

Han Cultural Integration and Identity among Ethnic Minorities in the Wei, Jin, Southern and Northern Dynasties: Evidence from Eaves Tiles

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Article

Keywords:

Posted Date: August 7th, 2026

DOI: <https://doi.org/10.21203/rs.3.rs-10183780/v1>

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Additional Declarations: No competing interests reported.

Abstract

During the Wei, Jin, Southern and Northern Dynasties (AD 220–589), large-scale ethnic migration and cultural integration occurred between northern non-Han groups and Han Chinese. Unlike prior text-based studies, this research adopts a material culture perspective by analyzing Eaves Tiles (Wadang) to investigate cultural identity formation. A total of 356 eaves tiles from 46 sites across China were analyzed for decorative motifs (lotus, cloud, animal mask, character patterns) and dimensional attributes (face diameter, rim width). Results reveal stylistic and dimensional convergence: northern tiles, initially larger with thicker rims, gradually adopted southern Han-style specifications after the Northern Wei capital relocated to Luoyang. Northern regimes incorporated lotus, cloud, animal mask, and character patterns rooted in Han traditions, while southern-style lotus seed pods, narrow rims, and refined craftsmanship increasingly influenced northern standards. By the late Northern Dynasties, northern and southern tile-ends achieved substantial alignment in dimensions and decoration, marking a transition from regional divergence to a shared paradigm. This study demonstrates that architectural material culture provides tangible evidence of multi-ethnic interaction, complementing textual records and revealing how northern ethnic minorities actively embraced the Han cultural and political order.

Introduction

Cultural integration and identity are not only the bond for exchanges and mutual learning among civilizations, but also a solid bridge for building a community with a shared future for humanity^{1,2}. The Wei, Jin, Southern and Northern Dynasties (AD 220–589) was an era of unprecedented great division and severe social turbulence in Chinese history, as well as a critical stage when northern ethnic minorities carried out large-scale migration into the Central Plains, established separate political regimes, and realized deep integration with the Han ethnic group^{3,4}. During this period, various ethnic groups from the western and northern frontiers moved inward one after another, creating an interlocking distribution pattern with the Han population⁵. For example, the Southern Xiongnu nobles claimed themselves to be descendants of the Han people, studied classics and history with Han Confucian scholars, and maintained close interactions with the officials in Luoyang^{6–8}. During the reign of the Later *Zhao* regime (AD 319–351, a *Jie*-led regime in the Sixteen Kingdoms period), *Shi Le*, the founding emperor of Later *Zhao*, appointed *Zhang Bin*, a prominent Han scholar-statesman, as his chief political strategist, implemented the Nine-rank Official Selection System (the original Chinese name is “Jiu Pin Zhong Zheng Zhi”) in the political field, and encouraged agricultural production and sericulture in the economic field^{8–10}. During the reign of the *Former Yan* regime (AD 337–370, one of the Sixteen Kingdoms established by the *Xianbei* ethnic group), the Murong clan of the *Xianbei* accepted a massive number of displaced Han people, and explicitly emulated the *Tuntian* (state-managed agricultural garrison) system that was widely adopted by the Han-ruled Wei and Western Jin Dynasties (AD 220–316)^{8,11}. During the reign of the *Former Qin* regime (AD 351–394, a *Di*-led unified regime governing most of northern China during the Sixteen Kingdoms period), *Fu Jian*, the ruler of *Former Qin*, appointed *Wang Meng*, a prominent Han statesman, as the highest administrative chancellor, vigorously established official Confucian education

institutions, and promoted Confucianism^{8,12}. During the reign of the Northern Wei Dynasty (AD 386–534, the first *Xianbei*-led unified regime governing northern China in the Southern and Northern Dynasties period), Emperor *Xiaowen* launched a series of top-down systematic Sinicization reforms, including relocating the imperial capital from Pingcheng to Luoyang, mandating the adoption of Han-style clothing across the ruling class, replacing *Xianbei* surnames with Han-style surnames, and establishing Han Chinese as the official spoken language for government affairs^{8,13}. Overall, during the Wei, Jin, Southern and Northern Dynasties period, ethnic minorities gradually developed recognition of the Han ethnicity in terms of politics, economy, culture and language, and were increasingly integrated into Han culture. Nevertheless, existing studies mostly focus on sorting out specific historical facts and conducting investigations at the political level, and rarely carry out in-depth discussions on the dynamic process and internal mechanism of ethnic integration in this period from the perspective of material culture or daily life^{8–13}.

During the Wei, Jin, Southern and Northern Dynasties period, frequent cross-regional population relocation and sustained inter-ethnic interactions spurred cultural integration on an unprecedented scale, whose core manifestations are concentrated in three dimensions: dietary culture, sartorial culture, and folk social customs. The integration of dietary culture is primarily embodied in two dimensions: cross-ethnic exchange of food raw materials, and the fusion of cooking techniques^{14,15}. In terms of ingredients, after the *Tuoba* clan of the *Xianbei* ethnic group founded the Northern Wei Dynasty, they shifted from a nomadic pastoral economy to settled agrarian production, and promoted the large-scale cultivation of staple crops including foxtail millet and wheat^{14–16}. In terms of culinary techniques, “*Qiang Zhu Mo Zhi*” (indigenous boiling and roasting methods originating from the Qiang ethnic group in northwest China and the Mo ethnic group in northeast China respectively) were deeply integrated with Han culinary traditions^{14–17}. The “*Guan Chang Zhi*” (grilled sausage dish) recorded in “*Qi Min Yao Shu*” (the landmark Northern Wei agricultural treatise written by *Jia Sixie*, one of the most complete agricultural works of ancient China) is a typical representative of this fusion¹⁸. Furthermore, non-Han ethnic groups also adopted Han-style stew preparation techniques, adding rice and wheat flour to lamb cooking to balance the rich umami of mutton and the mellow fragrance of grain^{14,15,17}. In the dimension of dietary culture, these ethnic groups voluntarily adapted to and integrated with the Han-centered cultural system, eventually forming stable identity recognition of the Han dietary tradition.

As a tangible visual marker of ethnic cultural identity, sartorial culture also bore witness to the in-depth cross-ethnic integration process during the Wei, Jin, Southern and Northern Dynasties period. For example, Emperor *Daowu* of the Northern Wei Dynasty implemented a hair-binding and headwear regulation policy, integrating the “*Chui Qun Feng Mao*” (draped-brim wind hat, a traditional *Xianbei* nomadic headwear with a back curtain for wind protection) with the Central Plains Han Confucian hair-binding ritual norms, forming a distinctive hybrid headwear system known as “hat-crown grafting”^{19–21}. On this basis, Emperor *Xiaowen* further established a comprehensive system of “*Mian Fu*” (imperial ritual robes for sacrificial ceremonies) and “*Chao Fu*” (court official uniforms), and introduced a hierarchical system that tied Han-style dress codes strictly to the official rank hierarchy²². In the sartorial domain,

Emperor Xiaowen further implemented Han-style adaptation of “*Ku Zhe*” (a traditional *Xianbei* nomadic two-piece attire consisting of tight upper garment and loose trousers), redeveloping it from a functional nomadic garment into formal attire aligned with Central Plains Confucian ritual norms^{21,23,24}. After the *Xianbei* “*Chui Qun Feng Mao*” (draped-brim wind hat) spread into the Central Plains, its crown was reduced in size, the rear wind-blocking drape was shortened, and its material was switched from leather to textile fabrics²⁵. The Western Regions-originated lapel robe was adapted into the left-lapel cross-collar style consistent with Han dress conventions, breaking the traditional sartorial boundary between *Hua* (Han-centric Central Plains cultural groups) and *Yi* (peripheral non-Han ethnic groups) in pre-modern Chinese discourse²⁶, and embodying non-Han ethnic groups’ active acceptance and stable identity recognition of Han ritual culture and aesthetic traditions.

The folk social integration of customary culture is primarily embodied in transformations of daily life practices, including residential patterns, travel and mobility arrangements, and funeral and burial rituals. The northern non-Han ethnic groups originally adopted a nomadic pastoralist lifestyle of “migrating with water and pasture resources”, and lived in “*Qiong Lu*” (dome-shaped felt yurts, traditional mobile nomadic dwellings)²⁷. After their inland migration into the Central Plains, under the influence of the Central Plains settled agrarian economy, they gradually transitioned to a sedentary lifestyle and began to construct walled cities and fixed residential buildings^{28–30}. Typical cases include the “Wolong City” built by the *Xiongnu*³¹, the “Tongwan City” (the only surviving capital city of the Southern Xiongnu regime in Chinese history) constructed by the *Helian* clan³², and the practice recorded in historical documents that the *Xianbei Tuyuhun* regime “built city walls and palaces, with all their secondary vassal lords constructing official residences”³³. In the domain of travel and mobility practices, non-Han ethnic groups, under the influence of Han institutional regulations and social customs of the Southern Dynasties, adopted ox-drawn carts as an official travel vehicle^{34,35}. During the reign of Emperor Xiaowen, the imperial ceremonial chariot fleet of the Northern Wei Dynasty already included “*Da Lou Nian*” (large building-style imperial ceremonial carriage), which was pulled by twelve oxen as recorded in official historical documents³⁶. By the reign of Emperor Xuanwu, ox-drawn carts had become a widely used means of transport across all social strata of the Northern Dynasties³⁵. In the domain of funeral and burial ritual systems, the imperial mausoleums of the Northern Wei Dynasty inherited the core funeral cultural doctrines of the Eastern Han Dynasty (AD 25–220) and the Wei-Jin Dynasties (AD 220–420 CE), and adopted the convention of placing inscribed tomb epitaphs, a core ritual practice of Central Plains Han funeral traditions under the influence of the Central Plains Han cultural system^{37,38}. The aforementioned transformations of residential patterns, travel ritual norms, and funeral and burial ritual systems demonstrate that non-Han ethnic groups have gradually established stable cultural identity recognition of Han culture in the spheres of production and daily life practices.

