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Jade for Bones in Hongshan Craftsmanship: Human Anatomy as the Genesis of a Prehistoric Style

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Abstract: Jade artifacts produced in prehistoric China continue to generate extensive scholarly interest. In the absence of textual data, inferring how works functioned in Jade Age communities remains challenging. This paper focuses on Hongshan 红山 culture (4500–3000 BCE) jades, a distinctively styled corpus primarily recovered from late fourth millennium BCE graves in northeastern China. Recent finds within and beyond the Hongshan core zone have enriched the jade inventory and expanded the known scope of its stylistic variations. The analysis sheds light on enigmatic types, reveals the complex representational nature of this corpus, and clarifies the mimetic intentions that resulted in the soft rounded forms characteristic of the style. Most objects examined were unearthed at Hongshan ceremonial centers and have sound excavation pedigrees. Their study relies on contextual archaeological data and comparative visual analysis and draws on the broader Hongshan material world. Further considerations include environment, funerary practices, materiality, cognition, and human anatomy. Ultimately, the paper uncovers new paradigms of figural representation that should open fresh investigative avenues for specialists of early China. Preliminary evaluation of jades unearthed further south at Lingjiatan 凌家滩 and Liangzhu 良渚 sites suggests that some late Neolithic societies adopted Hongshan practices. Current evidence hints at members of prehistoric communities attempting, through jade works, to rationalize their physical circumstances and assert their social power by symbolically fusing with elements of their environments.



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1. Introduction

Prior to turning molten alloys into sumptuous bronze vessels that today's visitors admire in museum galleries, inhabitants of ancient China had spent millennia transforming other substances into exquisite artifacts. During the Neolithic period, jade became a matrix of choice to craft an array of objects that archaeologists generally discover entombed with the deceased. Excavations have revealed a dramatic increase in the production of jade objects over the course of the Neolithic period, so much so that early China specialists classify the last phase as the Jade Age (3500–2000 BCE) (Childs-Johnson 1988; Mou and Wu 1999; Childs-Johnson and Gu 2009; Demattè 2006). Archaeological work conducted in northeast China continues to yield prehistoric jades, at once reinforcing well-established cultural corpuses and delighting specialists. This was the case in the last decade with finds from the Banlashan 半拉山 cemetery, a site located 13 km from Chaoyang City in Liaoning Province, and the Hamin Mangha 哈民忙哈 settlement in Horqin Left Banner, Inner Mongolia (Liaoning Provincial Institute and Longcheng District Museum 2017a, 2017b; Inner Mongolian Institute and Office of Cultural Affairs 2012; Inner Mongolian Institute of Cultural Relics and Research Center 2014). Excavations at Hamin Mangha led to the sensational discovery of burned houses filled with piled human remains, signs of a hasty site abandonment attributed to a plague outbreak approximately 5000 years ago (Zhou et al. 2022). The jades recovered at the site presented specialists with a novel corpus of forms reminiscent of well-known types produced in the Hongshan 红山 cultural sphere.

Banlashan, securely located further south within the Hongshan culture (4500–3000 BCE) core zone in the Daling 大凌 River valley, generated better-established jade types from more conventional funerary and ceremonial contexts.¹ Architectural features uncovered revealed a burial ground used over three centuries in the last part of the fourth millennium BCE. Alongside its jades, this cairn cemetery generated bottomless clay cylinders, anthropomorphic sculptures, an enclosed, stone-faced, and elevated platform area, and sacrificial pits, all consistent with material traces unearthed at other late Hongshan (3500–3000 BCE) jade-yielding ceremonial centers at Caomaoshan 草帽山 in Aohan Banner of Inner Mongolia (Shao 2004), Hutougou 胡头沟 in Fuxin 阜新 county (Fang and Liu 1984), Dongshanzui 东山嘴 in Kazuo 喀左 county (Guo and Zhang 1984), and the more extensive Niuheliang 牛河梁 complex in Lingyuan 凌源 and Jianping 建平 counties² (Liaoning Provincial Institute of Archaeology and Cultural Relics of Chaoyang City 2004; Liaoning Provincial Institute 2012b). Ceremonial centers functioned as magnets for communities that sustained their livelihood through hunting, gathering, and agriculture, and that lived in small villages made of semi-subterranean houses scattered throughout an area spanning north-eastern Hebei province, southeastern Inner Mongolia, and western Liaoning province in northeast China. Scholars suppose that the centers, manned by ritual specialists, served surrounding populations, and helped sustain broader socio-political cohesion (Peterson et al. 2010; Peterson and Lu 2013; Drennan et al. 2017). The ritual sites generally also functioned as resting places for select community members. Archaeologists often find the tombs near and inside large communal stone cairns associated with elevated platforms. They occasionally unearth jades from sacrificial pits and ritual platforms, but the majority come from these graves, solely furnished with jade burial goods. Scholars have posited that the tomb occupants were members of the Hongshan elite.³

Well known to scholars of early China, Hongshan jades have entered the visual field and captivated the interest of a broader contemporary public. Museum collections and auctions offer opportunities for modern viewers to see the often-enigmatic shapes that prehistoric people gave to these objects. Introductory surveys and monographs on the arts, archaeology, and emergence of civilization in China often feature jades from Hongshan tombs. These artifacts remain significant in quests to understand a remarkable culture, which experts of the prehistoric northeast consider as “the first clear steps toward complex social, political, and economic organization in this part of the world” (Peterson and Lu 2013, p. 56). Scholarly investigations, however, have largely focused on the ideology of Hongshan communities and highlighted its link to historical Han China (Peterson and Lu 2013, p. 56). Hongshan jades and the symbolism possibly embodied in their shapes are perceived as a window onto past values and beliefs. Regularly, discussions on these 5000-year-old artifacts imply that some Chinese cultural aspects date back to Hongshan times.⁴

The present analysis intervenes in a rich scholastic tradition, sustained in the United States with the exhaustive work of Elizabeth Childs-Johnson.⁵ The unearthing of Hongshan jades from tombs yielding little stratigraphic data has encouraged typological, taxonomic, and spatial distribution analyses to infer their relative dating and thus assist in the periodization of graves (Lu 1998; Deng 2002). These objects further stimulated inferences about the status and role of tomb occupants, the power they held in society, their command of ritual activities, and the control they exerted over the valued substance. To that effect, functional classifications often assign some jades to the category of ritual objects (Liu 2003; Li 2021). Material provenance studies suggest that Hongshan communities relied primarily on jade from Xiuyan 岫岩 in Liaoning Province, but also point at more distant origins such as the Lake Baikal area in Russia (Tang et al. 2020). Typologically diverse, Hongshan jades include forms used for body grooming and adornment. A few graves notably generated three-holed implements believed to have functioned as combs. Excavators sometimes unearth bracelets, the most common jade type, wrapped around the forearms of long-deceased tomb occupants, leaving no doubt about function. Scholars surmise that small apertures produced on other types facilitated attachment to garments and suspension from bodies. In the quest to understand the values, beliefs, and religious activ-

ities that sustained prehistoric Hongshan communities, substantial attention has turned to the symbolism of these artifacts. The recent essays of Cui Yanqin 崔岩勤 and Zhang Chi 张弛 exemplify recurrent links between zoomorphic jades and putative religious beliefs (Cui 2017; Zhang 2022). Some jade forms have served to support the idea that significant beliefs date back to pre-Bronze Age times and to validate the idea that Hongshan communities generated incipient forms of the Chinese cultural tradition (Barnes and Guo 1996, p. 216).⁶ Examples include the emergence of the dragon (Sun and Guo 2010), cosmology and related concepts ranging from *yin* 阴 and *yang* 阳 to heaven and constellations as well as shamanism, another interpretative paradigm whose impact endures in the academic discourse (You 1994; Deng 1997; Lu and Luan 2001; Nelson 2002; Guo 2004; Liu 2007). Li Xinwei 李新伟 recently integrated the concepts of cosmology and shamanism and suggested that Hongshan jades helped the elite display its control of sacred cosmology during public rites (Li 2021).⁷ However, evidence still does not support putative links between Hongshan jades, shamanism, and cosmology. Nor can it prove that Hongshan practices and ideology relate to later Chinese rituals and cosmological precepts (Zhang et al. 2013, p. 11).

While used to support hypotheses regarding social, political, or religious processes as well as putative cosmological interests or broader belief systems, Hongshan jades have puzzled specialists. Their growing repertoire with secure archaeological contexts offers exciting avenues for fresh investigation of what some regard as the prehistoric “culture that turned jade-working into a high art”.⁸ This study will endorse the proposition that some jades worn in life may have functioned as amulets (Childs-Johnson and Gu 2009). However, the analysis does not aim to uncover how the jades functioned in social, political, or religious contexts. Instead, it considers the topic through the double prism of style and how jade objects represented in the Hongshan cultural sphere. Therefore, in lieu of a teleological approach, our focus recenters on the circumstances by which jade forms came into being. Some of the questions this study attempts to answer include: Where does the distinctive style of Hongshan jades come from? How might analyzing their style help us better understand what some enigmatic types represent? How can we explain the occurrence of different styles within the corpus of some Hongshan jade types? Southern jade-working communities at Lingjiatan 凌家滩 in modern Anhui province adopted some Hongshan jade types but reproduced them through their own stylistic expression (Childs-Johnson 2020). Did communities closer to the Hongshan cultural sphere adopt the style of Hongshan jades?

The often-enigmatic Hongshan jades have puzzled the scholarly world. This study leads us to rethink what these artifacts represent through the prism of how they represented from the standpoint of their original makers and users. A first step will entail preparing a foundation to reconsider these Jade Age objects. To that end, we refocus attention on the peculiar physical characteristics that we associate with the Hongshan jade style, on the visual cultural landscape in which they appeared, and on enduring interests in material-representation synergies in Neolithic northeastern China. In the second step, the examination exposes how the already remarkable corpus of Hongshan figural works is richer than we assumed. Indeed, as detailed comparative analyses reveal, numerous Hongshan jades represent human bones and cartilage. Individual analyses will explore how significant jade types correspond to specific human skeletal constituents. They also illustrate how some jades featuring zoomorphic aspects resulted from a two-step process. First, while looking at human skeletal constituents, sentient beings (likely jade-makers) projected zoomorphic mental images on human osseous configurations. This cognitive process, known as pareidolia, has led to the emergence of figural imagery in prehistoric communities throughout the world, including China (Larrivé-Bass 2015, pp. 193–243). Second, jade-makers embodied these zoomorphic mental images when they represented human bones and cartilage. Our examination suggests that jade-makers, like the craftsmen who produced clay figural works for ceremonial centers, were interested in naturalism.⁹ Unlike the image-makers who worked with clay, however, jade craftsmen had less medium to spare. At any given time, their access to raw jade could have been inadequate, or the

size of mineral blocks would have limited what they could produce. They faced other obstacles. The subtractive processes they used to shape their medium into desired forms required that they conceptualize a form before extracting it from a raw mineral block. In their quest to naturalistically represent human skeletal constituents, they faced two additional challenges: the often large three-dimensionality of their bony models as well as their complex morphology. To remediate these obstacles, Hongshan jade-makers developed strategies. For savvy use of material, they employed jade slabs to represent some large skeletal body parts. In other instances, they engaged in a more synecdochical approach, and simply represented one bone segment to stand for an entire bone. They abstracted complex osseo-morphs into elemental shapes. They devised conventions to render each body part in jade. Their works nevertheless evidence formal variations resulting from enhanced abstraction, more limited skills, time constraints, or personal whim. Regardless of the shape they gave to the renderings, jade-makers made sure to confer an organic quality to their works. These physical characteristics are precisely what modern viewers associate with the style of Hongshan jades. Ultimately, the Hongshan style resulted from mimetic interests and the solutions that jade-makers devised to enhance the naturalism of their necessarily abstracted skeletal representations. In the third step, our study expands beyond the Hongshan world. First, diachronically, we consider how the Hongshan jade style may have perdured in northeast China following that culture's demise. Second, synchronically, we investigate the influence that Hongshan jades and associated representational interests had on southeastern jade-producing cultures. Preliminary evaluation of jades unearthed at Lingjiatan in Anhui province and Liangzhu 良渚 culture (3300–2300 BCE) sites in the Yangzi River delta suggest that these jade-working cultures gave selective reception to Hongshan practices. Lingjiatan and Liangzhu jade-makers appear to have embraced two Hongshan habits: the reproduction of human skeletal constituents with jade and the embodiment of pareidolia-induced figural imagery into jade forms. Furthermore, the style of Lingjiatan somatic representations identified in this study appears to derive from three factors: local aesthetic sensibilities, variations in human osteo-morphology, and likely efficiency requirements.

Methodologically, our exploration relies mostly on objects unearthed during archaeological excavations conducted in the Hongshan world, at Lingjiatan and at Liangzhu sites. Their study draws on contextual archaeological data, comparative visual analysis, the broader Hongshan material world, environmental factors, funerary practices, materiality, cognition, and human anatomy. For ethical purposes, the author photographed full-sized polyvinyl chloride bone models cast from original skeletons in China.

2. The Hongshan Jade Style

Hongshan jade-makers worked in communities whose ceremonial centers offered a rich visual experience. When mourners placed jades inside graves near or embedded in large cairns, the surrounding man-made environments were rich in textures, shapes, and colors. For example, ceremonial centers at Banlashan and Caomaoshan presented visitors not only with funerary cairns but also a display of colorful lithics used to erect or line enclosures and elevated altar platforms. Rusticated and wedge-shaped blocks of yellow sandstone complemented gray volcanic rocks (rhyolite) and white limestone at Banlashan. At Caomaoshan, red volcanic rocks (tuff) alternating with white ashlar blocks and yellow sandstone offered another visual experience. Beyond these rock features, conical ceramic turrets and multiple large bottomless red clay cylinders presented viewers with surfaces textured or painted in black, red, and white.¹⁰ During funerary processes and sacrificial offerings, greenish to whitish jades would have stood out as comparatively monochromatic if not pale.

Sculptures done in stone or clay complemented the already stimulating sights.¹¹ Large zoomorphic stone arrangements occupied platforms at Caomaoshan.¹² Archaeologists uncovered better-known animal-shaped renderings at the so-called Goddess Temple 女神庙 further south at Niuheliang. Built between the last phases of burials at this grand ceremonial complex, the semi-subterranean feature yielded an array of heretofore unseen

sculptural works. The archaeological team did not complete the excavation, but remains found thus far have revealed striking unbaked clay renderings, including an animal lower jaw and a feathered body. Scholars surmise that the high-relief anthropomorphic body parts found inside the structure belonged to larger-than-life or life-size renditions of complete bodies. All the remains found in the two temple chambers evidence a strong interest in mimicking life-like forms. Over the years, other discoveries within the Hongshan cultural sphere have generated a robust corpus of anthropomorphic sculptures. These works confirm a predilection for forms and form relationships with counterparts in the physical world. This representational style, known as naturalism, is exemplified here by a red tuff head found at Caomaoshan (Figure 1A). The large size and naturalistic clay and stone renderings of the Hongshan world remain unparalleled in the known corpus of figural imagery from fourth millennium BCE China. Current data clearly indicate that core zone jade-makers intervened in a rich representational tradition marked by a copious display, and perhaps manipulation, of anthropomorphic, and to a lesser extent zoomorphic, representations at ceremonial centers. We still do not know whether the same people made clay, stone, and jade artifacts and renderings. Nevertheless, we can assume that stone-work, architectural features, artifacts, and sculptures in the visual environment affected the aesthetic sensibilities of jade-users and viewers. So, one might ask: If Hongshan people favored works done in a naturalistic representational style for their ceremonial centers, what did they think of the style used by jade-makers to craft objects deposited in graves? If Hongshan communities wanted and appreciated carefully modeled, detailed, and life-like renderings, how could jade-makers get away with their barely legible sculptures of creatures? (Figure 1B,C). Likewise, if their contemporaries favored three-dimensional or high-relief sculptures, how did craftsmen render their flat jade plaques appealing? (Figure 1D).

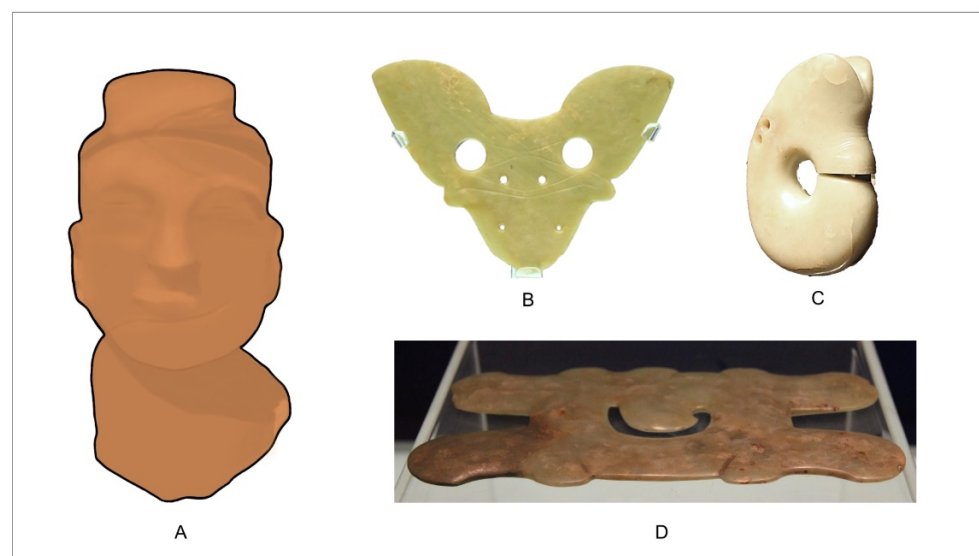


Figure 1. (A) Anthropomorphic sculpture (tuff) found at Caomaoshan (Source: Léa Bass (LB) and Sandrine Larrivé-Bass (SLB) on Procreate); (B) Jade plaque from tomb N2Z1 M21 at Niuheliang; (C) Jade pig-dragon at the Capital Museum, Beijing, (Source: Courtesy of Gary Todd, Ph.D.); and (D) Jade plaque at the Liaoning Museum, Shenyang (Source: Courtesy of Gary Todd, Ph.D.).

The formal qualities of jades illustrated in Figure 1 at first glance warrant us to dissociate these artifacts from the concept of naturalism. Seemingly lacking referents in external reality, the three jades appear abstract. If they do not represent entities from the material world, a derivative assumption may be that they stood for something associated with the spiritual world. We then might deduce that people who attended funerals at colorful ceremonial centers featuring naturalistic works did not expect jade-makers to engage in a representational style aimed at naturalism in the first place. However, our analysis will

highlight that Hongshan jade-makers were striving towards naturalism.¹³ They achieved their mimetic goals through an approach that combined several strategies and met the aesthetic sensibilities of their communities.

In a seminal article on Hongshan jades written before a broad corpus could be analyzed, Elizabeth Childs-Johnson captured what still aptly characterizes their style: “The Hongshan style is typified by a respect for expressive sculptural form and material luster. A jade’s edge is methodically rounded, and the surface carefully burnished in creating a wet, unctuous sheen. Features are delineated either as soft ridges and grooves, forming undulating wave patterns or as very shallow channels, creating delicate lines marking tusks or wrinkles of a snout. Lines defining features on smaller pieces may be crude but this quality is due to the limitations of size. Lathe marks sometimes appear, as on the interior of some horse hoof jades. In almost all cases the jade is handled as if modeled out of soft, pliable clay despite the jade’s otherwise obdurate hardstone property. Certain jades, such as the ‘pig-dragon’ and ‘horse hoof’ shapes, stand out three-dimensionally, expressive more as sculptures than as flat, two-dimensional images. Stylistically, Hongshan jades can be defined as both naturalistic and conceptual” (Childs-Johnson 1991, p. 88). The author further highlighted their sensuousity, a trait still emphasized in more recent characterizations.¹⁴ Since Meyer Shapiro’s 1953 publication of an essay on the topic, the term *style* has met detractors in art historical circles (Shapiro 1953). They include Robert Bagley, a scholar of art and archaeology in early China, who consigned the concept to the realm of arbitrary constructs (Bagley 2015). Both authors, however, value visual comparisons to tease out more in-depth characterizations. Briefly relocating Hongshan jades in broader aesthetic and representational environments enabled a few observations. Another juxtaposition of the same jades with a product of the southeastern Liangzhu culture (3200–2300 BCE) might help refine what characterizes their style (Figure 2). Viewers confronted with the comparison would likely agree that the southern jade (Figure 2A) seems abstract too, in the sense that it may not have a referent visible in external reality. Further, they may qualify the Liangzhu object as comparatively more detailed, angular, rectilinear, and geometric. They might observe that smooth edges and thickness modulation confer a pulse on Hongshan jades. Ultimately, viewers may propose that Hongshan objects exhibit biomorphic qualities nonexistent in the Liangzhu form. Our study suggests that these four jade works are all representational and reproduce organic forms through stylistic expressions grounded in different visual environments.

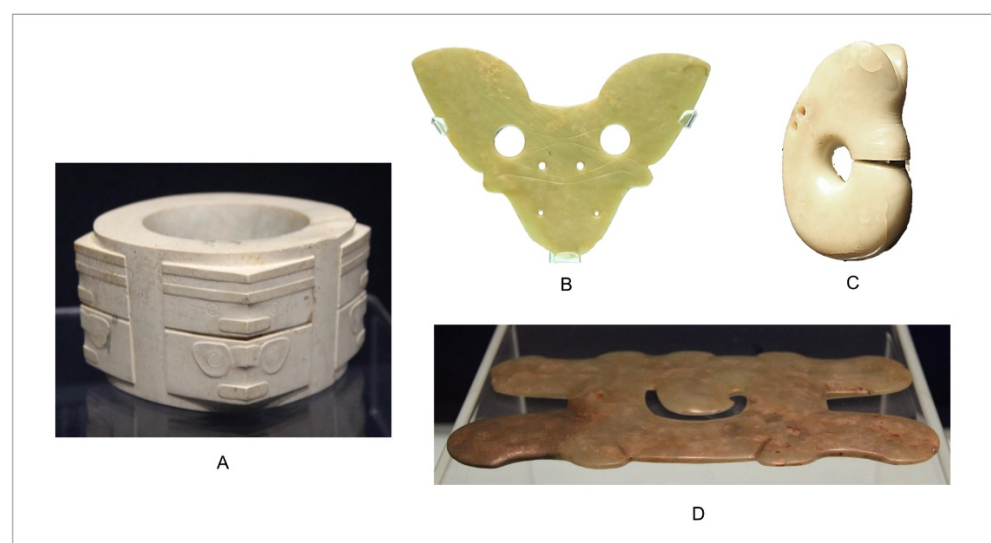


Figure 2. (A) Liangzhu culture jade *cong* at the Shanghai Museum; (B) Jade plaque from tomb N2Z1 M21 at Niuheliang; (C) Jade pig-dragon at the Capital Museum, Beijing; (D) Jade plaque at the Liaoning Museum, Shenyang (Source for the four photographs: Courtesy of Gary Todd, Ph.D.).

3. Stylistic and Evocative Considerations

Discussion on the style of Hongshan jades should focus on both macro- and micro-level concerns. The term style generally elicits distinctions among formal habits or conventions discernible within given places, times, or cultures, as well as the more idiosyncratic treatments individual craftsmen give to their work. Hongshan jade-makers undoubtedly produced artifacts whose shared aspects modern observers associate with Hongshan cultural expression. We certainly can account for the standards Hongshan jade-makers devised to represent entities and the distinct surface and edge treatments they tended to use. However, discerning concomitant individual crafting styles is more challenging. We do not know how many people produced the artifacts retrieved from Niuheliang and Banlashan tombs. Archaeologists dated these burials to the later phase of the Hongshan period (3500–3000 BCE), but limited stratigraphic data restrict inferences on the frequency or intensity of jade production over the course of that period. Formal distinctions exist among jades of the same type, but how these might correspond to different hands eludes us. A single person indeed could have produced several, but varied their work. Any inference about individual style would be tenable if we overemphasized the value Hongshan community members attributed to conventions, overlooked the freedom jade-makers likely enjoyed, and underestimated the creative and cognitive capacities of these prehistoric individuals. On that latter point, this study shows that Hongshan jade-makers at times relied on the same cognitive processes that Pablo Picasso and other Cubist artists deployed and demanded from their twentieth-century viewers. Considering formal variations within each jade category through the prism of putative personal styles could thus be misleading. Moreover, it would presuppose that the root of these variations lies solely in the jade-makers' touch. Our study shows that formal variations within jade types at times resulted from the morphological variants observed in the represented entities. Reflecting on stylistic variations for the purpose of seriation remains helpful. Variants may indeed assist in estimating the sequence in which the objects were produced. Once we can identify principles formulated by Hongshan jade-makers, we may discern subsequent deviations from those standards. Knowing what entities craftsmen sought to represent in the first place would help develop sound seriation-based hypotheses. Their creations are undoubtedly puzzling.

The enigmatic shapes and imagery of Hongshan jades do not help elucidate the socio-religious life of communities who buried these artifacts with the deceased at ceremonial centers. Nor do we know the status of community members who crafted these jades, their relation to the deceased, or their involvement in rituals performed around death. While the jades' placement inside tombs underscores their significance in socio-religious contexts, how community members felt about the objects and the creatures represented on them eludes us. Scholars of early China have sought to identify these zoomorphs to shed light on the beliefs that animated Hongshan communities. That search has led to a narrowed list consisting of bears, pigs, insects, birds, tortoises, dragons, phoenixes, and pig-dragons. In our quest to understand the Hongshan world, we may have overestimated the importance of represented creatures (and perhaps our faculty to identify some), underestimated the evocative power of materials during crafting processes, and overlooked the position of jades vis-à-vis the buried bodies. Ultimately, the approach may have obscured what Hongshan jade-makers were representing in the first place.

Two Hongshan jades featuring zoomorphic heads will help illustrate the issue (Figure 3A,B). The 2014–16 excavations conducted at the Banlashan site generated a jade representing the head of a creature (Figure 3A). Excavators introduced the object as an animal head-shaped handle finial ([Liaoning Provincial Institute and Longcheng District Museum 2017a](#), p. 21). A more recent analysis identifies a bear head and points to the ongoing significance of bear imagery in northeastern China from the Xinglongwa 兴隆洼 culture (6200–5200 BCE) to the Hongshan period ([Zhang 2022](#), pp. 55–56). Another jade calls our attention. Reports introduced a double-headed jade retrieved in 1979 from tomb N16 79M1 at Niuheliang as exhibiting two bear heads (Figure 3B) ([Liaoning Provincial Institute 2012b](#), p. 414). Ex-

cavators allocated the same animal species to clay paws, an ear, and a nose found inside the Goddess Temple (N1J1B), as well as a clay jaw recovered from the temple's southern chamber (N1J1A) (Liaoning Provincial Institute 2012b, p. 25). The jade's original placement near the buried man is unknown, as it was found outside a disturbed tomb. The ornamental rope-pattern lining its lower edge reinforces the functional interpretation generally attributed to the object: a hair comb (Liaoning Provincial Institute 2012b, p. 414). Despite the formal commonalities exhibited by these two Hongshan bear representations (Figure 3A,B), attention to material qualities encourages a reassessment of the *bear* classification. The unearthing of Asian black bear (*Selenarctos thibetanus*) bones at Niuheiliang leaves no doubt that Hongshan communities were familiar with the species (see Liaoning Provincial Institute 2012b, p. 312). How communities involved in hunting and gathering felt about these impressive and potentially dangerous animals is a mystery. The species attribution for the two jade artifacts remains uncertain, as alternative identifications could apply. The creatures' equally rounded ears and elongated snouts limit the range of options. Extending consideration to material factors may help. The Niuheiliang jade coloration, mostly ivory with black and brown streaks, does not correspond to the pelt of Asian black bears. The black nose on each head, however, suggests that the jade-maker sought to exploit color streaks in the raw lithic used to craft the three-holed implement. In this context, we cannot exclude the possibility that the color streaks embedded in the medium inspired the thought of representing a specific animal species. The other jade comb retrieved at Niuheiliang (from N2Z1 M17) exhibits a more unified creamy coloration, which better corresponds to the human heads crafted on its ends (Figure 3C). A possible contender whose snout, ear shape, and natural pelt find echo in the double-headed bear jade is the badger (*Meles meles*), a genus recovered at Niuheiliang (Figure 3D) (see Liaoning Provincial Institute 2012b, p. 508).

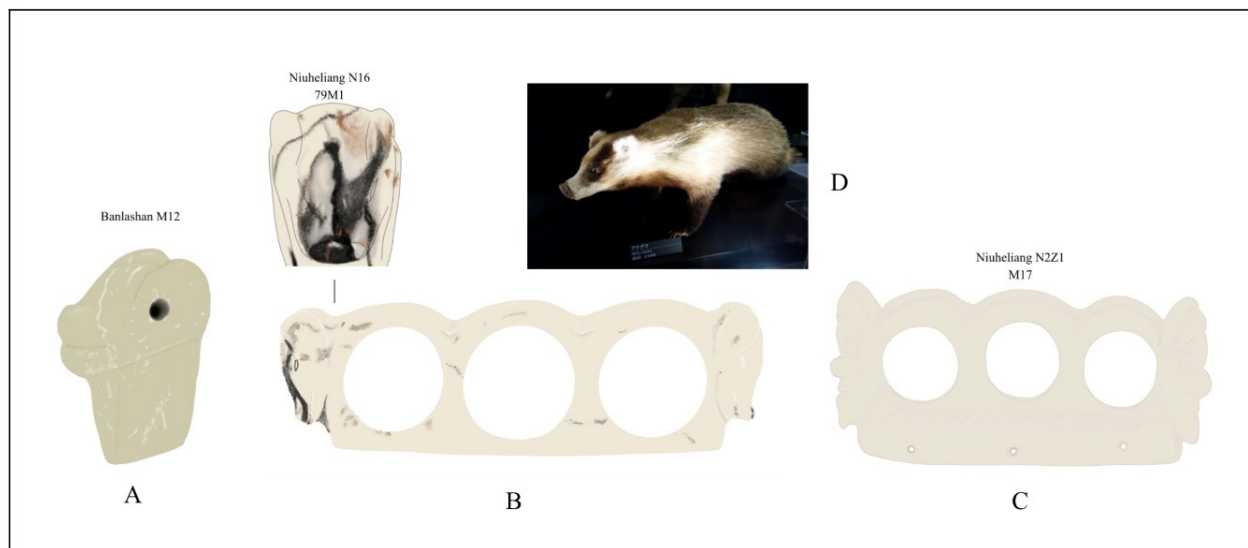


Figure 3. (A) Jade zoomorph from M12 at Banlashan; (B) Jade comb from tomb N16 79M1 at Niuheiliang; (C) Jade comb from tomb N2Z1 M17 at Niuheiliang (Source for the three images: LB and SLB on Procreate); (D) Badger (*Meles meles*) (Source: Daderot, CCO, via Wikimedia Commons).

The jade animal head unearthed more recently at Banlashan raises related issues. The artifact recalls a Hongshan jade exhibited at the National Palace Museum in Taipei (Figure 4C). These two jade heads exhibit remarkably similar eyes and ears, while their tapered lower bodies remain unparalleled in the known repertoire of Hongshan jades. Yet, the two creatures represented are undeniably distinct: one shows an avian figure, while the other evokes a mammal. Excavators hypothesized that the Banlashan jade functioned as a finial and its narrowed, tapered end as a tenon (Liaoning Provincial Institute and

Longcheng District Museum 2017a, p. 21). They speculated that it ornamented the handle of a large ceremonial stone ax found on the tomb occupant's waist. This would be the first known occurrence of a ceremonial ax-handle deposited inside a Hongshan tomb, with others being found further south in other Neolithic cultures (Liaoning Provincial Institute and Longcheng District Museum 2017a, pp. 21, 25–26). At this time, nothing makes certain that the Banlashan jade functioned as an ax-handle finial or that its mellow-looking creature represented a bear.¹⁵

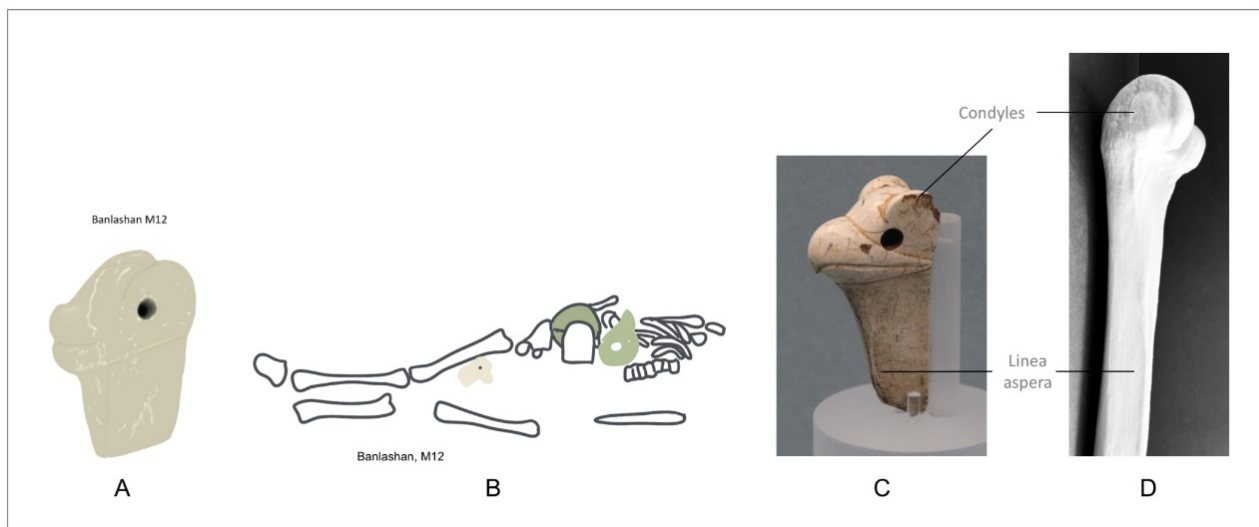


Figure 4. (A) Jade zoomorph from tomb M12 at Banlashan and (B) partial ground plan of tomb M12 at Banlashan showing the jade in situ (Source for the two images: LB and SLB on Procreate); (C) Jade zoomorph at the National Palace Museum, Taipei (Source: Courtesy of Gary Todd, Ph.D.); (D) Femoral condyles and shaft (Source: Author).

Stylistic considerations could explain why the avian jade creature and the Banlashan jade head exhibit the same ear-like projections. They might even point to a single jade-manufacturing site for the two artifacts. An alternative hypothesis involving material factors, however, can explain the recurrence and resemblance of both their ear-like projections and tapered lower bodies. To that point, the Banlashan jade position inside tomb M12 is significant. The object was found at mid-height of the deceased's right thigh bone (Figure 4B). Remarkably, commonalities on both jades correspond to morphological features visible on the distal end and shaft of a human femur (Figure 4D).¹⁶ The creatures' flat rounded ears recall femoral condyles, and their body wedging echoes the tapering occurring on the bone shaft. The bird jade exhibits similar condyle-like projections, and its body displays a ridge extraordinarily similar to the ridge (linea aspera) extending along a femoral shaft.

The badger heads adorning the Niuheliang comb emerged primarily because the black and brown mineral veining evoked the pelt of the animal. Natural patterning in the substance could be exploited to represent an animal whose cream-colored pelt featured black and brownish stripes. It happened to be a badger, an animal whose ears required that the craftsperson create rounded, projecting appendages. In contrast, the idea for the Banlashan bear-like creature emerged out of an osseous substrate (human femur), which a craftsman sought to partially reproduce in jade. The bone's morphology brought to the jade-maker's mind the image of a three-dimensional creature's head. For this to happen, the jade-maker experienced pareidolia, a subjective cognitive process that entails projecting mental images onto natural material configurations or objects, as when, for example, one sees an animal in a cloud formation against a blue sky or a human figure in the root of a plant. Associated with artistic creativity throughout the world, perceptive imagination is linked to the emergence of figural imagery in prehistoric China beyond Hongshan culture.¹⁷ A foray into the wider world of Hongshan jades will show that this discrete cognitive pro-

cess catalyzed figural representation beyond the jade creature retrieved from tomb M12 at Banlashan. The person who made this jade head experienced pareidolia triggered by more than form-likeness between the femoral condyles and ears. A more holistic set of triggers extending to other resemblances between bone and jade applied as well.

