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Wheeled Vehicles in the Chinese Bronze Age (c. 2000–741 B.C.)

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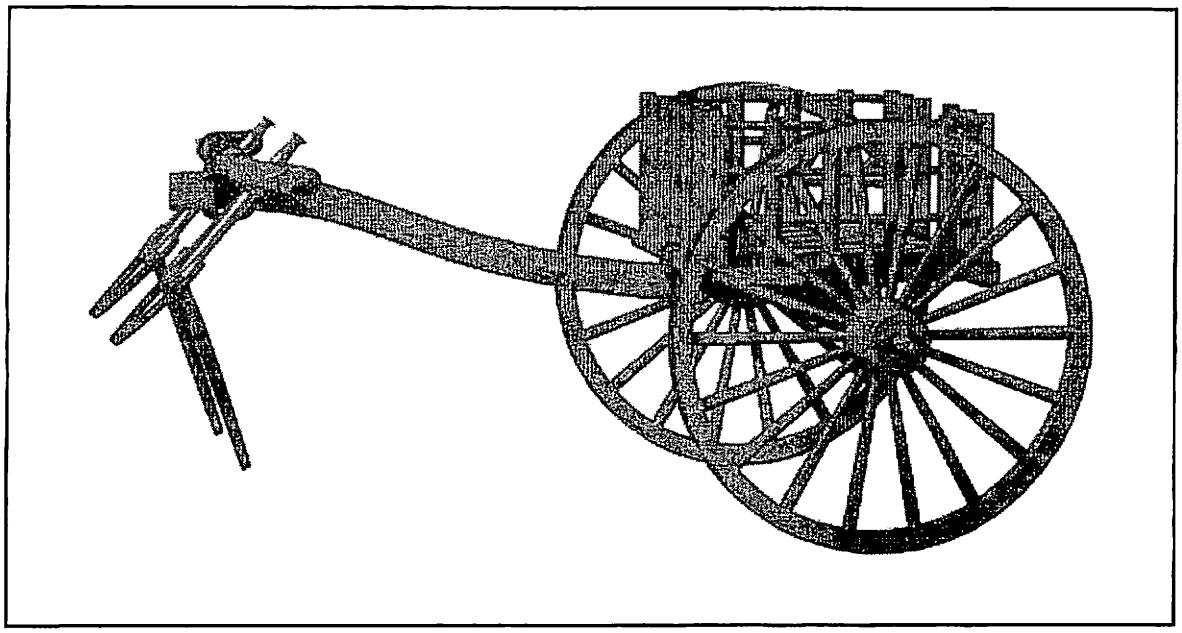

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I. Introduction--Wheeled Transport around the World

The invention of the wheel for transportation of humans and their cargo was one of the greatest inventions of the ancient world.[1] What makes the invention of wheeled transportation most striking is its novelty. Wheeled motion is the only form of movement which does not have a counterpart in the wild kingdom. There are animals which fly, swim, walk, slither, and hop, but there are none yet discovered which roll. Overcoming the resistance of friction and gravity, man's invention of the wheeled vehicle allowed him to multiply his productivity immeasurably, enabling a level of complexity and mobility in his societies which had formerly not been possible. It also gave him a frighteningly fast conveyance to use in brutal warfare against rival groups and an unmistakable marker of status to laud over those less fortunate. Therefore, it is not surprising that the wheeled vehicle made its first appearance in the early states at about the same time that early forms of writing and metallurgy were being systematized and refined to levels which enabled the rulers to administer and coerce large populations. Even though man had excellent tools and wood-working skills throughout the earlier Paleolithic and Neolithic periods, he never had occasion to invent the wheeled vehicle until the complexity of his society established the groundwork for its introduction.

However, the invention of wheeled vehicles is not an inevitable consequence of social complexity. There are other very important practical factors to consider. According to Stuart Piggott, the introduction of wheeled vehicles carries three prerequisites: 1) adequate domesticated draught animals 2) sophisticated wood carpentry skills such as joinery and heat bending 3) adequate timber resources.[2] To these I would add the fourth requirement of amenable terrain. Without all four of these requirements in place, a society, no matter how complex, would not be able to use a technology of wheeled vehicles.

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[1]An earlier version of this paper was submitted as an M.A. thesis to the Committee on Regional Studies--East Asia, Harvard University in May 1997. It has since been revised and expanded. I would like to thank Robert W. Bagley, David N. Keightley, and Victor H. Mair for their critique of the original paper and for their subsequent suggestions and assistance.

[2]Stuart Piggott, "The Chinese Chariot: An Outsider's View," in *Arts of the Eurasian Steppelands*, ed. Philip Denwood (London: Percival David Foundation of Chinese Art, 1978), 32-51; Stuart Piggott, *Wagon, Chariot, and Carriage: Symbol and Status in the History of Transport* (London: Thames and Hudson, 1992).

Figure 1. Wheeled pottery toy from Mesoamerica (Aztec). From Piggott, *The Earliest Wheeled Transport.*

For an example of the binding nature of these requirements, consider the case of the New World, where wheeled vehicles were never used for transportation before the Conquest. Yet, surprisingly, there are dozens of wheeled "toys" dating from A.D. 400 which prove that Mesoamericans knew how to make objects roll on wheels[3] (see fig. 1). These clay toys, whose function is uncertain, represent various animals or deities. Axles holding clay wheels travel through their front and rear feet. Why would societies as complex, aggressive, and skillful as those which arose in Mesoamerica, produce such toys yet choose not to exploit this technology in transportation or warfare? The answer lies in the fact that no suitable draught animals existed in the New World which could have pulled large vehicles. Neither equids nor bovids were present in the New World at this time, and available animals such as the llama or the dog simply could never provide adequate traction.[4]

Before turning to the case of the structure and function of the earliest Chinese wheeled vehicles, it is necessary to review briefly the history of wheeled vehicles in the other great centers of civilization in the Old World, namely the Near East, Europe, and the Indus River Valley.

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[3]For a discussion and illustration of wheeled toys from Mexico, see: Gordon Frederick Ekholm, "Wheeled Toys in Mexico," *American Antiquity* 11 (1946): 222-8; Earl L. Stendahl, "Wheeled Toys," *Masterkey* 24 (1950): 160-2; Matthew William Stirling, "Wheeled Toys from Tres Zapotes, Veracruz," *Amerindia* 1 (1962): 43-9.

[4]For a compelling study proposing environmental causes for the disparity between the two continents, see Jared Diamond, *Guns, Germs, and Steel: The Fates of Human Societies* (New York: W.W. Norton & Co., 1997).

The Near East

The wheeled vehicle was probably first invented in the fertile land between the Tigris and the Euphrates Rivers toward the end of the fourth millennium B.C. Our first evidence appears in the form of pictographs used in the proto-literate script of the Uruk IVa phase (*c.* 3200-3100 B.C.).[5] These representations take the form of platforms and superstructures resting on either captive rollers or actual wheels (see fig. 2).

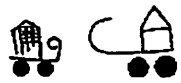

Figure 2. Uruk IVa pictographs. From Littauer and Crouwel, *Wheeled Vehicles and Ridden Animals.*

Then, during the Early Dynastic phase of the Sumerian civilization (*c.* 3000-2375 B.C.) there are abundant representations of a four-wheeled vehicle called a "battle car" (see fig. 3) which carried two men and was used in an unquestionably military context. It was drawn by animals which most closely represent half-asses or onagers (*Equus hemionus*).[6] At the same time, there is evidence for the use of two-wheeled vehicles for the first time, in a form which appears to some researchers to represent an antecedent to the chariot[7] (see fig. 4).

