
SINO-PLATONIC PAPERS

Number 321

January, 2022

The Late Shang, DNA, and Trifunctionality

by
Astrid Vicas

Victor H. Mair, Editor
Sino-Platonic Papers
Department of East Asian Languages and Civilizations
University of Pennsylvania
Philadelphia, PA 19104-6305 USA
vmair@sas.upenn.edu
www.sino-platonic.org

SINO-PLATONIC PAPERS

FOUNDED 1986

Editor-in-Chief

VICTOR H. MAIR

Associate Editors

PAULA ROBERTS

MARK SWOFFORD

ISSN

2157-9679 (print) 2157-9687 (online)

SINO-PLATONIC PAPERS is an occasional series dedicated to making available to specialists and the interested public the results of research that, because of its unconventional or controversial nature, might otherwise go unpublished. The editor-in-chief actively encourages younger, not yet well established scholars and independent authors to submit manuscripts for consideration.

Contributions in any of the major scholarly languages of the world, including romanized modern standard Mandarin and Japanese, are acceptable. In special circumstances, papers written in one of the Sinitic topolects (*fangyan*) may be considered for publication.

Although the chief focus of *Sino-Platonic Papers* is on the intercultural relations of China with other peoples, challenging and creative studies on a wide variety of philological subjects will be entertained. This series is *not* the place for safe, sober, and stodgy presentations. *Sino-Platonic Papers* prefers lively work that, while taking reasonable risks to advance the field, capitalizes on brilliant new insights into the development of civilization.

Submissions are regularly sent out for peer review, and extensive editorial suggestions for revision may be offered.

Sino-Platonic Papers emphasizes substance over form. We do, however, strongly recommend that prospective authors consult our style guidelines at www.sino-platonic.org/stylesheet.doc.

Manuscripts should be submitted as electronic files in Microsoft Word format. You may wish to use our sample document template, available here: www.sino-platonic.org/spp.dot.

All issues of *Sino-Platonic Papers* are free in PDF form. Issues 1–170, however, will continue to be available in paper copies until our stock runs out.

Please note: When the editor goes on an expedition or research trip, all operations may cease for up to three months at a time.

Sino-Platonic Papers is licensed under the Creative Commons Attribution-NonCommercial-NoDerivs 2.5 License. To view a copy of this license, visit <http://creativecommons.org/licenses/by-nc-nd/2.5/> or send a letter to Creative Commons, 543 Howard Street, 5th Floor, San Francisco, California, 94105, USA.

The Late Shang, DNA, and Trifunctionality

Astrid Vicas

Saint Leo University

St. Leo, Florida

ABSTRACT

This paper proposes hypotheses about the composition of the Late Shang population. They are intended to assist in discussing the thesis that the distinctiveness of the Late Shang polity rested in implementing a definitive project of social stratification in the Central Plains of China. Evidence about diet and human sacrifice is summarized to support claims about stratification, which is here understood to require exclusion from access to resources needed to make a living. Hypotheses tested using tools designed to extract information from ancient DNA data are employed in conjunction with archaeological information to make tentative suggestions about population composition, notably about who could have made up the bulk of the craftworkers in Late Shang society and who could have filled the role of warrior adjuncts in support of the Late Shang ruling elite. It is suggested that the bulk of the craftworkers could have been drawn from a melding of Central Plains and neighboring Shandong populations. Some of the warriors serving as adjuncts in support of the ruling lineage could plausibly be derived from the southeast Mongolia Ulaanzukh Culture. The Late Shang rituals of oracle bone consultation and human sacrifice are here interpreted as a public representation of deliberation with departed lineage heads by which the Late Shang ruling lineage asserted exclusive control over community resources and decision-making. By means of these rituals, the Late Shang rulers instituted a tacit Bronze Age virtue ethics or ethics of excellence. The organization established by the Late Shang rulership may have been the earliest effective realization of trifunctionality in the Central Plains.

Keywords: Late Shang and Shandong, Late Shang and Ulaanzukh, Late Shang DNA, Late Shang excellence, Late Shang population composition, Late Shang stratification, Trifunctional thesis

INTRODUCTION

This paper employs a combination of approaches from various fields to support a reconstruction of the Late Shang conception-in-action of excellence. It has philosophical interest insofar as this Late Shang Bronze-Age implicit virtue ethics or ethics of excellence is a precursor to Confucianism (V. Chen 2014). It may also be helpful in offering a broader context for situating trifunctional social divisions that are typically associated with the Platonic conception of a just society — which is an aspect of Platonic virtue ethics — and attributed to an Indo-European outlook, a thesis articulated by G. Dumézil (1995). The proposed reconstruction casts the Late Shang-enacted conception of excellence as a public display of exclusion. Ritual exclusion, it is suggested, was conveyed in the public representation of deliberation about stewardship over the ruling lineage's domain, which the ruler carried out in the guise of conversations with deceased lineage heads. Oracle bones and plastrons were the media through which the conversational exchanges were portrayed as occurring, and the inscriptions were their imprint. The proceedings were marked by the sacrifice of human victims.

The paper surmises that a distinctive feature of the Late Shang polity was its success in implementing a stratified social organization, of which the ritual of exclusion featuring oracle bone cracking and human sacrifice was a symbolic representation. The essay draws on political anthropology to characterize stratification. Relying on disciplines related to archaeology, including those that pertain to the study of diet and nutrition, the paper suggests that stratification, in the restricted sense adopted here to avoid ambiguity, had not been enforced in the Central Plains prior to the Late Shang experiment.

For the Late Shang ritual of exclusion to have both meaning and impact, it needed a public. Combining facts from archaeology and methods of drawing inferences from currently available ancient human DNA samples from the Central Plains and areas to their north, some hypotheses are presented about who its targeted audience was. The result is that, while acknowledging that samples from the period between Late Longshan in the Central Plains and Late Shang are not available as of this writing, one can tentatively project that the main audience would have been lineages of skilled artisans that had spread westward from Shandong sometime in the period between Late Longshan and Late Shang and blended with populations of the Central Plains. The evidence from archaeology and inferences from available ancient DNA also tentatively support the presence of a southeast Mongolian Ulaanzukh elite.

A trifunctional division of society into a ruler whose prerogative is the exercise of deliberation, a supporting warrior elite, and a larger category of craftspeople and producers could reflect the trans-Eurasian impact of the spread of social stratification. What we can infer from the successful imposition of this tripartite order in Late Shang society — if that is what occurred — is that a trifunctional division is better seen as a structural feature of early forms of stratified social organization rather than as a pattern that is culturally specific to Indo-Europeans.

In what follows, the paper provides a review of the concept of stratification as it is used here and summarizes current evidence of stratification from dietary patterns and sacrificial practices. It then ties archaeological information to inferences that can be drawn from ancient DNA to address the issue of who were the people over whom the Late Shang rulers asserted their supremacy.

The paper continues with a more philosophically oriented section that presents the notion of excellence in the Late Shang not as a personal characteristic of a ruler but as a public manifestation in ritual sacrifice. It then concludes by tying this public manifestation to what is suggested to be a distant echo of it, the Platonic conception of the virtue of justice. The connection suggested is that both Late Shang excellence and the Platonic virtue of justice are kindred forms of asserting the legitimacy of social stratification. Both forms can be construed as responses to the impact of specialized pastoralism.

STRATIFICATION, DIET, AND HUMAN SACRIFICE

STRATIFICATION

Evidence of specialized crafts and differentiation in grave goods and settlement patterns is frequently taken to indicate social stratification. This is a loose sense of the term. In the disambiguated sense in which the word is used here, a society is stratified if there is a group within it that acquires and maintains control over resources needed to make a living such as to effectively restrict access to them from other members of the society, for instance by imposing some kind of tax or labor requirement (Ames 2007; Fried 1967; Paynter 1989). In what follows, “stratification” will be used in this disambiguated sense.

In the ethnographic record, the earliest, most effective social organization for enforcing restriction on access to resources is the segmentary lineage: in effect, segmentary patrilineality. Lineality

of this kind emerges in ecological conditions of repetitive, long-term use of resources, access to which can be effectively controlled (Boone 1992, 316–317; Sahlins 1961, 342). A society that specializes in the herding of large animal domesticates is a typical example of a stratified society. Pastoralists are organized around male lineages (Borgerhoff Mulder et al. 2010; Janaki Holden and Mace 2003). In contrast, animal husbandry integrated with crop cultivation does not necessarily lead to stratification (Gurven et al. 2010). The key factor is control over an excludable resource needed by members of the community that are not part of the lineage (Blumberg and Winch 1972). A society that has diverse roles through which individuals can exercise competence and achieve recognition is a ranked society, but it is not necessarily stratified. In a society with rank, there are fewer such roles available for its members than there are individuals competent to fill them. However, no part of society exercises consistent and exclusive control over resources needed to make a living (Fried 1967, 109 ff.).