4. Jade, Bones, Mimesis, and Style

Symptomatic of a wider phenomenon involving human bone reproduction in Neolithic China, the Banlashan animal head jade did not emerge in a cultural and perceptive vacuum. Earlier interests and practices laid the ground for the cross-material phenomenon to emerge. Image-makers in Neolithic China at times displayed interest in a material-representation synergy, i.e., a partiality towards substances whose physical attributes are reminiscent of other substances (Larrivé-Bass 2015, pp. 149–60). In the area occupied by Hongshan communities in northeastern China, craftsmen working in the earlier Xinglongwa culture sought to represent, approximate, or at least evoke certain raw materials through other substances. For example, they used the lining of shells to represent teeth, acknowledging the whiteness and shine of enamel. They also selected jade to represent bone objects. At Chahai 查海, an important Xinglongwa culture site in Fuxin county of northwestern Liaoning province, people used jade to represent bone scoops (*bixingqi* 匕形器) regularly found at Neolithic sites (see Liaoning Provincial Institute 1994, pp. 13, 15, Figure 27.1 and Plate 38; Liaoning Provincial Institute 2012a, Plates 275 and 276). At Chahai and the Baiyinchanghan 白音长汗 site in Inner Mongolia, community members further used the material to craft small tubes. While they perhaps functioned as beads, they also evoked bone shaft sections (see Liaoning Provincial Institute 2012a, Figure 36, 619 and Plate 274; Institute of Cultural Relics 2004, Plate 19). A Hongshan tomb at Niheliang (N2Z1 M26) yielded a similar 4 cm long tubular jade (see Liaoning Provincial Institute 2008a, pp. 24–25, Figure 23). Archaeologists found the object on the right side of the deceased's chest, apparently between the upper arm bone (humerus) and a lower bone (radius or ulna). Perhaps the object functioned as a bead, but its extremities exhibit different diameters, and a protuberance running along its shank recalls the ridge running along a humerus, radius, or ulna bone shaft.¹⁸ Hongshan jade crafting practices may well have entailed signifying a long bone through a single, elemental component (a shaft segment or a long-bone end). A synecdochical approach focused on representing one portion to stand for an entire long bone allowed craftsmen to save some valuable jade material while approximating the natural girth of their bony referent.

We cannot determine what came first in Xinglongwa culture—the sight of jade lumps whose aspect was reminiscent of bones and consequently triggered the thought of transforming a lump of this rare substance into a bone implement or bone-like bead, or simply the idea of representing bone artifacts in a rare material. The uncanny resemblance of jade and bone likely made the substances cross-referential, as visual aspects shared by both materials encouraged craftsmen to substitute one for the other. Nephrite, the type of jade used at Xinglongwa culture sites, is a silicate of calcium, iron, and magnesium, whose felted microcrystalline structure renders it notoriously tough and thus hard to abrade. The material comes in hues and colors directly affected by its mineral components. For instance, a magnesium-rich silicate matrix tends to appear grayish white; a few iron oxides may add yellow-brown or brown streaks to the matrix, while an iron-rich nephrite will verge towards dark green (Lyman 1986; Tang et al. 2020). Apart from the color variability possible in nephrite (demonstrated by Xinglongwa culture jades), the mineral also exhibits varied degrees of translucence and opaqueness that artisans would have appreciated.¹⁹ Notably, nephrite's translucence and opaqueness is also visible on bones, a material that Xinglongwa people were used to handling and looking at when making tools. Bones primarily are an opaque substance formed by living organisms combining cells and fibers embedded in a variety of minerals (particularly calcium phosphate, from which bones derive their hardness) and proteins (notably collagen, which confers tensile strength), but they also incorporate translucent patches of cartilage, a tough connective tissue composed

of collagen fibers ranging in color from yellowish to bluish-white. Perhaps the unusual similarity of nephrite and bone invited substitution and stimulated a desire to reproduce these bone objects (Larrivé-Bass 2015).

The Xinglongwa and Hongshan people shared cognitive and perceptive predispositions. They did not handle the unprocessed raw materials used to make objects in a perceptual vacuum. In small communities accustomed to slaughtering animals for food and turning their bones into tools, jade-makers were better acquainted with the sight and feel of osseous remains than we are. The visual and material environments in which the Xinglongwa and Hongshan people lived were close enough; they also were profoundly different from ours. Projecting contemporary expectations about what constitutes mimesis on jade works would be misguided and prevent deeper appreciation for the array of representational endeavors these neolithic communities engaged in. In prehistoric China, mimesis operated on a range of levels and through a combination of perceptive channels (Larrivé-Bass 2015). How and how well a jade artifact may have represented another entity depended on more than form alone. Material resemblance between bone and jade would have contributed to how mimetic any bone representation made with jade would have appeared to Xinglongwa and Hongshan community members. In other words, naturalism would have been judged at both the formal and material levels.

Related contextual factors deserve attention when addressing Hongshan jade styles. These objects were experienced in milieus where people appreciated better than we do the qualities that bone shared with jade. In such a perceptual context, jade-makers could rely on material resemblance in their mimetic enterprise and lessen their attention to formal likeness. Another factor, position-induced associations, likely lowered the formal resemblance threshold viewers expected. The physical proximity between the jades and the bodies they accompanied inside tombs enhanced the object–bone link. As the next section aims to show, Hongshan community members tended to position jades on or near the human skeletal constituents they represented. The jade objects' proximity to their somatic referents likely further reduced original viewers' expectations about how *formally* naturalistic a jade bone needed to look. In turn, these prehistoric circumstances deserve our attention when assessing Hongshan jade styles. Indeed, they ought to lower our threshold of what constitutes form-likeness when we assess jade's naturalism. They additionally ought to increase awareness that Hongshan viewers perceived abstracted jade forms as more mimetic than we might. Ultimately, a greater tolerance for jade somatic abstractions should expand the range of stylistic variants we identify for each jade type under study.

5. Hongshan Jade Bones

5.1. Human Bones in the Visual Environment

Visual exposure to human skeletal remains in the Hongshan cultural sphere far exceeded the experience of most modern humans. Hongshan communities practiced secondary burials, as demonstrated by the large quantity of such tombs at the Niuheliang and Banlashan cemeteries. The practice entailed unearthing the decayed remains of a person buried a first time and burying the skeletal remains a second time. This funerary practice exposed communities to the sight, manipulation, and transportation of human bones. Another activity possibly subjected community members to the view of human body parts. Skeletal remains found around or embedded in sacrificial altars and pits point to the possibility that human sacrifices occurred at Dongshanzui and Niuheliang (Liaoning Provincial Institute 2012b, p. 349; Lee and Zhu 2002). Katrinka Reinhart discussed cases of human sacrifice, post-mortem dismemberment, and transportation of body parts in other parts of China during Neolithic times (Reinhart 2015). The presence of human and donkey bones inside an altar sacrificial pit at Banlashan (JK1), of human bones under the altar at the Niuheliang Locality 5, and of partial skeletons inside Hongshan graves imply that some Hongshan ritual activities performed at ceremonial centers may have involved human bodies. Secondary burials, and perhaps human sacrifices, must have heightened the visual knowledge and awareness that community members had of human anatomy. These practices also provide some context for how jade-

makers would have had access to human bones. Once human bones entered the visual field of Hongshan communities, their members became susceptible to developing the type of associations that contemporary osteologists make. Descriptions of osseous components tend to involve body imagery, notably referring to the “head” or “neck” of a bone. Radiologists, moreover, are prone to pareidolia-induced mental images involving animals when observing bones (Ridley 2018; Ridley et al. 2018). Let us now turn our attention to the world of jades unearthed from Hongshan graves.

5.2. A Creature

In 1989, archaeologists opened the N2Z1 M21 tomb at Niuheliang, the resting place of a man who died in his thirties towards the end of the fourth millennium BCE. The tomb contained 20 jades, a large number by Hongshan standards. Among those interred with the deceased, a 14.7 cm wide wedge-shaped jade plaque remains unique in the known jade corpus (Figure 5A). A ground plan of the tomb shows the object in situ placed flat on the deceased’s pelvic area (Figure 5B). Thin, sunken lines of unmodulated width and circular apertures give the jade the appearance of a creature’s head seen from a frontal vantage point. Classified by archaeologists as an ‘animal mask’ (Lu and Luan 2001; Liaoning Provincial Institute 2012b, pp. 97–99), the arresting piece led specialists of early China to note a resemblance with pigs and pig-dragons, mysterious creatures quintessentially associated with this northeastern jade tradition. The piece does exhibit facial features evocative of a creature. However, the jade’s triangular shape, size, and placement on the deceased raise the possibility of a more fundamental link with skeletal remains.

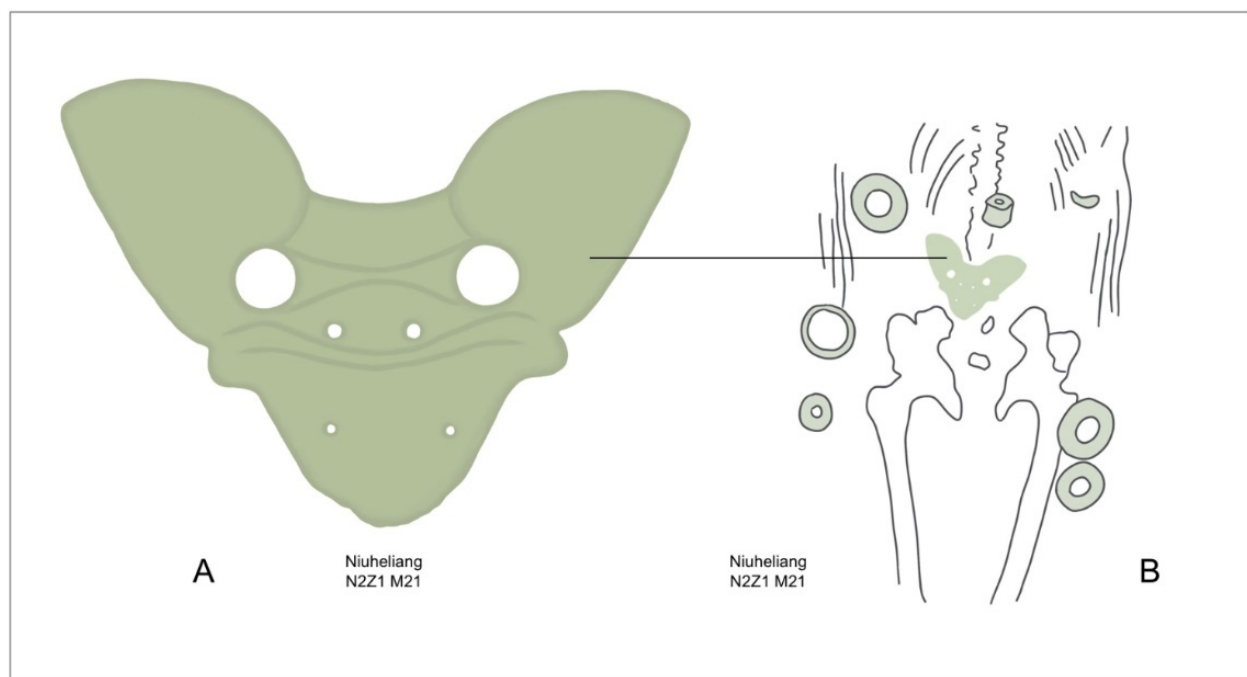


Figure 5. (A) Jade plaque from tomb N2Z1 M21 at Niuheliang and (B) ground plan showing the artifact in situ (Source: LB and SLB on Procreate).

The artifact, indeed, resembles the posterior part of a human pelvic girdle and, more precisely, a composite of two hip bone wings and a sacrum (Figure 6A,B). Significant pelvic girdle components, hip bones (os coxae), articulate with the vertebral column through the sacrum–coccyx complex. The wedge-shaped sacrum itself consists of vertebrae aggregate, which tends to fuse in old age with the coccyx, a smaller vertebral group marking the end of the axial skeleton (see White and Folkens 2005, pp. 241–45). To capture this significant skeletal articulation point linking the vertebral column to the basin and lower limbs, the jade-maker did not seek to represent the more complex pelvic osseous ensemble. To ren-

der the shape of a sacrum articulated with posterior hip bone segments, the person simply trimmed a lump of nephrite into a triangular mass. Not that this was an easy task, as jade is a notoriously hard substance that requires intensive abrasion to cut. A subsequent task entailed lowering the upper edge center to create lateral projections. Two diaglyph lines standing for sacro-iliac epiphyses sufficed to enhance the hip bone–sacrum legibility. Intent on fashioning a realistic reproduction, the craftsman incorporated other human bone features, but not without giving them a zoomorphic twist. This impulse likely resulted from observations of sacral morphological features. Before growing into a compact osseous mass (Figure 6C), the human sacrum consists of five isolated sacral vertebrae that fuse together through a lengthy process (Cardoso et al. 2014). The resulting delineations and openings at fusion points were not lost on the jade-maker. Once bonded, the bony mass bears circular apertures between sealed vertebrae. These holes (sacral foramina) allow nerves and veins to pass through the fused bone mass and correspond to circular apertures made on the jade. Also visible on a human sacrum are horizontal lines (transverse lines) left where the sacral vertebrae merge. Their fusion degree is age-dependent, so the resulting horizontal lines (transverse lines) range from open (unfused) to barely visible threads (fully fused).²⁰ The two uppermost sacral vertebrae do not fully fuse before puberty (Scheuer and Black 2004, Figure 6.20). The jade-maker (or an intermediary community member) must have observed a not-fully-fused human sacrum and projected onto it the mental image of a grinning creature (Figure 6D).²¹ By slightly modifying the size or position of sacral features (sacral foramina and transverse lines) replicated on the jade bone, the craftsman skillfully reproduced the mental image. The circular openings became signs supporting two referents: sacral foramina and a creature's eyes and nostrils. The thin intaglio lines representing transverse lines also operated as definers of facial features (notably the mouth). Additional jades analyzed later in this article incorporate pareidolia-induced mental imagery incurred during visual and physical engagement with human bones.

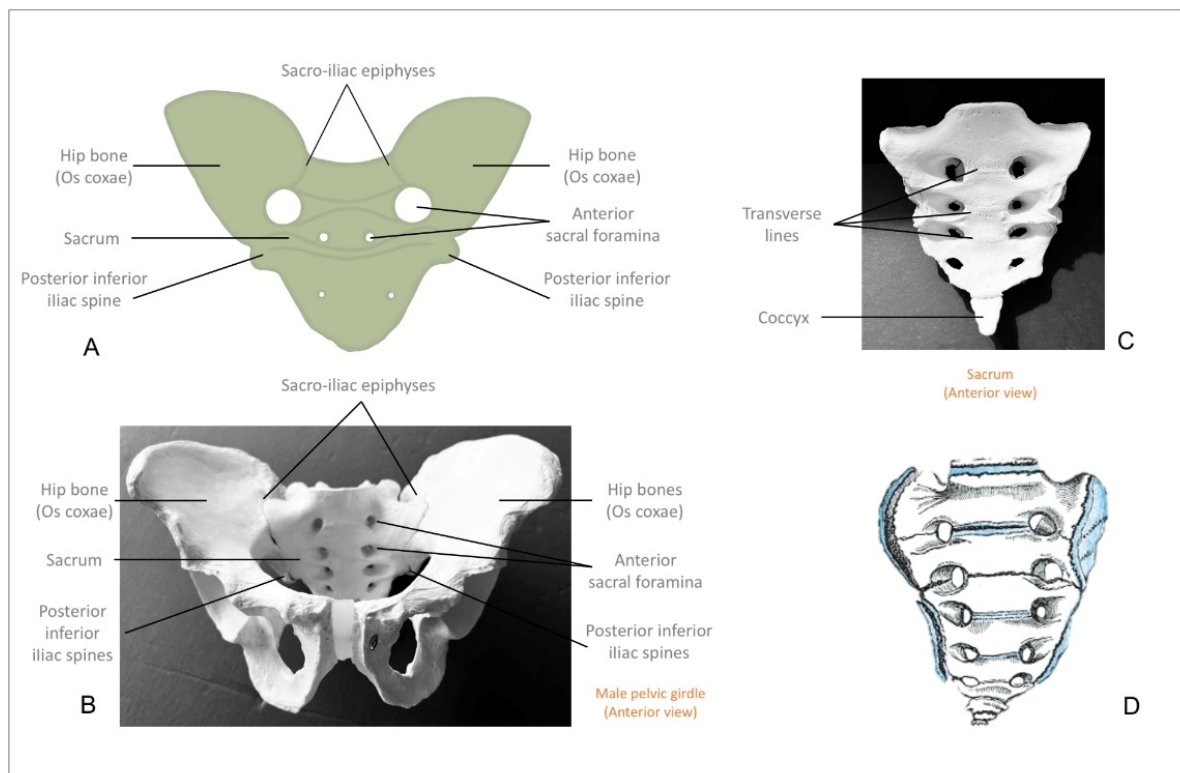


Figure 6. (A) Jade plaque from tomb N2Z1 M21 at Niuheliang (Source: LB and SLB on Procreate); (B) Human pelvic girdle; (C) Human sacrum (Source: Author); (D) Partially unfused sacrum (Source: Gray's *Anatomy of the Human Body*, 1918; public domain).

5.3. Hooked-Cloud Shapes (勾云形)

5.3.1. Overview

This jade category consists of irregular rectangular plaques defined by two parallel wavy horizontal sections connected through two shorter vertical segments. The ensemble frames a central aperture partially filled with a hook-shaped appendage. With that basic shape as model or in mind, craftsmen have engaged in substantial stylistic variations, resulting in a wide array of configurations observable in museum collections. Archaeologists discovered the hooked-cloud plaque shown in Figure 7 inside a Niuheliang tomb (N5Z1 M1). This mysterious jade type has invited a breadth of iconographic interpretations (Lu 1998; Deng 2002; Ma 2019). Associated with cloud imagery, the plaques have been viewed as celestial bodies or sculptural portrayals of an array of creatures: deer, boar, horned owl, phoenix, dragon, pig-dragon, turtle, or the *taotie* 饕餮, a common motif on Bronze Age artifacts.²² Since these hooked-cloud plaques have recognized archaeological contexts, our analysis first will focus on specimens retrieved from tombs at Niuheliang and one from M1 at Hutougou. This controlled corpus will help establish a baseline. Less than a centimeter thick, these flat artifacts range in length from 8.8 to 22.5 cm. Most occupy a comparable position vis-à-vis the buried body: the waist area.²³ This common placement is critical to understanding what Hongshan craftsmen had in mind when abrading raw jade into these enigmatic artifacts—the jades represent the bony human pelvic area some were found atop inside graves. This osseous assembly is more complex and occupies a greater volume than the posterior section represented on the sacro-iliac jade analyzed earlier (Figure 6A). It consists of a three-dimensional bony ring (pelvic girdle) articulated through notches (acetabula) with the proximal ends of the femurs. Jade-makers faced challenges in reproducing this skeletal structure.



Figure 7. “Hooked-cloud” jade plaque from tomb N5Z1 M1 at Niuheliang (Source: Courtesy of Gary Todd, Ph.D.).

Twenty-first century viewers acquainted with contemporary illustrations of human pelvic girdles articulated with the femurs (Figure 8A) might be disappointed by pre-modern renderings (Figure 8B–E). Recent two-dimensional diagrams owe much to prints and drawings done by artists who, since the Renaissance, have been interested in human anatomy, shading-based modeling, and volumetric perspectival composition. Modern readers of books on anatomy might even expect to find frontal, lateral, and dorsal skeletal views, exemplified here by what J.G. Heck did for his 1851 *Iconographic Encyclopedia of Science* (Figure 8B). Following the perspectival tradition, each illustration renders skeletal details observed from a single vantage point. Image-makers working outside that tradition re-

sorted to an array of representational strategies, opting for flattened and abstracted forms capturing different angles within a single, compressed representational field (Figure 8C–E).

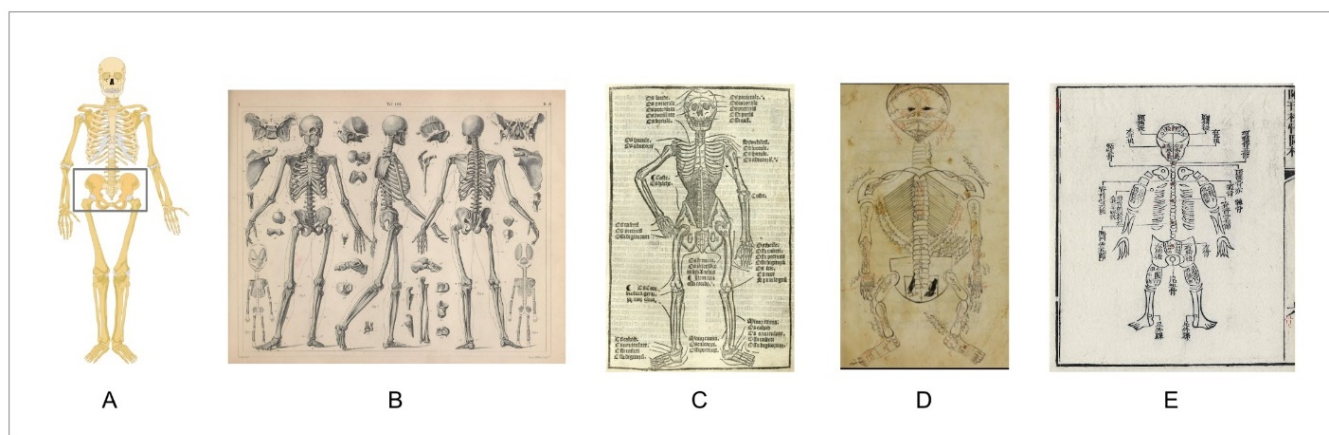


Figure 8. (A) Diagram of a female skeleton (Source: Mikael Häggström, Public domain, via Wikimedia Commons); (B) Heck, J. G. *Iconographic Encyclopaedia of Science, Literature, and Art* Vol.1 (1851), Plate 122 (Public domain); (C) Woodcut illustration of a human skeleton in Hieronymus Brunschwig's *Buch der Chirurgia*; Strasbourg: Johan Grüninger, 1497, Plate 261 (Public domain); (D) Illustration of a human skeleton in Mansur ibn Ilyas, *Tashrih-i badan-I insan* [Anatomy of the Human Body], Iran, ca. 1390, Plate 57 (Public domain); (E) Nomenclature of human bones in Song Ci, *Collected Records on Washing Away of Unjust Imputations*, 1843 edition (Public domain).

Disconnected from perspectival conventions and expectations, Hongshan jade-makers followed principles akin to those lauded since the advent of Analytic and Synthetic Cubism. To appreciate their creations, we first need to set aside expectations about what representations ought to be. Far from being illusionistic by current standards, the jade compositions remain no less representational than modern renderings. The craftsmen had no qualms about conflating several vantage points within the same plane to account for their model's three-dimensionality. They indeed faced constraints that impacted what they could do: the limited availability, size, and shape of raw jade. Slabs were economical for image-makers unconcerned by representational conventions of other times. Collapsed pelvic girdles visible when exhuming decayed bodies for secondary burial displayed an osseous structure compressed onto a more level plane, a sight that further legitimated flat renderings. As the analysis will show, some craftsmen managed to replicate remarkable anatomic details within the flattened field allocated by jade slabs. They developed their own standards, but evidence shows that they were open to stylistic variation, notably when pareidolia-induced figural imagery emerged.

5.3.2. Representational Conventions at Niuheliang and Hutougou

A comparative analysis between a skeletal replica and a hooked-cloud plaque found inside tomb N5Z1 M1 at Niuheliang will help establish how this Hongshan jade type is the sculptural rendering of a human skeletal midsection (pelvic girdle and upper femurs) (Figure 9A,B). Publications regularly present the jade plaques, with their central hook extending upward. Plaques in situ, however, tend to have the hook extending downward towards the deceased's feet. The N5Z1 M1 jade follows the proper orientation as its hook extends downward into the central aperture, like the vertebral column's lowest segment (sacrum–coccyx complex) does towards the pelvic inlet (Figure 9A).²⁴ To signify the complex nature of this skeletal structure, jade-makers devised a solution: an appendage projecting downward and whose tip points rightward. The convention brought resolution to a challenge: representing the sacrum–coccyx's triangular shape while acknowledging that it curves anteriorly towards the pubis. Evidently, a flat slab could not accommodate the depth effect. Aware that the sacrum–coccyx angle is best appreciated when looking

at a pelvic girdle from the side, jade-makers rendered it as if observed from a lateral left viewpoint (hence the hook pointing rightward) (Figure 9C). By conflating more than one vantage point, Hongshan craftsmen accounted for the three-dimensional nature and pointy shape of a curved, osseous appendage extending into a hollow girdle. To acknowledge the sacral surface's concave nature, they abraded the jade appendage to give its central plane a smooth, slightly sunken aspect. They used a similar surface treatment to represent other concave bony surfaces. They reduced hip bones (os coxae) to lateral upper segments, featuring smooth, rounder outer edges. Craftsmen allowed the jade plaque to approximate the hip bones' thickness but abraded their central plane down to reproduce the concave surface of the iliac fossae (Figure 9A,B). To represent this smooth depressed area, jade-makers applied the *wagouwen* 瓦沟纹 surface treatment so quintessentially linked to the style of Hongshan jades. Another convention consisted of abstracting the pelvic ring into a spiral ending in the sacrum–coccyx complex. Craftsmen reproduced the relief line surrounding the pelvic inner ring (arcuate line). Further form reduction was required to represent lower skeletal components. They made lower lateral segments slightly longer than their two upper counterparts, here echoing the width between two femurs whose heads articulate with the girdle through acetabula. The craftsmen extended the arch, spanning from the greater femoral trochanter edges to the iliopubic eminences on the girdle. They offered the same treatment to the arch bridging the lesser femoral trochanters and the pubis (orange arches in Figure 9A). They represented depressed areas between femoral heads and trochanters through smooth surface depressions akin to those used to render the iliac fossae of hip bones (Figure 9D). They also reproduced the pubis as visible on a collapsed pelvic girdle (Figure 9E).

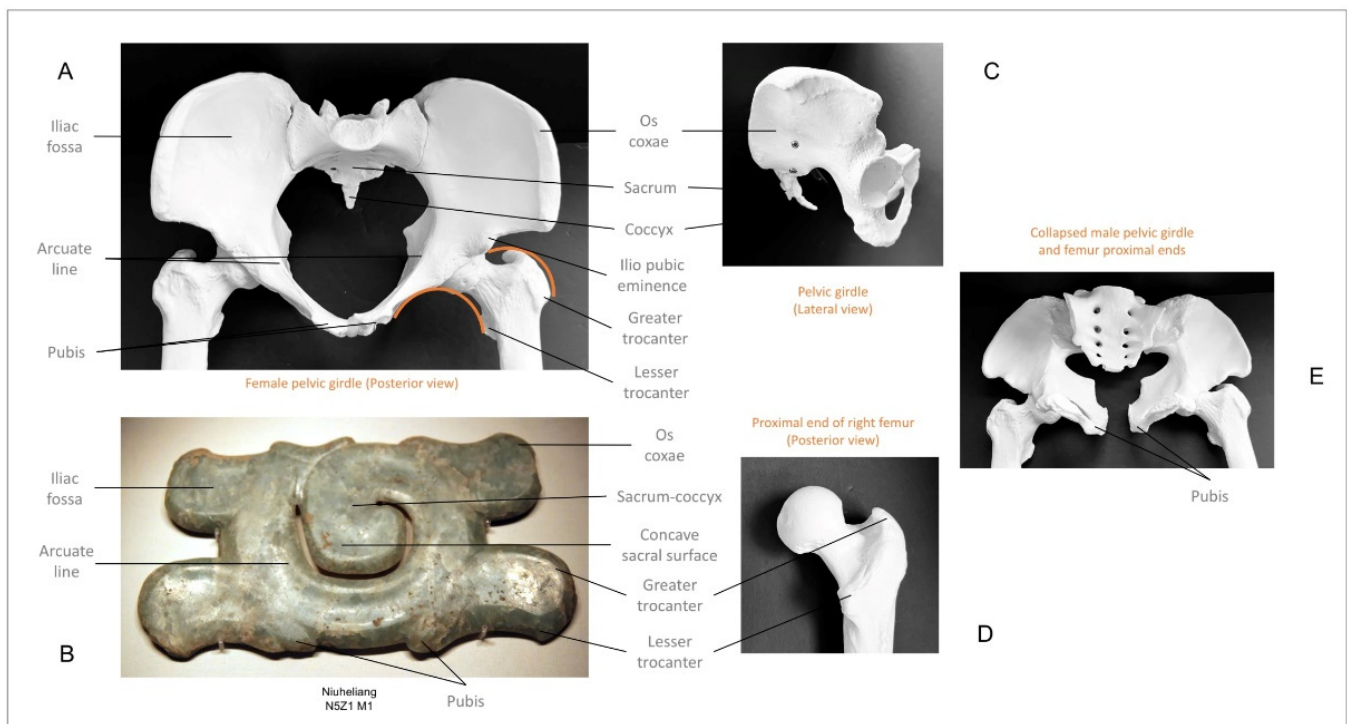


Figure 9. (A,C) Female pelvic girdle (posterior and lateral views) (Source: Author); (B) Jade plaque from tomb N5Z1 M1 at Niuheiliang (Source: Courtesy of Gary Todd, Ph.D.); (D) Proximal end of the right femur (posterior view); and (E) Collapsed male pelvic girdle (Source: Author).

To sum up, faced with the difficult task of representing a complex three-dimensional bone structure featuring uneven surfaces on a flat jade slab, Hongshan craftsmen developed conventions. They abstracted forms, reducing them to elemental shapes: a spiral ending in a pointed tip stands for a girdle ring–sacrum–coccyx osseous complex; four lat-

eral segments signify two iliac wings and two femoral heads articulated with the girdle. They conceived of their jade midsections as sculptural forms, but needed to compress their volume. To that end, they conflated into a single flat field the structures observed from different vantage points (lateral and posterior). To account for some sunken bony surfaces (iliac fossae), they abraded jade planes into smooth concave planes. They used the same surface treatment to represent other sunken features of the bones.

5.3.3. Stylistic Variations at Niuheliang and Hutougou

Most hooked-cloud jades found at Niuheliang and Hutougou exhibit the conventions identified in the previous section. Some plaques display stylistic variations, defined here as tangible departures from these standardized forms. First, some formal variants resulted from the subtraction, or addition, of morphological features observed on the bony models represented. This applies to the diminutive plaque from tomb N2Z1 M21, whose pelvic inlet the jade-maker reduced to a sacrum-free circular opening. Slight rotations exerted on a female pelvic girdle observed from a superior view expose or conceal the sacrum's projection into the pelvic inlet (Figure 10A,B). The jade from tomb N2Z1 M24 exhibits other changes derived from bone morphology (Figure 10C). Its maker added the fifth lumbar vertebra atop the sacrum and two lower apertures representing the openings (obturator foramina) on the ischium bones (Figure 10C,D). Therefore, we need to reconsider the attachment function generally ascribed to these double apertures. Second, other formal variants occurred when craftsmen engaged in greater form abstraction. This applies to the N2Z1 M14 plaque (Figure 10E) and its similar counterpart from grave M1 at Hutougou. The makers further abstracted the pelvic ring–sacrum–coccyx spiral, reducing the osseous form to a coiled band of unmodulated width, ending in a rounded tip. Moreover, they created four identical jade segments to denote upper and lower lateral projections, therefore employing a single form to stand for skeletal components of different shapes (iliac wings and femoral upper sections). In doing so, they relied on a discrete cognitive ability they shared with fellow community members: the capacity to communicate through visual signs.

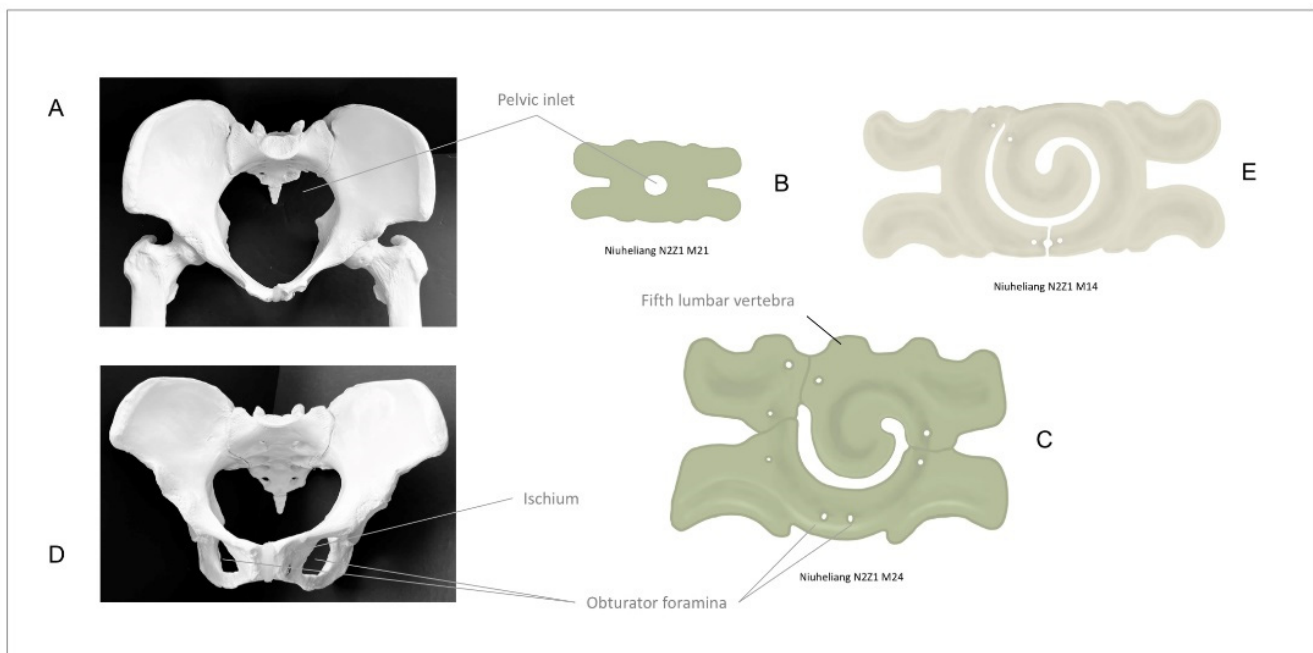


Figure 10. (A,D) Pelvic girdles (Source: Author); (B) Jade plaque from tomb N2Z1 M21 at Niuheliang; (C) Jade plaque from tomb N2Z1 M24 at Niuheliang; and (E) Jade plaque from tomb N2Z1 M14 at Niuheliang (Source: LB and SLB on Procreate).

Readers familiar with the work of twentieth-century Cubists may notice that Hongshan craftsmen followed similar representational approaches: forms abstracted into elemental shapes, several vantage points conflated within a flattened field, and forms reduced to signs standing for several referents. Two plaques exhibiting more striking stylistic variations even reveal that these prehistoric jade-makers engaged in semiotic play akin to that evidenced in Cubist compositions (Figure 11A,B). Discovered on the deceased's pelvis inside N2Z1 M23 and N2Z1 M26 at Niuheliang, the jades not only exhibit greater formal changes but also incorporate zoomorphic aspects. Following representational habits, their makers reduced osseous-morphological features to basic shapes while rendering a skeletal midsection as if observed from multiple vantage points. However, they conceived of the works as sculptural and the surfaces as representational fields. The jades concomitantly embody a human midsection and the mental images of creatures visualized on the bony models. For this purpose, the craftsmen did not shy from engaging in semiotic play. They indeed created forms (signifiers) whose meaning (signified) shifted within each composition.²⁵



Figure 11. (A) Double-owl jade plaque from tomb N2Z1 M26 at Niuheliang, and (B) Phoenix and dragon jade plaque from tomb N2Z1 M23 at Niuheliang (Source: LB and SLB on Procreate).

1. The Double-Owl Plaque

Archaeologists discovered the first of these two jades on the waist of a man buried inside N2Z1 M26. They identified the two avian heads visible on the thin (0.6 cm thick) 12.9 by 9.5 cm plaque as owls (Figure 12A). I classify the plaque as a midsection skeletal rendering. Its maker gave the work a conventional silhouette (two parallel, wavy horizontal sections framing a central aperture), but omitted the sacrum and elongated the pelvic inlet. The composition, however, includes anatomic details absent from more conventional examples. To include some of these details, the craftsman had to engage manually with a bony pelvic girdle. As detailed in Figure 12A, the work presents an oval central aperture lined with opposite prongs, inspired by ischial spines. Its parallel three-pronged crenulations stand for the corrugated edges of pubic bones or sacral crests. As for the conspicuous avian faces embedded in the jade pelvic matrix, pareidolia-induced vision may well have struck a person (the craftsmen or an intermediate) who manipulated a human pelvic girdle. A 180-degree rotation sufficed to conjure up the sight of two different avian faces that the craftsman then rendered on the jade plaque (Figure 12B). To operate, the mental images depended on semiotic reordering, a process whereby a bony configuration functioned as a sign whose signified changed upon rotating the pelvic girdle. Observed from a posterior view, the osseous structure features a coccyx (here reduced to a sign) that is readable as an upward pointy projection on a bird's head (signified 1). From an anterior view, however, the same coccyx points toward another referent: an avian beak (signified 2). A similar phenomenon occurs with the two pelvic girdle ischia. Reduced to a sign, each ischium stands for a wattle-like appendage observed from the same anterior view. From a posterior view, the same bony formation stands for another signified: an excrescence above an avian eye.

The jade plaque itself demonstrates that the Hongshan craftsmen engaged in semiotic play. The two opposing pointy protuberances on the inner rim stand for three distinct referents. They represent bony ischial spines (signified 1) that operate as two different avian features. Each spine stands for a beak (signified 2) and a head protuberance (signified 3): a beak on the upper face and a head protuberance on the lower bird. Hongshan viewers would have noticed, if not appreciated, the semiotic play in this jade composition.

