From Tower to Pagoda: Structural and Technological Transition

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This study is concerned with towers in an effort to articulate relationships between the early towers and multi-storeyed pagodas (*ta*) that flourished in China after Buddhism was introduced from India. The pagoda is a type of spiritual, monumental and high-tech architecture of the period from the late Eastern Han (AD 25 - 220) until the Qing dynasty (1644 - 1911) in China. In terms of architecture, represented by the Yingxian Wooden Pagoda (1056), the pagoda is essentially a storeyed tower, and each storey is a separate building consisting of all structural components.

Functioning as a Buddhist icon, the pagoda distinguished China from India. Archaeological evidence reveals that tower architecture pre-existed pagodas, and Chinese architectural historians have proposed that Buddhist pagodas adapted indigenous towers in China. The claim has been regarded as true, although chiefly conceptual. To date, a measure for principles, methods and techniques has not been developed and much scholarship has been devoted to the identification of events and styles. Thus the relationships between towers and pagodas remain obscure.

This study will test the proposition that Buddhist pagodas adapted indigenous Chineese towers, by analysing typology and technology to identify how the early pagodas were linked to their supposed tower predecessors. A comparative approach will constitute a methodological framework to study information obtained from architecture, archaeology and literature. Archaeological evidence will be used to help complete the architectural picture in two situations. First, where no building survived from ancient time, but there is a wealth of pottery models and visual representations on bricks, stones and walls which are pertinent documents. Second, where we have reason to believe or justify the essential continuity in building types and structural features in archaeological records and architectural evidence. An interdisciplinary approach will help discourse on issues confronting technological systems of multi-storeyed architecture in early China.

Textual Source: Terminology

There were a number of terms to describe multi-storeyed buildings in ancient China, i.e., *guan, xie, que, lou* and *ge*. They were all recorded in the *Shuowen Jiezi* (Analytical Dictionary of Characters, the first dictionary as such, compiled between 100 and 121), as storeyed buildings were favoured by the elite of the Han dynasty. In general, they were clearly distinct from one another during the Western Han period (206 BC - AD 8), but began to fuse soon after it. Technologically, the early form of *guan* was a high platform (*tai*) constructed for observation, usually made of rammed earth; the term refers to both the action and structure. The *xie* was a wooden framed building on a *tai*, which involved combined techniques of the rammed-earth platform and a timber-framed structure. It was called *que*: if two *xie* flanked a gateway, they functioned as watchtowers. *Lou* was a storeyed building. For the *ge*, scholars have provided at least eight interpretations according to different texts and periods.[1] We must understand the meaning of the term used throughout history. In the early texts, the *ge* was an elevated wooden structure that connected individual buildings or places, or as covered path on hills. In the Han dynasty, *ge* meant *lou*, and vice versa. In later times, such as the Ming dynasty (1368-1628), the *xie* referred to an open structure in a garden or landscape, from then on the *xie* and *ting* became more or less synonyms.[2] The *ting* is a pavilion recorded in the fifth century.[3]

From the Eastern Han until the Tang dynasty (618-907), Buddhist doctrines were all translated into Chinese. Many terms were transliterated into Chinese according to pronunciation. The Chinese *cutupo*

was a transliteration of the Sanskrit 'stupa' and/or the Sinhalese 'dagoba'. The stupa, originally a burial mound, is a funeral monument erected to enshrine relics (*sarira*) of the Buddha.[4] The most famous one is at Sanchi, Central India (third century BC to first century AD). It consists of three parts: a base, body and finial. The body is a masonry hemisphere of considerable mass and solidity, sitting on a terraced base and topped with a finial. The finial symbolises axletree - a pole going through three flattened circular umbrellas.[5] The three tiers of umbrellas represent the three stages of the Buddha towards the enlightenment. Religions such as Buddhism were not indigenous to China where only various types of ancestral and natural worship existed as ceremonial rituals (Figure 1). When Buddhism reached China, the Chinese extended their feelings of respect and admiration for ancestors and natural powers to the Buddha, whilst retaining the ceremonial rituals in such buildings including shrines (*ci*) and tombs (*fen*). Buddhism itself, on the other hand, had extended interpretations to accommodate Chinese moral forms and philosophy. The Buddhist religion was assimilated into Chinese culture and Buddhist temples adapted Chinese architecture, coming to characterise the Buddhism of China. Pagoda or *ta* represents this cultural phenomenon.
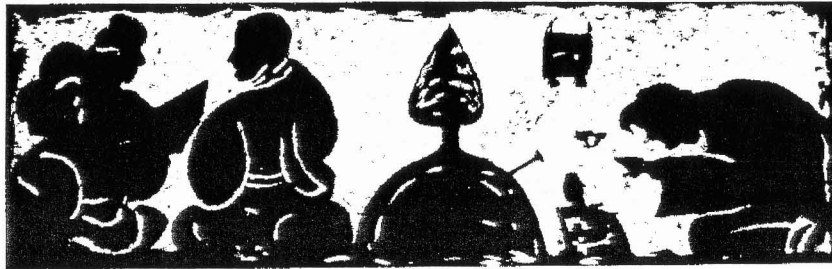

Figure. 1 Burial mound and ancestral worship depicted in stone art, ink rubbing, 2d half of the 2d century AD. Excavated in 1978 at Songshan, Jiaxiang, Shandong province.