DIETARY PATTERNS

Nutritional status is a significant indicator that restrictions on resources essential for living are in place. It can tell us whether some categories of individuals are treated differentially in a way that impacts their health and life prospects. Nutritional status is inferred from stable isotope analyses of human and animal collagen. Such analyses indicate there were no significant differences in diet among Neolithic farmers of the Yangshao Culture of the Yellow River Basin, dated around 5000–3500 BCE (Pechenkina et al. 2005). Isotope values for this period reveal a heavy reliance on millets and some consumption of animal products, such as pigs.

There is disagreement over whether the Dawenkou Culture of Shandong, partly contemporary with the Yangshao Culture, was socially stratified or not. It had rank, since some graves were more richly furnished than others. One study of dietary patterns concludes that there is no evidence of differences in diet (Dong et al. 2019), while another sees some dietary evidence of social stratification in the Late Dawenkou period, around 2800–2500 BCE. Some, but not all, individuals in elaborate burials of the Late Dawenkou period have higher nitrogen isotope values. Nevertheless, not enough is known about the nitrogen isotope values of their food sources to assess whether the difference is due to restrictions on preferential foods or rather to the practice of manuring or to reliance on aquatic resources, both of which would raise nitrogen values (S. Chen et al. 2019, 48–49).

Domesticated cattle did not appear until the Longshan period, which followed the Yangshao in the Central Plains. The herding of sheep and goats may have been practiced by the Early Longshan period, but pigs were still the main source of meat. With respect to meat consumption, no significant difference was found between males and females of the Longshan Culture (Pechenkina et al. 2005, 1177–1184).

Individuals sampled for the proto-Shang period from around 2000–1600 BCE were from a site in southern Hebei Province that provides archaeological evidence of metallurgy, oracle bones, and walled settlements (Ma et al. 2016, 436). The variety of grave goods recovered from burials allowed for testing whether diet and social status were related to grave goods. The study found that diet was still predominantly based on millets and farm animals fed on millets, while pigs, but not cattle, sheep, or goats, were the main source of animal protein. A similar pattern is reported for the Longshan period site of Wadian (Ma et al. 2016, 439), which is one of the sites for which there is ancient DNA.

It appears that dietary patterns in the proto-Shang period had not changed much from the Yangshao era. There was no significant difference in nutrition between males and females, and differences in grave goods were not related to differences in nutrition. Overall, the results suggest an increasing differentiation among individuals, which is undeniable given the differences in grave goods. Nevertheless, individuals classified by archaeologists as low status did not suffer from relative malnutrition (Ma et al. 2016, 441). One can infer that Central Plains society between 2000–1600 BCE had not rationalized control over resources to the extent that it could have a noticeable impact on nutrition and health.

This state of affairs can be contrasted with the Central Plains of the Eastern Zhou period (770 BCE–220 CE). By then, the effect of stratification on diet had become evident. The main diet still consisted of millets complemented by a limited amount of protein for the more favored categories of individuals. The difference is that wheat replaced millets for the poor, wheat being perceived as an inferior food source (Zhou et al. 2017, 217). In the Central Plains, preference for millet persisted until the third century CE, when the introduction of the flour mill gave wheat products a newfound popularity (Yü 1977, 73, 81). Preference for wheat was limited to areas influenced by steppe pastoralist customs, such as Xinjiang, Gansu, and Qinghai (Zhou and Garvie-Lok 2013, 31–32). Coming back to the Eastern Zhou period, women suffered from diseases due to malnutrition in childhood that affected bone growth

(Dong et al. 2017, 935–936). Thus, by the eighth century BCE, the impact of stratification on diet was clear. This had not been the case as late as 1600 BCE.

What happened in the meantime? The Late Shang period is dated around 1250–1050 BCE. In Late Shang society, differences in nutritional status show up even among individuals who belonged to lineages of craftspeople. Quantity and quality of grave goods now correlate with evidence of greater animal protein consumption. Moreover, males consumed more animal protein than females. Males buried in a prone position, a ritual that had not previously been encountered in the Central Plains, seem to have been privileged with respect to access to animal protein (Cheung et al. 2015). Sacrificial victims, however, had a poorer diet than the local residents of the Late Shang capital (Cheung et al. 2017).

Thus, even people engaged in the crafts in the Late Shang capital, especially if they were male, consumed more animal protein than their predecessors from the Longshan and Yangshao periods, and apparently more than people of later periods, so they benefited from the Late Shang social arrangement. There were now differences in nutritional status not only between males and females but also within the category of craftsmen. Moreover, males buried in a prone position were not outcasts, but privileged. The Late Shang period marks a turning point in the implementation of policies that clearly indicate stratification had taken hold.

HUMAN SACRIFICE

Diet is not the only evidence for assessing the impact of stratification. Effective exclusion from the use of resources requires coercion. Stratified societies organized in patrilineal are efficient at directing aggression outward and controlling territory at the expense of non-stratified societies (Sahlins 1961, 336ff.). They also direct aggression inward. The internal redirection of aggression aimed at enforcing stratification takes the form of ritual human sacrifice. Social scientists appear to be confident that the connection between stratification and ritual human sacrifice is causal (Watts et al. 2016).

Pastoralists of the Eurasian steppe practiced human sacrifice, as did cultures on which they impinged, the cultures of the Late Neolithic Qijia (Liu and Chen 2012, 327) and Shimao (Sun et al. 2017). The evidence from Late Shang is unequivocal. Human sacrifice had appeared in the previous, Erlitou, period and was practiced on an unprecedented scale in Late Shang (Campbell 2018, 84). In the beginnings of the Late Shang polity, over 25 percent of the content of oracle bone inscriptions

pertaining to sacrifice refers to human sacrifice. This proportion drops to 5 percent toward the end. The beginnings of the Late Shang society, marked by King Wuding's reign, saw a particularly intensive use of human sacrifice, such that more humans than animals were sacrificed during his rule (Campbell 2018, 199–200).

Estimates of the number of human sacrificial victims during the entire Late Shang period vary from around 13,000 to 23,000 (Keightley 2012, 69). This figure excludes death attendants inhumed in elite graves. It is estimated that there was an average of between five and twenty-five victims per month over the entire duration of the Late Shang period. During Wuding's reign, there might have been well over a hundred sacrificial victims per month. Most of the victims in that period were fifteen- to thirty-five-year-old males (Keightley 2012, 76–77).

Like the elite, the non-elite inhabitants of Late Shang were organized into lineages. Even residential zones of the Late Shang capital, Yinxu, were organized by lineage groups (Liu and Chen 2012, 356). Organization into lineage groups would have applied to specialized craftspeople (Chang 1980, 230). The latter would have been charged with producing the sophisticated bronze artifacts and other elite items on which the rulers depended for conveying their preeminence to external clients and competitors. Keightley surmised that it is these specialized laborers who were referred to as the *zhong* in oracle bone divinations. There is no divination recording that the *zhong* were offered as sacrificial victims in oracular ceremonies (Keightley 2012, 70). According to Keightley, the human victims of Late Shang sacrificial rituals are unlikely to have belonged to Late Shang society. The matter is confirmed by recent studies. Sacrificial victims, according to isotopic data, were not locals, although they might have been kept alive for some time as laborers before being put to death (Cheung et al. 2017). If so, Late Shang society must have had effective means of applying physical coercion domestically, since these victims were men of military age.

In summary, the Late Shang elite successfully converted a complex but still not-yet-stratified society into one in which one lineage and its allies took control over resources. This feat had not yet been accomplished by around 1600 BCE. But it must have been after Wuding's reign, in light of what is known about nutritional status in the Central Plains before and after the Late Shang.

Given changes in dietary patterns detectable after the Late Shang and the clear prevalence of human sacrifice in the earliest phase of the Late Shang polity, there can be no doubt that much of the

task of governing was taken up with what one might call a definitive project of social engineering. Who were the subjects of this project? The next sections address this question by adding evidence from archaeology and archaeogenomics.

WHO WERE THE LATE SHANG?

THE EVIDENCE FROM ARCHAEOLOGY

The Late Bronze and Iron Age populations of the Central Plains were derived from the earlier Longshan and Yangshao populations. Both archaeology and now archaeogenomic data (Ning et al. 2020) are in agreement on this point. Archaeologists’ assessments can be adduced in favor of Shandong having a formative impact on pre-Late Shang society. K. C. Chang believed that the Longshan cultures of Henan and Shandong provided the foundation for the Late Shang Culture (Chang 1980, 340). Liu and Chen opine that the Shandong Longshan, who were descended from the Dawenkou Culture, merged with Central Plains Longshan Culture bearers to form a predecessor culture to Late Shang (Liu and Chen 2012, 216). Moreover, Shandong had copper and tin resources needed in the production of bronzes. Shelach-Lavi places the integration of Shandong in the Shang cultural sphere by the Middle Shang period, which he dates to around 1400–1300 BCE (Shelach-Lavi 2015, 198–200). Even more archaeological observations can be adduced.