However, relying exclusively on transmitted textual records is insufficient to systematically clarify the evolutionary trajectory of multi-ethnic cultural identity during the Wei, Jin, Southern and Northern Dynasties (AD 220–589). Most surviving textual materials were produced by the Han scholar-bureaucrat

class of the Central Plains, with inherent narrative bias, which makes it impossible to fully present the full picture of multi-dimensional cultural interactions in multi-ethnic cohabitation contexts. Material cultural remains are tangible physical carriers of the production practices, daily lifestyles, aesthetic orientations, and cultural ideologies of different ethnic groups^{39,40}. They can fill the historical narrative gaps uncovered by textual records and restore the cultural outlook of grass-roots society with higher universality. Eaves tiles (Wadang) are a typical representative of material cultural remains with wide popularity and cross-regional representativeness across the north and south during the Wei, Jin, Southern and Northern Dynasties⁴¹. Eaves tiles are round or semi-circular ceramic components fixed at the end of rafters on the eaves of ancient Chinese architecture, with the core function of protecting rafter ends from moisture and decay, as well as dual attributes of protecting wooden overhanging eave structures and softening roof contour lines⁴²⁻⁴⁴. The patterned front face of Eaves tiles is called “Dang Mian” (tile face), the outermost raised edge is “Bian Lun” (border rim), and the central area is called “Dang Xin” (tile core)^{45,46}. Their decorative motif types, size specifications and other features carry distinct chronological markers and regional attributes, which serve as core physical scales for determining the age of relics and defining the cultural provenance of ethnic groups in archaeological research⁴¹. Prior to the Wei, Jin, Southern and Northern Dynasties, shaped by divergences in regional natural endowments, fragmented political structures and disparate cultural traditions, northern and southern tile-ends exhibited clear stylistic distinctions: northern tile-ends were dominated by lotus patterns and character patterns, while southern eaves tiles featured predominantly cloud patterns^{47,48}. About dimensionally, northern eaves tiles were generally slightly larger than contemporaneous southern equivalents. Against the broader backdrop of large-scale ethnic integration during the Wei, Jin, Southern and Northern Dynasties, eaves tiles craftsmanship and decorative styles across different regions underwent continuous mutual adaptation and diffusion, with motif typologies and dimensional specifications gradually converging^{49,50}. Therefore, starting from the material relic of eaves tiles can provide direct evidence for revealing the process of multi-ethnic cultural exchanges and identity construction during the Wei, Jin, Southern and Northern Dynasties.

Against this backdrop, this paper takes eaves tiles as the research object, systematically collects eaves tile relics unearthed from archaeological sites of the Wei, Jin, Southern and Northern Dynasties, conducts quantitative statistics and comparative analysis on core features of northern and southern eaves tiles including decorative pattern themes and size specifications, and explains the process of acceptance of and identification with Han culture in the Central Plains by northern ethnic minorities during the Wei, Jin, Southern and Northern Dynasties from the perspective of material cultural interaction. This study not only fills the relevant gap in physical historical material research in the field of ethnic integration during the Wei, Jin, Southern and Northern Dynasties, enriches the evidence dimension of ethnic cultural identity research for this period, but also provides more concrete and solid material cultural support for explaining the formation and development context of ancient China as a multi-ethnic country.

Materials and methods

Data source

This study takes eaves tiles (Wadang) remains as its core research subject. Data are primarily derived from published archaeological excavation reports and academic monographs, with a focus on collating eaves tiles specimens unearthed from representative sites dating to the Wei, Jin, Southern and Northern Dynasties (AD 220–589), including dynastic political centers, key urban settlements and high-status architectural complexes. A total of 356 eaves tiles were collected for analysis, spanning 17 archaeological sites in northern China and 29 sites in southern China (Fig. 1). Southern China eaves tiles are primarily concentrated in the middle and lower Yangtze River region and Southwest China, with most remains excavated in Jiangsu and Sichuan Provinces, core Han settlement regions during the Wei, Jin, Southern and Northern Dynasties. Their spatial distribution follows a diffusion pattern centered on the Six Dynasties political core and expanding outward to peripheral regions. A total of 174 eaves tiles remains from southern China dating to the Wei, Jin, Southern and Northern Dynasties period were collected for analysis (Table.S1). Their provenances include the Shierqiao, Jinshacun, Baoensi, Pilusi, and Daxinggong, etc. These eaves tiles are recovered not only from palace complexes and administrative precincts, but also from Buddhist monasteries, elite residential compounds, and prefecture-level urban settlements, reflecting the diverse usage contexts and broad social penetration of eaves tiles in southern China. A total of 182 eaves tiles remains from northern China dating to the Wei, Jin, Southern and Northern Dynasties period were collected for analysis (Table.S1). Geographically, relevant sites are concentrated in Henan, Shanxi, and Hebei provinces, including the Hanweigucheng, Mangshanchangling, Yungangshiku, Caochangcheng, Chngancheng, Yecheng Site, and Luoyangcheng, etc. These remains are similarly recovered from palace complexes, royal monastic sites, elite residential compounds and prefecture-level urban settlements, further corroborating the widespread adoption of eaves tiles across northern China and the hierarchical distinctions in their use.

Statistic analysis

To systematically clarify the integration path and evolutionary logic of northern ethnic minority cultures and Central Plains Han culture during the Wei, Jin, Southern and Northern Dynasties period, this paper systematically sorts out publicly published data on eaves tile relics from this period, conducts quantitative statistics on core attributes of all specimens including excavation location, chronological attribution, obverse decoration and size specifications. On this basis, we perform a comparative analysis of characteristic differences between northern and southern eaves tiles, and further unpack their convergent evolutionary trajectories against the broader context of large-scale ethnic integration.

In terms of the obverse decorative patterns of eaves tiles, this paper specifically selects four types of eaves tiles with distinct patterns, namely lotus pattern, cloud pattern, animal mask pattern and character pattern, as the key analysis objects. Among them, lotus-patterned eaves tiles are mainly composed of

four parts: the central boss (the core part of the lotus pattern), the inner zone theme pattern (the lotus petal part of the lotus-patterned eaves tile, that is, the core content of the obverse decoration), the interstitial pattern (the decoration between two adjacent lotus petals), and the outer zone decoration (the pattern located between the lotus pattern and the edge rim of the tile) (Fig. 2a)⁵¹. Cloud-patterned eaves tiles are mainly composed of four parts: the central boss (the central section of the cloud pattern), boundary bars (lines that divide the cloud pattern area into four symmetrical fan-shaped regions), the primary motif field (the cloud pattern section, which is the core content of the obverse decoration), and the outer zone decoration (patterns decorated between the cloud pattern and the edge rim of the tile) (Fig. 2b)⁵². Each fan-shaped region divided by the boundary bars bears a cloud pattern⁵². The animal mask-patterned eaves tile is a type of eaves tile themed on animal images, and its obverse pattern mainly depicts the facial features of the animal, including eyes, nose, ears, mouth, tongue, teeth and whiskers (Fig. 2c)^{53,54}. Character-patterned eaves tiles are a type of eaves tile that takes mould-imprinted or carved calligraphic characters as the core theme. They are mainly composed of four parts: the central nipple boss (the central section of the character pattern design), characters, partition grids (dividing structures between characters including crisscross “well-shaped” grids and fan-shaped grids), and auxiliary decorative nipple bosses (small evenly distributed raised bosses between the character partition grids) (Fig. 2d). The reasons for selecting these four types of patterns as key analysis objects are as follows: First, these four patterns have large unearthed quantities and wide distribution covering both southern and northern China, with strong universality; Second, eaves tiles with these four patterns appeared throughout the entire historical stage of the Wei, Jin, Southern and Northern Dynasties, with clear evolutionary context and distinct characteristics of the times; Third, these four types of patterned eaves tiles have distinctive features and prominent styles. The development trends and regional integration situation reflected by their patterns and sizes are important material carriers for revealing the social culture, ideological concepts and craft level of that period.

In terms of the size specifications of eaves tiles, this paper mainly selects the face diameter and edge rim width as research objects. The face diameter refers to the diameter of the obverse plane of the eaves tile; the edge rim width refers to the thick raised part around the eaves tile, calculated by subtracting the diameter of the decorative pattern area on the obverse face from the total face diameter of the eaves tile, which is a key parameter reflecting the edge structure of eaves tiles (Fig. 2e). These two indicators reflect the craft standards and technical levels of different periods and regions, and their abundant data can provide quantitative support for the analysis of the evolution and cultural exchange of eaves tiles.

Results and discussion

During the Wei, Jin, Southern and Northern Dynasties, China experienced prolonged political fragmentation between distinct northern and southern polities. Architectural art developed distinct characteristics against different regional and political backgrounds, while also mutually penetrating and integrating with each other through various forms of exchange. As a critical architectural fixture of eave

termini, eaves tile changes in the decorative schemes, dimensional specifications and materials of eaves tiles reflect differences in technical aesthetics, regime strength, and spiritual orientation between the south and the north. Over the course of this historical period, cross-regional cultural amalgamation also exerted a transformative influence on the decorative schemes, dimensional specifications, and material selection of eaves tile.

The Assimilation of Han Cultural Elements by Northern Ethnic Minorities from the Perspective of Eaves Tile Patterns

As a decorative component at the end of ancient building eaves, the decorative pattern design of eaves tiles is not a mere aesthetic choice, but a materialized carrier of ethnic cultural orientation and ideological identity in a specific era. During the Wei, Jin, Southern and Northern Dynasties, northern ethnic minority regimes actively adopted eaves tile patterns originally belonging to the Han cultural system, including lotus patterns, cloud patterns, animal mask patterns and character patterns, which is essentially an explicit expression of cultural identity. Lotus patterns and cloud patterns carry the cosmological views and spiritual beliefs of Confucianism and Taoism in the Han region; animal mask patterns follow the auspicious culture tradition of the Han Dynasty; while Chinese auspicious phrases, era names and political expressions on character-patterned tiles directly adopt the writing system and political discourse of the Han ethnic group. The large-scale popularization of such patterns in the areas ruled by northern regimes not only reflects the rulers' active acceptance of the core values of Han culture, but also shows the widespread recognition of Han cultural symbols in the multi-ethnic mixed society.

Lotus-patterned Eaves Tile

During the Wei, Jin, Southern and Northern Dynasties, with the prevalence of Buddhism, the lotus flower as a symbol of Buddhism gradually became an important theme for eaves tile decoration⁵⁵. Classified according to the inner zone theme pattern, lotus-patterned eaves tiles can be divided into two typological categories: single-petal lotus-patterned eaves tiles (Fig. 3a) and double-petal lotus-patterned eaves tiles (Fig. 3b). Single-petal lotus-patterned eaves tiles refer to tiles where each lotus petal on the obverse surface is separated and independent from each other (Fig. 3a). Double-petal lotus-patterned eaves tiles refer to tiles where the lotus petals on the obverse surface are connected in pairs, symmetrical left and right, merged into a large lotus petal that contains a pair of small lotus petals inside (Fig. 3b).