Figure 3. A "battle car" depicted on the so-called "Standard of Ur," From Strommenger and Hirmer, *5000 Years of the Art of Mesopotamia.*

[5]M.A. Littauer and J.H. Crouwel, *Wheeled Vehicles and Ridden Animals in the Ancient Near East.* (Leiden: E.J. Brill, 1979), 13-14.
[6]Ibid., 15-20.
[7]Ibid., 20-2.

Figure 4. Copper model of a "straddle car" from the site of Tell Agrab, Iraq. From Strommenger and Hirmer, *5000 Years of the Art of Mesopotamia.*

Subsequently, around 1700 B.C., cylinder seals from Anatolia start to represent a true chariot: a fast, light vehicle with two wheels of spoked design, drawn by domesticated horses. These seals show kings, deities, or other high-status individuals riding chariots in situations which could be related to either hunting or warfare.[8] The first step towards mass chariot warfare also seems to have taken place in Anatolia, where Hittite texts from the 17th century B.C. tell of opposing armies employing forty or even eighty chariots in battle.[9] Later, at the famous battle of Kadesh (*c.* 1286 B.C.) between the Egyptian pharaoh Ramses II and the Hittite king Muwatallish, the Hittites took the field with twenty-five hundred chariots (according to Egyptian accounts). The chariots at Kadesh were probably used as mobile firing platforms for arrows (Egypt) and spears (Hittite). This was the heyday of the war chariot in the ancient world. At the same time, the chariot was being used as a status marker by ruling kings. Five gorgeous state chariots were found in the tomb of Tutankhamun (*c.* 1352 B.C.).[10] These were fashioned of rare, imported woods and were splendidly outfitted in gold and other expensive ornament. These were probably not used as battle platforms, but as objects of awe-inspiring display.

Soon however, the Near Eastern chariot began to be replaced in importance by cavalry and then massed infantry. By the ninth century B.C., the mighty Assyrian kingdom was beginning to use mounted troops to perform the flanking function once served by the horse chariot.[11] By the second half of the first millennium B.C., the chariot was being used by the Persian Empire as merely a "shock" device to throw the enemy into confusion,

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[8]Ibid., 50-72.
[9]Ibid., 65.
[10]M.A. Littauer and J.H. Crouwel, *Chariots and Related Equipment from the Tomb of Tutankhamun* (Oxford: Griffith Institute, 1985).
[11]Littauer and Crouwel, *Wheeled Vehicles and Ridden Animals*, 137.

through the use of spinning metal scythes attached to the axle.[12] And finally, by the time of Alexander's conquest of the known world (324 B.C.), the chariot was once again only a marker of status for the nobility.

Europe

In continental Europe, wheeled vehicles first appear around 3000-2500 B.C. in the form of heavy wagons drawn by oxen and supported by four massive, single-piece disc wheels. These vehicles could weigh as much as a ton and required enormous planks from 400-500 year old oak trees to fashion the single-piece wheels. Actual wheels from these vehicles have been dug from bogs in Northern Europe and whole wagons have been found in high-status burials from Eastern Europe and Transcaucasia. Judging from representational evidence and from the burials, these vehicles were used for both utilitarian transport and elite ritual.[13]

Then, around 2000-1800 B.C., Europe also saw the introduction of the horse-drawn chariot. The first traces are from the Timber-Grave/Andronovo sites of the Sintashta-Petrovka culture in modern Kazakhstan[14] (see fig. 5). By the end of the second millennium, the

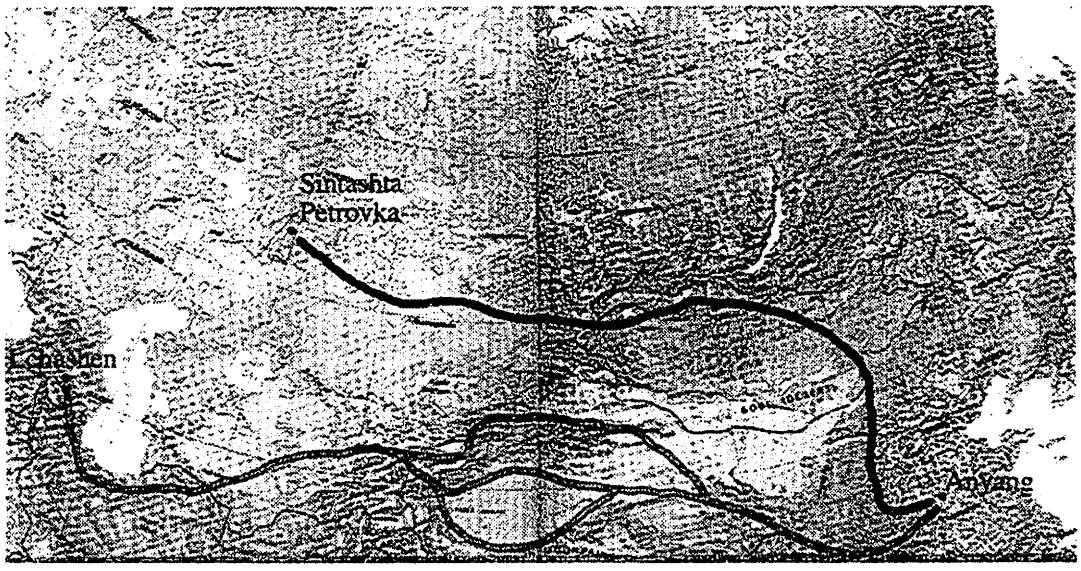

Figure 5. Map showing the locations of Central Asian and Russian chariot finds and the probable routes of transmission to China during the Bronze Age.

[12]Ibid., 152-3.
[13]Stuart Piggott, *The Earliest Wheeled Transport: from the Atlantic coast to the Caspian Sea* (Ithaca: Cornell University Press, 1983), 1-63; Piggott, *Wagon, Chariot, and Carriage*.
[14]Stuart Piggott, "Bronze Age Chariot Burials in the Urals," *Antiquity* 49 (1975): 289-90.

chariot had spread to all of continental Europe. Of particular note is the use of the chariot in Mycenaean Greece. Judging from the Linear B tablets and the somewhat anachronistic imagery of the *Iliad* epic, one can surmise that the chariot was mostly used in Bronze Age Greece as an elite conveyance. It was used primarily in ritual, but only sporadically in warfare, in a form of chivalrous combat between champions.[15] With the fall of Mycenae and the other great city-states at the hands of the "Sea Peoples" around 1200 B.C., Greece seems to have fallen into a dark age and lost knowledge, or need of, the chariot until around 800 B.C., when orientalizing influences from the East reintroduced it to pre-Classical Greece.[16] By the seventh century B.C., cavalry also became an important component of Greek armies, while the chariot began to be used almost exclusively for display and competitive racing, such as at the Olympics.[17]

India

In India during the third millennium B.C., the great Harappan civilization (*c.* 2600-1500 B.C.) arose in the Indus Valley. Distinguished by large complex cities with planned layouts and sewer systems, a relatively even distribution of wealth, and a still undeciphered writing system, the Harappan civilization has long been recognized as one of the indepen-

