichuan (the Ba and the Shu) came to Yunnan to traffic in slave children. The 'History of the Former Han Dynasty' and the 'History of the Huayang' state that "certain men of Shu owned as many as six-hundred slave children plundered from Dian" (Huang Ti & Wang Dao 1983:220). Burial 41 may have contained the remains of a high ranking slave-owner and his private slave who spun thread.

It is clear from the data that weaving workshops were of considerable economic importance during the Bronze Age in the Kingdom of Dian. The bronze retting brush from Lijiashan suggests that ramie (and/or hemp) was domesticated for cloth production. The niddy noddy indicates that cotton was processed during the early historical period in Yunnan. The prehistoric trade in cotton is discussed more fully in Chapter 9. Suffice here to say that botanists have traced the movement of *G. herbaceum* along the Silk Route to China and *G. arboreum* has been traced from East Bengal to Yunnan, via Assam and Burma (Kuhn 1988:58). Standard histories of this period indicate that cotton was rare in Han China at this time. If slaves in the workshops were from northern pastoral regions, wool may also have been spun. As Yunnan was not completely sinicized at this time, it seems unlikely that the workshops would have produced textiles for the Imperial coffers. In the Warring States period, every Chinese household paid taxes to the court in rice and cloth. Silk was one of the principal textile filaments along with bast fibres such as hemp, ramie, jute, abutilon and bean creeper. At that time, there was a Director of the Hemp Department in the Zhou palace in charge of the production of bast cloth and strict standards were maintained (see Kuhn 1988:19).

In summary, the data described in this chapter alludes to more than one cloth tradition in Lingnan. Bark cloth traditions dating back 6,000 years in the Pearl River delta that are crucial to Pacific prehistory were described. The data show the introduction of spinning and weaving traditions from southeast China into the Pearl River delta during Phase II. The data from Yunnan show increased production consistent with the development of textile workshops using slaves, including children. There is also sufficient evidence in this part of the Yangzi to suggest that warfare and cloth production were important economic activities. The data also suggest that some spinners and weavers from Yunnan may have been captured during this period of internecine warfare. Data from the tombs at Luobowan and Xianggang suggest that royalty was involved in cloth production at the beginning of the first millennium AD. The data from Yunnan suggest the movement of Chinese into Yunnan to set up weaving workshops manned by spinners and weavers from the barbarian tribes of the south (Southeast Asia) to produce exotic cloths for the early textile trade.

Chapter 5

Vietnam

The Cultural Significance of Cloth

It would be difficult to overstate the cultural significance of cloth to some traditional ethnic groups in Vietnam. The Tai (Thai, Thùy) from northeast Vietnam (Laos and Thailand), for example, not only articulate ethnic identity through their distinctive costumes but also call themselves according to the types of clothes they produce. The Thai Khao (White Tai) who generally live in the coastal regions produce and wear white clothes while the Thai Dam (Black Tai) who occupy the narrow mountain massif of the northwest are associated with dyed black clothes. Another branch of the same ethnic group known as the Tay, who also live in the north are called the *can slua khao* (people with white jackets) and are known to the Chinese as the *pai-ji* (white jackets) whereas their neighbours who also speak Tai are called the *can slua dam* (people with black jackets). This relationship between cloth, ethnicity and epistemology is well-documented (Tran Quoc Vuong, Nguyen Tu Chi, Cam Trong 1991:74-93) but its origins are unclear.

According to Vietnamese mythology, the earliest groups in this region did not have knowledge of spinning and weaving. The first indigenous "chiefdom" of Van Lang centred on the Red River delta was reportedly ruled by Hung kings who claimed direct descent from a heroic ancestor, Lac Long Quan (a dragon). The heroic ancestor, Lac Dragon Lord, came to the Red River plains from his home via the sea, subdued the evil elements in the region and civilized the people by teaching them to cultivate rice and weave clothes (Tessitore 1988-89:33). The archaeological evidence for cloth production described in this chapter shows the introduction of the hand spindle into the Red River delta from southeast China towards the end of the Neolithic, around 4000 years ago. Research into textile data from Bronze Age sites in Vietnam also shows greater technological (and cultural) complexity in Vietnam than generally held. Movements of spinners and weavers with new textile tools are also traced from Yunnan into the Red River delta. The research also shows technological change with the introduction of new types of looms into Southeast Asia before the Indic period. An argument is also put forward that from the Bronze Age onwards there is increasing evidence for craft specialization culminating in evidence for large-scale cloth production at sites in the Mekong delta prior to the Indianization period.

New Radiocarbon Dates

Much archaeological research has been undertaken in Vietnam since the French colonial period although most of the findings are reported in Vietnamese journals. The radiocarbon dates from some recently excavated sites shown in Table 5.1 were obtained from the Radiocarbon Dating Laboratory in the Research School of Earth Sciences at the Australian National University. Many more dates are anticipated now that the Institute of Archaeology in Hanoi has a Radiocarbon Laboratory.

Sample number	Site	ANU Laboratory code	Material	Radiocarbon date
97GOCHL11b1	Go O Chua	10876	soil	2420 ± 70 BP
97XOM1L40d2	Xom Oc	10878	charcoal	1900 ± 60 BP
97XOM1L50a1	Xom Oc	10897	charcoal	1910 ± 60 BP
97ANS1L3b3	An Son	10880	charcoal	3820 ± 70 BP
97TKH1L2-1a3	Tra Kieu	10882	charcoal	1570 ±100 BP
97ASH1B3L2-17	An Son	10881	charcoal	3370 ± 80 BP
97TKHL2-5b4	Tra Kieu	10883	charcoal	1980 ±60 BP
96TKH1L5-cd4	Trang Kenh	10884	charcoal	3440 ± 60 BP
98PDD5	Phia Diem	11119	charcoal	4170 ± 240 BP
98DK. No 1	Dakai	11120	charcoal	3160 ± 70 BP
98DKI. No2	Dakai	11121	charcoal	3090 ± 70 BP
99MBH2L2	Man Bac	11115	charcoal	3530 ± 60 BP
99OBTest7	Ong Bay	11122	shell	16630 ± 120 BP
99AML3T3	Ang Ma	11116	shell	2510 ± 220 BP
99DTTAL1	Dinh To 2	11171	shell	3060 ± 60 BP
99TTSLIII	Dinh To 3	11118	charcoal	3890±160 BP

Table 5.1 *New radiocarbon dates for Vietnam.*

Lang Bon

Before the earliest unequivocal cloth production sites from the Red River delta (Fig. 5.1) are discussed, some anomalies from the archaeological record need to be mentioned. The History Museum in Hanoi houses *2 doi xe chi* (spindle whorls) recovered by Colani (1930) from the cave floor at Lang Bon. The cave lies in Lang Bon village, Cam Thuy district, Thanh Hoa Province. It is extremely doubtful that the whorls (Fig. 5.2) are Hoabinhian material culture. Research into the cultural materials recovered from 131 other Hoabinhian sites in Vietnam failed to produce any evidence for whorls. The whorls from the cave floor are the only examples of this class of artefact found at a Hoabinhian site. Nor were whorls found at any of the 50 Bacsonian sites documented in Vietnamese sources. Furthermore, the functional attributes of the whorls from Lang Bon shown in Fig. 5.2 compare favourably with Late Neolithic and Metal Age whorls. As the whorls were surface finds, it seems more likely that they belonged to agricultural groups from Phung Nguyen sites discussed below where securely provenanced *doi xe chi* have been excavated.

Number	Material	Colour	Shape	Weight (g)	Diameter	Central Perforation (cm)
Ls18839	pottery	buff	biconical	35	3.20	0.40
Ls18840	pottery	buff	biconical	30	3.40	0.60

Table 5.2 *Functional attributes of Lang Bon whorls.*

Da But

Fig. 5.3 shows a large stone perforated disc recovered from the Middle Neolithic layers at Da But (Bui Vinh 1977). Da But is located in Vinh Tan village, Vinh Loc district, Thanh Hoa province. Five Da But sites have been excavated in the province thus far. Sites belonging to this post-Hoabinhian cultural complex first appeared along the coastal plains in North and Central Vietnam where prehistoric groups had not previously been found. The four uncalibrated radiocarbon dates given for the site range from 6095 ± 60 BP to 5710 ± 60 BP. The precise function of the stone discs from Da But is not clear, as positive identification was not possible from photographs. However, the stone disc from Da But shown in Fig. 5.3 is paralleled at Zengpiyan which suggests early relationships between maritime groups who occupied the coastal region of Bac Bo and groups from Lingnan

Phung Nguyen sites

The earliest unequivocal evidence for the hand spindle in Vietnam comes from very shallow graves (<1 metre in depth) at Phung Nguyen sites. More than 55 Phung Nguyen sites in the Red River delta (Fig. 5.4) have been identified thus far and the sites are significant in Southeast Asian prehistory for their early evidence for rice (Higham 1999). These small settlements are strategically located near rivers and streams above the surrounding terrain in the Red River delta. The earliest radiocarbon date for a Phung Nguyen site is 4170 ± 240 BP for Phia Diem. A similar date of 4145 ± 60 BP has also been obtained for Ma Dong (Nguyen Khac Su and Nguyen Lan Cuong: 1997). Both shouldered and quadrangular adzes occur at Phung Nguyen sites along with jade *bi* and *zhang*. *Zhang* are Chinese ritual weapons which first occur at Xia, Shang and Western Zhou sites dated between 4700 and 4000 BP (Diep Dinh Hoa 1996). *Zhang* have also been excavated in Fujian Province and Guangdong and Hong Kong (Shenzhen Museum 1993; Tran Quoc Vuong, Nguyen Tu Chi, Cam Trong 1991). Table 5.3 gives the numbers of whorls excavated from a number of Phung Nguyen sites investigated as part of the study.

Site	Location	Dates of excavation	Size of excavation (m^2)	Number of whorls
Phung Nguyen	Kinh Ke, Phong Chau, Vinh Phu	1959, 1959, 1961, 1968	158 3,700	14
Go Ghe	Thanh Dinh, Phong Chau, Vinh Phu		50	1
Go Da	Thanh Dinh, Phong Chau, Vinh Phu	1961	50	2
Go Cay Tao	Tan Trieu, Thanh Tri, Ha Tay	1972	150	2
Van Dien	Tam Hiep, Thah Tri, Ha Noi	1962	100	18
Go He	Van Thang, Ba Vi, Ha Tay	1973	112	3
Dong Vong	Co Loa, Dong Anh, Ha Noi	1977	275	3
Xuan Kieu	Duc Noi, Dong Anh, Ha Noi	1977	248	1
Go Dien	Gia Thanh, Phu Ninh, Vinh Phu	1968, 1973	187	3
Lung Hoa	Ving Lac	1965	190	4

Table 5.3 *Distribution of doi xe chi at Dong Dau sites.*

Only two sites yielded more than 10 whorls with only 14 whorls excavated from an area of 3,700 m^2 at Phung Nguyen (Hoang Xuan Chinh & Nguyen Ngoc Bick 1978; Nguyen Ba Khoach 1980). The presence of a few whorls at most sites suggests domestic production at the village level. Phung Nguyen *doi xe chi* (Fig. 5.5) in the History Museum in Hanoi were analysed and their functional attributes are given in Table 5.4.

Specimen	Material composition	Colour	Weight (g)	Diameter (cm)	Central perforation (cm)	Shape	Decoration
LS 10228	pottery	grey	35	4.73	0.6	flat disc	circles
LS 12573	pottery	grey	20	4.7	0.5	flat disc	concentric circles
LS 12574	pottery	buff	20	3.8	0.5	flat disc	-
LS 12575	pottery	buff	20	3.8	0.3	flat disc	-
LS 12575	pottery	buff	20	3.8	0.3	flat disc	lines
LS 12576	pottery	grey	20	3.8	0.3	conical	cross-hatches
LS 12577	pottery	red	20	3.8	0.4	conical	-
LS 12579	pottery	grey	18	3.5	0.4	conical	-
LS 12581	pottery	grey	15	2.7	0.3	conical	
LS 12582	pottery	grey	10	2.7	0.3	conical	lines
LS 12586	pottery	red	20	3.7	0.3	conical	-
LS 18839	pottery	buff	35	3.2	0.4	biconical	-
LS 18840	pottery	buff	30	3.4	0.6	biconical	-
LS 412576	pottery	grey	20	4.2	0.5	flat disc	-
LS 10227	pottery	buff	32	3.8	3.2	conical	-

Table 5.4 *Functional attributes and decoration of Phung Nguyen doi xe chi. History Museum, Hanoi.*

Without exception, the whorls were made from pottery (terracotta, black, grey, buff) and ranged in size from 2.7 - 4.73 cm. There is congruence between the morphology of Phung Nguyen whorls and the morphology of Tanshishan whorls. The biconical, conical and flat discs represented in southeast China are present. The spinners represented at Phung Nguyen sites are also linked to spinners from southeast China by the decoration on their spinning tools. Not only are the same design elements featured on Phung Nguyen whorls but they are also arranged in the same way using the same decorative techniques. Fig. 5.6 shows *doi xe chi* embellished with the small concentric circles that distinguished whorls from later sequences at Tanshishan sites as well as the radiating whirl motif found on whorls from earliest layers at the type site of Tanshishan.

Fig. 5.7 shows five pottery *doi xe chi* from the site of Bai Tu. The site is located in Cuong Giang Village, Tien Son District, Ha Bac. The 1973-4 excavations at the site covered an area of 94 m^2. The whorls were made from terracotta, buff and grey pottery, yet irrespective of the type of pottery used in their manufacture, all are biconical.

Phung Nguyen sites have also produced firm archaeological evidence for bark cloth production. Direct archaeological evidence comes from bark cloth beaters called *ban dap* (Fig. 5.8). These are described as "small blocks of parallelepedic schist with small parallel lines on the two opposed lateral faces while a big line goes through the other faces" (Ha Van Tan 1980: 80-83). The 1973 excavations at the site of Go He (Nguyen Khac Su and Nguyen Lan Cuong 1997), for example, produced 3 *ban dap* and 3 *doi xe chi*. The site is located in Van Thang village, Ba Vi district, Ha Tay Province. Three *ban dap* were also found in a 2 m^2 test pit at Dong Cho in Phu Phuong village, Ba Vi district, Hay Tay. Test pits at Go Thanh Den and Chua Cao also produced single finds (Nguyen Khac Su & Nguyen Lan Cuong 1997). The presence of different cloth production tools in the same layers at these sites indicates that the Late Neolithic groups in the Red River delta had knowledge of beaten bark cloth and textile technology.

The function of the bark cloth is not clear from the evidence. Was it made for clothing, flooring, shrouds? Aboriginal groups from Yunnan known to the Chinese as "wild men" reportedly wore only bark cloth prior to Chinese incursions (Ling 1963-4:34). Research also shows that it is not always possible to draw a sharp distinction between bark cloth and spinning and weaving as some Vietnamese groups weave bark jacket from spun bark fibres (Fig. 5.9). These ethnographic parallels confirm reports in the *Hou Han shu* that bark was twisted and woven into cloth by the barbarian tribes of the south which otherwise seem contradictory. Bark cloth may also have been produced for warfare. Historical sources also indicate that early groups in Lingnan made armour from bark cloth; the shape of bark cloth armour was the same as the metal armour worn by the Chinese but reportedly more flexible.

The Hsu shang (History of the Tang dynasty) refers to an expeditionary force of 1000 troops in the region clothed in pleated armour, too thick to be pierced by arrows.

Dong Dau sites

Cloth production tools continue in the archaeological record at Dong Dau sites, along with different types of evidence for production. Dong Dau sites are located in the same general area as Phung Nguyen sites (Fig. 5.10). Although a few pieces of bronze have been found at Phung Nguyen sites, Higham (1996:76) places the establishment of bronze working in the Red River area between 1500 and 1000 BC. Dong Dau sites are significant in Southeast Asian prehistory as they provide the earliest archaeological evidence of craft specialization for Vietnam. Nguyen Kim Dung (1996: 161-165) has established craft specialization at Trang Kenh, a Bronze Age workshop for manufacturing stone in Thuy Nguyen district, Hai Phong Province. The site has two radiocarbon dates: 3605 ± 90 BP and 3450 ± 100 BP (uncalibrated) with the earliest layers assigned to the Phung Nguyen culture. *Zhang* were also found at Trang Kenh, which provides unequivocal evidence for contact with Han Chinese during the Bronze period. Whorls were not found at Trang Kenh but it is possible that a jade *bi* and a tortoiseshell disc (D18) from the site shown in Fig. 5.11 are symbolic whorls manufactured by specialists from Trang Kenh for the graves of high-ranking spinners. Both materials were highly prized by Chinese and Southeast Asians in the early trade in Southeast Asia (see Wheatley 1961). In Chapter 2 we saw that elite Liangzhu burials contained jade whorls resembling *bi* attached to jade spindles.

The hand spindle is also well represented at other Dong Dau sites. According to Ha Van Phung (1979:48-58), more *doi xe chi* have been excavated from Phung Nguyen and Dong Dau sites combined than from sites belonging to any in subsequent culture. This suggests that cloth production became increasingly important to the Metal Age economies in the Red River region. The increasing numbers of *doi xe chi* recovered from Phung Nguyen and Dong Dau sites supports the proposition that spinning and weaving workshops could date back to the prehistoric period in the Red River delta. The geographical handbook, 'Indo-China' (Naval Intelligence Division 1943), refers to village specialization in the Tonkin delta during the last century where villages existed that were devoted entirely to carpentry, weaving and the husking of rice. Specialized villages of these types still exist on the outskirts of Hanoi.

Fig. 5.12 shows an assemblage of Dong Dau whorls from the History Museum in Hanoi that was investigated as part of the study. Table 5.5 shows the functional attributes of these Dong Dau whorls; these compare favourably with those from Phung Nguyen sites and there can be little doubt that they are from the same technical tradition. The 5 main types shown in Fig. 5.12 are paralleled at Tanshishan sites. Fig. 5.13 shows an entirely new type that is an elaboration of the basic disc with the outer edge higher than the central section. This shaping actually creates a concentric circle when the whorls are viewed from above. Whorls of this type are uncommon. According to Kuhn's (1988: Fig. 97) typology of atypical whorls in China, this type has only been found in Liaoning Province. Continuity is also indicated by the usage of concentric circles, radiating spirals and the silk reeling machine motif on Dong Dau whorls, all of which first occur at Yangzi Valley sites. The movement of spinners from the Middle Yangzi Valley into the Red River Valley is suggested by a black pottery whorl (LS8863) incised on its outer circumference, an unusual decorative style which characterized the Qujialing whorls discussed in Chapter 2.

Number	Material composition	Colour	Weight (g)	Diameter (cm)	Central Perforation (cm)	Shape	Decoration
LS5974	pottery	buff	30	3.70	0.60	flat disc	-
LS5956	pottery	grey	10	2.98	0.53	flat disc	-
LS5957	pottery	grey	12	3.25	broken	conical	-
LS7870	pottery	buff	50	4.75	0.60	biconical	reeling device
LS8350	pottery	buff	35	4.42	0.50	truncated conical	-
LS8853	pottery	buff	20	3.70	0.73	flat disc	line
LS8854	pottery	buff	12	4.00	0.50	flat disc	-
LS8857	pottery	grey	10	3.00	0.50	disc with raised edges	concentric circle
LS8858	pottery	grey	25	3.90	0.29	truncated conical	-
LS8859	pottery	buff	30	2.78	0.29	truncated conical	-
LS8861	pottery	grey	15	2.90	0.45	truncated concial	-
LS8863	pottery	grey	45	4.20	0.50	flat disc	incised lines
LS8864	Pottery	buff	12	4.00	broken	conical	-
LS8865	pottery	buff	30	3.74	0.40	biconical	-
LS8868	pottery	buff	20	3.80	0.35	biconical	-
LS8869	pottery	red	30	4.00	0.50	biconical	-
LS8872	pottery	buff	25	3.80	0.50	abacus	concentric circles, spiral

Table 5.5 *Functional attributes of Dong Dau doi xe chi housed in the History Museum, Hanoi.*

Fig. 5.14 shows a bronze implement of unknown function from a Dong Dau site which warrants closer scrutiny. This class of artefact first appears at Dong Dau sites and continues in the archaeological record at Go Mun and Dongson sites (Fig. 5.15). This research has found that in Yunnan bronze brushes of this type have been identified as tools used during the retting process to untangle wet ramie fibres prior to spinning and weaving (Chapter 4).

According to Ma Chengyuan (1986:20), bronze was used extensively for handicraft tools in China in Shang and Zhou times. The Dong Dau retting brush provides direct evidence for ramie processing. *The Tso Chuan* (Master Tao's tradition), written between 2468 and 2300 years ago, specifically mentions a ramie robe presented to the Zhou ruler of that time by groups from Lingnan. Chinese historical documents also refer to crop failures in China during the early dynastic period when hemp supplies were scarce, and ramie had to be imported from the south for textile purposes.

The handle of one of the retting brushes from Vietnam shown in Fig. 5.16 is worth noting. It is decorated with an elaboration of the ***S*** motif first observed on silk fragments adhering to a jade ritual weapon (Fig. 5.17) from Anyang. In both the *zhongyuan* and Vietnam the ***S*** motif first appears on Neolithic pottery. In the *zhongyuan*, the ***S*** motif can be traced back to Neolithic pottery. In Vietnam, the motif characterizes pottery from the Go Bong phase of the Phung Nguyen culture (Ha Van Tan 1991) (see Fig. 5.18). The elaboration of the ***S*** motif on the retting brush also distinguishes Chu and Shu art. The data suggest the introduction of different fibre processing tools along with Chinese art styles from Yunnan to Vietnam towards the end of the Dong Dau period. The ramie tools raise the possibility that weaving workshops of the type evidenced at Dian sites in Yunnan existed in Vietnam at the end of the Metal period.

The Ancient Technology Unit at the Institute of Archaeology in Hanoi houses a large collection of textile pseudomorphs on metals dating from the Dong Dau through to the Han period. Over time, the leaching salts from bronze and iron in burials preserved the tiny fragments of cloth buried with them; some in their origin form; others partially or completely mineralized. A few of the metal artefacts bearing traces of cloth are uniquely Vietnamese whereas others are paralleled in the *zhongyuan* and some are paralleled in Yunnan.

The fine bronze halberd (D74) shown in Fig. 5.19 was recovered during the 1962 excavations at Doi Da in Cam Thuong Village, Ba Vi district, Ha Tay Province. The site covered an area of 530 m^2. The bronze halberd is a Chinese weapon that developed from stone (jade) forms during the early dynastic period. Fine metal was cast into swords and halberds while inferior metals were used for agricultural tools (Ma Chengyuan 1986:18, 73). The halberd was Chinese military technology from the Shang and Zhou dynasties through to the end of the first millennium BC where it was connected to chariot fighting. Archers, armed with pairs of complex reflex bows, lancers and long hafted weapons flanked chariots. Each archer was also armed with swords, daggers and bronze knives (later from iron). Infantrymen positioned beside the chariots were armed with halberds for attacking the enemy. Traces of fine cloth are discernible on the halberd from Doi Da. The mineralized fibre could not be identified but the weaving technique, ie. 1/1 tabby is readily discernible in the magnified version in Fig. 5.20. The textile pseudomorph on the halberd indicates that weapons were probably wrapped in cloth before being placed in shallow graves at Dong Dau sites. The same mortuary practice is discussed more fully in the section on Han burials.

Go Mun sites

Sites belonging to the Go Mun culture have also produced copious quantities of mineralized cloth from Metal Age burials. The sites (Fig. 5.21) are located in the same vicinity as Phung Nguyen and Dong Dau sites with the greatest concentration on the banks of the Red River where it converges with the Da River.

The site of Go Mun is located in Cuong Giang Village, Tien Son District, Ha Bac and the excavations at the site in 1973-4 covered an area of 94 m^2. It seems to me that the principal motifs on Go Mun pottery (Fig. 5.22 - 5.23) resemble Chinese embroidery. These include the chain, cross and satin stitches used to embellish silk cloths in the early dynastic period. Embroidery as a decorative technique is well-documented in Chinese sources dating back to the Shang period. The *Shi ji* reports a mission sent by the Prince of Zhou to his neighbours with 100 horse chariots, 1000 ounces of gold, 200 jade tablets and 1000 rolls of embroidered silk to establish alliances against the Qin (Huang Nengfu 1991). Sites belonging to the Go Mun culture also produced some enigmatic pottery stamps that first occur in Vietnam at sites belonging to the Hoa Loc culture, discussed in detail below.

Ha Van Phung (1996:232) is firmly of the opinion that the two Go Mun sites, Go Chun and Hong Da were early silk weaving centres. While whorls occur at Go Mun sites, they are fewer in number than those from earlier Bronze Age sites. This may be less to do with production and more to do with the fact that no Go Mun burial sites have yet been located. The 7 different types of whorls found at Go Mun sites are shown in Fig. 5.24. The typology indicates a degree of technological continuity from the Neolithic to the Early Bronze periods in the delta. The decoration on the upper surfaces of some whorls also shows continuity from the Phung Nguyen to the Tanshishan. There is also sufficient archaeological evidence for different cloth production at pre-Han sites in Vietnam to suggest that the region was far more culturally and technologically diverse than generally appreciated.

Hoa Loc sites

Sites belonging to the Hoa Loc culture are located along the Vietnamese coast in the northern provinces of Thanh Hoa and Nga Son. The 19 sites found to date (2001) are dated between 4000 and 3600 BP. While Hoa Loc sites contain some elements of the Phung Nguyen culture, many Vietnamese archaeologists see Hoa Loc as a distinct pre-Dongson culture, ancestral to Sa Huynh and Cham (Ha Van Tan 1980). The most distinctive artefacts excavated from Hoa Loc sites are pottery stamps with deeply incised surfaces (Figs. 5.52). Stamps were excavated at Hoa Loc, Pan Thm Ha Dia, Loc Va and Van Hoa. Analysis of more than 500 pottery sherds from Hoa Loc sites failed to find any designs that matched the pottery stamps (Nguyen Kim Dung pers. comm.). This class of artefacts first occurs at Go Mun sites and continues in the archaeological record through to the Sa Huynh period. Stamps of this type have also been found at Ban Chiang (Chapter 8) where their function also remains obscure. Although pottery stamps are relatively rare in the Southeast Asian archaeological record, they occur at sites in India, Europe, the Middle East and Central America (Fig. 5.54). In India, pottery stamps with less deeply grooved surfaces date back to the Harappan Culture (3000 - 1500 BC). There they are mostly rectangular in shape but square, circular, plano-convex and trapezoid types also occur. Indian archaeologists identify stamps like those from Sonpur and Vaisali (Sinha and Roy 1969) as skin rubbers. However, the Indian examples (Fig. 5.55) do not have the curvilinear motifs that distinguish the stamps from Hoa Loc sites. In Europe, identification problems have arisen because scholars are not sure if the small clay stamps called *pintadera* that are widely distributed throughout archaeological sites were used to print designs on cloth or decorate the human skin (Barber 1996:226). Nor is the function of similar pottery stamps from Çatal Hüyük (Fig. 5.54) known.

Because of possible textile applications, an assemblage of Hoa Loc stamps from the Institute of Archaeology was formed for analysis. If the stamps had been used in textile printing, traces of dye or a resist medium like wax might have remained on their carved surfaces. No traces of dyes or resist mediums were discernible under the microscope; the absence of these substances on the stamps suggests that the stamps had another function.

In the *zhongyuan*, pottery stamps called dies had a role in bronze casting. The artefacts in question are not piece-mould fragments but tools that were used to impress design elements into the pottery moulds that were the basic components of bronze casting (Fig. 5.53). Casting was the pre-eminent technique for metal working from the Xia dynasty through to the Han and there has long been an important relationship between bronze casting and ceramic technology. By the Bronze Age, the Chinese had advanced ceramic technology (pyrotechnology); experience with refractories (heat resistant materials) and knowledge of use of clays; they also had developed kilns for reduction firing. The technology and the molding process were the ceramic legacy to the bronze production process (Chase 1991:30). In the *zhongyuan*, evidence for the usage of pottery stamps in metallurgy dates back to the Spring and Autumn period (770-221 BC) (Ma Chengyuan 1986:13). Decoration required only a single stamp to create standardized patterns. Stamps of the type shown in Fig. 5.53 impressed motifs on thin pieces of clay that were then joined to the mould according to specified designs. Because the decoration was impressed by dies and not carved by hand, the designs on the stamps lacked variety (Chase 1991). The main point is that there is a clear correlation between the motifs depicted on the stamps from Hoa Loc and motifs impressed with stamps on many bronzes from the Spring and Autumn period as well as the Dongson period (Fig. 5.560. This correlation suggests that the Vietnamese stamps *could be* metallurgy stamps.

The deeply incised spiral on one Hoa Loc stamp is the principal and defining motif of the *taotie* mask that distinguishes Shang bronzes. Fig. 5.57 shows the motif featured as a decorative frieze around the waist of the bronze *jia* (Fig. 5.57) from the Zhengzhou period (Erligang) period (16th - 14th century BC). The two bronze weapons shown in the figure feature two of the motifs on the Hoa Loc stamps. The *ge* (dagger axe) from the Shanghai Museum collection is decorated with the motif known to Chinese scholars as the cloud and thunder motif. Artefacts of secure Chinese provenance such as *zhang* and bronze halberds are generally interpreted in Southeast Asian archaeology as evidence for early trade and exchange. If these artefacts are indeed stamps used during the piece-molding process as proposed, then they suggest local production using Chinese technology.

Dong Son sites

The Dongson drums that are the hallmark of the Vietnamese Bronze Age provide the earliest unambiguous evidence for costume in Vietnam. More than 200 Dongson sites have been excavated since French scholars (Goloubew 1929) uncovered the first graves on the banks of the Red River in the village of Dongson in the 19th century. Altogether, 74 Dongson sites have been excavated in Than Ho, 52 in Hay Tay, 23 in Nam Ha, 22 in Vinh Phu, 25 in Nghe An, 4 in Hai Phong and 1 in Hai Giang Province. Fig. 5.25 shows the distribution of some of the main Dongson sites. Not all archaeologists identify sites in southern Vietnam as Dongson; some see Dongson artefacts at southern sites as evidence for trade and exchange. Everyone is agreed, however, that the Dongson period was one of the high points of Vietnamese prehistory.

The Dongson drums (Fig. 5.26) that mark the last phase of the Metal Age in the Red River region are finely cast and decorated with registers comprised of geometric and figurative motifs that become increasingly stylized over time. Fig. 5.27 shows figures on the middle registers wearing feather headdresses and capes. While the costumes are clearly ceremonial, we do not know if they were the ritual paraphernalia of Dongson warriors as Loofs-Wissowa (1991) has suggested, or the costumes of shaman. Certainly, large numbers of weapons have been found at Dongson sites but there is also historical evidence to link the drums to shamanic rituals. As Bernet-Kempers (1988) points out, Chinese historical documents mention that "shaman from the south placed pheasant tails on their heads prior to ritual trance dancing" and that the constant drumming of the Aboriginal shaman of Yunnan and Vietnam was completely alien to the Han Chinese. Swadling (1998) has recently advocated that the large feathers depicted on Dongson drums are Birds of Paradise feathers. According to Swadling, Melanesia contributed to the early trade in the South China Sea with the magnificent feathers from these birds. However, Vietnamese scholars do not identify feathers from Birds of Paradise amongst the feathers depicted on Bronze drums, only feathers from the white heron, hornbill, crane egret and pheasant. The large feathers are considered to be the white heron that is the totemic ancestor of the Vietnamese. This relationship is expressed epistemologically: the word for white heron is also the clan name for the Hong kings (Schaefer 1969:238). As Higham explains, the name of the kingdom of Au-lac of Vietnamese mythology (mentioned above) derives from a phonetic translation into Chinese of the word *vlang*, a large water bird in the Austro-Asiatic language. The centre of the first kingdom is located in Bach Hac district that is white heron in English. In other words, the Hung kings "chose a water bird as their totem" (Higham 1996:109).

On many of the Dongson drums, males are depicted wearing loincloths (Ngo Duc Trinh 1982:32-35) wrapped around the waist, under the crutch and tied at the front with the ends falling to the ground. Fig. 5.28 shows sarongs depicted on drums from Ngoc Lu, Song Ba, Huang Ha and Quang Xuang. It is not possible to say from the evidence if the sarongs were loincloths made from bark or simply folded cloth as both technologies are evidenced at Dongson sites. Other bronze figures are depicted wearing longer cloths, tightly fitting around the hips with a wide belt around the waist and two long flaps hanging down the front and back. The quantity of cloth, the decorative elements and the elaborate jewellery on the figures suggest that the latter belonged to elites.

Larger cloths would probably have been woven on upright looms whereas the shorter sarongs of the lower classes would probably have been woven on backstrap looms. While there is no archaeological evidence for the upright loom in Vietnam, stone frescoes depicting an upright loom and a silk reeling device have been excavated from an Eastern Han site in Tongshan county, Jiangsu Province (Bai Shouyi 1982:168). Dongson costume also included woven belts produced on different types of looms. During fieldwork in Vietnam, ethnographic examples of belt weaving were investigated as no prehistoric loom parts have as yet been found. Research showed the production of belts using different loom types by the Cham and Maa. The Cham use side-saddle looms (Fig. 5.30) to weave narrow strips to be worn as belts. The belts are woven in narrow strips (10 - 20 cm) of cloth *(jih)*. Contemporary Cham weavers make offerings of cooked rice and betel nut each Monday, Wednesday and Saturday to Ponvanh, the goddess of weaving. When technical problems arise during cloth production, weavers bow to the goddess and pray for better textile skills (Ba Trung Phu: unpublished report). There are also quite different loom types in the ethnographic record. Fig. 5.30 shows that the Maa from southern Vietnam also weave narrow bands on narrow backstrap looms that almost certainly are indigenous.