From the Eastern Jin to Six Dynasties period (AD 317–589), lotus-patterned eaves tiles recovered from Nanjing, Jiangsu Province (the core political and cultural center of southern regimes during this period) are representative of the southern China eaves tiles (Fig. 3a-g). Their typical characteristics are as follows: The center of the obverse surface has a raised lotus seed pod, with an odd number of lotus seeds; the lotus petals in the inner area are slender and thin, jujube-pit shaped, all single-petaled, with relatively rounded tip lines; the central ridge line on the petals appears with high frequency; the dividing patterns between petals are mostly diamond patterns, “T”-shaped patterns (Fig. 2e), inverted triangle

patterns (Fig. 2g), etc.; the outer area is dominated by raised string patterns as decoration. In the early Northern Wei Dynasty (AD c. 386–494), lotus-patterned eaves tiles excavated from sites in Datong (Pingcheng, the early Northern Wei capital) of Shanxi (Fig. 2h), Luoyang of Henan (Fig. 2i), and Xi'an of Shaanxi (Fig. 2j) are representative of the northern China eaves tiles. northern eaves tiles are mostly double-petal lotus patterns, with the number of lotus petals mainly being odd numbers such as 5 and 7, and there are also lotus eaves tiles with a relatively large number of petals such as 12 and 14 petals. A large number of treasure-decorated lotus-patterned eaves tiles appeared in this period (Fig. 2h, 2i), whose characteristics are as follows: The lotus petals are double-layered petals with ornate decorative details; the part near the center of the obverse surface is plump and rounded, with sharp and thin tips, showing a peach kernel shape; the center is often decorated with large nipple nails instead of lotus seed pods; linked bead patterns are mostly seen in the outer area decoration.

By the late Northern Dynasties (c. 534–581 CE), particularly during the Western Wei and Northern Zhou reign periods, the large nipple nails occupying the central field of northern China double-petal lotus eaves tiles were gradually replaced by the lotus seed pods, a decorative element pervasive in contemporary southern China eaves tiles. Furthermore, northern China lotus-patterned eaves tiles exhibited a clear evolutionary shift toward stylistic simplification (Fig. 2k, 2l): single-petal single-layer configurations supplanted the double-petal double-layer structures prevalent in earlier phases, and the morphological transition of petal apices from sharply pointed to rounded became increasingly pronounced. These changes constitute tangible material evidence for the adoption and integration of Han Chinese eaves tiles design elements by northern non-Han ethnic groups⁵⁶. Additionally, the inter-petal dividing patterns of northern China lotus-patterned eaves tiles evolved from poorly defined initial forms to standardized triangular and “T”-shaped patterns, an evolutionary trajectory that may also reflect stylistic influence from southern China lotus-patterned eaves tiles.

Cloud-patterned Eaves Tile

Cloud-patterned eaves tiles first emerged in the pre-Qin period (c. pre-221 BC), flourished throughout the Qin and Han dynasties (221 BC-AD 220), and their cultural influence persisted into the early phase of the Wei, Jin, Southern and Northern Dynasties. The widespread circulation of this Eaves Tiles typology is intrinsically linked to the ideological pursuits of contemporary feudal rulers: imperial palaces were intentionally designed to carry the symbolic meaning of Tianhan (the Milky Way in traditional Chinese cosmology), decorated with auspicious cloud motifs, as a material expression of the rulers' aspiration for immortality and ascension to the celestial realm. Classified by theme patterns, cloud-patterned eaves tiles can be roughly divided into four categories: cloud pattern (Fig. 4a), ram's horn-shaped cloud pattern (Fig. 4b), reversed cloud pattern and mushroom-shaped cloud pattern (Fig. 4c). The general evolution trend of the decorative patterns of various types of cloud-patterned eaves tiles is from complex to simple.

During the Wei, Jin, Southern and Northern Dynasties, cloud-patterned eaves tiles from the southern China are predominated by mushroom-shaped (Fig. 4c) and ram-horn cloud patterns (Fig. 4b), arranged symmetrically in pairs across four fan-shaped quadrants⁵⁷. Their typical characteristics are as follows: double or triple dividing lines segment the obverse face into four equal fan-shaped quadrants, with dividers converging at the central field, which is mostly a plain large nipple nail, surrounded by a circle of raised string patterns. Of particular note is that Six Dynasties cloud-patterned eaves tiles recovered from Sichuan province frequently bear character decorations. The characteristic of this type of eaves tile is that two vertical fan-shaped areas extend from the nipple nail, and there are inscriptions engraved in three areas: the upper and lower fan-shaped areas and the area where the central nipple nail is located. The inscriptions are mostly auspicious phrases, including “Da Fu Ji” (great fortune and auspiciousness) (Fig. 4d), “Jun Gao Qian” (wish for high official promotion) (Fig. 4e), and “Hou Fu Gui” (marquis rank, wealth and honor) (Fig. 4f).

Northern cloud-patterned Eaves Tiles are dominated by mushroom-shaped cloud patterns, with an overall style similar to that of southern cloud-patterned eaves tiles (Fig. 4g). Their characteristics are as follows: the central field is typically ornamented with floral and foliate motifs, ruler patterns (Fig. 4h), or grid patterns (Fig. 4i); the border rim and obverse field are commonly linked by rope patterns (short oblique line decorations) (Fig. 4g) or serrated patterns (Fig. 4j). Scholarly usually regards cloud-patterned eaves tiles with triangular serrated edge decorations as typical representatives of Han ethnic eaves tiles in the late Eastern Han Dynasty. The Northern Dynasties cloud-patterned eaves tiles unearthed from the Yongning Temple site in Luoyang, Henan (Fig. 4g, 4j) have extremely obvious triangular serrated edge features, so it can be inferred that they should have been influenced by the eaves tile patterns of the Han ethnic group in the late Eastern Han Dynasty⁵⁸. In addition, the “X”-shaped diamond pattern is a typical ring decoration in cloud-patterned eaves tiles of the Western Han Dynasty. The cloud-patterned eaves tiles from the Sixteen Kingdoms to the Northern Dynasties unearthed in Shaanxi all have “X”-shaped decorations on the outer single ring, which is very similar to the ring-decorated diamond pattern in Han Dynasty Han ethnic eaves tiles, which should also be influenced by Han ethnic eaves tile patterns⁵⁸. It is worth noting that cloud patterns, as a dominant eaves tile decoration popular among the Han ethnic group before the Wei, Jin, Southern and Northern Dynasties, are themselves one of the important characteristics of Han ethnic culture, representing the traditional philosophical concepts of Tian Ren He Yi (unity of heaven and humanity) and Tian Ren Gan Ying (interaction between heaven and humanity), encoding the centralized imperial aspiration for political authority, as well as popular understandings of traditional Han Chinese mythological system⁵⁸. During the Wei, Jin, Southern and Northern Dynasties, the adoption of cloud-patterned eaves tiles by various ethnic minority regimes was actually a kind of recognition of Han ethnic culture and political ideology by ethnic minorities.

Animal mask-patterned Eaves Tile

The origin of animal mask patterns Eaves Tile can be traced back to the pre-Qin period, and it is one of the core decorative themes of bronze ritual vessels in the Shang and Zhou dynasties (1600–2256 BC).

During the Wei, Jin, Southern and Northern Dynasties, influenced by the Taoist thought of immortality, the Han people believed that rare birds and animals were the bridges connecting heaven, earth, gods and humans^{58,59}. To carry the spiritual aspiration of praying for good fortune and ascending to immortality, they incorporated animal mask patterns into the decoration system of eaves tiles⁶⁰. The animal mask pattern has a majestic, rough and highly deterrent style, and when applied to architectural components, it also serves as a symbolic function to demonstrate ruling power⁶¹. From the perspective of structural features, the obverse decoration of animal mask-patterned eaves tiles takes the concrete animal face as the core, and usually depicts facial structures such as eyes, nose, ears, mouth, tongue, teeth and whiskers in detail⁶².

The earliest occurrence of animal mask-patterned eaves tiles in southern China can be traced back to the Eastern Wu period (AD 222–280). During the Wei, Jin, Southern and Northern Dynasties, the features of southern animal mask-patterned eaves tiles are as follows (Fig. 5a-e): The eyes are raised and simplified, with no distinction between the pupil and the sclera, shaped like inverted V-shaped water drops; the nose is slender and positioned high on the face, running down from the top of the animal face, and together with the fishbone-shaped forehead lines, forms a tree-like shape, while the tip of the nose is triangular; there are no ears; the mouth generally shows teeth, divided into upper and lower parts by a curved line: the upper section adopts the form of a horizontally oriented Chinese character “mu” (eye), while the lower section is Y-shaped, rendered with relatively fine craftsmanship; there are radial lines on the face, which should be the whiskers of the animal^{63,64}. On the whole, the lines of southern animal mask-patterned eaves tiles are relatively fine and elegant.

Northern animal mask-patterned eaves tiles (Fig. 5f-j) are mainly found in sites dating to the Northern Wei period (AD 386–534). Their features are as follows: The animal face has a broad forehead with wide-spaced wavy lines; it has thick eyebrows, and the eyes are depicted in a wide, angry glare; the nose is short, plum-blossom shaped, with ring-shaped nostrils; small ears are located on the upper part of the cheek, closely adjacent to the edge of the tile rim; the mouth is wide, with a long protruding tongue, broad plate-like incisors, and sharp, elongated upper fangs, while the curly whiskers around the lips are distinctly coiled⁶⁵. The northern China animal mask-patterned eaves tiles unearthed so far did not appear until the Northern Wei period (AD 386–534), while the southern China counterparts can be traced back to the Eastern Wu period (AD 222–280), significantly earlier than the northern ones^{63,66}. This chronological difference indirectly indicates that the emergence of such animal mask-patterned eaves tiles in the daily life of northern ethnic minorities was likely a result of the spread of southern eaves tiles, influenced by the Han culture from the south. In addition, the typical characteristics of animal mask-patterned eaves tiles (Fig. 5i, 5j) from before the Northern Wei moved its capital to Luoyang are round eyes, finely carved mouth parts, and prominent fangs⁶⁷. After the capital relocation to Luoyang, the eye shape of Northern Wei animal mask-patterned eaves tiles gradually shifted toward the inverted V-shaped teardrop form, and the elaborate carving of the mouth was replaced by simplified lines, with the overall style evolving toward abstraction and softness⁶⁷. These features are highly similar to those of southern animal mask-patterned eaves tiles, which reflects a trend of convergence between the northern and

southern animal mask patterns, and also embodies the absorption and recognition of Han culture by ethnic minorities.