The *ta* was recorded in a dictionary of the fourth century,[6] which was the earliest appearance of this character. The earlier synonyms of *ta* were *futu* or *fotu* and *tapo* and appeared in the Buddhist vocabulary in the documents of the Eastern Han.[7] There is a Sanskrit word, *tada*, which is used to mean mountain in yoga practice. Actually, *tada* is a tree trunk rather than a mountain, but the meaning is similar in that the posture (*tadasana*) is upright. It would be reasonable to assume that *ta* and *tada* were related, although there is no conclusive proof. Chinese terminology of Buddhist architecture did not reach consensus until temple architecture achieved its maturity. The earliest record of pagodas was about Futu Ci (literally, 'the shrine of pagoda') constructed between 190 and 193 in Xuzhou. Like all timber structures built in ancient China, early wooden pagodas have long since disappeared. According to the descriptions, Futu Ci was a multi-storeyed wooden tower surmounted by nine bright golden metal discs. Centrally positioned, the pagoda was surrounded by buildings and walkways. The compound was large enough for a ceremony with 3000 participants taking part.[8] The character *ta* consists of two elements: on the left is a symbol of earth, on the right a symbol of grass above and a covered space below. These elements signify the essentials of a tomb. In Korea and Japan, it is called *tap* and *toba*, respectively, which still retain the early Chinese names for *ta*.[9] It was translated into European languages as pagoda, which was adopted from the Portuguese version derived from Persian or Hindi.[10]

Architectural Records: Classification Techniques

Textual records describing building techniques in early periods were rare and occasional. The oldest

still in existence, and the best-recorded book on building, is the *Yingzao Fashi* (State Building Manual, 1103) written a thousand years after the Han period. The version we see nowadays was first reprinted in the 1920s, and the book has been an indispensable tool for architectural investigations and interpretations ever since.

The importance of the book goes beyond the factual record. It documents terminology and provides identification for methods and techniques used in the Song dynasty (960-1279). It reveals an overwhelming importance of *diantang* and *tingtang* structures, *pingzuo*, *chanzhu zao* and *chazhu zao* constructions. The *diantang* is a type of timber structure consisting of a uni-height column network, a bracketing unit (*puzuo*) and a roof frame, one placed on top the other, and arranged in certain patterns. The *tingtang* is formed by parallel transverse frameworks connected by longitudinal purlins and ties, available in many configurations. The *pingzuo* is an elevated piled flooring system (Figure 2-A),[11] upon which a wooden building stands (Figure 2-B). This way of building can be traced back to the Western Han or earlier and, historically speaking, it initiated a type of storeyed architecture. The *chanzhu zao* and *chazhu zao* are two main technical means of building multi-storeyed buildings. The former is a method whereby columns of the upper storey are set back from columns of the lower storey, and the corner column is supported by three capital blocks at each corner. The latter means, *chazhu zao*, is a method whereby the columns of the upper and the lower storeys are true vertical with connecting bracket sets, and the column of the upper storey is inserted into the bracket set as far down as the capital block.
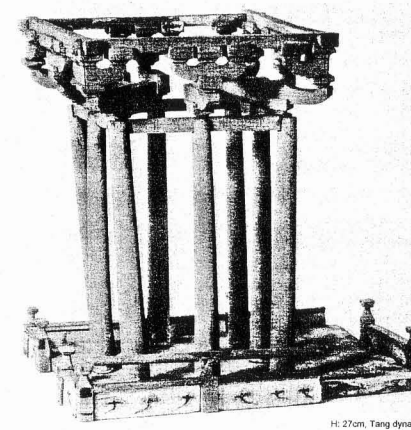

Figure 2A. Wooden model of pingzuo, 7th century. Excavated in 1973 from no. 206 tomb, A'sitana, Xinjiang.

Figure 2B. House on pingzuo, Japanese painting Adventures of Kibi in (Tang) China (detail), 12th century.

However, modern interpretations of the traditional structures are still problematic, for example about the *chanzhu zao*. In the author's opinion, the confusion has been caused by different understandings of the historical text. The work of past scholarship was restricted to limited architectural information and lacked a contextual and comprehensive inventory. It is important that architectural historians shift their focus to all related sources. Only then can we discuss the early history of Chinese multi-storeyed architecture and explain the historical relationships between tower and pagoda.

These are the first tasks of this study: whether the methods and techniques recorded in the *Yingzao Fashi* can be identified with archaeological data and existent pagodas? Are there any links between the

two distinguished bodies of material evidence. Do the two support such links? These questions will be dealt with in the following pages.

Archaeological Material: The Tower

A large number of funerary objects of the Han dynasty were earthenware model buildings including pottery towers. Most of them have been excavated in Luoyang, the region of the Eastern Han capital and the adjacent areas.[12] The pottery towers, dating from the period from the late Western Han to the end of the Eastern Han, reveal various building practices of the day. This study, therefore, relies to some extent on these architectural representations, of which only a few have been studied in reasonable detail.[13]

Fortified Homesteads

A courtyard manor house excavated from tomb number 6 at Jiaozuo, dating to the mid-Eastern Han period, is remarkable for its complexity and size.[14] The complex is composed of several storeyed buildings: a main building, two gate-towers and a watchtower (Figure 3-A). The tallest one is the main building; flanking the gateway of the courtyard is a gate tower on each side; the building outside the courtyard is the watchtower connected to the main building by a *ge*. The main building is a multi-storeyed structure with four roofs, raised on a base with an exterior stairway designed for access from the courtyard to the front balcony of the first level. Each roofed storey, except the top one, is supported by a base-like storey which suggests similarities to the *pingzuo* structure recorded in the *Yingzao Fashi*, and each *pingzuo* has a balcony. The building consists of a series of alternating 'pingzuo' and 'storey'. Technologically, the upper storeys were realised by repeating the storey and its *pingzuo*. We may contend that the *pingzuo* is not dictated by technological preference alone; it increases the height of the building.

Another good example is a glazed courtyard house (Figure 3-B).[15] It appears very different from the previous one, though they share basic architectural elements: storeyed main building, enclosed wall and watchtowers. The main building is situated in the centre of the compound, surrounded by walls that carry

elevated watchtowers at the corners. The watchtowers are interconnected by elevated walkways (*ge*). The compound has a square plan within which are partition walls dividing the plan into several sections. Such fortified large homesteads with tower-like buildings inside were rare in tombs of the earlier Western Han, but very popular throughout the Eastern Han. The Eastern Han appears to have been the golden age of storeyed architecture in Chinese history, which suggests a period of increased building technology and material wealth.