Fig. 5.31 shows figures on Dongson drums depicted holding unidentified objects which they appear to be reading. The central panels of these objects are decorated with the interlocking spiral, one of the principal motifs on Dongson pottery (Fig. 5.32). While the objects in question have not hitherto been linked to cloth, they could be woven materials made from stiff unspun fibres such as *Metroxylon sagu* (sago palm) or *Corchorus capsularis* (jute). Elsewhere (Cameron 2001), I have discussed the distribution of these specific bast cloths in parts of island Southeast Asia such as Kalimantan (Fig. 5.33) and Irian Jaya where prehistoric spindle whorls are not found. The Maa weave the same design elements on the Dongson object on jute cloths.

The most vivid impressions of the costume of Dongson groups come from tiny bronze figurines excavated from Dongson sites (Fig. 5.34). With only one exception, the figures sculptured in the round on the daggers are naked above the waist. The exception is a very small statue of a woman wearing a long sleeved blouse tucked inside her sarong from the site of Nui Nua, Mac Village. Vietnamese scholars consider the differences in the clothing and jewellery on bronze figurines reflect two different ethnic groups, the Au and the Lac, mentioned in ancient Vietnamese records. These same groups used different types of bronze drums.

The large numbers of bronzes with textile pseudomorphs found in the History Museum and Institute of Archaeology, Hanoi provide unequivocal evidence for the important role of cloth in burials during the latter part of the first millennium BC in Lingnan. Textile pseudomorphs of a finely woven 1/1 tabby are discernible inside the bronze *situla* (76N6) in Fig. 5.35. The vessel comes from the Dongson site of Nui Soi (Thu Nho 1976) which is located in Tan Phuc village, Nong Cong district, Thanh Hoa province. These vessels, known to Vietnamese as *chau hinh non cut*, first occur at Go Mun sites (Lan 1963: Plate VIII) and are widely distributed at Dongson sites. They have been classified into 2 main types: *tronconique* and cylindrical (Bezacier 1972:143). Unlike halberds, daggers and swords of Chinese origin, *situlae* are seen as indigenous to Vietnam (Higham 1996:132). They appear to be elaborations of Chinese ritual wine vessels *(zun)* which are large bodied, high necked with everted rims and flared mouths on tall foot rims. The *zun* of the Early Shang period (1500 - 1050 BC) had wide shoulders but the *zun* of the second half of the Shang dynasty and the Western Zhou (1050-771 BC) were taller and cylindrical (Rawson 1992:349), like Vietnamese *situlae*. Fig. 5.36 shows bronze artefacts from Chua Thong wrapped in so much cloth that their original shapes are hidden. The site is located in Quynh Do Village, Tranh Tri District, Ha Noi. The Dongson layers have an uncalibrated radiocarbon date of 2655 ± 90 BP. The site also produced 6 conical whorls. Textile pseudomorphs were recognized on one spearhead from a Dongson burial from Chua Thoang and its leaf shape enables us to provenience it to the Western Zhou. According to Ma Chengdu (1981:71), spearheads of Shang and Western Zhou periods are either large with wide bulging sides or leaf shaped.

The Dongson site of Nui Nap also produced large numbers of metal artefacts bearing traces of mineralized cloth. The site is located in Dong Hung Village in the Dong Son District. A few examples are shown in Fig. 5.37. Many of the bronzes excavated from Nui Nap are paralleled in the *zhongyuan*. According to Ma Chengyuan (1986), arrowheads were the earliest type of weapon cast in bronze in China. The bronze arrowhead, which is distinguished by a slightly rounded point and two barbs at the side, can be dated to the Warring States period when triangular arrowheads appeared. The end of the arrowhead *(tin)* that fits into the shaft is also longer than Shang examples. The cloth wrapped shovel in the figure also highlights the importance placed on agricultural tools in the expansionary period in Southeast Asia. Shovels of the type found at Nui Nap were known in Zhou times as *chan*. According to Ma Chengyuan, *chan* are formed by casting a socket on a square blade. The socket shown in the figure would have been fitted with a short handle. It is also worth noting that *chan* were used as mediums of exchange in transactions. The coarse fabric on the surface of the tool is probably hemp. Variation has been created in 1/1 tabby weave on one bronze by weft facing (Fig. 5.37a). The different sized warps and wefts are more easily distinguished under the magnifying glass.

The Dongson site of Chau Can is significant to textile history as its wooden coffins contained extant remains of mortuary shrouds and burial clothing. The site is located in Phu Xuyen district, Ha Ta province. Radiocarbon dates on the coffin wood are 1195 - 895 BC and 595 - 205 BC (Luu Tran Tieu 1977). The hollowed out tree trunks used for wooden coffins resemble coffins from the Wuyi Mountains, Tabon Cave (the Philippines) and Niah Cave (Sarawak). They are smaller in size than those found nearby at Viet Khe and contained fewer burial goods (bronze axes and spearheads) and no bronze drums. The absence of the latter may be due to the age and status of the occupants.

Textiles survived in 5 of the 8 of the excavated coffins from Chau Can. *Ban ve* I may have contained cloth but was exposed when found and the wood had disintegrated. A coarsely woven shroud was found in *ban* ve II (Fig. 5.39). Mortuary clothing loosely woven in a 1/1 tabby was identified in *ban ve* III (Fig. 5.38). Much finer material was found along with matting fragments in *ban ve* IV (Fig. 5.40). The same fine material was also found around the upper body in *ban ve* V (Fig. 5.41). Only matting was identified in *ban ve* VI (Fig. 5.42). According to Ha Van Phung (pers. comm.), three different fibres have been identified in the textiles from these Dongson burials: *gai* (ramie), *day* (jute), *bong* (cotton).

Chinese bronze coins bearing traces of cloth are also common at Dongson sites. Fig. 5.43 shows an example recovered from the Dongson site of Hoang Ly where it was found with large numbers of bronze weapons wrapped in cloth. Ancient Chinese coins are distinguished by square holes in the centre that enabled them to be strung together. Coins were first circulated in China during the Warring States period and in other places toward the end of the Warring States period (Ma Chengyuan 1986:186). Then, bronze coins were placed in the coffins of elites. At Hoang Ly, other weapons and tools such as the bronze spearhead shown in Fig. 5.44 were also wrapped in cloth before being buried.

The Dongson site of Lang Vac lies in Nghia Hoa village, Nghia district, Nghe An province. Fifty six whorls were found during the 1973 excavations and a further 57 during excavations carried out by the joint Vietnamese/Japanese team (Chu Van Tan, Hakari, Imagura 1990). The whorls were associated with a wide range of bronze artefacts, many of which were encrusted with prehistoric cloth. The absence of biconical types (Fig. 5.45) and predominance of conical types generally associated with China is noteworthy. Lang Vac burials also produced a bronze bracelet (Fig. 5.46) with traces of finely woven 1/1 tabby.

At Thieu Duong, 57 whorls were found with large numbers of bark cloth beaters. The site is located in Dong Son Village, Than Hoa Province. The large number of cloth production tools at the site may be a reflection of the size of the excavation (1640 m^2). Whorls in the History Museum in Hanoi were examined and their functional attributes recorded (Table 5.5). Both continuity and change are indicated by these Dongson examples. Dong Dau types distinguished by outer rims higher than the centre were also represented (Fig. 5.49) as well as new types such as whorls described as "nipple" shaped, a term first coined by Labbe (1985) to describe similarly shaped whorls from Ban Chiang. The symbolism is obvious.

Number	Material	Colour	Weight	Diameter	Central Perforation	Shape
4300	pottery	red	25	3.80	0.20	nipple
4301	pottery	buff	30	3.80	0.20	conical
4303	pottery	red	20	3.80	0.40	nipple
4304	pottery	red	20	3.80	0.40	nipple
4305	pottery	red	22	3.60	0.50	conical
4306	pottery	buff	20	3.20	0.45	conical
4307	pottery	red	25	4.00	0.40	nipple
4308	pottery	red	10	2.65	0.40	conical
4309	pottery	red	30	4.00	0.32	conical
4310	pottery	red	20	3.50	0.50	conical
4315	pottery	red	30	3.00	0.30	-
4320	pottery	red	30	3.00	0.30	-
4321	pottery	red	35	3.80	0.50	nipple
4322	pottery	buff	30	3.85	0.50	nipple
4323	pottery	red	22	3.85	0.50	nipple
4324	pottery	buff	15	3.40	0.42	conical
4325	pottery	red	20	3.25	0.45	conical
4326	pottery	buff	25	3.67	0.45	conical
4327	pottery	red	20	2.50	0.40	conical
4328	pottery	red	20	3.20	0.40	conical
4329	pottery	red	20	3.10	0.38	conical
4330	pottery	buff	20	3.88	0.30	conical
4331	pottery	red	40	4.25	0.42	conical
4332	pottery	red	20	2.50	0.35	conical
4333	pottery	red	41	4.65	0.50	conical
4334	pottery	red	30	2.95	0.35	conical
4335	pottery	buff	30	2.87	0.35	conical
4336	pottery	buff	20	3.67	0.35	conical
4337	pottery	buff	27	2.70	0.27	-
4338	pottery	buff	25	3.65	0.50	tr. conical
4339	pottery	buff	30	3.70	0.35	tr. conical
4340	pottery	buff	15	3.20	0.35	conical
4341	pottery	buff	20	3.75	0.45	nipple
4342	pottery	buff	30	4.40	0.44	-
4343	pottery	red	20	3.40	0.45	-
4344	pottery	buff	22	3.80	0.70	tr. conical
4345	pottery	buff	30	4.45	0.50	conical
4346	pottery	buff	15	3.20	0.35	conical
4347	pottery	buff	30	3.47	0.32	conical
4348	pottery	red	30	3.20	0.40	patty cake
4349	pottery	buff	20	4.60	0.42	conical
4350	pottery	red	10	3.20	0.35	flat disc

Table 5.6 *Functional attributes of doi xe chi from Dongson site of Thieu Duong.*

At Qui Chu, traces of woven cloth survived on a number of bronze artefacts in the burials. The site is located in Hoang Qui district, Hoang Hoa province and the bronzes were found in both layers of the 180 m^2 site. The bracelet shown in Fig. 5.50 was covered in a finely woven cloth (1/1 tabby). Weft wrapping was evidenced on another bronze implement.

Indirect evidence for fabric structures also comes from wide range of netting, matting and textile impressions on Dongson pottery. It is clear from this indirect evidence (Fig. 5.32) that fabric structures were ubiquitous during this period. Amongst the different structures of fabrics impressed on the pottery is a 3/1 warp faced twill. The increased contrast between the float span and the single "tie" shown in the diagram gives emphasis on the weft face.

After the French excavations at Dongson site of Quang Xuong, both spindle whorls and bronzes encrusted with textile pseudomorphs were deposited in the Musée Louis Finot (now the History Museum). The whorls were analysed as part of this research and their functional attributes are given in Table 5.7. Whorl Lsb19689 (Fig. 5.51) is incised with 12 bands and is glazed. Both the motif and the glaze date the whorl to the Western Zhou period. While lead glazes were developed in the Han dynasty, lime glazes were applied to pottery in the *zhongyuan* as early as the Shang and Zhou dynasties. Lime glazes used calcium oxide as flux. The whorl has the same distinctive green glaze discernible on the *he* (pot) excavated from the site of Tunxi in Anhui province. The *he* is dated to the Warring States period (475-221 BC) (Yang Gen 1985:175). This glazed whorl suggests contact with the *zhongyuan*.

Number	Material	Colour	Weight (g)	Diameter (cm)	Central perforation (cm)	Shape	Decoration
Lsb19690	pottery	buff	20	3.00	0.50	biconical	-
Lsb19688	pottery	buff	10	2.27	0.45	biconical	-
Lsb19720	pottery	red	20	3.30	0.45	biconical	-
Lsb19689	pottery	buff	20	3.25	0.50	biconical	raised bands, green glaze

Table 5.7 *Functional attributes of some doi xe chi from the site of Quang Xuong.*

In April 2002, a team of Vietnamese archaeologists led by Nguyen Viet (2002) located wooden coffins containing extraordinarily well preserved burial shrouds and clothing at the Bronze Age site of Duong Xa in the Red River delta. The site is located in the village of the same name, in the district of Gia Lam, Hanoi. Duong Xa was first excavated in 1987 when two layers were identified, the earliest of which belongs to the Go Mun culture. The textiles were located inside the wooden coffins, preserved by the unique anaerobic conditions created by the irrigation channel. The burials in the wooden coffins with cloth were assigned to the

Dong Son culture, dated between 500 BC and AD 300 (Nguyen Viet 2002). The material is the most significant textile discovery thus far in Southeast Asian archaeology. The anaerobic conditions in the irrigation channels at Duong Xa preserved the materials in the coffins so well that the weaves, dyes and decorative features are clearly discernible. The Dong Son materials are exceptional not only for their excellent state of preservation but also for their completeness. In contrast to the miniscule fragments of cloth excavated from other sites in Southeast Asia, complete layers of burial clothing were found in the wooden coffins at Duong Xa. In one burial, 5 distinct layers of clothing were recorded (Nguyen Viet pers. comm.). While fragments can tell us which fibres or filaments were spun and woven and the dyes and weaving techniques known to prehistoric groups, entire pieces of clothing tell us much more about the Bronze Age groups who put pieces of cloth together in culturally specific ways.

Sa Huynh sites

The unusual burial jars that distinguish Sa Huynh sites contained a number of unusual artefacts that were investigated during the study. The greatest number of Sa Huynh sites (Parmentier 1924) are clustered in the coastal dunes around the small bay of Sa Huynh at Long Thanh in central Vietnam (Fig. 5.60) although other Sa Huynh sites have been identified in the south. Of the 35 known Sa Huyhn sites, 25 belong to the Early Bronze phase (Long Tranh period), radiocarbon dated to 3370-40 BP. The second phase (Binh Chau period) is dated between 2000 and 1500 BP. The final phase (Sa Huynh period) is dated between 2200 BP and AD 100) (Vu Cong Quy 1991).

Although perforated discs have reportedly been found at Sa Huynh sites, opinion is divided over their function. Parmentier did not classify discs he found near jars in the sand dunes at Sa Huynh as whorls although in his report, *'Depots de jarres a Sa Huynh (Quang-ngai, Annam)'* (1924), he said that he did not consider them to be net weights. Solheim, on the other hand, was firmly of the opinion that the discs in question were whorls. According to Solheim (1959:107), "the idea of spindle whorls did not occur to Parmentier but when Colani publishes her paper on Sa Huynh a more satisfactory description of them will be given". Admittedly, some discs illustrated in Parmentier's report resemble whorls, however, examples on display in the Sa Huynh Museum in Hoi An (Fig. 5.61) differ markedly from whorls observed elsewhere in Vietnam.

In a paper specifically on the Sa Huynh culture, Solheim (1959) referred to an asymmetrical whorl (?), however, its significance does not appear to have been fully appreciated. This unusual whorl had been painted; one half was painted red while the other half left unpainted. It is generally accepted that painted pottery (red, white and black) is one of the distinctive characteristics of Yangshao sites from the Yellow River Valley. There, manganese and oxide were applied with brushes and as Yangshao kilns were not completely sealed, the iron oxides in the clay would oxidize fully resulting in red pottery. Painted pottery whorls are the prominent characteristic of late Qujialing sites described in Chapter 2. Using red, yellow and brownish black colours, Qujialing potters painted beautiful geometric motifs on their pottery whorls. Some were monchrome; others were polychrome. It is worth noting that some scholars (Kuhn 1988:110) consider the early period of Qujialing may have been related to the Yangshao culture. Previous chapters of this dissertation have also drawn attention to the appearance of painted whorls during the final stages of occupation at Tanshishan sites. The painted whorls from Sa Huynh suggest technological influence in Tonkin from spinners from the *zhongyuan* or the Middle Yangzi at the end of the Bronze period.

At Dau Giay, silk fragments were found in association with conical whorls (Fontaine 1979:97). The site is located in the village of the same name in Xuan Loc district, Dong Nai. Although Saurin (1963, 1966, 1968) did not identify any artefacts associated with cloth production at Hang Gong, pottery artefacts identified as *pendoliques* are of particular interest. The site is located on the banks of the Suoi Gia Leu River in Thoi Giao village, Xuan Loc district, Dong Nai Province and has two radiocarbon dates of 3950 ± 250 BP and 3044 ± 174 BP (uncalibrated). The *pendoliques* from Hang Gong measure between 7.7 and 8.9 cm. It is worth noting, however, that *pendeloques* could actually be the small weights attached to contemporary Cham looms that are still used in Central Vietnam (Fig. 5.62). Loom weights also occur at many prehistoric sites in the Mediterranean (Fig. 5.63) and similar tools, albeit unidentified, also occur at archaeological sites in India.

However, there are problems with the context of the spinning tools found at the Sa Huynh site of Phu Hoa. The site is located in Xuan Dinh Village, Ham Thuan district, Dong Nai province. It has two uncalibrated radiocarbon dates, namely 2590 ± 150 BP and 2400 ± 140 BP. Fontaine's excavations (Fontaine 1971; Fontaine and Hoang-thi Than 1971-1975) at the site produced whorls 31 whorls. The whorls are conical and truncated conical types measuring between 3.5 - 3.7 cm in diameter with central perforations measuring 0.4 - 0.6 cm in diameter. However, as Fontaine acknowledged in his first report (Fontaine 1972: Plate II, figs. 9-11, VII, fig. 6, IX figs. 4-6-6) none of the whorls was found within the jars. They were dug up by labourers working on nearby ground or unearthed during ploughing on agricultural land in the vicinity of the jars. It seems more likely that the whorls attributed to Phu Hoa are actually from Dong Nai sites where securely provenienced examples are well documented.

While it is not clear if the Sa Huynh groups buried at Phu Hoa produced cloth, we know that cloth played a central role in Sa Huynh burials. The data show that many of the bronze weapons interred with the dead were wrapped in silk. Colani (1937) found impressions of cloth inside pottery and fragments of very fine cloth adhering to iron artefacts at Phu Hoa. The burials also produced large numbers of the zoomorphic figurines that distinguished sites in the Middle Yangzi discussed in Chapter 2. Colani described the mineralized material on the iron tool as a 1/1 "plain weave" and although she was not able to identify the fibre used in its construction, she recorded the thickness of the thread as 0.5 mm (1937:11). Fontaine also observed traces of silk on an iron sword in another jar burial he excavated from the site. The sword had been deliberately broken for the grave. The cloth was lost during the excavation process. According to Fontaine, "the silk which adhered to it upon discovery has completely disappeared" (1980:97).

Dong Nai sites

Firm archaeological evidence for the intensification of textile production prior to the Indianization period comes from sites in South Vietnam belonging to the Dong Nai culture. Dong Nai sites are located along the alluvial plains of the Dong Nai river basin, the basalt plains of the Song Be, the hilly regions of the Eastern Nam Bo (Mekong delta) and the narrow valleys and alluvial plains of the Cam Vo and Dong Nai rivers not far from the coast (Fig. 5.67). Ho Chi Minh City (formerly Saigon) is built on Dong Nai sites. Sites belonging to the culture were first excavated by French scholars at the end of the 19th century and found to be markedly different from Dongson and Sa Huynh cultures to the north. Dong Nai sites span the end of the Neolithic through to the Iron Age (from 4500 to 1500 BP). Some archaeologists (Le Xuan Diem 1987:51) consider the skeletal material at Dong Nai sites belongs to "Indonesians" (pre-Dongson) who established a foothold on the plains of the Eastern Nam Bo.

The site of Doc Chua is very important to Southeast Asian textile history as it has produced unequivocal evidence for craft specialization and the intensification of cloth production. This site is located near the Be River in Tan My village, Tan Uyen district, Son Be province. The earlier of the two layers is attributed to the Bronze Age while the second layer to the Iron Age. The two uncalibrated radiocarbon dates for the site are 2495 ± 50 BP and 3145 ± 150 BP. A total of 458 whorls were recovered from the two layers of this 216 m^2 site. This is the largest number of whorls found at a single site anywhere in Southeast Asia. Moreover, whorls represent 32% of the total number of artefacts (1,417) found at the site. Doc Chua also produced the largest number of casting moulds found in Vietnam. The remaining artefacts which included *bi* (46), gold, iron and bronze figurines were prestige goods. The presence of such large numbers of gender based tools suggest craft specialization of a scale not previously encountered.

Fig. 5.68 shows the marked uniformity of the whorls from Doc Chua. Large numbers housed in the Binh Duong Provincial Museum at Long An were examined during fieldwork and use-wear marks were observed. The most striking feature of Doc Chua whorls, however, was their uniformity. They were all made of pottery and measured between 3.0 and 4.0 cm in diameter. It is also significant that the biconical whorl that characterized many of Red River sites was absent at Doc Chua. Three main types were noted: conical, flat discs (rounded, straight and angular sides) and whorls with raised outer edges of the type found at Dong Dau sites. This type of whorl is uncommon in China and only occurs at archaeological sites in Liaoning. Fig. 5.69 shows the decorative features of the whorls from Doc Chua. One whorl (76 DCH:603) was incised in four sections. Another (79 DCH:429) was incised at the base of its outer rim. The incised motif on whorl (DCH:476) occurred on whorls from Hemudu. One decorated whorl (79 DCH:23) depicts one of the silk reeling devices incised on whorls from Hemudu with threads clearly discernible.

Excavations by Bui Phat Diem and Vu Qum Hien (1997) at the nearby site of Go O Chua produced whorls with close affinities to those from Doc Chua. Go O Chua lies in Duc Giang village, Hoai Duc district, Ha Tay province. The site covers an area of $67m^2$. It belongs to the late Dong Nai/ Early Oc Eo culture and is dated between 2300 and 1700 BP. Altogether 48 whorls were found at the site. Most of the whorls housed in the provincial museum at Long An were conical or truncated conical types. Fig. 5.70 shows the design elements depicted on whorls which are paralleled at Go O Chua. According to Bui Phat Diem and Vu Qum Hien (1998 pers. comm.), some of the pottery was impressed with finely woven tabby weave gauze. A deer horn spindle was also found in layer 3 at a depth of 7 cm. The data from Doc Chua and Go O Chua strongly suggest that the two sites were prehistoric cloth production centres of considerable economic significance about 2000 years ago.

Excavations at Bung Bac (Pham Duc Manh 1996) produced *doi xe chi* that compare favourably with those from Doc Chua and Go O Chua. This Bronze Age site, located in the eastern part of Nam Bo, is significant in prehistory for its early evidence for wooden pile dwellings, preserved by waterlogged conditions in the delta. The 8 uncalibrated radiocarbon obtained for Bung Bac range from 3080 ± 40 BP to 2310 ± 40 BP. As Table 5.10 shows, the whorls measured between 2.4 and 3.8 cm in diameter. The whorls shown in Fig. 5.71 are all flat discs, distinguished by raised outer edges which was also a feature of other Dong Nai whorls. The report on the site also mentions distaffs (Pham Duc Manh 1996:45).

Artefact number	Material composition	Colour	Weight (g)	Diameter (cm)	Central perforation (cm)	Shape	Decoration
94BBHIIIB34-1	pottery	black	2	3.10	0.45	flat disc	-
94BBH1A3LI-1	pottery	black	3	3.80	0.40	flat disc	-

Table 5.8 *Functional attributes of doi xe chi from Bung Bac.*

The small island site of Cu Lao Rua, first excavated by French scholars (Fontaine 1975) earlier last century, produced a single whorl. The site has an uncalibrated radiocarbon date of 2230 ± 100 BP. The whorl (Fig. 5.65) measured 3.5 cm in diameter and was described by Fontaine as *"tres legerement agrandie"*. Fontaine observed that the whorl was paralleled at the Phung Nguyen site of Lung Hoa.

The textile evidence recovered during excavations at the prehistoric site of An Son indicates quite different relationships. The site is located on the plains of eastern Nam Bo. Test pits were initially excavated by Malleret and Lévy (1938) with the principal excavations carried out by Chinh and Tien (1978) between 1977 and 1978. Several uncalibrated radiocarbon dates have been obtained for the site: 2885 ± 60 BP, 2775 ± 50 BP and 3370 ± 80 BP. Chinh and Tien are firmly of the opinion that An Son was occupied during the prehistoric period by pre-Dongson groups ("Indonesians"). One isolated whorl displayed in the Long An Museum was examined during fieldwork. Unlike later whorls from Doc Chua and Go O Chua, the *doi xe chi* from An Son was a basic flat disc incised with a cross-hatched design that links the groups at An Son with spinners from Phung Nguyen sites. Earlier parallels come from Tanshishan sites discussed in Chapter 3.

The site of Giong Ca Vo produced evidence for cloth production of different proportions. The site is located on low-lying land between the mouths of the Sai Gon and Dong Nai Rivers in the Can Gio district near Ho Chi Minh City. More than 400 jar burials were found at Giong Ca Vo (Dang Van Thang and Vu Cong Quy 1995, 1998). An uncalibrated radiocarbon date of 2480 ± 50 BP has been given for the site. Less than 3.3% of the artefacts in the burials were tools; the vast majority of artefacts were pottery artefacts or ornaments such as carnelian and glass beads, gold, bronze and iron jewellery. The exotic jewellery at the site reflects the considerable wealth of the groups buried at the site. Some of the exotic jewellery from Giong Ca Vo is also paralleled at Giong Phet, Doc Chua, Ban Na Di and Ban Chiang.

Many of the prestige goods excavated from burials at Giong Ca Vo were also wrapped in woven cloth. While this mortuary practice is evidenced at earlier Vietnamese sites, Giong Ca Vo burials are distinguished by the amount of cloth wrapped around the metals before they were placed in graves. As Fig. 5.75 shows, some tools and weapons from the site were wrapped in many, many layers of cloth. The funerary rituals evidenced at the site certainly would have dazzled the audience with this ostentatious expenditure on cloth. In this way, symbols of men and women (cosmic dualism) are evidenced in the mortuary rituals at Giong Ca Vo.

Han dynasty sites

In 221 BC, a Chinese expeditionary force marched southwards between the peaks of the Nan Ling Ranges to subjugate the Yueh, a process which took 7 years. In 214 BC, 3 regular commanderies were established in the regions now known as northern and central Vietnam. In 111 BC, the Han conquered the Nanyueh, divided the region into 9 districts, one of which was the district of Chiu-chen in the province of Thanh Hoa. The Han brought craftspersons followed by civil and military mandarins. By 113 BC, the territory of the Nan Yueh was transformed into Chinese commanderies (Gernet 1996:126). Until the last century, Vietnamese officials of high rank wore Chinese robes, resplendent with rank badges associated with officials from the Middle Kingdom.

Many of the artefacts recovered during Janse's (1951) excavations of the Chinese tombs at Chiu-chen near Lach Truong were wrapped in finely woven silk. Even though large quantities of silk textiles were woven during the Han dynasty, silk was a luxury item that remained the cloth of elites. The sites are located on an estuary, very close to the sea and are considered to have been a Han port. The tombs are roughly dated between 300 and 200 BC (Janse 1951:xvi). At Lach Truong, traces of fine silk were found on a bronze lamp, silk wrappings were found on some tools as well as a thin piece of appliquéed gold with holes for attaching silk (tomb 1). In tomb 8, a bottle in the shape of a baluster was found wrapped in silk decorated with the double spiral motif. The bronze lamp shown in Fig. 5.76 was found outside the mortuary chambers. The lamp is comprised of a figure holding and attached to several bowls. Janse identified many Western influences in the material culture from the necropolis, including the bronze lamp. However, the headwear depicted on the figure is similar in style as that depicted on bronze figurines subsequently unearthed from Shizhaishan

(National Museum of Chinese History 1997:188). There are also similarities in the profile of the bronzes.

Fig. 5.77 shows whorls found in the Han tombs as well as on the floor of some of the kilns excavated by the French team. At Ngoc-Am, a biconical whorl made from chalky buff pottery was found in tomb 5. At Lach Truong, another biconical whorl was found in tomb 9. Biconical whorls were also found at Tam-Tho, both inside and outside Kiln A which indicates that the tools were locally produced. Janse was uncertain of the function of these tools primarily because of their presence in burials. According to Janse (1951:44), it is questionable whether the whorls should be considered as tools intended for posthumous use or as symbolic goods. Janse cites Maspero's (1929-30:249) research into Indochinese cosmology where he describes an association between spinning maidens and life where "spinning maidens hold in their hands the destiny of men". The spinning maiden of Chinese mythology was revered for her diligence and long hours at the loom. According to Maspero, the Han Chinese spinning maiden legend is depicted on a burial jar at Hallstatt along with a figure holding a spindle whorl (Hoenes 1898:plate XXIX).

Tra Kieu

The pre-Cham site of Tra Kieu (Glover and Yamagata 1996) produced fascinating evidence for the use of cloth in tiling manufacturing which gives us new insights into pioneering immigrants who settled in central Vietnam in the early part of the first millennium AD. The site is located near the citadel of the former Cham capital of Simphapura in Duy Xuyen district, Quang Nam province. Large numbers of sherds with cloth impressions pertinent to the study were amongst the 3099 tile fragments concentrated between spits 9-15. The fragments shown in Fig. 5.78 were made from fine clay fired at very high temperatures. The yellow, slightly curved fragment in the figure is part of a roof tile manufactured in a mould using traditional Chinese tile-making techniques that began during the Western Zhou period (11th - 10th century BC). The upper surface of the tile fragment is impressed with cord while the lower surface was impressed with cloth, the direct result of the manufacturing process. From detailed descriptions of the tile manufacturing process in Chinese sources, we know that woven cloth was first placed over a wooden roller. Pottery was then placed over the cloth, which was then separated the cloth from the roller. After a short period, the clay and the cloth were removed from the roller and cut into tile widths. The roller prevented the tiles from drying flat. This unequivocal evidence for Chinese technology marks the final stages of Chinese penetration into Lingnan.

In summary, the chapter traced the movement of the hand spindle from southeast China into the Red River delta around 4000 BP. Through the analysis of *doi xe chi* housed in the History Museum and the Institute of Archaeology in Hanoi, the study showed parallels between the spinning tools buried in shallow graves at Phung Nguyen sites in the Red River region and spinning tools excavated from the earliest layers at Tanshishan sites in Fujian Province. The textile data also showed greater complexity during the Bronze Age in Vietnam than generally held. Movements of textile producers with different fibre-processing tools were traced from Yunnan in southwest China into the Red River delta. The study drew attention to the presence of textile pseudomorphs on many Bronze and Iron weapons in Vietnam which suggest the movement of sinicized groups into this part of Southeast Asia at the end of the prehistoric period. This interpretation was based on parallels from Shang sites. Analysis of the pottery stamps from Hoa Loc sites showed no evidence for their role in cloth production. The study also raised the possibility that the stamps had a role in metallurgy. An argument was also put forward for craft specialization and the intensification of cloth production in the Mekong delta before the Indianization period.

Chapter 6

Cambodia

Indianization and Textile Technology

Cambodian archaeology is dominated by remains from the Indianization period in Southeast Asia and as a consequence, generations of French scholars have focused their research on the art and architecture of this period. Costumes are a notable feature of the statuary and bas-reliefs on the architectural monuments and Khmer history is reconstructed primarily from art styles depicted through these mediums. The comprehensive analyses of the costumes depicted in stone by Boisselier (1950) and Groslier (1966), remain the authoritative works on early Cambodian textiles. In *'Recherches sur les Cambodiens'*, Groslier raised the origin question and proposed that both textile technology and cotton (*karpasa* in Sanskrit) were introduced into Cambodia from India during the first millennium AD. Groslier based his hypothesis on Indian influence in Khmer costumes, the usage of the Indian word for cotton by Cambodian weavers and 13th Century accounts of textile production by Zhou Daguan, a Chinese diplomat resident at Angkor Wat between 1296 and 1297. Zhou Daguan commented disparagingly about the tools used by the Khmer spinners and weavers he witnessed. *In Notes on the Customs of Cambodia* (published as part of the *Shuo Fu* in 1368) he reported that,

> Cambodians are not given to raising silkworms or to cultivating the mulberry tree, and their women are entirely ignorant of sewing, dressmaking and mending. They are barely able to weave fabrics with products of the tree cotton, nor do they know how to spin with the wheel; thread they make with their hand spindles. Looms are unknown to them, and they are satisfied to fasten one end of the warp to their belts and to work from the other end. For shuttles they are forced to use pieces of bamboo. Recently, much attention has been given by the Siamese settlers in this country to raising silkworms and cultivating mulberries; their mulberry seed and silkworm stock all come from Siam. Grass-cloth, which they do not know, finds an equivalent in *lo-ma*. The Siamese use silk to weave the dark damask like textiles with which they do not clothe themselves. The Siamese women can sew and mend, and when the fabrics worn by the Cambodians become torn, Siamese are called in to repair the damage (Zhou Daguan in Pelliot 1903:37).

An Indian origin for cloth is implied in Khmer mythology. According to myth, the ancient Khmer did not wear clothing; *Kaundinya* (an Indian merchant prince) introduced *Liuye* (a Khmer princess) to cloth and Indian cosmology (Poree-Maspero 1955:257-276). The Indian merchant reportedly married into the Khmer royal family and assumed the throne. The children of the union succeeded the throne, divided the country into 7 communities, created

Fumanguo, a port near Oc Eo, and gradually extended the kingdom inland to central Cambodia, the *Plaine de Joncs* and the Ta Kev region. The *Nan-Chi-chu* provides the detail that at contact, the Khmer princess was naked, and on seeing this, the Indian merchant prince "folded a piece of cloth through which he made her thrust her head" (Mazzeo and Antonini 1978:22).