Character-patterned Eaves Tile

Character-patterned Eaves Tiles refer to Eaves Tiles that use mould-imprinted or carved calligraphic characters as their core decorative theme. During the Wei, Jin, Southern and Northern Dynasties, character-patterned eaves tiles were mostly found in northern China, with characters mostly being auspicious phrases or records of place names. Examples include the character-patterned eaves tile inscribed with “Da Qin Long Xing Hua Mou Gu Sheng” (Great Qin rises in prosperity, its merits match those of ancient sages) unearthed in Yi County, Hebei Province (Fig. 6a), and the tile inscribed with “Dai Guo Du Men” (Capital Gate of the Dai State) unearthed in Shandong Province (Fig. 6b). The characters on these tiles are all Chinese characters, which indirectly reflects the historical information of ethnic minorities integrating into and identifying with Han culture. In addition, the character-patterned eaves tile inscribed with “Tai He Shi Liu Nian Wu Zao” (Made in the 16th year of the Taihe era, year of Wu) unearthed in Jungar Banner, Yikezhao League, Inner Mongolia Autonomous Region (Fig. 6c), bears the era name “Taihe”, which also embodies the integration and identification of ethnic minorities with Han culture⁶⁸. The era name system was first created by Emperor Wu of the Western Han Dynasty (202 BC-AD 8), and inherently contains the Han ethnic concept of “the monarch’s virtuous governance and the interaction between heaven and humanity”.

In the late period of the Sixteen Kingdoms (AD 304–439), various ethnic minority regimes established their own era names one after another to demonstrate the legitimacy of their political independence⁶⁹, which reflects their identification with the political culture of the Han ethnic group. Furthermore, the Northern Wei “Wan Sui Fu Gui” (Long live and wealth) tile unearthed at the Wenmingtaihuang site (Fig. 6d) divides the obverse surface into nine areas by four vertical and horizontal lines, with one character carved in the center of the top, bottom, left and right positions respectively, arranged in the order of top, bottom, left and right⁷⁰. Its layout is very similar to the Han Dynasty “Wan Sui Fu Gui” tile collected by the Beijing Municipal Cultural Relics Bureau. This indicates that Han ethnic eaves tiles used for auspicious prayers also exerted a certain influence on ethnic minorities during the Wei, Jin, Southern and Northern Dynasties. In addition to the “Wan Sui Fu Gui” tiles, tiles such as “Da Zhao Wan Sui” (Long live the Great Zhao) (Fig. 6f) and “Da Dai Wan Sui” (Long live the Great Dai) (Fig. 6g) also appeared during the Wei, Jin, Southern and Northern Dynasties. The characters “Wan Sui” (long live) fully reflect the characteristics of Han culture: it is a manifestation of the deification of imperial power in the Han ethnic group, and also integrates the Confucian thought of “interaction between heaven and humanity”. The emergence of such tiles also demonstrates the integration and identification of ethnic minority imperial elites with Han culture.

The inscription “Chuan Zuo Wu Qiong” (May the imperial mandate be transmitted endlessly) also deeply embodies core ideological constructs of Han Chinese culture. The character “Zuo” originally denoted

“heavenly bestowed blessing”. The phrase “Tian Zuo Ming De” (Heaven blesses those of luminous virtue) from the “Zuo Zhuan” (Zuo Commentary)⁷¹, and “Huang Tian Jia Zhi, Zuo Yi Tian Xia (August Heaven commends him, granting him the world as a blessing) from the “Guo Yu” (Discourses of the States)⁷², already articulate the early ideological premise of “Tian Shou Huang Quan” (imperial authority granted by Heaven). In the “Dong Du Fu” (Rhapsody on the Eastern Capital) composed during the Eastern Han Dynasty, the line Wang Zhe Wang Mang Zuo Ni, Han Zuo Zhong Que (When “Wang Meng” usurped power, the Han dynastic fortune was interrupted”) indicates that the semantic scope of Zuo had shifted toward denoting “dynastic mandate / imperial throne” by this period⁷². The “San Guo Zhi” (Records of the Three Kingdoms), compiled by Chen Shou during the Western Jin Dynasty, also records the phrase “Chuan Zuo Wan Shi (transmit the dynastic mandate for ten thousand generations)⁷³. These textual sources collectively demonstrate that the concept of “Chuan Zuo” (transmission of the dynastic mandate) had evolved into a core Han Chinese ideological expression of aspirations for political stability and dynastic continuity by the Wei-Jin period. Large quantities of Northern Wei “Chuan Zuo Wu Qiong” eaves tiles excavated from the hilltop above the Yungang Grottoes site in Shanxi Province (Fig. 6h) indicate that non-Han ethnic regimes had absorbed influences from the more advanced Han Chinese political institutional system, and had begun to utilize the concept of “Chuan Zuo” as an ideological mechanism to maintain regime legitimacy and stability.

The Assimilation of Han Cultural Elements by Northern Ethnic Minorities from the Perspective of Eaves Tile Dimensions

The dimensional specifications of eaves tiles are not arbitrary craft parameters, but a tangible material embodiment of ancient Chinese architectural hierarchy and construction standard systems, whose evolutionary trajectory directly reflects the degree of adoption of Central Plains Han architectural institutions by different ethnic⁷⁴ (Qiu 1993). Prior to the Wei, Jin, Southern and Northern Dynasties, a clear dimensional dichotomy existed between northern and southern eaves tiles: tiles from northern nomadic regimes were generally larger with wider and thicker edge rims, adapting to the heavy, grand aesthetic preferences and architectural needs of nomadic culture, while tiles in the Central Plains Han region had formed a standardized size system matched to architectural ranks, with edge rim width and face diameter ratios strictly following traditional construction regulations^{75,76}. During the Wei, Jin, Southern and Northern Dynasties (220–589 CE), northern eaves tiles dimensions exhibited a pronounced trend of convergence toward southern Han-style tile specifications: discrepancies in face diameter gradually diminished, and edge rim width ratios approached the prevailing standards of Central Plains eaves tiles. Following the Northern Wei capital relocation to Luoyang under Emperor Xiaowen, the dimensional specifications of official architectural eaves tiles became fully congruent with those of official Central Plains tiles from the Wei and Jin periods. This dimensional convergence is far from a coincidental outcome of craft interaction: on one level, the adoption of Han-style tile dimensional standards constitutes an inherent recognition of Central Plains Han construction institutions and social hierarchy, serving as a material articulation of non-Han regimes’ active integration into the Central Plains political order. On another level, the standardization of dimensions reflects comprehensive Sinicization

of production systems and aesthetic orientations, indicating widespread acceptance of Han cultural norms across all levels of ethnic minority society, from official craft guilds to folk construction practices (Table.S2).

In terms of the face diameter of eaves tiles, southern eaves tiles continued the specifications of the Han Dynasty, with relatively concentrated diameters ranging from 9.5 cm to 25.7 cm (Fig. 7). The main size range falls between 12.0 cm and 16.4 cm, accounting for 80.6% of all samples. Smaller eaves tiles, such as those unearthed from the Qiaolang site at Jinsha Village, have a face diameter of only 11 cm, while larger specimens, such as those excavated from the Siyuan Buddhist Temple site, reach up to 18 cm. The face diameter of northern eaves tiles ranges from 9.2 cm to 19.6 cm, with the main distribution between 12 cm and 17 cm, accounting for 81.4% of samples (Fig. 7).

Overall, the face diameter values of northern eaves tiles are more scattered with greater fluctuations, and their specifications tend toward medium and larger sizes. These larger eaves tiles are mostly unearthed from high-level architectural sites such as palaces and Buddhist temples, reflecting the northern regimes' preference for large-scale architecture, but on the whole, the specifications of southern and northern eaves tiles tended to be consistent. In general, first, except for very few extra-large or extra-small outliers, eaves tiles from lower latitudes have smaller sizes; the higher the latitude, the larger the overall diameter of the eave's tiles, showing a gradual increasing gradient from south to north. Second, the face diameter values of southern eaves tiles are more clustered, presenting a more compact, delicate appearance and relatively unified specifications.

In terms of the edge rim width data of eaves tiles, the rim width of southern eaves tiles ranges from 0.6 cm to 2.5 cm, and 88.5% of them have an edge rim width between 0.8 cm and 1.4 cm (Fig. 8). The overall design is dominated by narrow rims, most of which are highly raised with more delicate lines. The rim width of northern eaves tiles ranges from 0.7 cm to 2.5 cm, with 80.0% of specimens having edge rim width between 1.1 cm and 2.0 cm. The edge rims are generally wider, with some reaching over 2 cm. Meanwhile, the edges of northern eaves tiles have prominent protrusions, and some are decorated with serrated patterns, linked bead patterns and other ornaments, presenting a strong sense of three-dimensionality and stability. In general: First, the difference in rim width among southern eaves tiles is small, and their craftsmanship is more standardized and unified. The stable norms formed by them became an important reference for the subsequent transformation of northern eaves tiles, laying a technical foundation for the convergence of sizes between southern and northern eaves tiles. In contrast, the rim width of northern eaves tiles varies more greatly, with a more rugged style. Second, eaves tiles from lower latitudes have narrower rim widths, while those from higher latitudes have significantly wider rim widths.

As time progressed, both southern and northern eaves tiles showed an evolutionary pattern of decreasing size, but their evolutionary paths and characteristics were different. The evolution of southern eaves tiles presented a trend of gradual shrinkage and standardization. From the Eastern Wu to the Western Jin period, the size of eaves tiles was not yet unified, but the characteristic of high edge rims

had already formed. During the Eastern Jin period, the size of eaves tiles began to shrink and stabilize^{77,78}. In the Southern Dynasties period, the size of eaves tiles was highly standardized, with the vast majority concentrated between 12.5 cm and 13.5 cm. The edge rims of eaves tiles were higher than the tile face, the width remained stable, the thickness of the central boss was reduced, and the sense of three-dimensionality was somewhat weakened. This overall compact and regular style, which pursues delicacy and elegance, not only reflects the unique aesthetics of the south, but also demonstrates the strict control of architectural components by the Southern Dynasties regimes.

The evolution of northern eaves tile sizes shows an overall characteristic of first increasing and then decreasing in size. During the Western Han Dynasty, northern eaves tiles had relatively large specifications and thick bodies^{79,80}. Taking the Han Chang'ancheng site as an example, the face diameter of tiles was generally between 15 and 17 cm, and the edge rim width ranged from 1.1 to 1.7 cm⁸⁰. In the late Eastern Han Dynasty, the face diameter of eaves tiles was concentrated between 14 and 16.2 cm, with edge rims higher than the decorative patterns, centered on round nipple bosses with relatively large diameters, presenting a simple and heavy style^{80,81}. During the Cao Wei and Western Jin periods (AD 220–316), the diameter range of eaves tiles expanded, and the height of the raised parts gradually increased. This period continued the structure of round nipple bosses, with slightly reduced boss sizes. By the Sixteen Kingdoms period, the bodies of eaves tiles were generally thick, with large differences in size, and there was an obvious trend of large-scale tiles, reflecting the pursuit of a grand and majestic style when various states built their capitals.