It is notable that storeyed buildings (*lou*), gate-towers (*que*) and watchtowers (*wanglou*) co-existed as three different types of buildings in the Han dynasty, and each had a specialised function. There are reasons to question whether they were original models of the pagoda, and what precise relationships existed between them if they were so. Scholars questioned the archetype of the pagoda, but no view has been stated, and perhaps none clearly seen.[16] The study below will discuss the storeyed buildings, gate-towers and watchtowers independently in their own terms before coming back to answer these questions.

Storeyed Buildings: Earth-timber Dual Character

A remarkable early example of multi-storeyed buildings was excavated from a tomb at Weihe near Zhengzhou.[17] The building is a grandiose one with five roofs. It consists of two parts: the lower part is a double-storeyed base, and the upper a five-storeyed building. The front and back of the base are designed differently: a double-storeyed veranda in front and two stairways at the rear (sheltered by a hip roof of two-storey height incised on the rear wall). A very important feature is that the sizes and heights of the storeys gradually diminish towards the top; only the first storey has lattice windows suggested by parallelograms pierced with holes (Figure 4-A). The building is regarded by archaeologists as a storehouse for grain.
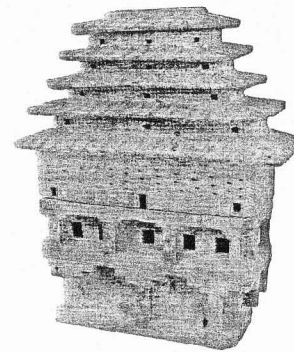
Figure 4 A. Storeyed building, mid-W. - early E. Han. Excavated in 1953 at Weihe, Xingyang, Henan. Height: 72cm; Length: 43cm (bottom); Width: 18cm (middle).

Figure 4 B. Storeyed building, in pictorial stone art, Eastern Han. Excavated in 1986 at liguo in xuzhou. 92x92cm.
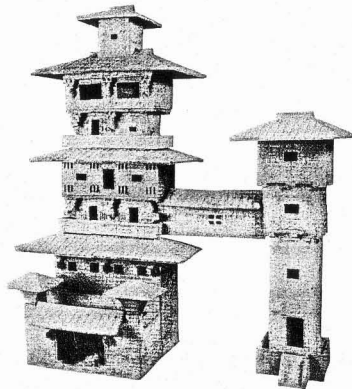

Figure 3 A. Painted pottery model of a fortified manor, mid-Eastern Han. Excavated in 1993 at Jiaozuo, Henan province. Height: 192cm (main building).
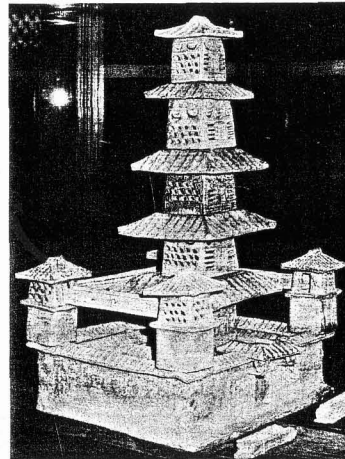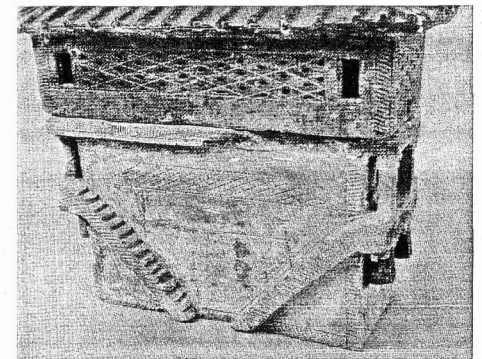
Figure 3 B. Glazed pottery model of a courtyard house, Eastern Han. Excavated in 1969 at Leitai, Wuwei, Gansu. Height: 105cm.

The pottery towers, together with other architectural representations, reveal that building materials used in the Han dynasty were earth, timber and masonry including tiles. This fact was corroborated by archaeological excavations which took place on many historical building sites. The construction methods and techniques revealed by the excavations were rammed earth and timber framing. When constructing a tall building, a rammed-earthen platform of considerable height was first made, upon and around which timber-framed buildings (and/or verandas) were then nestled. That is to say, technological problems of

constructing tall buildings were solved by providing a stepped earthen core to support timber frameworks. Such a technique was used as the earliest attempt to gain height; high-platform architecture has been found elsewhere in the Yellow River valley where the primary centre of the Han period was located. Architectural images impressed on bricks, incised on stones, and depicted on walls in Han tombs provide us with more information about them (Figure 4-B).[18] High-platform architecture was employed to house all activities, including those for domestic, ceremonial, pleasure and defensive purposes.

Gate-towers

The gate-tower (*que*) was erected on either side of a gateway to a walled city, or an enclosed domain for royalty, nobility, or officials (Figure 5-A). They were faithfully copied in funerary precincts as stone gate-towers survived from the Han dynasty, chiefly in the Sichuan province.[19] They demonstrate that the stone towers are all translations of conventional wooden ones. The Gaoyi-que is one of them: its lower part is a column-network (2x1 bay in plan), while the upper part is a pavilion (Figure 5-B).

History shows that the gate-tower was treated as a type of ritual (*Li*) architecture. Before the Qin dynasty (Qin 221-207 BC), it was only used by royalty and the aristocracy. A passage from *Chunqiu Gongyang Zhuan* records the importance of the *que* (or *guan*): the number of *que* is two for the king and one for the nobility or grand officials.[20] The *que* functioned to guard the homestead and to indicate the political status of the household. The individual families were linked to a large social network through a *que* culture.