The origin question was also addressed by the French archaeologist, Paul Lévy, who totally rejected an Indian origin for cloth production. According to Lévy,

> *Les trouvailles de fusaïoles dans les gisements préhistoriques de l'Indochine, la survivance en de nombreux points du métier très rudimentaire dit indonésien permettrent d'advancer, que ces techniques ne purent seulement qu'y être perfectionnées et non importes par l'influence historique indienne ou chinoise* (1943:42).

That is, the finds of spindle whorls in prehistoric contexts in Indochina and the survival of rudimentary "Indonesian" looms in several places, suggest that these techniques were perfected (locally) and not imported through India nor China.

This chapter examines the origin question and demonstrates that spinning and weaving were introduced to the Tonle Sap plains during the prehistoric period by groups from Lingnan. The research also reveals strong parallels between the motifs used to embellish pottery associated with cloth production tools at Metal Age sites in Cambodia and motifs used to embellish pottery from Middle Yangzi and Yellow River sites. A suggestion is also put forward that there may also be unrecognized weaving tools amongst the cultural material previously recovered by French archaeologists from the Mekong delta which suggests the warp weighted loom may have been introduced into Southeast Asia at the end of the first millennium BC. At the same time, Indian influence is also acknowledged with the introduction of new fibres, tools, motifs, costumes and concepts about cloth and the role of spinners and weavers in society.

Samrong Sen

The Neolithic site of Samrong Sen (Mansuy 1902, 1923) is important to textile history as it produced unequivocal archaeological evidence that the hand spindle was employed by prehistoric groups in Cambodia to produce cloth long before the Indianization period. Samrong Sen is a mound on the banks of the Chinit River (Fig. 6.1). Mansuy described a sequence to a depth of 4 m but we have only one uncalibrated radiocarbon date for the site of 1280 ± 120 BC (Carbonell and Delibras 1968). While interpretation of the whorls from Samrong Sen is constrained by a lack of stratigraphic data, it is significant from an origins perspective that the earliest evidence for spinning in Cambodia comes from a Neolithic site on the Tonle Sap plains, <30 km from the Mekong River.

Fig. 6.2 shows two whorls (15, 16) in the assemblage of artefacts from Samrong Sen. Basic types like these are widely distributed at cloth production sites in Lingnan and the Yangzi Valley. The design elements used to embellish some of the associated artefacts, however, warrant closer scrutiny.

There are unrecognized corellations between the motifs incised on the pottery earplugs called *ornament auriculaire* (Fig. 6.3) in the assemblage and textile technology. Not only do all of the motifs on the earplugs first occur on whorls from cloth production sites discussed previously, they may be inspired by the technology. The curvilinear motif incised onto earplugs 23 and 28 (Fig. 6.3) were documented at wet rice sites in the lower Yangzi. The motif distinguished whorls from layer 4 at the textile site of Hemudu (Fig. 2.20). In Chapter 2, this same motif was linked to silk reeling devices (Fig. 2.23) of the type still used for silk processing in Cambodia (Fig. 6.4). The needle-stitch pattern featured on earplug 29 was previously noted on whorls from Tanshishan sites (Fig. 38) and whorls from the Yuanshan layers at Tapenkeng. This research showed that designs made up from this basic motif are woven into the textiles of the Yami (Fig. 3.27). While there are obvious temporal differences between the Yangzi Valley and Cambodian site, the point here is that the data show clear artistic and technological parallels.

Earplug 29 from the Samrong Sen assemblage is incised with the ***S*** motif which first occurs at the earliest cloth production sites in the *zhongyuan*. While the ***S*** motif has not hitherto been linked to textile technology, there are good reasons for interpreting the motif in this way. The ***S*** motif on the prehistoric textiles from Anyang and Banton Island closely resembles a small hand held weaving tool called a ***S*** or reed hook (Fig. 6.5). This particular tool facilitates the drawing of the warp threads through heddle eyes, a process known as sleying. Elsewhere in Southeast Asia, the ***S*** motif is amongst a wide range of weaving tools depicted on contemporary textiles which suggests that the practice of decorating textiles with textile tools may actually date back to the prehistoric period. About 3% of the Iban textiles in the Museum of Archaeology and Ethnology at Cambridge which were analysed by Haddon & Start (1936) feature representational motifs derived from objects in daily use. The tools (Fig. 6.6) were amongst a series of tools used in daily life by the Iban which were identified by informants. Note the usage of the winding tool called a niddy noddy found at Shizhaishan. In Sarawak these are called *tayak gasing.*

Other technologically inspired motifs on the earplugs include the cross motif that characterizes Yangshao pottery from the *zhongyuan*. This motif represents the interlocking of warps and wefts which is the basic process in weaving.

The earplugs shown in Fig. 6.3 also feature additional textile motifs that also occur at the earliest cloth production sites in the Yangzi Valley. Fig. 6.7 shows a whorl from Hemudu which is incised with a distinctive motif comprised of clusters of parallel lines depicted within five rows of fairly uniform parallel concentric circles. The same inverted E motif shown in Fig. 6.8 (10a & 10b) is also painted onto later Neolithic spindle whorls in the Yangzi Valley (suggestive of interaction with Neolithic sites in the *zhongyuan*). The motif brings to mind an aspect of fibre preparation where shanks of thread are dried on poles, a process observed during fieldwork at a textile production centre on Mekong Island located between the Mekong and Bassac Rivers, a few kilometres from Phnom Penh (Fig. 6.9). As the same motif is painted inside the 4,000 year old pottery bowl from pre-dynastic Nagada I sequences in Egypt (Fig. 1.8), it is reasonable to link the motif to cloth production. In Thailand, silk fibres dyed using the ikat technique are also draped over poles to dry in the same way (Fig. 6.10). The single rows of parallel lines depicted on the earplugs from Samrong Sen and prehistoric spindle whorls from the Yangzi Valley and other parts of mainland Southeast Asia resemble unprocessed fibres which the writer observed placed on the ground prior to dyeing at Ta Keo.

Samrong Sen also produced a small pottery roller distinguished by rows of raised parallel bands (Fig. 6.11) which shows strong affinities to rollers from archaeological sites in Laos (Chapter 7) and Thailand. Examples of the latter in the Bangkok National Museum and the Ban Chiang National Museum have previously been linked to textile printing (van Esterick and Kress 1978) whereas the same artefacts from Bronze Age sites in Vietnam are linked to pottery decoration. Hà Văn Tân (1979) has demonstrated a correlation between the width between raised bands on rollers and the width of cord indentations on pottery (Fig. 6.12). These enigmatic rollers are discussed in more detail in Chapter 7.

Mlu Prei

Lévy's excavations of three Metal sites in the Mlu Prei region produced two different types of cloth production tools. The sites, O Pie Can, O Nari and O Yak are located at the headwaters of the Sen and Chinit rivers. The artefacts at Mlu Prei were a "confused mixture" of Neolithic and Metal Age assemblages (Bellwood 1978:190). Lévy (1943:32-35, pl. XX) identified a stone pounder recovered from the surface as a bark cloth beater (Fig. 6.13). Although these beaters are the simplest forms in the Southeast Asian archaeological record, they are the most difficult to identify at prehistoric sites primarily because the tools are unworked with smooth surfaces devoid of grooves, a feature that renders them ambiguous. Interpretation problems arise because beaters of this type could be used for either food or fibre processing. In Chapter 2, mention was made of ungrooved stone bark cloth beaters from Liangzhu sites in the Yangzi Valley which were linked (Ling 1962:pl.1V) to cloth production but this correlation was not generally accepted at that time. Ling's identification of the bark cloth beaters was based on detailed descriptions of bark cloth production in ancient Chinese texts dating back to the historical period and linguistic data. Lévy confidently linked the Mlu Prei tool to bark cloth production on the basis of ethnographic parallels used to beat bark cloth from the mountainous regions of Luang Prabang. Pavie (1904) interpreted a horned pounder from Laos (Fig. 6.14) in the same way. The term "horned type" was coined by Beyer (1947) to describe large numbers found at prehistoric sites in the Philippines (Rizal, Bulakan, Cavite, South Cebu, Misamistukidnon and Cotabato). Beaters of this type are not widely distributed throughout Southeast Asia but appear to be confined to Laos and sites in Taiwan and island Southeast Asia. An undated horned beater which compares favourably with that from Laos was amongst surface finds from Minanga Sippako in South Sulawesi (van Stein Callenfels 1951:pl. XIII). The majority of horned types are devoid of grooves but an example with deep longitudinal grooves on its upper face was recovered during excavations at Ampah, on the island of Borneo (van de Hoop 1935:468-70).

Fig. 6.15 shows several unusual stamps characterized by deep grooves on one surface from the Mlu Prei sites. The geometric motifs on the surface of 6a and 6b occur on Hoa Loc and Tanshishan pottery and are also incised on Vietnamese pottery from the Go Mun period (Fig. 6.16). The stamps from Mlu Prei are finished quite differently to the pottery stamps from Tanshishan sites described in Chapter 3. According to Lévy (1943), some of the stamps from Mlu Prei were glazed. A glaze is a glossy coating on the surface of a pottery vessel, which increases the vessel's mechanical strength and makes the pottery easy to wash. It also gives a decorative effect. The earliest recorded glaze in China was a lime glaze invented during the Shang period. It was made from calcium oxide and baked at very high temperatures. Low temperature glazes belong to the Han dynasty (see Gen *et al.* 1985). If the stamp is indeed glazed, then it marks a well-developed pottery tradition.

Mlu Prei also produced high-bodied conical whorls (Fig. 6.17, 2a, 2b, 2c) which were more crudely potted than the basic conical types from O Nari which suggests that hemp may have been introduced into the Tonle Sap plains during the Metal period. Although the fibres used to impress pottery from the Samrong Sen were never identified, some impressions on pottery sherds are wide enough for hemp although a number of other species mentioned in botanical studies (Petelot and Magalon 1929) could also have been used for this purpose (Table 6.1). More specific parallels could be explored through microscopic analysis of the cord-marked pottery but this was well beyond the scope of the study.

Botanical Name	Common Name
Aganonerion polymorphum	-
Ananas comosus	pineapple
Calamus salicipolius, C. viminalis	palm
Cannabis sativa	hemp
Coloni auriculata	-
Cocos nucifera	coir
Corchorus capsularis	palm
Corypha lecomtei	jute
Eichhornia crassipes	water hyacinth
Gnetum latifolium	-
Helecteres hirsuta	-
Ichnoncarpus frutenscens	-
Musa sp.	abaca
Nelumbo nicifera	-
Tetracera loureiri	
Tetrastigma harmandii	*planchon*
Triumfetta rhomboidea	*gurr*

Table 6.1 *Fibres used for cord and cloth production in Cambodia.*

Oc Eo

Excavations of more than 1000 m^2 in the Mekong delta produced outstanding architectural features made of brick, stone and wood, including vestiges of houses on stilts, traces of ancient canals, moats and over 10,000 items of material culture. Since Malleret's (1959-1963) excavations in 1944, more than 20 archaeological sites in southern Vietnam and southern Cambodia have been assigned to the Oc Eo culture (Le Xuan Diem 1987). It is generally agreed that Oc Eo was a port city of the Indianized state of Funan that was established in the Mekong delta between the 2nd and 6th centuries AD. This important period of proto-history was distinguished by the rise of mandalas in the lower Mekong, coastal Vietnam, northeast Thailand and the Chao Praya Valley (see Higham 1989). According to Coedès (1968:14), Oc Eo was one of the earliest Indian settlements in Southeast Asia built on sites that Indian merchants and seaman had frequented since prehistoric times. Oc Eo's status as an entrêpot in the maritime trade that linked Southeast Asia to the Roman Empire to the West and the Han Empire to the north-east is confirmed by the large numbers of exotic artefacts at the site, including pottery and jewellery as well a Roman coin and medallion (Higham 1989:251). Malleret (1959-1963) observed clear parallels between some of the artefacts from Oc Eo and artefacts from Sa Huynh, Samrong Sen and Dongson sites along with traits from Greece and Rome with an ancient Hindu culture playing the predominant role.

Malleret reported finding about 40 *fusaïoles* at Oc Eo, some of which were paralleled at other sites in mainland Southeast Asia; others were paralleled at Bronze Age sites in Europe. Almost all of the whorls from Oc Eo were made from unfired or poorly fired clay. Some were coated with what was described as a black varnish thought to be *damar* similar to that found at Kuala Selinsing. According to Malleret, this blackish slip? was found on whorls from a number of different contexts. Two were surface finds, one was found at a depth of 30 cm at the foot of a stone alignment; another was found amongst a pile of sherds in a deep layer at the site. Other examples were found by clandestine diggers in the vicinity of the site. In Chapter 5, glazed whorls of this description were recorded at Dongson sites which suggests that the slip on the fusaïoles from Oc Eo could possibly be black glaze.

Fig. 6.18 reproduces Malleret's (1960: Plate XLVI) typology of whorls from Oc Eo. Malleret observed that the spherical type (4200) in the typology was commonly found in Hallstatt tombs (in Austria) and a flattened version of this type was found at Hissalik (Troy). He also observed clear parallels between biconical whorls (with rectilinear and curvilinear sides) from Oc Eo (412 and 413) and whorls from Sa Huynh sites. When the whorls in Malleret's typology are compared to whorls described in earlier chapters, a number of further observations can be made. At a general level, only 30% (5/15) of the types excavated from Oc Eo appear to be represented at prehistoric sites in South China and Southeast Asia.

The now familiar biconical whorl (Type 1: 4522) that characterized Neolithic sites in Southeast China was represented, along with the oval type (Type 3: 4200) known to Chinese archaeologists as the abacus whorl which widely occurs in the provinces of Hunan, Hubei, Shandong, Fujian and Guangxi (Kuhn 1988: Fig. 96). Types 4 (3898), 5 (3898) and 6 (3898) were also well represented at prehistoric sites discussed in earlier chapters. The remaining whorls in the typology are exotic. Some appear to be molded, a manufacturing technique generally associated with Mediterranean pottery production (see Rice 1987).

More recent excavations of circular earthworks at Krek 52/6 (Albrecht et al 2000:20-46) considered to be identical with Malleret No.15 produced two pottery whorls. The site belongs to rice farmers from the first millennium BC. One whorl came from Unit II, square J/10 along with a *ding* and bracelet made from translucent green glass of possible Indian origin. It measured 3.5 cm in diameter. A second broken basic flat disc type measuring 2.8 cm in diameter were also found in Unit II, square J/9. The conical whorl from J10 is distinguished by four rows of indented spirals (Fig. 6.19). Neither types are amongst those in Malleret's (1960: Planche XLVI) typology and represent an earlier stage in cloth production in the delta.

No traces of cloth were recovered during Malleret's excavations in the Transbassac and the lack of material evidence at the site has obscured the significance of cloth in the transformation that took place in this part of Southeast Asia at the beginning of the first millennium AD. Historical documents indicate that during the period the Oc Eo sites were occupied, silk was the cloth of the elites in many different parts of the world and one of the principal commodities in the trade that linked Southeast Asia with the Roman and Chinese empires. According to Baity (1942), the Romans were not particularly skilled textile producers and apart from locally produced wool and some linen and hemp cloth (considered to be mainly from Roman Britain), they obtained their luxury cloths through imports and by capturing skilled spinners and weavers. Baity illustrates the excesses of the period: one rich Roman woman had a wardrobe consisting of 273 chests of silk garments, 410 of linen and 160 of fabrics embroidered in gold and jewels. At the end of the first millennium BC, imports of gold and silver embroidered cloths from Persia and silks from China (worth their weight in gold) threatened to ruin the Roman economy. Silk was highly prized for its lustre and strength and textile workers value added through the reeling process. Threads formed through reeling are very lustrous as there are no irregularities in the filaments to interrupt reflected light (Vollmer *et al.* 1984). The Official History of the Southern Qi dynasty (AD 479-501), for example, records that silk (along with gold and silver) was one of the most important commodities traded in the markets at Funan.

Elsewhere (Cameron 2000), I have discussed the early trade in other exotic fibres in the markets of Funan recorded in ancient Chinese written records (Appendix 1). Of these, asbestos cloth was also highly prized amongst elites for its lustre and incombustibility and there is some indications that in Funan supply could not meet demand (Laufer 1915:332). According to the Chinese alchemist, Ko Hung (AD 249-330), 3 different types of asbestos cloth were traded in the markets at Funan although he was confused about the origins of the fibres. He mentioned one type of asbestos cloth woven from "the flowers of trees"; a second type was described as "the bark of certain trees, boiled in lime and worked into a cloth much coarser than woven types". A third type of spun and woven asbestos cloth was mistakenly believed to have come from rat hair. We now know that asbestos is a generic term for a group of naturally occurring silicate minerals that can be separated into fibres.

There may also be unrecognized archaeological evidence for cloth production and early textile trade amongst some of the more obscure artefacts from Oc Eo. This potential evidence comes from female figures carved in low relief on stone *intaglios* (seals) (Fig. 6.20) recovered during Malleret's (1962:294) excavations at Oc Eo. Malleret identified one of the figures depicted in low relief on one *intaglio* as a female walking upright with the use of a cane (*femme debout appuyée sur une canne*); a second figure was identified as a female sitting on a four legged seat making libations to the altar of fire (*femme assuré sur un trépied offrant une libation au feu*). A literal translation of Malleret's description of the libation to fire is as follows:

> Figure of a woman with broad hips, a narrow waist and a long plait at the back depicted turned to the left and sitting on a seat with three legs in front of a pedestal table which supports what is probably a basin out of which comes short flames. With her left hand she seems to fan (poke) the fire while with her right hand she lifts a cup to her face. There is hardly any doubt that we have the image of a libation to the alter of fire. The heat and the pedestal table have turned or sculpted legs and it is possible that this scene is a domestic one rather than that of a ritual manifestation in a sanctuary. The representation of the flames reminds one of those found above alters of fire on the reverse side of certain Sassanid coins (trans. H. Loofs-Wissowa).

The central point here is that cloth production scenes are common on textile tools and seals from archaeological sites in other parts of the world when the textile trade was at its peak in the early historical period. The female figures on Oc Eo's seals could conceivably be interpreted as depictions of fibre processing, an argument that is further supported by large number of textile tools at the site. The first female figure at the bottom right of Fig. 6.20 could be interpreted as a female spinner with a drop spindle; she holds the spindle in her left hand and the thread being spun is depicted as a line. The second female on the seal shown at the top of Fig. 6.20 could well spinning cotton or reeling silk using the wooden silk reeling devices observed in the textile workshop attached to the Royal Palace in Phnom Penh. Figure 6.21 shows comparable depictions of spinning scenes on cloth production tools and seals from Mediterranean sites from the historical period.

There may also be unidentified loom weights with clear Mediterranean parallels amongst other artefacts from Oc Eo (see Fig. 6.22). Loom weights are the basic components of upright looms associated with Neolithic and Bronze Age sites in Egypt, the Mediterranean and Europe. As Barber's research shows (Fig. 1.7), this type of loom spread quickly throughout that region during the first millennium BC. The warp-weighted loom occurs in China much later. The closest parallels to those from Oc Eo are disc-shaped clay weights from Bronze Age sites in Minoan villages at Myrtos in Crete (Fig. 6.23). If these artefacts are actually warp weights, then their appearance at Oc Eo signals technological change and the movement of spinners and weavers from areas with warp-weighted looms into the Mekong delta. This argument is based on the fact that the warp-weighted loom differs substantially from the backstrap loom that is represented in the archaeological record of South China and Southeast Asia and requires technical skill and knowledge to use.

Given the significance of the textile trade of the historical period and the presence of craft workshops at Oc Eo, it is also possible that two small perforated pottery tablets (3436, 4255) of unknown function from the site (Fig. 6.24) were used for tablet-weaving. They measure 6 X4 cm and 8 X 6 cm, respectively. This type of weaving is known in China (Hommell 1969: Fig. 267) but the earliest archaeological evidence comes from Mesopotamia (Susa, Babylon) where it dates back to the 1st millennium BC (see Barber 1991). It is also worth noting that similar artefacts were found associated with pottery figurines and spindle whorls in Han tombs discussed in Chapter 5.

Very few representations of pre-Angkor cloth have been survived in Cambodia; one notable exception is a *sampot* engraved on a gold plaque (Fig. 6.25) from Oc Eo (Malleret 1959: Plate II). The *sampot* is long and tight fitting. While the costume resembles that worn by *apsaras* from the Angkor period, the wearer lacks the elaborate jewellery that distinguishes deities. The absence of any covering on the upper body suggests that the woman is not Chinese. The inevitable conclusion is that she is either Indian or Southeast Asian. There is no question that Indian textile technology influenced that of Cambodia and that Indian fibres, dyes and weaving techniques were introduced into this part of Southeast Asia when Oc Eo was occupied. In order to maintain economic and political hegemony over existing elites in the Mekong delta, Indian merchants would have introduced new fibres and decorative techniques to produce new types of exotic cloths. Indian influence is readily discernible in the motifs and overall arrangement of design elements on Khmer cloths. The most striking of the traditional cloths, the *sampot hol*, strongly resembles Indian *patola*. Sampot are dyed using a resist technique called weft ikat. The earliest archaeological depictions of resist dyed cloths come from India. Frescoes in caves at Ajanta 9 clearly show cloth dyed using a number of techniques, including weft ikat (Yazdani 1955: plates XIIXVII).

Table 6.1 shows the many different words associated with cloth production translated from pre-Angkor inscriptions (Jacob's 1979: 406-426) which reflect the economic significance of cloth in the Indic period. The weaving process was known as *tpan* (K66, B1, 16): a weaver was known as *tman* (K.956, 1.2) and a spinner known as *ranhvai* (K 155, 11, 1.10). The usage of different terms for spinning and weaving indicates a high level of craft specialization and workshop production. The usage of a specific word for silkworm *(mon)* in scripts suggests that sericulture was practiced in Funan and Zhenla. It is clear from this evidence that cloth was produced for clothing as well as for ceremonial purposes *(klas*: cloth umbrellas) and to define ritual space. Many of the different types of cloth in the vocabulary have not been identified.

Khmer	**English**
canlek	cloth
canlek amval	double-cloth
canlek yugala	double-threaded cloth
chat	umbrella
karap	ground cloth
kamvar	-
knop	belt
krapas	cotton
kapata	-
jli	-
klas	umbrella
pnan	screen
paren	Substance used to prepare threads
tpan	weaving (process)
tman	weaver
ranhvai	spinner
mon	silkworm
pnan pranala	cover for gutter
uladda	-
ule	-
vagrsa	-
pan-en	-

Table 6.2 *Terms for cloth in pre-Angkorian inscriptions (after Jacob 1979:406-426).*

Jacob's translations also give useful details about the relative value of cloth in pre-Angkor times. Cloth was bartered for paddy fields and exchanged for syrup and ginger conserve. One inscription reads, "a rice field near the tank of Devacila. The barter for it is paddy. The value of this is 5 ounces of silver and a *yau* of double cloth" (Jacob 1979:414). It is significant that not all of the textile words in the inscriptions are Sanskrit. Vickery (1998) is firmly of the opinion that *yau*, the basic term for cloth in the inscriptions, is a loan word borrowed from the Austronesian word *yau*, which means a unit of measurement of cloth. According to Vickery,

> These Austronesian terms [*yau*, *vlah*] must have been introduced into Cambodia through trade in Fu-nan or pre-Funan times, but their use of measurements or types of cloth called '*amval*' (a Khmer term) and '*yugala*' ('double,' Sanskrit) indicate that they had become institutionalized in Cambodia, and were no longer necessarily imported, but made locally (Vickery 1998:293).

The archaeological whorls from Metal Age sites discussed above explain the usage of non-Sanskrit terms in pre-Angkor inscriptions by demonstrating that prehistoric groups in Cambodia had knowledge of cloth production before the Indianization period.

Angkor

The only direct evidence for cloth production from the period of occupation at Angkor Wat is a bronze loom pulley on display in the National Museum of Cambodia in Phnom Penh. At a general level, the bronze pulley signals the usage of warp-weighted looms and the high status of some weavers within the temple complex. There is also some evidence to suggest that spinners and weavers at Angkor were perceived as slaves of the gods. This relationship is discernible in contemporary loom pulley iconography. The loom pulleys are sculpted in wood in the shape of *hamsa* (Hindu birds) and lotus flowers (Buddhist symbols) (Fig. 6.26). *Hamsa* is Sanskrit for the sacred goose that lives in the Himalayas. It was the vehicle of Brahma and occasionally of Varuna (the deity ruling the West). The lotus is an important motif in Hindu art with three main types depicted in Hindu iconography, distinguished by their petals (van der Hoop 1949). The lotus depicted on the wooden loom pulley strongly resembles the white lotus, half in bud. Petals from the lotus and *Artocarpus sp.* (jackfruit), which was used to dye Buddhist robes, are also depicted on the statuary and bas-reliefs at the temple complex. The statue of Prajnaparamita in the form of a child at Angkor Thom is shown in a long *sampot* decorated with four-petalled flowers typical of the Bayon style.

Although there are no spinning and weaving scenes amongst the "genre" scenes on the outer galleries at Angkor Thom, cloth is used to articulate ethnic identity in the many battle scenes along the small galleries at the site. The battle scenes record real episodes in the history of Angkor kingdom, when the Khmer were in conflict with the Cham. The distinctive battle jackets of the Cham are readily discernible in Fig. 6.27 showing the arrival of the Cham army in boats in 1177.

Inscriptions reveal that large numbers of weavers served the temple complexes producing differential textiles for the elites and functionaries at court and that spinners and weavers attained merit through cloth production. Some inscriptions contain lists of donors who gave offerings of cloth to the temple complex. The cloth was intended as clothing for the statues of the deities (Giteau 1965:226), a traditional practice observed elsewhere in Cambodia during fieldwork (Fig. 6.28). The Angkor temples were storehouses of treasure. Amongst the assets of a single foundation were 40,620 fine pearls, 4,500 precious stones, 967 voiles and silk (Thierry 1964). The evidence clearly shows that cloth was catalytic in consolidating status at Angkor from the reign of Jayavarman II (AD 902-850) to the decline of the empire with Jayavarman VIII's death in 1296.

When the taste for exotic cloth reached its peak between the 10th and 12th centuries, greater quantities of cloth were depicted on the statuary and bas-reliefs. When demand for beautiful cloth was very high, sampots depicted on the statuary and bas reliefs were fuller and longer with pleated forms well represented (Fig. 6.29). This indirect evidence indicates that rulers and elites made greater use of fine, exotic, colourful, decorated textiles and as the kingdoms prospered, court costumes and ritual paraphernalia became increasingly ostentatious. The highest-ranking individuals wore gold and silver brocade and silk cloths embroidered with jewellery of the type still worn by the Khmer royal family at ceremonies. Early examples of this conspicuous show of wealth are displayed in the National Museum of Cambodia.

Only the sovereign could wear textiles woven in all-over patterns, a hierarchy of materials sustained by sumptuary laws. Sovereign cloths were very rich and sheer, valued at 3-4 ounces of gold. In sharp contrast, black was the dominant colour worn by rural people and saffron yellow was the colour for the clothing of Buddhist monks (Delvert 1961).

Green (2000) has compared the costumes and textiles depicted on sculptures and bas-reliefs from the Angkorian period with textiles woven by contemporary Cambodian women and come to an interesting conclusion about the technologies evidenced at Angkor. Green points out that two different types of looms are indicated by the widths of the textiles depicted on the statuary. She points out that the longer sarongs and upper garments on the statuary and bas-reliefs from the later periods must have been woven on large upright looms of the type used by Cambodian weavers today. In contrast, the small cloths depicted as lower body garments on many images would have been woven on backstrap looms where the size of the weft is limited. The cloths are rolled with ends wound together and then passed through the legs and hitched at the waist. Small cloths of this type, known as *chawng kbun*, are still worn by the

Khmer. The sumptuous textiles produced in textile workshops associated with the court are depicted on the elites and their deities at the temple complex. The rolled sampots depicted as loincloths by commoners and prisoners (Fig. 6.30) were exiguous garments woven on backstrap looms of the type evidenced in the archaeological record of South China and Lingnan.

The bas-reliefs clearly establish that life at Angkor was punctuated by ceremony and cloth played a central role in many different types of ceremonies where it functioned as ritual paraphernalia. Registers depict the king's procession throughout the walled city, headed by soldiers bearing cloth flags and banners (Fig. 6.31), all of which would have woven on looms. Depictions show rulers preceded by 300 - 500 gaily dressed palace girls, some carrying gold and silver vessels, followed by bodyguards, royal wives and concubines with at least a hundred parasols made from cloth. The highest officials at Angkor were permitted four parasols, ranked officials were permitted a single parasol. The lower classes were only permitted kitty sols (parasols made from bamboo and paper). Indian inspired cloths were used in the courts and palaces to mark status and ritual space as room dividers, wall hangings and floor coverings.

Although the archaeological evidence for cloth production in Cambodia is small, the research has clearly established that the hand spindle of the type documented previously was used in Cambodia during the prehistoric period. An attempt was made to demonstrate parallels between the design elements depicted on pottery artefacts associated with spinning tools at Samrong Sen and spinning tools from wet rice sites in the Middle Yangzi. The motifs on these artefacts were shown to be technologically inspired. Attention was also drawn to a number of unidentified loom parts from Oc Eo, which suggests that the warp-weighted loom may have been introduced into Funan around 2000 years ago. The final section of the chapter showed a relationship between cloth and social stratification at Angkor consistent with the introduction of Indian religions and cosmology around 2000 years ago. The inscriptions and bas-reliefs clearly show that as Khmer society became increasingly stratified, greater quantities of cloth and more elaborate forms woven on larger looms were required to articulate status and reinforce the prevailing social order.

Chapter 7

Laos

Cultural Diversity and Origins

The People's Democratic Republic of Laos is a landlocked country bordered by China in the north, Vietnam in the east, Cambodia in the south and Thailand and Burma in the west. Altogether, 82 different languages are currently spoken in Laos. These belong to a number of different language groups: Daic, Tai-Kadai, Austro-Asiatic, Mon Khmer, Tibeto-Burman, Hmong and Mandarin. Undoubtedly, the linguistic diversity reflects longstanding movements across national boundaries.

Of these language groups, 71% of the population speak Tai-Kadai languages. The language spoken by the Lao-Lum, the largest ethnic group who occupy the lowlands along the banks of the Mekong and its tributaries, is closer to the Thai spoken in Thailand than to Lao-Tai. The Lao-Tai who live in the uplands include the Black Tai (Tai-Dam), Red Tai (Tai-Deng), Tai-Neue (Tai of the North), Tai-Phuan (Xieng Khouang Province) and the Phu-Tai. The Tai Dam (Black Tai), Red Tai (Tai Deng) and the Tai (Blanc) language groups are named after their textiles. It is interesting to note that Chamberlain (1978) once argued that the pattern of Tai language development shows a flow from an origin centre in the Red River area.

24.1% of the population of Laos speak Austro-Asiatic languages such as Mon Khmer which is part of a wider linguistic group scattered throughout southern China, Cambodia, northern Thailand and northeast Myanmar. There do not appear to be any obvious relationships between the Mon Khmer language groups and cloth production. According to Higham (1996:3), most of the prehistoric people of Southeast Asia would have spoken a language within the Austro-Asiatic family but towards the northern margins, it is possible that Austro-Tai languages were present.

Around 4% of the population speak Hmong (formerly known as the Meo or Miao). The Hmong are considered to have come to Laos from southern China several generations ago. At least two of the Hmong speaking groups are named after the specific coloured costumes they produce. These are the Hmong Daw (White Miao) and Hmong Njua (Blue Meo). Groups belonging to two dialects of the Phunoi, the Black and White Khoamy, are also named after their textiles. A very small percentage of the Laotian population (1%) speak Tibeto-Burman and Sino-Tibetan. However, there are no obvious correlations between Tibeto-Burman language names and cloth production.

According to mythology, the Lao are derived from a legendary ancestor called Kun Borom who gave birth to the Lao people by cutting open a gourd in the town of Muong Taeng (Dien Bien Phu). Kun Borom's seven sons then established the great Tai kingdoms (Cheeseman 1988:33). From a technological perspective, the myth seems apocryphal. More than 2000 years ago, the Man barbarians who lived in Yunnan made spindle whorls from gourds. The usage of the gourd in this way is recorded in the Official History of the Dianhai (see Rawson 1983:220). While gourd whorls have not been identified at Yangzi Valley sites, the gourd was one of the plants identified at Hemudu. We also know from the ethnographic research outlined in Chapter 3 that traditional groups in Taiwan, such as the Paiwan, still use gourd spindle whorls (Shih & Chen 1950:plates 1-2).

Textile scholars have hypothesized about the introduction of textile technology into Laos but there are theoretical problems with previous approaches. Cheesman (1988) based her reconstructions of the origins of spinning and weaving in Laos specifically on correlations between the motifs on prehistoric bronzes from the region and the motifs on contemporary Laotian textiles, particularly "Dongsonian" design elements (hook, S and "ship of the dead" motifs) that characterize Tai textiles. Based on these parallels, Cheesman linked the Tai-Lao to Dongson groups and attributed both metallurgy and "Dongsonian" textiles to an indigenous prehistoric culture with its roots at Ban Chiang. The main problem with the art historical approach to textile technology is the temporal differences between the cited evidence. Contemporary textiles are linked to prehistoric groups (not prehistoric textiles) but without firm archaeological evidence, we have no way of knowing if the prehistoric groups in Laos used Dongson motifs on their textiles. Problems with this methodology arise because there is historical evidence for the movement of spinners and weavers into Laos a few centuries ago. During the early stages of the Lan Xang Kingdom (1355-1707), for example, large numbers of weavers were brought into Luang Prabang from surrounding countries to spin and weave exotic textiles for the court using a combination of local materials and imported techniques and designs (see Naenna 1998). Moreover, Cheeseman's reconstruction appears to be based on very early dates for Ban Chiang which have been subsequently disproved (see Chapter 8).