Underhill points out that competition between the Central Plains and Shandong appears to have played out in the exchange of elaborate, eggshell-thin drinking cups, the impetus for which came from west Shandong. This competitive process seemed to continue to around 1900–1800 BCE. Similar drinking cups are found in west Henan (Underhill 1996, 141–143). The influence of styles might indicate a merging of populations, by which specialized craftworkers from Shandong joined what would later become the heartland of Erlitou Culture in the Central Plains.

Moreover, some early writing of the same general type as the oracle bone inscriptions of Late Shang was found in the Neolithic site of Shijia in Shandong (Keightley 2012, 28), while an inscribed oracle bone was found at Daxinzhuang in Shandong (Keightley 2012, 231).

While archaeologists have reservations about considering folklore from historical periods as evidence, one can add that the bird cult of the Shang people, which is alluded to in *Shijing* 4.5.303 and

which is tied to a purported Shang origin myth (Z. Chen 1999), places the beginnings of the Shang in Shandong. Some scholars see the bird motifs in Dawenkou pottery marks as pre-Shang, tying pre-dynastic Shang ancestors to the bird myth (Z. Chen 1999, 145; Keightley 2012, 363).

Finally, the influence of the Shandong Longshan Culture may have spread north. Some Shimao Late Neolithic jade blades and disks are similar to those found in the Shandong Longshan Culture (Sun et al. 2017). Shimao is situated in the Loess Plateau that lies north of the Central Plains. Converging evidence seems to support the idea that Shandong-related people were a source of the traditions of fine craftwork that made their way into the Late Shang polity.

There is also archaeological evidence to support a relationship between Late Shang and Lower Xiajiadian cultures. The latter provides the earliest evidence of the kind of oracle bone preparation that would become prevalent in Late Shang ceremonial (Flad 2008). Moreover, Chang believed that the beginnings of Shang bronze casting should be placed in the Lower Xiajiadian Culture (Chang 1980, 346). This early view on the beginnings of metallurgy in the Central Plains has been more recently reinforced by the suggestion that the piece-mold casting technology present in the Seima-Turbino phenomenon made its way to the Central Plains via the Lower Xiajiadian Culture (Lin and Liu 2017).

There is, in addition, archaeological support for cultural interaction between the Shimao Late Neolithic Culture and Eurasian Steppe communities, which might also have been a factor in the development of bronze metallurgy (Sun et al. 2017). It has also been suggested that the population of Shimao Late Neolithic Culture, after the downfall of their walled settlement, migrated southward to the Central Plains (Rowland 2017).

An indicator in favor of the idea that descendants of Late Neolithic Qijia Culture, in northwest China, left more than a cultural imprint on Late Shang society is that Qijia Culture yields evidence of the earliest remains of domesticated horses in China (Liu and Cheng 2012, 328). Horses and chariots were of vital importance to Late Shang rulers.

Finally, the role of the southeast Mongolia Ulaanzukh Culture in contributing skills in chariot warfare has recently received attention. There is evidence of a sudden increase in prone burials of death attendants in elite tombs of the Late Shang period. This form of burial is associated with specialists in chariot warfare from the north (Rawson et al. 2020). The hypothesis is that the source of this category

of specialists is ultimately the Ulaanzukh Culture of southeast Mongolia, which shares the prone burials and types of weapons and tools found in these death attendants' graves.

INFERENCES FROM ANCIENT DNA

While there are only two samples from the Late Shang period, each individual represents the genetic legacy of hundreds of predecessors, so examining even a small number of samples can be instructive. From the samples available it is possible to infer there was a Shandong-like population that spread westward to the Central Plains sometime between the Late Longshan and Late Shang periods. According to the dates of the samples on which this inference is based, the population movement would have occurred after 1900 but by around 1300 BCE. This is a period for which, as of this writing, there are no samples. The motive for thinking that a Shandong-like population was material to setting the stage for Late Shang development is that there exists a reasonable model in which individuals from Late Shang form a clade with a sample from the period of transition from the Mesolithic to the Early Neolithic in Bianbian, Shandong. This means that the Shang individuals are descended from a population represented by the sample from Bianbian. Central Plains Longshan and Yangshao do not share this characteristic at the same level of significance. Neither do West Liao River Basin individuals from the Lower Xiajiadian Culture. Samples from Late Neolithic Shimao and Qijia samples definitely do not share this characteristic (Appendix, Section 1).

Moreover, the Late Shang individuals are more north-shifted than the Central Plains Longshan for which there are currently samples (Appendix, Section 2). In this respect, they appear to be similar to an Early Neolithic individual from Boshan, Shandong, which gives additional, indirect support for believing that a Shandong-like population had an important impact on the descendants of the Central Plains Longshan Culture in the formation of the Late Shang.

One cannot exclude some additions from descendants of Late Neolithic Shimao and Lower Xiajiadian cultures, but they are neither more northern than Late Shang nor do they show the affinity to a Shandong-type population that the Late Shang individuals do, so they cannot have had a major impact on Late Shang. It is also possible that part of the northern shift in Late Shang is due to some influx from descendants of the Qijia Culture, known for horse breeding. Even so, the contribution from

descendants of the Qijia Culture cannot have been major, since the Late Neolithic Qijia individuals do not show any affinity to a Shandong-like population (Appendix, Sections 1 and 2).

Finally, it is possible to model Late Shang individuals with Late Bronze Age Ulaanzukh samples from Mongolia. This is not the case for the other populations examined, except for Lower Xiajiadian, although at a lower threshold of non-rejectability (Appendix, Section 3). Minor Ulaanzukh presence could be a factor in the more northern profile of Late Shang in comparison with the Central Plains Longshan (Appendix, Section 2). It is possible that it made its way from southeast Mongolia into the Central Plains via the West Liao River Basin, which was occupied by the Lower Xiajiadian Culture.

If one can draw a preliminary sketch of what the Late Shang were like, it would probably be a combination of Central Plains Longshan and an as-yet unsampled population that was most likely from Shandong and made its presence felt after 1900 but no later than around 1300 BCE. Some Ulaanzukh input to this mix is possible. One cannot rule out descendants from populations neighboring the Central Plains, such as from the Qijia and Lower Xiajiadian cultures, nor can one rule out descendants from the Late Neolithic Shimao Culture. Among the last three, the evidence in favor of an influence of Lower Xiajiadian on Late Shang is somewhat stronger.

THE LATE SHANG: SUMMARY

Who were the targets of the message communicated by the Late Shang public ritual of oracular consultation that cemented the status of the ruling lineage? A workable answer is that it was mainly a Shandongified Central Plains population. It is possible that the internal population of the Late Shang polity could also have incorporated descendants of northern populations such as the Qijia Late Neolithic Culture or perhaps the Late Neolithic Shimao Culture. Qijia, especially, was a source of horses and horse breeders, which the Late Shang needed. The Late Neolithic Qijia and Shimao cultures were accustomed to human sacrifice and their descendants might have been more likely to accept it. Input from Lower Xiajiadian of the West Liao River Basin also has some plausibility. It would be consistent with its being a source of the specific mode of oracle bone preparation characteristic of the Late Shang and also with its being a transit point for bronze casting technology from the Seima-Turbino phenomenon. The West Liao River area could, moreover, have been the route that the southeast Mongolian Ulaanzukh took on their way to the Central Plains.

It is possible that a military elite of ultimately southeast Mongolian provenance not only ensured the upkeep and operation of chariots for warfare but may also have contributed to enforcing the Late Shang political order. But it is a blend of Central Plains and Shandong-like populations that might have provided the lineages that looked after the production of goods on which the Late Shang elite relied. It is this blend that could have formed a significant part of the audience bearing witness to Late Shang sacrificial rituals.

LATE SHANG EXCELLENCE: THE LINEAGE OF THE PEERLESS

Oracle bones and their inscription played a role in statecraft. The implicit conception of action and decision-making they instantiate convey the vantage point of the ruling lineage. Oracle bone inscriptions tell us, indirectly, that excellence was seen as the demonstration of virtuosity in deliberation. We are used to thinking of excellence as a personal disposition. But, before the humanistic turn that came much later with Confucianism (V. Chen 2014), excellence was public. The ceremony of oracular consultation was in effect for the most part a consultation about matters of stewardship with deceased lineage heads. Like an apt steward of family resources, the ruler demonstrated his standing as one who deliberates with, or sometimes hosts, past lineage heads in conversations about managing the lineage's domain.