The gate-tower has two distinctive characteristics. First, it is a timber-framed pavilion (*xie*). Second, the pavilion is built on high walls. If there is no wall, such as in funerary parks, two smaller *que* are constructed next to the gate-towers to symbolise walls. The gate-towers made throughout the Han are characterised by a marked regionalism conditioned by materials. The material is a conditioning factor in the construction techniques adopted and the building appearances thus created. For example, it is obvious that the lower part of the gate-tower in Figure 5-C is made of earth - broader at the bottom than at the top, which is the technical nature of the rammed-earth construction process. Architectural appearance reflects construction techniques which in turn are determined by building materials.

Figure 5 A. Painted pottery tomb model of a fortified house (detail), mid-Eastern Han. Excavated at Jiaozuo. Width: 53cm, Depth: 55cm.

Figure 5 B. Stone tower, c. 210s, in front of the grave of Gao Yi in Ya'an, Sichuan province.
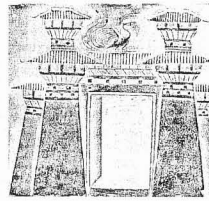
Figure 5 C. 'Phoenix' Gate, pictorial brick, Eastern Han. Excavated in 1975 in Chengdu, Sichuan. Height. 46cm. Width. 41cm.

Watchtowers

The watchtower was built to afford a wide view and a high position for security. It shared basic architectural features and construction techniques with the gate-tower. The chief difference is that the watchtower was a freestanding building within a compound, and was elevated by an earth-timber structure, or a system of wooden piles, or masonry structure.

Its basic features can be discerned, for instance, from a pictorial brick unearthed in Chengdu, Sichuan province. Figure 6-A shows a courtyard compound: at the upper right of the picture is a square building of four levels, in which a flight of stairs visible through the open doorway on the ground level changes direction on the second level. The third and fourth levels are major floors, each supported by joists spanning in both directions. On the third floor there are two openings: the one on the front elevation being bigger and the one towards the outside of the compound being smaller. The top storey is protected by a tiled roof with overhanging eaves. In order to support the eaves, block-and-bracket sets are huge in size and columns lean outwards. Building material and construction techniques both contribute to architectural outcomes: the lower part of the tower has an inclined outline from base up reflecting the reinforced earthwork, and the upper part is a timber-framed house.
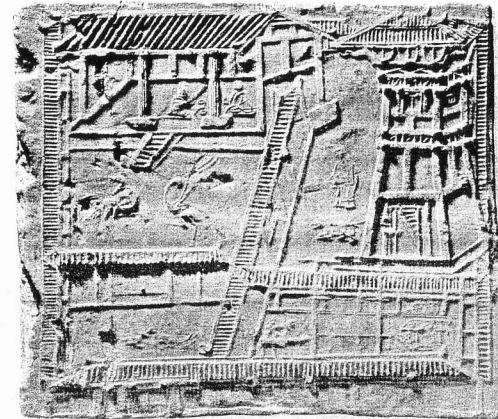

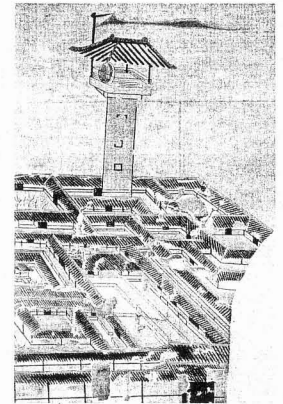*Figure 6-A. Pictorial brick, Han dynasty. Excavated in Chendu, Sichuan. province. 48x41cm.*

Figure 6-B. Watchtower depicted in the wall painting of a Han tomb, ad 176, at An'ping, Hebei province.

Figure 6-B is a wall painting in a Han tomb. It shows a five-storeyed tower in a courtyard compound near the compound wall, with a drum hanging in the top wooden pavilion.[21] This study takes the view that the tower probably functioned as a watch-drum tower. The painting suggests that the lower part of the tower, which is vertical, may be made of bricks. The manufacture of bricks and roof tiles was an important aspect of the Han dynasty building industry, and bricks were used in constructing all types of buildings, including dwellings, granaries and wells for water.[22] Tall towers with timber-framing-and-brick-walls and overhanging tiled roofs were fashionable in the Han period. The tower in the manor of the Confucian family in Qufu, Confucius' home town, shows the late application of such architecture. In the above examples, there are no gate-towers of *Li* architecture, which reveals that the watchtower was a type of functional architecture, more widely used than the gate-towers.

In addition to all the tower buildings discussed above, there existed another tradition: the wooden pavilion tower. Archaeological data reveal that the pavilion culture was contemporary with all counterparts in the Han dynasty.

Pavilion Towers: Emblematic and Pleasure Dualism

The architectural appearance and setting of the pavilion tower are entirely different from any of the previous types, as demonstrated by a discovery from a Han tomb at Songwanhe, Xichuan, Henan province. It is an open pavilion with three roofs. Circular in plan, the pavilion fronts to all directions, rising from a basin representing an island within a lake, stocked with fish, eels, frogs, etc. (Figure 7-A). The main feature of the pavilion is that it appears to be wall-less, or to have large openings. The overall design seems to have created a microcosm of paradise.

Two more pavilion towers can serve as examples to demonstrate different construction techniques practised in the Han dynasty. Both are from the Henan province, one being unearthed from number 4 tomb at Liujiaqu, Sanmenxia (Figure 7-B), and the other in Huaiyang (Figure 7-C).[23] They both have roofs and balconies appearing on three storeys without walls. One of the main purposes of the towers is to observe, and balconies provide stands for distant views. Structurally, the two buildings are quite different. The first one comprises two superimposed square pavilions, one placed upon another on a base structure. The base structure belongs to the *pingzuo* lineage. In the second tower, the *pingzuo* occurs between storeys. Figure 8 shows typological structural features of storeyed architecture exhibited by pottery towers of the Han period, and the author's reading of their character is given together with the images.