The Northern Wei period (AD 386–534) was a critical juncture for the fusion of northern and southern eaves tile styles⁸². After the capital was moved to Luoyang, northern eaves tiles abandoned the earlier pursuit of massive size and were gradually influenced by the standardized, miniaturized southern production style, with their dimensions moving closer to those of southern eaves tiles⁸². In the early and middle periods, northern eaves tiles shifted toward smaller sizes, showing a certain similarity to southern tiles in specifications, reflecting cultural dissemination and craft integration⁸². At the same time, the height difference between decorative patterns and the tile surface gradually increased, with patterns becoming more high-relief and the sense of three-dimensionality enhanced. Round nipple bosses continued to be used, with their size ratio remaining stable, but the decoration became more complex, with decorative layers such as “outer ring of linked bead patterns” appearing to highlight the central position of the boss⁸². In the late period after the capital was moved to Luoyang through to the end of the Northern Dynasties, influenced by the deepening of Buddhist culture, the decorative themes of eaves tiles were mostly lotus seed pods, with the size of the nipple boss slightly reduced⁸³. The overall dimensions of northern and southern tiles converged, and the style already showed signs of transition toward the eaves tiles of the Sui and Tang Dynasties.

In summary, the early characteristics of southern and northern eaves tiles showed clear regional differences: southern tiles had more concentrated overall sizes with a stable mainstream range, continuing the Han Dynasty tradition and maintaining compact, standardized features over a long period;

northern tiles had greater dimensional fluctuations, were generally larger and heavier, reflecting the northern regimes' pursuit of grand and imposing architectural styles. With changes in the political landscape of the Northern Dynasties and the deepening of cultural exchanges between the south and north, northern tiles gradually moved away from the early development trend toward large-scale production. After the Northern Wei moved its capital to Luoyang, northern tiles clearly converged toward southern standards, with sizes shifting from large to small and distributions gradually becoming more concentrated. By the late Northern Dynasties, the mainstream face diameter ranges of southern and northern tiles highly overlapped, and regional differences were significantly weakened, indicating that the early dimensional differences of eaves tiles had gradually moved toward unified formal standards. The edge rim width characteristics also reflect the evolutionary trajectory of southern and northern tiles from divergence to fusion. Southern tiles were dominated by narrow rims with small rim width differences and standardized, uniform craftsmanship, forming stable production techniques; northern tiles in the early period had wider rims with greater variation, featuring a rough style and strong three-dimensionality. With the deepening of cultural and craft exchanges between the south and north, northern tiles gradually absorbed the narrow rim characteristics of southern tiles while maintaining their own features: the rim width fluctuation gradually leveled off, the overall style became more refined, and decorative layers appeared. By the late Northern Dynasties, although the rim widths of southern and northern tiles still retained some traces of difference, their core range and production logic had gradually become consistent, completing the transition from regional characteristics to a shared paradigm.

Conclusion

This study has examined eaves tile— an underutilized category of architectural material culture — to investigate the processes of multi-ethnic cultural interaction and identity formation during the Wei, Jin, Southern and Northern Dynasties (AD 220–589). Through systematic collection and quantitative comparative analysis of 356 eaves tiles from 46 archaeological sites across northern and southern China, focusing on four key decorative motifs (lotus, cloud, animal mask, and inscribed character patterns) and two-dimensional parameters (face diameter and edge rim width), the following conclusions can be drawn: First, the decorative motifs of northern eaves tiles demonstrate a clear trajectory of adopting Han Chinese cultural elements. Lotus patterns (originally a Buddhist symbol deeply integrated into Han material culture), cloud patterns (embodying Han Confucian cosmological concepts of “Tian Ren He Yi” and “Tian Ren Gan Ying”), animal mask patterns (carrying the Han tradition of auspicious symbolism), and character patterns (directly employing the Han writing system, era names, and political discourse) were all actively embraced by northern non-Han regimes. The stylistic convergence is particularly evident in the transition of northern Lotus-patterned eaves tiles from double-petal configurations with large central bosses to the southern-style single-petal forms with lotus seed pod centers, and in the evolution of northern animal mask-patterned eaves tiles toward the more refined, abstracted style of their southern counterparts following the Northern Wei capital relocation to Luoyang. Second, dimensional analysis reveals a parallel convergence. Southern eaves tiles maintained compact, standardized specifications inherited from the Han Dynasty, with concentrated face diameters (12.0-16.4

cm, 80.6% of samples) and narrow, uniform rim widths (0.8–1.4 cm, 88.5% of samples). Northern eaves tiles initially exhibited larger, more variable dimensions reflecting a preference for monumental architecture. However, after the Northern Wei capital relocation to Luoyang, northern eaves tiles dimensions progressively converged toward southern standards: face diameter ranges increasingly overlapped, rim width fluctuations stabilized, and by the late Northern Dynasties, a shared formal paradigm had emerged across both regions.

This study demonstrates that architectural material culture serves as a tangible and verifiable proxy for understanding ethnic identity formation — one that complements the elite-biased perspective of transmitted textual records. The adoption of Han-style decorative motifs and dimensional standards by northern non-Han regimes represents not merely technical imitation, but a deeper ideological identification with Han political institutions, ritual norms, and cosmological worldview. These material changes provide robust archaeological evidence for the active role of northern ethnic minorities in the multi-directional processes of cultural integration that ultimately shaped the foundation of medieval Chinese civilization.

Declarations

Ethics Statements

This article does not contain any studies with human participants performed by any of the authors

Competing interests

No potential conflict of interest was reported by the authors.

Author Contribution

L.Y. was mainly responsible for the collection and organization of data, as well as writing the first draft and revising the manuscript. W. Y. was mainly responsible for the collection and organization of data, prepared pictures and tables, as well as the revision of the manuscript. Y. X. was mainly responsible for the collection and organization of data, the creation of pictures and tables, as well as the revision of the manuscript. H. M. was responsible for revising and editing the manuscript, coordinating with the editorial office, and offering many practical and constructive suggestions for the article.

Data Availability

No new standalone dataset was generated for this study. This study is based on qualitative analyses of eaves tiles from historical documents and archaeological excavation reports. Bibliographic details and

source identification information are contained in the article; additional source location information is available from the corresponding author on reasonable request. Access to, and reproduction of, archival or copyrighted materials are subject to the policies of the relevant libraries, archives, and publishers. Two supplementary data files (Table S1 and Table S2) are associated with this article.

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Figures

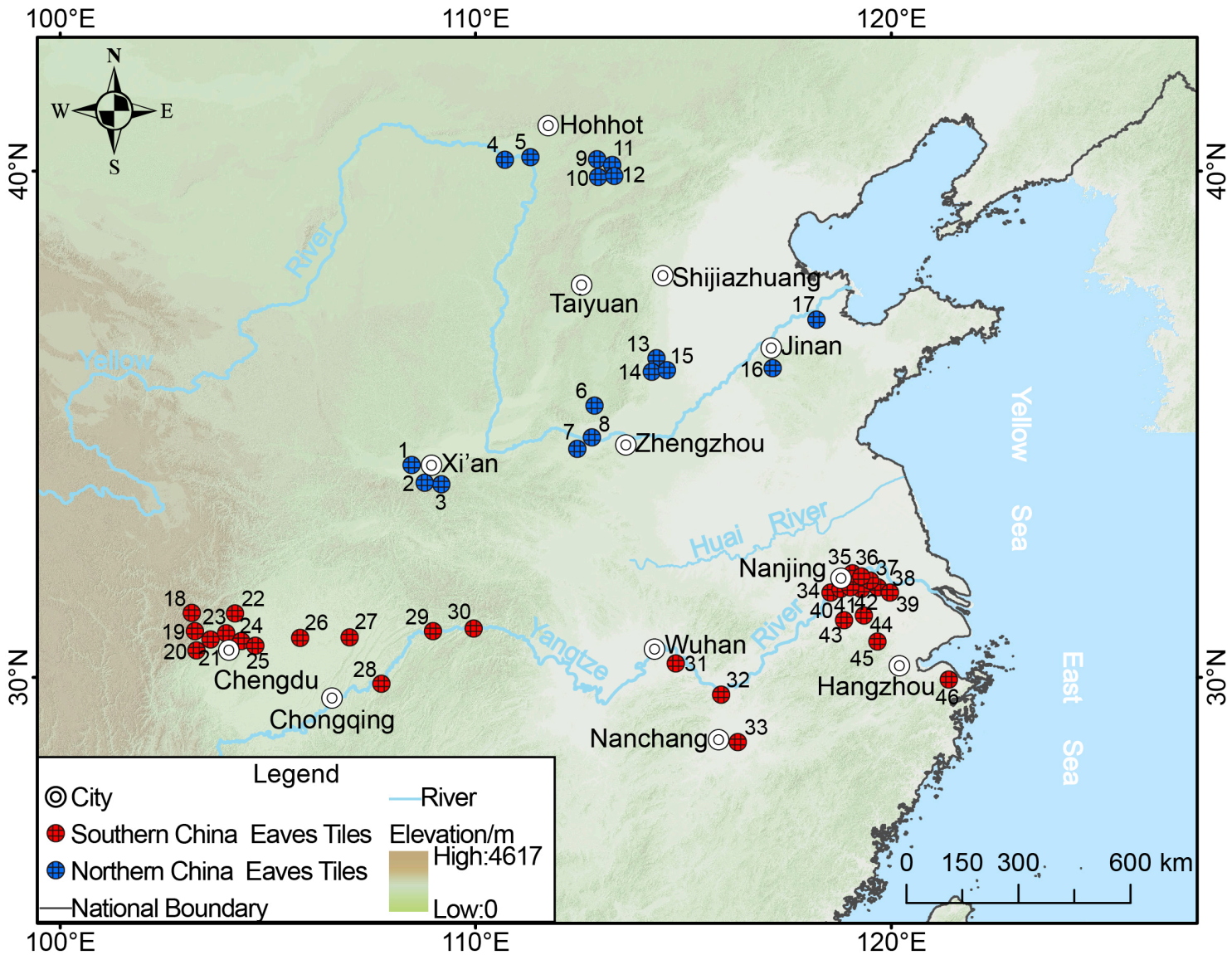


Figure 1

Study area and the site mentioned in this paper. North: 1 Zhangguancun; 2 Shentongsi; 3 Mengzhuang; 4 Nanying; 5 Yecheng; 6 Mingtang; 7 Caochangcheng; 8Yungangshiku; 9 Siyuanfosi; 10 Huaishuofosi; 11Mangshanchangling; 12 Hanweigucheng; 13 Yunzhonggucheng; 14Shierlian Cheng; 15 Lougetai; 16 No. 2 Changlegong; 17 Changancheng;**South:** 18 Shierqiao; 19 Dayixiejiang school; 20

Jinshacunqiaolang; **21** Experimental building in Qingshuihe Campus, University of Electronic Science and Technology of China; **22**Mianzhucheng; **23** Xiaonanjie; **24** Southern Dynasty Stone Carvings; **25** No. 16 courtyard, commercial street; **26** Tianfuguangchang; **27** Zijinwan Tomb;**28** Quxianchengba; **29** Kongdongbao Tombs; **30** Jiuxianping; **31** Tiaoshi; **32**Wuwangcheng; **33** Xunyangcheng; **34** Banzhoucheng of the Six Dynasties; **35** Yaogangcun; **36** Baoensi; **37** Tongzuofang in Zhongshan south street; **38** Daxinggong; **39** Six Dynasties Tombs, Fugui mountains; **40** Six Dynasties Altars, Zhongshan; **41** No.2 Temple, Zhongshan; **42** Xiaowei Tomb; **43** Pilusi; **44** Tiewengcheng; **45** Anjicheng; **46**Juzhangcheng.