Using firm archaeological evidence, this chapter traces the introduction of spinning technology from the Red River region into Laos towards the end of the prehistoric period. The research also shows correlations between whorls in Vietnam and Thailand but sees the technology linked to the movement of groups from east to west, rather than from Ban Chiang to Laos. The chapter also aims to show that there was sufficient economic expenditure on cloth production at some Laotian sites to suggest trade or exchange during the latter part of the first millennium BC.

Archaeological Evidence

Lao Pako

The greatest concentration of spindle whorls found thus far in Laos comes from the late prehistoric site of Lao Pako (Fig. 7.1), located on a hill near the banks of the Nâm Ngum River. Lao Pako has been excavated over three seasons. Table 7.1 shows a series of uncalibrated radiocarbon dates obtained for the site. The first two dates (ANU 10768, ANU 10769) are considered to be too old to relate to the artefacts; the three dates from the Stockholm Laboratory in Sweden are more likely (Thongsa Sayavongkhamdy pers. comm.) as are the two other dates from the ANU lab. (P. Bellwood pers. comm.).

Sample	Lab. Number	Material	Date
LPK S36	ANU-10768	charcoal	9390 ± 80 BP
LPK S34	ANU-10769	charcoal	3950 ± 120 BP
10	ST14398	charcoal	1760 ± 120 BP
11	ST14399	charcoal	1595 ± 70 BP
LPK-DI-S22	ANU-10874	charcoal	1520 ± 70 BP
6	ST14397	charcoal	1545 ± 90 BP
LPK-B2-S40	ANU-10875	charcoal	1840 ± 80 BP

Table 7.1 *Radiocarbon dates for Lao Pako.*

The excavations covered 25m^2 with three cultural layers identified (Källén & Karlström 1997, 1999). Altogether 43 spindle whorls were found at the site. Of these, 31 were obtained during the second season by the joint Swedish/Laotian team between 1995 and 1996 (Källén and Karlström (1997) with a further 12 from the final excavation (Källén pers. comm.). The functional attributes of the whorls from the second season are shown in Fig.7.1; those from the last excavation have yet to be published. With the exception of weight, all of their functional attributes are published in the report (Table 7.2).

Number	Square	Layer	Diameter (mm)	Height (D/H)	Ratio	Shape	Comment
7	E2	IV	31	29	1.07	biconical	-
27	D1	III	34	20	1.70	biconical	flat bottom part
28	E2	IV	26	13	2.00	annular	-
29	E2	IV	30	17	1.76	biconical	one half
35	B2	V	34	20	1.70	annular	-
46	D1	V	35	25	1.40	biconical	black
50	E2	V	35	25	1.40	biconical	-
60	D1	IV	28	19	1.47	biconical	-
61	D1	IV	32	17	1.89	biconical	-
62	E2	IV	40	35	1.14	biconical	decorated with parallel lines
72	D1	V	30	18	1.67	biconical	-
120	D1	V	38	26	1.46	biconical	-
121	D1	V	30	16	1.88	biconical	-
130	E2	V	30	15	2.00	annular	-
135	D1	VI	31	27	1.15	biconical	J29
136	D1	VI	35	26	1.35	biconical	J29
137	D1	VI	35	18	1.94	biconical	J29
179	E2	VI	32	23	1.39	biconical	-
228	E2	IV	29	19	1.53	biconical	-
229	E2	IV	28	18	1.56	biconical	-
230	E2	IV	25	18	1.39	biconical	-
231	E2	IX	35	-	-	biconical	broken, J50
231	E2	IX	26	-	-	biconical	J50
231	E2	IX	24	-	-	biconical	one half, J50
231	E2	IX	32	-	-	biconical	decorated with whirl pattern, J50
231	E2	IX	28	-	-	biconical	broken, black, whirl pattern, J50
231	E2	IX	26	-	-	biconical	J50
231	E2	IX	27	-	-	biconical	J50
231	E2	IX	33	-	-	biconical	black, whirl pattern
231	E2	IX	33	-	-	biconical	decorated with whirl pattern
231	E2	IX	40	-	-	biconical	J50

***Table** 7.2 Functional attributes of spindle whorls from Lao Pako (Källén & Karlström 1997:34).*

Certainly, the number of whorls at Lao Pako is greater than expected, given the very small size of the excavation (25 m^2). As Table 7.2 shows, 18 whorls came from the occupation layers (III, IV, V, and VI). The greatest concentration (13) was beneath two pottery jars in layers VI and IX; 3 were beneath J29 in square D1 and 10 beneath J50 in square E2. The single whorl in layer III, square D, suggests that spinning was not a major activity during the initial stages of occupation. The data show increased activity in layer IV (6 whorls from squares E2 and D1) with slightly more whorls (7) recovered from squares D1, E2 and B2 in layer V. If jars were used for burial, the presence of 13 spindle whorls under two of the jars (J50 and J29) indicates that the craft specialisation observable at Late Neolithic/Early Bronze Age sites in the Red River delta may have also have been in existence in Laos. The concentration of whorls beneath J50 and J29 also suggests that the identity of some of the prehistoric people is inextricably linked to cloth production.

Lao Pako's whorls are diagnostic; they are relatively small, ranging in size from 2.4 cm to 4.0 cm. With the exception of two round types, they are biconical, an attribute that links the spinners from Lao Pako to earlier spinners from Phung Nguyen and Dong Dau sites in Vietnam. When morphology is combined with decoration (Fig. 7.2), more specific relationships are discernible. Despite some variation in rendering, the basic motifs are the same. Five whorls beneath jar 50 were also incised with the whirl motif (Fig. 7.3) first reported for whorls from the Red River region and Fujian province as well as being painted on whorls from earlier Middle Yangzi sites. The concentric circle design on the lower surface of the round whorl in burial F27 is also paralleled on whorls from Phung Nguyen and Dong Dau sites, Sha Lo Wan headland, Lantau Island and many Tanshishan sites, and much earlier at Hemudu.

The presence of two different whorl types (annular and biconical) at Lao Pako indicates that more than one type of fibre was spun. As weights were not given in the reports on the site, it is not possible to correlate whorls with specific textile fibres. If we consider the fibre-producing plants recorded in French botanical sources (Crevost & Lemarie 1917; Petelot & Magalon 1929; Tixier 1966; Vidal 1934-60) shown in Table 7.3, a number of possibilities emerge, apart from silk filaments.

It seems unlikely that *Gossypium sp.* was spun at Lao Pako. In parts of Southeast Asia where short stapled cotton fibres are still spun with the hand spindle (see Hitchcock 1985:29), light wooden whorls are used. It is also unlikely that kapok (*Bombax malabarium* and *Ceiba petandra*), which grow throughout Southeast Asia today, was spun with the whorls. The fibres from *B. malabarium* and *Ceiba petandra* which are of Indian origin are probably too light and short to be spun with pottery whorls. Kapok floss measures about 5 cm and is difficult to spin because of its lack of cellulose. *Corchorus capsularis* (jute) which is also of Indo-Burmese origin is a strong possibility. Or the spinners may have introduced *B. nivea (ramie)* from China where the species originated (see Kuhn 1988). It is also possible that the prehistoric spinners at Lao Pako made use of plants like hibiscus or indigenous plants such as *Sesbania aculateata*.

Fibre-producing plants
Aganonerion polymorphum
Boehmeria nivea, B. virilatyfolia
Bombax malabaricum
Broussonetia papyrifera
Calamus salicifolius
Cannabis sativa
Careya sphaerica
Cococ nucifera
Colona auriculata
Corchorus capsularis
Crotularia iuncea
Eichhornia crassipes
Ficus rostrata
Gnetum latifolium
Gossypium arboreum, G. herbaceum, G. hirsutum, G. vitifolium
Helecteres hirsuta
Hibiscus sp.
Ichnocarpus frutescens
Luffa cylindrica
Morus indica
Musa textilis
Schumannianthus dichotomus
Sesbania aculeata
Sterculia pexa
Tetracera loureiri
Tetrastigma harmandii
Triumfetta rhomboidea
Urena lobata

***Table** 7.3 Plants used for cordage and textile production in Laos and Cambodia.*

Some whorls from Lao Pako were made available for analysis. As their functional attributes had previously been recorded (Table 7.2), the primary purpose of the analysis was to determine if the spindle whorls had been used for spinning or had been produced specifically for the grave. Use-wear marks were identified on the surface of the central perforations of several whorls where the wooden shaft would have pressed. One of these discrete areas of fabric attrition is visible on the edge of the central perforation in Fig. 7.4. Not only does this feature indicate that the whorls excavated from Lao Pako were legitimate tools but it also shows that the prehistoric spinners at the site had a low whorl tradition.

The black pottery whorl in Fig. 7.5 is very coarse and tempered with mica. It weighed 19.7 g and measured 3.5 cm in diameter with a central perforation of 0.48 cm. Discrete areas of fabric attrition consistent with heavy usage are discernible on one side of the central perforation. In terms of morphology, it is best described as truncated biconical. Thirty-one fine incised, parallel lines (0.3 cm apart) were identified on the outer rim of the upper surface;

no lines intersect, a feature that suggests that the lines held meaning. These distinctive types also occur with iron spearheads at archaeological sites in Southeast China (Fig. 7.13).

At Lao Pako, Källén & Karlström (1999:35) also found pottery artefacts (Fig. 7.6) identified as pottery rollers. They noted their resemblance to rollers from Ban Chiang (White 1982) and Ban Na Di (Higham & Kijngam 1984) that had previously been identified as stamp rollers and clay seals. However, Källén and Karlström also observed that Lao Pako's rollers differed from Ban Na Di rollers in one important respect. Whereas Ban Na Di's rollers were drilled completely through the centre, Lao Pako's rollers were drilled only about 5 cm from each end. This difference led them to conclude that the Lao Pako rollers could not have functioned as beads, nor clay seals, but were used in textile printing. This interpretation was also based on the absence of the motifs carved on the rollers on any of the pottery from Lao Pako.

The two rollers were forwarded to the ANU by the Department of Museums and Archaeology in Vientiane and their dimensions are given in Table 7.4. Both Lao Pako rollers had the shiny

Number	Material	Weight	Length (cm)	Width (cm)	Size of perforation (cm)	Motif
DF 44	black pottery	10.93	27	18.85	0.4	banded linear zigzags
DF 48	black pottery	14.58	28	27	0.49	concentric circles

Table 7.4 *Distinguishing characteristics of pottery rollers from Lao Pako.*

appearance of steatite seals and whorls found at sites in the Mediterranean and Middle East. However, elemental analysis using Scanning Electron Microscopy did not show magnesium (Fig. 7.7) thus indicating that the rollers were not made from steatite, but from pottery. The central perforation of one roller was found to be asymmetrical (Fig. 7.6), a feature that is of functional significance. If the rollers had been used in fabric printing as suggested, the latter would not have produced designs in straight rows and the dyes/ paints would have smudged during the process. A simple laboratory experiment was also conducted by this researcher to detect traces of dye on the surface of the rollers. Table 7.5 shows dyes that have been used in traditional textile production in Laos.

Scientific name	**Common name**	**Colour**
Bixa orellana	anatto	red
Diospyros molis	ebony	brown/black
Indigofera tinctoria	indigo	blue
Lakshadia chinensis	lac (insect)	red

***Table** 7.5* *Natural dyes used in textile production in Laos.*

The pottery rollers were examined under an ultra-violet lamp of the long wave type, a technique used by museum curators to identify dyes in ethnographic textiles (see Lakwete 1979:326-335). The technique is based on the principle that when textiles are subjected to ultra-violet rays, they fluoresce. It is possible to identify dyes using this method because each dye produces its own distinctive fluorescent hue (a signature). Six contemporary textiles woven in the People's Republic of Lao from the author's collection were examined under the ultra violet light and only one matched the hue emitted by the rollers from Lao Pako. The match came from a very dark indigo blue cloth produced by weavers from Carol Cassidy's Textile Workshop in Vientiane. This match appeared to indicate traces of blue dye, however, the results were misleading. When several of the pottery spindle whorls from the site were also subjected to the same ultra-violet rays, they produced an identical hue. It became clear that the fluorescence from the rollers and whorls was not resultant from dyes but produced by minerals in the pottery. The main point is that minerals also fluoresce and although the experiment showed a correlation between the rollers and the textile from Vientiane, it failed to establish that the correlation came from dyes. Problems had emerged with the experiment because soils around Vientiane have a heavy iron content. In addition, the textile from Carol Cassidy's workshop used in the experiment was not dyed using traditional plants such as *Indigofera tinctora*, as believed, but was dyed with an acid dye produced by the German company, Bayer. Further tests are proposed using more sophisticated techniques such as X-Ray emission (PXE) spectrometry, electron spectroscopical chemical analysis (ESCA) and Fourier Transform Infrared Spectroscopy. All that can be said with certainty at this stage is that preliminary tests failed to show any traces of dyes on the pottery rollers from Lao Pako and their function remains obscure.

Two different motifs were carved on the rollers. DF44 has a zigzag motif carved between raised bands and DF48 has rows of concentric circles. As Källén and Karlström observed, the same design elements occur on rollers from the late period at Ban Chiang. However, this research clearly shows that these design elements first appear on Vietnamese pottery belonging to the Phung Nguyen culture, continue as principal design elements on Go Mun pottery, through to the Dongson period (Fig. 7.8). It is also worth noting that the design elements on the rollers are the same design elements on the tympanums of Dongson bronzes (Fig. 7.8a).

The Plain of Jars

The Plain of Jars is distinguished by clusters of stone jars (Fig. 7.9) that lie over more than 60 acres of the uplands of Laos, extending across the provinces of Xieng Khouang and Hua Pan. The jars range in height from 3 to 10 ft. During Parmentier's investigations of the jars in 1923, he identified 3 principal types: squat, slender and squared and rectangular prisms with well-rounded corners. Parmentier noted that a typical stone jar contained one or two black pottery vessels, one or two hand axes, a "bizarre object which we call a lamp", a spindle weight of iron, glass and carnelian beads, stone and glass earrings and bronze bells.

The presence of iron spinning tools in the jars is significant as it indicates Indian textile technology. Securely provenienced iron spindles from Lopburi Tha Kae and Indian parallels are discussed in Chapter 8. While the iron spindles from the Plain of Jars do not appear to have been previously linked to India, Colani (1935) recognised parallels between the stone burial (?) jars in upper Laos, jar burials from the coastal dunes of central Vietnam (Sa Huynh) and stone jars from the North Cachar hills of northwestern India and concluded that the burials on the Plain of Jars belonged to descendants of the *Pong* (ethnic groups living in the vicinity) who were associated with the Sa Huynh culture. Colani believed that during the first millennium BC, the prehistoric groups buried in upper Laos were in the act of migrating to Vietnam from Assam, through Myanmar, Thailand and Laos. Colani saw three links in a chain: the ancient monoliths of Cachar, stone jars of Tran Ninh (now Xieng Khouang) and the necropolis of Sa Huynh. Because of these parallels, she believed that the Plain of Jars lay on an ancient trade route stretching from the Vietnamese coast near Danang to the North Cachar Hills of India.

Colani also noticed salt deposits on the Plain of Jars and concluded that the groups represented archaeologically were positioned on the plains during the prehistoric period to control the exchange routes between southern China, Bac Bo and the burgeoning chiefdoms of the Khorat Plateau (Higham 1989: 229, 230). Certainly, Chinese historical documents record that salt was mined in dry salt lakes on the peripheries of the Middle Kingdom and imported into the country as early as the first millennium BC (Gernet 1996). Salt was also traded in Funan, where, like silk and hemp, it was legal tender. Even though the *zhongyuan* produced enormous quantities of salt, the commodity was scarce amongst several of the "barbarian" tribes of the southwest (Schafer 1969:216).

Ban Ang

Colani also recovered pottery spindle whorls in a large cave at Ban Ang, the principal jar site on the plains. The cave lies about 2 kilometres northeast of Phonsavan (Xieng Khuang Province) and is surrounded by more than 250 stone jars. Fifty of these jars, including the largest yet found in Laos, were located on a ridge on the northeast of the site. From this, Colani concluded that the jars at Ban Ang contained the remains of chiefs. The large cave that contained pottery whorls relevant to this study was located on a limestone hill; the cave mouth was at ground level with large chambers created by erosion above. During her excavations, Colani observed that the northeast wall of the cave at Ban Ang was blackened by smoke. Along with the presence of cinerary vases in the cave, the blackened cave walls led Colani to conclude that cremations took place within the cave before bones of deceased persons were placed in the stone jars on the plain. According to Colani, Ban Ang was the ritual centre for the Metal Age groups who buried their dead on the plains.

Fig. 7.10 shows the spindle whorls described by Colani as *pesons (here peson = spindle whorl)*. Colani did not classify *petit pesons* less than 3 cm in diameter as whorls. Her interpretation is consistent with classification systems developed by contemporary bead scholars (Francis pers. comm.) who generally classify discs less than 3 cm as beads. Most beads are less than 2.0 cm in diameter (Liu 1978); the central perforations of very small beads are too narrow to hold a spindle. However, it is also possible that the tiny discs from Ban Ang were used to spin cotton. If the Plain of Jars lies on the ancient trade route to India as proposed by Colani, then it is entirely possible that some Indian spinning tools along with Indian cotton and dyes were introduced into Laos and Vietnam (and China) during this period.

Certainly, the positively identified whorls from Ban Ang belong to the same technological tradition described in previous chapters. Ban Ang's whorls were biconical (2) and truncated conical (1) types. The upper surfaces of Ban Ang's whorls were decorated with the ubiquitous small concentric circles found initially reported on whorls from Neolithic sites in the Yangzi Valley, the Pearl and Red River deltas.

Mansuy and Colani also recovered large numbers of schist-perforated discs identified as *"pendéloque perforée schiste"*. Examples from Ban Hin, Keo Hin Tan, Tham Ban and San

Kong Phan are shown in Fig. 7.11. The schist discs fall within the range of prehistoric stone whorls and may have functioned as tools and jewellery. During fieldwork, ancient spindle whorls incorporated into strings of beads worn by Southeast Asian spinners were observed. The motifs on the *pendéloque* are also paralleled on whorls from earlier Yangzi Valley sites as well as the convention of decorating the outer rims of whorls with motifs, correlations that suggests shared technological and artistic traditions.

Although the stone jars that characterize the Plain of Jars have not hitherto been linked to textile production, there are some archaeological and ethnographical parallels which support this association. Textile dyeing as a chemical process dates back to the prehistoric period and at most archaeological sites, the process is identified from containers used to hold dyes rather than the identification of prehistoric dyes (Barber 1991). At Myrtos in southern Crete, for example, the process has been identified from tubs and channels. Excavations of Hellenistic sites in Corinth and Tell Beit Mirsim in Palestine produced elaborate sets of vats, tanks, channels and ash pits which have been interpreted as evidence for dyeing cloth. The presence of 30 stone vats at Tell Beit Mersim led archaeologists to conclude that the small town was mainly devoted to weaving and dyeing textiles (Albright 1941-43).

In remote areas of Guizhou, women still dye cloth in large vats cut out of limestone cliffs using concoctions made from *Indigofera suffruticosa* leaves (Balfour-Paul 1996). The water containing dyes in the stone dye vats heat up during sunlight; the openings are smaller than storage vessels for other commodities but large enough to remove cloths still completely immersed in water (not wrung out) with the edges of the openings curved to reduce oxidation. Lids are placed on all dye vats as fermentation only occurs in anaeorobic conditions and it is worth noting that some lids were found on the Plain of Jars. The position of the jars on the plains away from local villages supports this hypothesis. As urine is often used as a mordant, dyes become noxious during the fermentation process and the smells become increasingly offensive. Ancient dye vats were traditionally placed away from villages, on hills where they could capture the morning sun to heat the dye solutions in the vats and use prevailing winds to blow the offensive smells away.

Tam Hua Pu

Recent excavations of Tam Hua Pu (Sayavongkhamdy & Bellwood 2000) produced a single pottery spindle whorl and fragments of mineralized cloth on iron artefacts. Tam Hua Pu is a cave site located on the southeastern slope of Pa Pak Peo, a hill at the foot of the Pu Luang mountain range in Luang Prabang Province. Table 7.6 gives five radiocarbon dates obtained for the site from the Radiocarbon Laboratory at the Australian National University.

Lab. Number	Date
ANU-10138	1340 70 BP
ANU-10139	2820 60 BP
ANU-10770	4440 100 BP
ANU-10771	3849 150 BP
ANU 10141	3750 70 BP

Table 7.6 *Radiocarbon dates for Tam Hua Pu.*

The pottery whorl from Tam Hua Pu shown in Fig.7.13a, is a flattish conical whorl with distinctive incised markings. Whorls of this type were very common at sites in the Dong Nai Valley, at both Doc Chua (Fig. 5.69) and Go O Chua (Fig. 5.70a).

Tam Hua Pu also produced the only extant remains of prehistoric cloth yet found in Laos in the form of mineralized textiles on an iron spearhead (Fig. 7.14). The spearhead was lying at the bottom of a pit with secondary burials, pottery, a socketed axe, exotic beads, bronze and other iron artefacts (staples, knives, hinges and a hairpin). When removed, fragments of cloth still adhered to the surface of the weapon. The textile-encrusted spearhead shown in Fig. 7.15 was made available for analysis. Scanning Electron Microscopy showed that the coarse fibres in the fragments had become completely mineralized through contact with the leaching salts of the iron tool. As distinguishing features of the fibres (striations...) had long gone, the original fibres could not be positively identified. Under magnifications of 127, fibre bundles measuring 53.2 μm were recorded. The basic structure of the cloth is a 1/1 tabby weave.

Closer examination of the spearhead revealed that traces of cloth remained on all sides of the metal blade and around the handle of the weapon (Figs. 7.16), a feature that indicates that the weapon was wrapped in cloth prior to burial. Had the cloth been a fragment of burial clothing or a shroud, traces of cloth would almost certainly have been left on one side of the spearhead. The position of the mineralized cloth on the weapon also tells us something about the relative value of the two materials during the Iron Age. The cloth wrapping suggests that iron was more precious than the coarse woven fabric surrounding it. Undoubtedly, iron was highly significant in the development of prehistoric societies. Iron tools would have greatly facilitated land clearing for agriculture and iron weapons would have given their owners considerable advantage in the warfare that was widespread throughout Southeast Asia and China in the latter stages of the first millennium BC.

We know from previous chapters that weapons were wrapped in woven cloth prior to being placed in graves as early as the Shang dynasty in the *zhongyuan* and Bronze Age in Southeast Asia. It is not clear if the spearhead had been wrapped in a small cloth or if the fragments are remnants of a woven sheath used to protect the weapon. Fig. 7.17 shows a jade *ge* (22.2 cm x 4.7 cm) bearing traces of silk and ramie cloth woven in twill from Anyang, Henan Province. The Museum of Far Eastern Antiquities in Stockholm (Sweden) also houses a Shang dynasty *yue* (axe) bearing traces of figured silk (Huang Nengfu 1991). It seems pertinent that the mortuary practice requiring tools used in a deceased's lifetime be placed in the grave are recorded in the Books of Rites compiled during the Zhou dynasty (see de Groot 1892-1910).

There is also compelling evidence to link the iron spearheads to Vietnam. Iron spearheads encrusted with prehistoric cloth from Phu Hoa and Giong Ca Vo were illustrated in Chapter 5. Like the spearhead from Tam Hua Pu, the spearhead from Giong Ca Vo had been wrapped in coarse cloth prior to burial. It is also significant in this context that the greatest concentration of iron spearheads in the Southeast Asian archaeological record come from the site of Shizhaishan, located on the shores of Lake Dian on the Yunnan plateau. Shizhaishan, which means "fortress on the hill", is located about 50 kilometres from Kunming, an important entrêpot on ancient trade routes. Fig. 7.18 clearly shows the concentration of these artefacts at Shizhaishan where no fewer than 229 spearheads were placed in burials, along with 214 swords and 266 arrowheads. Some spearheads have two perforations at the lower edge of the blade to attach tassels; others have two lugs on the sockets for the same purpose. The pseudomorphs could not be tassel remnants, as tassels are not woven. During the early historical period, the Dian who lived in this part of southeast China were known as Southern barbarians or Man barbarians. The *Yuan Huan Kuan* (Treatise on Salt and Iron) records that the Dian were very rich but given to war.

Although few, the cloth production sites described in this chapter indicate that textile technology was not invented independently in Laos but introduced by Metal Age spinners and weavers from Vietnam. The functional attributes and decoration of whorls from Ban Ang, Lao Pako and Tam Hua Pu are paralleled at Dong Dau sites. While laboratory experiments on the pottery rollers from Lao Pako failed to produce chemical evidence for dyes, analysis of their design elements suggests that the rollers may have been used to decorate pottery. Watson (1992:176) had previously noted parallels between rouletted pottery from Khok Charoen and Non Nok Tha in Thailand and angular rouletted decorations found on burnished pottery at the site Dadunzi of northern Yunnan (Yunnan Provincial Museum 1979). The research also highlighted parallels between the cloth encrusted iron weapons from Tam Hu Pua and cloth encrusted weapons in Vietnam and Yunnan. The research also shows that the Metal Age groups in these regions shared mortuary rituals involving cloth and metal.

Chapter 8

Thailand, Part 1

Coastal Hunter-Gatherer, Neolithic and Bronze Age sites

Excavations of archaeological sites in Thailand have produced many fragments of mineralized cloth, preserved through contact with metal. Chiraporn Aranyanak (1991) from the Fine Arts Department in Bangkok has analyzed more than 1700 metal artefacts in search of textile pseudomorphs and her findings are published in *Archaeological Textiles in Thailand* (1991) (in Thai). Many archaeological sites have also produced prehistoric spindle whorls but the functional attributes of Thai spindle whorls have never been systematically recorded. While the evidence clearly indicates knowledge of cloth production from 2000 BC onwards, it is not clear if textile technology was independently invented in Thailand, or if the technology was introduced from China or India as has been proposed. The central proposition put forward in this chapter is that textile technology is inextricably linked to the arrival of rice in Thailand.

The question concerning the origins of rice has been long debated in Southeast Asian archaeology and several different hypotheses have been postulated. In 1977, Chester Gorman proposed that Hoabinhian groups cultivated taro around 14,000 years ago and experimented with rice cultivation around 9,000 years ago. But as Higham (1998:69) has pointed out, Gorman had no firm archaeological evidence to support his model. Gorman's model differed to that proposed earlier by Sorensen (Sorensen & Hatting 1967) to explain the origins of Neolithic groups with distinctive pottery found at archaeological sites in central Thailand. Sorensen proposed that the Late Neolithic groups at Ban Kao migrated to central Thailand from North China along an overland route following the Yangzi River upstream to Central Yunnan, across the mountainous regions, then down the Salween River to the coast (Fig. 8.2). While few archaeologists would now agree with Sorensen's reconstruction, it was based on the orthodox view of the time when archaeologists believed that the Longshan culture was derived from a single origin centre on the Central Plains and rapidly diffused to eastern coastal China (see Chang 1963, 1968). Since then, archaeological research in China has provided new insights into the "Lungshanoid Horizon" on which Sorensen's interpretation was based and shown that the Longshan is not only represented in South China but some of the earliest examples come from sites in southeast China (Chang 1988). Higham and Thosarat (1998) have put forward an alternative model that linked the invention of rice cultivation to coastal groups like those evidenced at the site of Khok Phanom Di. They argued that while the saline soils on the coast were not suitable for riziculture, subsequent falls in sea level could have led to the expansion of rice up the river valleys. The model was based on early dates and the presence of rice at Khok Phanom Di but when radiocarbon dates later showed that the site was only occupied from about 2000 BC, the model was abandoned. More recently, Higham and Lu (1998:867-887) have convincingly argued that rice cultivation first began in the Middle Yangzi Valley by 8500-8000 BP and expanded into other parts of South China and Southeast Asia during the prehistoric period. Scholars now generally hold that the earliest rice in Thailand is derived from the Yangzi Valley and not resultant from the independent development of wild species as suggested by Gorman (1977), Solheim (1972) and White (1997).

Fig. 8.1 shows the location of archaeological sites in Thailand with firm evidence for cloth production. As Glover (1990) has previously noted, the material evidence for cloth production in Thailand is concentrated at sites in central and northeast Thailand while there is no archaeological evidence in the south or the northwest. This chapter attempts to explain this pattern by tracing the initial introduction of the technology into Thailand by spinners belonging to the Tanshishan culture of southeast China. Movements of spinners and weavers from Vietnam are also traced. The main purpose of the chapter is to demonstrate that the cloth production tools and associated pottery excavated from archaeological sites in Thailand are part of a much wider technological complex that has its roots in Southeast China.

Ban Kao

Although the Ban Kao sites (Sorensen and Hatting 1967) are not generally associated with cloth production, excavations at these sites by members of the Thai-Danish Prehistoric Expedition retrieved cloth production tools. In contrast with other cloth production sites, these sites are near the coast. Ban Kao sites are also distinguished by tripods and pedestal vessels that also occur nearby in Sai Yok Cave and on the Malay Peninsular (see Leong Sau Heng 1990). In China, these vessels are called *ding* and *dou*. The *ding* is a Chinese cooking pot and the *dou* is a serving vessel. Chinese parallels led Sorensen to conclude that Ban Kao groups arrived in Central Thailand (and Malaysia) "fully formed" as a result of migration from Central China. As stated above, the data on which Sorensen's reconstruction was based has changed with new archaeological evidence from South China revealing that *ding* and *dou* distinguish Neolithic sites in the Yangzi Valley. In Chapter 2 we saw *ding* amongst the Early Neolithic pottery at Xianrendong (Figure 2.6). Not only has the Yangzi Valley produced some of the earliest forms, this class of artefact occurs in greater numbers and shows a greater range of types in the Yangzi region along with *dou*. Chinese archaeologists date *ding* in terms of stylistic attributes. For example, *ding* from Songze sites are distinguished by chisel shaped legs. Some *dou* also have cut-outs, a feature which distinguishes Middle Yangzi vessels from their Lower Yangzi counterparts.

Of the Ban Kao sites, only the Bang Site contained evidence for cloth. The site is located in the valley of the Kwae Noi River. The 44 burials excavated were assigned to three distinct phases: two Neolithic phases (Early and Late) and an Iron Age phase. Because the site lacked clear stratigraphy, it was difficult to seriate the burials and Sorensen's interpretation of the cultural sequences has been questioned (Higham 1996; MacDonald 1978; Parker 1968; Solheim 1969). Higham (1996:258) has drawn attention to graves that are intermediate and believes the two groups at the site were not separated by a long time interval.

Ten pottery whorls (Fig. 8.4) were found in layers 6, 5, 4 and 3 (Table 8.1). Some perforated stone discs from the site may have functioned as whorls and it is also possible that a disc described as "stone (possibly tortoiseshell)" associated with a sexed female skeleton is a symbolic whorl of the type discussed for Trang Kenh in Vietnam. The pottery whorls are buff, grey and black, and tempered with mica. One black whorl (BK 1) was burnished. It is worth noting that black pottery is predominant at earlier cloth production sites in the Yangzi Valley. Fig. 8.5 shows a range of vessels produced during excavations at the important textile site of Hemudu; black pottery is also common at Longshan sites. While black pottery comes from soil with a high iron content and can be produced wherever these soils exist, the high gloss that was observed on black pottery in Thailand appears to be connected to firing techniques practiced by Neolithic potters from the Yangzi and southeast Chinese coast. Chinese analysts have determined that the glossy black surface on Longshan black is "the result of a higher jgloss value in the firing due to the penetration of a considerable amount of carbon" (Yang Gen, Zhang Xiqiu and Shao Wengu 1985:16).

The functional attributes of the whorls from the Bang site shown in Table 8.1 were obtained from data contained in Sorensen's unpublished field notes. With the exception of a single broken piece measuring 2 cm, the whorls from the Bang site measured between 3.2 cm and 5 cm in diameter. None was decorated. They are of 3 main types: flat discs, conical and biconical. The recurrence of the biconical types that distinguish Tanshishan sites is significant. The truncated conical whorls in the table are also not inconsistent with these findings as these occur with biconical types at Dongzhang and Tanshishan (see Chapter 3).