Figure 7 A (1) Model of waterside pavilion with figures, Eastern Han. Excavated at Songwanhe, Xichuan. Height: 53cm, Diameter 43cm.
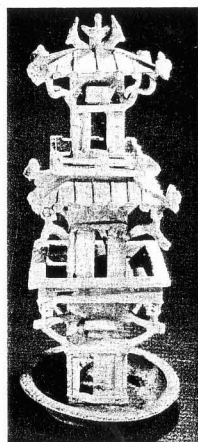
Figure 7 B. Pavilion tower, 2d half of Eastern Han. Excavated in 1987 from no. 4 tomb, Liujiaqu, Sanmenxia. Height: 107cm, Diameter 45cm.
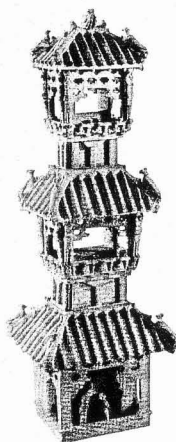
Figure 7 C. Pavilion tower with its basin lost, late Eastern Han. Collected in 1954 at Niunuzhong, Huiyang. Height: 144cm, Width: 43cm, Length: 47cm.

Many pottery models discovered in ancient tombs show the overwhelming importance of pavilion towers during the Han dynasty. Archaeologists have interpreted them as venues for greeting immortals or for entertainment. The distinction between towers for greeting immortals and towers for entertainment

is not attested by written records. Their exact names are still a matter for speculation. In the Han dynasty, entertainments (*baixi*) included music, dance, acrobatics and recitation by storytellers. The term *baixi* appeared in the *Hou Han Shu* (History of the Later Han).[24] The architecture, evolved from the *xie*, retains the *xie* character. According to the *Shi Ji* (Records of the Historian, Juan 12: Emperor Wu Di), the '*xie*' was first built in an imperial park resort, and the royal example was imitated by people throughout the country.
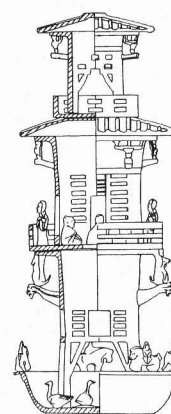

Figure 8 A. Section of a pottery tower unearthed at Liujiaqu, Shaanxian. The structure on the ground is a pingzuo, upon which two buildings are erected. The construction technique used between the pingzuo and the building upon it is chazhu zao.

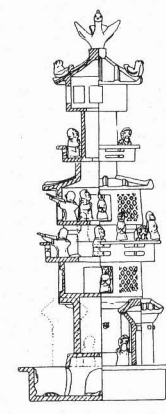*Figure 8 B. Pottery tower unearthed in 1955 at Liujiaqu, Shaanxian. Each storey is supported by a base structure (pingzuo) that is a spatial level with functional balconies.*
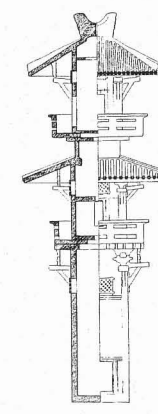
Figure 8 C. Pottery tower unearthed at Yangyuan, Hebei. The vertical walls reveal that the tower is made of bricks, but its bracket sets and base structure under the top storey speak the language of wooden architecture.
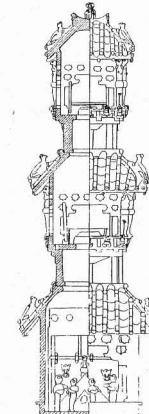
Figure 8 D. Section of Fig. 7C. The pingzuo between storeys is hidden, without overhanging balconies.

The tower, as the tallest building, is a landmark of the elite realm of paradise, to which the immortals would come. Usually square in plan, the building faces all four points of the compass; all facades are identical and all are front elevations. Stood in isolation in water, the tower reaches high into the clouds, and the tower only communicates with the sky. It visualises an intermediate stage between the supernatural and reality, thus linking man and divinities. All pavilion towers are more or less elaborate cosmological symbols reflecting Chinese concepts of the universe.

A series of symbolic themes appear in pavilion towers, such as birds or phoenix perching on roof ridges, and decorative leaves on ridge ends. Appearing to reproduce naturalistic representations, the birds are emblematic of the immortality gained by being able to fly into the sky. The pavilion symbolically functions in two ways: it would invite immortals down from high above on the one hand, and man could

fly off on a bird on the other. The bird theme which originated in the Han, had been popular throughout history; it can still be seen in important historical buildings as an ornamental design, called *xianren zoushou* (heavenly creatures) in late imperial China. It lined in rows on hip-ridges, with the first one at a corner being an immortal riding on a phoenix (Figure 9). It is fair to say that architecture cannot be fully explicated without understanding historical relationships between architecture, art and belief.
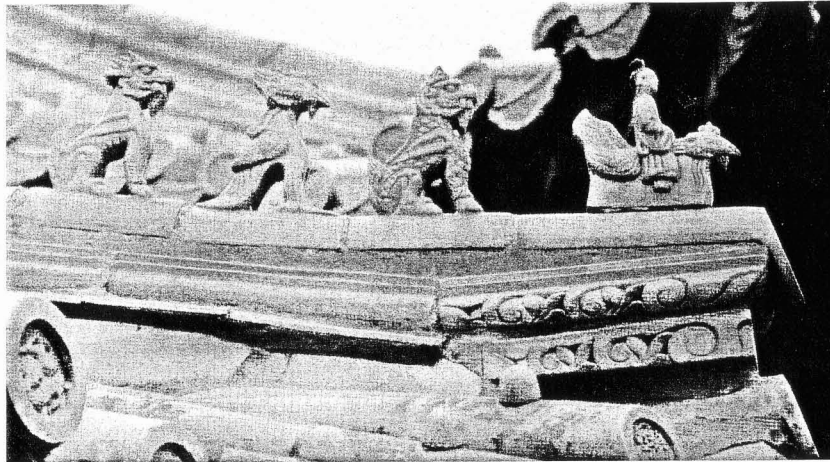