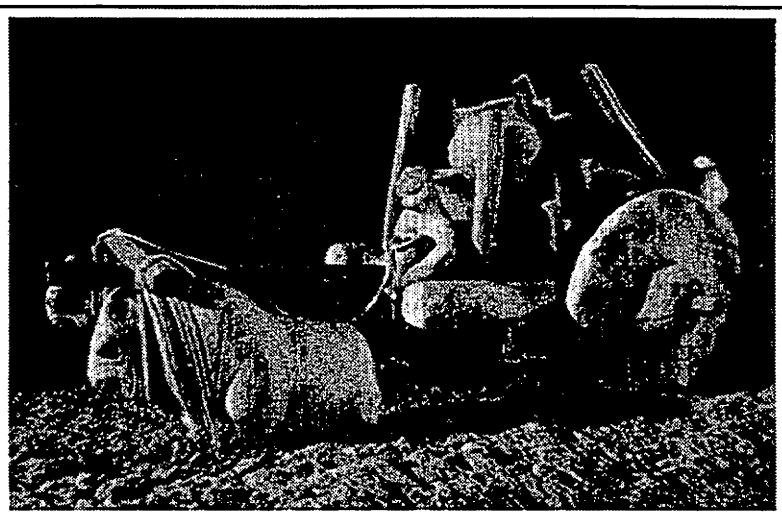

Figure 6. Terracotta model of Harappan ox-cart. From Wenke, *Patterns in Prehistory.*

[15]Piggott, *Wagon, Chariot, and Carriage*, 58-63.
[16]Piggott, *The Earliest Wheeled Transport*, 128-30.
[17]Piggott, *Wagon, Chariot, and Carriage*, 71-3.

dent centers of urban civilization in the Old World. Though preservation conditions and the absence of intentional burial have deprived us of actual examples of wheeled vehicles such as those found in Europe or Egypt, Harappan civilization reveals to us the form of their earliest vehicles through the use of terracotta models (see fig. 6). This illustration shows a heavy cart being pulled by a pair of oxen under a yoke bar. The wheels are apparently of single-piece or possibly tripartite wooden construction. Given the cargo of large jars, the purpose of this vehicle seems to be utilitarian and commercial. Model carts of this type have been excavated from the Harappan sites of Alamgirpur, Chanhu-Daro, Harappa, and Mohenjo-Daro.[18]

Attendant on the collapse of Harappan civilization around 1500 B.C., was an influx of people from the north known as the Aryans. This Indo-European speaking group immortalized their ritual and culture in an epic known as the *Rig Veda*. In the *Rig Veda,* the Aryans use wheeled vehicles of several types, but the one they prize most is the horse-drawn chariot. Vedic chariots are used in the races, hunting, and shooting rituals of the elite, but not in large-scale organized warfare.[19] Whether the Aryans caused the collapse of Harappan civilization with their lightning-fast chariots is not known, but after their entrance into the subcontinent, the chariot was smoothly taken up into the permanent repertoire of wheeled vehicles in historic Indian civilizations. Many depictions of chariots are seen on the famous Sanchi monuments northeast of Bhopal which date to the first century A.D.[20]

Thus, in each of these societies, one sees a similar developmental course in the technology and use of wheeled vehicles. First, come the large, bulky vehicles drawn by bovids or asses which were used for utilitarian transport and elite ritual and which first appeared in the late fourth and early third millennium B.C. in Mesopotamia, Europe, and India. Then, in the first half of the second millennium B.C., the chariot was invented, either in the Caucasus or in Mesopotamia. This light and fast vehicle, which used the innovative draught of paired horses, was a sophisticated piece of technology. Its manufacture required

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[18]C. Margabandhu, "Technology of Transport Vehicles in Early India," in *Radiocarbon and Indian Archaeology*, ed. D.P. Agrawal and A. Ghosh. (Bombay: Tata Institute of Fundamental Research, 1973), 182-8.
[19]M. Sparreboom, *Chariots in the Veda* (Leiden: E.J. Brill, 1985).
[20]Ibid., 93-118.

advanced skills in carpentry (mortising, scarf joints, heat bending) and its maintenance and use required a sophisticated knowledge of animal husbandry and vehicular dynamics.[21] As the new invention of the chariot swept across the Old World in the second millennium B.C., it found an amenable home in each society it encountered, principally because each of these cultures had already acquired at least 750-1000 years of experience with other forms of wheeled transport, albeit slower and less complex ones.

China

We turn finally to China, the so-called "Cradle of the East." In recent literature on this subject, a very different scenario is portrayed for the early development of wheeled transport. It is stated by leading authorities that no form of wheeled vehicle existed in China prior to the introduction from Central Asia of the chariot around 1200 B.C. (See "E. Origins of the Shang Chariot" on page 37). For example, Stuart Piggott states in his most recent book that "Shang chariotry appears to mark the first appearance of any wheeled transport in the area which was to become the nucleus of Imperial China."[22] And Edward Shaughnessy declares, "There is no evidence of any type in China to suggest a vehicular development leading up to the mature chariot."[23] Furthermore, Western scholars maintain that early Bronze Age China only possessed the borrowed technology of the chariot and never possessed or invented any other forms of conveyance or hauling such as carts or wheelbarrows. For instance, in his recent survey on the origins of the Chinese chariot, Edward Shaughnessy declares that in the Shang period, "there is absolutely no artifactual evidence for other types of wheeled or tractive conveyance."[24]

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[21]Unlike the earlier bulky carts, the frame of the chariot was flexible, allowing it to travel rough terrain without shaking apart. This was accomplished through a construction technique which avoided the use of nails or rigid joints in favor of light timbers lashed with leather straps. Such construction allowed the vehicle to respond to the terrain like the horses which pulled it, flexing a skeleton connected by sinews. Nevertheless, lightly-built chariot parts did break frequently. The timber and leather modular construction did allow the driver to replace various parts in the field and disassemble the vehicle when needed to reduce the stress on its parts. Thus, the chariot was both powerful and fragile, much like a modern thoroughbred horse.

[22]Piggott, *Wagon, Chariot, and Carriage,* 63.

[23]Edward L Shaughnessy, "Historical Perspectives on the Introduction of the Chariot into China," *Harvard Journal of Asiatic Studies* 48.1 (1988): 208.

[24]Ibid., 192.

It is the primary purpose of this paper to challenge both of these assertions. I will argue that no society could accept and adapt such a sophisticated package of machinery as the horse-drawn chariot so smoothly without extensive previous experience with wheeled vehicles. Drawing support from archaeological, artistic, inscriptional, and textual data, I will suggest that the chariot was established in China on top of a foundation of other vehicles. Furthermore, I will introduce several recent discoveries which suggest that during both the Shang and Western Zhou periods, many other forms of vehicle were used for human conveyance and material transport. Indispensable to this study will be an examination of the actual technology involved in Chinese wheeled vehicles. This will take the form of a computer-assisted, color reconstruction of a specific excavated Chinese chariot from the Anyang period with a complete analysis of each of its parts (See "C. Structure of the Shang Chariot" on page 23). Finally, large portions of this paper will be dedicated to trying to reconstruct the actual use of these vehicles, whether it be for military, ritual, or utilitarian purposes. Through this study, I hope to present a much more complete and vivid portrait of the wheeled-vehicle technology utilized during the Bronze Age by one of the greatest technologically innovative civilizations.