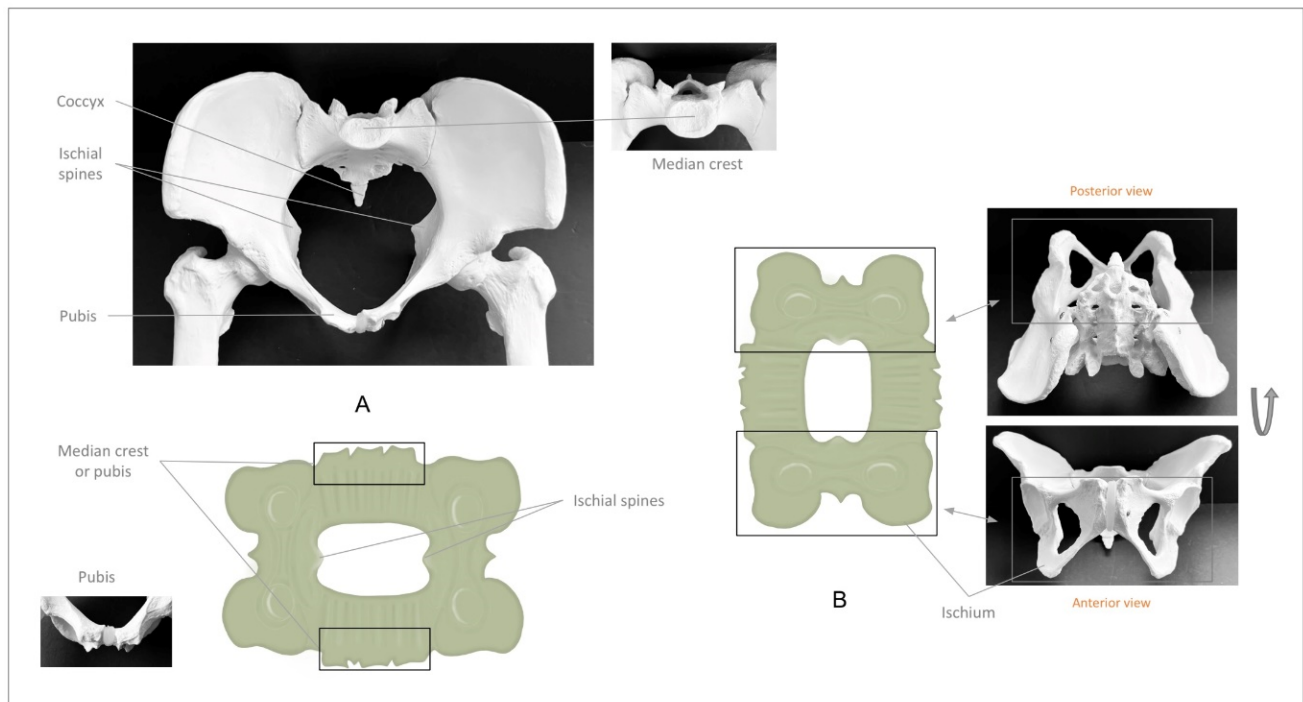


Figure 12. (A,B) Osseo-morphology of a rotated pelvic girdle as source of inspiration for the double-owl plaque (Source: LB and SLB on Procreate; photographs by the author).

2. The Phoenix and Dragon Plaque

As the double-headed owl plaque shows, once Hongshan jade-makers conceptually reduced skeletal midsections to irregular rectangular shapes and pelvic inlets to voids, they enjoyed stylistic freedom. Archaeologists discovered a jade inside N2Z1 M23 deposited on the tomb occupant's pelvis (Figure 13A). From its zoomorphic imagery, they inferred that Hongshan communities already worshipped the phoenix and the dragon, two mythical creatures associated with historical China. I classify the item as a midsection skeletal representation, which demonstrates a tenuous attachment to representational standards and shows the artistic freedom enjoyed by its maker. The plaque orientation in Figure 13A corresponds to the placement made by mourners who deposited the jade on the tomb occupant. By doing so, they deliberately positioned jade skeletal details on top of the corresponding bony areas they represented. So, the three-pronged crenelation on the plaque's upper edge was atop the deceased's sacral median crest. The smooth circular depression on the plaque's lower left corner corresponds to the deceased's right hip socket (acetabulum), the articulating point for the thigh bone and hip bone. The person who crafted the artifact paid attention to another significant anatomic detail overlooked in other renditions: the two large openings (obturator foramina) on the ischium bones. The craftsman could rely on shared knowledge with other community members who, used to seeing human bones in the context of secondary burial practices, knew that pelvic girdles feature a large pelvic inlet but also two adjacent apertures (obturator foramina). The three openings' differentiated sizes and relative positioning on the jade plaque sufficed to activate their representational charge in viewers' minds. The jade-maker, moreover, em-

bodied the pareidolia-induced mental images experienced during the manipulation and observation of bony models (Figure 13B). Lateral plaque rotations reveal three different profiles: a “dragon” and two avian heads. Two collapsed hip bones (os coxae) can notably produce a profile reminiscent of the “dragon” head (Figure 13B.1). Once more, the jade-maker could rely on fellow community members’ appreciation of signs pointing at different referents. Accordingly, the smooth circular depression added to mark a hip socket (acetabulum) could carry another semantic charge: a creature’s nostril. Two short and pointy bony projections (superior articular processes visible on a sacrum’s upper edge) near a circular opening (a sacral foramen through which blood vessels and nerves pass) likely evoked the mental image of a left-facing long-beaked bird (Figure 13B.2). Observed from the other side, the same bony formation may have inspired the creation of the avian head profile positioned near the sacral crest (Figure 13B.3).

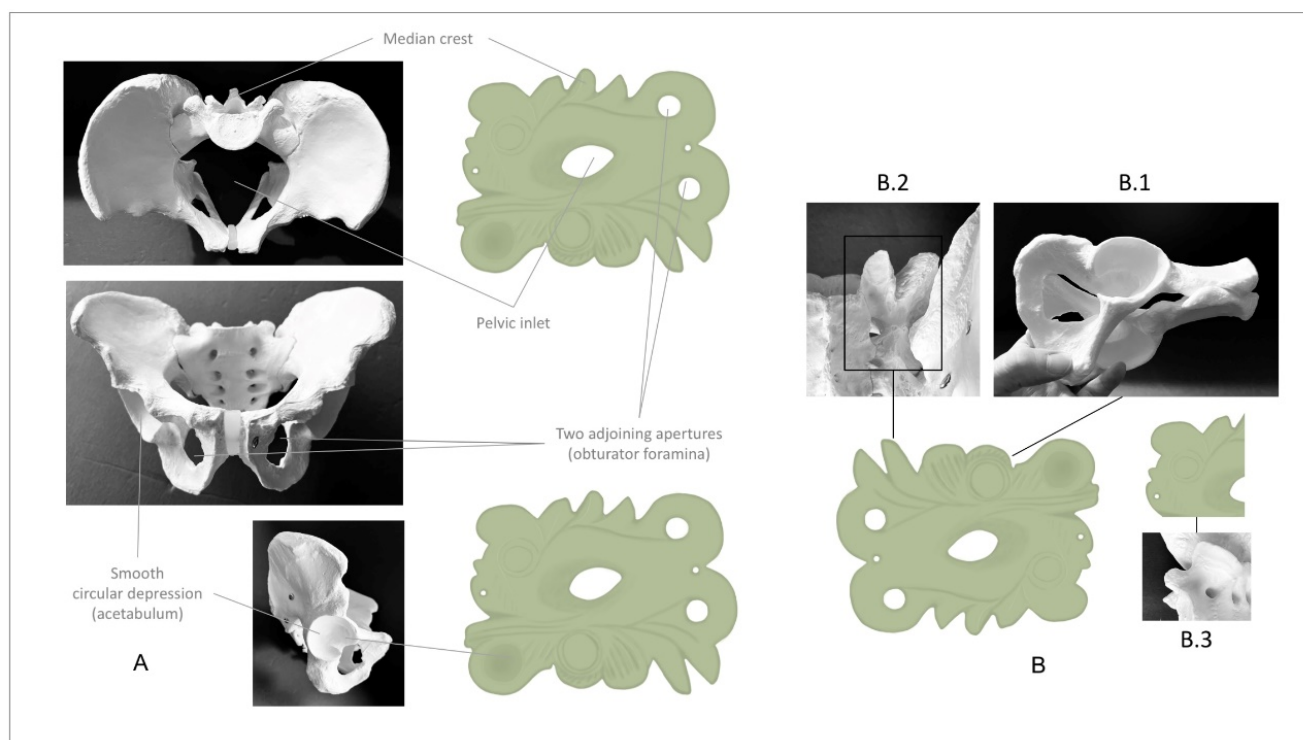


Figure 13. (A,B) Osseo-morphology of a rotated pelvic girdle as source of inspiration for the phoenix and dragon jade plaque; (B1–B3) Osseous configurations conducive to pareidolia-induced imagery (Source: LB and SLB on Procreate; photographs by the author).

5.4. Birds at Niuheiliang, Hutougou, Dongshanzui, and Banlashan

5.4.1. Styles and Seriation

Archaeologists working at Hongshan culture sites have excavated a few other jade bird representations (Figure 14). They include an exquisite bird profile (Figure 14A) and several smaller avian figurines discovered at Niuheiliang (Figure 14B), Hutougou (Figure 14C), Dongshanzui (Figure 14D), and more recently at Banlashan (Figure 14E). The Dongshanzui image-maker crafted the figurine out of turquoise, a substance also selected for two Hutougou fish-like pendants as well as semi-circular and triangular ornaments recovered from tombs N16 M4 and N2Z1 M23 at Niuheiliang (Figure 14F).²⁶ Image-makers likely crafted the Dongshanzui bird figurine from the same turquoise matrix as the pendant found inside N2Z1 M23 at Niuheiliang (both items feature a turquoise front and a black back)—a contemporaneous dating for both jades is thus possible. Stylistically, two jade avian figurines from tomb M1 at Hutougou (Figure 14C1,2)) are closer to the Dongshanzui turquoise bird (Figure 14D) than to the Niuheiliang jade figurine retrieved from N16 79M2 (Figure 14B). Necks dissociate

heads from bodies, feathered wings expand laterally, and tails appear fanned, while well-defined eyes and beaks enliven the avian faces. The third Hutougou figurine (Figure 14C3) is more schematic. Lacking wing bars and facial features, it stylistically appears closer to the Banlashan specimen (Figure 14E). The most abstract of all renditions is the barely representational, unique avian figurine recovered at Niuheliang (Figure 14B) (Zhang and Li 2020). The 2.45 cm tall jade lacks facial features and presents vaguer head–body and wing–chest differentiations. The image presents a particularly rounded silhouette, its zoomorphic qualities barely emerging from the mineral matrix. Excavators found this jade bird inside a grave also furnished with a jade skeletal midsection (Figure 14B).

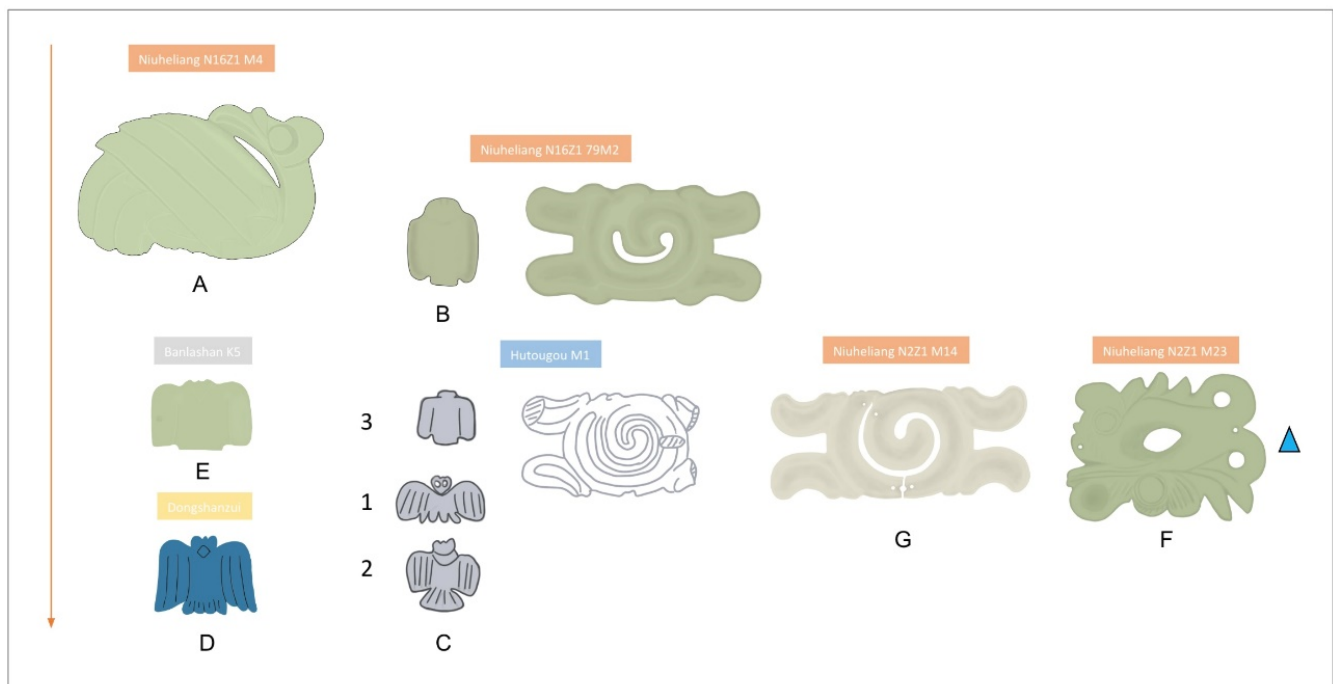


Figure 14. Preliminary seriation chart for avian figurines excavated at Hongshan culture sites. (A) Niuheliang N16Z1 M4; (B) Niuheliang N16Z1 79M2; (C1–3) Hutougou M1; (D) Dongshanzui; (E) Banlashan K5; (F) Niuheliang N2Z1 M23; (G) Niuheliang N2Z1 M14 (Source for all the images: LB and SLB on Procreate).

Considering stylistic observations explained earlier, the N16 79M2 pelvic–femoral rendering exemplifies early representational conventions, and thus likely predates counterparts found inside N2Z1 M14 (Figure 14G) and N2Z1 M23 (Figure 14F). The assumed contemporaneity of turquoise items found at Dongshanzui and inside N2Z1 M23 further lends support to the hypothesis that the sole avian figurine found at Niuheliang predates other excavated specimens in that Hongshan jade category. Accordingly, nothing suggests that its maker sought to represent the well-defined owl-like bird of prey later depicted elsewhere. As art historians well know, inferring the relative dating of figural works based on how abstracted or formally naturalistic they appear is methodologically unsound. Schematic renderings may predate or postdate more formally mimetic works. Without our initial jade midsections analysis and material evidence (turquoise artifacts), asserting that the barely legible N16 79M2 bird rendering predated more articulated and detailed figurines was untenable. Remarkably, excavators at Niuheliang clearly established that the N16 79M2 tomb postdates the N16 M4 tomb (see [Liaoning Provincial Institute 2012b](#), pp. 358 and 393). Consequently, not only did Hongshan craftsmen produce well-defined avian figurines after this simple specimen from Niuheliang, but evidence suggests that they crafted this tenuously representational piece after the exquisite avian plaque found inside N16 M4 (Figure 14A). As placement inside each grave may not correspond to the

years during which each was crafted, we cannot specify the relative dating. Setting aside the order in which they were produced, both works exhibit soft rounded outlines, yet exhibit a noticeable mimetic disparity. Attributing this distinction to their makers' putatively unequal representational talent, however, would rely on the assumption that they sought to represent the unmediated sight of a bird observed in nature. Considering each bird in isolation, focusing on its form and position inside each grave will suggest otherwise.

5.4.2. Two Full-Bodied Avian Representations from Locality 16 at Niuheliang

1. Small bird

Recovered from N16 79M2 during the 1979 excavations, the 2.45 cm piece was located near the tomb occupant's feet (Figure 15A) (Liaoning Provincial Institute 2012b, pp. 417–18). The jade is barely representational and devoid of any attention to feet, plumage, or even eyes. Presented en face, its oblong head is disproportionately broad and stout. A wide, soft angle extending from one shoulder to the other signifies the presence of a beak and contributes to the avian interpretation. Facial topography is reduced to a slight depression around the beak area and two tiny V-shaped depressions on the forehead. Narrow lateral ridges, connected to the chest through smooth, concave transitions, denote wings on a centripetally compact body. The chest is broad and squarish. Two notches abraded on the bottom edge evoke a tail. Perhaps its maker simply sought to represent a bird.

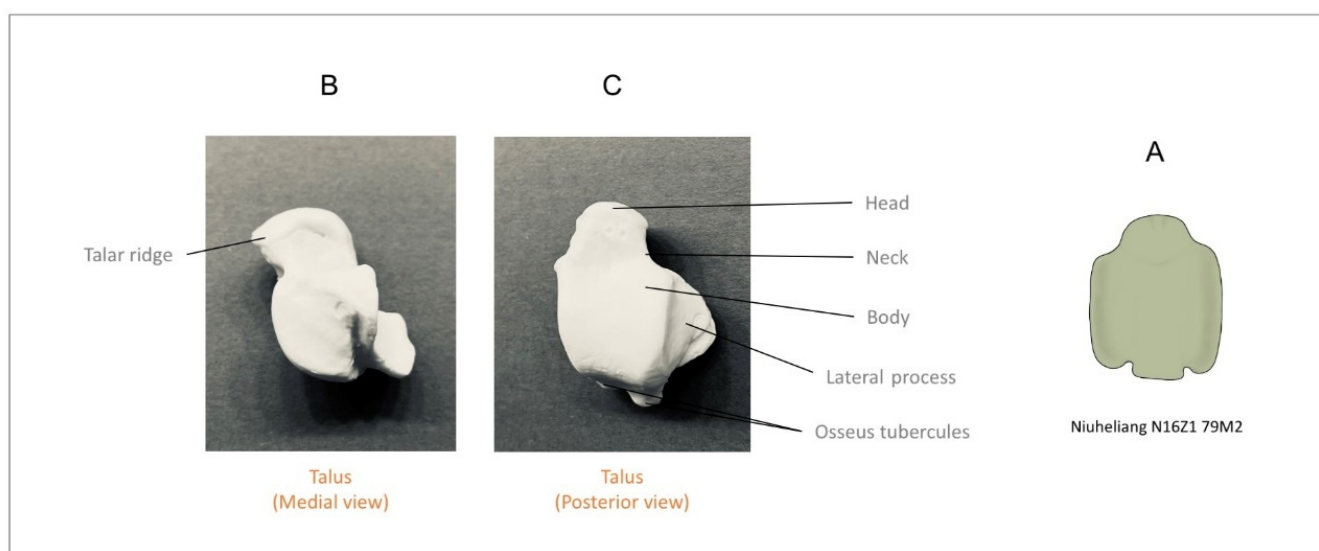


Figure 15. Comparison between a talus bone and the avian figurine found inside tomb N16Z1 79M2 at Niuheliang (Source: (A) LB and SLB on Procreate; (B,C) photographs by the author).

However, considering crafting practices discussed earlier and the jade's position near the deceased's feet, an osteo-morphological link is conceivable. Remarkably, the shape the craftsmen gave to this avian figure echoes the form of a significant tarsal bone (Figure 15B,C). Composed of seven osseous components, the ankle joint complex mediates the lower leg with the sole and toes. Its largest bone at the heel (calcaneus) supports the second largest ankle bone (talus), which anchors and articulates directly with the tibia and fibula (White and Folkens 2005, p. 292). The talus figures among the bones regularly described in scientific literature with terms such as "body", "head", and "neck". The terms, respectively, differentiate the bulk, the rounded section articulating with the navicular bone, and the recessed area separating the two. The medial view of a talus shown here may be conducive to a pareidolia-induced image of a bird profile, its lateral process evoking a wing (Figure 15B). The bone's resonance with the profile of a bird likely explains why osteologists call a pointy excrescence present on a talus head a "beak" (see Lawrence et al. 2014). Even in the absence of a sharply pointed growth on a talus head, morphological variations of human taluses

regularly possess a talar ridge whose shape and location may suffice to evoke the idea of a beak (see [White and Folkens 2005](#), Figure 4.1). The superior view of this human bone, achieved through a 90-degree lateral rotation, lends support to the hypothesis that a human talus inspired the 79M2 jade-maker (Figure 15C). From this perspective, the bone exhibits a broad neck, a stout head, and a wide squarish body reminiscent of the 79M2 bird rendering. The bird's recessed wing placement against the chest is echoed in the talus, which features a lateral process similarly recessed on part of the bone designated as its 'body' in Figure 15C. The two lower osseous tubercles occupy the position representing the bird's tail on the Niheliang figurine.

2. Big Bird

During subsequent excavations conducted at Niheliang Locality 16, archaeologists found inside tomb M4 a jade plaque positioned underneath the five-thousand-year-old skull of a man who had died in his forties. The 19.5 cm long jade represents a bird introduced as a swan, a phoenix, or a heavenly bird ([Liaoning Provincial Institute 2008b](#), p. 11; [Li 2021](#)). The creature displays a plumaged profile reduced to a semi-circular body and a proportionately large beak and head (Figure 16A). The avian figure is in a resting position (its head faces backward), but its open eye preempts concluding that it is asleep. An unusual combination of physical features challenges species identification. The figure has an elongated neck, a thick, long, downward curving beak, a prominent nostril operculum-like bulge, and a large circular eye from which a wide wedge-shaped extension projects. Without this prominent appendage crowning the eye and extending toward the neck, the creature could pass for a swan or a bird of prey. Its peculiar characteristics perhaps belonged to an extinct avian species observable in the Hongshan environment.

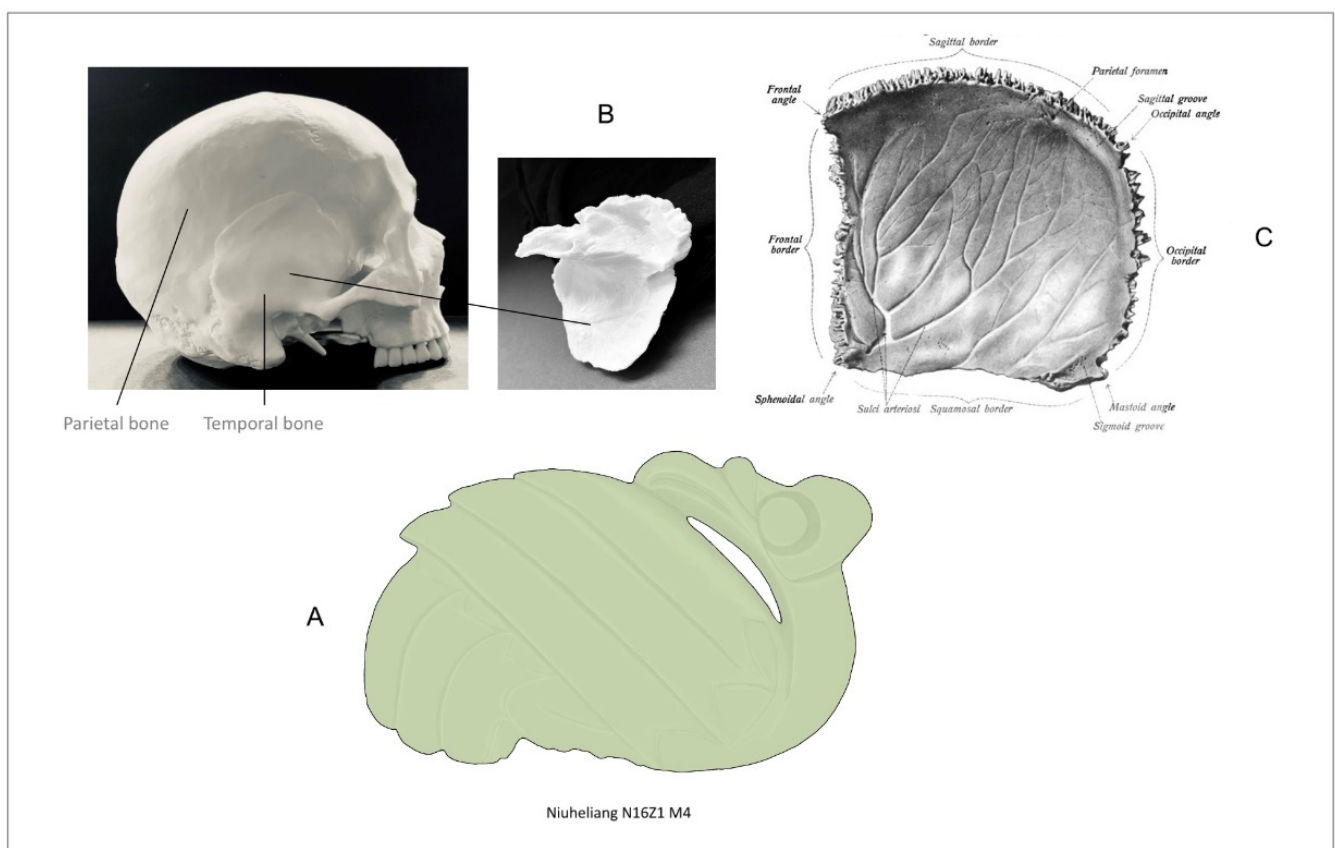


Figure 16. Endocranial osseo-morphology as source of inspiration for the phoenix jade plaque (Source: (A) LB and SLB on Procreate; (B) photographs by the author; and (C) *Gray's Anatomy of the Human Body*, 1918; public domain).

Considering the jade's position underneath the deceased's skull, we nevertheless may entertain the possibility of a link between the artifact and skull osteomorphology. Indeed, it may well be that the image-maker paid close attention to a human endocranial cavity. A skull's inner walls present features that, through pareidolia, may conjure the mental image of a bird. In particular, the medial view of a temporal bone evokes an avian head seen in profile (Figure 16B). Remarkably, the skull image shares with the jade bird the unusual aggregate of physical features noted earlier. This resonance alone may have conjured in the jade-maker's mind the image of a bird and sufficed to inspire the jade. However, other morphological factors may have played an additional part. A human endocranial cavity exhibits surface patterns that could lead to the perception of plumage (Figure 16C). The jade-maker likely noticed that blood vessel marks looked like feathers. The brain and its envelope (the outer meningeal sheet called dura matter) leave notable imprints on their bony, protective surroundings. Part of the complex craniovascular system, middle meningeal vessels traverse the dura matter endosteal layer. As the brain cortex exerts pressure on these vessels, their traces are imprinted onto the endocranial wall (Eisová et al. 2019). Physical factors, ranging from blood pressure to vessel size, affect the dimensions of these imprints, and evidence shows that they tend to fade through adulthood. The middle meningeal artery imprint generally starts at the base of the skull near the temporal bone and extends upward on the parietal bone toward the back of the skull. The artery stem generally divides into three branches (bregmatic, obelic, and lambdoidal), out of which smaller veins may branch, resulting in variable endocranial imprints described as pseudo-fractal (De Lázaro et al. 2018). While this classification may not apply to the jade bird plumage pattern, the latter still results from three primary sunken lines whose main orientation corresponds to that of bregmatic, obelic, and lambdoidal branches visible on a temporal and its adjacent parietal bone (Figure 16C).

5.5. *Fanged Beast Faces* (有齿兽面)

5.5.1. Overview

Another significant category in the Hongshan jade repertoire encompasses plaques deemed to represent the face of a fanged animal or a monster. The abstracted form jade-makers gave to these represented entities has challenged any secure identification. An array of interpretations has linked the form to a person undergoing a shamanic trance, a bird, a phoenix, a dragon, a pig-dragon, the *taotie*, or a tiger. The excavators of the Niuheliang sites classify them as "hooked-cloud" shaped objects (Liaoning Provincial Institute 2012b, p. 426).

This study focuses on pieces scientifically unearthed from Hongshan tombs, a list thus limited to artifacts recovered from Localities 2 and 16 at Niuheliang. The objects range in length from 6.2 cm to the 28.6 cm plaque discovered near the deceased's head inside tomb N2Z1 M27 (Figure 17).²⁷ The plaques appear to represent not a fanged creature but rather part of a toothless human skull. Here again, Hongshan jade-makers faced challenges from the availability and size of raw jade, which presumably rarely matches the volume of human skulls. Any attempt at size approximation—which they appear to have sought in other osseous representations—required creative solutions. To reduce the positive space taken up by the represented forms, slabs once again proved economical for craftsmen willing to conflate different vantage points to convey their models' three-dimensionality. As for the equally complex midsection skeletal forms, representing parts of neuro-cranial and facial bones on flat jade slabs demanded conceptual simplifications. Jade-makers reduced forms and came up with a set of standards observed on the Niuheliang artifacts. Each plaque represents the cranium as a compressed entity.

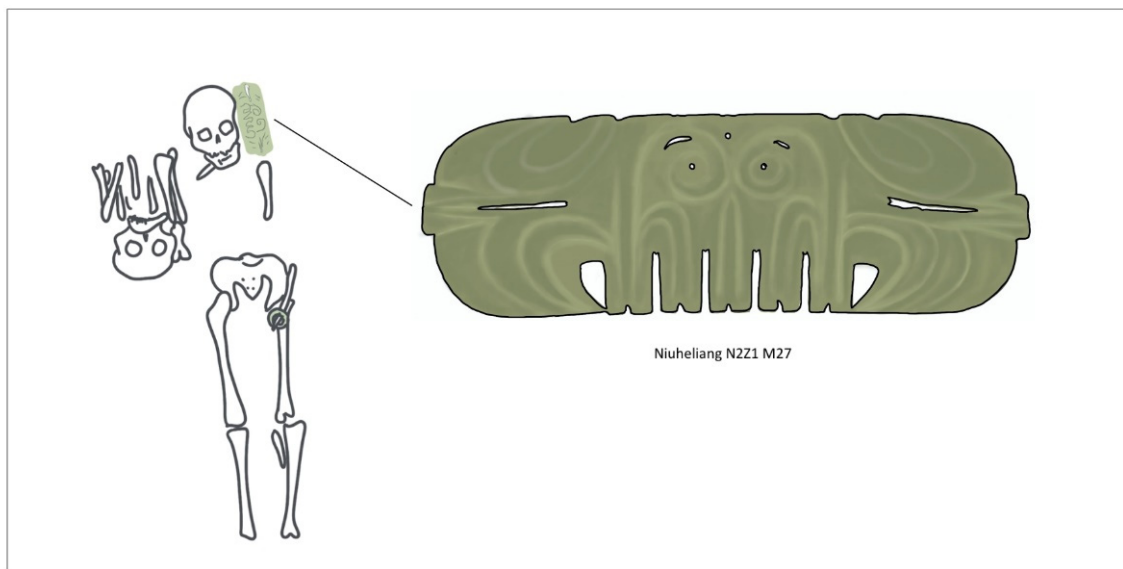


Figure 17. Partial ground plan of tomb N2Z1 M27 at Niuheliang with jade plaque in situ (Source: SLB on Procreate).

5.5.2. Representational Conventions at Niuheliang

A comparative analysis will demonstrate how the jades represent the osseous structure near which excavators found the 28.6 cm long specimen when they opened N2Z1 M27. The examination will show that the renderings exhibit formal variations resulting from the differentiated reproduction of anatomic details. The human skull replica used for comparative purposes was cast from a skeleton in modern China. Its features are specific to a single, modern individual and, thus, cannot represent all Hongshan community members. A study of skulls found inside graves at Niuheliang concluded that Hongshan people generally shared wide zygomatic bones, a broad and flat face, a narrow nasal aperture, and jaws and orbits of average size. Furthermore, occipital bone deformation observed at both sites on some skulls resulted in flattened posterior surfaces, a cranio-morphologic trait that tends to shorten cranial length (anterior to posterior) and increase facial flatness and width.²⁸ Such characteristics are consistent with the appearance of clay and stone head renderings found at Hongshan sites.

The plaques' elongated and flattened plane presents morphological features visible on the skull when rotated laterally. Jade-makers here approached their representational enterprise following a convention discussed earlier. Each artifact conflates several vantage points within the same flat field: anterior and lateral views of the bony model. The most abstracted rendition is the diminutive specimen found inside tomb N2Z1 M9 at Niuheliang (Figure 18). Its maker captured the semi-circular shape of a human calvaria and reduced the rest of the face's structure to two small eye sockets and a maxilla framed by two mastoid processes. The craftsman did not attempt to account for the complex bony bridge (zygomatic arch) or other surface properties on a lateral cranial view. They only alluded to the bony eminence visible on a temporal bone (articular tubercle), rendering it as a slight projection on the arch extending from the mastoid process to the maxilla.

Jade-makers who represented the same osseous complex on plaques retrieved from tombs N2Z1 M27 (Figure 19A) and N16 M15 (Figure 19B) reproduced the same arch slightly differently. For the latter, the craftsman produced a simple $\cap$ -shaped notch. For the M27 plaque, the craftsmen captured the more acute angle above the mastoid process.

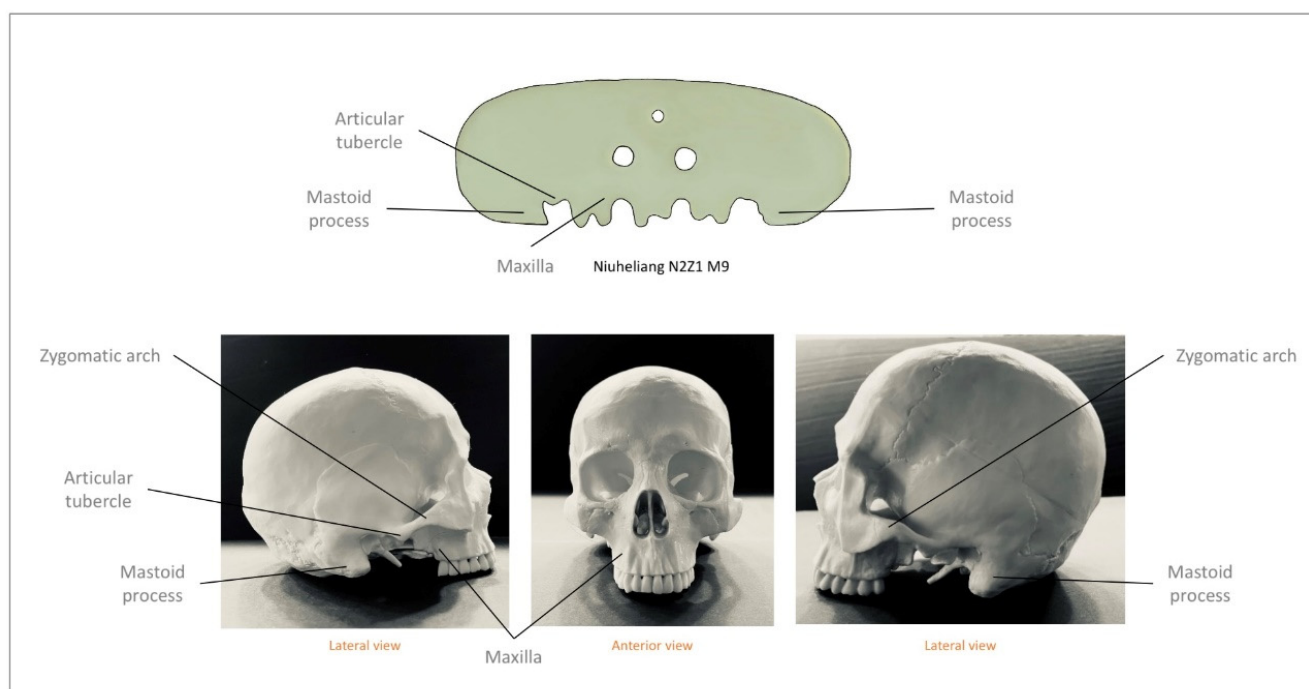


Figure 18. Comparison between a jade plaque from tomb N2Z1 M9 at Niuheliang and a skull (lateral and anterior views) (Source: LB and SLB in Procreate; photographs by the author).