Number	Context	Material	Colour	Diameter (cm)	Height (cm)	Shape
BKI, FI64,f	layer 5	pottery	buff	4.0	1.80	conical (tr.)
BKI, F5,be	layer 3	pottery	black	3.8	2.90	flat disc
BKI,F69,i	layer 4	pottery	black	5.0	1.40	flat disc
BKI,F89,e	layer 5	pottery	black	3.2	1.70	conical (tr.)
BKI F121,m	layer 5	pottery	black	3.5	2.71	conical (tr.)
BKI, F146,g	layer 6	pottery	black	2.0	1.60	flat disc
BKI,F164,f	layer?	pottery	black	4.4	1.80	flat disc
BKI,F255,p	layer 4	pottery	grey	3.7	1.85	conical (tr.)
BKI,F299,q	layer 5	pottery	grey	3.6	2.20	conical (tr.)
BKI,F325,b	layer 3	pottery	buff	3.3	3.20	biconical

tr.= truncated

Table 8.1 *Functional Attributes of Whorls from the Bang Site.*

Layer 5 also produced a pottery artefact (Fig. 8.3) that is paralleled at Tanshishan sites. It is an oval beater made from hard-fired clay with a crosshatch design carved on its upper surface. As pointed out in Chapter 3, archaeologists from the Fujian Provincial Museum classify these artefacts as bark cloth beaters. Pottery technology was sufficiently developed during the Neolithic in southeast China to produce high-fired pottery tools strong enough to beat soft fibrous material or apply watermarks to beaten bark cloth. The material composition of the beater and its parallels in southeast China suggest that soft bark fibres from the paper mulberry *(Broussonetia papyrifera)* could have been worked. Elsewhere (Cameron 2003), I have drawn attention to distinctive types of bark cloth beaters in southern Thailand and Malaysia. In Thailand today, *B. papyrifera* is gregarious on disturbed areas in the deciduous forests near streams all over the country (Phengklai and Khamsai, cited in Matthews 1996:122). The plant is indigenous to China (Matthews 1996) and could have been introduced to central Thailand with barkcloth technology during the prehistoric period. It is also possible that decorative design elements were impressed onto damp bark cloth. There are strong parallels between the designs worked into the surface of the bark cloth beaters from Lingnan sites and the watermarks created by contemporary wooden bark stamps used in Pacific barkcloth.

The pottery *ding* that came from Ban Kao culture *might* conceivably have had a role in textile production. Research in Mexican archaeology has established a previously unknown relationship between pottery tripods and spinning. In order to keep fibres clean and controlled, spinners often keep their fibres in bowls or baskets, a practice that dates back to the prehistoric period (Barber 1991). Pottery spinning bowls also keep fibres anchored to the ground, providing tension against which spinners can pull (Crowfoot 1931). Excavations

(Smith 1988: 349-358) of Aztec sites (AD 1350-1519) in the Mexican state of Morellos produced *ding* that functioned as spinning bowls (Fig. 8.9). Smith's interpretation of these artefacts is corroborated by historical documents *(Codex Mendoza)* and ethnographic analogy. The Aztec spinning bowls in Fig. 8.8 are morphologically the same as those found at Ban Kao (and in the Yangzi region). While these Mexican parallels do not establish that the tripods from Thailand and Malaysia had this function, they simply raise the possibility that could be further investigated through use-wear analysis. In summary, the pottery vessels, beater and all whorls from the Bang site are paralleled at Tanshishan sites

Nong Nor

Although textile tools were not positively identified at Nong Nor (see Higham and Bannanurag 1998), the site produced a number of perforated discs that resemble whorls. The site (Fig. 8.1) is located on the floodplain of the Bang Pakong River. Two phases of occupation have been identified. The earliest, belonging to coastal hunter-gatherers is dated to about 2400 BC while the second phase identified in a Bronze Age cemetery is dated between ca. 1000 and 500 BC. The discs in question were analyzed by Nigel Chang who suggested that they could be either beads, pendants, earplugs or spindle whorls (1998:302). Their dimensions are given in Table 8.2.

Number	Context	Material	Length	D.1	D.2	W.D.	P.D.
69	B15	clay	22.1	40.6	35.2	35.1	6.4
751	Unit 5	clay	-	50.0		10.4	6.3
78	XI, surface	shell	12.9	28.2	23.9	20.7	5.3 – 9.0

Table 8.2 *Dimensions of perforated discs from Nong Nor (after Chang 1998:302).*

Fig. 8.10 shows the artefacts in question. Although these artefacts are perforated like whorls and compare favourably with discs identified as whorls from Hemudu (Kuhn 1988:Fig.97) and Sa Huynh. Notwithstanding its central perforation, disc 69 also resembles earplugs from Indian archaeological sites that have been identified as earplugs. Positive identification was not possible from photographs; the central perforations of the Nong Nor discs need to be more closely examined for signs of fabric attrition consistent with spinning.

Khok Phanom Di

The site of Khok Phanom Di (Fig. 8.1) on the floodplain of the Bang Pakong River is significant in Southeast Asian prehistory for its early evidence for social stratification (Higham & Thosarat 1994) and early evidence for rice (Thompson 1996). When the site was occupied (2000-1500 BC), it was located on the coast at the mouth of the Bang Pakong River and the extraordinarily rich maritime habitat of the region is reflected in the material culture. Although woven cloth was never found at the site, Khok Phanom Di has a special place in the prehistory of cloth in Southeast Asia.

Khok Phanom Di produced the earliest examples of beaten barkcloth for Thailand and possibly for Southeast Asia as a whole. Not only is the barkcloth from Khok Phanom Di securely provenienced and dated, it provides important insights into the role of barkcloth in prehistoric societies in central Thailand 2,000 BC. Large numbers of the burials spanning the entire mortuary sequence in this small coastal hunter-gather village were wrapped in barkcloth (Higham *et. al.* 1987:152, Bannanurag 1989:39). Beaten barkcloth was recovered from graves numbered 40, 54, 57, 64, 90, 102, 107, 112, 114, 117, 125-6, 130-4, 136, 139, 140, 142, 151 (Thompson 1992:175). In some burials the barkcloth ran over ceramic grave goods. This led Higham and Bannanurag (1990:188) to conclude that it probably functioned as shrouds. Shrouds are also indicated by the close proximity of upper arm bones to upper torsos in some burials.

While the function of Khok Phanom Di's bark cloth is well established, its material composition remains less certain. As Thompson (1996: 109) points out, the fibres from Khok Phanom Di were analyzed by a number of specialists but some of the results were inconclusive and conflicting. Maloney (Maloney 1986, 1988; Maloney and Brown 1990; Maloney and Rovner 1991) positively identified *Artocarpus sp.* in the pollen record and *Echinochloa, Compositae, Cyperacea and Commelinaceae from* phytoliths in the soil under burial 149. Botanists from the Royal Botanical Gardens, Kew (London) could not identify samples of fibres because of limited reference materials from the region. The Kew botanists simply described the fibres as "groups of fibres with short chains of thinner-walled cells adhering to them in places" (T. Lawrence cited in Thompson 1992:180).

As part of her research into the botanical remains at Khok Phanom Di, Thompson analyzed six samples from the site. She divided them into 2 distinct categories. One group (burials 125, 151, 136 and feature 23) contained fibres with a fibre diameter of 5 μm. A second group (burials 117, 125, 136, 151 and pit 10:7 feature 29) comprised numerous, long, fine fibres of even diameter. An EDAX of the fibres obtained with the Scanning Electron Microscope produced prominent peaks of silicon that Thompson believed might have included phytoliths. According to Thompson, the samples were probably the same as those subsequently identified by Chiraporn Aranyanak (1991) from the Fine Arts Department in Bangkok as asbestos fibres. The silicon peaks that characterize asbestos are clearly discernible in Chiraporn

Aranyanak's photomicrographs and comparable photomicrographs of asbestos from the Textile Institute (Manchester, UK) (Fig. 8.11). The diameter of the fibres in the second category was larger and Thompson noted that they had more diverse chemical profiles. They were "not finely filiform and had notch-like projections along their length" (1992: 175). Photomicrographs of samples (burials 117 and pit 10:15 feature 23) are shown in Fig. 8.12 along with photomicrographs of comparable ethnographic samples of *Artocarpus* barkcloth from the Marquesas and *Broussonetia* barkcloth from Fiji and Tikopia. Thompson was unable to find any correlations between any of the barkcloth samples. Consequently she was unable to positively identify any of the fibres in the assemblage or confirm or deny that the burials at Khok Phanom Di were wrapped in *tapa*.

My attempts to relocate the fibres examined by Thompson in the Archaeology Department at the Research School of Pacific and Asian Studies for further analysis were unsuccessful. Nevertheless, a few observations can be made from the published photomicrographs and data on prehistoric barkcloth. As Thompson acknowledged, prehistoric barkcloth is extremely rare in the archaeological record and she referred to only one comparable find in coastal Peru (Bell cited in Thompson 1996:108). However, there are much closer parallels within Southeast Asia. Excavations at the cave of Lubang Angin in Gunung Mulu National Park (Ipoi 1993, Ipoi and Bellwood 1991) produced extended burials wrapped in barkcloth. The radiocarbon dates given for Lubang Angin fall between 700 BC and AD 500.

Although the prehistoric samples of *Artocarpus from* Khok Phanom Di did not match the ethnographic sample of *Artocarpus* barkcloth from the Marquesas Islands in Thompson's experiments, the Marquesan sample may have produced misleading results. Kooijman (1972:179) specifically mentions inferior quality greyish *tapa* made in the Marquesas from *A. incisa* whereas Khok Phanom Di's barkcloth was consistently described as white. Given such intra-species variability, *Artocarpus* sp. remains a possibility for Khok Phanom Di's barkcloth. Further research is suggested using a wider range of *Artocarpus* fibres, especially as Maloney (1986, 1988) positively identified *Artocarpus* in the pollen record of the site.

Undoubtedly, the most unusual fibres produced by Khok Phanom Di were the asbestos fibres. As well as the samples from Khok Phanom Di, Aranyanak (1991) has also positively identified asbestos fibres (Fig. 8.13, 8.14) in samples from Ban Chiang, Ban Prasat and several Portuguese settlements. The relationship between asbestos and elites has been explored elsewhere (Cameron: 2000) (see Appendix). However, Higham (pers. comm) is of the opinion that Khok Phanom Di's bark cloth with traces of asbestos is not of exotic origin but manufactured at the site using local materials.

Because evidence for spinning consistently occurs at archaeological sites with early rice throughout Southeast Asia, it is surprising that neither whorls nor woven cloths were found at Khok Phanom Di. The presence of knives and awls amongst the cultural materials suggests that matting or unspun sago palm fibres (see also Appendix 2) were woven at the site. Twill reed matting was found at Hemudu; a more complicated twill with a double warp and a double weft was recovered from Qianshanyang in Zhejiang Province (Kuhn 1980:41). During the Shang dynasty (1520-1030 BC), matting was painted in the *zhongyuan*; during the Zhou dynasty (1030 – 221 BC), mats were also lacquered and bound with silk. The cultural significance of matting in the first millennium BC is clear from the usage of 17 different but nonetheless specific terms for matting in Zhou documents (Kuhn 1980: 79).

Matting made from pandanus, fine bamboo, straw and coconut palm was an important commodity in the early maritime trade in Southeast Asia (Wheatley 1958:64). Chau Ju-kua (Hirth 1911; 1967) also mentions mats made from an unknown fibre carried by foreign traders to China. He described them as being made from plants that resembled rattan in shape but more than 10 feet in length with a smooth, striped, longitudinal surface, without knots. The latter was probably to distinguish them from non-spun *abaca* textiles that are knotted. In description of the "barbarous peoples" he mentions dyed red and black mats woven by women into checkered patterns which were reportedly warm in winter and cool in summer.

Throughout the villages of Thailand, soft mats are woven with the choice of fibres contingent on the available materials. At Chanthaburi in Chonburi Province, mats are woven from reeds from *Phragmites* sp. which grow in profusion around the waterways. In Phattalung Province, mats called *kachud* are woven from the tough water plant, *Lepironia arpiculata*. The hard leaves are steeped in mud to soften them before they are pounded into flat strips. In the southern provinces of Krabi, Narathiwat and Pattani, *Pandanus* sp. remains the principal fibre producing plant for matting. Sometimes narrow mats made from single *Pandanus* leaves are sewn together, one on top of the other for sleeping mats. *Pandanus* mats are still prescribed for mortuary rituals in the province but are not interred with the dead (Pitathawatchai 1976; Tettoni and Warren 1994). Knives are used to cut fibres into workable lengths, then to separate the leaves from the prickly stems. The fibres are then exposed to an open flame before being cut into strips of uniform width, then tied into bundles and soaked in water for several days before being dried in the sun. Knives are finally used to scrape the fibres again until they are very smooth (Newman 1977: 114, 115, 117, Pitathawatchai 1976:126). Fibre preparation could have produced the shine that the directors of the Khok Phanom Di excavations observed on the knives from the site. Knives are also used to prepare unspun bast fibres such as *Metroxylon sagu* (sago palm) and *Corphyra sp.* (jute) for weaving on backstrap looms.

Non Nok Tha

The site of Non Nok Tha is located in the Chi River catchment and was used for burials during the second millennium BC. The sequence has been divided into the Early Period (EP), Middle Period (EP) and Late Period (LP). The EP was divided into three distinct phases. The first two of these (which lacked bronze) are dated between 2000 – 1500 BC. The 5 AMS radiocarbon dates obtained for the MP range from 3065 ± 70 BP calibrated to 1468 - 1152 BC for MP 5, to 2880 ± 80 BP calibrated to 1312-894 BC for MP 1 (Higham 1996:191). Altogether, 91 whorls were excavated; 9 were found during the 1966 excavations and 81 in 1968 (Solheim & Bayard: unpublished report). Table 8.3 gives their distribution.

Levels	1966 excavations	1968 excavations
EP 1	0	0
EP 2	0	0
EP 3	0	0
MP 1	2	0
MP 2	0	0
MP 3	0	0
MP 4	2	16
MP 5	1	60
MP 6	0	0
MP 7	0	0
MP 8	4	5
LP1	-	-
LP2	-	-
LP3	-	-
LP4	-	-
LP5	-	1
LP6	-	-
	9	82

Table 8. 3 *Distribution of whorls at Non Nok Tha (after Solheim and Bayard n.d.).*

It is significant that spinning tools first appear with bronze in layers belonging to the Middle Period (MP). The table shows that whorls were common in MP 4 with the greatest number (60) from MP 5. The single whorl in LP 5 is considered to be intrusive (Solheim and Bayard: unpublished report). At least 30 spinners appear to be evidenced during this period of occupation at the site. This estimate is based on the assumption each prehistoric spinner had two whorls although it is possible that a spinner had more than one type in her possession. The whorls ranged in size from 3.1 cm to 2.3 cm and averaged 22 g in weight. They are described as biconical, flattened biconical, spherical, sphero-conical, truncated and hemispherical (Solheim & Bayard unpublished report).

According to Bayard,

> A feature, which does serve to distinguish the middle period from the earlier three levels, is the common presence of axially pierced biconical objects of fired clay interpreted as spindle whorls. These may indicate the introduction of cotton cultivation and woven fabrics during Level IV times; however, this is naturally extremely speculative (Bayard 1971: 34).

The predominance of biconical types is also important from an origins perspective. The biconical whorls from Non Nok Tha are of the same type that occurred with *ding* and *dou* at Ban Kao and it is of more than passing interest that Non Nok Tha also contained an elaboration of the *ding* with zoomorphic figures attached to its feet. In the *zhongyuan*, zoomorphic pottery featuring birds and domesticated animals (Fig. 8.15) date back to the Yangshao period and occur frequently at sites belonging to the Eastern Zhou period (770 - 256 BC). Zhou potters were no longer satisfied with Neolithic shapes or impressed and geometric decorations. The modeling was crude, the clay was low-fired but the expression on the animals was characteristically intense (Beurdeley & Beurdeley 1976:44). The two animals (elephant and turtle) depicted on the *xian* from Non Nok Tha were amongst the most highly prized imports into China. Early groups had a predilection for ivory and tortoiseshell and both commodities feature in the early maritime trade in Southeast Asia (Wang Gungwu 1959). While there are clear and unequivocal spatial and temporal differences in the zoomorphic pottery, they appear to belong to the same pottery tradition.

Fig. 8.16 clearly shows the asymmetry of the biconical whorls (NNT 198) from Layer 5 in the first report on Non Nok Tha (Bayard 1971) which suggests that the tools could have been made specifically for burial. The small concentric circles and radiating spirals on the whorls (Solheim and Bayard: unpublished report) link the spinners at the site to Vietnam and Laos where parallels exist. Although Bayard and Solheim suggested that the whorls were used to spin cotton which they observed *Gossypium* growing in the fields surrounding the site (along with other fibre producing plants such as *Bambussa* sp. (bamboo), *Corphyra* sp. (jute) *Musa* sp. and *Morus* sp. (mulberry), this is extremely unlikely. Biconical whorls first appear in the archaeological record at Neolithic sites belonging to the Tanshishan culture where bast and silk textiles occur and biconical whorls are conspicuously absent from prehistoric sites close to India where the earliest cotton fragments occur. Moreover, the heavily potted pottery biconical whorls from Non Nok Tha are too heavy for spinning cotton. It seems more likely that the biconical whorls from Non Nok Tha were used to spin bamboo, jute fibres which occur in the area. *Boehmeria sp.* (ramie) and silk are also strong possibilities.

Ban Chiang sites

Although the Ban Chiang culture is better known in Southeast Asian archaeology for its metallurgy and red painted pottery, Ban Chiang sites have also produced abundant evidence for spinning and weaving. There are sufficient numbers of textile pseudomorphs and whorls attributed to the culture to suggest that fibre processing and weaving may have consumed more hours of labour at these sites than either the metallurgy or pottery for which they are famous. The settlement site of Ban Chiang is located on the flood plains of the Songkhram River in Nong Han district, Udon Thani Province. The startling, 4th millennium BC dates first proposed for Ban Chiang (Gorman 1976) that have long been disputed have recently been revised. Most archaeologists reject the earlier 4th millennium BC dates as implausible (see Higham 1996:246) but debate continues between proponents of a 3rd millennium BC date and proponents of a mid-second millennium BC date. Because of strong parallels between the material culture at Ban Chiang and Ban Na Di, Higham prefers a date of around 2200 BC for the earliest levels with the Bronze Age layers datable to 1400 BC onwards.

It is significant that whorls were not present in the earliest layers at Ban Chiang sites. As with Non Nok Tha, the pottery in the layers without whorls shows close affinities to pottery from Vietnamese sites. Biconical whorls from the Middle Layers of Ban Chiang are currently housed in the National Museum in Bangkok. A single biconical whorl was also recovered from the middle layer (Layer 4/3) at Non Nok Chik (Wilen 1989:19) and the upper layers at Don Klang (Schauffer 1976) also produced biconical whorls associated with glass beads and the small pottery pellets that characterize Tanshishan sites.

Over 400 whorls from Ban Chiang sites were analysed by Labbé (1985:62) from the Bowers Museum and three different types are featured in an exhibition catalogue of illicit finds (Fig. 8.17). These are conical, biconical and whorls described as flat on the surface while inclined upward in a "nipple fashion". As stated above, the biconical types suggest relationships between the spinners at Ban Chiang sites and their counterparts from Ban Kao and Non Nok Tha. The "nippled" whorls from Ban Chiang sites resemble whorls from a site in the Yangzi region known as Yingpaili that lies in close proximity to Tanshishan sites and, interestingly enough, has also produced all whorl types evidenced at sites in Central Thailand, including the biconical whorl. The "nippled" whorl is not found in China but has been found in India.

None of the motifs incised on the prehistoric whorls from Ban Chiang illustrated in the catalogue is unique to Ban Chiang sites. The so-called "hemp stitch pattern" first appeared on whorls at Hemudu and Tanshishan sites. The "reeling device" motif first appeared on whorls from Hemudu and Tanshishan sites. The whirl motif appears on conical whorls from Dong Dau sites in Vietnam as well as at Lao Pako. Interestingly, Labbé (1985) reported that groups now living in Ban Chiang Village believe the ancestors of the Ban Chiang people came from "Dong Phaeng" in Laos. Their ancestors reportedly crossed the Mekong and migrated further south in search of high land above floodwaters. The textile evidence suggests this may have happened during the Bronze Age.

The late period at Ban Chiang sites is characterized by large numbers of pottery rollers (Fig. 8.18). Some were found in children's graves but greater numbers came from non-burial contexts (White & White 1994). Of all the artefacts recovered from Ban Chiang sites, none has received more attention, yet their function remains obscure. Most scholars (Charoenwongsa 1973; Gorman 1976; Van Esterick & Kress 1978; White & White 1994) have interpreted these artefacts as textile tools used to apply paint to cloth. Van Esterick and Cress (1978) proposed that they also functioned as status symbols, worn by high-ranking individuals during rituals to mark success at trade and war. Folan and Hyde (1980) interpreted the rollers as ideographic tokens whereas Higham (1984) interprets this class of artefact as seals. White and White (1994) contend that Ban Chiang's rollers could not have functioned as seals because they differ from Middle Eastern seals in the following respects. They are manufactured from terracotta rather than stone, shell or metal and are more straight-sided than Middle Eastern parallels and none of the distinctive motifs (writing, human figures, gods and animals) that characterize Middle Eastern seals appear on these artefacts from Ban Chiang sites.

In order to test the cloth production hypothesis, Van Esterick and Cress (1978) devised a simple series of experiments. Using techniques practiced by traditional groups in Melanesia and the Pacific, they dipped the clay rollers in paint and rolled them over woven cloth. During the experiments, Van Esterick and Kress noted that the paint had to be re-applied to the surface of the roller after each rotation. As discussed in Chapter 7, they also noted that while the paint adhered to the cloth, the overall effect was "very sloppy" and the process was very time-consuming. These problems were attributed to the crudeness of the prehistoric rollers and the type of paint used in the experiment. The anthropologists subsequently changed the experiment and applied hot wax to the rollers and then dyed the cloth, a resist dyeing technique. Again their findings were inconclusive. When the wax was lightly applied, the wax spread out on the cloth and destroyed the original design.

White and White (1994) link the Ban Chiang rollers to fabric decoration and have identified 3 main decorative motifs. The majority (Type I) is distinguished by parallel bands of rectilinear lines of varying thickness which produce simple repetitive motifs such as straight lines, zigzags and "wave form rings". The notable feature of Type 1 is replicability: the same design is reproduced on cloth irrespective of the point of application. Type II was distinguished by two different motifs on the cylinder, which combine to form a design after a single rotation. The last category (Type III) was produced when a series of motifs form a pattern after a complete rotation of the roller. The motifs on the Ban Chiang rollers have not as yet been compared to archaeological parallels from Laos, Cambodia and Vietnam.

This research shows that the motifs on the pottery rollers from Thailand occur on pottery from Vietnam and the *zhongyuan*. The same types of pottery stamps that were found at Hoa Loc sites were also found at Ban Chiang. In Chapter 5, an argument was presented that Hoa Loc stamps were used to decorate pottery. Closer inspection of the design elements on the stamps and bronze artefacts (Fig. 8.19, 8.20) at these sites also links them to pottery and bronze decoration rather than cloth production.

During excavations at Ban Chiang, Suthiragsa (1979:49) found impressions of coarsely woven materials in the Early Metal Phase at a depth of 280 cm amongst ash heaps, charcoal and cooked rice. The fragments were of woven matting or basketry. In 1973 a Thai doctor

> came across a cluster of thread in one of the burial sites, lying near the right knee of a skeleton some 2.2 metres below the surface, or halfway down to the lowest level of human habitation. Microscopic tests conducted by the National Museum revealed it to be silk thread, unwoven and undyed; and tests made by Japanese University on other artefacts found in the same grave showed them to be between three and four thousand years old (Warren and Tettoni 1994:89).

Prehistoric textiles were also found in the Middle Period at the site at a depth of 220 cm associated with cooked rice and green glass beads. An assemblage of 10 fibres from Ban Chiang sites was analysed by Chiraporn Aranyanak (1985:83) whose findings are shown in Table 8.4. Aranyanak identified silk filaments in the first sample. The undyed, transparent filament had a fibre diameter of 10μm. Textile scholars (Conway 1992:16) have interpreted this as firm evidence for local silk production during the prehistoric period in Thailand using wild silkworms rather than domesticates *(Bombyx mori)*. Some of the painted motifs on the red pottery (Fig. 8.22) have also been interpreted as depictions of silkworms, silk cocoons and mulberry leaves. However, sericulture has yet to be established, scientifically for Thailand.

Sample	Site	Context	Direction of spin	Fibres in bundle	Fibre diameter (µm)	Fibre	Museum
1	Ban Chiang	in soil	-	-	10-?	silk	Prehistory
2	Ban Chiang	on metal	Z	125-50	8-15	hemp	National (Bangkok)
3	Ban Chiang	on metal	Z	?	13-19	hemp	National (Bangkok)
4	Ban Chiang	on metal	Z	?	13-19	hemp	Suan Pakkad Palace
5	Ban Chiang	on metal	Z	140-150	5-12	hemp	Suan Pakkad Palace
6	Ban Chiang	on metal	Z	100-120	11-13	hemp	Suan Pakkad Palace
7	Ban Chiang	on metal	Z	125-200	3-10	hemp	Suan Pakkad Palace
8	Ban Phak Top	on metal	Z	125-200	11-19	hemp	Suan Pakkad Palace
9	Ban Phak Top	on metal	Z	200-250	5-10	hemp	Suan Pakkad Palace
10	Ban Chiang	on metal	Z	150-160	10-12	hemp	Silpakorn University

Table 8.4 *Distinguishing characteristics of fibres in an assemblage of prehistoric fragments of cloth from Ban Chiang sites (after Aranyanak 1985:83).*

The silk threads from Ban Chiang probably came from domesticates. The filaments measured 10 µm or less which is within the range of *Bombyx mori* and seem too fine for wild silk. Chapter 2 showed that domesticated silk was woven into cloth more than 4000 years ago. Out of China, 6th century BC Hallstatt sites in southwest Germany have produced silk cloths (Wild 1984), as have 5th century BC burials at Pazyryk in the Altai Mountains of Russia (Rudenko 1970:174-178). Ban Chiang's silk filaments could be remnants of Early Chinese diplomacy. Silk cloths were exported west as early as the Qin Dynasty (221-207 BC) for political advantage. China had a monopoly on sericulture and in order to extend its influence amongst its southern and southwestern neighbours, the Chinese developed a policy of ostentatious generosity prior to the Han period. The policy was systematic, extremely costly and effective with "incalculable" amounts of silk bestowed on neighborhood groups. The Prince of Zhou sent 1000 reels of embroidered silk to neighbours to establish good alliances as well as to provoke dissension amongst China's enemies (Gernet 1996:132).

Date	Floss silk in pounds weight *(chiu)*	Rolls of silk
51 BC	6000	8000
49 BC	8000	8000
33 BC	16000	18000
25 BC	20000	30000
1 BC	30000	30000

Table 8.5 *Value of Chinese gifts of silk, end of the first millennium BC (after Gernet 1996:132).*

As Table 8.5 shows, the usage of silk reached its peak towards the end of the first millennium BC. Silk gifts were exceedingly generous and represented a large proportion of the annual income of the Chinese empire of the time. According to Gernet, annual gifts to foreigners in the Han Dynasty were equivalent to 4/10ths of the annual income of the empire (excluding the Emperor's private income). In AD 91, silk gifts to a single group (the Xiongnu) amounted to 100,900,000 pieces of currency (Gernet 1996:132). While there are obvious temporal differences between the prehistoric silks and the historical records, the records are used in this context to demonstrate the extent of the practice of giving silk at the end of the first millennium BC and the beginning of the first millennium AD.

Chiraporn Aranyanak (1991) also identified cotton, hemp and asbestos fibres amongst the fragments found at Ban Chiang sites. The cotton fibres adhered to a bronze bracelet of uncertain provenience (Fig. 8.21). One fragment was woven from both cotton and hemp in a 1/1 tabby weave. The cotton fibres were spun in an anti-clockwise direction (S direction) while the hemp was spun in a clockwise direction (Z direction). While this appears to be the earliest cotton found thus far in Thailand, the fragment does not have a secure provenience. The earliest securely provenienced cotton cloth found to date comes from the site of Ban Don Ta Phet, discussed below.

Chemical tests showed that the majority of the textile fibres recovered from Ban Chiang sites were made from *Cannabis sativa*. The hemp fragments were invariably coarse tabby weaves of the type shown adhering to 11 individual bronze bracelets (225/2515/23) housed in the National Museum of Thailand (Fig. 8.21). The bracelets encircled a child's arm. Similar bracelets made from iron occur at Iron Age sites discussed in the following chapter. It is significant that most of the textiles on the Khorat Plateau were made from hemp. *Cannabis sativa* is one of the earliest fibres used for textiles in China where it is still cultivated for food, oil and the psychotomimetic drug extracted from its seeds. It is thought to have originated in Asia but its centre of origin is not known because *Cannabis sativa*, unlike many other textile plants, is adept at rapid and radical changes in response to new environments (Barber 1991: 17). Seeds from *C. sativa* have been reported from Neolithic sites in Europe (Renfrew 1973:163) and the Ukraine dating back to the 5th millennium BC. In China, hemp was the pre-eminent bast fibre used in textile production from the prehistoric period through to the present and archaeological evidence shows that the Chinese were the first to spin and weave hemp.

Positively identified hemp textiles in China have been found at a prehistoric site belonging to the Qijia culture, dated between 2150 and 1780 BC (Anon. 1974:29-61). Fragments of coarse hemp cloth were found inside the interior of a jar at the site. Archaeological textiles woven from hemp were also found at Qianshanyang (Anon. 1972:5-7) in Zhejiang Province. Hemp was of considerable economic significance in the *zhongyuan* in the first millennium BC. During the Zhou dynasty (1050-221 BC) hemp was of such importance that an official known as the Director of the Hemp Department was located within the Zhou Palace. An ordinary Chinese of the Warring States period was obliged to furnish the state not only with grain but also with woven hemp cloth (see Kuhn 1988). The character *pu* denotes both spade money and hemp cloth; both commodities were legal tender. In Han times, the standard length of one unit of hemp money was 11 m while its width ranged from 50-60 cm, depending on the type of loom used for weaving (Hsu Cho-Yun 1977).

Male workers obtained fibres for cloth production and females, from the age of 10 onwards, produced woven cloths. Concubines within the Zhou palace compounds also produced hemp and silk cloths. Women from the upper classes shared the same "lot"; they taught new techniques and supervised other women in weaving workshops. Kuhn (1988:21-22) points out that in Early China, the demand for hemp was extremely high. It was used for rope, towels, clothing, sheets, bandages and shoes. The Chinese believed hemp had supernatural properties. In order to keep death at bay, long canes of hemp were placed over a sick person's bed to drive away evil spirits (Fitzherbert 1523 cited in Burkhill 1935). This practice has also been observed in island Southeast Asia (see Burkhill 1935).

Shrouds woven from hemp are also prescribed at Chinese funerals (Li Chi, ch.3, p.34a; ch.8, p.14a). Hemp is so inextricably linked with Early Chinese ethnicity that specific types of hemp garments were prescribed at Chinese burials to express mourning. According to the sumptuary laws laid down in the Books of Rites *(I Li, Li Chi and Li Ki)*, relationships were symbolized through fibres. At funerals, close kin were required to wear robes woven from the coarsest hemp (female plants) with finer white headbands (male plants) (see de Groot 1917).

Most of the fragments of hemp from Ban Chiang identified by Chiraporn Aranayanak (1991) were found adhering to metal ornaments such as the bracelet shown in Fig. 8.21. It is also worth noting that all of the bronze and iron tools impressed with mineralized and partly mineralized cloth at Ban Chiang such as adzes, axes, spearhead are paralleled in Vietnam. The quantity of hemp and its location on the bracelet indicates that hemp was wrapped around the arm of the corpse. If the bracelet had simply rested on a hemp garment within the burial, the fragment would have adhered to only one side of the bracelet.

Illicit excavations at Ban Chiang sites also produced a pottery vessel, which, if authentic, represents one of the earliest depictions of costume anywhere in Southeast Asia. The vessel was part of the above-mentioned exhibition of Ban Chiang artefacts organized by the University Museum (Pennsylvania), the Smithsonian and the Fine Arts Department in Thailand (Labbé 1985). The vessel is considerably larger (41.7 X 47.8 cm) than excavated vessels from the Middle and Upper layers at Ban Chiang sites and unlike securely provenienced finds, was found intact. The vessel's globular form and everted rim compare favourably with excavated pottery, the main difference being its decoration: "a rare depiction of the human form" (White 1982: 145). Beneath the rim of the vessel several figures are depicted in costume with hair piled high on their heads and hair flowing in the wind. A sarong with five pleats is depicted, held at the waist by a belt. The only other decorated vessel in this genre depicts a highly stylized deer with the more characteristic curvilinear designs of excavated red painted pottery above its base. The question remains: are these exceptional examples authentic vessels produced for elites or are they fakes? Thermoluminescence testing could clarify the question.

Ban Na Di

Excavations at the Bronze Age site of Ban Na Di (Higham and Kijngam 1984) have given us further insights into the role of cloth in prehistoric burials in northeast Thailand. Attributed to the Ban Chiang culture, the site is located about 23 kilometres southwest of Ban Chiang, at the confluence of the Songkhram and Pao Rivers. The site has a clear stratigraphic sequence and radiocarbon dates suggest that initial settlement probably took place between 1400 and 1000 BC (Higham 1998:100).

Clay figurines were a notable feature of the burials at Ban Na Di. The figurines were of cattle, elephants, deer and humans. Figurines of this type first occur at Neolithic sites in the Yangzi Valley (Chapter 2) and then appear at Bronze Age sites throughout mainland Southeast Asia, including Ban Chiang where they occur in the Middle Period (White 1982:70). The excavators of Ban Na Di suggest they represent wealth. Elsewhere (Cameron 2002), I have drawn attention to parallels from Middle Yangzi sites belonging to the Shijia culture in Hubei province. In 1955, when the figurines were first excavated they were assigned to the Han dynasty (206 BC-AD 200). At that time, archaeology was primarily based on seriation and it was thought that they belonged to the Chinese tomb figurine tradition. This traditional interpretation was "turned on its head" in 1989 when thousands of these small figurines were found in Middle Yangzi burials dated between 2400 and 2000 BC (see Rawson 1996).