Ancestral lineage heads would have acquired an abstract and temporal dimension by being identified with days of the ritual calendar, in which individuals of past generations were blended into virtualized ancestors. This enabled the ruling lineage to create a conception of time that shaped the socially shared calendar of events. The deliberation conducted between virtualized, past lineage heads and the current, physical instantiation of the lineage in the body of the ruler was enacted with oracle bones or plastrons "speaking" through the sounds and cracks they made when heated. The main beneficiaries of the ceremonies of oracular consultation with past lineage heads would have been all males descended from the current ruler's direct ancestors or his uncles (Chang 1980, 100).

Late Shang rulers seem to have had the foresight to broaden their appeal. The allegiance of women relatives and individuals not related to the ruling lineage might have been enhanced by incorporating their participation in the preparation and enactment of ceremonies. Female relatives are

thought to have been involved in the ritual preparation of oracle bones and plastrons (Keightley 1978, 16–17). Diviners in the first period of the Late Shang era, which saw the greatest number of human sacrifices, would have been called upon to “read” the voicings, that is, the physical cracks in the bones or plastrons. These interpreters could have been relatives of royal consorts (Keightley 1983, 549, 553).

The ritual and oracles could not have been incomprehensible to those who were neither part of the ruling lineage nor indirectly related to it. In fact, the ceremonies of oracle bone cracking and attendant sacrifices could not have fulfilled their function of enforcing power if they had not been witnessed by those who did not belong to the ruling lineage. The large expenditure of resources and life that accompanied oracular ceremonies called for public display. And public display requires an audience.

So we return to the issue of who would have been the most important domestic audience of the ceremonial of ritual consultation between the ruler and virtualized ancestors, sealed with a profuse shedding of human blood, which had no other function than to enforce stratification. It is most likely those on whom the rulers depended for the production of elite goods that sustained their status. The production of bronze artifacts, notably, reaches new heights in the Late Shang period both in quantity and elaborateness of design.

One might ask why bronze objects were not favored as the medium for oracular consultations. Part of the answer relies on extant tradition, since oracle bones were prepared in the Late Neolithic Lower Xiajiadian Culture in a manner that is very similar to Late Shang practices. Another part of the answer is that those who were capable of producing the needed bronze or jade artifacts would have been specialized craftspeople, who were organized in their own lineages. They were the ones who were to be excluded from the conduct of community affairs while, at the same time, their cooperation had to be ensured, since they were the people on whose labor the ruling lineage depended.

The ritual time inhabited by virtualized Late Shang ancestors of the ruling lineage was the framework through which the attachment shown by specialized workers to their own ancestral lines could be integrated into and then subordinated to the interests of the ruling lineage. Perhaps these workers were, after all, not distantly removed from the Late Shang elite, if they all shared common Central Plains and Shandong-sourced ancestry. That would have been all the more reason for the Late

Shang rulership to assert distinctions. How else could one convince distant relatives that they no longer have any business participating in family affairs?

The spectacular bloodshed of human sacrifice would have been effective in amplifying social distance from the ruling lineage. Nevertheless, it would not have been shrewd to use up the pool of specialized craftspeople as sacrificial victims. That is probably why specialized workers were not mentioned as targets of human sacrifice and perhaps also why some of them were well fed. Certainly, it appears that the craftsmen of the Late Shang period had access to more animal protein than the people of preceding and later periods.

The Late Shang rulers' ritual consultation with their own deceased lineage heads, expressed through the manipulation of oracle bones and plastrons, brought home to the audience of specialized workers that their skills were not called upon in deliberations concerning how to organize the life of the community and set its goals. That implicit message would not have been persuasive if the means of communication with ancestors of the ruling lineage had to be mediated through bronze or jade artifacts. These were objects that could not be produced without the expertise of the lineages of craftspeople. If bronze or jade artifacts were used as media for such rituals, the ritual of ancestral voicings would have laid bare the dependency of the ruling lineage on the skills of the specialized craftspeople, and that would have diluted the effect of the sacrificial shedding of human blood.

For all the need to create distance, the scenario of a conversation between the ruler and Late Shang virtual lineage heads enacted by heated oracle bone "voicings" would have been intelligible to the audience of specialized craftspeople. They were familiar with how decisions about household and lineage affairs are reached. The ordinary process of decision-making among them probably took place through conversational exchanges among older and younger lineage members and probably incorporated some sharing of food and drink.

The Late Shang rulers devised a ritual that was meaningful not just to themselves but that could also be understood by those they intended to exclude. It consisted of a process of consultation with members of the older generation, sealed with food and drink. Those to be excluded, the specialized workers, still needed to be part of the community. The dramatization of communication with ancestral lineage heads through oracle bone manipulations — which did not require the same degree of productive virtuosity as bronze metallurgy or the manufacture of jade ornaments — and the shedding

of human blood as a way of offering nourishment to ancestral lineage heads were the means through which both inclusion and exclusion were manifested simultaneously and in public.

The specialized craftspeople were included in the proceedings as witnesses validating a ceremony that symbolized deliberation and decision-making among ruling lineage members. Deliberation and decision-making were processes specialized craftspeople understood. They also must have understood they were being excluded and were validating their own exclusion through their very presence as witnesses. The excellence of the Late Shang ruling lineage did not rest in productive virtuosity. They did not have it. The specialized craftspeople did. Excellence had to be displaced to what the Late Shang rulers could control through coercion, which was exclusionary decision-making in managing resources and setting goals for the community.

Late Shang spectacular sacrificial ritual, especially during the reign of first ruler Wuding, aimed at supporting enforced control over complex, coordinated activity in crafts, animal husbandry, and crop cultivation to benefit the ruling lineage. Why was spectacular human sacrifice necessary? The answer is that stratification in the Central Plains had developed from the inside. The Late Shang ruling elite probably voluntarily drew in supporting specialists in warfare from southeast Mongolia, who were not external conquerors but rather adjuncts to the ruling lineage. Stratification was not imposed from the outside by conquest, which is by definition coercive. The coercion had to be all the more memorable since it came from a lineage that other social groups might not have initially considered more deserving than their own. Prior to the Late Shang period, there are signs of increasing social differentiation. After the Late Shang, stratification definitively set in.

CONCLUSION

Chang had seen that the transformation that occurred in the Bronze Age Central Plains was internal, in the sense that it was not brought about by external conquest (Chang 1980, 329). The transformation that is the topic of this paper is the institution of a stratified social organization. The Late Shang elite captured the process of diversification of complementary, coordinated activities that had been building up since the Late Neolithic for the benefit of their lineage. They represented decision-making, to themselves and to the specialized craftspeople on which they depended, as a ritual conversation about

community stewardship with deceased lineage heads. That is how they signaled their preeminence. The outcomes of ritual trans-generational deliberations within the ruling lineage were sealed with lavish public demonstrations of human sacrifice. The proceedings taught the productive members of society that they were excluded from participating in deliberation about community affairs but also that they must participate in the maintenance of this hierarchical dominance.

We can infer a tentative picture of the source populations of the individuals that were called upon to bear witness to these rituals. They were perhaps primarily a Shandong-derived population that had mixed with their Central Plains counterparts. The resulting melting pot could have incorporated descendants of the Lower Xiajiadian Culture, and perhaps also of the Qijia and Late Neolithic Shimao cultures, although, for the latter, archaeological evidence is more compelling than evidence from ancient DNA.

There is no doubt that the populations of the Eurasian steppe that were instrumental in transmitting metallurgical know-how (Linduff and Mei 2009) were stratified societies organized into patrilineal groups. By the Late Bronze Age, all Eurasian societies would have had to adapt in some way or other to the impingement of these patrilineal groups, through which metallurgy, horses, and chariots spread. The Late Shang had all three. Metallurgy, horses, and chariots were put to use in warfare. The Late Shang were the first to do so in the Central Plains, through a process of social transformation from the inside. It is likely that they were assisted by specialists in chariot warfare from southeast Mongolia Ulaanzukh, to which they probably awarded special status. The evidence for this is primarily archaeological, but it is also tentatively supported by ancient DNA.

It is something of an accident of plate tectonics that the broad landmass connecting China to Europe is suitable to pastoralism, a mode of resource use that developed in the wake of the Neolithic adoption of integrated plant cultivation and animal husbandry, especially cattle domestication. Pastoralist societies that specialize in the herding of large animal domesticates are stratified. Their adaptation to the Eurasian steppes is likely a factor that was instrumental in transforming Eurasia into the locus of the most intense form of social inequality on record worldwide (Kohler et al. 2017). We do not know the details of how social stratification was implemented in Europe, although we know it must have been largely in place in the second millennium BCE and probably earlier, since early steppe pastoralist incursions date as far back as the last half of the fifth millennium BCE. We are not likely to

know the details because the transformation occurred in societies that were not literate. There is no reason to rule out myth as a source of insight to complement what can be learned from archaeology and archaeogenetics.