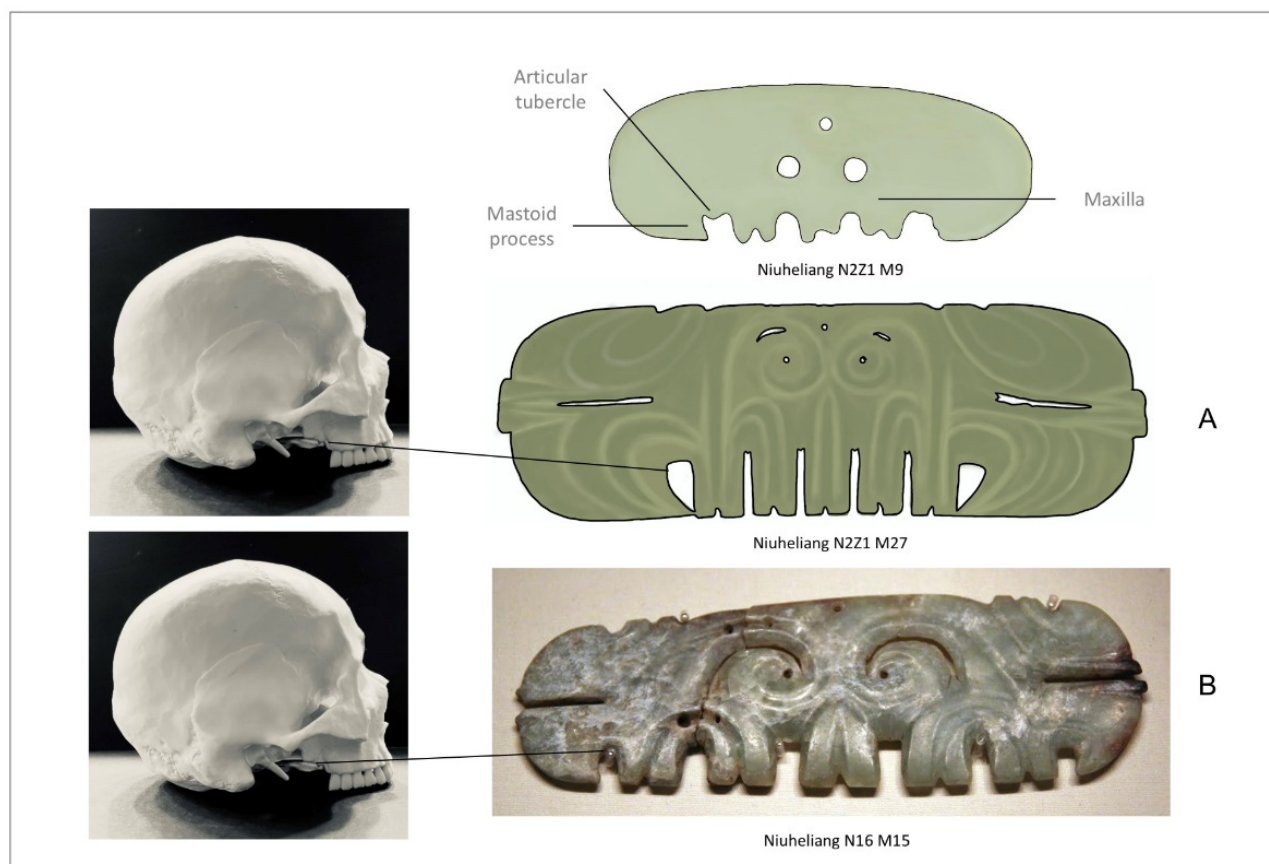


Figure 19. Comparison between two more complex jade plaques and a skull (lateral section) (Source: (B) Courtesy of Gary Todd, Ph.D.; (A) uppermost plaque: LB and SLB on Procreate; photographs of the skull by the author).

Focusing on the upper part of cranial sides represented on the jades will shed light on additional heretofore mysterious configurations and show how jade-makers conceptualized what would become representational conventions. The two jades under study display not only mastoid processes, but also bony arches (zygomatic arches) extending from the temporal bone to the cheekbone upper corner (zygomatic bone) (Figure 20). Made of two projecting bone segments fused at a midpoint (the zygomatic and temporal processes), this bony bridge runs parallel to the temporal bone. Both jade renditions acknowledge the parallel position of these parts and the open space separating them. The jade cranium found inside N2Z1 M27 reflects the circumscribed nature of this gap. Unlike the two parallel and straight horizontal segments used on the N16 M15 jade to define this complex anatomic detail, their equivalents on the N2Z1 M27 artifact eventually intersect and enclose the opening. Slightly bent and featuring triangular ends, they replicate bony formations with greater accuracy.

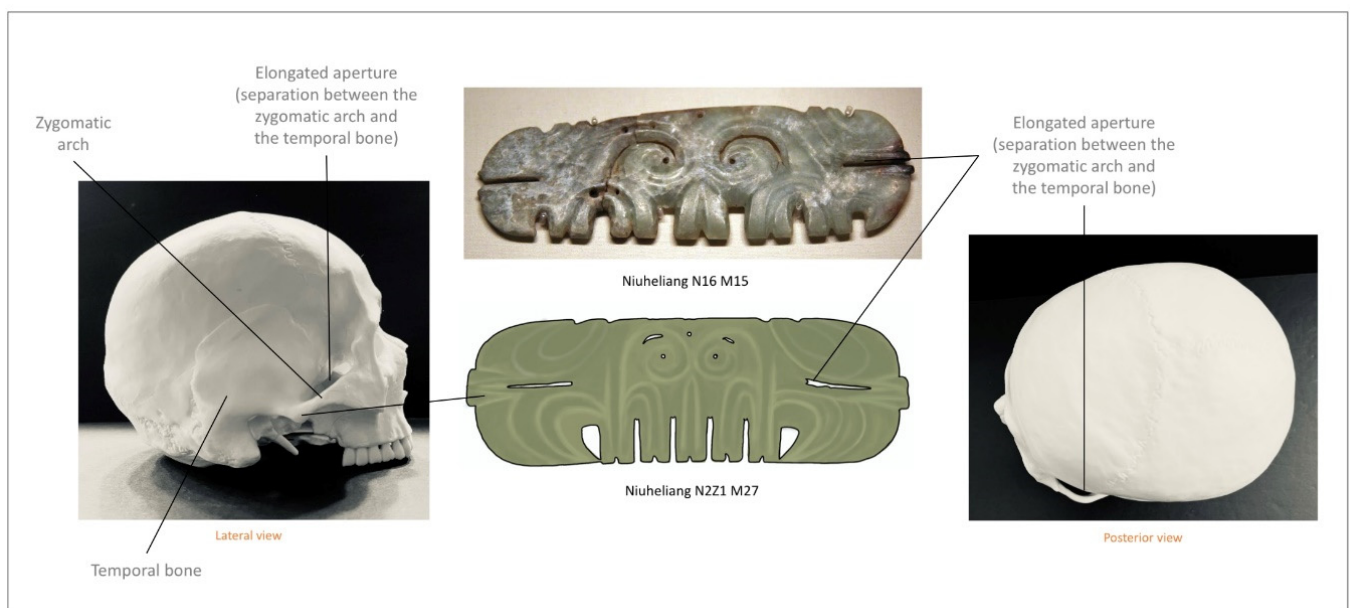


Figure 20. Comparison between two anatomically detailed jade plaques and a skull (Source: Photograph of the plaque from tomb N16 M15 at Niuheliang, courtesy of Gary Todd, Ph.D.; other plaque representation (SLB on Procreate); photographs of the skull by the author).

The two jade workers equally reproduced cranial surface features above the zygomatic arches: two temporal ridges (temporal lines), separated by a shallow depression, framing a deeper recessed area (temporal fossa) (Figure 21A).²⁹ Like Cubist artists later would, Hongshan craftsmen focused on the relative positioning of these features. Reproducing the varied heights and depths of this cranial topography on thin jade plaques was challenging. The jade-makers devised a convention to signify that a temporal fossa is wider and deeper than the sunken band between two temporal lines and to account for all these features. They represented the width- and depth-differentials on the upper rim of each plaque by enclosing a wider and deeper U-shaped notch (temporal fossa) with two concentric relief bands (temporal ridges) divided by a narrower and shallower U-shaped band (the concave area between temporal ridges) (Figure 21B).

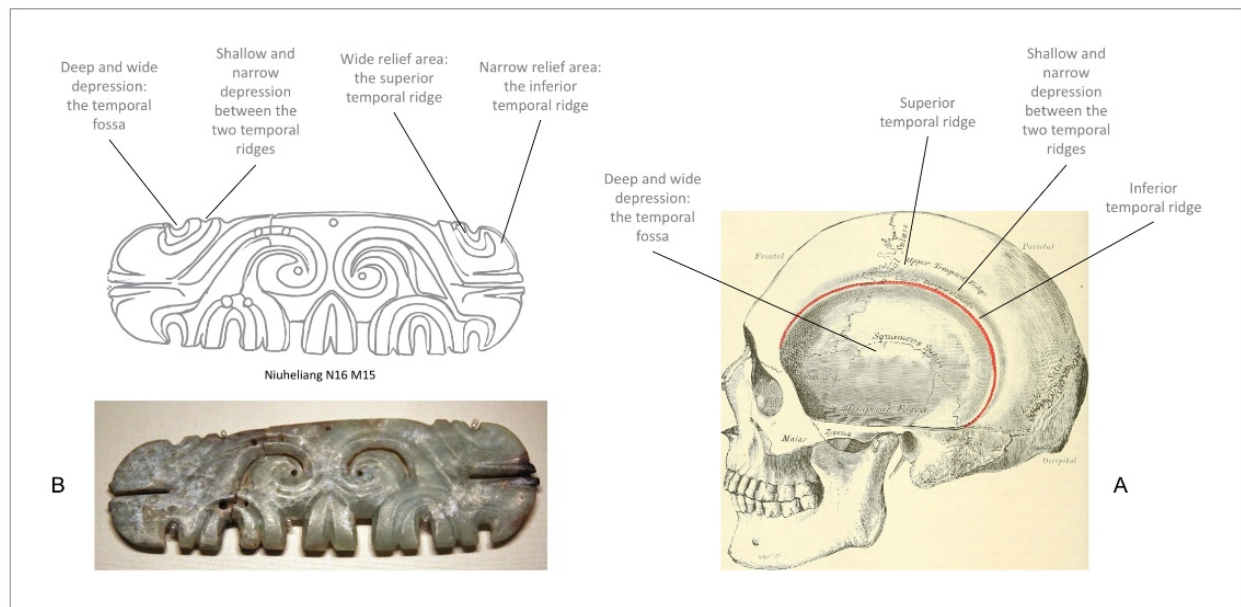


Figure 21. Skull surface topography as source of inspiration for the sunken and raised areas on the jade plaque (Source: (A) Henry Gray, *Anatomy, Descriptive and Surgical*, 1897, public domain); (B) Jade plaque from the N16 M15 tomb at Niuheliang (Source: Courtesy of Gary Todd, Ph.D.); Tracing (Source: LB and SLB on Procreate).

Jade-makers devised other conventions to reproduce a skull on the plaques' centers. They concentrated on the orbits, the two maxillae bones (upper jaw), and the nasal and cheek bones (Figure 22A). Concern for precision compelled them to represent orbits as trapezoids, whose rims frame the tapering (and thus seemingly receding) inner walls. Open-work further helped define optic canals and superior orbital fissures on the sphenoid orbital base. Craftspeople paid attention to a horizontal bony depression separating upper orbital margins from brow ridges (superciliary arches). The makers of the N16 M15 and N2Z1 M22 jade crania extended that depression along the frontal process towards the cheek bones' lower edges (masseteric origins) (Figure 22B,C). The central notch on the uppermost edge of the N2Z1 M22 plaque helped denote the V-shaped curvature of the superciliary arches. The absence of frontal eminence above the superciliary arches suggests that jade-makers omitted the skull calotte from their cranial representations (Figure 22A).

To represent features below the orbital openings, jade-makers devised other principles that modern viewers acquainted with standard sculptural skull representations will perceive as profoundly unconventional (Figure 23). On the central axis of each plaque, they produced a bifurcated vertical appendage emanating between the orbital openings and ending on the maxilla. Its triangular outline echoes the shape formed by the nasal bones and fossa. Its axial sunken line corresponds to the fissure between the adjoining nasal bones, the recessed septum within the nasal fossa, and the suture line between the two contiguous maxillae bones (Figure 23a). Devising other unusual representational standards, jade-makers rendered the maxilla area with more accuracy. First, they focused on the bony maxilla and did not represent the teeth. Therefore, despite their serrated lower edges suggesting the idea of teeth or fangs, all the Hongshan jade crania are toothless. Craftspeople, perhaps seeking uniformity, circumvented the issue of modeling their works after maxillae missing some teeth. Moreover, focused on material acuity, they may have deemed jade inadequate to stand for both bone and tooth enamel within the same composition.

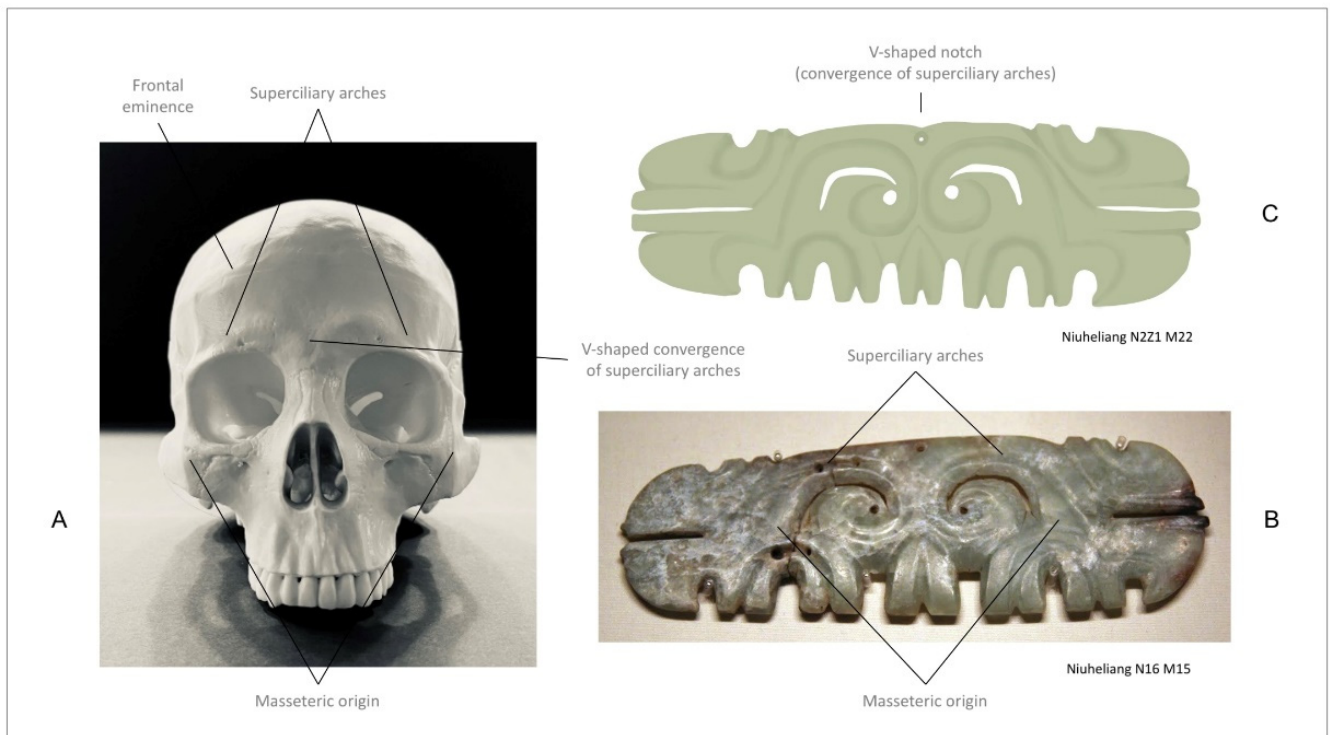


Figure 22. Facial skeleton as source of inspiration for configurations at the center of each jade plaque (Source: (B) Courtesy of Gary Todd, Ph.D.; (A) photograph by the author; (C) LB and SLB on Procreate).

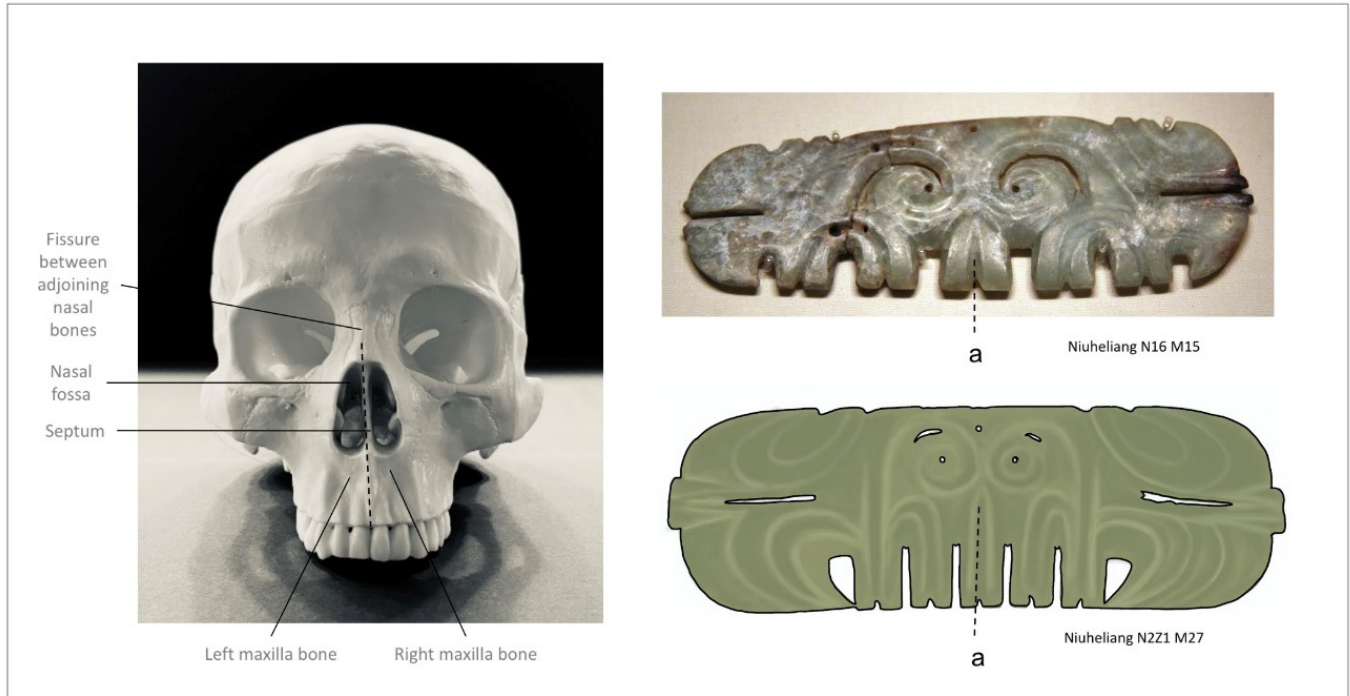


Figure 23. Identification of facial skeletal features replicated on the plaques' central axis (Source: Photograph of the Niuheliang N16 M15 plaque, Courtesy of Gary Todd, Ph.D.; photograph of the skull and representation of the Niuheliang N221 M27 plaque with Procreate by the author).

For the toothless representations, they leveled all reproduced features so that they aligned with the mastoid processes included on each lateral plaque segment (Figure 24). As illustrated earlier in Figures 18 and 19, jade-makers represented the low arches bridging the

mastoid processes to the maxilla (Figure 24, “A”) as well as a taller triangular section whose outline follows the nasal bones and fossa (Figure 24, “B”). The N2Z1 M9 jade exhibits much simplification: its arches are unified in shape and size, and the nasal triangular area is nonexistent. On other plaques, craftsmen allocated a different height to arches closer to each plaque’s central axis (Figure 24, “C”).

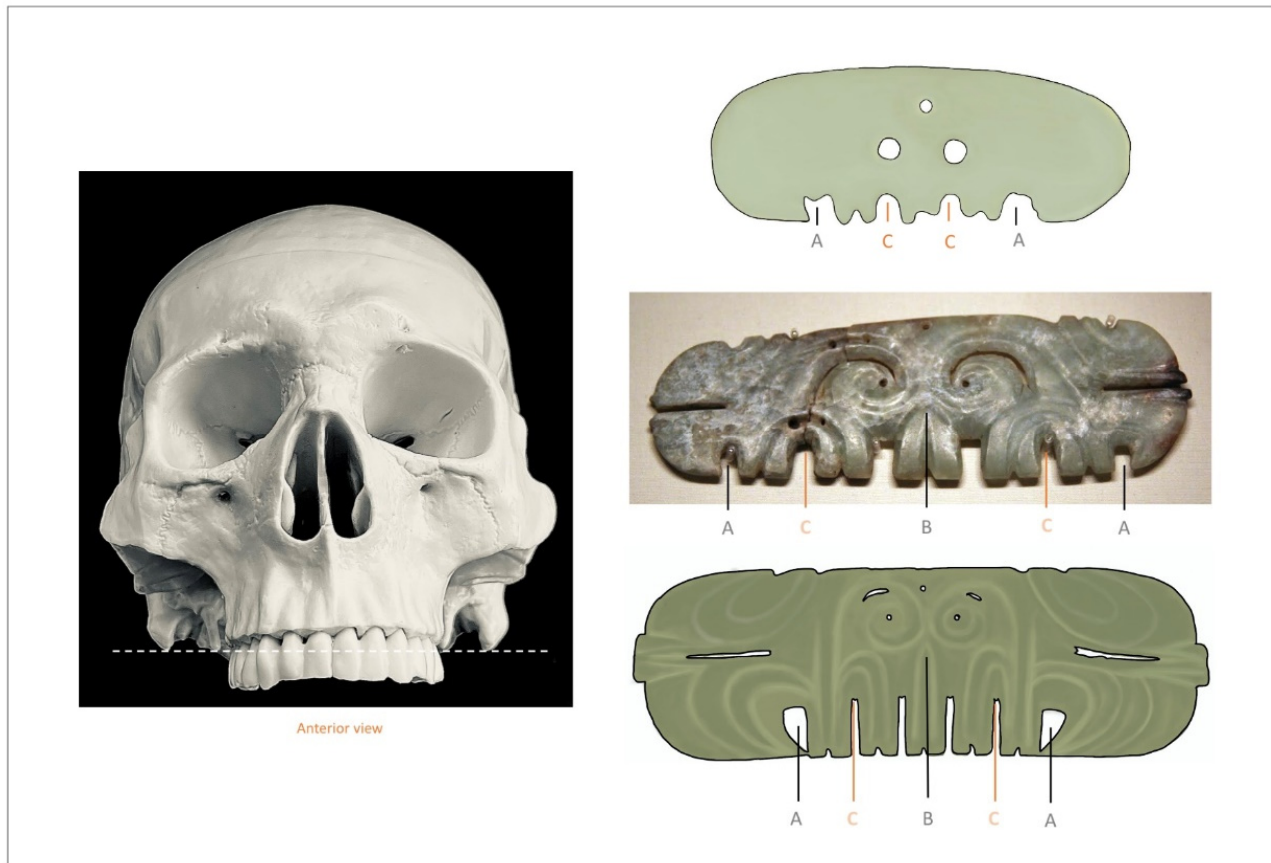


Figure 24. Identification of lateral and frontal bony arches represented on plaques from N2Z1 M9, N16 M15, and N2Z1 M27 (Source: photograph of the plaque, Courtesy of Gary Todd, Ph.D.; skull photograph and plaque renderings on Procreate by the author).

While the mirroring “A” arches reproduce features visible laterally (Figures 18 and 19), the “C” arches represent an anterior view. Unlike the single-layered “A” arches, the “C” arches consist of two adjacent arches (Figure 25). One starts at the mastoid process level and continues through the cheekbone masseteric origin before concluding in a curving suture (zygomatic and maxilla articulation point). While curving around a concave area (canine fossa), the arch divides into two parallel lines on each side of an opening in the maxilla bone (infraorbital foramen) before ending in two parallel vertical eminences (canine jugum and nearby alveoli) on the alveolar process. The double teeth-like jade segments thus correspond to the sight of two adjoining eminences above the tooth alveoli.

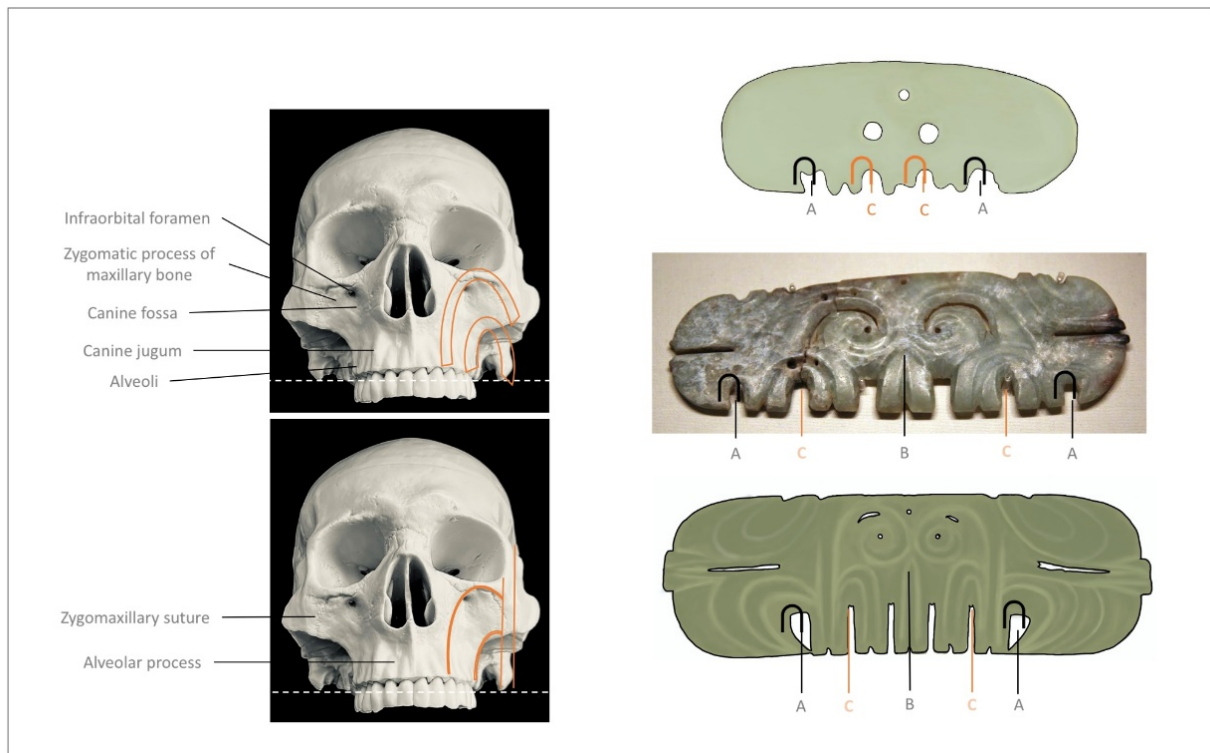


Figure 25. Identification of double arches reproduced on the plaques. (Source: photograph of the plaque, courtesy of Gary Todd, Ph.D.; skull photograph and plaque renderings on Procreate by the author).

5.6. Dragons (龙) and Pig-Dragons (猪龙)

From Dragons to Pig-Dragons, and Back to Dragons

1. C-Shaped Dragons

As noted in the section devoted to “hooked-cloud” plaques, scholars of early China have recognized the effigy of dragons in Hongshan jades. This section addresses jades within this broad category, from simple dragons to so-called pig-dragons. Before we turn to the established corpus of archaeologically excavated Hongshan dragons, this short section will address two C-shaped jades collected in Wengniute Banner, Inner Mongolia (Figure 26A,B). Interpreted as dragons since their discoveries in 1971 and 1986, the artifacts have unclear provenance and may date to a later culture (Childs-Johnson and Gu 2009, pp. 305–7). They remain among the best-known Hongshan jades. Both creatures have limbless slender bodies coiled into a large C. They share proportionately large oblong eyes positioned atop their heads and long snouts separated by a depression. Their most salient stylistic difference is the mane-like appendage each displays on its nape. On the specimen found at Sanxingtala 三星他拉 (Figure 26A), the mane is longer and wider and further detaches from the creature’s back. It also exhibits a pointed tip reminiscent of jade sacrum–coccyx tips and the projections found on the renderings of mastoid processes. Setting aside the color difference of their matrixes, the objects further diverge in their sizes: one is 26 cm tall, and the other is 16.8 cm.

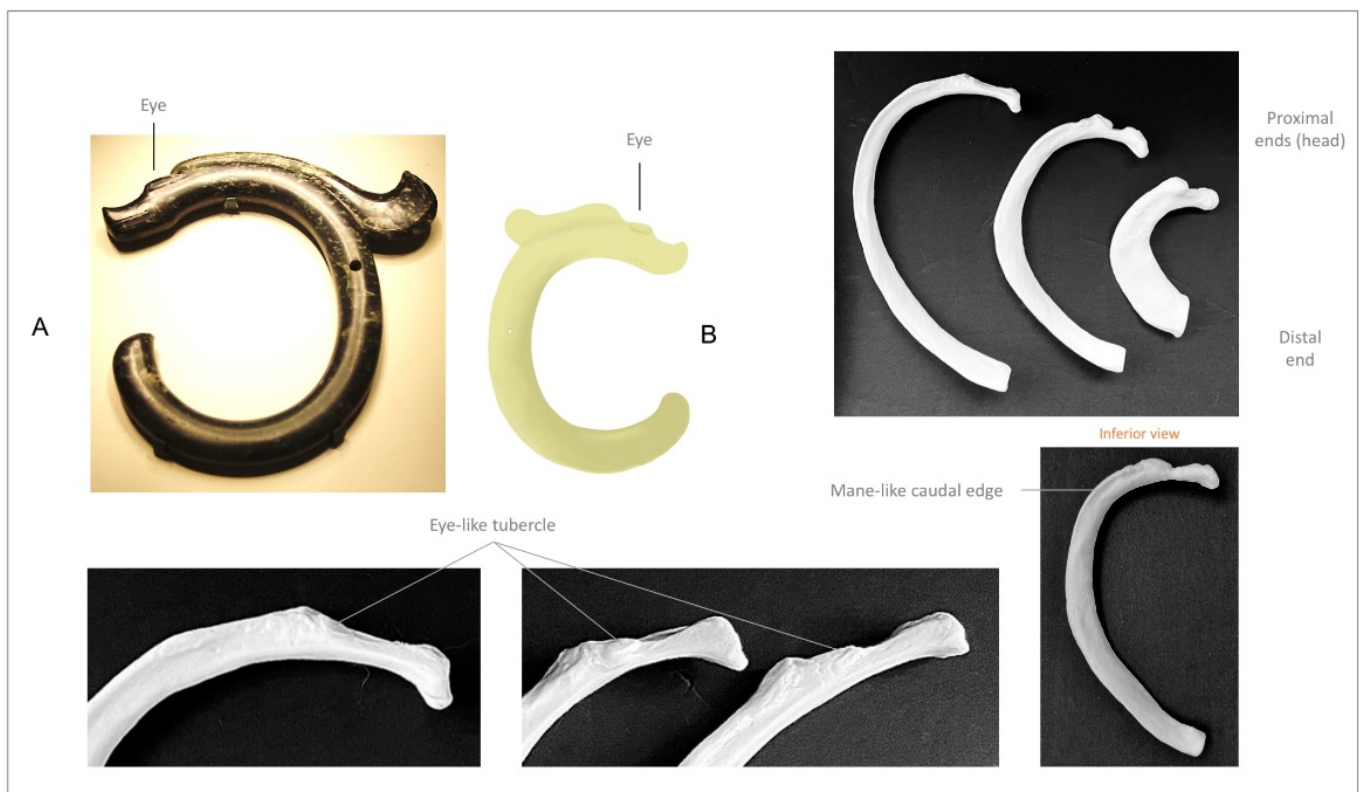


Figure 26. Comparison between two dragon-shaped jade artifacts and human ribs. (A) Photograph of the Sanxingtala dragon at the National Museum of China, Beijing (Source: Courtesy of Gary Todd, Ph.D.); (B) Jade dragon collected in Guangdegong Town (Source: LB and SLB on Procreate); Ribs (Source: photographs by the author).

Considering the attention that Hongshan jade-makers gave to human bones, we may entertain a link between these C-shaped creatures and human osteomorphology. The unusual features the creatures share, as well as their size difference, may be explained by an analysis of human rib structure (Figure 26). As major rib cage components, these C-shaped bones vary in size and number (there are usually 12 on each side of the sternum). The difference in dimension is most noticeable among ribs whose distal end (flatter end) attaches directly to the sternum via costal cartilage (ribs one to seven) (see [White and Folkens 2005](#), p. 185 and Figure 10.4). Setting aside their size difference, the ribs share noteworthy morphological features and figure among the bones that specialists describe through references to human body parts. Their “head” corresponds to the proximal end in contact with one of the twelve thoracic vertebrae; their “body” consists of a shaft (more rounded and thicker for ribs three to six) on which an array of tuberosities, grooves, and edges may be present ([White and Folkens 2005](#), pp. 185–92). Jade-makers perhaps perceived creatures in rib heads, projecting the idea of eyes onto tubercle facets and manes onto caudal edges.

2. Double-Headed Dragon

During excavations conducted at Dongshanzui, archaeologists recovered an enigmatic curved jade artifact from a square architectural foundation (Figure 27A). On the basis that its two tips resemble dragon heads, excavators intimated that the object related to rain-inducing worship—a premise derived from the power allocated to dragons over meteorological events in historical China. David W. Pankenier pointed at a resemblance with a bicephalic arched oracle bone graph from the late second millennium BCE, meaning ‘rainbow’ ([Pankenier 2013](#), p. 396). We cannot assume that the crafting habits discussed for Hongshan jades thus far necessarily apply to this artifact. However, since the object was recovered at a ceremonial complex where human remains were found near a circular altar,

the prospect of a connection to human bones remains. The jade exhibits characteristics that point to the hyoid bone, an important neck bone (see [White and Folkens 2005](#), pp. 155–56). Indeed, the jade’s diminutive size (4.1 cm long), arch shape, symmetry, prominent mirroring heads, erect horn- or ear-like appendages, and elongated snouts all match features observable in a hyoid bone (Figure 27B,C). Osteologists call upon somatic imagery to describe this small bone situated on the anterior part of a throat, referring to its central core as a body, the upper edge projections as lower horns, and the segments extending posterolaterally on each side as greater horns ([Scheuer and Black 2004](#), p. 141; [De Bakker et al. 2019](#)). Struck by pareidolia, a jade-maker (or an intermediary manipulating a human hyoid bone) possibly projected a mental image on each extremity, reading the great horns as long-snouted zoomorphic heads and lesser horns as erect ear-like prominences. Beyond turning mental images into concrete zoomorphic heads, the jade-maker appears to have reproduced the bone’s median ridge, the adjacent concavities (attachment points for muscles), and reliefs visible on the superior surface of the osseous core (Figure 27B).

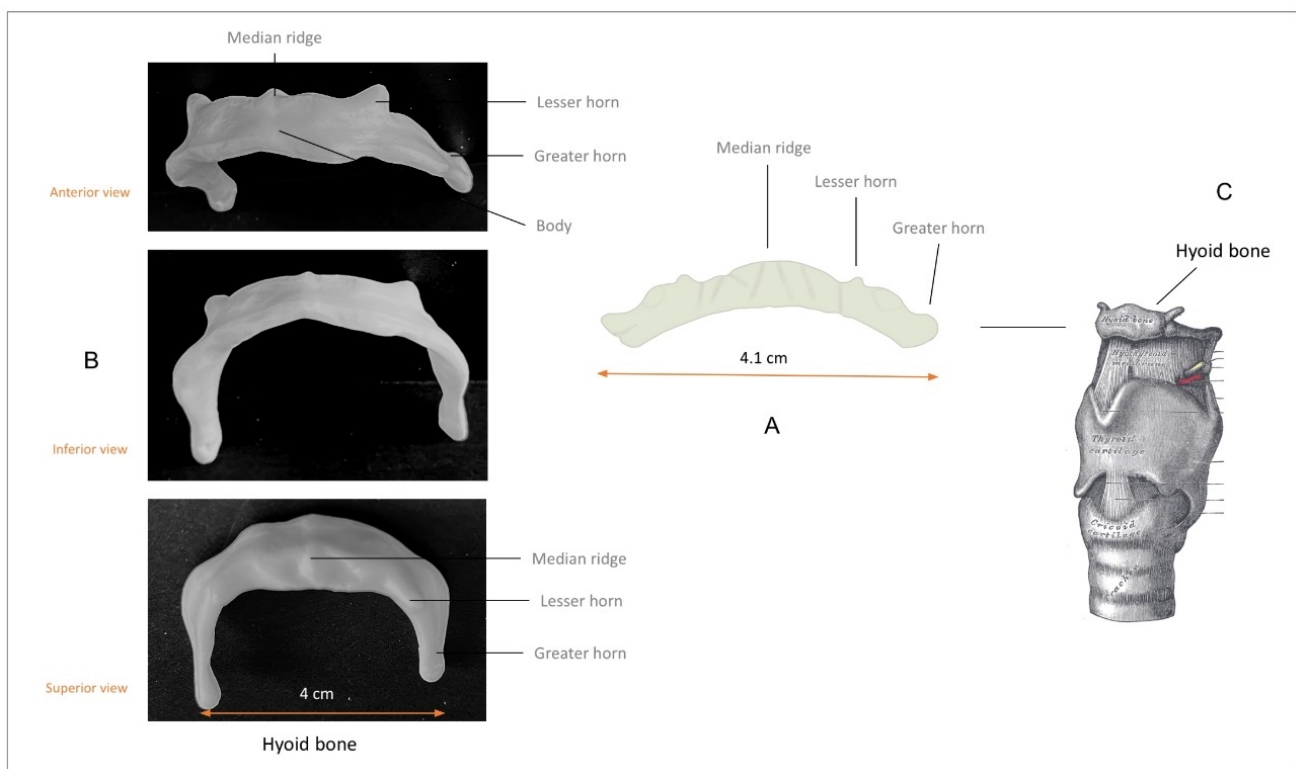


Figure 27. Morphology of a hyoid bone as source of inspiration for the double-headed dragon arch discovered at Dongshanzui (Source: (A) LB and SLB on Procreate; (B) photographs by the author; (C) Hyoid–larynx, *Gray’s Anatomy*, Public domain).