The excavations at Ban Na Di produced pieces of cord, fragments of matting and prehistoric cloth (Higham and Kijngam 1984). Pilditch investigated the material and structural composition of the fabrics from the site and her findings are given in Table 8.6.

Provenience	Phase	Context	Weave	Type	Diameter
A4 burial 48	1C	On bracelet	tabby	leaf strips	0.5 mm
F6 burial 36	1C	On bracelet	weft faced	silk	9.2μm
A4 burial 29	1C	on anklet	tabby	leaf strips	0.30 mm
A4 burial 19	1b	in bead	?2 ply	vegetable fibre	0.47 mm
F8 burial 19	1b	On bracelet	tabby	leaf strips	0.45 mm
F6 burial 16	1C	silk	tabby	silk	4.7μm

Table 8.6 *Distinguishing characteristics of an assemblage of fibres and filaments from Ban Na Di (Pilditch 1984:126, 127).*

A small piece of twisted cord removed from inside a bead in Burial 29 (Phase 1b) was "made from vegetable fibres with long and comparatively wide cells that were clearly seen under magnifications of from 20 to 40. Two of these were plied together..." (Pilditch 1984: 126). The diameter of the bast fibre was 0.47 mm. From the regularity of the twists in the cord, Pilditch concluded that the fibre was probably spun with a whorl.

Woven matting was also recovered from two graves at Ban Na Di. Burial 48 from Phase 1c produced a bronze bracelet to which a fragment of tabby weave matting adhered. Higham (Higham & Kijngam 1984) believed the fragment might have been part of a shroud because it was the only example of such material adhering to bronze in a mortuary context.

It is worth noting that matting made from *Bambusa* sp., *C. sativa* and *Typha* sp. were used for shrouds during the Zhou dynasty (and possibly earlier) in China. Moreover fibre choice there was significant. Fibres and filaments silently articulated and re-enforced the prevailing order in the highly stratified Chinese societies. For example, the *Li Ki* specifically instructs that the body of a Great Ruler is placed on a finely woven mat of *Bambussa* sp; A Great Officer on a mat of *Typha;* an Ordinary Officer on a mat of *Phragmites*. The Chinese predilection for metaphor expressed in media such as pottery was also expressed in woven matting. It is not difficult to see that finely woven matting which requires a high degree of technical knowledge, precision and control would be seen as the mark of a great man. The type of fibre used in a dying man's mat was very important. There is a poignant description of a dying man in the *Li Ki* (Chapter 9, Section 1.38) in which he begged his servant permit him die on a specific type of mat rather than the one on which he was lying. The servant replied "the illness of the master is extreme, therefore it may not be changed. If we are so happy as to survive until the morning, I will beg your leave to change it". The ailing master replied, "What do I ask but to die in the correct way". Whereat the servant took him and changed the mat. When the master was placed on the correct mat, he expired (de Groot 1964:317). While such details seem irrelevant to modern sensibilities, the main point is that in there is an established relationship between status and the fibres used for shrouds in some parts.

Pilditch (1984) identified three different types of cloth in the assemblage from Ban Na Di. The first cloth was described as a loosely woven tabby weave made from very fine silk thread of "crimped" appearance. This material was very fragile and disintegrated during the cleaning process. The same unusual type of fibre was observed by the writer in burials left *in situ* at Niah. A second 1/1 tabby weave was also identified which was made from a different type of silk. Pilditch also identified a piece of warp-faced cloth, a technique used where the warp threads are partially concealed by the wefts. This weave was also observed on bronze tools in Vietnam discussed in Chapter 5. The Ban Na Di fragments confirm that the warp faced technique was known to Bronze Age weavers in Southeast Asia.

Using Scanning Electron Microscopy, Pilditch positively identified more than one type of silk in the Ban Na Di assemblage. Some filaments had the morphology of domesticates while several silk filaments appeared flattened. The flattened filament was identified as wild silk although Pilditch raised the possibility that these morphological differences might have been due to corrosion or ageing. The size of the filaments is also diagnostic. The two different sized filaments in the assemblage indicate that two different types of silk were used in burials at Ban Na Di. Only silkworms that had been domesticated over thousands of years could produce filaments as fine (4.7 μm) as the filaments from burial 16. The wider filaments (9.2 μm) from burial 36 had the ribbon like features of Tussah (wild) silk. Interpretation is complicated by the presence of domesticated silk in prehistoric contexts in South China and wild silk in prehistoric contexts in India. The species could be positively identified using chemical tests devised by the Textile Institute. Tussah swells but does not dissolve in cold, concentrated hydrochloric acid. In boiling 5% caustic soda, tussah disintegrates to a pulp but does not completely dissolve whereas domesticated silk (*Bombyx mori)* dissolves completely (Textile Institute 1991). The finer, domesticated silk fragment was found in association with an iron spearhead. The cultural tradition of wrapping weapons, particularly spearheads with textiles has been described elsewhere. Spearheads were associated with textiles in burials from Yunnan, Vietnam and Laos. The Ban Na Di textile pseudomorphs link some of the groups buried at Ban Chiang sites in Thailand to Bronze Age groups from Vietnam, Laos and Yunnan.

Ban Prasat

Excavations (Phommanodch 1991; Monkhonkamnuanket 1992) at the moated site of Ban Prasat produced unusual fragments of cloth, and whorls. The site lies close to the Lam Prasat, a tributary of the Mun River. A notable feature of Ban Prasat is its very deep stratigraphic sequence. Radiocarbon dates show the site was first settled between 800 and 500 BC with a second phase of occupation dated between 500 BC and AD 500. The burials in the earliest layers contained painted pottery decorated with curvilinear motifs and red slip. One high status individual (burial 49) was buried with 49 complete vessels. The open museum site was visited during fieldwork but the textile data were not analysed. Nevertheless, a few observations can be made from published data. The biconical whorls that characterize many Bronze Age sites in Southeast Asia appear to be absent from Ban Prasat. Instead, the conical and "nipple" shaped pottery whorls represented at Ban Chiang sites predominate (Figure 9.9). These "nipple" shaped artefacts are also represented at the site of Mohenjo Daro (Figure 9.10) where they occur in large numbers and have been interpreted by Indian scholars as toy wheels. The location of hemp cloth on the outer edge of a bronze bracelet suggests that groups at these Iron Age sites wrapped their dead in hemp shrouds.

Ban Lum Khao

Ban Lum Khao is a Bronze Age cemetery located at the junction of two small streams in the upper Mun River Valley. The first excavations conducted by a team led by Charles Higham and Rachanie Thosarat from the Origins of Angkor Project produced 111 burials and 96 spindle whorls. The whorls were associated with stone bracelets, adzes, black and red slipped pottery, clay pellets and figurines, bone implements and bronze. The earliest radiocarbon date from the Waikato Radiocarbon Laboratory (BLK 160) shows that the site was first occupied 3120 ± 50 BP (calibrated 1461-1255 BC) (Higham 1999). At the invitation of the co-directors of the Origins of Angkor Project, I traveled to Phimai in 1997 to analyze the whorls from Ban Lum Khao along with whorls from the Iron Age sites of Noen U-Loke and Non Muang Kao discussed in the following chapter. Each spindle whorl was measured, weighed, drawn and its functional attributes recorded for comparative purposes. Pottery colour was measured using Munsell's Soil Chart and all decorated whorls were photographed.

Nine of the 96 whorls came from burials (both male and female) (O'Reilly pers. comm.). Two graves (1, 2) contained 2 whorls while 5 graves (5a, 27, 37, 41 and 103) contained single finds. One of the burials with whorls contained a child. We can only speculate about the numbers of spinners evidenced by the whorls. The presence of two whorls in some burials and single whorls in others suggests that some spinners may have used one whorl while others may have used two whorls. If all spinners used two whorls (discussed more fully below) then no more than half of the population (48/111) of Ban Lum Khao was engaged in spinning. The whorls came from all three layers at the site and their distribution is shown in Table 8.7. As the table shows, layer 3 produced 1 whorl, layer 2 produced 66, and layer 1 produced 27. The data show that unlike previous textile sites, the earliest groups at the site had knowledge of spinning and that the greatest economic investment in spinning occurred during the middle period of occupation.

Layers	Numbers of Whorls
1	27
2	66
3	1

Table 8.7 *Distribution of spindle whorls at Ban Lum Khao.*

All of the 96 whorls in the assemblage were analysed and their functional attributes are given in Table 8.9. With the exception of a single whorl (234) which is made from laterite (?), all are made from clay. The pottery was red, buff and grey. One whorl was red slipped.

The spindle whorls in the assemblage measured between 2.51 and 5.14 cm in diameter. Whorls measuring more than 5 cm were exceptional. The central perforations ranged in size from 0.30 cm to 0.64 cm with the larger central perforations belonging to larger whorls. The whorls weighed from 6g to 56g although most of the smaller weights were broken pieces. Some of the heaviest whorls (more than 30g) were from burial contexts. Whorl 150 from burial 1 weighed 45g, whorl 149 from burial 2 weighed 39g, whorl 572 from burial 27 weighed 31g while less than half of whorl 1196 from burial 103 weighed 16g. The very large whorls in the burials may be symbolic. The large whorls probably were used to spin bast fibres into cord. Some of the heavier whorls could also have spun hemp fibres to weave bags for the salt that was mined in the area. The smaller whorls are more likely to have been used to spin lighter fibres for clothing and other domestic purposes. At this stage, it is not possible to link specific whorl types to specific fibres.

The discs were classified them into 9 different types based on morphology (Fig. 8.23). Type I was a flat disc. Type III was ovaloid (Kuhn's abacus bead type), type IV was biconical, type V was hyperboloid, type VIII was conical, type X was conical with a curved base (crescent), type XI was an elaboration of the conical type with rounded profile (steamed bun), type XVIII was truncated conical, type XV was similar to a biconical whorl with a squarer profile.

Whorl type	Number	Percentage
I	1	1.1
III	2	2.1
IV	20	20.8
V	2	2.1
VIII	42	43.7
X	7	7.3
XI	15	15.6
XV	6	6.2
XII	1	1.1

Table 8.8 *Percentages of whorl types from Ban Lum Khao.*

The vast majority of whorls are conical types. 43.7% are standard conical types (VIII) while 15.6% are elaborations (XI) of the conical type (steamed buns). 2% are conical types (X) with concave bases. Together, the three conical types represent 61.3% of the whorls at the site. 20% of the whorls are biconical (IV). Only 1 whorl (1527) from the assemblage conforms to the basic autochon type (type I) from which other whorls are derived. It represents 1.1% of the whorls in the assemblage. Of the remainder, 2% are ovaloid (III), 6% are square ended biconical (XV), 2.1% are hyperboloid (V), 7% are elaborations of the basic conical with concave bases (crescent) (X) and 1.1% are elongated conical (XII). The Moment of Inertia on the latter (type XII) would be so low it may actually be a net weight rather than a spindle whorl.

It is significant that the earliest forms from Ban Lum Khao were biconical. Had the earliest spinners at the site been novices, one would have expected to find the most elementary forms in layer 3. While 1 of the whorls in the assemblage was of this type, it was not from the earliest layer. In Central Thailand, biconical whorls first appear at the Bang site (Sorensen 1967) and Non Nok Tha (Bayard: personal communication). The biconical whorls from Ban Lum Khao show such striking parallels to biconical whorls from Non Nok Tha that the same potter could have produced them. This type of whorl was also found at Ban Na Di and Ban Chiang. Like Non Nok Tha, greater numbers of whorls occur in the middle layers at Ban Lum Khao.

It is also significant that all of the types from Ban Lum Khao are paralleled at Tanshishan sites. This correlation is clear when the different types from Ban Lum Khao are compared to the different types found at the Tanshishan site of Dongzhang. Dongzhang produced 334 pottery whorls, many of which were biconical in shape. They were red, buff and grey pottery and roughly potted like those from Ban Lum Khao. This congruence strongly suggests relationships between the spinners and weavers from Dongzhang and spinners and weavers from Ban Lum Khao.

Whorl number	Bag number	Material	Shape	Weight (g)	Diameter (cm)	Central perforation (cm)	Motif
3	4	pottery	X	31.0	4.18	0.53	*
4	4	pottery	X	21.0	3.82	0.42	-
8	6	pottery	IV	30.0	4.02	0.59	#
13	8	pottery	VIII	10.0	2.95	0.30	-
17	3	pottery	VIII	30.0	4.54	0.49	-
23	?	pottery	VIII	20.0	3.62	0.49	-
25	13	pottery	XI	29.0	3.70	0.43	-
30	16	pottery	XI	8.0	4.00	0.30	#
33	16	pottery	XV	29.0	4.31	0.47	#
36	17	pottery	X	42.0	4.63	0.52	-
43	23	pottery	IV	30.0	4.47	0.40	#
48	24	pottery	IV	26.0	4.35	0.62	#
52	27	pottery	IV	30.0	4.23	0.42	lines
85	32	pottery	IV	40.0	4.38	0.48	-
111	59	pottery	IV	55.0	4.65	0.58	*
149	7+	pottery	IV	39.0	4.35	0.44	*
150	5+	pottery	IV	45.0	4.20	0.65	fingernail impressions
156	79	pottery	VIII	30.0	4.00	0.49	-
160	80	pottery	V	20.0	3.48	0.35	*
163	7+	pottery	VIII	11.0	3.04	0.53	*
169	86	pottery	VIII	40.0	4.40	0.34	#
172	87	pottery	X	35.0	4.53	0.44	-
175	89	pottery	XI	22.0	4.33	0.36	-
177	94	pottery	IV	12.5	3.67	0.55	-
188	102	pottery	VIII	41.0	4.53	0.53	-
196	109	pottery	XV	36.0	3.80	0.44	*
204A	120	stone ?	VIII	7.5	2.84	0.46	-
217	125	pottery	XI	13.0	3.00	0.39	-
234	130	laterite?	XV	30.0	3.78	0.79	-
239	130	pottery	XV	57.0	4.64	0.53	-
245	133	pottery	XI	11.0	2.90	0.41	-
250	135	pottery	IV	40.0	4.23	0.42	-
264	?	pottery	VIII	13.0	4.04	0.44	#
274	5	pottery	VIII	14.0	3.65	0.50	*#
282	142	pottery	IV	32.5	4.17	0.52	figure
313	27	pottery	XVII	12.0	3.76	0.34	#
315	149	pottery	IV	50.0	4.62	0.70	#
373	158	pottery	VIII	10.0	2.87	0.35	-
397	159	pottery	VIII	14.5	3.50	0.41	-
425	127	pottery	VIII	11.0	3.28	0.41	*
465	172	pottery	XI	12.0	3.10	0.33	-
466	167	pottery	X	10.0	2.96	0.36	#
499	132`	pottery	VIII	11.0	2.98	0.46	*
500	130	pottery	VIII	13.0	2.88	0.55	*
504	178	pottery	XI	25.0	3.65	0.53	+ concentric circles
518	181	pottery	VIII	11.0	3.28	0.38	-
527	178	pottery	XI	10.0	2.77	0.32	*#
535	184	pottery	XI	10.0	2.98	0.39	-
567	186	pottery	III	35.0	3.55	0.55	-
572	189	pottery	XV	31.0	3.95	0.64	concentric circles *
593	194	pottery	IV	40.0	4.24	0.59	-
638	195	pottery	IV	15.0	4.10	0.37	-
659	206	pottery	VIII	35.0	3.72	0.41	radiating lines
710	213	pottery	III	56.0	4.65	0.57	fingernail impressions
744	213	pottery	IV	45.0	4.12	0.60	-
1090	292	pottery	X	35.0	4.39	0.34	-
1135	300	pottery	XI	9.0	2.63	0.3	-
1138	301	pottery	VIII	6.0	3.00	0.33	#
1154	303	pottery	XI	30.0	4.00	0.45	-
1172	311	pottery	IV	26.0	3.91	0.50	-
1178	312	pottery	IV	32.0	4.17	0.52	#
1196	314+	pottery	VIII	16.0	3.80	0.45	*#
1233	313	pottery	IV	20.0	3.54	0.47	-
1524	134	pottery	VIII	10.0	4.00	0.40	#
1525	23	pottery	VIII	22.5	4.05	0.45	#
1526	8	pottery	VIII	14.0	4.00	0.45	#
1527	8	pottery	I	10.0	2.51	0.46	-
1528	8	pottery	VIII	11.0	2.90	0.41	-
1529	120	pottery	XI	14.0	3.30	0.37	-
1530	120	pottery	VIII	25.0	4.02	0.33	#
1531	184	pottery	VIII	12.5	3.40	0.40	-
1532	184	pottery	VIII	50.0	5.14	0.55	-
1533	184	pottery	VIII	27.0	4.23	0.48	-
1534	184	pottery	XI	16.0	3.32	0.45	#
1535	159	pottery	VIII	29.0	4.06	0.54	-
1536	158	pottery	VIII	16.0	3.32	0.45	-
1537	158	pottery	XI	17.5	3.80	0.50	#
1538	158	pottery	VIII	9.0	2.70	0.35	#
1539	158	pottery	VIII	10.0	3.06	0.28	-
1540	158	pottery	VIII	6.0	2.72	0.42	-
1541	158	pottery	VIII	12.0	3.10	0.45	-
1542	158	pottery	VIII	10.0	2.80	0.41	-
1543	158	pottery	VIII	11.0	2.80	0.34	-
1544	292	pottery	1V	34.0	3.68	0.48	-
1545	292	pottery	VIII	11.0	3.53	0.50	-
1546	292	pottery	IV	15.0	4.24	0.55	#
1547	125	pottery	VIII	25.0	3.83	0.40	-
1548	13	pottery	VIII	20.0	3.63	0.41	#
1549	195	pottery	XV	25.0	3.66	0.47	-
1550	195	pottery	V	26.0	4.20	0.51	#
1551	178	pottery	X	6.50	2.97	0.37	-
1552	80	pottery	XI	29.0	4.10	0.47	-
1553	80	pottery	VIII	15.0	3.45	0.40	-
1554	189	pottery	VIII	27.5	4. 54	0.50	-
?	186	pottery	VIII	15g	4.00	0.54	-
?	186	pottery	VIII	15g	3.90	0.48	#

Key : * = burial # = incomplete + = slipped

Table 8.9 *Functional Attributes of Ban Lum Khao's Spindle Whorls.*

At Ban Lum Khao, biconical whorls also occurred with conical types. All single whorls in the burials are conical but two burials (1 and 2) produced both conical and biconical whorls. In Chapter 3, this pattern (conical and biconical types) was recorded for other early rice sites in island Southeast Asia suggesting that two different fibre types such as silk and ramie were used together to produce cloths.

Six of Ban Lum Khao's whorls were also decorated on their upper surfaces or outer rims. The design elements are shown in Fig. 8.24. These embellishments also link Ban Lum Khao's spinners to spinners from early rice sites in Vietnam (Phung Nguyen) and Thailand (Ban Chiang). The outer rims of two whorls (150, 710) were decorated by the fingernail impressions that distinguish whorls from early rice sites in the Yangzi and southeast China. The small concentric circles that distinguished Hemudu's whorls are also featured on two (505 and 572) of Ban Lum Khao's whorls. The radiating line that distinguishes whorl 659 first appears on whorls from early rice sites in the lower Yangzi (Hemudu).

Whorl 315 (Fig. 8.25) from Ban Lum Khao is unparalleled in Thailand. Whereas other whorls are decorated with geometric motifs, whorl 315 is incised with a motif that resembles a strange anthropomorphic figure. One of the whorls from Lao Pako has what may be figurative motif but to my knowledge, whorls decorated with definite figurative designs only occur at one site in the *zhongyuan*. Excavations at the site of Chenqiao Yangjiaoshan in Liuhe district, near Nanjing in Jiangsu province, yielded two zoomorphic whorls. The site is Neolithic although archaeologists are undecided as to whether it belongs to the Liangzhu or the Hemudu Culture. One of the whorls at Chenqiao is incised on its upper surface with five spirals in a radiating pattern opening out into heads of birds (Rawson 1996). The same motif appears on a clay dish from Hemudu. The whorl bearing the bird motif from Chenqiao has small crosses incised on the lower surface. The latter frequently occur on prehistoric spindle whorls in China where they are interpreted as sun symbols (He Xin 1986: 1-19). The second incised whorl from Chenqiao depicts a figure with a human body and a masked animal head. These rare figurative whorls have been interpreted as ritual symbols (Rawson 1998). Although the design elements on Ban Lum Khao's whorl are slightly different to those from Chenqiao, they follow the same stylistic convention.

Very few prehistoric or contemporary spindle whorls are decorated with anthropomorphic or zoomorphic figures. Interestingly, the Salish use whorls decorated with strange anthropomorphic figures during spinning rituals. During the spinning process, the anthropomorphic motifs on Salish whorls cause spinners to go into trance and their altered states of consciousness supposedly assist spinners produce remarkable textiles. It is impossible to know if Ban Lum Khao figurative whorls were used for the same purpose but we can say that these rare motifs link the prehistoric spinners from Ban Lum Khao in Thailand to early rice groups from the lower Yangzi Valley.

The material composition, shape, size and decoration of the prehistoric spindle whorls from Bronze Age sites in Thailand links the spinners and weavers at these early rice sites to spinners and weavers from early rice sites in the Yangzi Valley and southeast China. The evidence for cloth production clearly shows that textile technology was not invented independently in this part of Southeast Asia but part of a much wider cultural complex that had its roots in Southeast China.

Chapter 9

Thailand, Part 2

The Iron Age

This chapter is concerned with data from Iron Age sites in Thailand. Significantly, there are greater numbers of archaeological sites from this period than from any other prehistoric period in Thailand. Iron Age sites are also much larger in size than their Neolithic or Bronze Age counterparts. For example, the site of Non Chai covered an area of almost 38.5 hectares and it has been estimated that during the very short period that the site was occupied, its population exceeded 1,000 (Higham 1998:164, 165). Population increases of this magnitude are particularly relevant to the study, not only because large quantities of cloth would have been required to clothe them but also because such changes raise fundamental questions for Southeast Asian prehistory. How might these increases in population be explained? Are they resultant from changes in food production? Are these population increases accompanied by increased numbers of cloth production tools, or fragments of cloth? Are exogenic influences involved? By focusing on the archaeological evidence for spinning and weaving at Iron Age sites in Thailand (and Myanmar) this chapter attempts to answer some of these important questions.

Higham (1998:135) has noted that the Iron Age marks a period of considerable social change and population increase in Thailand and that the last few centuries of the Iron period saw a major expansion of groups belonging to the Qin and Han dynasties into the south. Fig. 9.2 clearly shows China's penetration into mainland Southeast Asia between 255 and 206 BC. The map comes from Herrmann's (1966:14, 15) historical atlas of China, which is generally accepted as an accurate account of historiography (Wheatley in Herrmann 1966:vii). The map shows China's political boundaries extending close to the present northeast borders of Thailand towards the headwaters of the Mekong and Chao Praya Rivers. It is also worth noting that China's expansionist policies of this period involved the movement of large populations to the south. The capitals of the largest commanderies shown on the map had populations exceeding

100,000 whereas smaller commanderies had populations around 10,000. The data from historiography is particularly relevant to this research as China received tribute from Southeast Asian groups during this period and woven cloths were amongst the main tribute goods. The textile data analysed here show both continuity and change. The central argument put forward in this section of the thesis is that there are changes in the archaeological evidence for cloth production at Iron Age sites that are inextricably linked to China's expansionist policies and inter-regional trade. This section of the dissertation will show the introduction of new fibres into the weaver's repertoire and new fibre processing techniques. Some new fibres are of Indian origin while some of the new fibre-processing techniques are paralleled in the Middle Yangzi and the Yellow River Valley. The data indicate greater technological complexity than initially appreciated.

Most Iron Age sites in Thailand are located within the Mun River Valley. This strategic area is important in Southeast Asian prehistory as it links northeast Thailand to the Central Plains through its waterways (Higham 1996:205). Welch and McNeill (1988) have established two phases of occupation for sites in the area: prehistoric settlements dated between 1000 and 600 BC and Iron Age settlements dated between 600 and 200 BC. While archaeologists are generally agreed that there was an expansion of early cultures in the Mun River Valley between 500 BC and AD 500, opinion is divided over its cause. Welch (1986:327) has hypothesized that improved rice yields led to the expansion of prehistoric groups into the area. However, this hypothesis is not testable, as it is not possible to determine rice yields from grains (B. Cameron pers. comm.). Higham (1996:217) considers that local deposits of salt provided the catalyst. This hypothesis is based on ethnographic parallels in the vicinity of Non Dua where local groups exploit substantial deposits of rock salt. Certainly, primary Chinese sources discussed earlier in the dissertation confirm that salt was imported into southwest China and the *zhongyuan* during this period and that the trade in salt in the Middle Kingdom was considerable. Even though enormous quantities of salt were produced in the China and an early evaporation industry had been established in the ancient state of Chu, salt was scarce in the southwest (Yunnan). We also know from these same sources that rock salt was also mined from dry salt lakes on the peripheries of the Middle Kingdom. During the Zhou dynasty, a new class of merchant emerged with close connections to the princely courts in the south and the early trade in salt was considerable. One settlement on the Mongolian frontier reportedly gathered more than 14,000 piculs (hundredweights) of salt annually for the trade. Jung-barbarian salt, shining and luminous salt, and seal salt were amongst the different types imported. Jung-barbarian salt was a mixture of salts gathered from the crystalline beds of great lakes outside China. Shining and luminous salt was rock salt and seal salt was refined salt from the north. Coloured salts (green, blue, red and black) were also acquired from neighbouring regions for medicinal purposes. Like silk and hemp, salt was legal tender in Funan (Schafer 1969:216).

The Iron Age sites in the Mun River region are surrounded by moats but while this is well documented, the function of the moats remains obscure. Their connection to nearby streams has led to a number of hypotheses, including defense, transport and trade (Welch & McNeill 1991), irrigation and water storage (Moore 1992). Higham (1996:224) believes that the advent of iron facilitated the construction of the moats and there can be little doubt that iron tools would have greatly assisted early farmers clear agricultural land and build moats.

While moats have not hitherto been linked to textile production, there is a relationship between moats and fibre processing that raises the possibility that moats may have played a central role in cloth production in the Mun River region. Both the *Shu jing* and *Shi jing*, written long before the Mun River sites were occupied, specifically mention the role of moats in fibre processing. It is worth stressing that the authenticity of these sources is the least contested (Biot in Legge 1960:142); works on agriculture were not included in the "burning of the books" ordered by the First Emperor. In the Middle Kingdom, moats were located near domestic dwellings and the soaking pool was an integral part of village life. Hemp (*C. sativa*) was the principal fibre retted in moats although one species of ramie (*Boehmeria nivea forma indica var. tenacissima* Gaudich), also known as white ramie, was also processed this way. The procedures used to process fibres in moats were laid down in agrarian laws of the Zhou dynasty (770 - 221 BC). Each Chinese household was allocated 100 Chinese acres; mulberry trees, rice fields and fibre-producing plants were planted around each house. In every region where hemp was planted, the fibres were bundled up after harvesting and placed in moats (Kuhn 1988:29). One of China's earliest books, the *Shi jing* (Book of Odes), attributed to the Shang dynasty (1900-1100 BC), contains a poem specifically about moats, fibre preparation and women:

The moat at the East Gate
Is fit to steep hemp in
That beautiful virtuous lady
Can respond to you in songs

The moat at the West Gate
Is fit to steep *Boehmeria* in
That beautiful, virtuous lady
Can respond to you in discourse
(Legge 1960:2080).

According to Kuhn (1988:24-28), retting was the oldest and most widespread method of fibre preparation in the *zhongyuan* and a very detailed account of the complicated, time-consuming process is given in his treatise on Chinese textile technology. The main point here is that retting was never done in running water but required still, clean water; too little water resulted in coarse fibres. Lime was an essential component of the retting process, sprinkled on bast fibres before they were placed in water. Lime was obtained by burning limestone, or, when limestone was not available, by burning clamshells. Retting also produced a useful by-product. The Chinese used retted water as an insecticide, to exterminate insects and drive worms out of the earth (Schafer 1967). Retting was abandoned in the *zhongyuan* when it was realized that the same result could be obtained by boiling fibres in hot water (Wu Lei Hsia 1988).

The environmental conditions in the Mun River Valley would have been suitable for the cultivation of both hemp and ramie and the retting process. The moats are sufficiently deep but not too deep for retting fibres. They are also in close proximity to running water. This is an important point as traditional Chinese textile techniques require retted fibres to be rinsed in running water to remove all traces of lime before the fibres were dried in the sun. As fibre processing was exceedingly labour intensive with 3 to 4 crops textile fibres harvested per annum in China (Kuhn 1988:24-28), one might expect any Southeast Asian cloth production sites involving Chinese textile techniques to be strategically located near rivers.

Lopburi

Fig. 9.3 shows partially mineralised fragments of cloth from excavations (You-di 1976) at the Lopburi Artillery sites. Lopburi is a rich prehistoric cemetery located in the Khao Wong Prachan Valley. Thermoluminesence dates indicate that the site was occupied from the second well into the first millennium BC (Higham 1998:95). Chiraporn Aranyanak's (1991) analysis of the fibres showed them to be made of hemp, woven in a basic 1/1 tabby weave. Hemp is synonymous with China; it is the pre-eminent fibre at agricultural sites from the Neolithic onwards. Pottery analysis also showed that more than 100 of the pottery sherds from Banpo were impressed with hemp textiles (tabby, twill, leno and gauze) (Huang Nengfu 1991:1). Banpo also produced extant remains of hemp woven in the same 1/1 tabby weave evidenced at Lopburi. Because hemp was the pre-eminent fibre in the Yellow River Valley, the archaeological textiles made from hemp at Yangzi Valley sites are interpreted here as evidence for interaction between South China and the *zhongyuan* during the prehistoric period.

At Lopburi Tha Kae (Glover & Ciarla 1990), archaeologists with the Thai-Italian Lopburi Regional Archaeological Project also found cloth production tools. According to Ciarla (pers.

comm.), an iron spindle was excavated. While this component of the hand spindle is very basic, it may be far more technologically significant than is generally appreciated. Iron spindles are very rare in the archaeological record. To my knowledge, this is the only metal spindle found at a Southeast Asian site. Significantly, examples have been excavated from archaeological sites in India and South China. In India, iron spindles occur at sites with whorls made from a range of different materials (pottery, metal, stone, wood and faience). Some Indian spindle whorls have two central perforations and Indian archaeologists have linked iron spindles to these unusual types (Ghosh 1987:187). Iron spindles also occur at historical sites in South China. A hand spindle comprised of an iron shaft measuring 20 cm in length was found in tombs at Guizhou which have been dated from the Han to the Song dynasties (Kuhn 1988:150). At Changsha, in Hunan Province, an iron spindle measuring 19 cm long was found with a pottery whorl attached (Anon. 1978:52: Kuhn 1988:150). In Fujian province, iron spindles were found in a tomb at the Qin dynasty site of Miaohoushan (Kuhn 1988:151). The material composition of the spindle begs the question. Was the iron spindle from Lopburi symbolic or functional? Examples of jade spinning tools in high status graves at Liangzhu sites were documented in Chapter 2 and bronze loom parts in high status graves in Yunnan were documented in Chapter 4. Because of propinquity, it seems more likely that the iron spindles at Lopburi are functional and of Indian origin.

Chansen

Excavations at Chansen by a joint team from the National Museum of Thailand and the University of Pennsylvania Museum (Bronson & Dales 1973) also produced prehistoric whorls. Chansen is located about 30k north of Lopburi and the dates given for the site range from 800 BC to about AD 1200. While Chansen is recognised as a minor Dvaravati site, it is significant in Southeast Asian prehistory because it provides a continuous sequence from the mid-late Metal Age through to the period of fully developed states. Evidence for cloth production comes from stone and pottery whorls described by Bronson as "generally biconical and small". He said that "the study of the whorls is not yet complete" but "they are common and carefully made enough for it to be possible to demonstrate variation" (1976:29). At the broadest level, the biconical whorls at Chansen link the spinners at the site to spinners from other Bronze Age sites discussed in Chapter 8.

Ban Don Ta Phet

The earliest unequivocal evidence for the early textile trade in Southeast Asia comes from the Iron Age site of Ban Don Ta Phet. The site is located in Kanchanaburi Province and dated to about 400 BC. Excavations conducted by a joint team from the Fine Arts Department of Thailand and the Institute of Archaeology in London (Glover 1990) produced a number of fragments of cloth that give us unique insights into the Early Southeast Asian textile trade. The fragments (Fig. 9.4) were amongst those in an assemblage from the site analysed by Chiraporn Aranayanak (1991) but their historical significance does not seem to have been fully appreciated.

Altogether, 11 pieces of prehistoric cloth were successfully excavated from the site. These came from burials 46, 56, 59, 60, 65, 76, 79, 130, 226, 326 and 272. Three fragments were found attached to a bone and a bronze figurine in burial 46. Two fragments were attached to a bronze *situla* of the Vietnamese type (see Chapter 5) in burial 76. The findings from Chiraporn Aranyanak's analysis are shown in Table 9.1.