The pattern in Indo-European mythology that Dumézil thought he had found is significant for conveying a world view in which inequality is written into the nature of things. It is the world view that we can presume derived from the pastoralist lifeway of the Proto-Indo-Europeans. Modern anthropological studies of pastoralist societies describe them as typically organized into patrilineal lineages: traditional pastoral production is family-based but can be complemented with the labor of families poor in livestock. Over 80 percent of pastoralist societies have social strata, which can include forms of hereditary slavery. Moreover, pastoralists have an ideology of male valor, exemplified in some cases by special institutions of warriorhood (Borgerhoff Mulder et al. 2010, 36). The cultures described are twentieth-century pastoralists of East and West Africa and southwest Asia. In all cases, herds included large animal domesticates. The short description provided above might well have applied to Bronze Age pastoralists or those of the Eneolithic from Ukraine and parts of southern Russia, with whom speakers of Proto-Indo-European are currently identified. Dumézil's thesis, for all the criticism it has encountered, probably captures something of the way Eneolithic herders of the Ukrainian and Russian steppes thought about their social world.

There is no comprehensive theory of social development that satisfactorily accounts for the emergence of stratification. A frequently expressed belief seems to be that it arises naturally from surplus production (Childe 1951; Amin 1974). Drawing on Amin's neo-Marxian categories, as some archaeologists have done recently, pre-Shang society would be categorized as a blend of surplus-generating community mode of production, simple commodity exchange, and long-distance trade. Shang society would be described in terms of a tribute-paying mode of production, which replaces Marx's Asiatic mode of production. This kind of categorization, although useful, does not address how the Shang of the ruling lineage were able to extract tribute. The view implied in this paper is that it had to create a form of stratification to match the stratification embedded in the organization of pastoralist societies and that it did so because it could not otherwise procure horses and chariots, resources that originated in the Eurasian steppes and that were necessary for waging war.

Theories of social development could probably articulate more compelling analyses of social stratification by drawing on studies of the lifeways of pastoralists, but also the lifeways of communities that were or are able to exercise exclusive control over resources, since it is the exercise of exclusive control that is the key to stratification. Pastoralism is one form in which exclusive control over a resource is implemented. There are still opportunities for new ways of thinking about the pastoralist worldview, as exhibited in Indo-European mythology. A recent proposal that highlights the highly stratified character of the Indo-European outlook as expressed in mythology suggests that the fundamental worldview of Proto-Indo-European pastoralist society reserved the status of human only to those who exercise control, the herders. The other elements of society are dehumanized and are categorized as dog or sheep. They either assist the herder as a sheepdog or serve the herder’s consumption as sheep (Nakagawa 2021). There is perhaps an implicit reference to Thrasymachus’s conception of justice in *Republic* 343b in this arrangement. The new tripartite proposal suggests that speakers of proto-Indo-European thought lineage relationships applied only to themselves, those rich in herds. They would not apply to humans that were slotted to play the second and third roles. This view assumes that sheepherding was the primary occupation of the speakers of Proto-Indo-European and that it was the herding of sheep, not large animal domesticates, that shaped their social outlook. Palaeozoological evidence might help sort out the plausibility that a sheepherding model was fundamental to how speakers of Proto-Indo-European construed their social world.

Domesticated dogs have indeed been present in Siberia since the Late Paleolithic (Perri et al. 2021). Faunal analyses of the Pontic-Caspian steppes argue for the appearance of animal domesticates sometime in the last half of the sixth millennium BCE from a western source, the farmers of the Linear Pottery Culture. The whole package, including cattle, pigs, sheep, and goats, is first brought to west Ukraine (Motuzaitė Matuzevičiūtė and Telizhenko 2016, 103). From there, domesticated animals would have made their way to the Dnieper Basin. Animal domesticates appear in the Lower Volga Basin around the first half of the fifth millennium (Vybornov et al. 2015, 68, 72). There is apparently no stage at which only domesticated sheep to the exclusion of cattle were being herded in Dnieper and Volga basins (Motuzaitė Matuzevičiūtė 2014, Table 2). Faunal analyses for most of the areas relevant to the origins of the Proto-Indo-Europeans tend not to favor the claim that a shepherd/dog/sheep relationship was primordial.

Nevertheless, it is not clear whether there were only domesticated sheep in the northern Caspian Sea region or whether the lack of cattle bones in the area reflects limited bone sampling (Vybornov et al. 2015, 73). While the region to the north of the Caspian Sea does not seem to be favored as the ultimate source of the Proto-Indo-Europeans, one cannot really say for sure. The Proto-Indo-Europeans acquired substantial Caucasus Hunter-Gatherer admixture, the source of which is still unknown. Perhaps this source population specialized in sheepherding. One therefore cannot entirely rule out that some sheepherding community had an impact on the formation of the Proto-Indo-Europeans. The issue is resolvable and might soon be. Whatever the verdict, Nakagawa's proposal offers fertile ground for thinking about how Dumézil's thesis could apply to the Proto-Indo-European question. It could continue to do so as a model-to-think-about even if not directly supported by paleozoological evidence because it forcefully highlights an important feature, the inegalitarianism amply manifested in Indo-European myths. It also serves as a reminder that stratification is not compellingly explained as something that seamlessly evolved from surplus-generating farmers, as theories of social development appear to assume.

The Platonic ideal of justice can be thought of as a distant, literary echo of the preliterate pastoralist ethos expressed in myth. It is the impact of steppe social stratification that we see reflected jointly in Plato's narrative of an ideal society and the Late Shang's ritual of exclusion. In both cases the rulership exercises the prerogative of decision-making. Its rule is supported by a warrior elite. The Platonic conception of justice would have each order within society act in accordance with its proper function. This applies especially to those who support the community through productive labor. They are excluded from deliberating about the conduct of community business (Plato 1961, 421c, 433b, 434a). Their participation in deliberation about community affairs would be, in the Platonic view expressed in *Republic*, a corruption of justice. It would be incompatible with human excellence.

Late Shang oracle bone inscriptions give us something not available for Europe, a ringside view of the definitive implementation of stratification. The public manifestation of the ruler's wisdom in deliberation needed to be punctuated by ostentatious sacrifice of human lives and sent a message its audience could not have failed to register. It conveyed in an overwhelming sensory experience what *Republic* could only express in a shadow form, which is that, for the greater part of the polity, the just

order of society rested on most of its members bearing witness to their own exclusion from community affairs.

APPENDIX

This appendix provides the results on which the statements concerning populations are based. Only new results, not available in the literature as of this writing, are presented. The following are the samples available as of this writing and on which the results are based.

SAMPLES FROM NING ET AL. 2020:

Sample ID, location and dates of samples:

- Grouped as Late Shang (2 samples): JXNTM23, Jiaozuoniecun, 1231–1123 calBCE; JXNTM2, Jiaozuoniecun, ~3000 BP.
- Grouped as Longshan (8 samples): HJTM107, Haojiatai, 2118–1950 calBCE; HJTM109, Haojiatai, 2031–1888 calBCE; PLTM312, Pingliangtai, 2135–1939 calBCE; PLTM313, Pingliangtai, 2118–1894 calBCE.; PLTM310, Pingliangtai, 2275–2045 calBCE; PLTM311, Pingliangtai, 2201–1844 calBCE; WD-WT1H16, Wadian, 2239–2033 calBCE; WD-WT5M2, Wadian, 4000–3900 BP.
- Grouped as Yangshao (8 samples): WGM35-1, Wanggou, 5500–5000 BP; WGM20, Wanggou, 5500–5000 BP; WGM35, Wanggou, 3354–3106 calBCE; WGM43, Wanggou, 5500–5000 BP; WGM70, Wanggou, 5500–5000 BP; WGM76S, Wanggou, 5500–5000 BP; WGM94, Wanggou, 5500–5000 BP; XW-M1R18, Xiaowu, 4225–3987 calBCE.
- Grouped as Amur River Valley Early Neolithic (AR_EN) (2 samples): WQM4, Wuqi, 5430–5270 calBCE; ZLNR-2, Zhalaينوer, 5525–5460 calBCE.
- Grouped as Lower Xiajiadian (3 samples): EDM124, Erdaojingzi, 1664–1543 calBCE; EDM139, Erdaojingzi, 3970–3294 BP; EDM176, Erdaojingzi, 3970–3294 BP.
- Grouped as Qijia (7 samples): JCKM1-1, Jinshankou, 1948–1884 calBCE, LJM14; Lajia, 4000–3800 BP; LJM25, Lajia, 4000–3800 BP; LJM2, Lajia, 4000–3800 BP; LJM3, Lajia, 2125–1959 calBCE; LJM4, Lajia, 4000–3800 BP; LJM5, Lajia, 4000–3800 BP.
- Grouped as Shimao Late Neolithic (3 samples): SM-SGDLM27, Shengedaliang, ~4000 BP; SM-SGDLM6, Shengedaliang, 2193–2035 calBCE; SM-SGDLM7X, Shengedaliang, ~4000 BP.