3. Pig-Dragons (猪龙)

Another quintessential Hongshan jade type linked to dragons is the “pig-dragon” (Figures 1C, 2C and 28A,B). Archaeologically excavated specimens with precise provenance are rare: only three were found inside graves at Niuheliang, two inside N2Z1 M4 (Figure 28A), and one inside N16 M14. The official Niuheliang site report lists two additional specimens recovered in Jianping county. More recently, tomb M12 yielded another pig-dragon at Banlashan (Figure 28B). Other examples with less secure origins are held in museums and collections inside and outside of China.

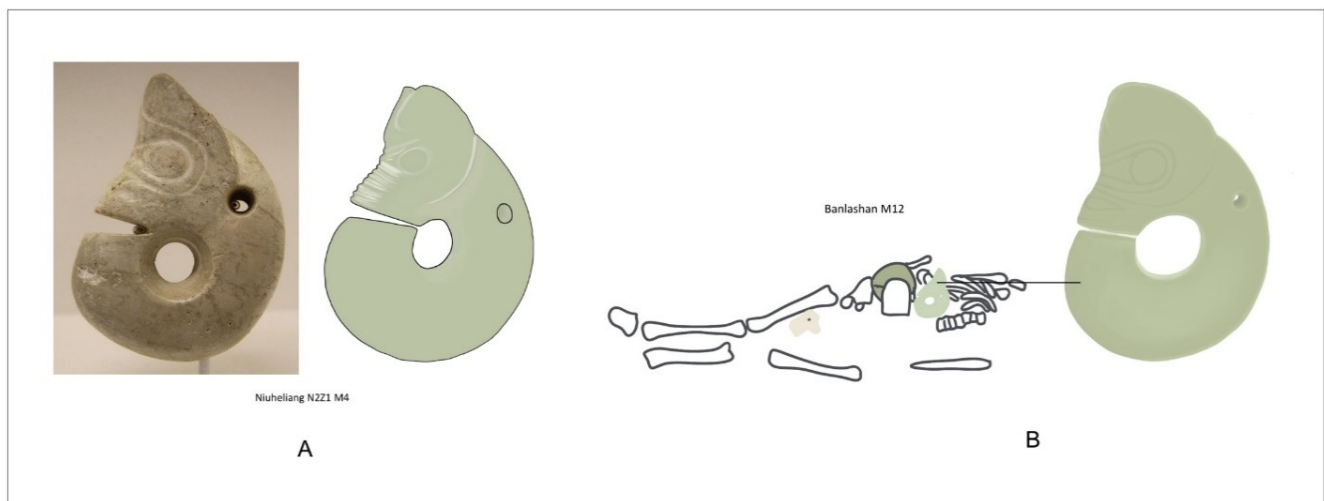


Figure 28. Illustration of two pig-dragons found on the chest of a male buried inside tomb N2Z1 M4 at Niuheiliang and pig-dragon in situ inside tomb M12 at Banlashan (Source: (A) Photograph of Niuheiliang pig-dragon, Courtesy of Gary Todd, Ph.D.; (A,B) LB and SLB on Procreate).

Scholars of early China have offered an array of interpretations for this puzzling Hongshan jade type. Some assumed functions range from worship, ritual activities, fertility symbols (Childs-Johnson 1991), and harvest ceremonies (Forsyth 2012, p. 62) to the proposition that the jades functioned as amulets (Childs-Johnson 1991, 2002; Childs-Johnson and Gu 2009; Forsyth 2012). Scholars have hypothesized on the source of inspiration for this jade type. Conjectures include slit jade rings (*jue* 玦) crafted in earlier cultures in northeast China and southern imagery from Lingjiatan in modern Anhui province (Rawson 1995; Childs-Johnson 2002; Zhu 2011). Beyond the creatures' physical characteristics (pig-like heads and elongated bodies), archaeological finds (pig bones excavated at Dongshanzui, the site that generated the double-headed dragon arc just analyzed) contributed to the pig-dragon association. The strong resemblance between jade pig-dragons and second millennium BCE Shang 商 period graphs meaning dragon reinforced the association (Childs-Johnson 1988, p. 32). The dragon and the pig readings have endured in modern scholarship, yet not without challenge (Jao 1988). The bear has been another contender. Liaoning archaeologists, too, surmised that pig-dragons share the bear-shaped silhouette of Mulanshan 木栏山, a mountain visible from the Niuheiliang site (Barnes and Guo 1996). Other hypotheses have related pig-dragons to larvae or animal fetuses (Childs-Johnson 2002, pp. 21–22). The animal fetuses postulate was subsequently associated with a hatchling alligator inside an egg (Thorbjarnarson and Wang 2010, p. 64). Other scholars have assessed resemblance to specific animals as untenable (Thorp and Vinograd 2001, p. 34).

Our analysis proposes another source of inspiration for these enigmatic creatures. In view of the working habits discussed earlier, Hongshan jade-makers likely found inspiration in human anatomy to produce 'pig-dragons.' Moreover, in keeping with burial practices highlighted earlier, the hypothesis that these jades relate to skeletal parts near where archaeologists find them seems sensible. The specimen recovered from tomb N16 M14 lay next to the skull of a woman in her thirties whose bones had been piled up. However, the arrangement of pig-dragons on extended skeletons at Niuheiliang (N2Z1 M4) and Banlashan (M12) is consistent: all three jades were on the deceased's chest or stomach area. A relevant and intriguing source of inspiration for these jades is the larynx–trachea skeleton (Figure 29).

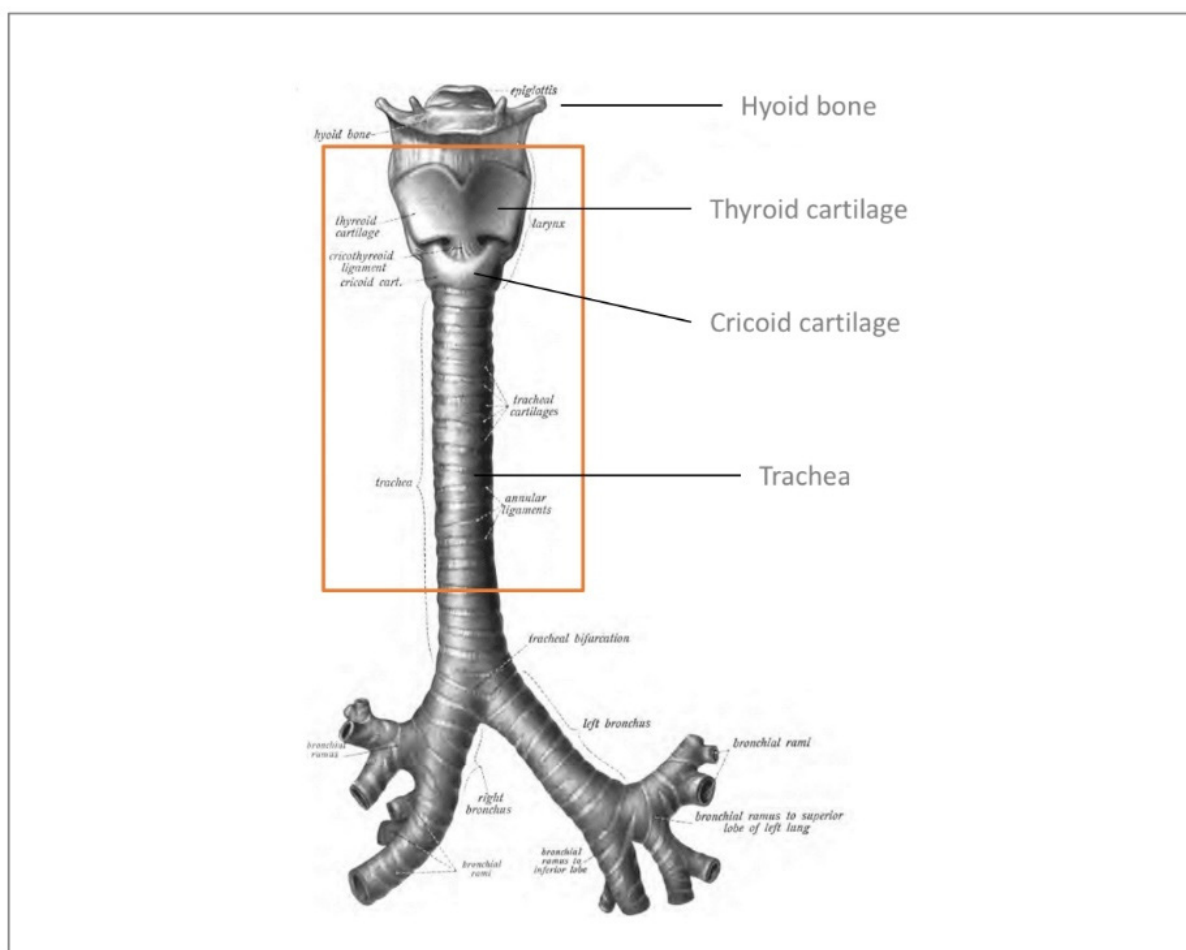


Figure 29. Illustration of the human trachea and larynx (Source: *Sobotta's Atlas and Textbook of Human Anatomy*, 1906; public domain).

Unlike the osseous models discussed thus far, these skeletal constituents leave fewer traces following decomposition. Made of cartilage and other softer tissues (fibro-elastic membranes and ligaments), they are more susceptible to decay than bones. Osteologists pointed out that occasionally an ossified larynx may be found in the cervical area during tomb excavations (see [Scheuer and Black 2004](#), p. 148). However, crafting jades based on a larynx–trachea structure most likely entailed observing and manipulating fresher body parts. This suggests that jade-makers may not have derived their anatomic knowledge from the sole observation of bones retrieved from secondary burials.³⁰ In what contexts they accessed fresh human larynx–trachea chondroskeletons and how often they did so eludes us. We still do not know what activities took place atop the elevated platforms adjacent to burial cairns. Scholars of the Hongshan world surmise that rituals took place there. We may only hypothesize about their nature. Did they involve human sacrifices, as mentioned earlier? To that end, were knowledge of human anatomy and access to human body parts acquired in the context of violent ritual events? We may also entertain the idea that the processing of human bodies prior to burial took place on the platforms, be it at the hand of Hongshan community members or perhaps through exposure to birds of prey. Were fresh body parts observed and manipulated in such contexts? Did quests for the rationalization of diseases result in dissection and close observation of inner constituents seemingly associated with ailments?

Regardless of how Hongshan jade-makers accessed fresh somatic constituents, in view of their work habits, they had to simplify this complex chondroskeleton before abrading jade into the abridged forms we see now. To use jade sparingly, they also sought to reduce

the positive space allocated to represent the cartilaginous formation. These two prerequisites can explain much about what we now call pig-dragons. Indeed, the larynx alone is a body part whose complexity and natural width necessitated some reduction. This significant throat part protects the airways during deglutition through movement of the epiglottis. Strong and flexible, it holds vocal cords and enables pitch modulation (Bailey and Goldenberg 2019, p. 232). An anterior view reveals a main body made of two articulating components, the cricoid and thyroid cartilages (Figure 30A). The cricoid articulates at its lower side with the windpipe (trachea). Made of cartilaginous rings, muscles, and connective tissue, this conduit positioned vertically between the sternum and the esophagus extends downward to the lungs. The thyroid cartilage features two slightly concave lateral pentagonal projections (laminae) that meet anteriorly, forming a prominence commonly known as Adam's apple (thyroid prominence) (Flynn and Vickerton 2022). Jade-makers who reproduced laminae stopped their jade extensions at a diagonal ridge (oblique line) and did not represent the thinner bilateral superior horns that would have required a larger jade mass (Figure 30B). One of the two jade pig-dragons found inside N2Z1 M4 exhibits two slightly smaller laminae-like prominences (Figure 30C). The formal difference perhaps resulted from the larynx being used as a model. Sexual dimorphism applies to thyroid cartilage. Female thyroid laminae are smaller than those of males, whose size increases and whose interlaminae angle becomes more acute during puberty.³¹ Parsimonious with the jade material they used, Hongshan craftsmen possibly further narrowed the angle between the two laminae to lessen the width of jade material needed to craft each pig-dragon, thereby creating a more acute angle on the superior thyroid notch (Figure 30B). The thickness of the two pig-dragons (2.5 cm for N2Z1 M4:3 and 2.61 cm for N16 M14:3) still corresponds to the average width of human tracheas (Figure 30D). The average length of the human trachea is approximately 10 cm (Premakumar et al. 2018). Measuring the coiled pig-dragon tracheas or subtracting the creatures' heads from their published body heights (15.6 to 7.9 cm) equals the approximate length of the human trachea (about 10 cm).

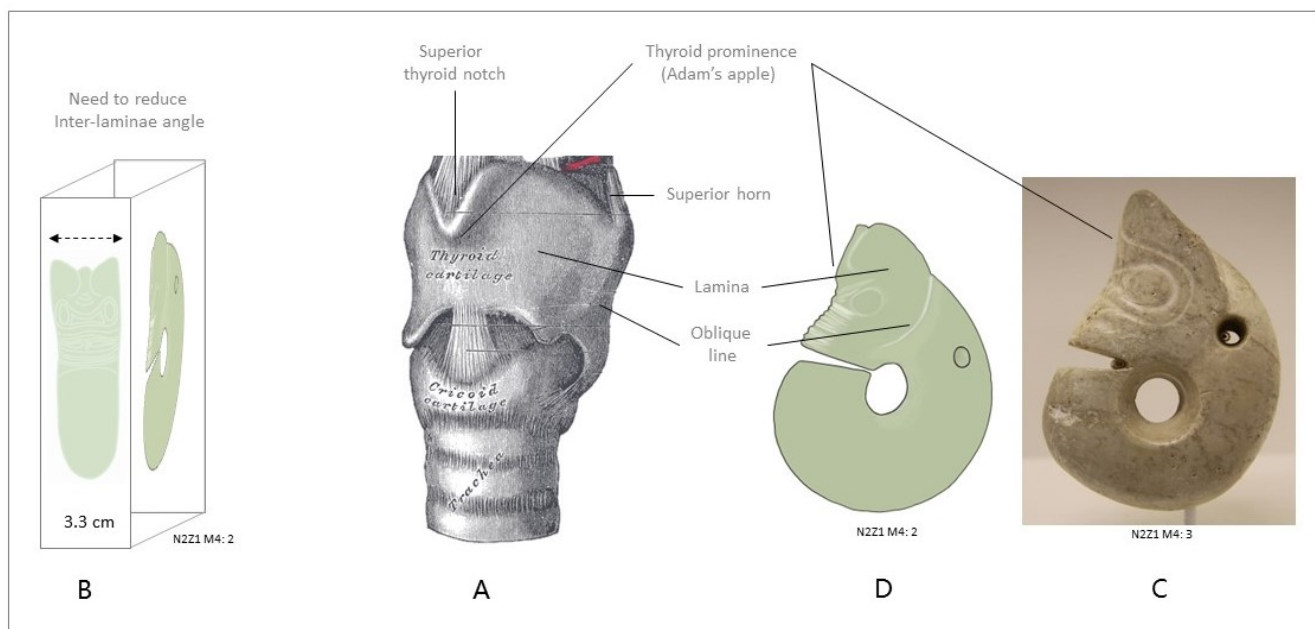


Figure 30. Comparison between the human larynx and pig-dragons. (A) Larynx (Source: Gray's Anatomy, public domain); (C) Photograph of a Niuheliang pig-dragon from N2Z1 M4 (Source: Courtesy of Gary Todd, Ph.D.); (D) Other pig-dragon found inside N2Z1 M4 (Source: LB and SLB on procreate); (B) *en face* drawing of a pig-dragon (Source: SLB on Procreate).

The smooth, coiled body of each pig-dragon most likely corresponds to a trachea curled backward. A savvy decision, the loop permitted the representation of a full-length

trachea out of a raw jade mass of limited dimensions. Coiling the windpipe backward acknowledged its flexible nature and eliminated the need to represent the open back of a conduit made of C- or $\subset$ -shaped cartilaginous rings. A slight depression or break of the cricotracheal ligament connecting the laryngeal cartilage and the trachea (Figure 31A) could explain the semi- (Figure 31B) or fully open space (Figure 31C) beneath pig-dragons' chins.³² An alternative source of inspiration, however, may be the presence inside the thyroid cartilage of two horizontal folds (vocal cords) that cut across the windpipe (Figure 31D).³³ On the jade representation, leaving a single back segment connecting the head to the creature's body may have been the easiest method of signifying this somatic detail.

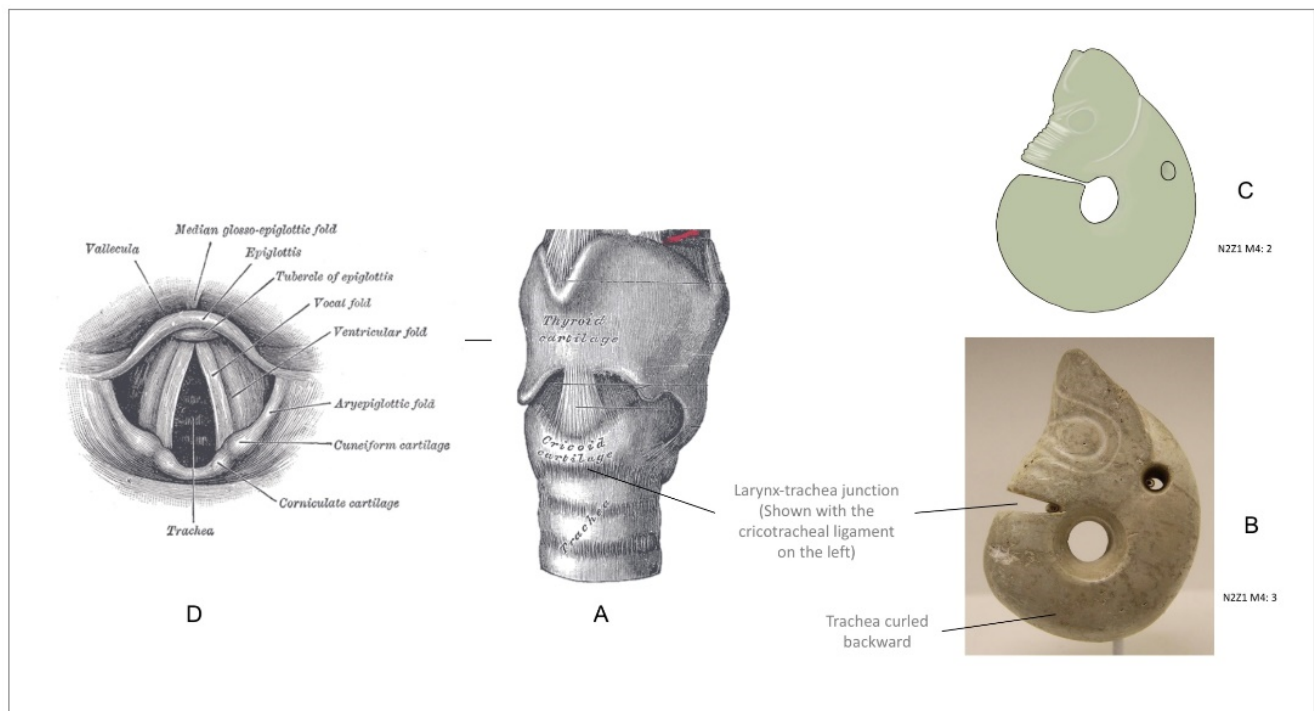


Figure 31. Breach in the central cricotracheal ligament or aperture between vocal cords as source of inspiration for the opening under the snout of pig-dragons. (A,D) Larynx and vocal cords (Source: Gray's Anatomy, public domain); (B) Photograph of a Niuheliang pig-dragon from N2Z1 M4 (Source: Courtesy of Gary Todd, Ph.D.); (C) Representation of the other pig-dragon from the same tomb (Source: LB and SLB on procreate).

Once more, pareidolia can explain what creature viewers unmistakably discern in pig-dragons. Human larynx–trachea complexes lend themselves to perceptive imagination, as some modern products exemplify (Figure 32A,B). So Hongshan jade-makers (or an intermediary) very possibly projected a zoomorphic mental image on anatomical structures, and then proceeded to include the creature in the somatic representation. Laryngeal characteristics could certainly contribute to the association. Perhaps the sight of an Adam's apple moving in someone's throat prompted the idea that a creature could inhabit this body part. Common morphological features certainly contributed to the visualization of eyes on laryngeal laminae. Laryngeal cartilage indeed regularly starts to ossify in early adulthood, but one or two unossified or under-ossified circular areas (windows) remain at the center of each lamina (Scheuer and Black 2004, pp. 146–47; Pascual-Font and Sanudo 2016, p. 1211). Alternatively, another common occurrence—circular openings developing more posteriorly on the thyroidal laminae (foramen thyroidum)—may have triggered the observation of eyes (see Figure 101.1 in Pascual-Font and Sanudo 2016, p. 1209). The snouts of pig-dragons certainly exhibit features observable on this chondroskeletal complex. Indeed, the arch delineating the snout from the eye area mirrors the shape of an inferior

thyroid notch (Figure 32C,D). Of all archaeologically excavated jades, the N2Z1 M4:3 pig-dragon presents the most anatomically naturalistic snout (Figures 31B and 32D). Its craftsman based the wide snout bridge on the connective band (middle cricothyroid ligament), linking the thyroid and cricoid cartilages. Inspired by the slightly recessed lateral portions of the cricothyroid ligament (cornus elasticus), the jade-maker created sunken lines that viewers read as nostrils. Other pig-dragon makers minimized the connecting band, preferring to emphasize the creature's nostrils. Once the convention was set for the overall pig-dragon figure, stylistic modifications focused on added snout creases (Figure 32E,F) and even fangs, as seen on a well-known specimen found in the Jianping area (Figure 32G). Here, stylistic variation did not derive from observed morphology. The addition of fangs turned an innocuous-looking creature into a potentially more malevolent entity. So, perhaps stylistic evolution had to do with beliefs projected onto an uncanny creature inhabiting people's throats.

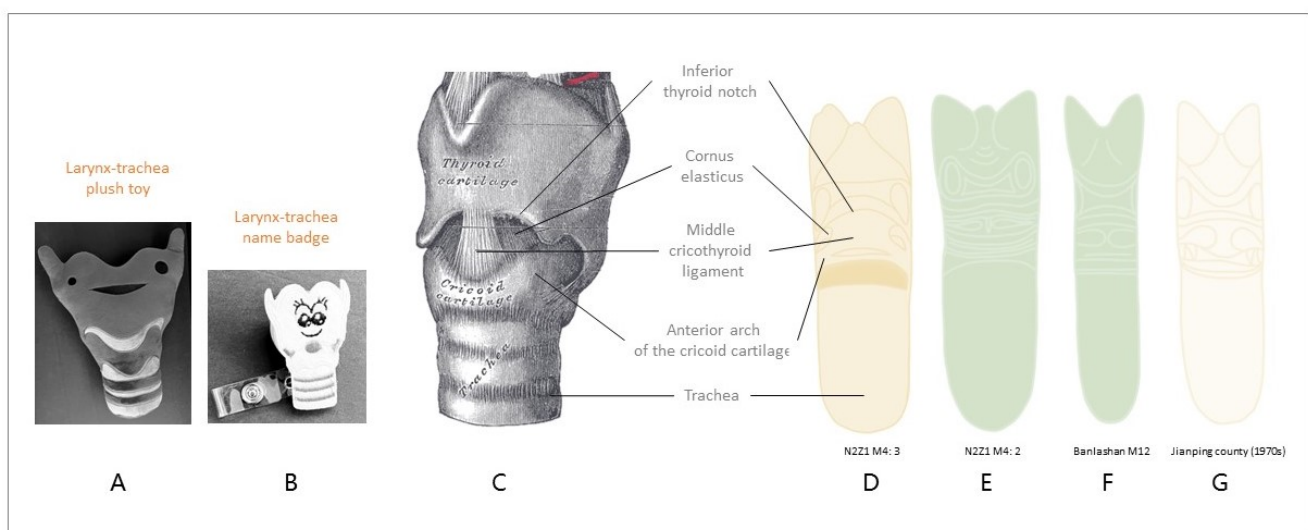


Figure 32. Examples of creatures perceived in laryngeal configurations by modern viewers and identification of somatic features represented by jade-makers (Source: (A,B) photographs by the author; (C) Larynx, *Gray's Anatomy*, public domain; (D–G) SLB on Procreate).

4. Additional Dragons and Arm Bands

The observation of human laryngeal–tracheal complexes possibly inspired other Hongshan jade categories. In the absence of an established archaeological context for these artifacts, caution should prevail. The working hypothesis may extend to two elongated and flat plaques found during surveys in Fuxin County, Liaoning Province (Figure 33B,C), recently interpreted as pig-dragons transforming into chrysalises (Li 2021, p. 101). Both artifacts represent an upright limbless creature featuring eyes centered on two bilateral laminae-like head segments, a mouth, and a long, ribbed body. The two Y-shaped figures share the silhouette of larynx–tracheal chondroskeletons and correspond to uncoiled and de-volumized pig-dragons seen frontally (Figure 33A). Sparingly crafting the figures out of thin jade slabs still allowed jade-makers to represent some somatic details more naturalistically than on more standard pig-dragons. Unconcerned about the jade volume that three-dimensional pig-dragons required, jade-makers working on flat plaques could expand the represented entity laterally. Widening their representational field to 6 cm notably permitted them to render the less acute inter-laminae angles observed on thyroid cartilage. While not rendering the tracheal conduit's three-dimensional tubular nature, craftsmen emphasized its ribbed surface (human tracheas are made of C-shaped cartilage rings held together with a fibro-elastic membrane). The same body part possibly inspired jade-makers to craft Hongshan jades believed to serve as arm bands (Figure 33D). The artifact's grooved aspect and C-shaped tubular form indeed evoke flexible tracheal conduits.

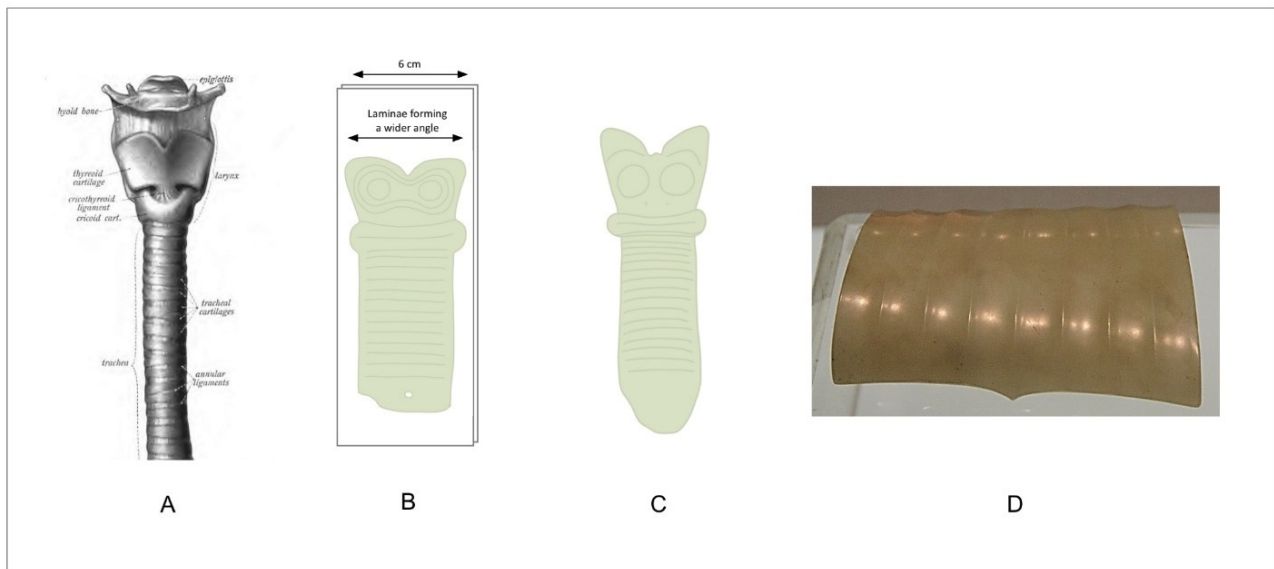


Figure 33. Illustration of a human larynx–tracheal chondroskeleton and three jades inspired by its form (Source: (A) Sobotta's *Atlas and Textbook of Human Anatomy*, 1906, public domain; (B,C) LB and SLB on Procreate; (D) jade arm guard, courtesy of Gary Todd, Ph.D.).

5.7. More Cartilage?

5.7.1. Anthropomorphic Bovine Figurines

If, in addition to bones, Hongshan jade-makers reproduced human cartilage, their sources of inspiration possibly extended beyond laryngeal and tracheal tissue. Nasal bones and cartilage are common sources for pareidolia-induced imagery, and such imagery could explain the anthropomorphic bovine figurines held in worldwide collections.³⁴ As illustrated in Figure 34, this aggregate of cartilaginous forms may be conducive to the visualization of a horned figure resting its hands on knees brought back towards the chest.³⁵

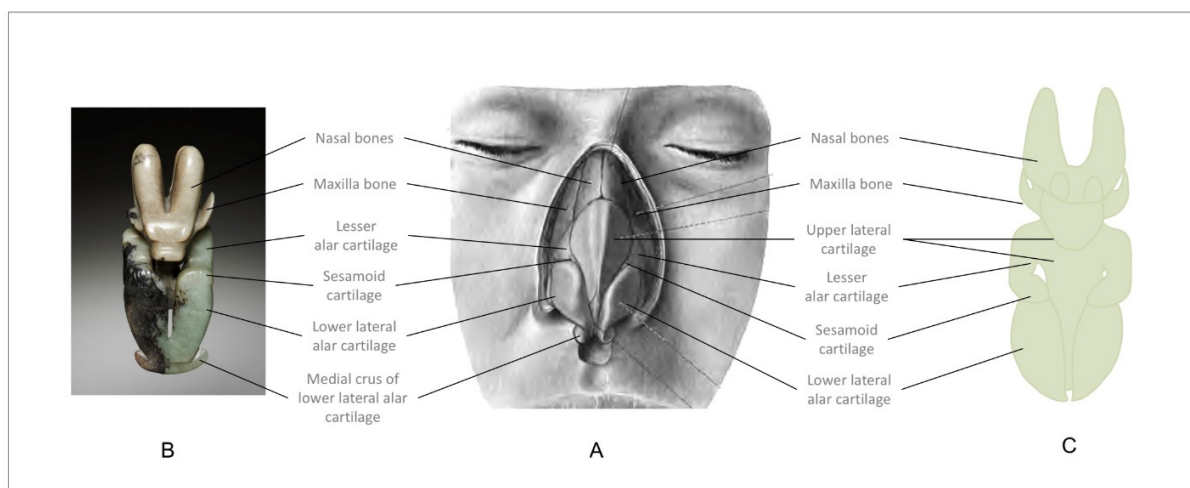


Figure 34. Comparison between human nasal cartilage and anthropomorphic bovine jade figurines (A) Nasal cartilage (Source: Sobotta's *Atlas and Textbook of Human Anatomy*, 1906, public domain); (B) Nephrite amulet in the form of a seated figure with bovine head (Source: The Cleveland Museum of Art, public domain); (C) Bovine figurine (Source: LB and SLB on Procreate).

5.7.2. Horse Hoof-Shaped Tubes (马蹄形筒形器)

Scholars generally identify the objects belonging to this category as 'horse hoof-shaped' tubes. Archaeologists have recovered a wide array of these jades throughout several Ni-

uheliang locations. Three graves dug at the N2Z4 location, and believed to predate the Goddess Temple, generated the three earliest known Hongshan jade cylinders. Occupied, respectively, by a woman in her twenties (M9), a man in his late forties (M8), and an ungendered individual (M16), these tombs yielded tubes, respectively, 12.7 cm, 16 cm, and 9.3 cm high (Liaoning Provincial Institute 2012b, pp. 173–74). Subsequently, community members continued to deposit jade cylinders inside Niuheliang graves. Among the last Hongshan phase cairns, N2Z4 generated three more tubes, as well as an unusual tube jade core recovered from M15. Excavated graves at N2Z1 generated six cylinders. These include a specimen from tomb N2Z1 M21 illustrated here (Figure 35A) as well as the tallest known tube (18.6 cm high), which excavators discovered alongside a man in his late thirties (N2Z1 M4) (Figure 35B). A single tomb (M7) at N3 generated a jade cylinder, but five more were recovered from N16 graves. The archaeological report lists two additional tubes recovered in the Niuheliang area (Liaoning Provincial Institute 2012b, pp. 463–64). More recently, archaeologists working at Banlashan discovered a 17.5 cm high specimen inside a sacrificial pit (JK 12). These open-bottomed artifacts, characterized by thin walls and an oblique mouth, all have an elliptic cross-section and feature differing degrees of slant and height (from 4.6 cm to 18.6 cm). Function-wise, presented as head rests (Asian Art Museum of San Francisco 1994), these jades are more often viewed as hair implements or headdresses.

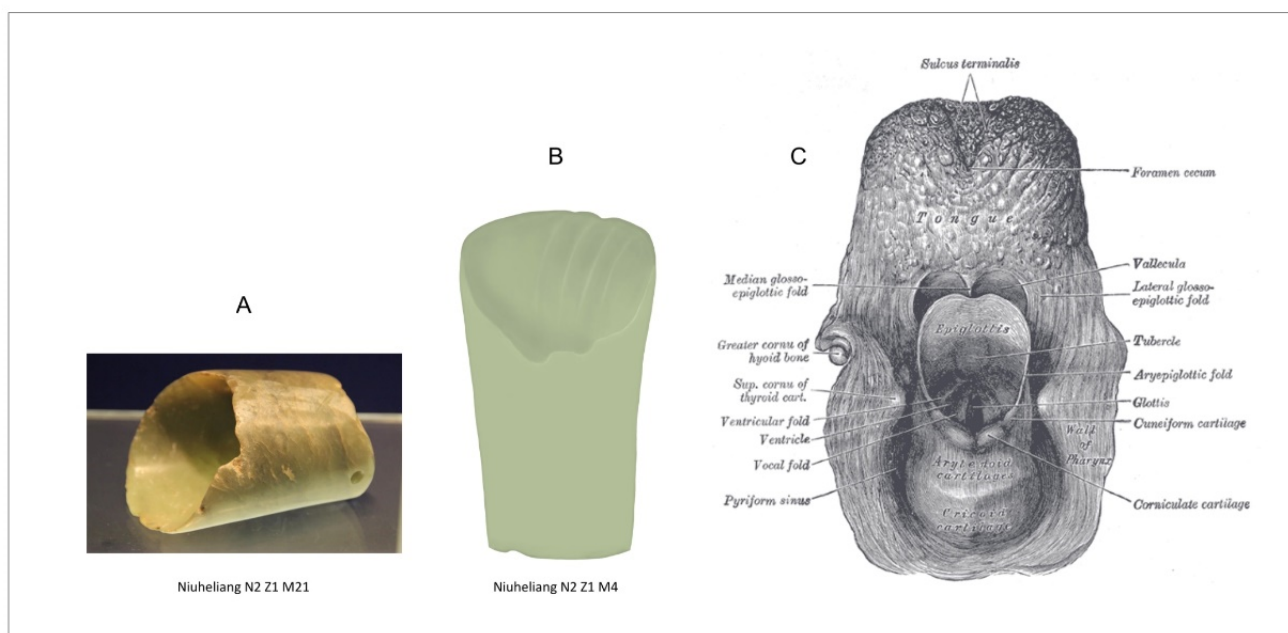


Figure 35. (A,B) Oblique jade tubes (Source: Courtesy of Gary Todd, Ph.D., and LB and SLB on Procreate) and (C) human throat conduit (Source: *Gray's Anatomy*, Public domain).

Close attention to their location inside Niuheliang graves, however, reveals a predilection for the placement of these artifacts on the tomb occupant's torso. Positioned near or under the deceased's heads inside N2Z1 graves, the tubes tend to be found elsewhere inside other localities' tombs. In the earliest jade-bearing Niuheliang tombs, the cylinders were placed on the tomb occupant's chest (N2Z4 M8 and M16) and near the head (N2Z4 M9). In later Hongshan burials, tubes found at the same N2Z4 location continued to be placed on the chest (M2 and M15).³⁶ The female interred inside M15 had two tubes. The one on her chest shared the earlier tubes' lack of lateral suspension holes; the other cylinder was found near her head and featured these small openings, a feature solely associated with the latest jade tubes. At the relatively early N16Z1 M4 and subsequent N16 79M2, a tube was placed on the occupant's chest as well.³⁷ Considering the early and lasting place-

ment of jade tubes on the deceased's torso, inferring that an anatomical feature of the chest inspired their crafting seems tenable.