Specimen	Context	Description	Fibre identification
608	46	threads on tall bronze bird	?
604	46	threads on bone	cotton
400	46	woven basketry fibres on bone	
910	56	threads on surface of bronze situla	
1330	59	thread on bronze	not identifiable
1243a	60	thread on bronze matting like fibre	probably hemp
591	65	fibres from bronze	hemp
1500	76	fragment of woven textile, 5 X 4 mm	probably raw silk
3477	76	threads from bronze rings	more sample needed
9480/93	79	matting or basketry fibres below bronze rings	
8048	130	three textile fragments on bronze bowl	? in U-Thong Museum
8037	226	textile impressions on bronze bowl 3441	not yet examined
8033	326	textile fragment	not yet examined
7145	372	textile fragments on inside of bowl 7145	not yet examined

Table 9.1 *Material composition of archaeological textiles and matting from Ban Don Ta Phet (Glover 1990:176).*

The thread that adhered to the bone in burial 46 was positively identified as *Gossypium sp.* According to Glover, the thread from Ban Don Ta Phet is "the earliest identification of cotton from a Thai prehistoric site" (1990:175). The cotton from Ban Don Ta Phet is much more than this. It is the earliest cotton from an archaeological site in Southeast Asia and, more significantly, the earliest fragment of Old World cotton out of its origin centre. It is generally held (Barber 1991) that a small mordanted fragment of cotton from the port of Fostat, dated between the 13th and 17th centuries AD, is the earliest cotton out of India (Pakistan). Ban Don Ta Phet's cotton is significant to textile history as it predates the Fostat material by at least 1600 years. The earliest extant Old World cottons in what was once India come from Mohenjo Daro, an early metropolis on the right bank of the Indus River in the Larkana District of Sind in Pakistan. The site is dated between 2500 and 1500 BC. When found, the fragment was described as "exceedingly tender and penetrated by fungal hyphae" (Marshall 1931:585). In spite of the contamination, Gulati and Turner from the Technological Research Lab. in Bombay were able to identify the fibre as *G.arboreum* or one of its varieties, *G. neglectum, G. indicum or G. cernum.* The convolutions in the photomicrographs showed that the cotton was not the wild species, *G. stocksii,* which grows wild in Sind (Marshall 1931: 33) but a domesticate some distance removed from its wild progenitor (Allchin 1969:315). Turner's findings are given below.

Fibre	Cotton
Weight of fabric	202
Counts per warp	34S
Counts per weft	34S
Ends (warp threads)	20 per inch
Pack (weft threads)	60 per inch

Table 9.2 *Distinguishing characteristics of Mohenjo Daro fibres (Marshall 1931:7).*

The prehistoric fibres from Mohenjo Daro were preserved by leaching salts from a small silver vase buried in close proximity to the cloth. Remarkably, traces of madder dye from *Rubia tinctorium* remained in the fibre. Using thin layer chromatography, de Graff identified alum in the cotton which indicated that 4,000 years ago, spinners and weavers in Pakistan were not only well advanced in cotton domestication but also in dyeing fabric. They used sophisticated mordant techniques involving the application of a substance, usually a metal salt, which then reacted with the dye to form a permanent fixed colour. Dye vats, bronze needles and carved figures dressed in elaborately decorated costume were also found at the site. It is also worth noting that Mohenjo Daro's cotton was not an isolated find. At Harappa, traces of cloth woven in tabby were found inside faience vases and on bricks (Vats 1974-1975:50, 51, Plate LXXII, CXXXVIII). At Bairat, Rairh, Paithan and Akota coins were also found wrapped in cotton cloth. Cotton cloth was amongst India's most important commodities in the early trade with the Mediterranean countries. Herodotus (ca. 484-425 BC) describes Indian mercenaries fighting for the Persian King, Xerxes, clothed in "an exotic cloth that had been woven by Indian craftsmen for more than 1,000 years". Pliny (AD 23-29) also reports that cotton was the main commodity traded by Indian merchants in Babylon. The presence of Indian cotton has also been interpreted (Burnard 1994:8) from large numbers of Indian seals at some sites. This interpretation is based on the practice of wrapping bales of goods in matting and woven cloth and the presence of large numbers of Indian seals at Lothal (Ghosh 1987). *The Periplus of the Erythraean Sea*, written in the century AD, mentions the port of Broach in Gujerat as one of the main Indian textile production areas and exporters of fine Indian cloth (Crill & Murphy 1991:23).

Very little is known about the early cotton trade in Southeast Asia and reconstructions are based on historiography. China did not produce cotton cloths before the first millennium AD even though cotton was *de rigeur* in the Han court. Cotton was imported by elites. Chinese documents tell us that Emperor Wu, for example, had a predilection for cotton; he wore the same cotton hat for 3 years and used the same cotton quilt for 2 years (Kuhn 1988). The *Houhanshu*, dated to the Later Han (25 BC - AD 9), refers to direct and indirect trade with Indian traders. Wheatley's (1961) reconstruction of the early cotton trade in Southeast Asia (Fig. 9.6) shows the shipment of coloured cottons of unspecified type to Champa, unspecified cotton cloth to the Philippines, the Red River region, Sumatra, Java but Thailand is not shown on the map. Ban Don Ta Phet's cotton is therefore significant to Southeast Asian history as it demonstrates that Indian cotton moved across the Bay of Bengal into Southeast Asia before the official maritime trade of the Han period.

Chiraporn Aranyanak (1991) also identified a bundle of fibres in the assemblage from Ban Don Ta Phet as *Musa sp.* (abaca) (see Fig. 9.7). While botanists are generally agreed that *Musa* is a Southeast Asian domesticate, opinion is divided over its precise origin. Some scholars (Crevost and Lemarie 1917-1921) had previously placed Musa's origin centre in the Philippines or Borneo but other scholars (Alexander and Coursey 1991:181) have subsequently placed it in the Malay Peninsula, believing that its westward diffusion would have been facilitated by early maritime traders of the 1st century AD, sailing between Southeast Asia, South India, Arabia and East Africa. Chinese historical sources indicate that abaca was not produced in the Middle Kingdom. The Han Emperor, Wu Di, reportedly introduced *Musa* sp. to his palace gardens but the plants quickly died from the cold (Kuhn 1988). Early dynastic records such as the *I Wu Chih* (Records of Strange Things), the *Nan Fang I Wu Chih* (Records of Strange Things from the Southern Regions) and the *Kuang chih* (Extensive Records of Remarkable Things) record the production of abaca textiles in Annam, Guangdong and Guangxi (Hui-Lin Li 1979:32-35). Ban Don Ta Phet's fragments are therefore significant to botany as they suggest that if the fibres were woven at the site, the species must have spread to Central Thailand during the first millennium BC.

Glover (1990) believed that the *Musa* fibres from Ban Don Ta Phet could have functioned as rope. *Musa* sp. has long been used for ropes and rigging and continues to be the world's premium natural cordage fibre for maritime purposes. It is 3 times stronger than cotton, twice as strong as sisal and considerably stronger than hemp. The fibre is valuable for sails and sheets because of its tensile strength and resistance to water (Burkhill 1935). Certainly, woven fabrics made from *Musa* sp. were found at Ban Na Di. Matting fragments of other materials were also found attached to metal at the site. According to Glover (1990), the matting resembled palm leaf sleeping mats woven by contemporary groups in Thailand.

Silk was also amongst the fibres in the assemblage identified by Chiraporn Aranyanak. The question remains: was the silk locally produced? While it is feasible that silk was spun with whorls at the site, the earliest unequivocal evidence for local silk production in Northeast Thailand is discussed in the following chapter. Given the preponderance of Indian artefacts and the presence of Indian cotton at this site, it is also possible the silk was from India. Although India is more often associated with muslin and printed cotton, Indian weavers also produced silk brocades with floral pattern using wild silk and silver and gold threads to give the silk strength. According to Baity (1947) Indian wild silk (tussah) is identifiable by its dark colour but as all archaeological textiles take on the colour of the surrounding soil, the colour of prehistoric silk is not an accurate guide to species.

We know from the presence of spindle whorls that some textiles were produced at the site. Altogether, 87 whorls were excavated; 49 during the 1980-81 season and 38 during the 1984-85 season. The whorls were confined to level 7. Most burials produced 1 or 2 although some produced large numbers. Burial 59 produced 11, burial 55 produced 9 and burial 49 produced 6. As it is unlikely that a single spinner would use 9 whorls; the large number in burial 55 could have indicated status. While this status difficult to establish, archaeologically, textile research shows that a few weavers achieve high status in traditional Southeast Asian societies. During fieldwork, a few discrete tattoo marks were observed on the knuckles of an Iban woman; these indicated she was a Master Weaver of very high status within her own community.

Ban Don Ta Phet's whorls (Fig. 9.5) were of 3 main types: biconical, cylindrical and flat discs. The tools, which are housed in the Institute of Archaeology in London, are to be analysed by Ho (Glover & Glover 1990: 175). While the presence of biconical whorls links the spinners at this site to the hand spindle tradition identified at prehistoric sites throughout Southeast Asia discussed in previous chapters, interpretation of the other whorls is complicated by the presence of Indian cotton at Ban Don Ta Phet. In my view basic types such as the conical and flat discs site are not diagnostic, particularly when located near Indian archaeological sites. Chiraporn Aranyanak (1991) has drawn attention to parallels between the flat and conical whorls from Thai archaeological sites and these basic types at Shang sites. While the whorls *may have* originated in the Middle Kingdom, it is worth noting that conical and basic flat disc whorls also occur at Indian archaeological sites (Ghosh 1987:187). Moreover, Indian fibres have been identified in the cloth from Ban Don Ta Phet.

At a more general level, the distribution of whorls in graves at Ban Don Ta Phet indicates a relationship between textile production and women. According to Glover,

> If we make the assumption that spindle whorls are more likely to be associated with women, and they occur in roughly half of the funerary deposits is about the only 'evidence' that both men and women were present in the Ban Don Ta Phet burial ground. This assumption gains some support from the fact that spindle whorls were associated with socketed spearheads only in a single instance (context 220), and only infrequently were they found (in 6 out of 25 contexts) with arrowheads tanged points and other more obvious weapons with iron. Spindle whorls were, however, more regularly found with socketed iron tools, billhooks and agricultural looking tools (Glover 1990:175).

Ongbah

Sorensen's (1973, 1979) excavations of the large cavern site of Ongbah provides further evidence for Dongson material culture in other parts of Southeast Asia at the time the Chinese moved into Lingnan. The site, distinguished by wooden coffins, is located in the Sri Sawat district of Kwae Yai. More than 90 hardwood coffins were found at the site, some of which were decorated with carved bird's heads at each end. The coffin wood has a radiocarbon date of 403 BC-AD 25. Although the site had been looted, Sorensen retrieved 6 bronze Dongson drums of the type that distinguish sites in the Red River delta. The highly stylized motifs on the drums in the cave at Ongbah date them on stylistic grounds to the middle of the Dongson period. Comparable drums made using the lost wax technique, the same morphology, design elements and arrangement have been found at Dongson sites. It is also interesting to note that the arrival of groups with Dongson drums in Thailand is recorded in rock art. The entrance to Tha Duang Cave features a painting on its walls of figures thought to be carrying 2 suspended bronze drums (Fig. 9.11). Some of the anthropomorphs are depicted in strange costumes, some of which are paralleled on Dongson drums (Fig. 9.11a). Other caves in Thailand contain paintings depicting rice and domesticated animals (dogs, buffalo) (Higham 1998:131) that also appear to be pictorial accounts of events that took place at the end of the first millennium BC. The truncated conical whorls found at Ongbah also link the spinners and weavers at Ongbah with spinners from Ban Prasat, discussed previously.

Noen U-Loke

Excavations over 2 seasons at the site of Noen U-Loke produced large numbers of whorls that were analysed as part of the study. The site is strategically located on elevated ground between two streams (Huai Yai and Huai Don Man) and surrounded by 5 moats, the largest number recorded at any Southeast Asian site (Higham 1996:220). The excavations covered a total area of 220 m^2 and produced 1000 m^2 of cultural materials. The 15 radiocarbon dates obtained for Noen U-Loke place the period of occupation at the site between 800 BC and AD 400. All layers belong to the Iron Age. Large numbers of metal tools were buried with the dead with some graves distinguished by thick layers of silicified rice. As rice was prescribed at Chinese funerals, it is conceivable that some groups may have been buried in accordance with Chinese mortuary rituals (see de Groot 1910).

Ornament was a notable feature of the Iron Age burials in the Mun River Valley with large numbers of rings, belts and bangles manufactured from stone, glass, bronze and iron interred with the dead. The iron rings are of special interest here. While rings have not hitherto been linked to cloth production in Southeast Asian archaeology, these artefacts had an important role in fibre processing in the *zhongyuan*. Strips of ramie were retted in moats, the outer layers of the fibres were then scraped off with an iron ring worn on the thumb and a knife held in the hand. The outer layers from the fibre ribbons were then hung up to dry (Bally 1957:21).

According to O'Reilly (pers. comm.), whorls were found in the graves of individuals of all ages and sexes. The richest burials at Noen U-Loke belonged to the middle-aged group (30-39 years) and female burials contained slightly more artefacts than male burials. This is consistent with status in cloth producing societies where only a few Master spinners and weavers continue to produce finely woven cloths because eyesight generally diminishes with age. The Bronze Age layers at Noen U-Loke produced few whorls. Five were found in layers 5 and 6; the majority (61/77) was in layer 4. Only 4 were found in layer 3 and 2 were found in layer 2. None was found in the upper layer. Some whorls were analysed as part of this study and their functional attributes are given in Table 9.3. The whorls ranged in size from 2.65 cm to 4.25 cm with central perforations measuring 0.34- 0.6 cm; whorls with the largest perforations were also the heaviest and widest in diameter. As Table 9.3 shows, most whorls are relatively light, clustering around 10g in weight. Both the light and heavy whorls came from burials. The heaviest (628) from burial 2 weighed 20g. The lightest (661) weighed 8g.

Table 9.4 shows the colours of the whorls, based on Munsell's Soil Colour Chart (2000). There was no correlation between morphology and colour. Morphology was more significant. Whereas whorls from other sites were distinguished by rounded edges, Noen U-Loke whorls had very sharp angles and points. This distinction is significant as sharp-angled whorls are relatively rare in the archaeological record. Kuhn's (1988; Fig. 97) typology of atypical Chinese spindle whorls shows that sharp edged whorls that compare favourably with those from Noen U-Loke were found at Yingpaili (Anon. 1962), a Late Neolithic site in Qingjiang, Jiangxi province. The site is located near the Gang Jiang that flows into Lake Poyang, which, in turn, feeds into the Yangzi River. In fact, all of the 92 whorls from Yingpaili display the same predilection for sharpness (Fig. 3.9). At Noen U-Loke, these whorls first appear in layer 4 where they occur in large numbers.

Munsell Colour	Description	Whorl Numbers
Hue 10 YR 6/2	light brownish grey	495, 765
Hue 10 YR 7/1	light grey	638
Hue 10 YR 4/6	dark yellowish-brown	709, 413
Hue 10 YR 2/2	very dark brown	315
Hue 7.5 YR 25/2	very dark brown	312
Hue 7.5YR 2.5/1	black	502, 449
Hue 7.5 YR 4/1	dark grey	429, 350, 465
Hue 7.5 YR 4/3	brown	403, 405
Hue 7.5 YR 6/3	light brown	465
Hue 7.5 YR 7/2	pinkish grey	781
Hue N YR 3/1	very dark grey	529, 659, 628
Hue 7.5 YR 2.5/2	very dark brown	381
Hue 5 YR 4/1	dark grey	132, 409,597, 465
Hue 2.5 YR 2/1	reddish black	113, 502
Hue 2.5 YR 5/6	red	335, 535
Hue 2.5 YR/5/1	reddish grey	147 , 596
Hue 2.5 YR 5/1	reddish black	597
Hue 2.5 YR 4/2	weak red	641
Hue 2.5 YR 4/6	red	

Table 9.4 *Colour Measurements of Noen U-Loke's pottery whorls.*

As stated above, this distinctive whorl also occurs in India where examples are also glazed. Fig. 9.8 shows an extreme version of a "nipple" shaped whorl from Noen U-Loke that was analysed for the study. It seems particularly striking that whorls of the same unusual shape occur at Mohenjo Daro (Fig. 9.8). The whorl from Noen U-Loke appeared to the naked eye to be coated with a substance resembling a glaze or slip. The whorls from Mohenjo Daro were also glazed (Marshall 1931); some have a light blue glaze while others have a greenish glaze similar to that observed on the whorl from Noen U Loke. Glazed whorls have also been found at Metal Age sites in Vietnam and the Philippines.

Non Chai

Excavations (Bayard, Charoenwongsa & Rutnin 1986) at the Iron Age site of Non Chai are of importance to the study as they produced very specialized tools that enable the prehistoric data to be linked to specific ethnographic groups in Thailand for the first time. This very large site (38.5 ha) is located at the confluence of the Chi and Phong Rivers. As Higham (1998:4) points out, Non Chai is one of the most significant sites in the area. The site was occupied only during the Iron Age and despite the considerable stratigraphic build-up of cultural materials (15 metres above the surrounding terrain), it was occupied for a relatively short time and thus provides opportunities for changes and developments to be measured over time.

Five phases were identified. Phase I is radiocarbon dated from 400 - 300 BC; Phases II-III are radiocarbon dated from 300 - 200 BC; Phase IV from 200 - 1BC; Phase V from 1 - 200 AD. Two classes of artefacts relevant to this study were amongst the pottery found at the site: spindle whorls and bowls described as "thread spacers". Their distribution is shown in Table 9.5. It is significant that as when "thread spacers" appear at the site, spindle whorls disappear.

Artefact Type	Surf--ace	VC	VB		VA		IVC	IVB	IVA		III		II		1	Total
spindle whorls	-	-	1	-	-	-	-	-	1	1	1	2	10	2	12	30
thread spacers	4	3	3	13	3	4	1	-	-	-	-	-	-	-	-	30

Table 9.5 *Distribution of spindle whorls and thread spacers at Non Chai (Bayard, Charoenwongsa & Rutnin 1986:Table 3).*

Altogether, 31 whorls were found at Non Chai. Bayard (pers. com.) is of the opinion that the 10 whorls found in the layer 5/6 interface of the 1968 excavation may have been concentrated there by the erosion of the upper Middle period layers. No whorls were found in layer 6; 12 came from layer 5 and 14 from layer 4; only 2 whorls came from layer 3, 1 from IVA and 1 from VB (Bayard & Solheim: unpublished report). It does seem significant that like many sites in Thailand, spinners were not represented in the earliest stages of occupation. Other patterns are discernible. As with other Metal Age sites in Thailand, textile tools were not confined to female burials at Non Chai. Three burials containing whorls belonged to young or middle-aged women, 1 belonged to a child and 2 belonged to middle-aged males (approx. 30 yrs.). One male burial contained 7 whorls (Bayard pers. comm.).

In the final stages of occupation at the site when whorls are rare (1 only), thread-spacers appear. These artefacts are distinguished by lugs. According to Bayard and Solheim, "the centrally placed lug which allows for the combination of several small filaments into a single, more sturdy one, and may be associated with the spinning wheel to produce thread, although further study of the thread spacers and their modern counterparts is necessary to confirm this" (Bayard & Solheim unpublished report:76).

It is worth noting that contemporary forms of this class of artefact known as *toui i pe* have been described by Lefferts and Cort (1999). While their study did not include examples from the prehistoric period, their research enables us to link specific Iron Age textile tools to contemporary groups. Fig. 2.17 shows contemporary *toui i pe* made from stoneware that are used in silk production by Tai textile workers. Silk is comprised of twin filaments called brins that are gummed together with sericun. The bowls are used in association with reeling machines to remove silk filaments from cocoons prematurely before the silkworms would leave their cocoons. After passing through the lug on the *toui i pe*, filaments are taken up and combined using the silk reeling machine to produced unbroken thread which can measure up to 900 m. The process is very labour intensive and requires technical knowledge and skill. To my knowledge, the Tai are the only Southeast Asian groups who use these bowls.

These specialized bowls also provide the earliest unequivocal evidence for local silk production in Thailand. Moreover, they provide further links to the Yangzi Valley. In Chapter 2, this class of artefact was first identified at the Neolithic site of Hemudu in Hangzhou Bay (Chapter 2) and an argument was put forward that silk reeling devices of the type used with the bowls are depicted on pottery whorls from Hemudu. The same wooden reeling devices are depicted in early Han engravings. While wooden reeling devices were not found at Non Chai, they are indirectly evidenced by the *toui i pe*. This evidence establishes silk production in the

Mun River Valley during the Iron Age.

Non Muang Kao

Excavations at the Iron Age site of Non Muang Kao (Mound of the Ancient City), about 20k from Ban Prasat, produced a few whorls. The mound, seven metres above the surrounding rice fields was first identified and recorded by Lunet de Lajonquiere (1907) and excavated almost a century later by Dougald O'Reilly (1999). Non Muang Kao is surrounded by two wide moats. The site was settled towards the end of the first millennium BC. The radiocarbon dates in Table 9.6 indicate that Non Muang Kao was occupied between 0-400 AD (Higham 1998:150). Ten burials were excavated at Non Muang Kao with the cultural sequence divided into 3 distinct phases.

Code	Wk	DC13	%Modern	Result	Corrected
NMK 32	4512	-26.9+/-0.2	80.4+/-1.6	1750 ± 160 BP	3BC-639 AD
NMK 81	4513	-24.0+/2.0	NA	1640 ± 70 BP	315-584 AD
NMK 66	4514	-25.3+/0.2	80.9+/0.9	1700 ± 90 BP	129-545 AD
NMK 32	4515	-26.2+/-0.2	81.9+/-0.6	1610 ± 90 BP	336-600 AD

Table 9.6 *Radiocarbon dates for Non Muang Kao (O'Reilly 1999:137).*

Non Muang Kao is one of several Mun River sites distinguished by clay floors and clay architectural features. Other sites include Non Yang (Nitta 1991) and Ban Takhong (Higham 1996). At Non Muang Kao, the burials and clay floors and architectural features distinguish the upper layer (above 2.4m) where the dead were interred with large quantities of rice, pottery and exotic glass. In my view, this links the occupants of the site to Middle Yangiz groups. As described in Chapter 2, clay floors and clay architectural features were a distinctive feature of Daxi sites located along the middle reaches of the Yangzi River. Daxi groups plastered the outside walls of their houses with grey clay mixed with burnt clay fragments and potsherds. Interior surfaces were washed with yellow clay and floors were plastered with clay tempered with fine sands while outer walls were plastered with clay mixed with rice husks. The usage of clay in this way in the Yangzi rivaled its importance for ceramics (Vainker 1991:23).

Non Muang Kao produced only 2 whorls, both of which came from the upper layers. Their functional attributes are given in Table 9.7. The whorls were the basic conical types which are a common feature of Middle Yangzi and Yellow River sites. Their relative small size suggests that they probably spun light fibres.

Number	Bag	Material	Shape	Weight	Diameter (cm)	Central perforation (cm)	Motif
13	149	pottery	conical	10	2.68	0.34	-
15	149	pottery	conical	9	3.00	0.34	-

Table 9.7 *Functional attributes of whorls from Non Muang Kao*

The main diagnostic feature of the whorls from Non Muang Kao is material composition: they were made from black pottery. This is significant as black pottery is one of the distinguishing feature of early cloth production sites in the Yangzi Valley. These include the textile site of Hemudu where black pottery was shown to be a significant aspect of material culture. According to Rawson, food was placed in tall black pottery stands in burials at Daxi and Qujialing sites (Rawson 1996:32). In China, black pottery was prescribed for funerary purposes (Beurdeley & Beurdeley 1976); grain, pigs, dogs and chickens were placed in black pottery ritual vessels. At a conference on Ritual and the Social Significance of Death in Chinese Society, Keightley (1985) gives a detailed account of these ritual vessels and the offerings placed in them and explains the practice of interring the dead with the exigencies of life in terms of Chinese cosmology. According to Keightley, the secular quality of grave goods reflects the hopefulness that postmortem experience would be a continuation of premortem experience. Black pottery has also been found at many other clothg production sites discussed in previous chapters. Black pottery vessels were found at Samrong Sen (Chapter 6) and the same vessels were described at Ban Kao (Chapter 8).

In terms of distribution, it is worth noting that the range of black mortuary pottery extends beyond Thailand to Myanmar (and India). Although Myanmar as a region was not included in the study, mention should be made of some examples of black burial pottery found in association with cloth production tools at a site on the Irrawaddy Plain in Myanmar. However, this archaeological evidence for cloth has been overlooked by some scholars. According to Stargardt,

> Both the manuscript sources and the material evidence for cloth itself are destroyed by the climate. It is very likely that the contacts between Beikthano and Nagarjunakonda led to knowledge of the exquisite range of Indian ceremonial cloths for royal and religious festivities and that such cloths were adopted by the Pyu and left a lasting impression on the local textile production. In other words, I suggest that the processes can be traced among durable materials such as imported rouletted pottery and their local offshoots, probably apply as well as the domain of perishable but more valuable goods such as cloth (Stargardt 1990:265).

As previous chapters have demonstrated, the tropical climate of Southeast Asia does not always destroy all material remains of cloth. Moreover, fragments of prehistoric silk have actually been found in Myanmar. UNESCO archaeologist, Pierre Prichard, actually found a small fragment of silk inside Temple 315 at Pagan (Fraser Lu 1988:18). Furthermore, Stargardt has overlooked evidence for cloth production from the Metal Age site of Taungthaman on the Irrawaddy Plain, near Rangoon. As Bronson has pointed out "She (Stargardt) and Aung Thaw both identify a group of clay objects as beads which most archaeologists would consider to be spindle whorls: weights used for spinning implements" (Bronson 1992:436, 437). The clay objects were associated with pile-dwellings, stone adzes, rice (impressions on clay hearths), iron tools and black pottery. Thermoluminescence dates on pottery from the Research Laboratory for Archaeology and Art History at Oxford place the period of occupation at the site to the middle of the first millennium BC (Stargardt 1990:16). The "flattish conical terracotta discs" from Taungthaman in Fig. 9.12 are whorls of the type found at other Metal Age sites in Thailand. The vessel described as a "tall vessel bowl" is a *dou*, made in two sections and characterized by a very high ring foot and flared mouth of the type reported earlier at Liangzhu sites (Shanghai Museum 1992). Although the conical whorls from Taungthaman are not diagnostic in isolation, when they are considered as part of an assemblage including rice, iron tools, *ding* and *dou* they link the Iron Age spinners and weavers in Thailand to the Metal Age spinners and weavers discussed in previous chapters.

The archaeological evidence for cloth production from Late Neolithic and Bronze Age sites discussed in Chapter 8 linked the prehistoric spinners and weavers from Thailand to prehistoric spinners and weavers from Southeast China and other parts of Southeast Asia (particularly Vietnam). In contrast, the archaeological evidence for cloth from Iron Age sites in Thailand (and Myanmar) shows relationships with both India and China. The latter suggests a much wider range of interaction during the Iron Age. The primary evidence for Indian contact comes from Ban Don Ta Phet where exotic cotton textiles of Indian origin were reported. The cottons from Ban Don Ta Phet were shown to be the earliest known cottons thus far out of their origin centre and the earliest archaeological evidence for the early textile trade found thus far in Southeast Asia. Indian spindles were also identified at Lopburi, further supporting early contact with India. The weight of evidence for interaction with the Middle Yangzi and Han China comes from moats, hemp, iron rings, clay architectural features and conical whorls. There is also sufficient evidence to suggest that there was considerable economic expenditure on cloth production in the Mun River Valley with workshops that may have contributed to the expansion of early groups into the Mun River Valley between 500 BC and AD 500.

Chapter 10

Discussion and Conclusions

The Database

The task of locating and documenting much of the fragmentary evidence for cloth production excavated from archaeological sites in mainland and parts of island Southeast Asia has been completed. This was the principal aim of the study. There is now sufficient evidence to address the other questions laid down in the introduction and convert the manifold small-scale observations reported during the dissertation into a broader framework. The sites investigated thus far span the Early Neolithic (pre- 8000 BP) through the Bronze and Iron periods to the Indianization period in Southeast Asia (ca. 2000 BP). The evidence examined included fragments of prehistoric cloth, loom parts, spindle whorls, textile pseudomorphs, spinning bowls, figurines, bark cloth beaters, pictorial data and pottery stamps. Admittedly, there is considerable regional variation in the evidence but this was resultant from marked differences in the numbers of excavations in different parts of Southeast Asia, rather than sampling. Whereas hundreds of archaeological sites have been excavated in the Yangzi region, Vietnam, Thailand, Taiwan and the Philippines, fewer have been excavated in other parts of Island Southeast Asia and very few sites have been excavated in Laos, Cambodia and Myanmar. There were also marked differences in the size of excavations in these different regions that seriously limits quantitative analysis. The size of excavations ranged from a test pit in Laos of $28m^2$ to excavations in the Red River region extending beyond 1,000 m^2. Because of this disparity, comparisons were not made between numbers of textile artefacts at different sites although comparisons were made between the numbers of artefacts associated with individual burials. While these inconsistencies precluded some quantitative analysis, they did not adversely affect the typological comparisons that were made between artefacts from different sites. In this final chapter, the findings of each of the preceding chapters are summarized before an attempt is made to interpret the evidence in the light of contemporary reconstructions of Southeast Asian archaeology. The final section is devoted to unanswered questions and future directions for the research.

Chapters Summarized

An argument was presented in Chapter 2 that certain stone-perforated discs from Early Neolithic sites in the Middle Yangzi ought to be re-interpreted as spindle whorls. The essence of the argument was threefold. First, ethnographic parallels were identified. Stone spindle whorls that are used to spin nettle fibres by the Salish were described. Then, archaeological parallels that have been positively identified as spindle whorls from Neolithic and Bronze Age sites in the Middle East and the Mediterranean were discussed. The study then showed that some of the stone perforated discs excavated from Neolithic and Bronze Age sites in South China have the functional attributes of spindle whorls. Drawing heavily from the work of archaeologists from the Jilin Museum, the study demonstrated that the size of the central perforations of some perforated discs from the Yangzi Valley was too small for the artefacts to have functioned as digging implements. Using these criteria, the chapter showed that spinning was practiced in the Yangzi Valley at least 8000 years ago.

By plotting the distribution of prehistoric spindle whorls (stone, pottery) at Xianrendong, Chengbeixin, Qujialing, Daxi and Hemudu sites, the research identified an autonomous prehistoric textile zone (Fig. 10.1) in the Yangzi Valley. The zone is distinct from the much cited origin centre for Chinese textile technology in the Yellow River Valley. Technological continuity was demonstrated by showing the continued usage of stone spindle whorls during the initial stages of development of the hand spindle in the Yangzi Valley. The appearance of pottery whorls at Middle Yangzi Valley sites around 5000 BC was not interpreted as evidence for cultural interaction with the Yellow River because pottery had previously been invented independently in the Yangzi Valley long before the appearance of whorls. Pottery whorls were interpreted as local adaptations of an existing technology for different purposes.

Cultural interaction with spinners from Yangshao sites in the Late Neolithic was interpreted from changes in the decoration of whorls from Daxi, Chengbeixin and Qujialing sites. The research showed that the earliest pottery spindle whorls in the prehistoric textile zone of the Yangzi Valley were incised and impressed with the geometric design elements that characterize other Neolithic pottery whereas later whorls were painted with the curvilinear designs and palette that characterize Yangshao pottery. The study does not presume to know precisely when such changes first took place, simply to point out the influence of the painted pottery tradition from the *zhongyuan* on prehistoric whorls from South China. This was interpreted as early evidence for cultural interaction in the Yangzi Valley during the prehistoric period. These findings are not inconsistent with the general interpretation of Middle Yangzi sites as mixed sites in Chinese archaeology.

The chapter then drew attention to large numbers of pottery zoomorphic figurines from Middle Yangzi sites of the type found at archaeological sites throughout mainland Southeast Asia. While these artefacts have not hitherto been linked to textile production, they are pertinent to the study for several reasons. First, they are frequently associated with whorls at Southeast Asian archaeological sites; they are also frequently depicted on textile tools; and they are also woven into traditional Southeast Asian textiles. The thesis has provided the rationale for these pervasive motifs in Southeast Asian art.

Chapter 2 also elucidated a hitherto unknown relationship in Southeast Asian archaeology between textile technology and riziculture. The research showed that the earliest spindle whorl sites in South China were also the earliest wet rice sites. All of the wet rice cultures in the chronology of Chinese Neolithic cultures produced whorls. The hand spindle was traced from wet rice sites belonging to the Hemudu culture up the Yangzi to wet rice sites belonging to Chengbeixin and Daxi groups. Zengpiyan discussed in Chapter 3. Attention was drawn to Chinese site reports that indicated that Neolithic groups at Hemudu had the hand spindle and the backstrap loom as early as 5000 BC. This data refuted the dominant paradigm in Southeast Asian textile history that the body-tension loom depicted on a bronze cowry container from Yunnan was the earliest archaeological evidence for the backstrap loom in Southeast Asia. The study also demonstrated that weaving was not in an early stage of development at the site of Hemudu. The large proportion of textile tools in layer 3 (22.38 %) led to the inevitable conclusion Hemudu was a flourishing textile centre between ca. 5000 and 3000 BC. An argument was also put forward that some of the pottery bowls with lugs from Hemudu *could have been used* for silk processing.

Contrary to the common misconception that the earliest surviving textiles in China were made from *Cannabis sativa* (hemp), the study showed that the earliest extant forms of weaving were made from *Pueraria thunbergiania* (bean creeper), *Boehmeria nivea* (ramie) and *Bambussa sp.* (bamboo). The chapter also pointed out that fragments of prehistoric silk from the Liangzhu site of Qianshanyang are the earliest extant silks in the archaeological record.

A proposal was also put forward in Chapter 2 that the curvilinear motifs depicted on prehistoric whorls from Hemudu and other Yangzi Valley sites are depictions of textile technology: silk reeling devices of the type still used by spinners and weavers in Vietnam, Cambodia, Laos and Thailand. In Thailand, the Tai use these devices with the above-mentioned pottery bowls. An argument was also put forward that the small concentric circles depicted on other Hemudu whorls *might be* grains of rice, representing fertility.