II. The Earliest Chinese Wheeled Vehicles

A. Legendary Origins

There are, of course, Chinese legends which claim that the chariot/carriage/cart, *chē* 車, was invented long before the Shang Dynasty.[25] Legend says that during the reign of Yu 禹 of the Xia Dynasty, whose reign is dated by one tradition to 2205-2197 B.C., a min-

[25]A problem in tracing textual origins is caused by the ambiguous meaning of the Chinese graph 車 pronounced *chē* in standard Mandarin and *jū* in Literary Chinese. In Classical texts it often means chariot, but it can also signify a cart. Even in modern Mandarin the unmodified graph can mean car, bicycle, bus, or even train. In the Shang, before the graph was standardized, this character had several variant forms which signified different vehicles or different parts of a vehicle, depending on how it was drawn (such as on the oracle bone, *Heji* #10405). In the latter Western Zhou, the character for cart was modified by a single character before it which specified its type. Thus: 大車 : large carriage of nobles (*Shijing* #73); 金車 : chariot of noble, with bronze fittings (such as in the gift list on the "Mao Gong *ding*"); 後車 : baggage carts used by the military to carry equipment (*Shijing* #230); 戎車 : military chariots of war (*Shijing* #178); 田車 : hunting chariots (*Shijing* #179). In Western Zhou bronze inscriptions, many other characters appear to denote specific parts of the chariot, such as the yoke bar, the handrails, or the harnessing equipment. See Table 2 on page 86.

ister at court named Xi Zhong 奚仲 invented the chariot/cart. He carried the official title of 車正 "rectifier of vehicles." Later, his descendants were enfeoffed in the state of Xue 薛 in modern Shandong province. It is said that one of his descendants even served as a minister to the founder of the Shang Dynasty, Tang 湯.[26] Another version of this legend (found in the *Gushi kao* 古史考, 3rd century. A.D.) says that it was the Yellow Emperor 黃帝 (tr. 2697-2598 B.C.) who invented the cart, and that it was his son, Shao Hao 少昊 (tr. 2597-2514 B.C.), who first attached oxen to it. In this version, Xi Zhong merely learned to harness horses to make the chariot proper. Unfortunately, no contemporary written records from that time have turned up to verify any of these legends.

These legends do, however, have some interesting qualities. The traditional Chinese dates for the Xia dynasty fall at the end of the third millennium B.C. and the beginning of the second (tr. 2205-1767 B.C.). By the end of this time frame, the steppe zone and semi-arid regions of southern Russia had become populated with nomadic pastoralists who possessed wheeled vehicles. An adoption or adaptation by China of a cart from the steppe regions at this time would be entirely possible. Furthermore, the second variant of the legend seems to have retained the normal stages of evolution of wheeled transport by implying that oxen were used to draw carts before the horse was used.

Many Chinese archaeologists (most notably K.C. Chang) equate the stories of the Xia dynasty with the Erlitou culture discovered in Henan. Both the dates for the Erlitou complexes (2100-1800 B.C.) and the coincidence of geographic scope seem to corroborate his theory. The Erlitou site itself represents a very advanced culture, with walled compounds, palace foundations, and bronze metallurgy. As of today, no vehicle remains or even representations of vehicles have turned up from any Erlitou site.

B. Actual Vehicle Remains

Archaeological preservation is a very fickle mistress. Under some atmospheric and soil conditions, wooden remains can be preserved for five or six thousand years (such as at the Neolithic site of Hemudu), while under others they dissolve to dust within just a few.

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[26]The Xi Zhong legend first appears in the *Zuozhuan* 左傳 (Duke Ding 1). The legend is later distilled into a four character expression, "Xi Zhong zuo che" 奚仲作車, which appears in nearly every major philosophical and historical work of the Warring States and Han periods. So far I have found it in *Mozi, Xunzi, Guanzi, Lushi chunqiu, Shuowen jiezi, Shanhai jing,* and *Huainanzi.*

With wheeled vehicles there is a further problem. Wheeled vehicles designed for utilitarian use are likely to be broken down and used for kindling when they have outlived their usefulness. There are not likely to be allowed to sit on the surface to be slowly covered by silt like some tyrannosaur. The greatest assistance to archaeologists studying wheeled vehicles has come from ancient cultures which so treasured their vehicles in this life, or for use in the next, that they intentionally buried them in the ground. This practice was common in Europe, Egypt, the Near East, and Central Asia in the earlier half of the second millennium, yet only begins in China around 1200 B.C.

The earliest actual remains of a wheeled vehicle in China were found at the site of Dalitaliha, near Nomhon in Dulan county, Qinghai province. Located near the Qaidam River, the Nomhon site was surveyed as part of a regional project in the late 1950s.[27] The site is enormous, over 60,000 m^2 in area and over 5 meters deep in cultural deposits. The excavators found several house foundations, some graves, a small earthen wall, and a wooden animal enclosure with evidence of sheep husbandry (see fig. 7). Near the entrance to the pen (top of oval), they found two wooden wheel hubs (see fig. 8).

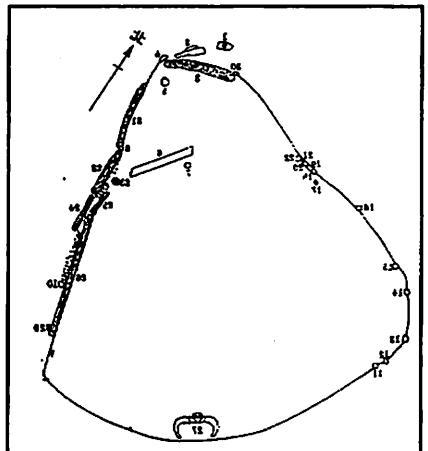

Figure 7. Outline of a livestock pen found at the site of Nomhon. From *Kaogu xuebao* (1963.1)

The wheel hubs were made of crudely dressed pine and could have held sixteen spokes. The inside diameter of the nave was 6.5 cm throughout the 26 cm length of the hub. The spokes themselves were roughly rectangular in cross section, measuring about 5-6 cm in width. Later Shang and Zhou chariots have naves measuring greater than 40 cm in length and carry axles which seem to taper *within* the hub itself (see plate 3 and discussion in "Wheels" on page 24). Also, Shang and Zhou chariots usually had eighteen or more spokes, tapering from 3-5 cm in width. Thus, I would conclude that the vehicle to which these hubs belonged must have been either a very small chariot or a medium-sized cart.

[27]Qinghai Sheng Wenwu Guanli Weiyuanhui, Zhongguo Kexueyuan Kaogu Yanjiusuo Qinghaidui, eds., "Qinghai Dulan xian Nuomuhong Dalitaliha yizhi diaocha yu shijue 青海都蘭縣諾木洪搭里他里哈遺址調查與試掘 " (Survey and test excavation at the site of Dalitaliha near Nomhon in Dulan county, Qinghai province), *Kaogu xuebao* (1963.1): 17-44.

The fact that it was found in an animal husbandry context suggests to me that this vehicle was a two-wheeled cart for carrying farm cargo (wool, feed, manure) and not a human conveyance.