Due to its placement, shape, and color, a laryngeal conduit is the likely source of inspiration for the so-called “horse hoof-shaped” tubes (Figure 35C). A truncated cone composed of nine cartilage components held together by muscles, membranes, and ligaments, a larynx exhibits bluish hues (due to its hyaline content) but also yellowish tones most noticeable on the epiglottis. Living in visual environments whose color palette did not equate the multitude of colorations contemporary viewers enjoy, Hongshan viewers possibly associated jade material not only with bone but also with a more extensive range of body constituents made of hyaline and non-hyaline cartilage. Once a substance-based cross-referential link was established, jade-makers could formally abstract the complex morphologic nature of this important conduit, whose main functions include sustenance, breathing, and vocalization. Considering the tubes' early origin in Hongshan culture, this first foray into cartilage replication may then have extended to other body parts, including the crafting of pig-dragons and anthropomorphic bovine figurines.

5.8. Human Figurine

5.8.1. Overview

During 2002 excavations conducted at Niuheliang Locality 16, archaeologists opening tomb M4 discovered a narrow, 18.6 cm long jade plaque positioned on the corpse's pelvic area (Figure 36A). The jade represents a human being, the sole anthropomorphic Hongshan jade with a clear archaeological context thus far. Since its discovery, scholars have associated the figure with shamanism. Its compact body conjured the idea of a pupa and inspired the propositions that the object represents a wizard undergoing an insect-like metamorphosis (Li 2021) or a shaman facilitating access to the gods of earth and heaven (Gu and Li 2013).

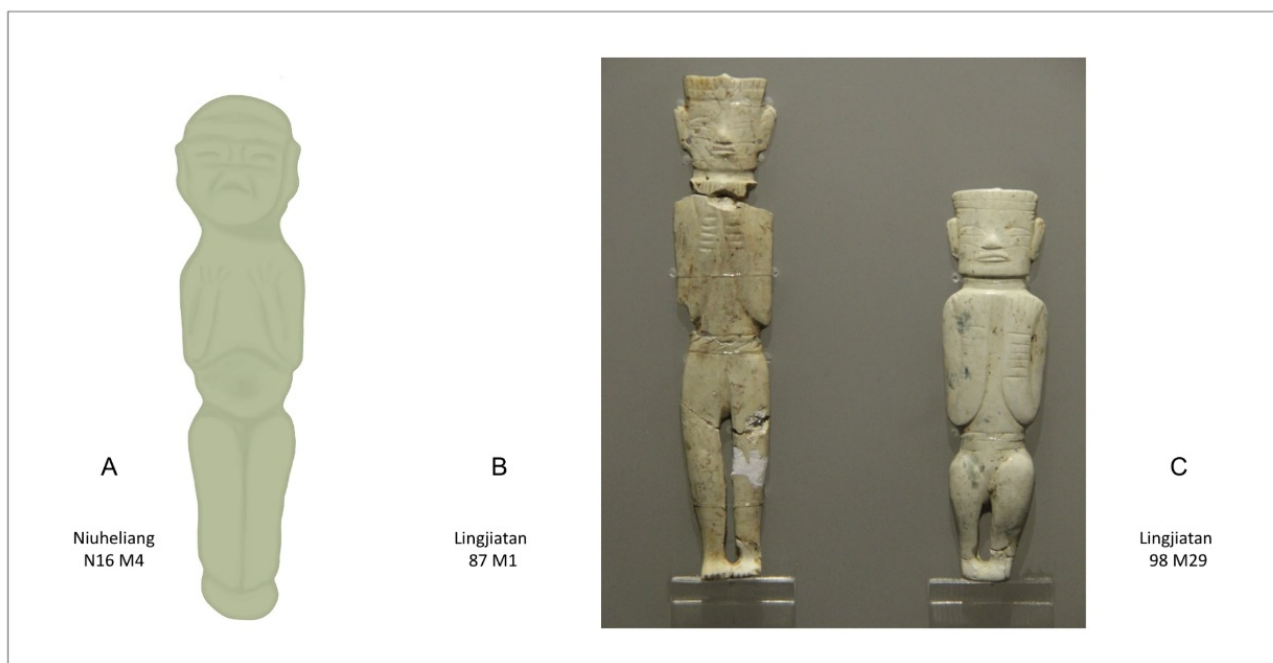


Figure 36. (A) Jade figurine found at Niuheliang (Source: LB and SLB on Procreate); (B,C) Jade figurines recovered from two Lingjiatan tombs in Anhui province (Source: Courtesy of Gary Todd, Ph.D.).

5.8.2. Stylistic and Morphological Contrasts with Distant Counterparts

The northeastern Niuheliang jade figurine has six well-known jade counterparts discovered further south at Lingjiatan, just north of the Yangzi River in Anhui Province. Ex-

cavations conducted in 1987 at Lingjiatan yielded three figurines from tomb M1 (9.6 cm; 9.3 cm; 9.8 cm) (Figure 36B shows one of the three found), and the site generated three more when archaeologists opened tomb M29 in 1998 (Figure 36C illustrates one of the three discovered inside that grave). Despite a shared body posture characterized by arms retracted onto the chest, the seven anthropomorphic figures exhibit stylistic and formal variations. All the figurines display a curvaceous silhouette, yet their overall styles hover between the smooth, rounded, and compact Hongshan form and the more angular and open Lingjiatan body type. In lieu of a rounded uncovered cranium, the southern figures display an isosceles trapezoid-shaped headset with a pointy central detail. This difference aside, the seven figures all exhibit disproportionately large heads and prominent ears. Reduced to trapezoids with pierced lobules amenable to earrings on Lingjiatan specimens, the ears of the northern figurine appear less angular. Their helix exhibits mid-height tapering, a constricted aspect echoed in four additional narrowings at the neck, waist, knees, and ankle levels. The seven anthropomorphs exhibit additional differentiating features. Wearing headgear and a belt, the partially clothed southern figurines evoke a male entity. The nude Niuheliang image is less obviously gendered. Another significant difference may be observed in the treatment given to the legs. At Niuheliang, the image-maker defined the two limbs by creating curved diaglyph lines near the inguinal area and running a straight vertical line along the figure's axis. The craftsperson further denoted the lower limbs in a schematic fashion: two depressions mirroring inguinal folds differentiate legs from feet at the ankle level. By contrast, the Lingjiatan image-makers went beyond the mere surface treatment of a compacted form to define their figurines' lower limbs. Instead, they used openwork and even crafted fully dissociated legs for one of the three figures found inside M1. Technical difficulties perhaps could explain why craftsmen preferred openwork instead of full leg separation for five of the six figurines. An additional detail differentiates the three figurines found inside M1 from those recovered from M29. The former exhibit much longer legs than the latter, to the extent that even if viewers were to perceive the M29 figures as seated and their legs as foreshortened, their bodies would still appear anatomically disproportionate.

The double hypothesis deployed in this study (cross-referential use of jade to reproduce human skeletal constituents and pareidolia-induced imagery) might well apply to these seven jade figurines and explain the morphological and stylistic variations just observed. Since the Lingjiatan figures come from tombs whose occupants disintegrated, their original placement vis-à-vis entombed bodies is unknown. In contrast, the Hongshan figurine comes with a clear context. It possibly fell from the deceased's chest during post-mortem decay, but remained largely aligned with the tomb occupant's spine. The jade anthropomorph bears a noteworthy resemblance to a human sternum, a bone nearby or on top of which the figurine could have been placed when the deceased was entombed (Figure 37A,B). This significant bone articulates the shoulders to the thorax through the clavicles and serves as an anchoring point for cartilage leading to the ribs (White and Folkens 2005, p. 81). From gestation to adulthood, the breastbone undergoes osteological developments that were not lost on jade-makers. This bone starts as a compact cartilaginous body that evolves into slowly ossifying centers, whose ultimate fusion tends to vary by adulthood (Scheuer and Black 2004, p. 230). By birth, four centers of ossification emerge, and by age one, a distinctly large head segment (manubrium) is discernible. Four lower segments (sternebrae) fuse to form the main body (mesosternum), which articulates with the ribs at constricted points (costal notches). A fifth component (xiphoid process) starts ossification in early childhood but generally fuses with the mesosternum after age forty (Figure 37B) (Scheuer and Black 2004, pp. 230–38). Comparing the Hongshan jade figure's outline with a generic sternum rendition may not expose striking resemblances (Figure 37B,C). The bone and the figure nevertheless share an elongated silhouette with a proportionately large head and lateral constrictions at different body heights. Closer observation, however, reveals additional similarities. A V-shaped protuberance on the manubrium echoes the topography of a human face (the convergence of superciliary

arches, nasal appendage, and orbital depressions). Moreover, the highest costal notches' position corresponds to the figurine's ears, and their constricted shape mirrors the anthropomorph's ear helix.

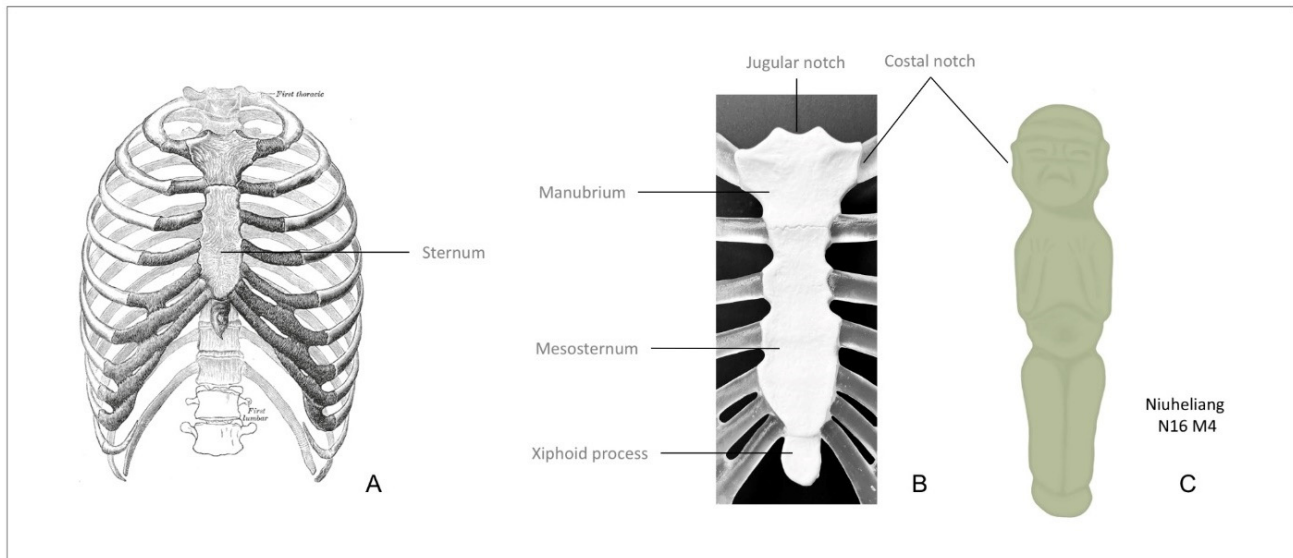


Figure 37. (A,B) Human ribcage and sternum (Source: (A) *Gray's Anatomy*, public domain; (B) Photograph by the author); (C) Jade figurine found inside N16 M4 at Niuheiliang (Source: LB and SLB on Procreate).

Perhaps more remarkably, the formal distinctions observed among the seven anthropomorphic jade figurines discovered at Niuheiliang and Lingjiatan correspond to a range of osteo-morphological variations recurrently seen in human sternums. Sternal morphological variants appear at a similar frequency among modern populations from different parts of the world. Some variations may be more present in some groups (Rojas et al. 2022), and sternum peculiarities run in families to the point that they help establish biological affinity (Cvrček et al. 2022). Figure 38A illustrates sample variations that human sternums may exhibit. As these silhouettes demonstrate, the manubrium (head) outlines oscillate between rounded and polygonal shapes, and the jugular notch is not necessarily pronounced. However, they also can exhibit details such as suprasternal tubercles that develop in pairs or are isolated on the jugular notch.³⁸ These morphological characteristics possibly inspired the Hongshan figure's rounded head and the more angular heads of the Lingjiatan figurines. Once suprasternal tubercles were observed on related sternums, southern jade-makers could rationalize their presence by coiffing their figurines with headgear displaying a triangular projection (Figure 38D). Furthermore, the seven figurines exhibit common features seen on the lower portion of the human sternums. The mesosternum generally does not fully fuse before age 30, and transverse lines may persist at sternbrae fusion points (Scheuer and Black 2004, pp. 230–38). While the two uppermost sternbrae each tend to start as a single ossifying segment, their two lowermost counterparts often develop from bilateral ossification segments whose lateral fusion at the midline fluctuates (Figure 38B). The midline may be closed, but marked with a vertical fusion line; it may also be partially opened at the midline. An aperture (sternal foramen) at the level of these low sternbrae is indeed a common sternum defect (Scheuer and Black 2004, p. 232). A related variation (sternal cleft) may result in the development of two separate leg-like appendages, a characteristic visible on one of the Lingjiatan figurines found inside tomb 87M1 (see Anhui Provincial Institute 2006, Plate 12.3–4). These variations occurring at the midline of the sternums may have inspired the diaglyph delineation used for the Hongshan figure's closed legs and the openwork or full leg separation used for the legs of the Lingjiatan figurines.

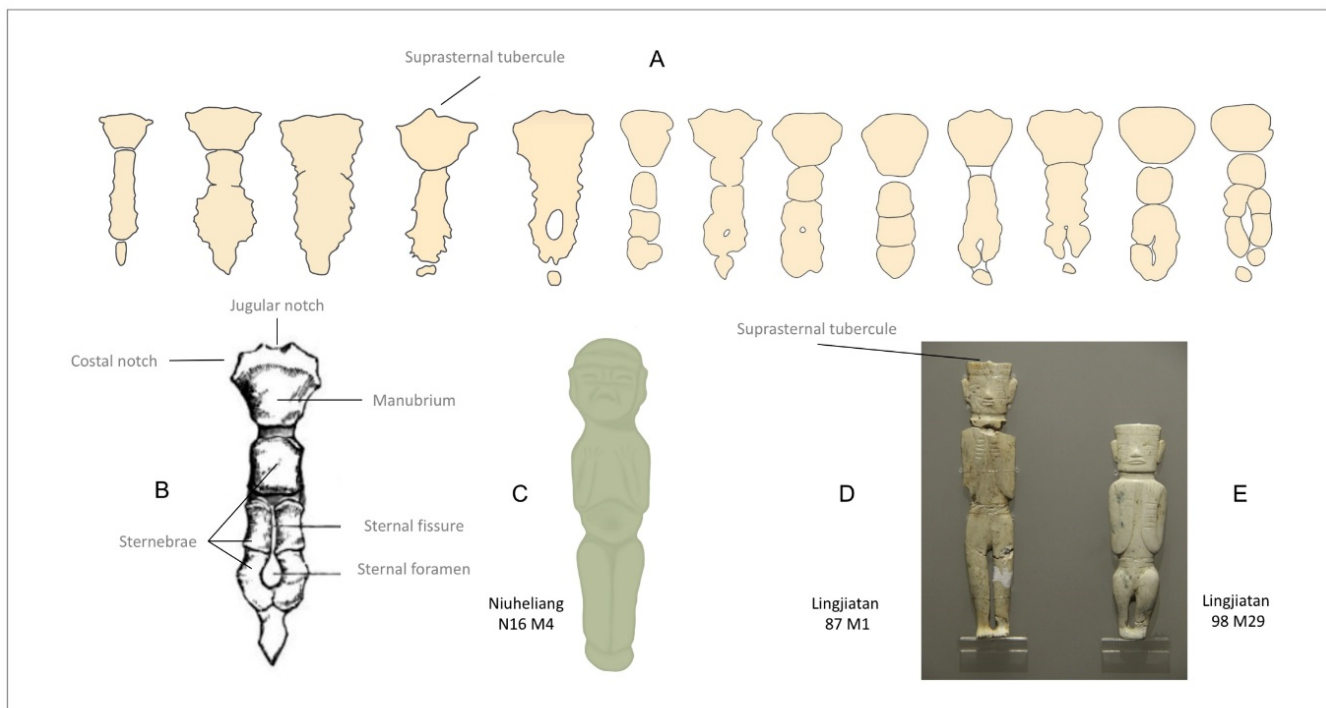


Figure 38. (A) Examples of sternal variations in the human population and sternal morphological development (Source: Tracing by the author of sternums pictured in Hanifi Bayarogullari et al. “Evaluation of the postnatal development of the sternum and sternal variations using multidetector CT”. *Diagn Interv Radiol*. 2014 Jan-Feb, 20 (1): 82–9, and Duraikannu C, Noronha OV, Sundararajan P. “MDCT evaluation of sternal variations: Pictorial essay”. *Indian J Radiol Imaging*. 2016 Apr-Jun; 26 (2):185–94; (B) *Gray’s Anatomy*, public domain; (D,E) Courtesy of Gary Todd, Ph.D.; (C) LB and SLB on Procreate).

5.9. Tortoises

Two Hongshan tombs each generated a set of two jade tortoises. One pair comes from M1 at Hutougou and the other from tomb N5 M1 at Niuheiliang (Figure 39B). The Niuheiliang site yielded two additional specimens: one reduced to a plastron-carapace form was on the N2Z1 M21 tomb occupant’s chest, while a legless jade turtle was recovered at N16. Each pair consists of two species, possibly a box turtle (*mauremis reveesi*) and an Amur soft-shell turtle, a pattern that might imply an underlying significance. Perhaps the soft-shell turtle evoked the initial fleshy state of the buried body, and the hard-shell box turtle recalled the bony state of the deceased following decomposition—the dermal bone of soft-shell turtles appearing fleshier than the harder box turtle shell. Regardless of the significance Hongshan dwellers attributed to these reptiles, the clear burial context for the N5 M1 pair (lacking for the Hutougou jade turtles) invites attention: the turtles lay next to the tomb occupant’s hands (Figure 39A). How the tradition of burying two jade turtles alongside the deceased emerged eludes us. Considering the attention Hongshan jade-makers gave to human anatomy and their propensity to embrace pareidolia-induced figural imagery, the sight of hand carpals may have evoked the idea of a turtle carapace in the first place (Figure 39C).

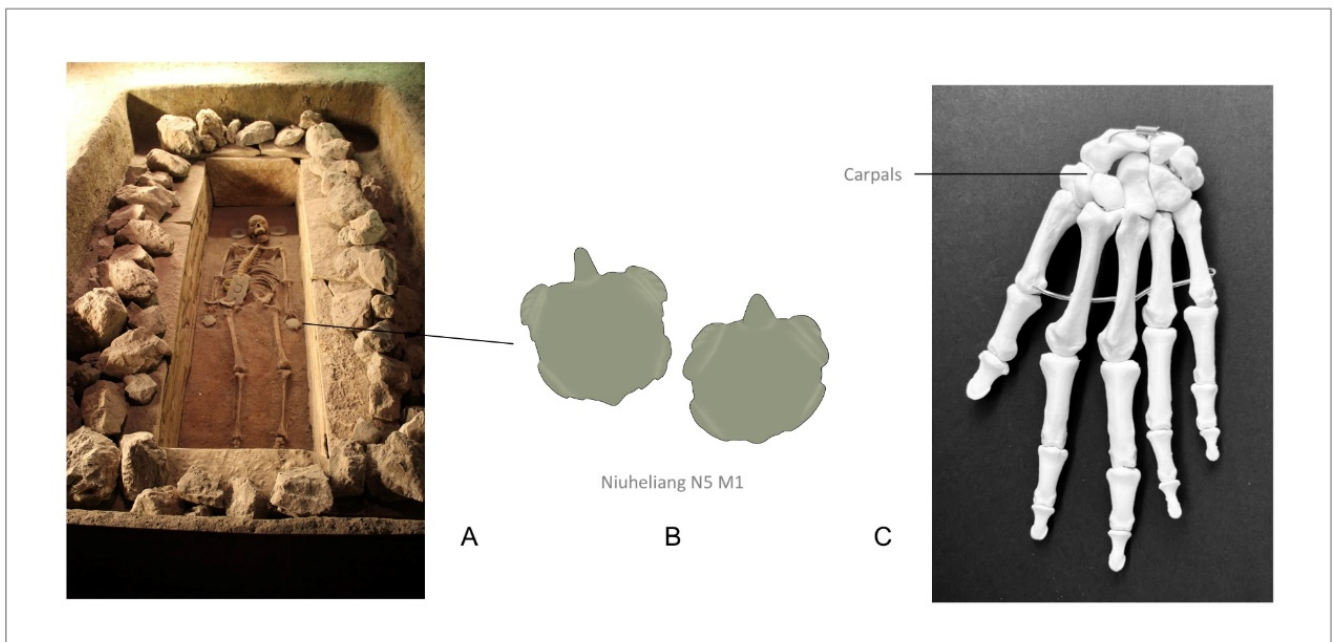


Figure 39. (A) Replica of the N5 M1 burial at Niuheliang. Note the placement of jade turtles near the deceased's hands. (Sources: (A) Courtesy of Gary Todd, Ph.D.; (B) LB and SLB on Procreate; (C) photograph by the author).

6. Discussion

This analysis presented a fresh view on Hongshan jades, exploring their style and refining their complex representational nature. Before further attention to stylistic considerations, we will contemplate possible reasons for the creation of these jade bones and for their placement inside graves.³⁹

6.1. Rationales

Understanding jade somatic reproductions on or near buried bodies as body adornments akin to jade bracelets might suffice as an explanation for their presence. Sumptuary regulations could then explain the different allocations of jades in tombs, with the number of body ornaments found commensurate with the social status of the tomb occupant. However, the fact that Hongshan communities buried some members with jade representations of skeletal constituents calls for further consideration. Until future scholarship addresses social, religious, economic, or environmental implications, we offer a few questions and hypotheses. Current evidence hints at communities attempting, through jade work, to assert social power by symbolically fusing bodies with elements of the environment while rationalizing their physical concerns.

6.1.1. A Special Environment

Hongshan jades did not emerge in cultural or environmental vacuums. Hongshan communities had an intimate knowledge of their physical environment and ecosystems. They lived in small settlements, relocated regularly, traveled to ceremonial centers to bury select individuals, and relied on their environment for sustenance. Osteological analysis of animal bones found at sites offers a glimpse of the fauna they engaged with. Beyond the Asian black bears and badgers mentioned earlier, excavators working at Niuheliang have unearthed remains of pheasants, dogs, hares, Transbaikalian zokor, sika and roe deer, wild boar, and water deer (*hydropotes inermis*) (Liaoning Provincial Institute 2012b, pp. 178, 312, 326, 338, 347, 351, 359, and 507). More recently, archaeologists recovered the bones of an adult and a juvenile donkey from sacrificial pit JK1 at Banlashan (Liaoning Provincial Institute and Longcheng District Museum 2017b).

What Hongshan communities thought about these different animals eludes us, but we can assume that it differed from how they would have viewed the extraordinary extinct fauna distributed throughout Hongshan territory. Hongshan studies do not address this significant, and likely relevant, extinct biome. Hongshan territory covers an area where paleontologists have uncovered the Jehol Biota (热河群), an impressive paleo-ecosystem layered as stratigraphic formations, each replete with extraordinary, fossilized remains of fauna and flora (Larrivé-Bass 2015). Readers might recall the feathered dinosaurs discovered in that part of northeastern China.⁴⁰ As Adrienne Mayor demonstrated, the sight of fossilized remains in less remarkable fossil-bearing beds influenced myths and figural representations in the ancient Greek and Roman worlds, as well as in the Americas (Mayor 2011; Mayor 2023). We should consider the possibility that this also occurred in northeastern China, where some of the world's richest fossil deposits lie. It so happens that Hongshan communities lived, hunted, roamed, and gathered sustenance from that land, and there is a reasonably high likelihood that individuals would have encountered fossilized remains.

The archaeological record includes signs that local prehistoric communities made some discoveries of fossilized creatures. In 1994, archaeologists uncovered a 19.7-meter-long stone ensemble at the heart of a Xinglongwa culture village near a centrally positioned graveyard. Found at the Chahai site, the figural ensemble made of brown cobbles is believed to represent a dragon (see Liaoning Provincial Institute 2012a, Plates 59–62). In China and beyond, paleontologists familiar with the Jehol Biota have long established a link between fossilized creatures and dragons (Norell 2005). The representation's zoomorphic shape, its large size, and its placement on the ground are intriguing considering how rich in fossils the area is. Selecting stones to reproduce a large, fossilized creature follows a certain logic for cross-materially minded Xinglongwa people: fossilized bones have undergone a natural process that turns them into a rocky substance, which community members would have found appropriate to approximate with stones (Larrivé-Bass 2015).⁴¹ As noted earlier, some Chahai individuals used jade to reproduce bone spoons and bone tubes. Their interest in cross-referential materials may well have extended to the larger project of using stones to reproduce a fossilized dinosaur skeleton observed in their environment at the heart of their settlement area. The discovery of rock-like fossilized bones perhaps even contributed to the idea of using lithics to represent bony entities in the first place (Larrivé-Bass 2015). The discovery of a large extinct creature likely left traces in the imagination of prehistoric northeastern communities beyond the concrete large-scale representation that post-Xinglongwa people continued to see at Chahai. Considering their shared territory, the Hongshan people likely saw the Chahai dragon. This figural precedent perhaps contributed to the crafting of creature-shaped stone ensembles found at the Hongshan culture Caomaoshan ceremonial center further west. In 2001, excavators working on the second locality uncovered two large stone assemblages among the altars and seven Hongshan graves. One featured a creature's head around 150 cm in length. A larger stone ensemble positioned approximately fifteen yards away on another platform represented a turtle-like creature (see Shao 2004, pp. 27–28). We cannot know for certain if these stone compositions represented extinct creatures found fossilized by the Hongshan people. However, considering the presence of Hongshan ceremonial centers in the heartland of extinct biota-yielding sites in western Liaoning, we cannot rule out this possibility. Nor can we dismiss the idea that the placement of ceremonial sites within Hongshan territory corresponded to areas where extraordinary stone creatures had been observed.

Archaeologists working at Niuheliang thus far have not identified large-scale stone compositions of creatures. However, the site remarkably yielded anthropomorphic sculptures of extraordinary dimensions, both inside and outside the so-called Goddess Temple. The discovery of large fossilized mammal bones catalyzed the idea of human giants in Greco-Roman times (Mayor 2011). A similar discovery and rationalization perhaps explains the presence of three times larger than life anthropomorphic clay body parts at the Goddess Temple. Until the temple is fully excavated, we perhaps need to hold back on

the idea that clay claws recovered there belonged to an eagle (Figure 40A). Their resemblance to the feathered feet of Eurasian eagle owls and the fleshier talons of Cinereous vultures, Steller's sea eagles, or white-tailed eagles is tenuous. By contrast, a wide array of Jehol Biota creatures exhibit similar bony feet. A large pottery sherd recovered at a Niuheliang N2Z2 stone feature further invites reflection: 16.8 cm long, it bears the engraved silhouette of an aberrant creature (N2Z2:48) (Figure 40B) (see [Liaoning Provincial Institute 2012b](#), p. 127). Its elongated scaled body meets the head with a large eye, sharp teeth, and an ear-like appendage jutting from the top. Classified in the report as a fish-dragon, the entity represented was possibly inspired by the sight of a well-preserved, flat amphibian whose large heart-shaped head has crescent eyes and a wide mouth. These features may be observed in *Chunerpeton tianyiensis*, one of the twelve Jurassic–Cretaceous salamander species recovered by the thousands in western Liaoning. Once connected at the tips, their external gills produce a form akin to an ear jutting from the head (see [Sullivan et al. 2014](#), p. 251, Figure 5).

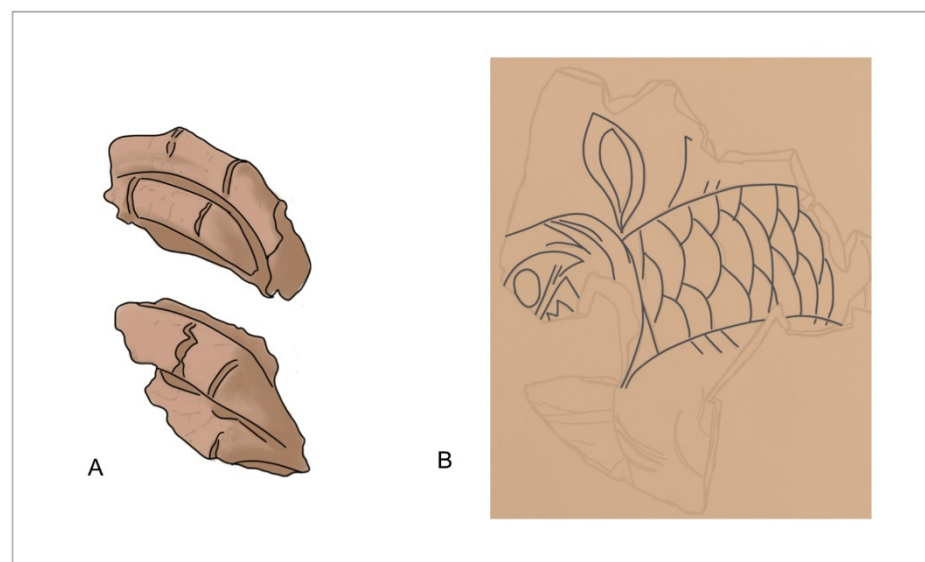


Figure 40. (A) Clay claws recovered at the Niuheliang Goddess Temple; (B) Incised motif on a large pottery fragment from the same site (Source: LB and SLB on Procreate).

Future archaeological work will perhaps bring to light other large-scale stone creatures at ceremonial sites or evidence that Hongshan communities knew that they shared land with strange stone skeletal creatures. Until then, we can suggest that with their increasing reliance on agriculture and extraction of lithics to build ceremonial centers and cairn funerary monuments, the Hongshan increased their chances of uncovering extinct specimens. Plowing fields enhanced the probability of encounters with fossilized remains; the lithics they extracted, transported, and handled to build architectural features and craft figural works (sandstone, volcanic rock) may also have generated fossils. Ultimately, the Hongshan elite who lived in a fossiliferous land may well have enjoyed in their afterlife the materiality and burial contexts they observed in Jehol Biota creatures. Hence, perhaps their privileged burials with this evocation of fossilized bones within cairn layers. Upon burial with jades at ceremonial sites, they too would have entered the extraordinary world of rock-bound beings whose skeletons had turned to stone.

6.1.2. Assemblages, Identity, and Health

Regardless of what compelled Hongshan communities to bury their elite alongside jade bones in large stone mounds, the record indicates that they placed different sets (numbers and types) in each tomb. Plundering generally complicates the analysis of jade assemblages retrieved from Hongshan tombs ([Childs-Johnson 2009](#), p. 304). Be that as it

may, lines of inquiry should remain open regarding whether these jades were owned in life or simply deposited with bodies upon death. We cannot exclude the possibility that health conditions specific to individuals during their lifetime or responsible for their demise were intrinsic to the identity of the deceased or simply acknowledged at burial in a sort of jade pathologic portrait. Osteological analysis conducted on physical remains from jade-bearing Hongshan tombs might help uncover pathologies up to a point. Bioarchaeological research can shed light on some physical strains or ailments that afflicted neolithic communities in northeastern China.⁴² However, most pathologies leave no trace on skeletons (Pechenkina et al. 2017). Moreover, even established pathologies could not help infer whether Hongshan people attributed health conditions to creatures represented on jades. For example, whether the N16 M4 tomb occupant's cavities and mesial impacted wisdom teeth caused him any pain cannot be established. Whether the creature recognized on an endocranial cavity and represented on the so-called phoenix jade plaque found under his head was deemed responsible for the issue eludes us. Were it the case, the role of jade-makers within Hongshan communities might have extended to performing health-related divinatory functions.

Links between health conditions and jade somatic representations nevertheless remain possible. This could certainly explain the presence of jades in sacrificial pits, as exemplified by the laryngeal oblique tube recently recovered at Banlashan. That prehistoric communities not immune to illness or accident would include jade body parts as sacrificial offerings or wear them in life for protective or healing purposes seems sensible. Indeed, these jades could have been amulets (Childs-Johnson 2009, p. 306). Considering jade-makers' propensity to use specific forms to stand for different referents, Hongshan minds would have been open to the allocation of multiple meanings per jade type. For example, health conditions ranging from toothache to headache perhaps warranted a cranial rendering; chronic stomach afflictions or death in childbirth could have demanded a jade pelvic girdle; and respiratory infections might have required a so-called pig-dragon. Ultimately, we should not assume that these prehistoric communities enjoyed the luxury of allocating single meanings and functions to jade artifacts.

6.2. *Genesis and Transformations in Northeastern China*

6.2.1. *Genesis of a Style: Bone Material, Forms, and Surfaces*

Until archaeological finds prove otherwise, current evidence suggests that Niuheliang graves hold the earliest jades representing human skeletal matter in prehistoric China. While Hongshan jade-makers inherited the earlier practice of emulating bone with jade, they developed a formal style that enhanced the illusionism that Xinglongwa jade-makers earlier had sought to achieve through material evocation. We may trace the genesis of their style to several factors.⁴³ Faced with the task of rendering complex osseous morphology in a relatively scarce jade substance, Hongshan jade-makers devised material-conserving and representational strategies. If applicable, they acknowledged their subjects' symmetry, apertures, and at times even the pareidolia-induced imagery that bone structures may elicit. They abstracted the shapes, length, and volume of human bones and cartilage into more elemental shapes, shortening and flattening their compositions as they saw fit. They abbreviated or omitted projections (processes) and other hard-to-represent or material-consuming details. However, while restricted in their representational quest, they remained dedicated to reproducing surface aspects and the fundamentally rounded and curvy silhouette of bones. When parsimoniously relying on flat jade slabs to represent complex, three-dimensional skeletal structures, Hongshan jade-makers did not sacrifice their quest for naturalism. The abraded thin jade plaques were designed to capture their referents' shallow and smooth surface incurvations (fossa), soft ridges, fusion lines, faintly tapering and rounded edges, and, ultimately, their biomorphic nature. Qualities that modern observers associate with the Hongshan style ultimately resulted from jade-makers' naturalistic impulses as they made savvy use of jade.

6.2.2. Attachment to Surface Qualities

Niuheliang, Hutougou, and Banlashan tombs yielded an array of human skeletal forms reproduced in jade. Beyond the types identified in this study, jade-makers likely represented other human skeletal forms. One example is the 3.8 cm high- and 3.2 cm wide cube-like jade retrieved from tomb N2Z1 M21 (Figure 41A,B) (Liaoning Provincial Institute 2012b, p. 104). Found atop the deceased's lower spine, the jade shares some formal characteristics with vertebral column segments. As the thoracic and lumbar vertebrae illustrate in Figure 41C, these multipart bones consist of a main body as well as a series of processes jutting from an arc around a central aperture (vertebral foramen), the spinal canal. Considering their skilled reductions in intricate bony structures and tendency to conflate forms within representational fields, the Hongshan craftsmen here integrated the spinal canal within the main vertebral body. The resulting rendering appears concurrently abstracted and naturalistic. Shape-wise, the jade object blends two elemental vertebral aspects: a rounded yet squarish main body and a spinal canal. Its materiality evokes osseous matter. The jade-maker would have saved energy by keeping the bony walls straight instead of abrading them down to smooth curves. However, they did abrade those walls to reproduce the smooth waist incurvation of the vertebral main body. This attention to bony curvature and smooth surfaces remained a hallmark of the Hongshan style in the core zone. It differentiates the osseous representations from others produced further north.

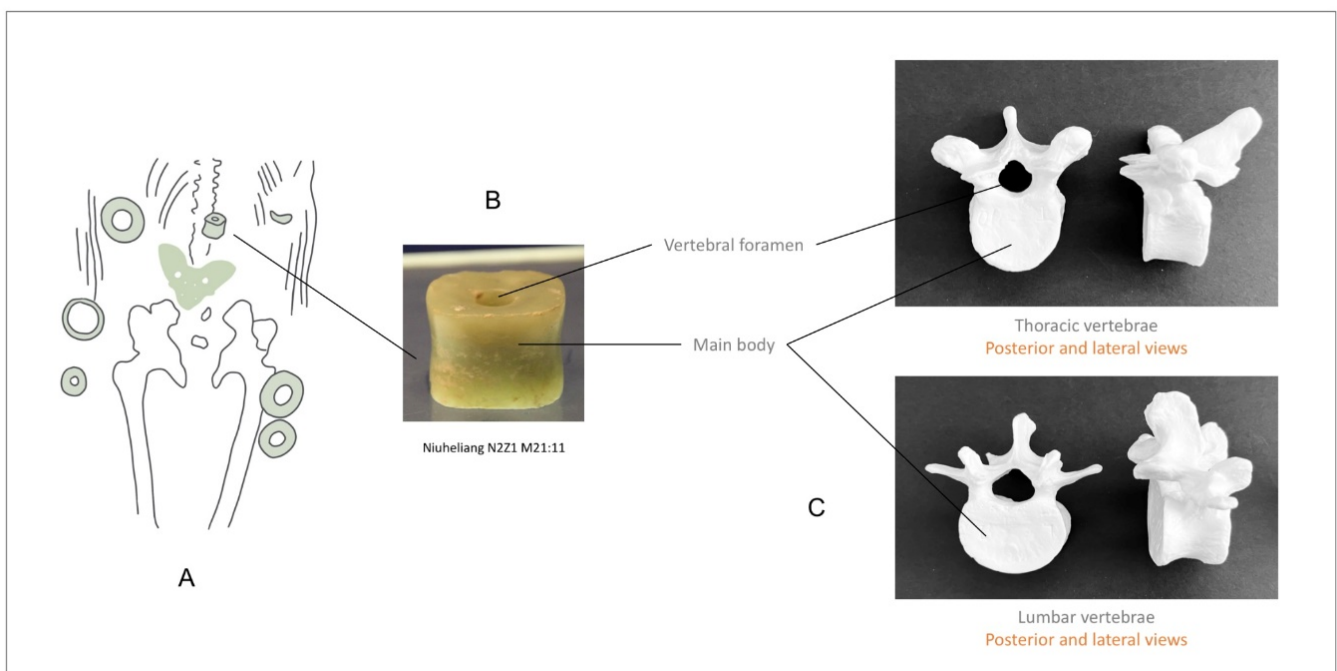


Figure 41. Position of a jade found inside tomb N2Z1 M21 at Niuheliang and comparison with human vertebrae. (Source: (B) Courtesy of Gary Todd, Ph.D.; (A,C) Placement of jades on the body done on Procreate and photographs by the author).