SAMPLES FROM YANG ET AL. 2020:

Sample ID, location and dates of samples:

- Bianbian, Bianbian, Shandong, 9545–9480 calBP.
- Boshan, Shandong, 8320–8040 calBP.
- Liangdao2, Liang Island, 7590–7560 calBP.
- Qihe2, Fujian, 8428–8359 calBP.

SAMPLES FROM WANG ET AL. 2020:

Sample ID, location and dates of samples:

- Grouped as Mongolia_LBA_2_Ulaanzukh (4 samples), I12960, I12972, I14037, I13964, Ulaanzukh, 1447–1296 calBCE.
- All other individuals/populations are from a curated dataset, V42.4, the dataset current at the time of writing, available at <https://reich.hms.harvard.edu/allen-ancient-dna-resource-aadr-downloadable-genotypes-present-day-and-ancient-dna-data>.

For inferences concerning relationships among populations, the software used is *qpDstat* 755, *f4* mode; *qpWave* 410, setting allsnps: YES.

f4 statistics measure the covariance of allele frequency differences between two populations pairs (Haak et al. 2015; Patterson et al. 2012). *qpWave* summarizes information from multiple *f4* statistics. *qpWave* can be used to make inferences about whether a set of populations (also called “left populations”) are cladal with respect to a set of reference populations (also called “right populations”). It can also be used to indicate how many waves of populations can account for admixture among populations (the “left populations”) with respect to a set of reference populations (“right populations”). Reference populations are populations from which there is no recent gene flow into the “left populations.”

The choice of reference (“right”) populations closely tracks Yang et al. 2020: Ethiopia_4500BP_published.SG, Russia_Ust_Ishim_HG_published.DG, Russia_Kostenki14.SG,

Iran_GanjDareh_N, Yana_UP.SG, Russia_HG_Karelia, Papuan.DG, Indian_GreatAndaman_100BP.SG, USA_Ancient_Beringian.SG, China_Tianyuan, Ikawazu, Kolyma_M.SG, Laos_Hoabinhian.SG, Russia_BA_Okunevo.SG, Indus Periphery (merged Turkmenistan_Gonur_BA_2 and Iran_BA2_ShahrISokhta). These samples are in the V42.4 dataset.

For inferences using *qpWave*, the cut-off point for not rejecting results is $p \geq 0.05$. In some cases, results at $p \geq 0.01$ are noted.

SECTION 1: POSSIBLE RELATIONSHIP BETWEEN LATE SHANG AND AN AS-YET UNSAMPLED SHANDONG POPULATION

Using *qpWave* for cladality tests of Central Plains populations and northern neighbors with Boshan, a Shandong representative, one can establish that no population is cladal with Boshan when Bianbian, an earlier individual from Shandong, is included in the reference (“right”) populations, representing deeper ancestry, from which no recent admixture is expected (Table 1a).

The set of reference (“right”) populations for these models includes Bianbian and Qihez.

Table 1a Test of cladality: Boshan, Late Shang, and other populations of the Central Plains and northern neighbors

X and Boshan in “left”	p-value
X=Late Shang	9.72E-06
X=Longshan	1.50E-05
X=Yangshao	1.15E-04
X=Lower Xiajiadian	2.42E-03
X=Qijia	1.12E-07
X=Shimao Late Neol	1.11E-03
X=Mongolia Ulaanzukh	5.25E-09

However, one cannot reject that Late Shang is cladal with Bianbian if Bianbian is rotated out of the reference (“right”) populations into the “left” populations and treated as a possible source, an indication

that there was gene flow from a Shandong-like population in Late Shang. If non-rejectability is broadened to include models with $p \geq 0.01$, then Longshan and Lower Xiajiadian may also have received gene flow from a Shandong-like population, and so would Yangshao, at least given the samples available. Qijia, Shimao Late Neolithic, and Ulaanzukh do not give evidence of gene flow from a Shandong-related population (Table 1b).

Table 1b Test of cladality: Bianbian, Late Shang, and other populations of the Central Plains and northern neighbors

X and Bianbian in “left”	p-value
X=Late Shang	1.02E-01*
X=Longshan	1.81E-02†
X=Yangshao	3.57E-02†
X=Lower Xiajiadian	1.94E-02†
X=Qijia	1.67E-05
X=Shimao Late Neol	9.06E-03
X=Mongolia Ulaanzukh	1.12E-05

* light-green shading indicates $p > 0.05$

† light-yellow shading indicates $p > 0.01$

In comparison with Longshan, Yangshao, and Lower Xiajiadian, Late Shang has a stronger affinity to a Shandong-like population. Qijia and Shimao Late Neolithic do not show this affinity. They are not likely to be a major source of population influx into Late Shang, nor can one anticipate that Ulaanzukh was a major source of population influx. That descendants of the Qijia and Shimao Late Neolithic cultures are not likely to be major sources of population influx into Late Shang society is an informative result.

Conclusion

It is possible that Late Shang differs from earlier Central Plains populations, but also from northern neighbors, by an affinity with an as-yet unsampled population that is here represented by an individual from Shandong from the period of the transition to the Neolithic.

SECTION 2: NORTHERN SHIFT FROM LONGSHAN TO LATE SHANG AND POSSIBLE SIMILARITY WITH AN AS-YET UNSAMPLED SHANDONG POPULATION

The issue of whether there was a north–south movement of populations from the Longshan period to Late Shang can be addressed by looking at whether there was a change in affinity for a northern population over a southern one in the transition from Longshan to Late Shang. Amur River Basin Early Neolithic (AR_EN) is used here to stand for a northern population, while Qihe2, from Fujian, represents a southern coastal population. Mbuti is a stand-in for an outgroup population that is genetically equally distant from all the populations examined.

If the Z -score of the f_4 statistic of the form $f_4(\text{Mbuti}, X; \text{Qihe2}, \text{Amur River Early Neolithic})$ is close to zero, the population X is symmetrically related to the southern and northern populations. If Z is significantly positive ($Z \geq 3$), population X shares more affinity with the north Asian rather than the south Asian population.

Given the results in Yang et al. 2020 and Ning et al. 2020, all tested populations are expected to show an affinity to a northern population, that is, Amur River Early Neolithic, over a southern population represented by Qihe2. This would be indicated by a positive Z -score for the f_4 statistic. A significant result has $|Z| \geq 3$. Ning et al. 2020 also report results at a lower threshold, $|Z| \geq 2$.

Late Shang individuals show greater affinity with a north Asian population in comparison with the sampled Longshan individuals. Some of the northern shift could be due to the contribution of a combination of any of the other northern populations (Lower Xiajiadian, Qijia, Shimao, Ulaanzukh.)

Table 2a Comparative strength of affinity for a north Asian population among Late Shang and other populations of the Central Plains and northern neighbors

X	f_4 (Mbuti, X; Qihez, AR_EN)	Standard Error	Z	#SNPs
Late Shang	0.003096	0.000916	3.381	70373
Longshan	0.00187	0.000705	2.652	74238
Yangshao	0.002323	0.000792	2.932	74133
Lower Xiajiadian	0.003148	0.000984	3.199	67932
Qijia	0.003835	0.000774	4.956	74024
Shimao Late Neol	0.002834	0.000878	3.227	73924
Mongolia Ulaanzukh	0.005408	0.000772	7.001	73155

It can also be noted that Late Shang shows a northern affinity that is similar to that of Boshan, a representative of a Shandong Neolithic population, and so the northern shift in Late Shang can be due to an as-yet unsampled Shandong population (Table 2b).

Table 2b Boshan: Affinity for a north Asian population

X	f_4 (Mbuti, X; Qihez, AR_EN)	Standard Error	Z	#SNPs
Boshan	0.003479	0.001054	3.301	73512

Conclusion

There appears to be a northern shift in the Central Plains from the Longshan period to the Late Shang. It is possible that a blend derived from populations like Shimao Late Neolithic, Lower Xiajiadian, Qijia Late Neolithic, or Ulaanzukh could have accounted for some of the northern shift in Late Shang in comparison with Longshan, although the contribution of Qijia, Shimao, or Ulaanzukh could not have been major, given their lack of Shandong-like affinity, as noted in Section 1.

Boshan, a Neolithic-era individual from Shandong that represents an as-yet-unsampled Shandong population, is more north-shifted than Central-Plains Longshan. That is consistent with an

as-yet unsampled population from Shandong's being a possible source of the northern shift in Late Shang in comparison with the Central Plains Longshan.

SECTION 3: POSSIBLE PRESENCE OF ULAANZUKH IN LATE SHANG

qpWave is used to test whether the hypothesis that two waves of distinct populations, represented by Liangdao2 and Mongolia Ulaanzukh, can model various populations of interest (X). The reference populations ("right populations") for these models is the full set, including Bianbian and Qihez. Liangdao2 represents a southern source.