The study subsequently showed the more widespread distribution of spindle whorls at late prehistoric sites in the Lower Yangzi belonging to the Majiabang, Songze and Liangzhu cultures consistent with the beginnings of craft specialization and the emergence of elites in the region. Technological continuity was demonstrated by showing that the motifs depicted on whorls from Hemudu continued in the archaeological record of the Yangzi Valley through to the late prehistoric period. Finally, the chapter showed a relationship between silk textiles and jade in high-status Liangzhu burials. The research also showed a relationship between women and the textile crafts articulated by the recovery of spindle whorls in sexed female graves at Beiyinyanying. A suggestion was also put forward in Chapter 2 that silk textile production may have actually contributed to the substantial wealth evidenced at Liangzhu sites. Not only were fragments of silk found at some archaeological sites but also frequently both materials were incorporated within the same structural compositions (jade suits sewn with silk and silk face cloths embellished with jade).

Chapter 3 showed the emergence of regional differences in textile tools towards the end of the Neolithic period in Southeast China. The study drew attention to the appearance of biconical whorls at Tanshishan sites between 3000 and 1500 BC. Based on Kuhn's (1988) study of Chinese prehistoric spindle whorls, the research showed that pottery biconical whorls were produced exclusively by Tanshishan groups who occupied rice sites along riverbanks and the narrow coastal strip of Fujian province in Southeast China. Because Kuhn had established the cultural specificity of biconical whorls in Fujian and the total absence of these types in the *zhongyuan*, biconical whorls were seen as diagnostic. By tracing the movement of diagnostic biconical whorls, the study showed that the adoption of spinning and weaving in Taiwan and other parts of Southeast Asia followed a period of agricultural expansion into mainland and island Southeast Asia. The chapter stressed that these correlations were not simply based on whorl morphology. The central point is that spindle whorls are as variable as other forms of pottery. The data showed that the spinners and weavers evidenced at sites in Taiwan and the Philippines made the same technological choices as spinners and weavers evidenced at Tanshishan sites. The research showed that the whorls had the same functional attributes. Instead of manufacturing spindle whorls from wood, stone, bone or shell, the Late Neolithic spinners at early rice sites in other parts of Southeast Asia chose to manufacture whorls from pottery, of similar size, shape and weight to those produced in southeast China. The analysis also showed that the early rice groups who used biconical whorls in these disparate places decorated their pottery biconical whorls with the same design elements using the same techniques used by Late Neolithic spinners from Tanshishan sites.

Chapter 4 drew the reader's attention to little-known archaeological evidence for bark cloth production from Early Neolithic sites in Lingnan which have necessitated a re-appraisal of the prehistory of bark cloth. Prior to the excavation of bark cloth beaters from Xiantouling (and other Neolithic sites in the Pearl River region), only ambiguous pounders were known on the Asian mainland and on that basis, bark cloth technology had been traced back to Taiwan where the earliest unambiguous bark cloth beaters had been identified. Prehistoric bark cloth beaters from the sites of Xiantouling and Dahuangsha belonging to Phase I in the Pearl River delta (4500 and 3700 BC) were described and their significance to Pacific cultural history recorded.

A proposition was also put forward in this chapter that there *could possibly be* unrecognized archaeological evidence for an elementary form of fabric construction in Lingnan. A suggestion was put forward that an engraved design on an enigmatic pebble found during excavations at Fu Tei on Chek Lap Kok Island *could be* an instructional diagram of sprang. The period of occupation at the site was dated between 3900 and 3600 BC. The research into data on the hand spindle from the Pearl River delta also elucidated an unknown relationship between spinners from the Pearl River delta and spinners from Tanshishan sites in Southeast China which supports Au Ka Fat's reconstruction of interaction patterns between Southeast China and Pearl River sites.

The section on Yunnan clearly demonstrated Chinese influence in cloth production in southwest China at the end of the first millennium BC. The weaving scenes depicted on bronze drums showed craft workshops. The main point was that although the spinners and weavers depicted on the drum used the simple looms evidenced at archaeological sites in South China, these specific scenes revealed changes in the organization of production. The bronze loom parts in high-ranking burials also confirmed that weaving workshops in Yunnan were owned by elites. The chapter produced historical evidence for the employment of slaves in the handicraft industries, pointing out that slaves became part of the economy during the Han period when the focus of production shifted from agriculture to commerce. This section of the dissertation also showed that the weaving and battle scenes on bronze drums from the prehistoric site of Shizhaishan provide unequivocal archaeological evidence for division of labour based on sex in this part of Southeast Asia.

Chapter 5 showed the introduction of the hand spindle into the Red River Valley from southeast China around 2000 BC. Analysis of *doi xe chi* housed in the History Museum (Hanoi) and the Institute of Archaeology (Hanoi) demonstrated that the whorls excavated from Phung Nguyen sites had the same functional attributes as whorls excavated from the earliest layers at Tanshishan sites. At the same time, the chapter acknowledged greater complexity than previously considered with the introduction of different fibre-processing techniques into the Red River region during the Bronze Age. Bronze retting brushes were identified in Vietnam and correlations drawn between examples from Yunnan and Dongson sites. The study also pointed out that the design elements engraved on the bronze retting brushes from Dongson sites first occur on Shang textiles. The study showed that this distinctive motif occurs on pottery and bronzes from the *zhongyuan* as well as on Vietnamese bronzes. The chapter also suggested that the textile pseudomorphs on bronze and iron weapons in Vietnam are paralleled in the Yangzi Valley and the Yellow River and reflect similar burial practices.

The section on data from Dong Nai sites raised the possibility that some perforated discs recovered from pre-Cham sites off the coast of Vietnam could be loom parts of exogenic origin. An argument was also put forward that the very large numbers of whorls at some Dong Nai sites indicate craft specialization and the intensification of cloth production in the Mekong delta considerably earlier than the Indianization period.

The origin question was revisited in Chapter 6 and the dominant paradigm in Southeast Asian art history postulated by Groslier (1966) that textile technology and cotton were introduced to Cambodia from India during the Indianization period was refuted. A re-examination of artefacts recovered by French archaeologists earlier this century from several Metal Age sites on the Tonle Sap plains firmly established that cloth was produced in this part of the Mekong Valley during the prehistoric period. The conical whorls and other items of material culture from Samrong Sen and Mlu Prei sites were shown to have earlier parallels in Vietnam and the Yangzi Valley.

In the process of documenting tools recovered by Malleret (1959-1963) and his team from Oc Eo, some obscure unidentified pottery artefacts were linked to cloth production. A class of artefact called loom weights, generally associated with the warp-weighted loom, was described. Loom weights are basic components of vertical looms called warp-weighted looms, which are markedly different from the horizontal, backstrap loom distributed throughout Southeast Asia and the Pacific. The study pointed out that the earliest surviving pottery loom weights come from Neolithic and Bronze Age sites in the Mediterranean and Europe where they were used to produce flax and wool textiles. A suggestion was also put forward that there may also be unidentified tablet weaving tools amongst the cultural materials from Oc Eo. The chapter pointed out that while the archaeological evidence for tablet weaving is scant, the technology was known in the Caucasus and Mesopotamia before it spread to other parts of the world. In addition, spinning scenes were identified on *intaglios* excavated from Oc Eo and the study drew attention to spinning pictographs from Bronze Age sites in the Mediterranean. While one of these exotic artefacts at Oc Eo could have been interpreted as evidence for trade and exchange, the presence of three different classes of textile artefacts with Mediterranean parallels strongly suggests specialized textile tools associated with different types of looms were used in weaving workshops in the Mekong delta at the beginning of the Indianization period. Based on technological parallels, a case was made that Southeast Asian spinning tools were used at Oc Eo along with introduced types. Although Oc Eo did not produce any textile tools of clear Indian origin, Indian influence in traditional Khmer cloth production and usage was documented which must have accompanied the introduction of Indian religious philosophies and art styles into the lower Mekong during the early historical period.

One of the main points of this chapter was that the absence of prehistoric cloth in Cambodia has obscured the importance of cloth in the early trade at Oc Eo in Southeast Asia that linked the two superpowers of the first millennium (China and Rome). Ancient Chinese sources were cited which showed that cloth was an important trade good with exotic cloths made from silk and asbestos amongst the most important commodities traded in the markets of Funan. Evidence for craft specialization and workshop production was obtained from translations of inscriptions, specifically different terms for spinners and weavers. Translations of textile terminology in inscriptions also showed that perceptions of the role of spinners and weavers in the first millennium AD were influenced by Indian cosmology; spinners and weavers "slaves of the gods". The inscriptions also revealed that cloth was a very valuable commodity in the early historical period with some cloths bartered for land. At the end of the chapter, an attempt was made to show a correlation between changes in cloth production and social stratification. The statuary and bas reliefs at Angkor Wat showed that as the Khmer courts became increasingly wealthy and stratified, greater quantities of cloth requiring upright looms were required for costume and ritual paraphernalia to display and re-enforce social status.

Chapter 7 highlighted the continuation of the dispersal pattern established in Chapters 3, 4 and 5. The study demonstrated the movement of the hand spindle into Laos during the late prehistoric period. Relationships with prehistoric groups from Dong Dau sites were articulated through the morphology and decoration of whorls. Laboratory experiments conducted on pottery rollers of unknown function from Lao Pako failed to show any traces of dyes on the surface of the rollers and thus link these enigmatic finds to textile production. However, analysis of the motifs carved on the surfaces of the rollers from Lao Pako linked the rollers to Vietnamese pottery dated from the Phung Nguyen to the Dongson period.

A re-examination of the pottery spindle whorls found more than fifty years ago at Ban Ang showed that they belonged to the same technological tradition evidenced at Lao Pako thereby linking the spinners at the two Metal Age sites through cloth. In this chapter, an argument was also put forward that some of the stone jars that characterize the Plain of jars could have been used as vats to dye cloth. This suggestion was based on ethnographic parallels in Guizhou where weavers dye cloth in vats cut out of limestone cliffs.

The mineralized cloth on the iron spearhead from Tam Hua Pu showed different relationships. Examination of the mineralized cloth on the iron spearhead showed the presence of pseudomorphs of 1/1 tabby on all sides of the spearhead, which indicated that the implement had been wrapped in cloth prior to burial. Analysis of the fibres using Scanning Electron Microscopy showed that the fibres were completely mineralized. Archaeological parallels (mineralized cloth impressions on iron spearheads) were previously identified at Giong Ca Vo in southern Vietnam with the largest concentration of spearheads at Shizhaishan in Yunnan. In this way, the archaeological data seems to confirm Chinese historical documents about the movement of Han Chinese into parts of South China at the beginning of the historical period.

Chapters 8 and 9 continued to trace the movement of the hand spindle into Thailand and showed that spindle whorl sites in this part of Southeast Asia also produced archaeological evidence for rice. The diagnostic whorls that were first recognized at Tanshishan sites in Fujian were located at the Bang site, Non Nok Tha and Ban Chiang sites and Ban Lum Khao. The study also showed that whorls did not always occur in the earliest layers at Bronze Age sites, a factor that suggests that women may have not been amongst the earliest groups at these sites. The functional attributes of the whorls at Bronze Age sites in Thailand compared favourably with functional attributes of whorls from Laos and Vietnam. The main point about the whorls from Ban Chiang sites is their close affinities to whorls from Dong Dau sites in Vietnam. The study also drew attention to parallels in the pottery beaters from the Bang site and beaters from Tanshishan sites.

In Chapter 9, an argument was put forward that Chinese fibre-processing techniques might have been used at Iron Age sites in northeast Thailand. The chapter proposed that there is indirect evidence that ramie and hemp were retted in moats in this part of Thailand as they were in the *zhongyuan*. Exogenic influences from India were also highlighted from the evidence for cloth production at sites in Central Thailand and attention was drawn to what appear to be the earliest Old World cottons out of context at the site of Ban Don Ta Phet.

Conclusions

The study has accomplished its principal aim to document the archaeological evidence for cloth production in Southeast Asia. The task remains to elucidate the rationale behind the data and its distribution throughout the region. This will be done by examining some of the critical questions raised in Chapter 1.

One of the fundamental aims of the research was to provide some new insights into the origin(s) of cloth production in Southeast Asia. As discussed in Chapter 1, previous hypotheses concerning the origins of cloth production in linguistics and art history were based on scant archaeological evidence. The expanded database created by this systematic study makes it feasible to determine if textile technology was resultant from diffusion or local evolution. The most significant finding of the research was the identification of an autonomous prehistoric textile zone in the Yangzi Valley (Fig. 10.1) which established that the hand spindle and simple looms were used by wet rice groups in this region at least 8000 years ago.

Through mapping the distribution of prehistoric spindle whorls at archaeological sites in South China and Southeast Asia, the dissertation has shown the dispersal of the hand spindle from Tanshishan sites in southeast China into several different directions. Whorls were traced across the Straits of Taiwan to the islands of Taiwan and the Philippines. Whorls were also traced down the southern coast of Fujian province to the Pearl River delta then across Bac Bo to the Red River delta, Laos and Thailand. Prehistoric spindle whorls with distinctive design elements were also traced from Vietnam into Northeast Thailand.

Obviously, spindle whorls are inanimate objects and the presence of such tools at prehistoric sites could be interpreted as evidence for population movements, trade and exchange or simply for the transmission of ideas. As caution is necessary when interpreting the past, particularly in terms of population movements, all these explanations for the distribution of spinning and weaving tools in the Southeast Asian archaeological record were considered. It was finally concluded that whorls indicate the movement of prehistoric spinners and weavers, an interpretation consistent with the interpretation of spindle whorls in other parts of the world. There are crucial factors specific to textile technology, which militate against trade as interpretation. First, there are no ethnographic parallels anywhere in the world for spindle whorls or loom parts being traded. Spinning and weaving tools are made from mundane, inexpensive materials of no intrinsic value to anyone other than craftspersons (see Barber 1990). The prehistoric whorls that are the focus of this study were made of pottery, which was not exotic at early rice sites. Like other pottery, whorls were also made at these prehistoric sites using local materials. Furthermore, textile tools require technical knowledge to use and without written records, technical instructions could only have been transmitted by skilled craftspersons. Not only is a high level of technical knowledge and skill required to spin the whorls and weave the cloths described in the study but knowledge of suitable fibres and their preparation would also have been necessary. Furthermore, there is also linguistic evidence for the movement of populations in the prehistoric period.

Nor does the data support the proposition that spinning originated independently in many different parts of Southeast Asia. While one whorl might be like any other to most archaeologists, whorls are as variable as other pottery artefacts. The functional attributes of the whorls analysed as part of the research do not indicate multiple origins. There are several reasons for this conclusion. Had spinning been invented independently throughout this vast region, basic types would be expected at the earliest archaeological sites. Basic types such as flat and conical discs spin more slowly than the biconical types represented in the study. The technological difference between the two types is quantifiable. To reiterate, the performance of any whorl can be measured by its Moment of Inertia, a formula devised in physics and biconical whorls have a much higher Moment of Inertia than that of flat discs. This indicates that skilled spinners first appear in some regions rather than novices.

In addition, the functional attributes of the whorls discussed in this dissertation are remarkably uniform. Fig. 10.2 gives the typology of Southeast Asian spindle whorls developed for the study. The whorls in the typology are not only similar in shape but are also of similar material composition, size, shape and weight. Great pains were taken to demonstrate this uniformity through the usage of large numbers of diagrams in the study. Finally, it is highly improbably that independently invented spindle whorls would have been decorated with the same design elements arranged in the same way as those from Tanshishan sites, particularly as many of the motifs are not simply decorative but technologically inspired.

It is not possible to know precisely when the hand spindle was first invented in South China nor who invented the tool. The research identified an autonomous prehistoric textile zone amongst Neolithic rice producers living in the Yangzi Valley more than 8000 years ago.

It is clear from the data that the hand spindle was used to spin cord, rope and textile fibres in the Yangzi Valley and the technology gradually spread throughout South China during the Late Neolithic period. The tool continued in the archaeological record in South China until it was superseded by the spinning wheel at the end of the Zhou period (Kuhn 1988). The broad pattern elucidated by the evidence is that the adoption of spinning and weaving in Southeast Asia followed the broad pattern of agricultural expansion into Southeast Asia identified by Lu and Higham (2000). The study shows the gradual movement of spinners and weavers with diagnostic tools from Tanshishan sites in southeast China into Taiwan, island Southeast Asia, Hong Kong, Vietnam, Cambodia, Laos and Thailand. Absolute dates are also a problem for Tanshishan sites but an approximate 3rd millennium BC date for the movement of biconical whorls is consistent with Higham's (1996:323) date for the expansion of agricultural communities in Southeast Asia of around 2800 BC.

The fact that the early textile sites mapped in the study are also early rice sites raises interesting theoretical questions. Is there a causal relationship between agriculture and textile technology that could explain this congruence and the absence of evidence at hunter-gatherer or coastal sites in Higham's chronological table (1989: xv, xvi)? A relationship between agriculture and textiles has been noted in other parts of the world. The earliest prehistoric textiles in the Middle East and Europe occur at Neolithic sites with agriculture. The site of Jarmo, which produced the earliest unequivocal archaeological evidence for weaving in that region, lies in the "heart" of the territory where fibre-producing plants (flax) and animals (goats, sheep) were first domesticated. The Fertile Crescent stretches to the south, southeast and to the west-northwest of Jarmo. According to Barber (1991:258), the piedmont zone where flax and sheep's wool were available was the original home of weaving in the Fertile Crescent.

In China, agriculture appears to have developed autonomously in two different regions (North and South) with different plants and was not the result of a diffusion of stimuli from neighbouring countries (Wood 1985:278). In North China, agriculture first appears at the confluence of the Huanghe (Yellow River) and its tributaries, the Fen and the Wei. These early agricultural sites in North China compare favourably with Jarmo in that they are located in the transitional zone between the high wooded plateau of the west and low marshy lands to the east. The two different types of millet, *Setaria italica* (foxtail millet) and *Panicum miliaceum* (little millet) were domesticated there. In Southern China, agriculture and animal domestication arose at the same time but with different species: *xian rice (Oryza sativa indica)*, *Zizania* (a gramineous *Oryza)* and dogs, pigs, buffalo and chickens (Lu 1999).

Textile technology has followed the same pattern with different fibres domesticated for cloth production in the two agricultural zones.

The common nettle plant can provisionally be added to Barber's map of prehistoric textile fibres (Fig. 10.3). Although nettle fibres were not found in the autonomous textile zone, stone whorls of the type found at Xianrendong and other Neolithic sites were used to spin nettle in other parts of the world. The two main types, *Boehmeria nivea* forma *chinensis* (Gaudich) (white ramie), and, *Boehmeria nivea* forma *indica* (var. *tenacissima* Gaudich) (green ramie) have different origins. The former which grows throughout South China is indigenous to the *zhongyuan* whereas the latter which only grows in the southern provinces of China is derived from India (Kuhn 1988:19). Prehistoric ramie fragments were found at Qianshanyang (Figure 2.1) and there are good reasons to conclude that white ramie moved into Vietnam, Laos and Northeast Thailand with prehistoric spinners. The iron rings found at Iron Age sites in Northeast Thailand could have been used to process ramie. *Pueraria thunbergiania* (bean creeper) can also be added to the map. Prehistoric cloth fragments from Caoxieshan were identified as bean creeper. As Barber's map shows, North China has long been associated with *Cannabis sativa*. Hemp fibres are much coarser than other bast fibres and in regions where weavers have a choice, hemp is mostly used for rope and sails which are relatively unaffected by saltwater or for shrouds and mortuary attire. There is also evidence that Middle Yangzi groups from Qianshanyang used hemp in the prehistoric period. The basic conical whorls evidenced in the *zhongyuan* and mixed Yangzi sites, suggest that hemp moved with Metal Age groups into Vietnam, Laos, Cambodia and Northeast Thailand with Bronze Age spinners. The picture is more complicated at proto-historic sites because of trade. *Gossypium* sp. for example, first appears in Southeast Asia at archaeological sites such as Ban Don Ta Phet with firm evidence for trade with India. The same applies for *Musa textilis* (abaca).

Silk can be added to the world map of prehistoric fibres for South China and Southeast Asia. South China is particularly important to the history of silk as the earliest dated silks come from the Yangzi Valley; only indirect evidence for prehistoric silk (silkworm cocoons, inscriptions on oracle bones and depictions on pottery) have been found to date in the *zhongyuan*. It is very likely that silk was processed at Hemudu. While silk textiles have been found at many archaeological sites in Thailand, the earliest unequivocal evidence for local silk production comes from the Iron Age site of Non Chai where fibre- processing bowls were found.

Undoubtedly, agriculture provides a catalyst for the development of cloth production technologies. Once Neolithic groups learned to domesticate food crops, the same principles would have been applied to textile fibres and domestication would have resulted in increased production. Lightweight woven bags have been required to transport agricultural produce. Moreover, agriculture supports large populations and provides the surplus needed for craft specialization. At a symbolic level, cloth would have provided an ideal medium for class differences to be articulated as new elites emerged.

The development of looms in Southeast Asia must surely be linked to settlement. The hand spindle is a small, light portable device that is easily transported. Looms, however, vary in weight and construction and the different types of looms in the archaeological record vary in portability. The simplest backstrap looms with tension controlled by the weaver's feet are transportable, as are elaborations of the same where the warps are attached to wooden poles and verandah posts. The upright Cambodian and Cham looms of the historical period are permanent structures, which would not have been easily transported or re-assembled, undoubtedly developed by settled agriculturalists.

A typology of prehistoric bark cloth beaters was developed (Fig.10.4) for the study. The research showed that bark cloth was produced in Southeast Asia during the Early Neolithic period, long before the technology diffused into the Pacific. Previous reconstructions of bark cloth prehistory were based on the premise that bark cloth and textile technology were inextricably linked and initially developed together in Southeast Asia. However, the data shows a more complicated pattern. The earliest layers of some of the earliest bark cloth production sites such as Xiantouling did not produce evidence for textile technology and some bark cloth sites in Vietnam did not produce any evidence for spinning whatsoever. Notwithstanding this, bark cloth beaters have been found at sites in the autonomous textile zone. One possible conclusion is that not all bark cloth producing groups had knowledge of textile technology but all textile-producing groups had knowledge of bark cloth production. More research is obviously needed to establish this proposition.

As words generally survive longer than prehistoric tools, linguistic data are pertinent. One problem at issue in this dissertation is how evidence for the dispersal of textile technology into Southeast Asia during the prehistoric period fits into theories about the dispersal of languages. It is a difficult question as the data for spinning and weaving identified in the study transcends contemporary language barriers. The distribution map of textile sites shows the technology dispersed from an origin centre in Southeast China, bifurcating across the Taiwan Straits into Taiwan and some parts of Island Southeast Asia as well as moving down the coastline into Vietnam, across the Laos, Cambodia and Northeast Thailand. Problems arise because the prehistoric groups with these diagnostic textile tools on the mainland are linked to the Austro-Asiatic language whereas those with the same diagnostic tools in Taiwan and the Philippines are linked to the Austronesian language (see Blust 1993, 1999; Bellwood 1979; 1985; 1996). How might this be explained? The study adds credence to the proposition first put forward by the Austrian linguist, Schmidt (1906) that the Austronesian and Austro-Asiatic languages share a common ancestor, the Austric phylum. Blust (1976, 1985, 1993) and Reid (1993) also see the Austronesian languages derived from a single source in Southeast China. Although the diagnostic spinning tools identified in the study belong to the Late Neolithic period when the proto-Austronesian languages had separated from proto-Austric, the technology was invented in the autonomous zone much earlier.

It is also conceivable that the spinners and weavers described in the study were not Austronesian speakers at all but Chinese. Some scholars have suggested that the prehistoric groups in the Yangzi had Chinese. This might explain the strong correlation between the artefacts placed in prehistoric burials in Southeast Asia and artefacts prescribed for Chinese burials discussed earlier.

One of the principal aims of this research was to engender Southeast Asian archaeology by showing a firm relationship between textile production and women. Gender is one of the most elusive concepts in archaeology and very little systematic work on the archaeological study of gender has been undertaken in Southeast Asian archaeology. Reconstructions about the role of women in prehistoric societies are invariably influenced by women's role in contemporary societies and cloth production tools seemed worth investigating, particularly as cloth production is women's work in Southeast Asia. In traditional societies, the cosmos is perceived in terms of dualism and as products of women's labour, textiles are perceived as tangible elements of the female elements of the bipartite universe (Maxwell 1990:156). This relationship is expressed at rites of passage ceremonies where textiles are given to represent the female element (Maxwell 1990:93).

Anthropological studies of cloth showed that textile tools are also used in Southeast Asia to express the notion of cosmic dualism. When an Iban child is in the womb, s/he is asked to determine their sex. If the unborn chooses a knife, he is born male; if the unborn chooses a textile implement, she is born female (Gill 1968; Vogelsanger 1979). In Vietnam, the Tai express the role of textile technology in cosmic dualism in a ceremony conducted three days after the birth of a child. A ceremony is conducted about 20 m from the residence and, depending on the sex of the child, involves a basket or a weaving shuttle for a girl and a knife or gun for a boy. Prayers are offered to the gods and spirits in the hope that the boy will become a good hunter and the girl a good weaver (Tien Dung 1997:464). These rituals suggest that cosmic dualism dates back to the prehistoric period in Southeast Asia but paradoxically, this investigation failed to show that cloth production tools belonged exclusively to female graves. Although whorls were frequently found in sexed female burials, this was not a universal pattern. Women were buried with spindle whorls at sites in the Yangzi Valley. At Beiyinyangying, for example, the pattern was observed in burials dating from the Neolithic through to the dynastic period. The same pattern was also observed at Tanshishan sites. Archaeologists from the Guangxi Museum (Guangxi Archaeology Team 1978) also observed that whorls and swords never appeared together in graves and although none of the excavated burials were sexed, they concluded that the whorls belonged to female burials and swords to male burials. The data from the tombs of the King of Yueh also showed women involved in cloth production. But whorls were associated with sexed male burials at Iron Age sites in the Mun River Valley and this anomaly has yet to be explained (Higham pers. comm.).

One possible explanation for this anomaly explored in this study was that males buried with female tools at Metal Age sites in Thailand were slaves employed in handicraft workshops. In the *zhongyuan*, slaves were part of the wealth of merchants and as the demand for cloth increased, slaves were used in textile workshops; some expert spinners and weavers were enslaved by the Chinese as prisoners of war; some skilled workers were themselves traded. From several hundred thousand to a million slaves were employed in China at the height of the luxury of the Han Dynasty (Wilbur 1943). However, this explanation is not plausible for Thailand. The males buried with whorls were also richly adorned with bronzes, glass beads, bronze belts and fine pottery vessels. They were also interred in what appear to be family groups.

Unanswered questions and suggestions for further research

This first attempt to identify and cumulate data for spinning and weaving distributed throughout archaeological sites in mainland and island Southeast Asia is only a beginning and many unanswered questions remain. One fundamental question remains. Why did spinners and weavers move out into Southeast Asia during the prehistoric period? The most logical explanation for the movement of these technologically advanced groups proposed here is displacement. There is some evidence to suggest that the spinners and weavers identified in the study slowly moved out from the Yangzi Valley and southeast China into other parts of Southeast Asia around the same time that groups from the *zhongyuan* expanded into South China. This displacement was probably caused by environmental factors. Ancient Chinese documents attest to marked climatic differences between the northern and southern zones and that groups in the north often suffered from droughts and food shortages whereas groups from the sub-tropical south with wet-rice agriculture were never hungry.

Although a new database has been created, it has not been possible during the period of candidature to analyze all of the artefacts identified in the study and do justice to all of the data. Consequently, some interpretations are quite superficial given the significance of some of the evidence to textile history. Each surviving piece of evidence warrants detailed analysis.

While some areas of Southeast Asia are well represented, there are some gaps in the archaeological record. For example, Myanmar was only briefly mentioned in the study (Chapter 9) primarily because little has been published on archaeological research in this region. While research has firmly established the presence of Palaeolithic groups in the Irrawaddy Valley, the Neolithic is "virtually: unknown" and the only synthesis of the prehistoric and proto-historic periods (Stargardt 1990) has been seriously questioned. New insights into the prehistoric period are expected when the proceedings of the 1999 workshop on the Bronze Age culture of Nyuanggan are published but at the time of writing, too little archaeological data were available to address the origin question properly.

It is also imperative to undertake further research into the archaeological evidence for cloth production in India. A number of Indian tools were identified during the study but as no systematic research has been undertaken into Indian nor Pakistani textile technology, more data remain to be identified and analysed. While Indian data is not pertinent to the general hypothesis concerning the origins of Southeast Asian textile technology, it is relevant to the interpretation of data from early historical sites. Further research into Indian cloth production tools is planned, specifically prehistoric dye vats and small ambiguous discs recovered with cotton fragments from Harappan sites.

Time did not permit the analysis of cord impressions on pottery. Analysis of cord and mat impressions on Hoabinhian pottery sherds, as well as fabric impressions on Neolithic and Metal Age pottery remains to be done. The methodology developed by Sugao Yamanouchi (1964) to analyze Jomon pottery seems worth adopting for cord marked sherds from Spirit Cave, Laaeng Spean, Padahlin and Hoa Binh.

As with all taxonomies, some artefacts in the archaeological record were ambiguous and further research is intended into a number of pottery discs of unknown function from sites in island Southeast Asia and Melanesia. These include re-worked pottery sherds from the island of Fiji as well as perforated shell discs from New Guinea and Timor. Further research is also planned into some of the very small (<3 cm in diameter) pottery discs which were excavated at some prehistoric sites (Sa Huynh, Chansen, Ban Don Ta Phet) in Thailand and Myanmar (Beikthano) as studies of prehistoric textile production in Mexico have shown the usage of exceptionally small round pottery whorls to spin cotton. Given Thailand's close proximity to the origin centre for some species of *Gossypium*, these discs need to be closely examined for use-wear marks.

Further research into fibre processing in northeast Thailand is suggested. The moats surrounding Iron Age sites in the Mun River Valley may have been used for fibre processing as carried out in the *zhongyuan* but this function has yet to be established. The question is important to textile history. If the moats surrounding Iron Age sites in northeast Thailand were used for retting, then much more time was invested in cloth production than is indicated by the textile tools. Identification of hemp and ramie from the retting process may be possible by coring selected areas of the moats and phytolith analysis.

It was impossible during the course of the candidature to determine the function of the fibres spun by the whorls. The lightest whorls were probably used to spin thread for textile purposes with heavier whorls used to spin thicker, coarser and stronger fibres for rope. We know from Chinese sources that cloth and woven matting were used for sails from the dynastic period onwards. Given the importance of maritime technology in the early expansion into the Indo-Pacific region, further ethno-botanical research is proposed into the usage of bast fibres for sails and rigging.

One of the textiles featured in Chiraporn Aranyanak's (1991:72) book of Thai prehistoric textiles deserves further research. The textile in question is an unusual beaded textile from Thanon Thongchai located in Tak Province, (near Myanmar). The beads in the archaeological textile from Thanon Thongchai are strung onto the wefts prior to weaving. While beads are often sewn onto textiles, they are rarely woven into the fabric structure. Archaeological textiles of this type have only been reported at two sites. Examples were found in the tomb of Tutankhamon (Carter and Mace 1923; Riefstahl 1944; Barber 1991) and at the archaeological site known as Kerma, which is located on the Nile, several kilometers south of the third cataract in Sudanese Nubia. There, excavators found more than 3800 beads in one grave, some of which had been "sewn to cloth or woven into it" (Reisner 1923: 103-104, 300, 303, plate 63.1). The weft was worked in some undescribed way to produce a lozenge pattern" (Barber 1991:155).

The social implications of prehistoric cloth production and craft specialization in Southeast Asia warrant further research. Scholars are generally agreed that there is a relationship between modes of production and social development. The topic is important in prehistory because economic specialization is held to be a concomitant of large, complex societies. Childe (1952) established this correlation in European prehistory by showing the important role craft played in articulating social division and propelling societies into the trajectories that followed between the 2nd and 3rd millennium BC. In the *zhongyuan*, craft specialization is linked to metallurgy. Despite firm archaeological evidence for craft specialization (metallurgy) and stratification in Bronze Age burials in Southeast Asia (Higham 1989, 1996), a number of scholars have maintained that the archaeological evidence for craft specialization at Southeast Asian sites does not fit the European model. Based on material evidence for metallurgy from Bronze Age sites in northeast Thailand, Muhly (1988), White and Piggott (1996) and O'Reilly (2000) have argued that complex societies first appear in the archaeological record with the introduction of iron, ca. 500 BC, long after specialization occurred. While Vietnamese archaeologists have not contributed directly to this discussion, recent excavations have produced new evidence for craft specialization during the Bronze Age that challenge previous interpretations. Nguyen Kim Dung (1990, 1996) identified Bronze Age workshops for manufacturing stone ornaments in the Red River and Dao Linh Con and Nguyen Duy Ty (1993) identified a specialist Bronze Age site in the Dong Nai Valley with firm evidence for both bronze and cloth production. The site, Doc Chua, produced the largest number of tools used in cloth production found at any Southeast Asian site. My analysis of the whorls showed standardization of the type generally associated with mass production. The underlying principle in this inferential process is that highly standardized tools indicate that intensified production by craftspersons using a limited range of materials (fibres) and techniques. Is Doc Chua a single specialized site or did craft specialization and cloth production extend beyond the village level to the regional level in this area before the generally recognized trade of the historical period? Further research into the scope of cloth production in the lower Mekong during the late prehistoric period is proposed to place textile production within the more general process of economic differentiation and the development of complex societies.

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