Two northern jades exemplify the lesser attention that their makers gave to surface qualities. First, a fragmented cranial rendering found inside a Shuangta 双塔 tomb in Baicheng 白城, northwestern Jilin province, resembles a Hongshan jade (Research Center and Jilin Provincial Institute 2013) (Figure 42A). However, its maker likely produced the object by copying the overall features of a southern model. Indeed, the object's shortened lateral extension, matrix (likely Baikal Lake jade), and surface treatment all point at a crafting done outside the Hongshan core zone. Its maker replicated skeletal facial features with sunken lines of unmodulated width and depth and did not attempt to reproduce the natural curviness of bone surfaces. The inclusion of pointed arches on each side of the "legitimate" pointed nasal arc suggests that the jade-maker did not use a skull for the model.

Reduced to a flat plaque, the object lacks quintessential Hongshan surface aspects and anatomic accuracy. It thus qualifies as a Hongshan core zone jade type done in a northern style, perhaps by a jade-maker who did not know that this Hongshan jade type represented a human facial skeleton in the first place. Another northern jade (a hooked-cloud plaque) collected from the Nasitai 那斯台 site also evidences a lack of naturalistic surface treatment (see [Balinyou Banner Museum 1987](#), p. 517, Figure 14.1). While its overall shape follows conventions observed on Niuheliang jade midsections, its maker did not seek to reproduce the smooth iliac fossa depression featured in all plaques recovered in the core zone.

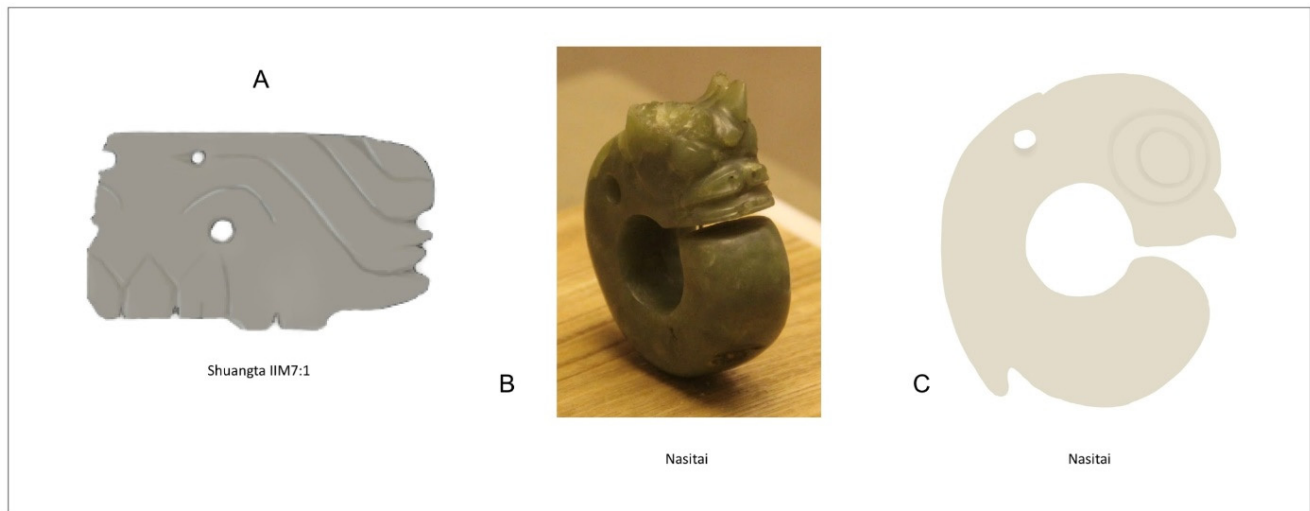


Figure 42. Examples of jade artifacts recovered beyond the Hongshan core zone. (Sources: (B) Pig-dragon photographed by Gary Todd, Ph.D.; (A,C) LB and SLB on Procreate).

6.2.3. Formal Evolutions

Hongshan jade-makers' capacity to capture the essential, synthesize complex forms into coherent compositions, and embrace abstraction without abandoning material illusionism perdured in the core zone. We can observe changes in jades found beyond that area. Objects made outside the core zone tend to have sizes that do not correspond to initial somatic referents. For example, the so-called pig-dragons found at Nasitai are smaller than their core zone counterparts, whose overall dimensions correspond to actual human tracheal-laryngeal cartilage (Figure 42B). Some finds at Nasitai exemplify how jade-makers beyond the core zone at times amplified the zoomorphic qualities, sometimes to the point of losing an obvious link with their somatic referents (bones or cartilages). At the same time, some northern jade-makers emphasized their zoomorphic features. By doing so, they further dissociated the jades from their original referents (tracheal and thyroid cartilage). A Nasitai stone pig-dragon exhibiting a beak further shows creative fluidity ([Balinyou Banner Museum 1987](#), p. 516, Figure 13.1) (Figure 42C). The adoption of a non-jade substance and the avian resonance distanced the piece from both the original cartilaginous referent and the pareidolia-induced mental image experienced while looking at human skeletal components. The same applies to most small jade birds vis-à-vis the talus substrate onto which the concept of bird had been projected.

Concomitantly, elements point to simplification of jade skeletal midsections and cranial renderings outside of the core zone. Comparative analyses of core zone specimens revealed that once jade-makers had devised conventions to represent complex forms, some craftsmen engaged in further abstraction (form reduction), while others developed variants featuring complex zoomorphic renderings. It appears that even more abstract forms developed. Some Niuheliang and Banlashan tombs appear to have generated such variants. Likewise, jades recovered from Hamin Mangha houses beyond the Hongshan core zone evidence attempts at further essentializing somatic reproductions. Reduced to even

more elemental shapes, the skeletal representations still maintain quintessential Hongshan naturalistic qualities: material resemblance, as well as curvy and smooth shapes and surfaces. Another Hongshan characteristic these jades embody is their makers' and original viewers' willingness to associate a given form with different referents or to accept that different forms may point at a single referent. Ultimately, the core zone Hongshan jade corpus evidences great flexibility of forms while also maintaining a profound attachment to material-based mimesis and the organic quality of their referents' rounded shapes and modulated surfaces.

1. Circular *bi* 璧 Disks Used as Jade Midsections

Niuheliang tombs generated a sizable quantity of jade *bi* disks whose sizes and surface treatment hint at differentiated potential for representation. Jade-makers who gradually reduced the plaques' thickness around the central aperture rim created products that evoke receding and tapering bony walls around a skeletal opening. A noteworthy example is a jade discovered near the waist of the N2Z1 M15 tomb occupant ([Liaoning Provincial Institute 2012b](#), p. 92, Plate 80.4). Considering the object's placement, it likely functioned as a rendering of a pelvic girdle (Figure 43A). The plaque's 0.65 cm thickness gradually decreases towards the inner rim edge, a detail that evokes the tapering of receding walls around a pelvic inlet viewed from above. The more developed midsection representations studied earlier exhibit such a characteristic too (Figure 43B). The skeletal rendering found inside M15 reduced the pelvic girdle to its elemental form (a bony mass surrounding a pelvic inlet). Thus, its materiality, tapering surface treatment, and placement reveal its representational charge. In the same vein, a tremolite *bi* disk found alongside a woman buried in M39 at Banlashan is remarkable (Figure 43C) ([Liaoning Provincial Institute and Longcheng District Museum 2017a](#)). The preliminary report does not specify where archaeologists found the object vis-à-vis the entombed body. However, the circular jade plaque exhibits a central aperture and body thickness gradually tapering toward the inner rim. The jade plaque moreover features two projections evoking hip sockets and a smaller counterpart positioned where a sacrum articulates with the first lumbar vertebra.



Figure 43. Example of jades used to represent human skeletal midsections in lieu of more complex renditions. (Source: (B) Courtesy of Gary Todd, Ph.D.; (A,C) LB and SLB on Procreate).

2. Angular *bi* Disks Used as Jade Midsections

Some more angular *bi* plaques too carried the potential to stand for abstracted midsections. Upon opening the M12 tomb at Banlashan, excavators discovered not only a laryngeal–trachea jade form (pig-dragon) on the body's chest and a jade creature's head between its femurs but also a squarish tremolite *bi* on its waist (Figure 44A) ([Liaoning Provincial Institute and Longcheng District Museum 2017a](#), 19). Considering its size (14.5 cm wide), wide central aperture reminiscent of a pelvic inlet, and placement on the body, the object was likely intended to represent a human skeletal midsection. Archaeologists ob-

tained absolute dates for this late Hongshan burial thanks to C14: the calibrated dating is 5030–5020 BP. The object could thus be a late abstraction replacing the more detailed Niuheliang counterparts analyzed in Section 5.3. Its fusiform cross-section still captures the organic quality of osseo-morphology. We cannot ascertain whether a jade-maker purposefully simplified a somatic representation due to skill or time constraint, or whether community members chose to deposit inside M12 a pre-made jade that they deemed evocative enough of a skeletal midsection. Angular *bi* plaques recovered in 2012 from the ill-fated Hamin Mangha village further north also had the potential to stand for midsections (Figure 44B,C). Many dwellers at this large settlement in the Kerqin steppes of Inner Mongolia met their demise during a catastrophic epidemic (*Yersinia pestis*) before the site was abandoned towards the end of the fourth millennium BCE. Archaeologists recovered the objects from a dwelling (F46), so whether the local population intended to use these objects for placement over buried bodies is unclear. The F46:9 specimen captures a rectangular silhouette devoid of sharp corners characteristic of skeletal jade midsections found inside Niuheliang and Hutougou graves. The F46:15 piece shares the rounded square form of the Banlashan M12 plaque. The two jades retrieved from F46, however, exhibit details that raise questions: Did Hamin Mangha jade-makers know what the forms represented for Hongshan communities further south? Did they model their jades after human skeletal parts or after Hongshan jade works? They indeed might have reproduced Hongshan jades, not human bones. This could explain why the F46:9 jade has a narrow and fully angular central aperture, and the F46:15 pelvic girdle has a sacrum extending laterally from its edge.

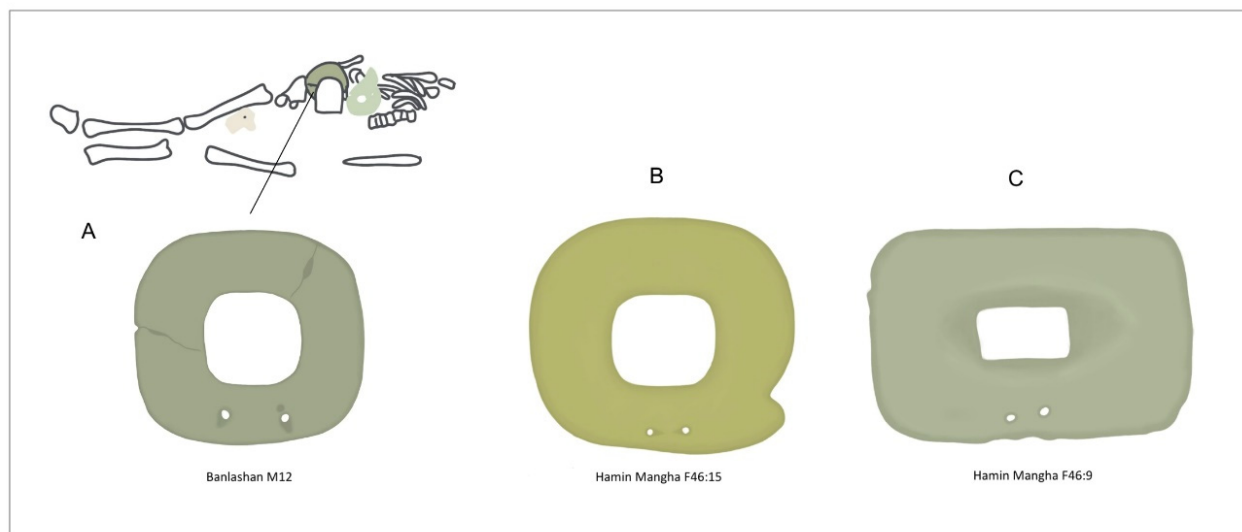


Figure 44. Examples of angular plaques representing the human skeletal midsection. Note the placement of the artifact on the body's waist in tomb M12 at Banlashan. Note also the representational double apertures signifying obturator foramina. (Source: (A–C) LB and SLB on Procreate).

3. Abbreviated Cranial Representations

Finds at Hamin Mangha signal that Hongshan forms influenced local jade production and that jade-makers simplified not only southern pelvic renderings but also jade cranial representations. Located outside of the Hongshan core zone, Hamin Mangha yielded jades reminiscent of those found inside Hongshan graves. Some jade-working techniques and material (Baikal Lake jade) used at Hamin Mangha link the site to the Jilin–Heilongjiang–Lake Baikal jade tradition. Evidence shows that some northern techniques and substances made their way to Banlashan and Niuheliang (Xiong et al. 2020, p. 90). However, the influence likely stopped there. Indeed, the production of human jade bones and cartilage appears to have started in Hongshan lands before some jades made their way further north. Archaeologists recovered a fragmented jade cranial rendering inside dwelling F46

at Hamin Mangha (Figure 45A). Its details and sharpness dramatically contrast with the less refined local jades that reproduce Hongshan types. The fragmented object originated from the Hongshan core zone and possibly served as a model for Hamin Mangha jade-makers. Even so, no jade cranial renderings were found at the site. Two local products recovered from houses F46 and F47, however, are noteworthy and illustrated here with specimen F46:11 (Figure 45B). They appear to reproduce the corrugated aspect of a toothless human maxilla.

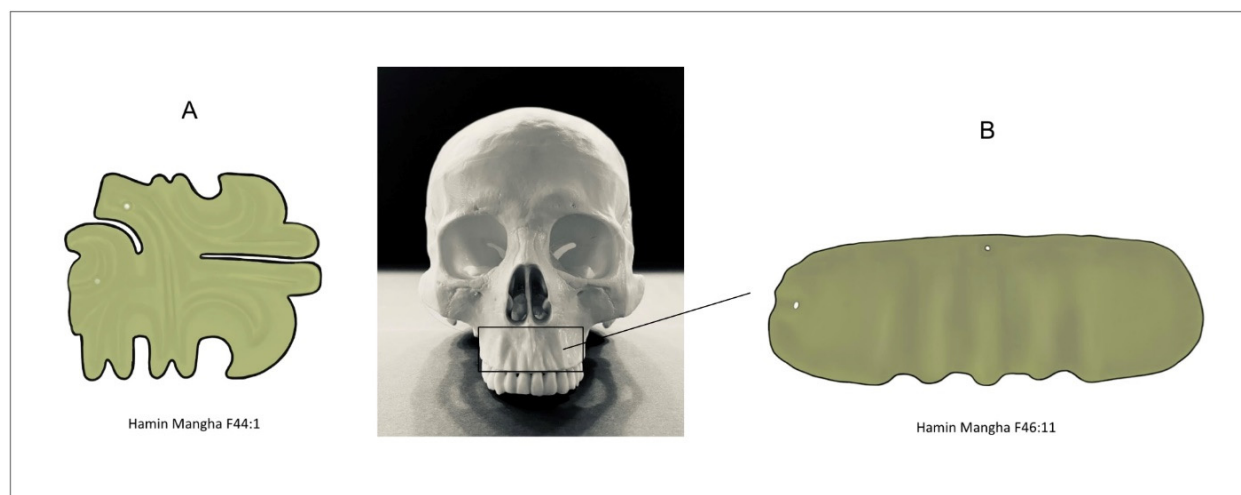


Figure 45. (A) Illustration of a fragmented Hongshan core zone cranial rendition found at Hamin Mangha; (B) Abbreviated version representing a maxilla produced outside of the core zone (Source: LB and SLB on Procreate).

6.2.4. Early Misunderstandings?

In a recent study, Zhu Naicheng 朱乃诚 highlighted how multiple sources of influence affected the form of jades in the Liao River area after Hongshan culture's demise. The author aptly distinguished Hongshan objects from subsequent iterations (Zhu 2016). To me, the form of some jades held in museum collections suggests that their makers did not know what core zone Hongshan jades often reproduced. One such specimen comes with a secure archaeological context that further proves this happened as early as the Bronze Age (Figure 46A). Archaeologists found the piece inside the tomb (M821:5) of a young person at Dadianzi 大甸子, a site near Chifeng in Inner Mongolia, dateable to the later phase of the Lower Xiajiadian 夏家店下层 period (ca. 2300–1600 BCE) (Institute of Archaeology 1996, pp. 168–79, Plate 52.3). The sealed deposit in which the object was found provides a terminus ante quem for its creation, and thus proves that a Bronze Age or Neolithic person produced the artifact. Unless created as a purposeful hybrid coalescing cranial and pelvic forms, the object's conception resulted from a misunderstanding or a lack of awareness. At first sight, the jade looks like a skeletal midsection or a cranial rendering. Upon closer inspection, if it were a pelvic girdle, it should not feature a horizontal slit framed by two thickened edges, because these features represent the empty space between the bony ridge (the zygomatic process of temporal bone) and the temporal fossa on a skull. Just as if it were a cranial rendering, it should have two orbital parts instead of a single sacrum-like pelvic appendage. Therefore, the piece is likely a Hongshan-style copy of two core zone Hongshan jade types. The inaccuracies point to an imitator (perhaps even a forger intent on deceit) who copied genuine Hongshan jades while ignoring what they represented to their original makers and users. In the eyes of viewers disconnected from original crafting practices, the hybridized jade form that conflates two signifiers (cranial and pelvic forms) could have acquired a new meaning.

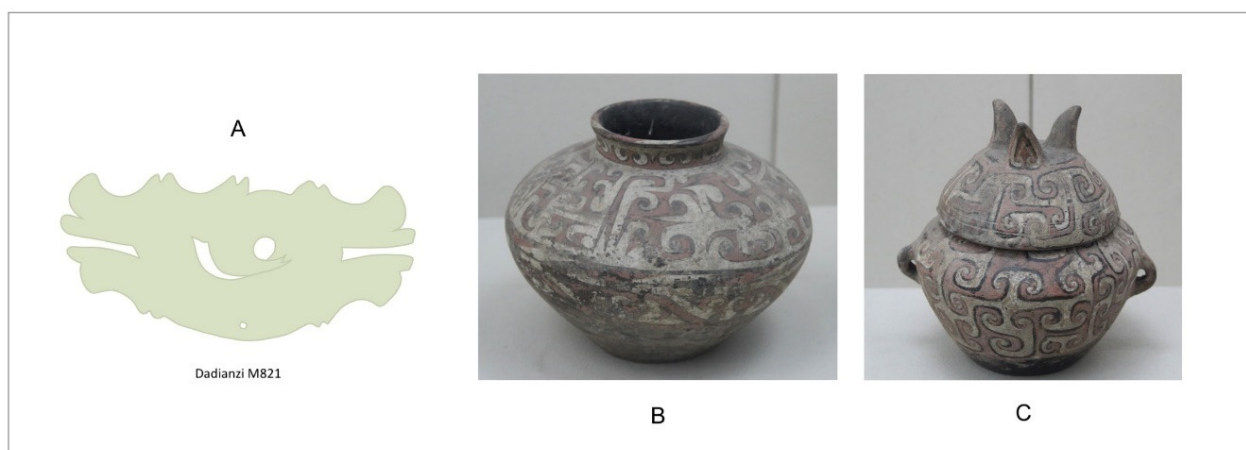


Figure 46. Hongshan-style jade found inside a Lower Xiajiadian Culture tomb at the Dadianzi cemetery and contemporaneous pottery (Source: (A) LB and SLB on Procreate; (B,C) Courtesy of Gary Todd, Ph.D.).

6.2.5. From Jade to Pottery Surface Motif

Part of the message conveyed through the Hongshan-style jade in northeastern China after the Hongshan period would have been its link with a past culture whose remains were still partially visible in the local landscape.⁴⁴ By the time Lower Xiajiadian mourners placed the object inside grave M821, the practice of representing human skeletal matter with jade likely was out of memory. Ceramic patterns found on Lower Xiajiadian pottery placed inside graves nevertheless echo the curvilinearity and configurations of Hongshan jades (Figure 46B,C). Done in white on red grounds, the motifs stand out thanks to the black outlines used for shading purposes. On some painted pottery, these motifs appear to be protruding from the ground like jades would from a flat support. Pottery painters likely sought to reproduce the form and three-dimensional physicality of Hongshan jades on flat ceramic surfaces. Through shading technique, they achieved a virtual texturing of smooth pottery walls and reproduced the visual effect of jade plaques slightly protruding from a surface. This may well have allowed the Hongshan jade style to survive in the form of ceramic motifs linked to local antiquity.

6.3. Adoption of a Practice beyond Northeastern China and Fusion with Local Style

Lingjatan jade-makers were exposed to different jade-working traditions (Childs-Johnson 2009, p. 374). Archaeologists and early China specialists well know that some objects unearthed at this southern site bear a striking resemblance to some Hongshan jade types. The source of influence was once debated, but the current consensus favors the notion that northern jades influenced Lingjatan jade-makers. Pointing to their style, Elizabeth Childs-Johnson identified that they were not imports but rather local variants based on Hongshan prototypes (Childs-Johnson 2009, pp. 371–74). Considering the hypothesis developed in this article, we may ask: Did southern craftsmen merely reproduce Hongshan jade types? Did they know what the Hongshan jades represented? Did Lingjatan jade-makers adopt Hongshan practices and reproduce human skeletal constituents too? Evidence suggests that jade-makers' jades and their engagement with human anatomy spread beyond the Hongshan cultural sphere. Just like their northern counterparts, southern jade-makers seem to have represented human skeletal constituents and concretized on jade bones their own pareidolia-induced imagery. However, their reception of the practice was selective. Biomorphous jades do appear in the Lingjatan repertoire. The corpus includes some pieces whose curved silhouette, and occasionally incurved surfaces recall the style and the form of Hongshan skeletal renderings. However, their work generally lacks the attention that Hongshan jade-makers had allocated to osseous surface topography. The resulting style is preponderantly angular and comparatively devoid of surface incurvations.

6.3.1. Lingjiatan Jade Tortoises and Niuheiliang Hoof-Shaped Tubes

In 2007, archaeologists found artifacts inside tomb 07M23 that complemented earlier evidence of a link between Hongshan and Lingjiatan jade types. They found three hollow jades with one or two jade sticks inside. They classified one implement as a tortoise shell and two others as tortoise-shaped tubes ([Anhui Provincial Institute 2008](#), p. 13 (07M23: 123), (07M23: 125), (07M23: 127); pp. 15–16, Figures 5, 6, and 7). Establishing a link with oblique “hoof-shaped” tubes from Niuheiliang led to the conclusion that the Lingjiatan finds, and by analogy, the Niuheiliang tubes, functioned as divination implements ([Anhui Provincial Institute 2008](#), pp. 16–17). An alternative interpretation is that only the 07M23:123 object represents a tortoise shell (akin to the specimen found on the chest of the deceased inside N2Z1 M21 at Niuheiliang and a southern counterpart recovered from tomb 87M4 at Lingjiatan), while the two others replicate Hongshan oblique jade tubes ([Li 2021](#), pp. 99–100). The placement of jade slips inside the two Lingjiatan tubes, however, could shed light on the function of opposing holes in the Hongshan tubes identified as laryngeal conduit representations. Southern jade-makers possibly handled northern tubes in which perishable clappers were suspended. Considering the hypothesis presented earlier, the inclusion of a mechanism allowing sound production inside Hongshan tubes would have been a sensible addition to jades representing a somatic conduit significant for both life-sustaining matter (air, liquid, and food) and phonation. Thus, we might surmise that Niuheiliang and Lingjiatan tubes could emit sounds, as clapper-bells do. Perhaps the length of each corresponded to a preferred sound.

6.3.2. Selective Reception: Style and Types

Tubes found inside grave 07M23 at Lingjiatan illustrate the selective reception that southern craftsmen gave to Hongshan jades. They concurrently adopted a northern form, a jade laryngeal tube featuring an oblique rim, but made notable transformations. They replaced the often-everted rim observed on these so-called “horse hoof-shaped tubes” with a slightly constricted lip. In lieu of the uneven thickness and smooth edges of their northern model, they produced tubes of unmodulated thickness and straight edges. The overall angularity that permeates their renditions characterizes a substantial part of the Lingjiatan jade output. An explanation may be that producing jades featuring smoother corners and fewer angular forms would have demanded greater labor. We know that their jade industry was more intensive than in Hongshan culture. In both cultures, communities buried their elite with burial goods largely limited to jade artifacts. However, they allocated jades differently. The most jade-yielding grave in Lingjiatan (07M23) contained 214 jades, a sharp contrast with its counterpart at Niuheiliang (N2Z1 M21), which only held 20 pieces. Of the 45 Lingjiatan graves excavated, only 6 lacked jades. In contrast, of the 71 graves excavated at Niuheiliang, 30 lacked jade objects ([Wang 2017](#), pp. 38, 40). Wang Wenjing recently differentiated the labor invested at Niuheiliang and Lingjiatan as follows: at Lingjiatan, the labor focused on burial goods (jade), whereas it was more concentrated on ritual and ceremonial architecture at Niuheiliang. Based on the quantity of jades found inside graves at each site, Wang computed that the labor investment in grave goods production was approximately six times greater at Lingjiatan ([Wang 2017](#), p. 40).

The selective reception that Lingjiatan communities gave to Hongshan skeletal renditions extended to the types and the quantity per type reproduced. Setting aside the two jade laryngeal conduits found inside 07M23 at Lingjiatan, two additional jades represent associated Hongshan forms. Tomb 98M16 yielded a well-known pig-dragon (Figure 47A), and tomb 87M9 generated a Y-shaped trachea-thyroid cartilage jade representation ([Anhui Provincial Institute 2006](#), pp. 196 and 98, Plates 157.2 and 72.2). However, these shapes and the cartilage that they stood for may not have been appealing to Lingjiatan communities. Cartilaginous forms were not popular at Lingjiatan, and craftsmen appear to have mostly represented bones. Replicating sound-producing, bell-like jade laryngeal tubes did not necessitate looking at fresh body parts. Pareidolia-based pig-dragons, their Y-shaped equivalents, and tracheal arm guards could have entailed a less palatable engagement with fresh somatic constituents. However, the armguard recovered from tomb 87M2 does not exhibit any of the

tracheal ribbing visible on its Hongshan counterparts (Anhui Provincial Institute 2006, p. 41, Plate 16.1–2). The craftsman who produced the Lingjiatan pig-dragon may even have reproduced the overall, albeit flattened, shape of an existing Hongshan jade pig-dragon. Nothing ascertains that the Lingjiatan jade-maker had a Hongshan pig-dragon as opposed to a Liangzhu culture pig-dragon as a model. The Lingjiatan jade exhibits a greater resemblance to pig-dragons found in the Liangzhu cultural sphere, as exemplified by a specimen found at the Guanjiingtou 官井头 cemetery (Figure 47B). That pig-dragon was retrieved from tomb M65, an early Liangzhu grave which further generated two *huang* 璜 whose ends exhibit the profile of pouncing feline-like creatures (State Administration 2013, p. 9). Since graves 87M8, 87M15, and 07M22 at Lingjiatan generated similar jade *huang*, we may assume a stronger link between pig-dragons from these two cultures (see Anhui Provincial Institute 2006, Plates 65.1 and 116.1–2). However, we can still hypothesize that if Lingjiatan craftsmen found inspiration in Hongshan pig-dragons, they conceived their creation through the prism of the environment they partially shared with Liangzhu communities located further east. Research suggests that between 7000 and 1000 BCE, alligator *sinensis* populated the Yangzi River and the Huai River basin from 30° to 35° N latitudes. Their range extended further east to the Qiantang River and its drainages around Hangzhou Bay (Thorbjarnarson and Wang 2010, p. 29). This indicates that both the Lingjiatan and Liangzhu communities shared their environment with these crocodilians. John Thorbjarnarson and Wang Xiaoming proposed that early dragon forms, like pig-dragons, represented coiled hatchling alligators (Thorbjarnarson and Wang 2010, p. 64). The upturned snouts of alligator *sinensis* and pig-dragons recovered at the Lingjiatan and Liangzhu sites reinforce the hypothesis (Figure 47C). The tapering tail and the dorsal striations visible on the Lingjiatan specimen evoke more of an alligator tail and its osteoderm scutes than the human tracheal conduit that Hongshan jade-makers represented.

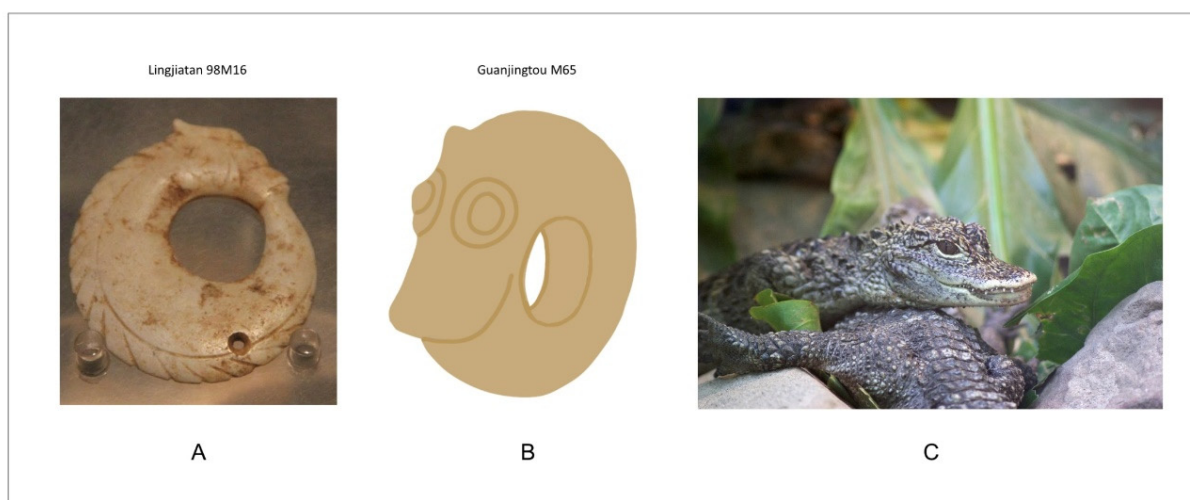


Figure 47. Illustration of two pig-dragons found at southern sites (Lingjiatan (A) and the Liangzhu culture site of Guanjiingtou (B)) and photograph of two juvenile alligator *sinensis*. Note their elongated, upturned snout and prismatic back scutes. (Source: (A) Courtesy of Gary Todd, Ph.D.; (B) LB and SLB on Procreate; (C) Berthold Werner, Public domain, via Wikimedia Commons).

In Section 5.8, we examined the anthropomorphic jade recovered from tomb N2Z1 M21 at Niuheiliang in tandem with its six counterparts found inside two Lingjiatan graves. In that context, we highlighted the varied forms they embody, and the rounded or angular aspects each displays. The comparative analysis revealed that cultural expression did not affect the form jade-makers gave to their works as much as osseo-morphologic details specific to the human sternum that craftsmen used as a model.⁴⁵ It also suggested that pareidolia-induced mental images led to the figural embodiment. Ultimately, the seven figurines exemplify a remarkable level of self-reflexivity at both sites. Folding the figurines' arms over their own chests was more than a savvy decision to avert straying beyond the

confines of a human sternum silhouette. Positioning the anthropomorphic figures' folded arms so that they framed and brought attention to their own sternum amounted to an astonishing *mise en abyme* by prehistoric craftsmen. Remarkably, the six Lingjiatan figurines feature a detail missing from their Niheliang counterpart: ribbing on their forearms consisting of 5 to 7 segments (Figure 48B). Positioned on each side of the framed sternum area, these segments correspond in number and placement to the cartilaginous segments linking the sternum to the ribs (Figure 48A). While humans generally have 24 ribs, their number may also be 22 or 26 (White and Folkens 2005, p. 185). Remarkably, excavators retrieved 22 jade *huang* from 87M17 and 26 from tomb 87M15 (see Anhui Provincial Institute 2006, Plates 125–9 (87M17) and Plates 111–116 (87M15)). We may hypothesize that some jades commonly classified as *huang* represent human ribs at Lingjiatan. Their placement on the chest of the 07M23 tomb occupant reinforces this idea. And as they did further north, human ribs exhibit features that may have triggered pareidolia at Lingjiatan, too. Tomb 87M9 yielded a *huang* exhibiting what archaeologists described as a dragon head (Anhui Provincial Institute 2006, p. 98, Plate 73.1–3) (Figure 48C). As Section 5.6 showed, some Hongshan “dragons” are ribs whose ends evoked a creature’s profile. Lingjiatan jade-makers expanded that imagery to include the profile of feline-like creatures presented as tigers in the archaeological report. These creatures occupy the end of *huang* jades recovered from graves 87M8, 87M15, and 07M22 (Anhui Provincial Institute 2006, pp. 90 and 143–144, Plates 65.1 and 116.1–2; Lingjiatan Site Archaeological Team 2020, pp. 24–25, Plate 26). The majority of these rib-like jades, however, exhibit more angular cross-sections. A style possibly derived from the need to standardize rib sets or labor economy at moments when mourners needed large jade burial assemblages to bury their loved ones.

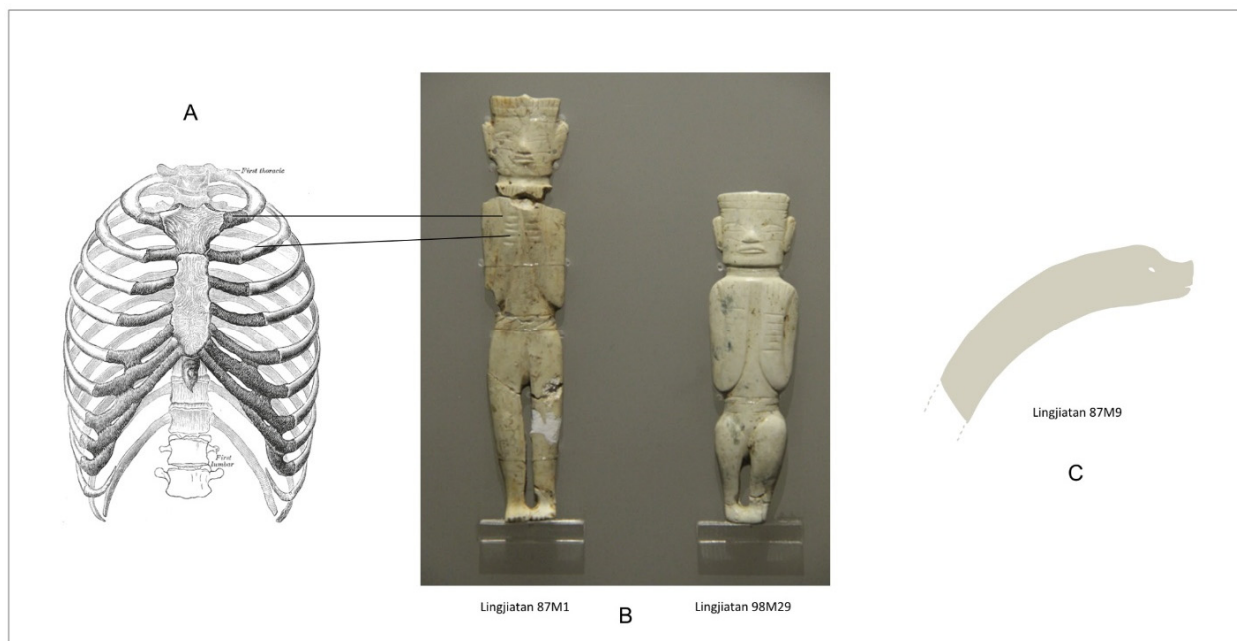


Figure 48. Human ribcage, ribbing on the Lingjiatan figurines' forearms, and rib-like *huang* jade. Note how the figurines reference their own sternum (forearm placement) and ribs (ribbing on the forearms). Note how the rib-like jade (C) embodies a creature visualized in osseous morphology (Source: (A) *Gray's Anatomy*, public domain; (B) Courtesy of Gary Todd, Ph.D.; (C) LB and SLB on Procreate).