Only in the case of Late Shang is the hypothesis that Mongolia Ulaanzukh can serve as a northern source clearly not rejected. The hypothesis is not rejected for Lower Xiajiadian at a lower threshold. It is rejected for all other populations (Table 3).

Table 3 Ulaanzukh can model Late Shang and, perhaps, Lower Xiajiadian

X, Liangdao2, and Mongolia Ulaanzukh in "left"	p-value
Late Shang	1.04E-01*
Longshan	1.08E-07
Yangshao	5.35E-07
Lower Xiajiadian	3.08E-02 [†]
Qijia	3.43E-09
Shimao Late Neol	2.67E-05

* light-green shading indicates $p > 0.05$

† light-yellow shading indicates $p > 0.01$

Conclusion

It is possible that Ulaanzukh was present in Late Shang society. Given that the result for Lower Xiajiadian is significant at $p > 0.03$, it is possible that individuals similar to the Ulaanzukh samples made their way from Mongolia to the Central Plains via the West Liao River Basin and that their presence might have had some impact on the composition of the Lower Xiajiadian population.

REFERENCES

- Ames, K. M. 2007. “The Archaeology of Rank.” In *The Handbook of Archaeological Theories*, ed. R. A. Bentley, H. D. G. Maschner, and C. Chippendale, 487–513. Lanham, MD: Alta Mira Press.
- Amin, S. 1974. “Modes of Production and Social Formations.” *Ufahamu: A Journal of African Studies* 4(3): 57–85.
- Blumberg, R. L., and R. F. Winch. 1972. “Societal Complexity and Familial Complexity: Evidence for the Curvilinear Hypothesis.” *American Journal of Sociology* 77(5): 898–920.
- Boone, J. L. 1992. “Competition, Cooperation and the Development of Social Hierarchies.” In *Ecology, Evolution and Social Behavior*, ed. E. A. Smith and B. Winterhalder, 301–337. New York: Aldine de Gruyter.
- Borgerhoff Mulder, M., I. Fazio, W. Irons, R. L. McElreath, S. Bowles, A. Bell, T. Hertz, and L. Hazzah. 2010. “Pastoralism and Wealth Inequality: Revisiting an Old Question.” *Current Anthropology* 51(1): 35–48.
- Campbell, R. 2018. *Violence, Kinship and the Early Chinese State: The Shang and Their World*. Cambridge University Press.
- Chang, K.-C. 1980. *Shang Civilization*. New Haven: Yale University Press.
- Chen, S., Q. Yu, M. Gao, M. Miller, G. Jin, and Y. Dong. 2019. “Dietary Evidence of Incipient Social Stratification at the Dawenkou Type Site, China.” *Quaternary International* 521: 44–53.
- Chen, V. 2014. “The Fading of Political Theology and the Rise of Creative Humanism.” In *Dao Companion to Classical Confucian Philosophy*, ed. V. Shen, 23–51. Dordrecht: Springer.
- Chen, Z. 1999. “A Study of the Bird Cult of the Shang People.” *Monumenta Serica* 47: 127–147.
- Cheung, C., Z. Jing, J. Tang, D. A. Weston, and M. P. Richards. 2017. “Diets, Social Roles, and Geographical Origins of Sacrificial Victims at the Royal Cemetery at Yinxu, Shang China: New Evidence from Stable Carbon, Nitrogen, and Sulfur Isotope Analysis.” *Journal of Anthropological Archaeology* 48: 28–45.
- Cheung, C., Z. Jing, J. Tang, Z. Yue, and M. P. Richards. 2015. “Examining Social and Cultural Differentiation in Early Bronze Age China Using Stable Isotope Analysis and Mortuary

- Patterning of Human Remains at Xin'an Zhuang, Yin Xu." *Archaeological and Anthropological Sciences* 9: 799–816.
- Childe, V. G. 1951. *Man Makes Himself*. New York: New American Library.
- David Reich Lab. 2020. Allen Ancient DNA Resource (AADR): Downloadable Genotypes of Present-Day and Ancient DNA Data. Formerly, Downloadable Genotypes of Present-Day and Ancient DNA Data (Compiled from Published Papers). V42.4. March 1 2020 <https://reich.hms.harvard.edu/allen-ancient-dna-resource-aadr-downloadable-genotypes-present-day-and-ancient-dna-data>.
- Dong, Y., C. Morgan, Y. Chinenov, L. Zhou, W. Fan, X. Ma, and K. Pechenkina. 2017. "Shifting Diets and the Rise of Male-Biased Inequality on the Central Plains of China during Eastern Zhou." *Proceedings of the National Academy of Sciences* 114(5): 932–937.
- Dong, Y., L. Lin, X. Zhu, F. Luan, and A. Underhill. 2019. "Mortuary Ritual and Social Identities during the Late Dawenkou Period in China." *Antiquity* 93(368): 378–392.
- Ember, C. R., M. Ember, and B. Pasternak. 1974. "On the Development of Unilineal Descent." *Journal of Anthropological Research* 30(2): 69–94.
- Dumézil, G. 1995. *Mythe et épopée*. Paris: Gallimard.
- Flad, R. 2008. "Divination and Power: A Multi-Regional View of the Development of Oracle Bone Divination in Early China." *Current Anthropology* 49(3): 403–437.
- Fried, M. H. 1967. *The Evolution of Political Society: An Essay in Political Anthropology*. New York: Random House.
- Gurven, M., M. Borgerhoff Mulder, P. L. Hooper, H. Kaplan, R. Quinlan, R. Sear, S. Bowles, E. Schniter, C. von Rueden, T. Hertz, and A. Bell. 2010. "Domestication Alone Does Not Lead to Inequality: Intergenerational Wealth Transmission among Horticulturalists." *Current Anthropology* 51 (1): 49–64.
- Haak, W., I. Lazaridis, N. Patterson, N. Rohland, S. Mallick, B. Llamas, G. Brandt, S. Nordenfelt, E. Harney, K. Stewardson, Q. Fu, A. Mittnik, E. Bánffy, C. Economou, M. Francken, S. Friederich, R. G. Pena, F. Hallgren, V. Khartanovich, A. Khokhlov, M. Kunst, P. Kuznetsov, H. Meller, O. Mochalov, V. Moiseyev, N. Nicklisch, S. L. Pichler, R. Risch, M. A. Rojo Guerra, C. Roth, A. Szécsényi-Nagy, J. Wahl, M. Meyer, J. Krause, D. Brown, D. Anthony, A. Cooper, K. W. Alt, and D. Reich. 2015.

- "Massive Migration from the Steppe Was a Source for Indo-European Languages in Europe."
Nature 522 (7555): 207–211.
- Janaki Holden, C., and R. Mace. 2003. "Spread of Cattle Led to the Loss of Matrilineal Descent in Africa: A Coevolutionary Analysis." *Proceedings of the Royal Society B: Biological Sciences* 270 (1532): 2425–2433.
- Jeong C., K. Wang, S. Wilkin, W. T. T. Taylor, B. K. Miller, J. H. Bemmman, R. Stahl, C. Chiovelli, F. Knolle, S. Ulziibayar, D. Khatanbaatar, D. Erdenebaatar, U. Erdenebat, A. Ochir, G. Ankhsanaa, C. Vanchigdash, B. Ochir, C. Munkhbayar, D. Tumen, A. Kovalev, N. Kradin, B. A. Bazarov, D. A. Miyagashev, P. B. Konovalov, E. Zhambaltarova, A. V. Miller, W. Haak, S. Schiffels, J. Krause, N. Boivin, M. Erdene, J. Hendy, and C. Warinner. 2020. "A Dynamic 6,000-Year Genetic History of Eurasia's Eastern Steppe." *Cell* 183(4): 890–904.
- Keightley, D. N. 1978. *Sources of Shang History: Oracle-Bone Inscriptions of Bronze Age China*. Berkeley: University of California Press.
- . 1983. "The Late Shang State: Whence, Where, and What?" In *The Origins of Chinese Civilization*, ed. D. N. Keightley, 523–564. Berkeley: University of California Press.
- . 2012. *Working for His Majesty: Research Notes on Labor Mobilization in Late Shang China (ca. 1200–1045 B.C.), as Seen in the Oracle-Bone Inscriptions, with Particular Attention to Handicraft Industries, Agriculture, Warfare, Hunting, Construction, and the Shang's Legacies*. Berkeley, CA: Institute of East Asian Studies.
- Kohler, T. A., M. E. Smith, A. Bogaard, G. M. Feinman, C. E. Peterson, A. Betzenhauser, M. Pailes, E. C. Stone, A. M. Prentiss, T. J. Dehenny, L. J. Ellyson, L. M. Nicholas, R. K. Faulseit, A. Styring, J. Whitlam, M. Fochesato, T. A. Foor, and S. Bowles. 2017. "Greater Post-Neolithic Wealth Disparities in Eurasia than in North America and Mesoamerica." *Nature* 551: 619–622.
- Lin, M., and X. Liu. 2017. "The Origins of Metallurgy in China." *Antiquity* 91(359): 1–6.
<https://doi.org/10.15184/aqy.2017.177>
- Linduff, K. M., and J. Mei. 2009. "Metallurgy in Ancient Eastern Asia: Retrospect and Prospects." *Journal of World Prehistory* 22: 265–281.
- Liu, L., and X. Chen. 2012. *The Archaeology of China: From the Late Paleolithic to the Early Bronze Age*. Cambridge University Press.