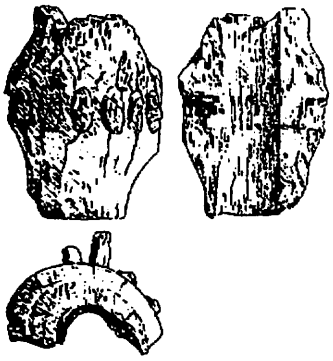

Figure 8. Wooden wheel hubs found near Nomhon. From *Kaogu xuebao* (1963.1).

The dating of this find has been the subject of some debate in the last few years. Originally, the excavators dated the site to the Warring States or Qin periods.[28] Later, however, one of the wooden posts from the animal pen came back with a ^{14}C date of around 2000 B.C. In addition, Emma Bunker has concluded that a curved bronze knife found at the site should be stylistically dated to 1500 B.C.[29] If these dates hold up, that would make these Qinghai wheels some of the oldest preserved wooden, spoked wheels ever discovered in the world.

Curiously, the other material culture found at the Nomhon site does seem to show similarities to the Gansu/Qinghai phases of the Yangshao culture, even though Dulan county is about 200 km away from those type sites to the east of Lake Qinghai. Several of the pottery fragments from Nomhon show strong affinities of shape to Majiayao (*c.* 2500 B.C.) and Machang phase (*c.* 2000 B.C.) pottery, yet they do not share the elaborate decoration seen on those famous funerary urns. The bronze knives from Nomhon also show rough similarities to the famous bronze knife from the site of Linjia, located 200 km east of Nomhon in Dongxiang county, Qinghai province.[30] This knife has been dated to around (2500-2000 B.C.). Thus, I would tend to accept the dating of the wheels to the broad 2000-1500 B.C. time period. Culturally, the Nomhon group seems to have been engaged in agriculture as well as animal husbandry. They had access to small scale metallurgy, but most of their implements were still of stone and bone. They also seem to have had trade connections to the east with the Yangshao cultures of Qinghai. And most important for our discussion,

[28]The site contained seven cultural strata, with most of the bronzes and the wheel hubs found in the upper layers. The excavators originally chose a Warring States date based on this placement and because of the presence of advanced, spoked wheels and metallurgical remains.

[29]Jenny F. So and Emma C. Bunker, *Traders and Raiders on China's Northern Frontier* (Seattle, London: University of Washington Press, 1995), 26.

[30]*Kaoguxue jikan* 4 考古學集刊, (1984): 111-61.

they used wheeled carts to assist in agricultural production. This area of Qinghai is also in a good position geographically for trade and migration routes to the West. It lays on a branch of the later historic Silk Road, which traveled through this area as one of the access routes to Xinjiang and the rest of Central Asia.

Material remains of a very different type of wheeled vehicle have been unearthed in Xinjiang province, located in the far northwest of modern China. As was just pointed out, this was a crucial migration route between the East and the West. During the last decade, more and more evidence has been unearthed which shows that the Tarim Basin of Xinjiang was a cultural meeting place for peoples of East and West as early as the second millennium B.C. The most notable evidence of this Western contact is the Caucasian-looking mummies from Xinjiang, recently published by Victor Mair.[31]

These westerners from the Central Asian steppe seem to have also brought their wheeled vehicle technology with them. Tripartite wooden plank wheels have been found in a late second millennium grave from the cemetery at Qizilchoqa at the oasis village of Wupu in the Gobi Desert, northeast of the Tarim Basin. These wheels are similar in construction to those that have been found throughout Russia, Western Asia, and Europe from the early second millennium B.C. The wheels themselves are said to date to around 1600 B.C.[32] Cloth fragments from this same cemetery have been dated to around 1200 B.C., and the mummies are reported to date from 2000-1000 B.C.[33]

Solid plank wheels, such as those found in Xinjiang, never seem to have made much of an impact on Chinese wheel technology. As one can see from the Qinghai evidence above, China seems to have missed, or simply bypassed, the stage of large, bulky solid wheels and progressed directly to light, spoked wheels. Practical factors could be involved in this. Most likely, China at this time did not possess the four hundred year-old hardwood trees which were required to produce large, single-piece wheels. Thus, the dearth of a certain resource may have favored a technology which required very little timber to fashion a wheel. And while it is still uncertain where the idea for spoked wheels first came from, the

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[31]Victor H. Mair, "Mummies of the Tarim Basin," *Archaeology*, Mar/Apr 1995, 28-35.
[32]Emma C. Bunker, "Shang wenhua wanqi mache de yinjin 商文化晚期馬車的引進" (The introduction of the Late Shang-period chariot), in *Zhongguo Shang wenhua guoji xueshu taolunhui* 中國商文化國際學術討論會 (Yanshi, China, 1995), 317-8.
[33]Mair, "Mummies," 28-35.

later Shang and Zhou penchant for and skill at mortising as many as thirty spokes into a hub suggests that Chinese Bronze Age craftsmen perfected the spoked wheel, if they did not invent it outright.

C. Representational Evidence

Leaving the relatively unambiguous territory of artifactual evidence, we venture now into the shady world of representational evidence. Chinese art from the Neolithic until the Han tends to show a greater tendency towards abstraction and geometric reduction than it does towards naturalistic representation. There are definite human and animal representations on some Neolithic pottery of the Majiayao and Machang phases of Gansu/Qinghai Yangshao and on certain Neolithic jades from Liangzhu sites, but there does not tend to exist in this early period, however, the urge to represent daily life in clay which predominates in the later Han tomb figurines. Scholars of Western wheeled vehicles are greatly assisted by the penchant of Near Eastern and European peoples to make models, or at least drawings, of their vehicles. Such a phenomenon does not seem to occur in China until the late Western Zhou period (see fig. 26 on page 72).

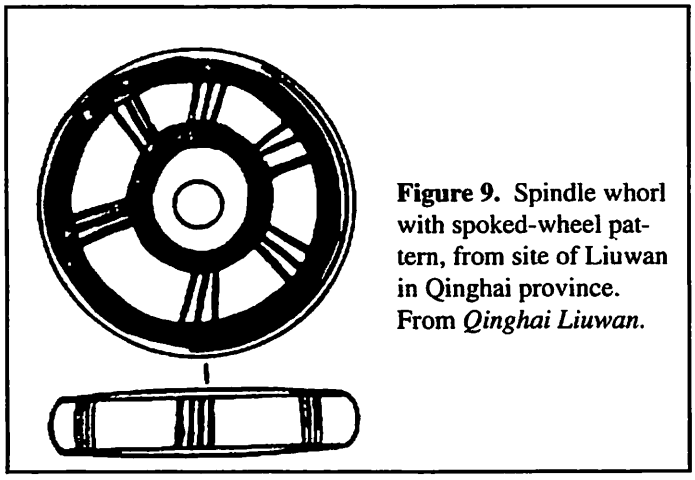

Figure 9. Spindle whorl with spoked-wheel pattern, from site of Liuwan in Qinghai province. From *Qinghai Liuwan.*

However, there are some curious representations from the early period which I would like to introduce. At the Majiayao/Machang site of Liuwan in Ledu county, Qinghai province, dozens of pottery spindle whorls were unearthed which carry a pattern curiously reminiscent of spoked wheels[34] (see fig. 9). Spindle whorls from central China, from the earlier Yangshao site of Banpo near Xi'an, do not show such a pattern. What makes this pattern interesting is that this site is roughly contemporary (*c.* 2400-1900 B.C.) with the site of Nomhon some 200 km to the west, where the

[34] Qinghai Sheng Wenwu Guanliju Kaogudui, Zhongguo Shehui Kexueyuan Kaogu Yanjiusuo, eds., *Qinghai Liuwan* 青海柳灣 (Report of the Liuwan site of Qinghai province) (Beijing: Wenwu Chubanshe, 1984), 31, 95.

previously mentioned wooden wheel hubs were unearthed. While this pattern could be coincidental and not an intentional representation of spoked wheels, it is at least suggestive. Spindle whorls are, after all, wheels which spin on a centrally placed axis. The people who fashioned the designs on the spindle whorls may have been making a logical connection between various functions of the "wheel concept" and directly mimicking, in a smaller format, a design which they were familiar with from spoke-wheeled vehicles used in other contexts.