Beyond sternums and ribs, Lingjiatan jade-makers appear to have represented long bone parts as well as vertebrae. Several burial assemblages, including those found inside 98M29 and 87M4, include jade tubes reminiscent of the long bone segments Xinglongwa craftsmen already produced (see Anhui Provincial Institute 2006, Plates 205.1 and 35.1). Some knob-like jades bear a strong resemblance to femoral heads, while others seem to

capture the concave end characteristic on fibulae (87M14 and 98M16) (see [Anhui Provincial Institute 2006](#), Plates 103.3 and 158.1–3). Furthermore, southern jade-makers appear to have implemented the approach already observed at Niuheliang to craft the jade lumbar vertebra found aligned with the deceased's spine inside N2Z1 M21. They also reduced the complex osseous forms to cube-like entities whose walls they smoothly incurved, and they relocated the spinal canal toward the core. Lingjiatan mourners possibly strung together those found inside graves 87M4, 87M9, and 87M15 (see [Anhui Provincial Institute 2006](#), pp. 248–49, Figure 203, 249, Plate 201). Finally, we should not exclude the possibility of a link between human osseo-morphology and the famous bird and boar composite from 98M29 (see [Anhui Provincial Institute 2006](#), pp. 248–49, Figure 203, 249, Plate 201). The rounded forms characterizing the hybrid jade creature may indeed stem from bony shapes. My hypothesis is that its form derives from pareidolia-induced mental images formed while looking at the two uppermost human cervical vertebrae: the atlas and the axis (Figure 49). The atlas lacks the cubical vertebral body and the complex spinous process that surrounds the spinal canal on other vertebrae. Instead, two articular facets and lateral extensions frame the central aperture. The articular facets on which the occipital cranial bone sits may recall the ears of a boar-like creature whose eyes and snout are conjured by the bony extensions (see [White and Folkens 2005](#), Figures 9.9–10, p. 168). The ensemble suggests a double-headed entity. The second vertebra, the axis, functions as a pivot for the atlas, which rotates during lateral head movements (see [White and Folkens 2005](#), pp. 163 and 169). It has two wing-like articular facets and a silhouette that conjure the idea of a bird. Stacked up and observed posteriorly, the atlas and the axis fuse the two zoomorphic images, the spinous process on the axis evoking a bird's tail. Scholars tend to attribute a cosmological or astronomical meaning to the circular and star-like configuration engraved on the jade. This detail occupies the same position as the spinal canal on the two stacked-up atlas and axis vertebrae. It may well represent two features that are visible when looking at this hollow core from above. The canal's inner walls slightly taper. In fresh specimens, they also feature intersecting alar and cruciate ligaments. The Lingjiatan jade-maker appears to have reproduced the pattern of intersecting ligaments as an octagram. To resolve the challenge of representing both the hollow canal and the criss-crossing ligaments on a flat field, the craftsman created an octagram with a central opening.

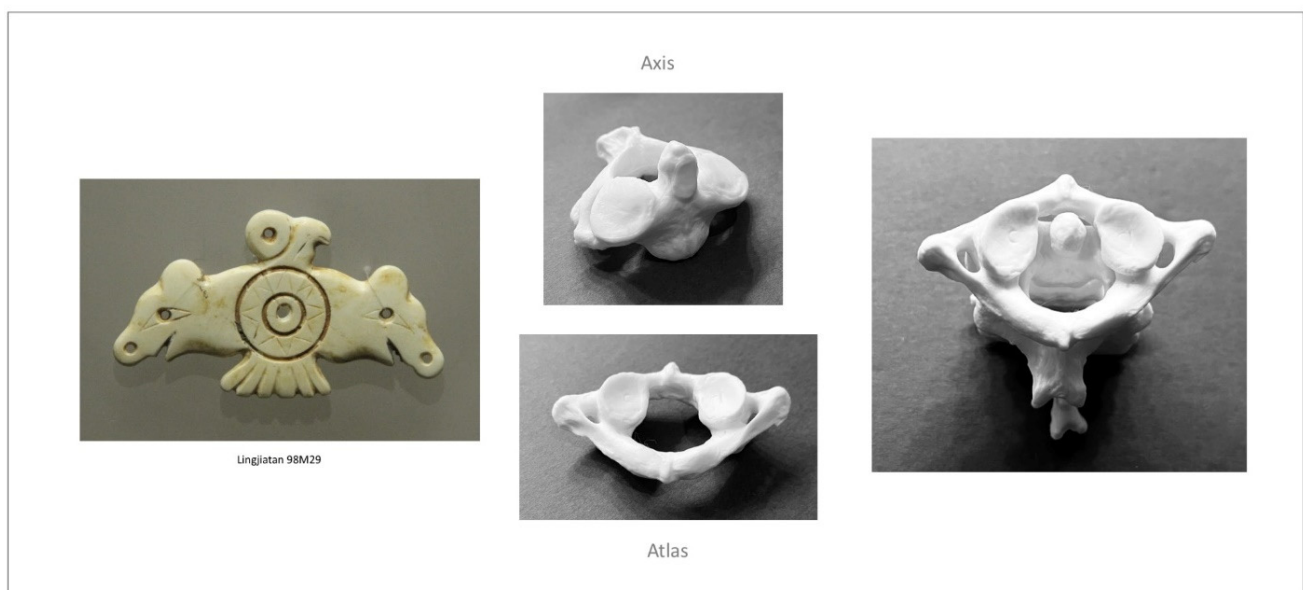


Figure 49. Illustration of the famed boar-bird from tomb 98M29 at Lingjiatan juxtaposed with human axis and atlas bones. Note how the Lingjiatan figurine and the bones exhibit soft, rounded surfaces and edges. (Source: Photograph of the Lingjiatan bird-boar, courtesy of Gary Todd, Ph.D.; the author photographed the bones).

6.4. Jades of the Liangzhu Culture

Our analysis will conclude with a hypothesis concerning the *bi* 璧 and *cong* 琮 jade types quintessentially associated with the Liangzhu culture (3300–2300 BCE) in the Yangzi River Delta area (see [Fanshan 1988](#)). As discussed in Hongshan contexts, circular *bi* disks could stand for skeletal parts featuring a prominent circular aperture, alleviating the need to represent complex skeletal referents in detail. Exhibiting straight rim edges, a cross-section of unmodulated width, and a lack of surface topography, Liangzhu culture *bi* disks lack the biomorphic qualities of their Hongshan counterparts. Nevertheless, they functioned in a visual culture seemingly devoid of highly naturalistic figural works (like those unearthed at Hongshan ceremonial centers). In a southeastern visual environment lacking such a representational benchmark, the resonance of substance—jade with bone—may have sufficed to make more geometric jades adequate to represent human bones. Considering the narrow central aperture and broad lateral coverage of Liangzhu *bi* disks, the human skeletal structure they could best represent may be a skull. When viewed post-inferiorly, the human skull exhibits a narrow yet prominent circular opening (foramen magnum) through which the nervous system extends from the brain into the vertebral column. An abstracted and flat rendering of the surrounding bone plane may have sufficed to signify a human skull.

In the same vein, the jade *cong* tubes, often found alongside *bi* jades inside Liangzhu culture tombs, may well represent a human vertebral column. At least two sites linked to the Liangzhu culture, Huating 花廳 in Jiangsu province and Fuquanshan 福泉山 in Shanghai 上海, generated necklaces featuring *cong* beads topped with anthropomorphic heads, hinting at the possibility of the form as a human trunk or its axial skeleton (see [Childs-Johnson and Gu 2009](#), Figures H1-1 and H1-2, p. 346; [Nanjing Museum 2003](#), Figures 151 and 155). A sacrum-less vertebral column is made of cervical, thoracic, and lumbar vertebrae that exhibit morphological variations affecting their width, the shape of their spinal canal, and the form and size of projections (spinous processes) emanating from this opening. However, the basic structure of a vertebral column remains the same: a tubular form made of cartilaginous intervertebral disks separating stacked vertebrae, whose bony extensions protrude from a circular opening. This basic form corresponds to that of *cong* artifacts, whose surfaces exhibit vertically aligned projections separated by narrow horizontal bands. Our analysis showed how Hongshan and then Lingjiatan craftsmen resolved the challenging task of representing the complex forms that human vertebrae take. They reduced each vertebra to a cubical or cylindrical shape featuring a central opening (spinal canal) and reproduced the smoothly incurved outer walls of vertebral bodies. Liangzhu jade-makers appear to have embraced the simplified form given to each vertebra, their *cong* conceptualized as piled-up cubical or cylindrical shapes with a central spinal canal. However, they appear to have rejected the smooth, incurved outer wall surface treatment. Perhaps aesthetic sensibilities favored the angular shapes we associate with their style. However, another scenario can explain not only Liangzhu craftsmen's rejection of incurved outer vertebral walls, but also the four columns of projections they added to their *cong* as well as the prismatic shape that they gave to these protrusions. Liangzhu communities lived in a peculiar wetland environment that they molded through extensive hydraulic work, creating a city crisscrossed with rivers and canals ([Liu et al. 2020](#), pp. 22–24). In order to achieve their engineering feat, they had to contend with environmental challenges. As discussed earlier, archaeological evidence points to the presence of alligator *sinensis* in the Yangzi River basin and the water landscape surrounding the Qiantang River, the main river crossing modern-day Hangzhou 杭州, where Liangzhu City was located. Artifactual evidence pointing to the species' presence around Liangzhu includes the incised profile of a crocodilian on a black piece of pottery excavated at the important Mojiaoshan 莫角山 site near Pingyao 瓶窑 in Yuhang 余杭 district.⁴⁶ Beyond the pig-dragon-like jade found inside grave M65 at Guanjiingtou, whose head profile corresponds to an alligator *sinensis*, other Liangzhu sites generated similar artifacts testifying to the species' local presence (see [Fang 2020](#), pp. 148 and 150, Figure 4.30). Florida residents would likely appreciate how

potentially life-threatening hydraulic work would have been in such an environment. Archaeologists have exposed a complex and extensive hydraulic system constructed around Liangzhu City that likely facilitated transport and helped with irrigation and flood prevention (Liu et al. 2020, pp. 33–36). Taming water courses with these animals lurking nearby would have required bravura, in addition to engineering skills. How Liangzhu community members felt about these animals must have depended on their degree of involvement in water work and how physically exposed they were to wildlife. For the elite who directed the operations and mastered the waterways, the water beast may have been a mighty equal. With crocodilians in their visual environment, jade-makers found a resemblance between human skeletal columns and alligators. Little more than an alligator's triangular head and columns of dorsal prismatic scutes are visible once the animal is submerged in water. This is precisely this sight that Liangzhu jade-makers may have associated with human spinal morphology and that motivated the four alignments of projections on jade *cong*. As highlighted in this analysis, the same kind of pareidolia that affects contemporary osteologists and radiologists played a part in the emergence of figuration in Hongshan and Lingjiatan jade crafting. A human sacrum shares the trapezoid shape and upturned snout of an alligator *sinensis*'s head; the spinous and transverse processes aligned longitudinally on a human spine find echo in the spiky osteoderm of the alligator's backs; a human vertebral column undulates like a crocodilian's can (Figure 50). Ultimately, the prismatic projections were as naturalistic as jade-makers working in a style that favored geometric lines were willing to go when representing alligator scutes on a jade human vertebral column (Figure 51).

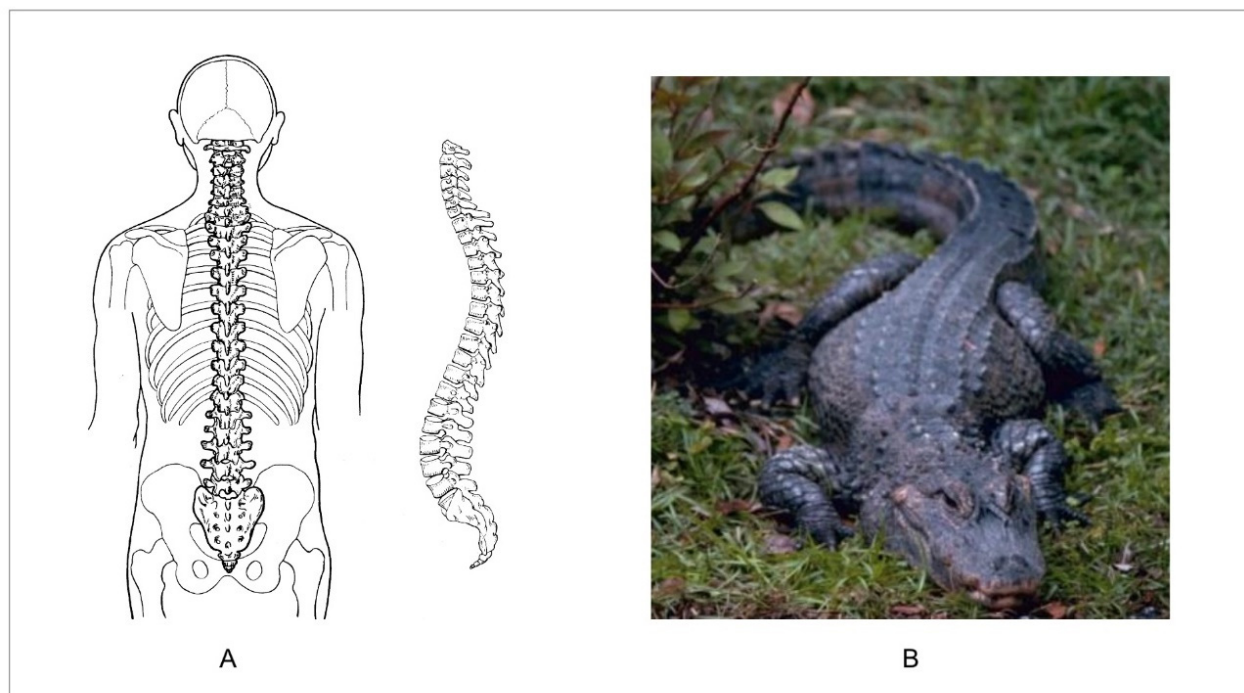


Figure 50. Illustrations of a human vertebral column and an alligator *sinensis*. (Source: (A) Pearson Scott Foresman, Public domain, via Wikimedia Commons; (B) Gary M. Stolz, U.S. Fish and Wildlife Service, Public domain, via Wikimedia Commons).

If Liangzhu jade-makers represented a human-spine-alligator hybrid in *cong* artifacts, an in-depth inquiry into their craft might reveal that awl-shaped implements (*zhuixingqi* 锥形器) with tapering shafts, sacrum-like alligator head jades (Figure 52A), and other significant Liangzhu jade types were derivative products. Establishing that tubes articulated with three-pronged implements (*sanchaxingqi* 三叉形器) (Figure 52B–E) represent the same hybrid connected to a human pelvic girdle would encourage us to reassess their entire corpus.

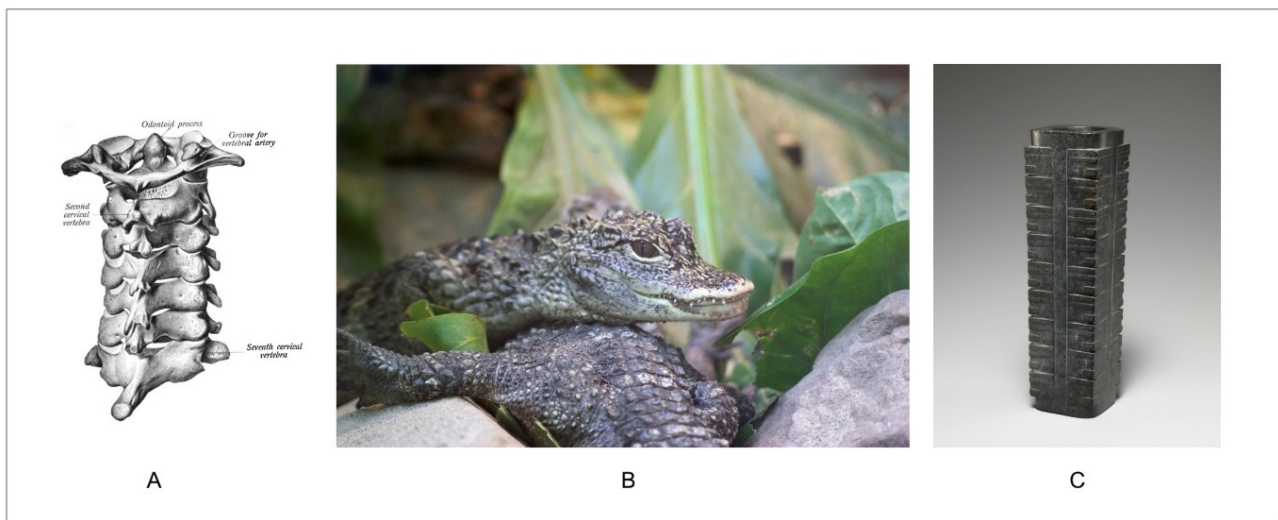


Figure 51. Illustrations of piled-up human cervical vertebrae, alligators sinensis, and a Liangzhu Culture jade *cong* tube (Source: (A) *Gray's Anatomy*, Public domain; (B) Berthold Werner, Public domain, via Wikimedia Commons; (C) Ritual object (*cong*), Purchase, Sir Joseph Hotung Gift, 2004, Accession Number: 2004.52, Metropolitan Museum of Art, NYC, Public domain).



Figure 52. Liangzhu culture jade types possibly linked to the human-alligator fusion proposed for the *cong*. (A) Triangular plaque exhibiting features reminiscent of both an alligator head and a human sacrum; (B–E) Tubes and three-pronged implements. Note how the animal head on tube (D) would align with the lateral projections (hipbones?) on (C) and would secure the assembly like a sacrum. The projections' slightly everted aspect echoes the orientation of hipbones (see Figure 10) (Source: LB and SLB on Procreate).

7. Conclusions

Our study of Hongshan culture jades sought to shed light on the etiology of their peculiar style and shapes. Through multiple lines of inference, our result points at the strong likelihood that first, Hongshan craftsmen used jade to represent human skeletal parts, and second, that some late Neolithic cultures adopted the praxis in the Yangzi basin area. Comparative analyses highlighted how some northeastern jade types have counterparts in human osseo-morphology. They also showed that other physical peculiarities (biomorphism, roundness, smoothness, and surface treatment) associated with the Hongshan jade style likely result from a broader predilection for figural naturalism at Hongshan

ceremonial centers. Our work focused on providing a more nuanced understanding of the origin of a style and some jade typology from prehistoric northeastern and southeastern China. It is our hope that future research will investigate the underlying reasons and implications for this praxis, be they religious, social, or political. As a first step on that path, our study pointed to a multi-factorial hypothesis for the Hongshan praxis. First, interest in material-representation synergies in prehistoric northeastern China extended to the use of jade to signify bone. Second, inherited lore and Hongshan communities' own observations of extraordinary stony creatures often embedded in lithics in their own fossiliferous environment catalyzed interest among the elite for an equally extraordinary burial state. As a result, communities provided select deceased members with stony skeletal constituents for an afterlife spent inside lithic mounds. Third, the individual physical conditions of people who lived five millennia ago may partly explain discrepancies in the assemblages of jade skeletal components deposited inside graves. If so, we should not exclude the possibility that pareidolia-induced creatures were invoked, deemed responsible for, or served protective functions in the face of fragile health conditions. Wearing an avian-shaped pendant in life, for example, could have been intended to protect against injury or heal broken or sprained lower bones in the Hongshan cultural sphere.

By some means, the works of Hongshan jade-makers came to the attention of those who lived just north of the Yangzi River in the Lingjiatan area. Their reception of the types and styles of Hongshan jades was selective. If they had not represented bones themselves before, Lingjiatan jade-makers appear to have embraced the practice under this influence from the northeast. Occasionally, they concretized in their bony representations the pareidolia-induced imagery elicited by raw skeletal forms or natural jade coloration. Due to local needs and visual sensibilities, southern jade-makers employed biomorphism to a point. They created some smooth and rounded somatic representations, but favored more angular renderings, notably for ribs whose quantity likely demanded shortcuts. They appear to have followed the approach and surface treatment used in the northeast to represent vertebrae, resulting in jade cuboids with smoothly incurved outer walls. The attention Lingjiatan jade-makers paid to vertebrae perhaps derived from local circumstances: while in the northeast communities like Hamin Mangha endured a devastating zoonotic disease (*Yersinia pestis*), southeastern communities working in rice fields may have had to contend with spinal tuberculosis (see [Zhou et al. 2022](#)). It seems sensible to assume that ensuing physical consequences, notably kyphosis (hunchback), would have been devastating and warded against in the broader Yangzi River basin. Ultimately, the expansion of a northeastern jade-working praxis and style involving the representation of human skeletal parts in the Lingjiatan and Liangzhu areas should invite broader reassessments of Neolithic jade-producing cultures in southeastern China.

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Data Availability Statement: No new data were created or analyzed in this study.

Conflicts of Interest: The author declares no conflict of interest.

Notes

- ¹ For English introductions to Hongshan society, settlements, and subsistence strategies, see ([Peterson 2006](#); [Peterson et al. 2010](#); [Peterson and Lu 2013](#); [Shelach-Lavi 2015](#); [Womack 2020](#)).
- ² For the history of Hongshan archaeology, see ([Guo 1995](#); [Shelach 2005](#), pp. 53–57).
- ³ Gideon Shelach-Lavi offered warranted cautionary words about inferring social differentiations from prehistoric mortuary practices: “Archaeological correlates for stratification are found in domestic contexts or in graves. Differences in house size, the quality of materials from which they were built, and the quality and type of artifacts (including food remains) found in them suggest wealth and power differentials between families and individuals. Although graves have ritual contexts, archaeologists assume a correlation between the power and prestige people enjoyed during their lifetime and the treatment they receive after death. We cannot assume, of course, that it is a straightforward one-to-one correlation. As we know from both historical and ethnographic studies, some societies tend to highlight differences, while others tend to downplay them; nonetheless, we assume that every society has certain norms that govern social relations and their mortuary expression, and that the systematic study

of a large enough sample of graves from a given prehistoric society will reveal its rules. The differences between graves can be quantified in terms of the labor invested in their construction and the artifacts placed in them, but also in terms of the presence of unique artifacts or symbols that represent political or religious authority.” (Shelach-Lavi 2015, pp. 95–96).

4 As Gina L. Barnes recently highlighted, the Hongshan culture is perceived as part of the national heritage and the emergence of civilization in China. The author captured the significance of this prehistoric culture in the context of national identity in East Asia as follows: “Since East Asian archaeologists have traditionally been trained mainly as cultural historians—seeking to elucidate local developments, tracing the historical roots of their own societies, and re-creating the lifestyles of former inhabitants in particular periods—archaeology as presented on national levels is essentially ‘nationalistic.’ This is despite the international collaboration in excavation and conservation projects, and despite the increasing attention paid to Western theory. One feature of this cultural nationalism is the effort to show continuity of the current national units through time: speaking of 5000 years of Korean art, or using the Hongshan culture to extend the reach of Chinese ‘civilization’ back into the Neolithic, or using Kofun-period tombs in Japan to define a long-lived state” (Barnes 2015, pp. 391–92). Noteworthy, located in northeast China close to the Korean peninsula, the Hongshan culture more recently attracted nationalistic attention in South Korea (see Logie 2020).

5 This article is indebted to the exhaustive work conducted by Dr. Elizabeth Childs-Johnson on jades produced within the Hongshan cultural sphere and beyond. Publications include (Childs-Johnson 1988, 1991, 2002, 2009, 2020; Childs-Johnson and Major 2023). I am grateful to Dr. Childs-Johnson for inviting me to share my work on prehistoric jades and for stimulating a reflection. This study is the fruit of a lengthy process, started in 2012 with a text I shared with two anonymous readers at Columbia University, whom I thank for their thorough and helpful comments. Research on material-representations synergies and the role of subjectively mediated cognitive processes in figuration presented in my Ph.D. dissertation, *Embodied Materials: The Emergence of Figural Imagery in Prehistoric China* (Columbia University, 2015) reinforced my belief in the main hypothesis developed here. Dr. Childs-Johnson’s invitation to address the concept of style led me to reconsider and refine my understanding of how some prehistoric people approached mimesis and the process of representing. Ultimately, this new prism solidified my vision of what Hongshan men, women, and perhaps children, sought to represent in the first place. It further led me to consider whether they alone engaged on that path during the Jade Age. During the peer-review process, three anonymous readers offered helpful comments for which I am grateful. All conclusions and mistakes are my own. I also express gratitude to Simon Penzer for editing my work, to Gary Todd, Ph.D., who generously shared photographs taken in Chinese museums, and to Léa Bass for helping me produce digital images of burial ground plans, clay, stone, and jade artifacts with the Procreate software.

6 Scholars deploy a spectrum of methodologies to investigate material cultures beyond the confine of textual history. Recurrent interpretative paradigms pervade scholarship on the Hongshan culture. They include shamanism, cosmology, rituals, fertility worship, and goddess worship. Topics addressed are all worthy of attention. We nevertheless ought to acknowledge that this set of approaches tends to result in hypotheses, not facts. For the historiographical foundation of some paradigms and the origin of others in a broader worldwide discourse on prehistoric art, see (Larrivé-Bass 2015, pp. 81–134).

7 The author argued that the Hongshan elite engaged in shamanic performances at Niuheliang, displaying figural jade artifacts that embodied significant cosmological precepts (notably the Big Dipper asterism and the celestial Pole). By so doing, the elite demonstrated their exclusive knowledge of cosmology to the audience, their exclusive right to communicate with supernatural forces, and their ability to maintain smooth operations of the celestial Pole and thus of the universe. Hongshan jades, thus, would confirm a fundamental link between the celestial Pole and Hongshan rulers. Li’s analysis implies that aspects of the cosmo-political culture of historical China emerged as early as the fourth millennium BCE in the Hongshan culture. As David Pankenier highlighted, the celestial Pole was “the celestial prototype of the cosmically empowered Chinese monarch” as early as the Bronze Age (see Pankenier 2013, pp. 114–15). The “astral-territorial correspondence” between the celestial Pole and the king emerged in the eleventh century BCE, when Shang dynasty kings started to identify their royal ancestor as the high god Di who dwelled in the celestial Pole. The “genetic relationship” was reinforced in the subsequent Zhou period when the king became the “Son of Heaven”. (see Pankenier 2013, pp. 44, 114–15).

8 <https://www.sothebys.com/en/articles/inviting-the-touch-jades-of-the-hongshan-culture>, Accessed on 19 January 2023. For a history of jade working in northeast China prior to the Hongshan culture, see (Tang et al. 2020).

9 In this article addressing jade crafting in small prehistoric communities, the word “craftsmen” merely refers to people who transformed materials (clay or jade) into objects. The term does not presuppose a specific gender, an adult age, or a craft specialization.

10 Hongshan communities devoted considerable attention, and labor, to clay cylinders. Estimates suggest that over ten thousand lined the edges of architectural features at the Niuheliang localities (Guo 1995, p. 42). On the different colors visible at Niuheliang, see (Zhang et al. 2013).

11 Scholars tend to consider that figural remains validate the idea that Hongshan communities generated incipient forms of subsequent Chinese cultural standards, of which ancestral worship was a crucial component (See Shelach 2004).

12 The zoomorphic stone arrangements on elevated platforms indicates their significance. For a ground plan, see (Shao 2004, p. 27).

13 For an early discussion on Hongshan jades, their style, and their naturalism, see (Childs-Johnson 1991).

14 For example: “Hongshan jades are distinctive in style, characterized by superbly polished, very smooth, softly rounded surfaces that appeal to the haptic sense. They include both figurative and abstract items, and the features on the former and the decoration

on the latter are equally indicated in a highly subtle manner, sometimes only through slight changes of the surface plane or through shallow, raised or grooved lines, that can be felt, but are often visible only at close inspection, when turning the piece in the light". <https://www.sothebys.com/en/articles/inviting-the-touch-jades-of-the-hongshan-culture>, Accessed on 19 January 2023.

Adorning ceremonial axes with the head of mighty animals like bears and birds of prey would be suitable for northeastern communities. A bear-head shaped finial would be unexpected if it belonged to an axe-set of southern origin. Regardless, nothing ascertains that the Banlashan jade functioned as an axe-handle finial or that its mellow-looking creature is a bear.

For references on human femur morphology, see (White and Folkens 2005, pp. 255–67).

Seminal works on pareidolia include (Guthrie 1995; Gombrich 2000; Gamboni 2002; Voss et al. 2012). For the role of pareidolia in image-making in prehistoric China, see (Larrivé-Bass 2015, pp. 193–243).

For the anatomy of the humerus, radius, and ulna, see (White and Folkens 2005, pp. 203–24).

Jessica Rawson has made compelling comments about how valuable the translucence and durability of jade must have been in early communities. See (Rawson 1995, pp. 20–28).

Despite developmental variability and degenerative issues, a sacrum develops age-specific characteristics useful for forensic anthropologists to estimate the age-at-death of populations under study (Passalacqua 2009).

For photographs of sacrum showing various fusion levels, see (Mahato 2020).

For interpretations see (Lu and Luan 2001; Deng 2002; Li 2021). For the *taotie* influence, see (Zhang 2004, p. 89).

Two exceptions at Niuheliang are specimens found above the deceased's left shoulder in tomb N2Z1 M21 and near the deceased's head in tomb N16 M2.

This sacral angle evolves from approximately 20° at birth to 70° in adults (Cheng and Song 2003).

Readers familiar with Picasso's work will recognize the artist's treatment of his canvas in *Still Life with Chair Caning* (1912). The elliptical canvas was at once a sculptural rendition of a circular table-top observed from a distance and a support for the pictorial field. A rope (signifier) wrapped around the canvas stood as both a table rim decoration (signified 1) and a canvas frame (signified 2) (see Krauss 1986).

For a synthesis of turquoise finds at Neolithic sites in China, see (Pang 2016).

Inside other tombs the plaques were on or near the rib cage or abdominal area (N2Z1 M9; N2Z1 M22; N16 M15). Excavators found two lateral fragments near piled-up bones inside N16 M13. They also found a plaque outside a tomb at N2Z1 and another fragment at N16Z1 (Liaoning Provincial Institute 2008a, pp. 18, 28; Liaoning Provincial Institute of Archaeology and Cultural Relics of Chaoyang City 2004, pp. 42, 52).

Whether sleeping habits during infancy or artificial intervention led to occipital flatness and derivative osteological changes was inconclusive (Wang 2022). The form of underlying bones (maxilla and zygomatic bone) determines cheek size and shape (see Oettle et al. 2016).

"Temporal lines on the lateral ectocranial surface mark the attachment of the temporalis muscle, a major elevator of the mandible, and its covering, the temporal fascia, a fascial sheet that covers the temporalis. The temporal line defines the superior edge of the temporal surface (and fossa). This line becomes a crest in its anterior, lateral extent (on the zygomatic process of the frontal). It often divides into superior and inferior lines as it sweeps posteriorly" (White and Folkens 2005, pp. 87–88).

I am grateful to an anonymous reviewer for encouraging a clarification on this issue.

As a result, vocal cords lengthen, and male voices deepen (Scheuer and Black 2004, p. 145). A female interlaminate angle tends to be 10 to 20° wider than on male larynxes (Eckel et al. 1994, p. 34).

Diagrams or drawings provide accurate illustrations of forms Hongshan jade-makers may have sought to render. Less palatable to contemporary viewers, color photographs of actual human larynxes and tracheas nevertheless enhance appreciation of other aspects Hongshan jade-makers may have sought to reproduce. For example, photographic data better illustrate the jade-like qualities and shine of cartilaginous skeletal parts connected by membranes. Photographs in the following article further exemplify a cricothyroid membrane depression, a detail that might have inspired the gap created beneath the chin of pig-dragons (see Figure 2b in Garbelotti et al. 2019).

For images of vocal cords and mucosal constriction, see Figures 10 and 11 in (McCullagh et al. 2022, p. 815).

This jade type is discussed and illustrated in (Forsyth 1990).

For details on nasal anatomy, see (Anderson et al. 2008; Stevens and Emam 2012).

Tombs N2Z4 M2 and N16 Z1 M4 both yielded unusual and similarly-shaped turquoise pendants, likely a clue to their contemporaneity. See (Liaoning Provincial Institute 2012b, pp. 202 and 406).

See (Liaoning Provincial Institute 2012b, pp. 405 and 417). For stratigraphic data about the relative dating of N16Z1 M4, see (Liaoning Provincial Institute 2012b, p. 393).

Modern populations from different areas show similar frequencies in sternal morphological variation. Some variations may be population specific as suggested by studies conducted on some South Asian, African, Spanish and French populations. See (Rojas et al. 2022, p. 292).

- 39 During the peer-review process, I was asked to consider how the crafting and presentation of jade human bones may have contributed to the embodiment of cosmological power in the Hongshan culture. The detailed comparative analyses presented in this work demonstrate a clear and fundamental correlation between Hongshan jades and human anatomy. My research uncovered no evidence of interests in or activities linked to cosmology. Therefore, I cannot comment on possible links between Hongshan jades and cosmology or between human bodies and cosmology. Be that as it may, lack of material archaeological proof cannot determine (1) that Hongshan people had no interest in cosmology or (2) that they never established a link between jade works and cosmology or between human somatic constituents and cosmology. However, current physical evidence supports none of these hypotheses. What the archaeological data suggests, and my work aims to demonstrate, is that Hongshan communities' primary use of jade pertained to body ornamentation (bracelets) and the crafting of jade human skeletal constituents for placement on buried bodies. Scholars often assert a cosmological basis for a well-known bird-boar jade from Lingjiatan as well as *bi* and *cong* artifacts produced in the Liangzhu culture. As discussed in Sections 6.3 and 6.4 of this article, I suspect that these southern jades also represent human skeletal constituents. Whether Hongshan, Lingjiatan, or Liangzhu communities ever established a link between human anatomy, jade somatic representations, and cosmology remains beyond the scope of this investigation.
- 40 In 2005, Mark Norell highlighted the significance of the ensemble: "The Liaoning discoveries have come to be called the Jehol biota. Fossils at this locality range from about 135 to 110 million years old. Most were deposited on the floors of lakes, where they were preserved in fine-grained volcanic ash that rained down on the lakes' surfaces. Some specimens are also preserved in more coarsely grained rocks, and some seem to have been buried alive. Toxic volcanic gasses may have caused mass mortality. All kinds of animals and plants have been found as fossils. Fish, leaves, and insects are the most common, but mammals, frogs, and lizards, as well as true birds, have also been discovered, along with dinosaurs. Many of these organisms are extremely important to scientists studying the origin of modern groups. Most of the mammals appear to be primitive relics of much more ancient forms. One has even been found with its last meal of baby dinosaurs preserved. Arguably, the first (or at least some of the earliest) flowering plants are known from Liaoning, as are extremely primitive birds that retain the 'reptilian' characteristics of teeth and long tails. Beyond this, through a serendipitous confluence of factors, many of these specimens contain preserved soft body parts like scales, skin, and even feathers. While we have known for a long time that birds are the direct living descendants of dinosaurs, it was these fossils that demonstrated just how birdlike in appearance and even behavior many of these dinosaurs were. These remains have told us much about how and why feathers evolved, about the origin of flight in modern birds, about the dynamic of ecosystems in the 'Age of the Reptiles' and, ultimately, about the very nature of the evolutionary process itself" (Norell 2005, pp. 24–25).
- 41 Gregory S. Paul described the fossilization process as follows: "Depending on the circumstances, fossilization can be rapid or very slow to the point that it never really occurs even after millions of years. The degree of fossilization therefore varies and tends to be more extensive the further back in time the animal was buried. The most extreme fossilization occurs when the original bone is completely replaced by ground water-borne minerals. Some Australian dinosaur bones have, for instance, been opalized. Most dinosaur bones, however, retain the original calcium structure. The pores have been filled with minerals, converting the bones into rocks much heavier than the living bones." (Paul 2016, p. 55).
- 42 A study on vertebrae health at the Xinglonggou site helped establish differentiated activities amongst male and female community members (Hou et al. 2017).
- 43 I borrow the phrase "genesis of a style", also alluded to in the title, from Meyer Shapiro (Shapiro 1953).
- 44 Excavators found evidence of Lower Xiajiadian culture features and objects at Niuheliang at a time when its altars and cairns must have been visible.
- 45 How may we explain the presence of 3 similar jade sternums inside each Lingjiatan tomb? Since sternal variation marks biological affinity, the jades may replicate the breastbone of related individuals. Sternal foramen and cleft tend to be congenital (see Duraikannu et al. 2016). A study conducted on a three-generation Central European family showed that resemblance in the overall shape of sternums increased with relatedness degree. In that study the sternums of inbred individuals showed the greatest resemblance (see Cvrček et al. 2022). If we rule out close biological affinity, then the two groups of three jades found inside M1 and M29 may each have been inspired by the sight of a single sternum.
- 46 For a color photograph, see *Major Archaeological Discoveries* 2007, p. 23.

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