Figure 9. Heavenly creatures (xianren zoushou), Summer Palace, Qing dynasty, Beijing

All pavilion towers are open timber structures with interior spaces used for many pleasure or ritual activities. Taking Figure 7-C as an example, there is a big bed for rest on each of the upper storeys. Archaeological data of the Han dynasty provide no evidence of the existence of any structure in the centre of the pavilion tower. This type of tower seems to suggest an independent origin. Some scholars have tried to propose that wooden pavilions were popular in southern China, but not commonly seen in the north until the Tang period.[25] The earth-timber technique has been considered a long-standing technology in the north, and the wooden building in the south. To question this theory is largely beyond the scope of this study, but certain comments can be made. Both techniques of earth-timber and wooden building appeared in archaeological records in the entire Yellow River valley, and beyond the region in the Yangtze River valley during the Han period. This study suggests that the occurrence of the two basic construction methods was the direct result of environmental determinants, rich natural materials available in the region. Towards cultural unification, the Han was a unified state where various materials were available and different building techniques were intermingled and new architectural types were generated.

From Tower to Pagoda

The construction of towers persisted in China for a long period before any pagodas appeared. Buddhism was adopted by the Chinese at large by means of worshipping the Buddha. When the Chinese immortal soul joined the Buddhist spirit, the tower as an imposing architecture was transplanted to the pagoda, most likely pavilion towers in the late Eastern Han. For several reasons the pavilion tower was

considered to denote the Buddha: first, for its symbolic nature; second, for its cosmic form; third, for its landmark quality, and fourth, for its social function as a place for admiring the landscape. It had been customary to climb mountains for views since ancient times, and this evolved into a festival in the Eastern Han.[26] It is logical that tall buildings found favour among people as vantage points looking over an area. The towers developed to a great extent and the pagoda was one of them. The pagoda appears as a tower since it was made by fundamentally altering the function of the tower. From the view of architectural history, the pavilion tower initiated a major architectural principle for constructing Chinese pagodas. All pagodas are different, but there is a common feature which is a miniature stupa on top of the roof. It is reasonable to surmise that the pagoda was created by decorating the Chinese tower with an Indian stupa on the roof as a religious symbolic icon. That is to say, to demonstrate the new iconological identity, the tower was crowned with a miniature stupa as finial, instead of a phoenix. No architectural evidence of the transition has survived, but abundant archaeological objects and related textual records seem to lead to this assumption. One character of Chinese architecture is interchangeable function, which has long been recognised among architectural historians.

The symbolism of pavilion towers transformed from immortality to Buddhism led to the emergence of a new type of architecture: the multi-storeyed pagoda. That is to say, the mini-stupa of Indian origin as a finial brought the multi-storeyed tower a more dignified appearance, and the Buddha's relics (*sarira*) gave meaning and sacredness to the building. The location of the Buddha's relics is one of the points that this study wants to make. In China, the Buddha's relics have been found both in foundations of pagodas and in bases of finials, which confirms that the finial was essentially a stupa.[27] The finial is called *cha*, and is composed of a long central pole passing through a number of discs (maximum 13), an umbrella and other symbolic elements to symbolize the (highest) Buddhist heaven. The platform, called *xumi zuo* (literally 'sumeru podium'), represents the earth. In the Buddhist belief, *xumi* is a mountain at the centre of the world. The *xumi zuo* is a solid monumental base, usually ornamented with brick mouldings of 13 courses, on which a pagoda is seated, symbolically joining heaven and earth together. The functions of the pagoda are twofold: the symbol of the Buddha and the symbol of the Buddhist sacred precinct.

The pagoda is a part of the material manifestation of this new ideological movement. It is a kind of public building used for religious worship that had not existed before in China. The iconological significance of the pagoda attracts pilgrims. The exotic finial and the magnificent podium functioned as iconological identities to distinguish the tower as a religious building at a distance and close-by, respectively. Here, it should be pointed out, is a relationship between the pagoda finial and the roof type. We notice that there is a ridge on the roofs of Han towers, although the towers are mostly square in plan (Figure 10). In order to receive a large finial, the pagoda roof had to be pyramidal. Aesthetically, the roof gives symmetrical appearances to pagodas viewed at all angles.

Tower architecture never disappeared and continued to play an important role outside the Buddhist sphere. Its application and function were so broad and varied, such as seen in Chinese cosmosophy and geomancy. Innumerable towers were built to exert favourable influences upon the geomantic conditions of particular places or areas. They enjoyed popularity, diversity and regionalism. Variety enabled them to maintain their continuity. It is not exaggerating to say that the pagoda greatly stimulated the development of tower architecture and gave it new significance; the importance and life of towers was prolonged by the infusion of Buddhist symbolism. It is also true that the pagoda, as stylistic continuity of the tower over many centuries, suggests that the ceremonies were similarly coeval.
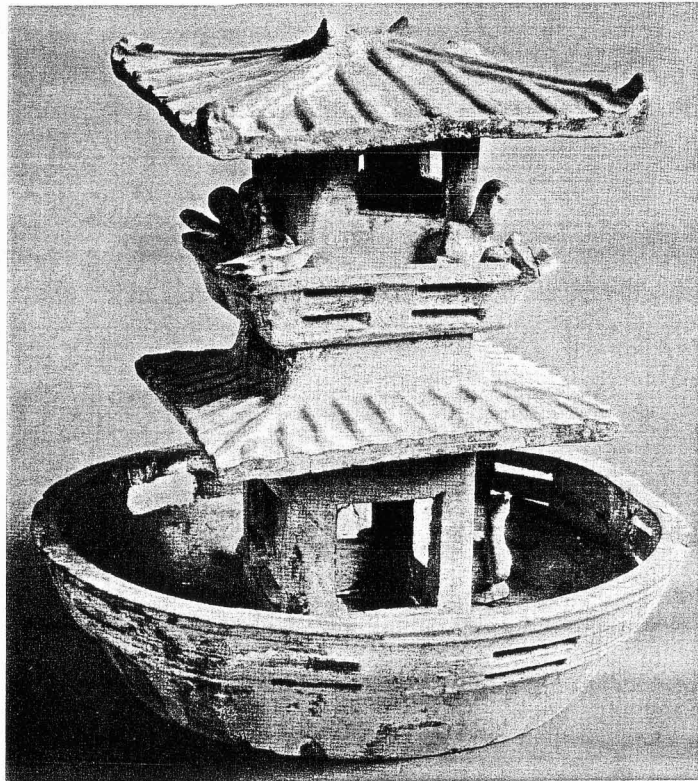
Figure 10. Glazed pavilion, Eastern Han. Height: 51cm. National History Museum, Beijing.