D. Indirect Evidence

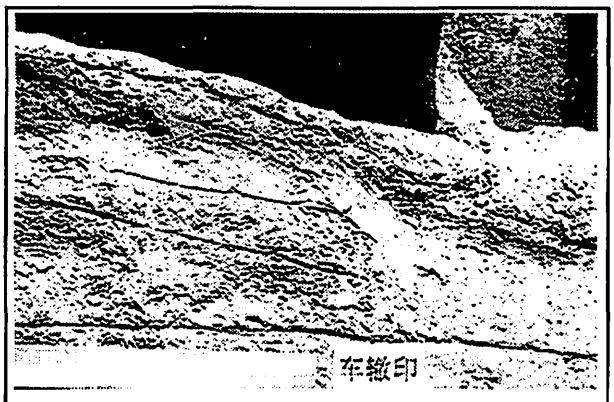

Figure 10. Wheel ruts near the city wall of the early Bronze Age site at Yanshi, Henan. From *Kaogu* (1998.6).

So far, all of the evidence I have presented for wheeled vehicles in China in the pre-Anyang period has been far removed from the Central Plain. To demonstrate that the Shang had previous experience with wheeled vehicles before they imported and adapted the horse chariot around 1200 B.C., evidence must come from pre-Anyang sites in Henan or Shandong. Just such spectacular new evidence has very recently come to light.[35] In 1983, a walled city was found in Yanshi county, Henan province, between the Dahuaishu village and the Luo River. The founding of the city can be dated to approximately 1700-1600 B.C.[36] The city at Yanshi is surrounded by a moated, rammed-earth wall which is over 14 m broad at its base. The wall, which measures 1240 m by 1700 m, has seven gates.

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[35]Zhongguo Shehui Kexueyuan Kaogu Yanjiusuo Henan Di'er Gongzuodui, "Yanshi Shangcheng huo zhongda kaogu xin chengguo 偃市商成獲重大考古新成果 " (Important new archaeological discoveries at the Shang city site at Yanshi), *Zhongguo wenwu bao* 中國文物報 , 8 December 1996; Zhongguo Shehui Kexueyuan Kaogu Yanjiusuo, Henan Di'er Gongzuodui, ed., "Henan Yanshi Shang cheng dongbei yu fajue jianbao 河南偃師商城東北隅發掘簡報 " (Simplified report of the excavations at the northeast corner of the city wall at the site of the Shang city near Yanshi, Henan province), *Kaogu* (1998.6): 1-8; Du Jinpeng 杜金鵬 , Wang Xuerong 王學榮 , Zhang Liangren 張良仁 , and Gu Fei 谷飛 , "Shilun Yanshi Shang cheng dongbei yu kaogu xin shouhuo 試論偃師商城東北隅考古新收獲 " (A preliminary discussion of the new archaeological discoveries from the northeast city wall of the Shang city at Yanshi), *Kaogu* (1998.6): 9-13, 38.

Evidence has also been found for a sewer system, internal road network, palatial structures, and large-scale bronze production.[37] Inside the wall, in the northeast corner, excavations uncovered a slanted rampart mound about 70 cm high which leans up against and skirts the inside edge of the wall. This mound was made of layers of rammed earth which had been paved with cobbles. The surface seems to have seen much use, for it had been repaved several times. On top of the lowest layer, built right on the wall's foundation, excavators recently found two parallel ruts, probably made by the repeated passage of wheeled carts (see fig. 10). The distance between the ruts is about 1.2 meters, and they track for five or six meters on a parallel course. Each rut is fairly wide (20 cm), but at several places two branch ruts run off the track, also along a parallel course. These mistrackings are only about 10 cm wide. Such a situation suggests that this wheel track was travelled over several times. Between the ruts, there is very pitted soil, possibly the hoof tracks of some unidentified draught animal. The excavators tried to recover a complete hoof trace for species identification, but the bumps were too irregular. The northern rut runs very close to the city wall, coming within 20 cm at times. Given the narrow gauge and the proximity to the wall, the vehicle which made the Yanshi ruts would have had a rather small frame, but substantial tire width. It obviously cannot be known whether the wheels had spokes. Because the tracks were on the lowest and thus oldest layer of the mound, they would seem to date from near the founding of the city itself.

These tracks bear a strong resemblance to tracks found in a similar context at Anyang, Huayuanzhuang (see page 48). Whatever the carts at Yanshi looked like, they were too small to be chariots (Anyang chariot wheel-bases are twice as wide) and might have been human powered. My guess is that such a vehicle, which I will term a "city cart," was the urban cousin of the vehicles seen in agricultural contexts at Nomhon. It was probably

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[36]The dating and cultural affiliation of the site are matters of extreme controversy. A ^{14}C date taken from a piece of charcoal found near the palace foundations was dated 3650±130 cal. B.P. Other radiocarbon dates from the site are similar. Based on the typology of pottery fragments found within the wall's foundation, the wall was constructed after the start of the third (some say fourth) level at Erlitou, but definitely before the construction of the Erligang period city wall at Zhengzhou. Thus, a range of dates around 1700-1600 B.C. seems reasonable. Recently, an even earlier city has been discovered within this walled enclosure, underlying the later remains.

[37]He Xianwu 何賢武 and Wang Qiuhua 王秋華 , eds., *Zhongguo wenwu kaogu cidian* 中國文物考古辭典 (Dictionary of Chinese archaeology and cultural relics) (Beijing: Liaoning Kexue Jishu Chubanshe, 1993), 106-7.

used for the utilitarian tasks of hauling goods around the early Bronze Age cities and was not specifically for human transport or elite ritual.

Besides the Yanshi wheel ruts, other pieces of indirect evidence have recently been reported which suggest that wheeled vehicles at this time were very advanced, even incorporating bronze reinforcing elements. It has been reported that excavators at Yanshi have found a bronze, axle end-cap within the city, though neither the context of the find nor any photographs nor drawings of it have been published.[38] The same report mentions that casting debris from a bronze workshop at the Erligang period city at Zhengzhou (*c.* 1500 B.C.) has revealed a mold for casting a similar bronze, axle end-cap. Once this data is more fully reported, scholars can compare the shape and decoration (if any) of these caps with later Anyang examples to determine if they are more primitive pieces, or perhaps just intrusive later objects.