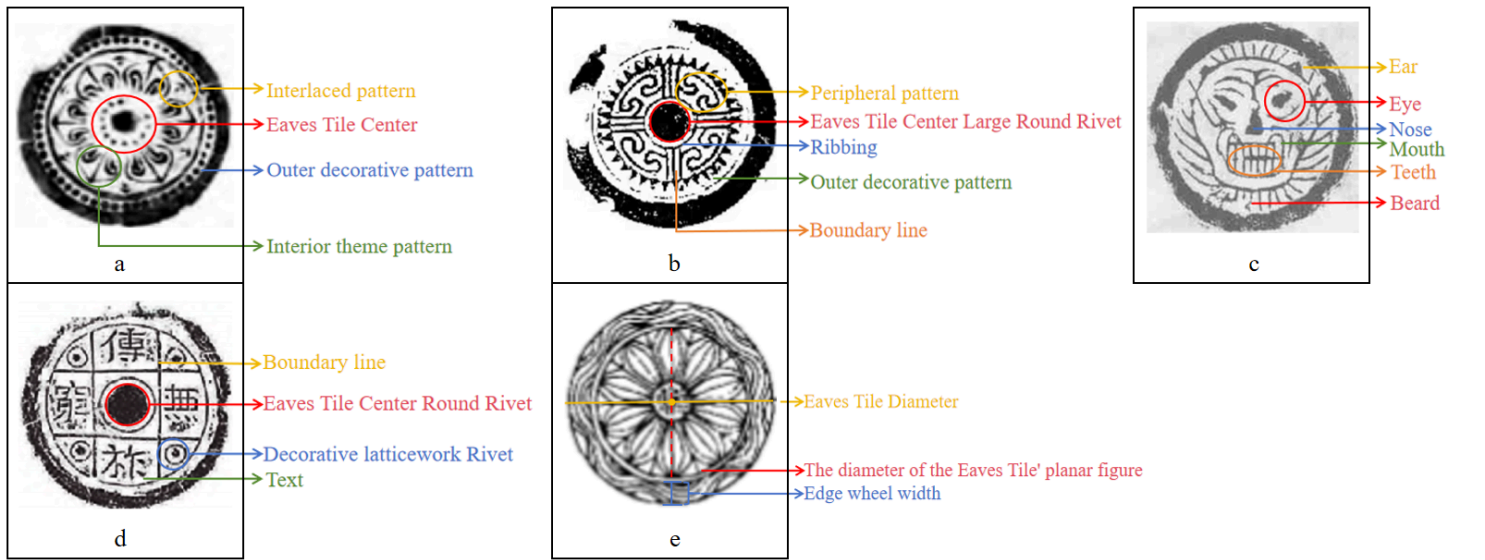


Figure 2

Schematic diagrams of the front face structure characteristics of different types of tiles and the surface diameters and edge rim width. **a**Lotus pattern eaves tile structure (Northern Wei eaves tile unearthed from Hanweigucheng site). **b** Cloud pattern eaves tile structure (Northern Dynasties eaves tile unearthed from Hanweigucheng site). **c** Animal mask pattern eaves tile structure (Eastern Jin eaves tile unearthed from Chaotiangong site). **d** Character pattern eaves tile structure (Northern Wei eaves tile unearthed from Yungangshiku site). **e** Schematic diagram of the eaves tile diameter and edge rim width (Southern Dynasties Liang Eaves Tile unearthed from Xiaowei Tomb site).

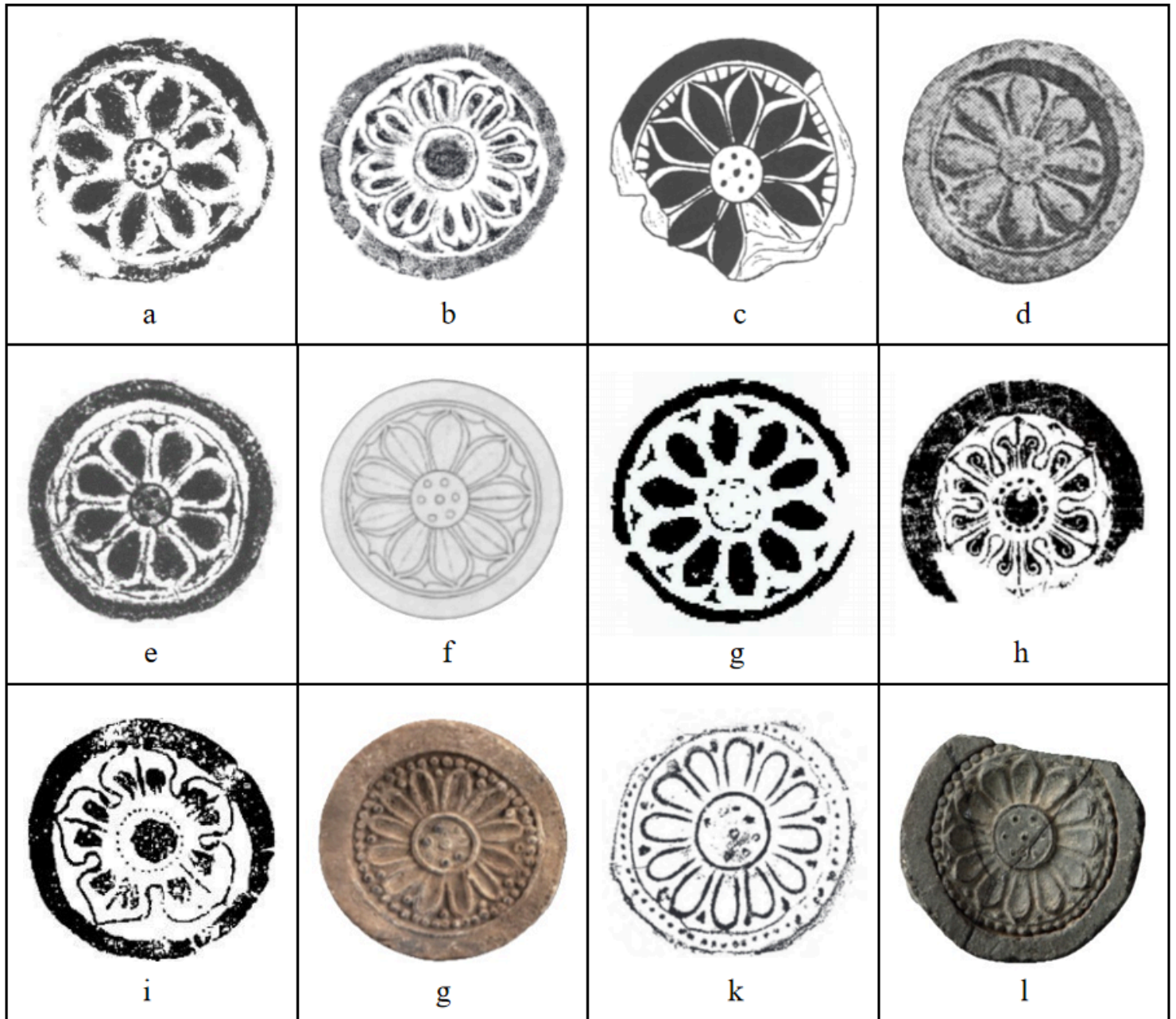


Figure 3

Lotus-patterned eaves tiles of the Wei, Jin, Southern and Northern Dynasties unearthed from archaeological sites in both southern and northern China. **a** Single-petal lotus pattern eaves tile of the Liu Song Dynasty unearthed from the Six Dynasties Altars site, Zhongshan. **b** Double-petal lotus pattern eaves tile of the Northern Wei Dynasty unearthed from Caochangcheng site. **South eaves tile:** **c** Lotus pattern eaves tile of the Eastern Jin Dynasty unearthed from the Six Dynasties Tombs site, Fugui mountains. **d** Lotus pattern eaves tile of the Southern Dynasties unearthed from Baoensi site. **e** Lotus pattern eaves tile from the late Qi to early Liang Dynasty unearthed from Xiaowei Tomb. **f** Lotus pattern eaves tile of the Six Dynasties unearthed from Pilusi site. **g** Lotus pattern eaves tile of the Six Dynasties unearthed from No.2 Temple site, Zhongshan. **North eaves tile:** **h** Lotus pattern eaves tile of the Northern Wei Dynasty unearthed from Gaochangcheng. **i** Lotus pattern eaves tile of the Northern Wei

Dynasty after moving the capital to Luoyang, unearthed from the Northern Wei Luoyangcheng site. **j** Lotus pattern eaves tile of the Northern Dynasties unearthed from No. 2 Changlegong site. **k** Lotus pattern eaves tile of the Northern Dynasties unearthed from Changancheng site of the Han Dynasty. **l** Lotus pattern eaves tile of the Northern Dynasties unearthed from Changancheng site of the Han Dynasty.