Structure and Technology in Transition

The authenticity of the structural transition may be supported by the four sets of analyses summarised below.

Block-bracket Sets

The most important architectural feature of the storeyed architecture is the block-and-bracket sets. In Figure 11-A, two sets are employed at each corner, parallel with the building elevations, which demonstrate the early techniques of the block-bracket system. The pottery tower found in Wangdu, Hebei province, shows that at the corners not only block-and-bracket sets are separated, but also their supporting columns are independent. Two columns are used and each supports its own set (Figure 11-B). This independent-column technique is also revealed by archaeological excavations on early building

sites, such as the Yongningsi pagoda (516), which indicates that the transverse and longitudinal frameworks were separately made (see discussion below).

Pavilion towers are mostly square on plan while storeyed buildings are rectangular. Between them there is an important distinction: a 45-degree beam is used in the pavilion tower to support a corner bracket set (*mojiao gong*) (Figure 11-C). This implies that the squared pavilion tower and the rectangular storeyed building are different not only in form and size, but also structure. Size and form influence structural design.
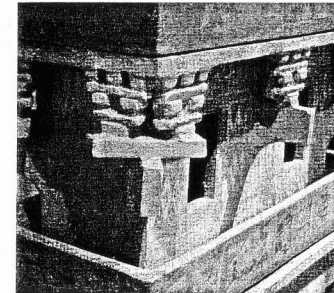

Figure 11 A. Corner block-bracket set of five-storeyed building, mid-Easter Han. Excavated in 1972 at Jiaozuo (photo taken by author at Henan museum).
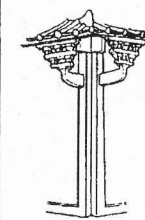

Figure 11 B. Corner column of pottery tower. Handynasty. Excavated at Dongguan, Wangdu, Hebei.
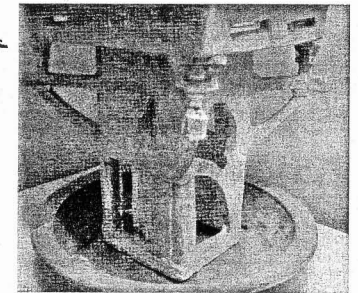

Figure 11 C. Detail of Fig. 7-B.

Chanzhu Zao

The Yongningsi pagoda was the biggest pagoda known to us in Chinese architectural history: it was built in 516 and burned down in 534. The *Description of Buddhist Temples in Luoyang* notes the size and appearance of the pagoda, but not the construction method. Information about the structure and construction can only be obtained from the remains unearthed by archaeological investigations. The excavation report notes that there are three stone bases at each of the four outer corners of the pagoda. This point, however, seems to have been ignored or has not been correctly interpreted by most researchers.[28] The three stone bases indicate that the building had three columns at each corner, which in turn indicate that the wooden frame network consisted of three structural units: the longitudinal, the transverse and the diagonal. On this aspect, the Yingxian pagoda reveals a somewhat similar character in its ground level: several columns are used at each corner of the framework, both the inner framework and the outer.

This feature is also visible in the Guanghuasi pagoda (1165) in Putian, Fujian province, and the Youguosi pagoda (988) in Kaifeng, Henan province, both being octagonal on plan. The first example is a five-storeyed stone pagoda. Each of its corner columns is boldly treated as three columns (Figure 12-A). The stone pagoda bears an aesthetic relationship to its wooden pagoda predecessors, and it is so distinctive as to signify the evolution of the structure of the Yongningsi pagoda. The second example is a 13 storeyed glazed-brick pagoda, every detail of which is a faithful imitation of a timber original. Its blocks and brackets cross each other and project out from their supporting columns on each storey. Above the corner column, a subsidiary capital block sits on either side of a corner capital block, and supports attached brackets and blocks above (Figure 12-B). With columns of an upper storey, each corner

column is surrounded by three capital blocks, and other columns are set on beams or brackets adjacent to capital blocks (Figure 12-C). This structure is recorded as *chanzhu zao* in the *Yingzao Fashi*. By putting all the information together, architectural, archaeological and from literature, a picture of the structural development of Chinese multi-storeyed architecture can be established.

In this regard it is worth stressing that the *chanzhu zao* seems to have emerged from an early phase of the three-column construction technology. While the corner sets were integrated as a system, the structures were incorporated into a framework. The study of block-bracket sets provides a possible explanation for the *chanzhu zao*. According to the *Yingzao Fashi*, the *chanzhu zao* is a construction method of framing columns and beams at corners, and this framed structure is *pingzuo*. The three-column structure and three-block technique help us reconstruct the Yongningsi pagoda and understand the *Yingzao Fashi*. At this juncture we acknowledge our inability to provide more details and full documentation in multiple respects, and some interpretations given above are based on inference.
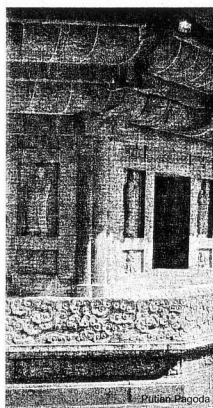

Figure 12 A. Corner column: Guanghua Pagoda (1165), Guanghua Temple, Putian, Fujian. Height: 36m.
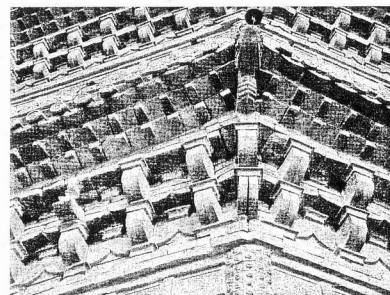
Figure 12 B. Corner brock-bracket set: Liuli Pagoda (1044), Youguo Temple, Kaifeng, Henan. Height: 54.6m.