E. Conclusions

On the basis of current evidence, sketchy though it is, it appears that wheeled vehicles made their first appearance in East Asia at the beginning of the second millennium B.C. in the western provinces of Qinghai and Xinjiang. The earliest wheeled vehicles were small two-wheeled, or possibly four-wheeled, carts carried by light, spoked wheels. These were most likely used in a utilitarian, agricultural context, without significant conferral of status on the owner. Concurrently, larger, bulkier wagons of Western origin found their way into Xinjiang under the care of Caucasian groups migrating from the steppe. By the middle of the millennium (*c.* 1600 B.C.), as the drive toward urbanism accelerated on the Central Plain, small carts found use within the walls of early Bronze Age cities. They were probably needed in order to meet the demands of large-scale bronze production, waste management, and the construction of massive earthen walls and foundations.

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[38]Du Jinpeng, et al., "Shilun Yanshi Shang cheng," 13.

III. The Shang Chariot at Anyang

A. Background

During the third millennium B.C., the centers of civilization which had arisen in the Near East, Egypt, and the Indus Valley had matured and grown, creating large urban networks, long-distance trade connections, and flourishing cultures. As open land and other resources became more valuable, conflicts arose between city-states, yet most conflicts remained regional affairs. The accumulated effects of centuries of settled agriculture greatly increased populations and eventually pushed people to colonize marginal areas which were still sparsely populated, such as the wooded steppe of Russian Central Asia.

What the data from the second millennium seem to show is the repeated mass movements of human populations out of these Caucasian and steppe homelands, creating a chain reaction of dislocations in neighboring populations, and eventually leading to collisions with the great riverine kingdoms. Streaming down from southern Russia, an Indo-European speaking group known as the Aryans descended upon India, possibly supplanting the older Harappan civilization. In Egypt a people known as the Hyksos, foreigners from the north, conquered the land of the Nile around 1700 B.C. In China, the Shang dynasty vied for supremacy with other established states and tribes along the Yellow River while being constantly pressured by belligerent nomadic groups to the north and the west. Finally, all across Asia, from the Urals to the Tian Shan Mountains, a cultural horizon opened up known as the Andronovo. Its shared burial and technological features point to a superhighway of people and ideas across all of Central Asia. In a rapidly changing political and cultural climate such as this, the diffusion of technologies and ideas occurs far more rapidly and over longer distances than would have been possible previously. The second millennium also marks the dawn of large-scale human conflict. These dual phenomena are best embodied by the chariot.

The chariot of the second millennium B.C. was a light, fast, two-wheeled vehicle, drawn by a pair of domesticated horses. Though debate still rages over where the chariot first emerged, many scholars now conclude that the two-wheeled chariot first emerged just east of the Ural Mountains in present-day Kazakhstan in a proto-Aryan culture known as Sintashta-Petrovka around 2000 B.C.[39] As reviewed earlier, previous forms of wheeled-

transport were known in Mesopotamia, Anatolia, and southern Russia, but the chariot was lighter, with only two, spoked wheels instead of four disc-type wheels, more flexible, and faster, pulled by horses rather than oxen or onagers. During the second millennium, it became the supreme vehicle of warfare and mayhem. It spread quickly to Anatolia, Egypt, Mesopotamia, Greece, and India, so that by 1500 B.C., it was ubiquitous throughout the known world west of China.

Then, around 1200 B.C. we suddenly see the first evidence of the chariot in Chinese civilization.[40] More than three dozen chariots have been excavated to date from seven major loci around the Shang capital near modern-day Anyang. Buried intentionally as a sacrifice, the chariots are often accompanied into the pit by drivers, horses, and various weapons and tools. The form of the Chinese chariot is extremely advanced. Sporting as many as twenty-six spokes on the wheels as well as various bronze fittings and decorations, the Chinese chariot is as complex as any chariot depicted or excavated in the Near East.

B. Archaeological Context

Chariot pits have been excavated from every major location in the Anyang excavation area (see fig. 11). Table 1 on page 83 summarizes all of the finds to date.[41] The sacri-

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[39]For the southern Russian origin of the chariot, see David W. Anthony and Nikolai B. Vinogradov, "Birth of the Chariot," *Archaeology*, Mar/Apr 1995, 36-41. Also, Stuart Piggott, "Chariot Burials in the Urals"; Piggott, *Wagon, Chariot, and Carriage*. For the Near Eastern invention of the chariot, see Littauer and Crouwel, *Wheeled Vehicles and Ridden Animals*.

[40]The reasons for this approximate date are given in Shaughnessy, "Historical Perspectives." He gives this date as the upper limit for the evidence because chariot burials and the "unstable" written graph for chariot all appear about this time. But, it may merely be that the ritual of burying chariots and horses only begins at this time. Also, since no earlier writing has been found, all graphs make a sudden appearance around 1200 B.C., and many appear in variant forms. There are a couple of reasons to believe that chariots were around for several decades before Wu Ding's reign. First, the metal parts on the relatively earliest Shang chariots are already fully adapted to Shang methods of bronze casting and decorative schemes. Second, the oracle-bone character for driving a vehicle pulled by horses, *yù* 御=馭, already has the extended meanings of "'drive' out demons," "'control' barbarians," and "'handle' matters." Thus, it seems that the date for the chariot's introduction should be pushed back a century or so prior to the reign of Wu Ding. For now, let us continue to use 1200 B.C. as an approximate marker.

[41]References to many of the original site reports for these finds can be located in: Yang Baocheng 楊寶成, "Yin dai chezi de faxian yu fuyuan 殷代車子的發現與復原" (The discovery and reconstruction of the Shang-era chariot), *Kaogu* (1984.6): 546-55; Zheng Ruokui 鄭若葵, "Shilun Shang dai de chema zang 試論商代的車馬葬" (A preliminary discussion of the chariot and horse burials of the Shang Dynasty), *Kaogu* (1987.5): 462-9; Liu Yiman 劉一曼, "Jin shinian lai Yinxu kaogu de zhuyao shouhuo 近十年來殷墟考古的主要收獲" (The important archaeological discoveries from the last ten years from the Ruins of Yin), *Gugong wenwu yuekan* 188 (1998): 56-69.

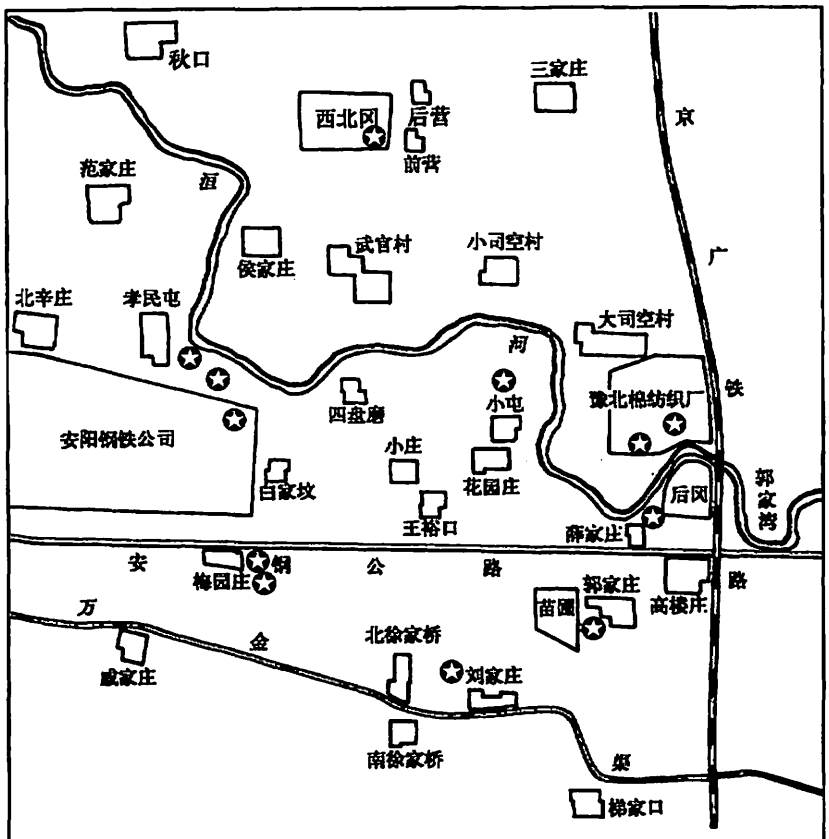

Figure 11. Locations of major Anyang chariot finds. Chariot burials marked with a ✪. Chinese captions are in simplified script. Base map from *Anyang Yinxu Guojiazhuang Shang dai muzang*,