- Ma, Y., B. T. Fuller, D. Wei, L. Shi, X. Zhang, Y. Hu, and M. P. Richards. 2016. "Isotopic Perspectives ($\delta^{13}\text{C}$, $\delta^{15}\text{N}$, $\delta^{34}\text{S}$) of Diet, Social Complexity, and Animal Husbandry during the Proto-Shang Period (ca. 2000–1600 BC) of China." *American Journal of Physical Anthropology* 160: 433–455.
- Meicun, L., and X. Liu. 2017. See Lin and Liu 2017.
- Motuzaitė Matuzevičiūtė, G. 2014. "Neolithic Ukraine: A Review of Theoretical and Chronological Interpretations." *Archaeologia Baltica* 20: 136–149.
- Motuzaitė Matuzevičiūtė, G., and S. Telizhenko. 2016. "The First Farmers of Ukraine: An Archaeological Investigation and AMS Dating of Wheat Grains from the Ratniv-2 Site." *Archaeologia Lituana* 17: 100–111.
- Nakagawa, Y. 2021. "Georges Dumézil, Trifunctional Theory, Proto-Indo-European, Setback in 1950, Three-tiered Organization, Shepherding, Dogs as Mediators, Pontic-Caspian Steppe." *The Journal of Economics* 61(5–6): 209–246.
- Ning, C., Tianjiao Li, K. Wang, F. Zhang, Tao Li, X. Wu, S. Gao, Q. Zhang, H. Zhang, M. J. Hudson, G. Dong, S. Wu, Y. Fang, C. Liu, C. Feng, W. Li, T. Han, R. Li, J. Wei, Y. Zhu, Y. Zhou, C.-C. Wang, S. Fan, Z. Xiong, Z. Sun, M. Ye, L. Sun, X. Wu, F. Liang, Y. Cao, X. Wei, H. Zhu, H. Zhou, J. Krause, M. Robbeets, C. Jeong, and Y. Cui. 2020. "Ancient Genomes from Northern China Suggest Links Between Subsistence Changes and Human Migration." *Nature Communications* 11(1): 2700.
- Patterson, N., P. Moorjani, Y. Luo, S. Mallick, N. Rohland, Y. Zhan, T. Genschoreck, T. Webster, and D. Reich. 2012. "Ancient Admixture in Human History." *Genetics*. 192(3): 1065–1093.
- Paynter, R. 1989. "The Archaeology of Equality and Inequality." *Annual Review of Anthropology* 18: 369–399.
- Pechenkina, E. A., S. H. Ambrose, and X. Ma. 2005. "Reconstructing Northern Chinese Neolithic Subsistence Practices by Isotopic Analysis." *Journal of Anthropological Science* 32: 1176–1189.
- Perri, A. R., T. R. Feuerborn, L. Frantz, G. Larson, R. S. Malhi, D. J. Meltzer, and K. E. Witt. 2021. "Dog Domestication and the Dual Dispersal of People and Dogs into the Americas." *Proceedings of the National Academy of Sciences of the United States of America*. 118(6), e2010083118. <https://doi.org/10.1073/pnas.2010083118>.
- Plato. 1961. *The Collected Dialogues of Plato, including the Letters*. Edited by E. Hamilton and H. Cairns. Princeton University Press.

- Rawson, J. 2017. “Shimao and Erlitou: New Perspectives on the Origins of the Bronze Industry in Central China.” *Antiquity* 91 (355): e5. doi:10.15184/aqy.2016.234.
- Rawson, J., K. Chugunov, Y. Grebnev, and L. Huan. 2020. “Chariotry and Prone Burials: Reassessing Late Shang China’s Relationship with Its Northern Neighbours.” *Journal of World Prehistory* 33: 135–168.
- Sahlins, M. D. 1961. “The Segmentary Lineage: An Organization of Predatory Expansion.” *American Anthropologist* 63: 322–345.
- Shelach-Lavi, G. 2015. *The Archaeology of Early China: From Prehistory to the Han Dynasty*. Cambridge University Press.
- Sun, Z., J. Shao, L. Liu, J. Cui, M. F. Bonomo, Q. Guo, X. Wu, and J. Wang. 2017. “The First Neolithic Urban Center on China’s North Loess Plateau: The Rise and Fall of Shimao.” *Archaeological Research in Asia*. <http://dx.doi.org/10.1016/j.ara.2017.02.004>.
- Underhill, A. P. 1996. “Craft Production and Social Evolution During the Longshan Period of Northern China.” In *Craft Specialization and Social Evolution: In Memory of V. Gordon Childe*, ed. B. Wailes, 133–150. University Museum Monograph 93, University Museum Symposium Series Vol. 6. Philadelphia: University of Pennsylvania Museum of Archaeology and Anthropology.
- Vybornov, A., P. Kosintsev, and M. Kulkova. 2015. “The Origin of Farming in the Lower Volga Region.” *Documenta Praehistorica* 42: 67–75.
- Wang, C.-C., H.-Y. Yeh, A. N. Popov, H.-Q. Zhang, H. Matsumura, K. Sirak, O. Cherone, A. Kovalev, N. Rohland, A. M. Kim, R. Bernardos, D. Tumen, J. Zhao, Y.-C. Liu, M. Mah, S. Mallick, K. Wang, Z. Zhang, N. Adamski, N. Broomandhoshbacht, K. Callan, B. J. Culleton, L. Eccles, A. M. Lawson, M. Michel, J. Oppenheimer, K. Stewardson, S. Wen, S. Yan, F. Zalzal, R. Chuang, C.-J. Huang, C.-C. Shiung, Y. Y. G. Nikitin, A. V. Tabarev, A. A. Tishkin, S. Lin, Z.-Y. Sun, X.-M. Wu, T.-L. Yang, X. Hu, L. Chen, H. Du, J. Bayarsaikan, E. Myagmar, H. Kanzawa-Kiriyama, M. Nishino, K. I. Shinoda, O. A. Shubina, J. Guo, Q. Deng, L. Kang, Dawei Li, Dongna Li, R. Lin, W. Cai, R. Shrestha, L.-X. Wang, L. Wei, G. Xie, H. Yao, M. Zhang, G. He, X. Yang, R. Hu, M. Robbeets, S. Schiffels, D. J. Kennett, L. Jin, H. Li, J. Krause, R. Pinhasi, and D. Reich. 2020. *The Genomic Formation of Human Populations in East Asia*. BioRxiv preprint. <https://www.biorxiv.org/content/10.1101/2020.03.25.004606v1>.

- Watts, J., O. Sheehan, Q. D. Atkinson, J. Bulbulia, and R. D. Gray. 2016. "Ritual Human Sacrifice Promoted and Sustained the Evolution of Stratified Societies." *Nature* 532(75–98): 228–231.
- Yang, M. A., X. Fan, B. Sun, C. Chen, J. Lang, Y. C. Ko, C. H. Tsang, H. Chiu, T. Wang, Q. Bao, X. Wu, M. Hajdinjak, A. M. Ko, M. Ding, P. Cao, R. Yang, F. Liu, B. Nickel, Q. Dai, X. Feng, L. Zhang, C. Sun, C. Ning, W. Zeng, Y. Zhao, M. Zhang, X. Gao, Y. Cui, D. Reich, M. Stoneking, and Q. Fu. 2020. "Ancient DNA Indicates Human Population Shifts and Admixture in Northern and Southern China." *Science*. 369(6501): 282–288.
- Yü, Y. 1977. "Chapter 2: Han." In *Food in Chinese Culture: Anthropological and Historical Perspectives*, ed. K. C. Chang, 53–83. New Haven: Yale University Press.
- Zhou, L., and S. J. Garvie-Lok. 2015. "Isotopic Evidence for the Expansion of Wheat Consumption in Northern China." *Archaeological Research in Asia* 4: 25–35.
- Zhou, L., S. J. Garvie-Lok, W. Fan, and X. Chu. 2017. "Human Diets during the Social Transition from Territorial States to Empire: Stable Isotope Analysis of Human and Animal Remains from 770 BCE to 220 CE on the Central Plains of China." *Journal of Archaeological Science Reports* 11: 211–223.

All issues of *Sino-Platonic Papers* are accessible to readers at no charge via our website.

To see the complete catalog of *Sino-Platonic Papers*, visit

www.sino-platonic.org