Figure 12 C. Column between corners (chanzhu bianzao): library of Longxing Temple, 12th century, Zhengding, Hebei.

Gable-on-hip Roof

The roof requires attention: there is a horizontal line in the middle of roofs of early architecture (Figure 13-A). This feature can be seen in pictorial bricks, stone towers (*que*) and pottery buildings in China, and the Tamamushi shrine (mid-seventh century) in Horyuji Temple, Nara, Japan. It strongly suggests that the roof was formed by two frameworks. In other words, the building might be formed by two structures: a major one surrounded by a minor. Two pottery houses excavated in Henan province demonstrate that the upper part of the roof is gable and the lower part is hip, and the two parts are separately made (Figure 13-B). Suggested by the evidence, a hypothesis for the gable-on-hip roof (*xialiangtou zao*) is that it might have evolved from a gable roof and winding veranda. Figure 13-C is such a house of the early Ming dynasty (1368-1644).
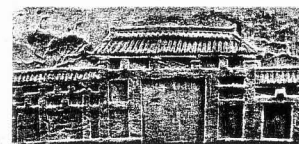

Figure 13 A. Gate of manor courtyard house, Han dynasty. Excavated in Huangxu, Deyang, Sichuan. 63X22cm.

Figure 13 B. Storehouse of gable-on-hip roof (gable part is missing), mid-, late E. Han. Excavated in 1953 in Zhengzhou. Height: 45cm, Length: 43.5cm, Depth: 17cm.
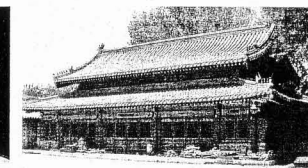
Figure 13 C. Sacrifice slaughter pavilion, early Ming. Altar of Agriculture, Beijing.

Exterior Stairways

Multi-storeyed buildings were provided with exterior stairways leading from the ground to the building on the first floor level, and this design was inherited from the high-platform architecture. We have been trying to understand the building traditions and their relationships, and attempt to provide an answer. The evidence presented above suggests two separate building traditions: earth-timber and wooden-frame. There is a fascinating instance of a formal detail of earth-platform architecture preserved in wooden architecture: exterior stairways, which are vividly expressed by pottery houses (Figure 14-A) and extant buildings. The gatehouse of Chion-in Temple in Kyoto, Japan, reconstructed in 1619, is bound to the traditional practice. The upper storey of the building is accessible only by external stairs (Figure 14-B).

The construction of high-platform architecture must have required earth-moving on a large scale. This practice began to be abandoned in the Eastern Han in favour of buildings made entirely of wood. The activities of high-platform building ceased after the Han dynasty. The exterior stairway was a part of the technological system of high-platform architecture which has remained unchanged as an architectural style. The line between technology and style was blurred: the stairway had more than utility. When building technology associated with material is changed, the stylistic function of the stairway is served materially.
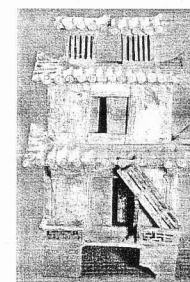

Figure 14 A. Two-storey building, late Eastern Han. Excavated in 1963 from no.2 tomb, Mixian, Henan. Height: 107cm Length: 54cm, Depth: 41cm.
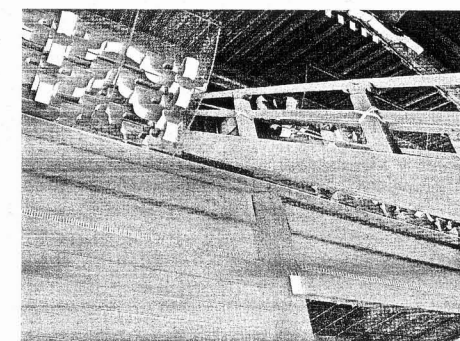
Figure 14 B. Gatehouse, 1619. Chion-in Temple, Kyoto, Japan.

Conclusion

Pagodas appear to have been part of a lineage of tower architecture, as a continuation of the towers. The Han tower played an important part in the formation of pagoda architecture. From a typological evolutionary perspective, the dynamism of technological transformation was in the material change from earth-timber to masonry-timber and timber that took place in China throughout the Han period. Following this shift, architectural creation assumed different structure and form. The evidence accumulated suggests a relative chronology of building techniques: the high-platform architecture seemed to be far more commonly used in the first phase (Eastern Zhou, 770-476 BC to late Warring States, 475-221 BC). The integrated block-and-bracket sets did not occur in Phase I, so that *pingzuo* technological expertise did not appear before Phase II. Multi-storeyed construction techniques may therefore have developed in Phase II (Han, 206 BC - AD 220), which required higher levels of design and greater control of construction than high-platform architecture did. There was apparently a smooth transition between tower and pagoda. It is evident that Chinese building systems had been well established long before Buddhism was introduced from India, and Chinese architecture was an indigenous development. Would Chinese towers have come about without direct and indirect influences from civilizations further west? A question such as this is unanswerable, but nothing is clearer than the difference between the stupa of India and the wooden pagoda of China. Evidence affirms that the Buddhist influence in Chinese architecture only revealed itself in minor aspects.

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