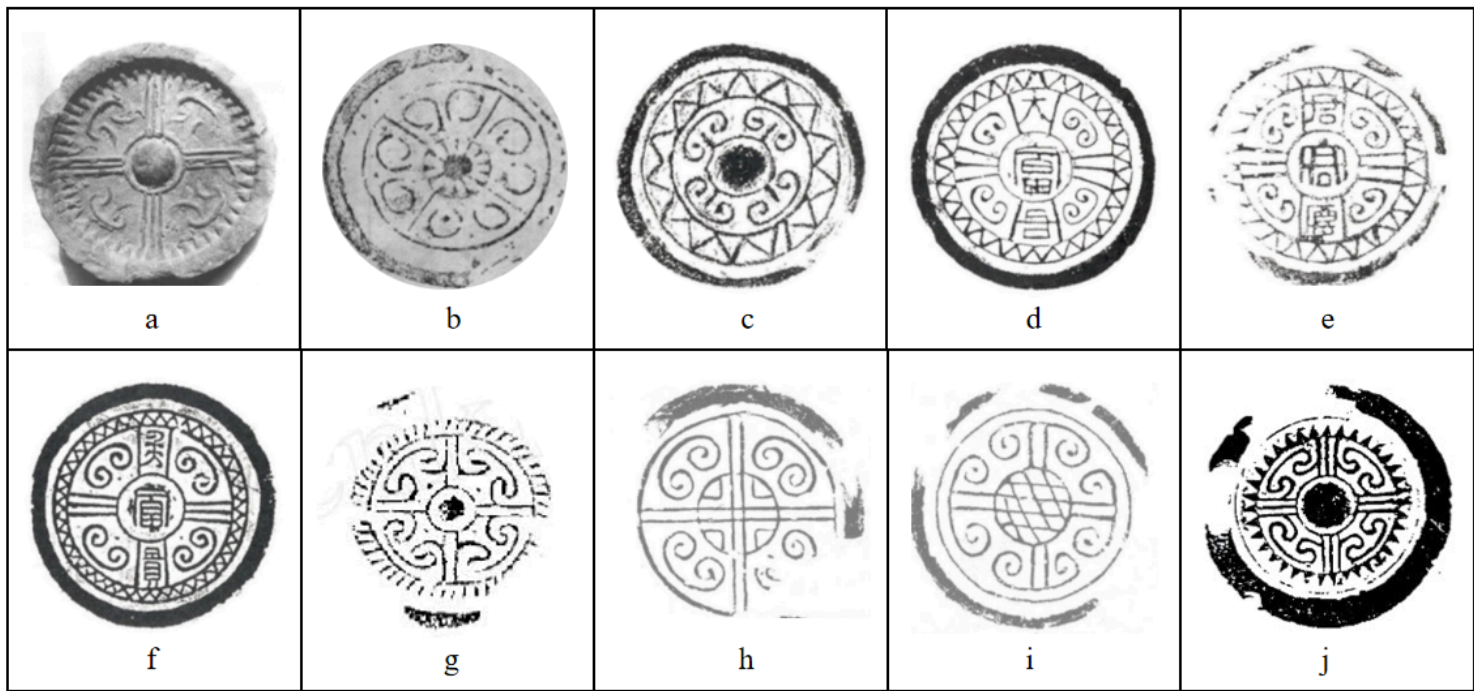


Figure 4

Cloud-patterned eaves tile during the Wei, Jin, Southern and Northern Dynasties unearthed from archaeological sites in both southern and northern China. **a** Cloud pattern eaves tile of the Eastern Wu to Western Jin Dynasty unearthed from Daxinggong site. **b** Ram’s horn-shaped cloud pattern eaves tile of the Six Dynasties unearthed from Xunyangcheng site. **c** Mushroom-shaped cloud pattern eaves tile of the Six Dynasties unearthed from Mianzhucheng site. **d**“Da Fu Ji” (Great Fortune and Auspiciousness) cloud pattern eaves tile of the Six Dynasties unearthed from Shierqiao site. **e** “Jun Gao Qian” (Wish for High Official Promotion) cloud pattern eaves tile of the Six Dynasties unearthed from Tianfuguangchang site. **f** “Hou Fu Gui” (Marquis Rank, Wealth and Honor) cloud pattern eaves tile of the Six Dynasties unearthed from Mianzhucheng site. **g** Mushroom-shaped cloud pattern eaves tile of the Northern Dynasties unearthed from Hanweigucheng site. **h** Cloud pattern eaves tile of the Sixteen Kingdoms to Northern Dynasties period unearthed from Lougetai site. **i** Cloud pattern eaves tile of the Sixteen Kingdoms to Northern Dynasties period unearthed from Lougetai site. **j** Cloud pattern Eaves Tile of the Northern Dynasties unearthed from Hanweigucheng site.

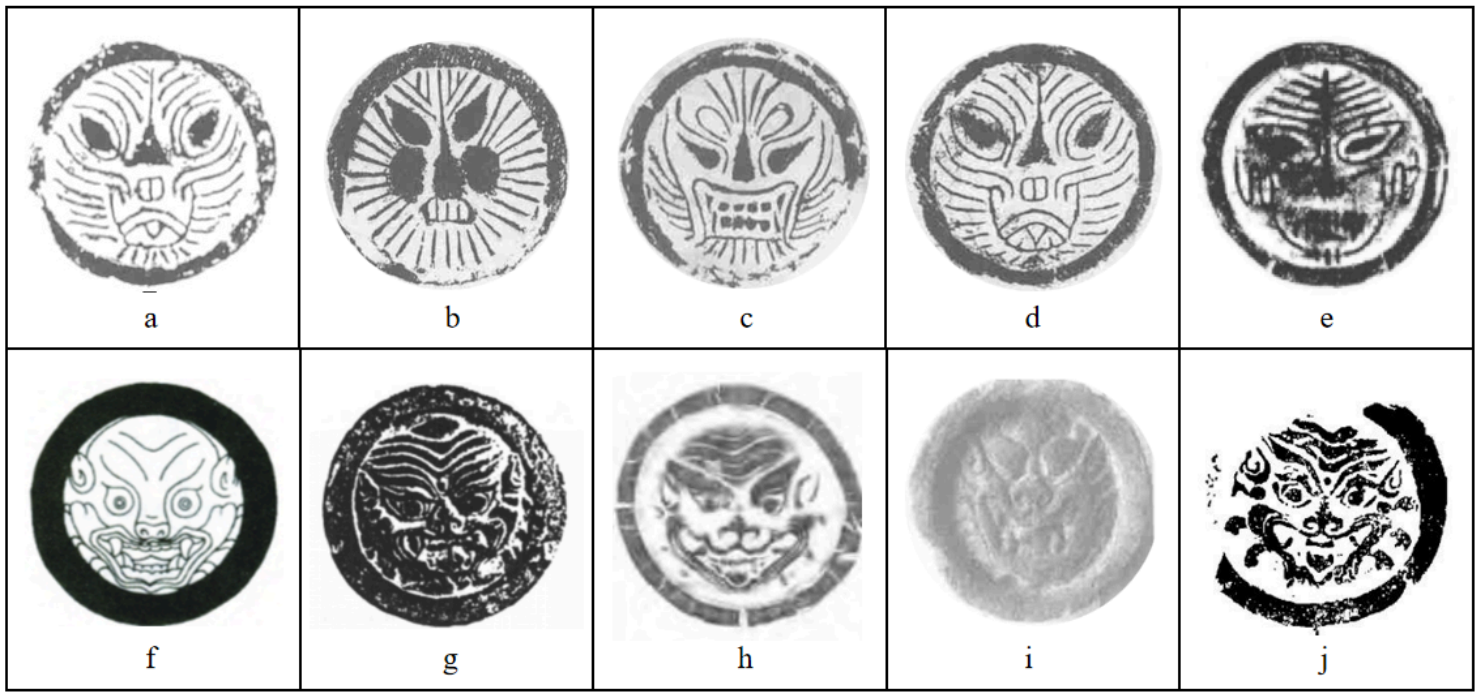


Figure 5

Animal mask-patterned eaves tile during the Wei-Jin and Southern-North Dynasties unearthed from archaeological sites in both southern and northern China. **a** Animal mask pattern Eaves Tile of the Southern Dynasties unearthed from Daxinggong site. **b** Animal mask pattern Eaves Tile of the Eastern Wu Dynasty unearthed from Tiewengcheng site. **c** Animal mask pattern Eaves Tile of the mid-late Eastern Jin Dynasty unearthed from Tongzuofang in Zhongshan south street site. **d** Animal mask pattern Eaves Tile of the Southern Dynasties unearthed from Pilusi site. **e** Animal mask pattern Eaves Tile of the Six Dynasties unearthed from Shierqiao site. **f** Animal mask pattern Eaves Tile of the Northern Wei Dynasty unearthed from Mingtang site. **g** Animal mask pattern Eaves Tile of the Northern Wei Dynasty unearthed from Hanweigucheng site. **h** Animal mask pattern Eaves Tile of the Northern Wei Dynasty unearthed from Hanweigucheng site. **i** Animal mask pattern Eaves Tile of the early and middle period after the Northern Wei moved its capital to Luoyang, unearthed from Daxinggong site. **j** Animal mask pattern Eaves Tile of the early and middle period after the Northern Wei moved its capital to Luoyang, unearthed from Hanweigucheng site.

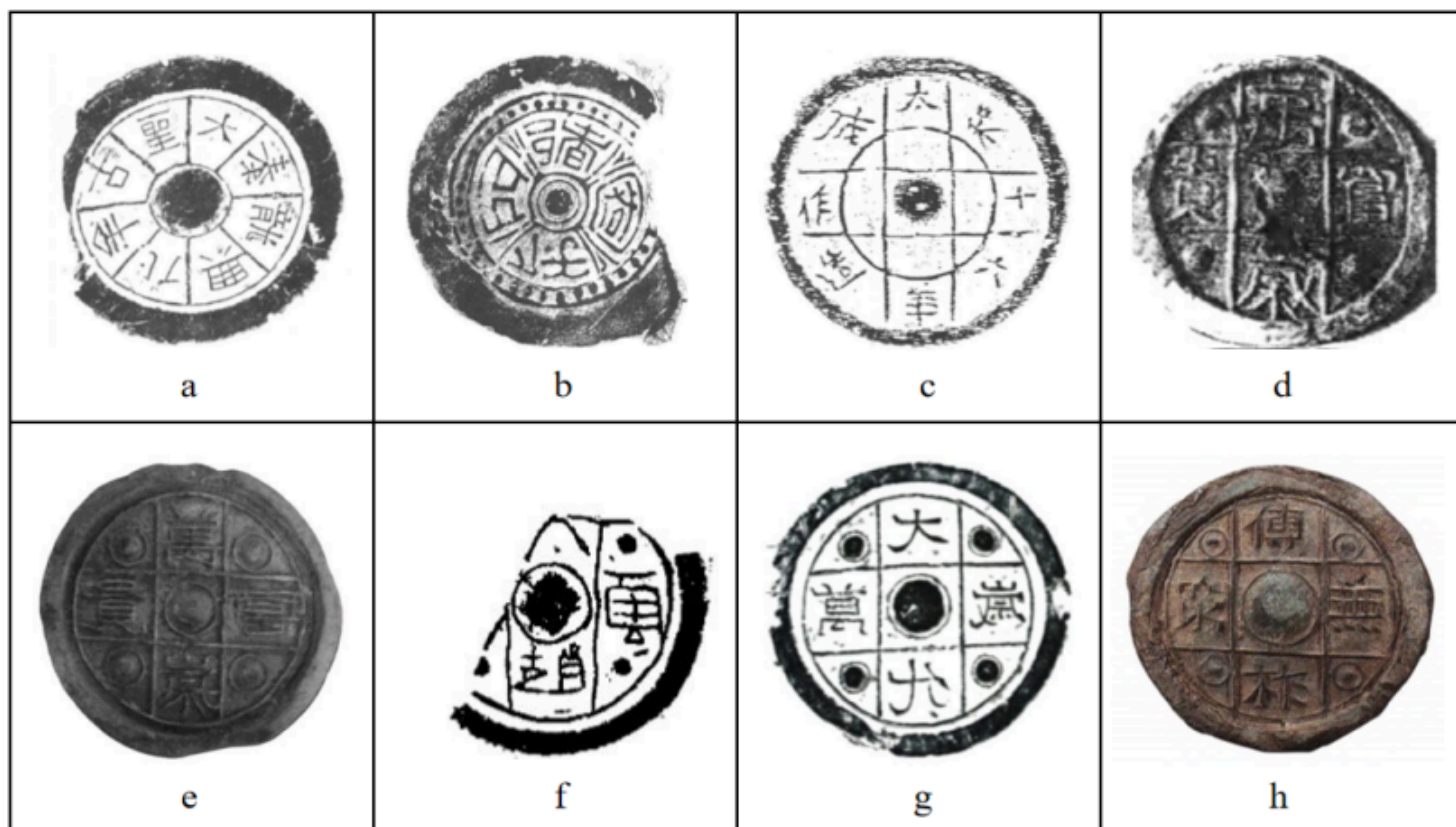


Figure 6

Character-patterned eaves tile during Wei-Jin and Northern and Southern Dynasties unearthed from archaeological sites in both southern and northern China. **a** "Da Qin Long Xing Hua Mou Gu Sheng" character pattern eaves tile of the Wei to *Former Qin* period unearthed from Yi County. **b** "Dai Guo Du Men" character pattern eaves tile of the Dai State unearthed from Shandong Province. **c** "Tai He Shi Liu Nian Wu Zao" character pattern eaves tile of the Northern Wei Dynasty unearthed from Shierliancheng site. **d** "Wan Sui Fu Gui" character pattern eaves tile of the Northern Wei Dynasty unearthed from Wenming Taihuang site. **e** "Wan Sui Fu Gui" character pattern eaves tile of the Northern Wei Dynasty unearthed from Caochangcheng site. **f** "Da Zhao Wan Sui" character pattern eaves tile of the Northern Dynasties unearthed from Yecheng site. **g** "Da Dai Wan Sui" character pattern eaves tile of the Northern Wei Dynasty unearthed from Yunzhonggucheng site. **h** "Chuan Zuo Wu Qiong" character pattern eaves tile of the Northern Wei Dynasty unearthed from Siyuanfosi site.

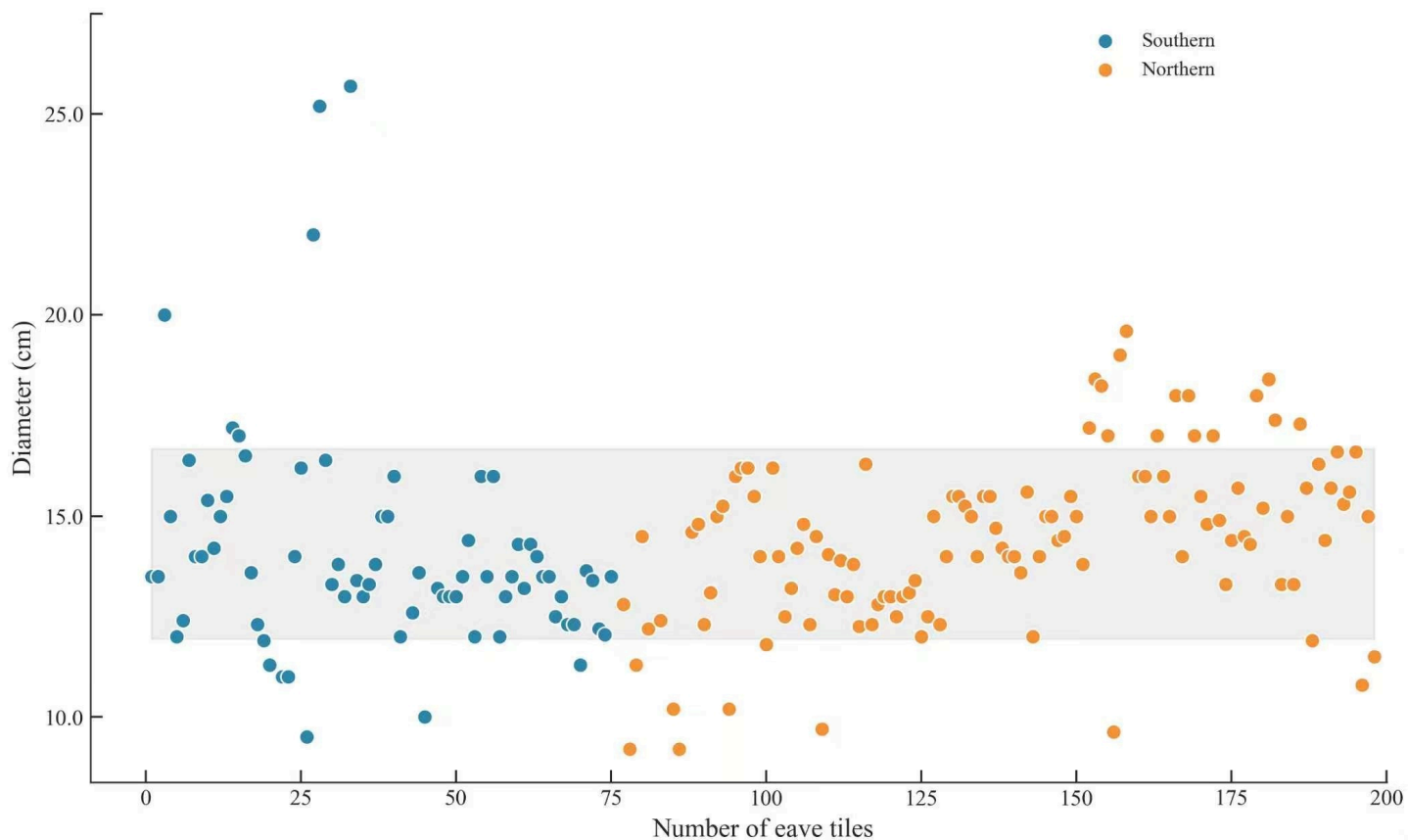


Figure 7

Map of the distribution of Eaves Tile by diameter in the north and south during the Wei, Jin, and Northern and Southern Dynasties.

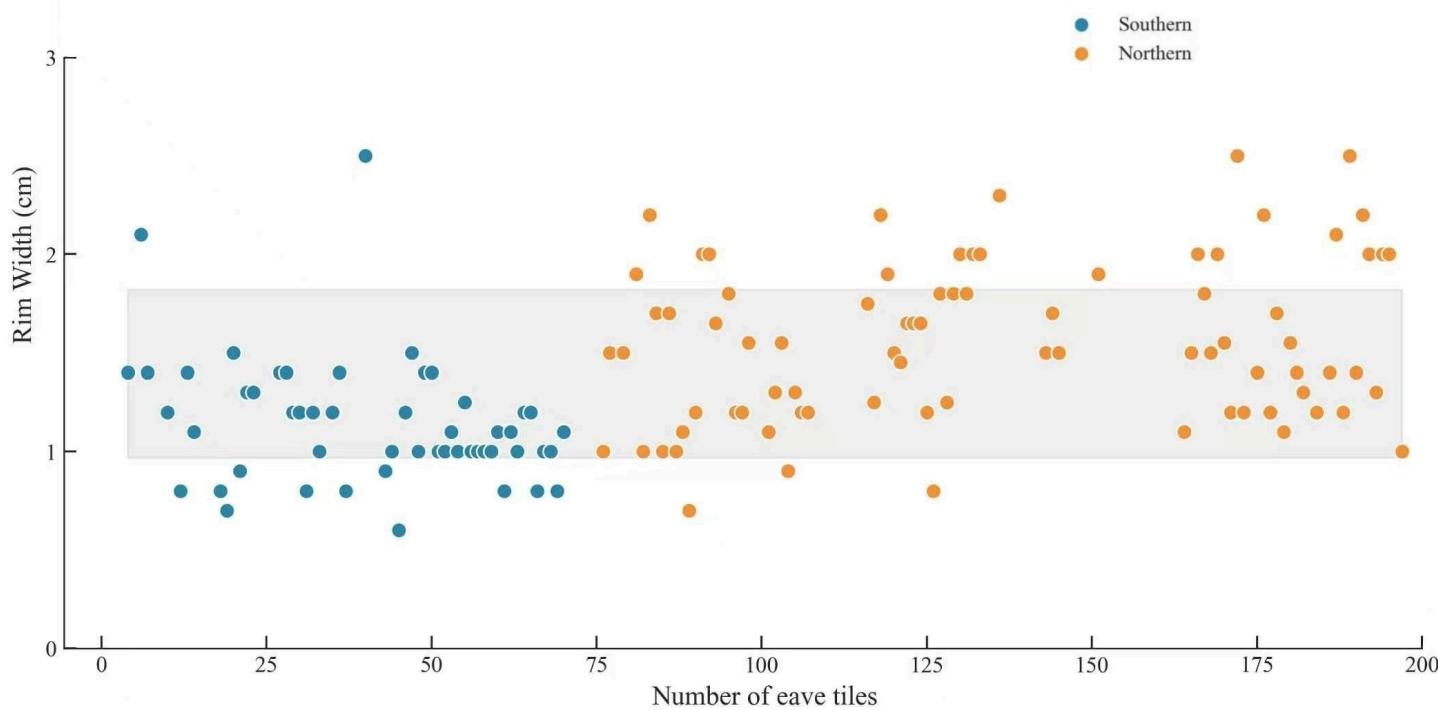


Figure 8

Map of the distribution of Eaves Tile by rim width in the north and south during the Wei, Jin, and Northern and Southern Dynasties.

Supplementary Files

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- [TableS1.docx](#)
- [TableS2.docx](#)