ficial pits are sometimes independently situated (Xiaotun chariots), but are usually associated with "royal" or other high-status tombs.[42] When buried in the tomb proper, the chariots are usually found in the southern portion of the shaft (Xibeigang M1001) or on the southern ramp (Xibeigang M1003). When buried next to a tomb, the pits are usually dug in pairs, located some 30 m to the south or southwest of the main tomb shaft (Guojiazhuang M146/M147). Sometimes they are accompanied by other burial pits containing harnessed sacrificial horses, together with young male humans. The pits are rectangular or square in plan and most bear a north/south orientation (with the chariot facing south), though some follow other orientations, matching that of the tomb proper. The pits are larger at the opening than the base and average 3.3-4 m in length and 2-3 m in width. Depth is usually around

[42]For example, based on the orientation of the pits and the style of the interred artifacts, it is thought that the chariot pits Guojiazhuang M52/M58 belong to the large ramped-tomb M172, even though they are located more than thirty meters from it.

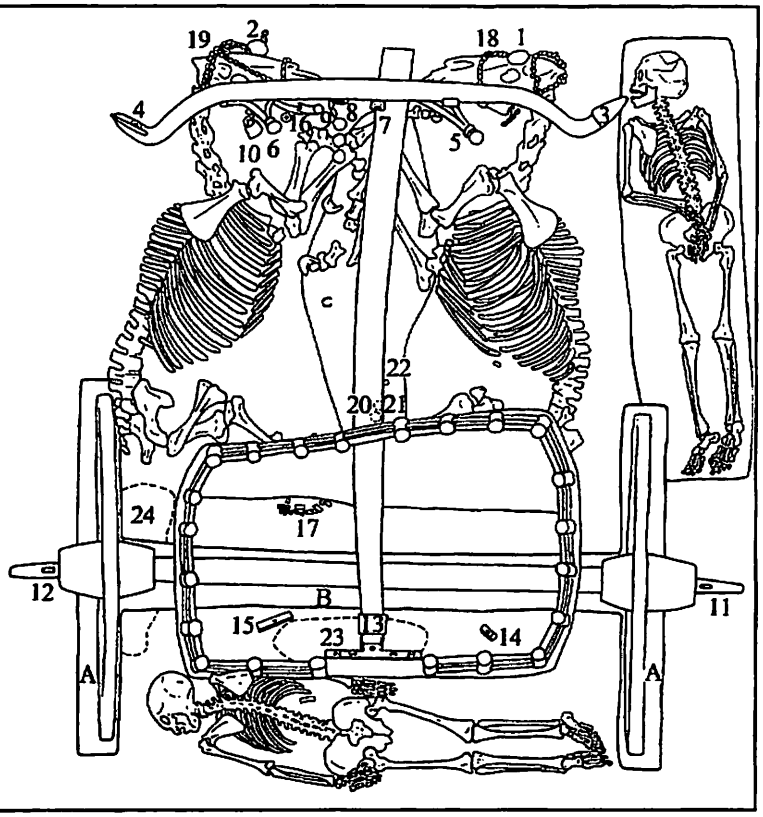

Figure 12. Plan of the chariot pit at Guojiazhuang, M52. From *Anyang Yinxu Guojiazhuang Shang dai muzang.*

Legend

A. wheel trench.
B. axle trench.
C. draught pole trench.
1-2. large bronze discs.
3-4. triangular yoke ornaments.
5-6. bronze yoke saddles.
7-8. animal-mask yoke ornaments.
9. medium-size bronze discs.
10. bronze horse bell.
11-12. bronze axle end-caps and pins.
13. bronze heel.
14-15. bronze finials.
16. small shell ringlet.
17. bronze decorative chips.
18-19. seashell halter ornament.
20-21. medium-size bronze discs.
22. small bronze discs.
23-24. wood residue, lacquer traces.

1.5 to 2 m. Special trenches are usually dug in the floor of the pit to accommodate the wheels, the axle, and the draught pole. The trenches for the wheels are sometimes half the height of the wheel, allowing the chariot to present a lower profile in the pit, and thus requiring less initial excavation.[43] In addition, small niches are sometimes carved into the walls to accommodate the axle ends, if the pit was not designed large enough. In a few cases, the chariots are placed in the pit partially or completely disassembled (Xiaotun M20/ Liujiazhuang M339). In one case, a complete chariot was placed in a pit along with a smaller disassembled chariot (Meiyuanzhuang M40).

Based on the configuration of the remains, it appears that the horses were placed in the pit first, followed by the human sacrifices. Only then was the chariot placed in the pit. (see fig. 12). The horses are always found lying on their sides, sometimes back to back, sometimes facing each other. In some cases it seems as if the horses' legs were intention-

[43]These wheel trenches might also recreate how chariots were normally parked when they were not in use. The delicate wheels of a chariot are subject to distortion from even the exceedingly light weight of the vehicle body. Near Eastern and Greek vehicles were usually disassembled or hung up when not it use to prevent such distortion.

ally posed in a galloping posture after interment. In many instances, the horses still carry traces of harnessing equipment.

In the majority of excavated examples, from one to three humans were also sacrificed and placed within the chariot pit. These have been interpreted as warriors or valets, and when determinations of sex are reported, they are said to be invariably male (20-35 years old).[44] One was usually placed at the rear of the chariot box, lying parallel to the axle. The other individuals could be placed in various locations. Extra trenches were occasionally dug for the men and the horses (Guojiazhuang M147), who were sometimes wrapped in cloth or covered in cinnabar (Guojiazhuang M52).

The object assemblages found within the pits come in several varieties. In some cases, the chariots are found with unquestionably military assemblages, including arrows, halberds, and daggers (Dasikongcun M175; Xiaotun M20; Guojiazhuang M147). Other times, a diverse toolkit is found within the box, including adzes, knot detanglers, and chisels (Dasikongcun M175; Meiyuanzhuang M41).[45] After placement of all the sacrificial objects, the pit was filled with earth and rammed tight. This final step resulted in serious damage and distortion to the wheels and box of the chariot lying underneath.

Chronologically, the earliest chariot burials are thought to be those of the "royal" tomb M1001 (identified by many as the tomb of Wu Ding) and the Hougang pit, both of which can be dated by the typology of intrusive pottery to the first or second phase of the Yinxu occupation. Many of the other pits are associated with outlying "clan" cemeteries and are dated later (Yinxu phase 3-4). A detailed relative chronology of the chariot pits, focusing on the evolution of construction techniques and the style of bronze fittings, has not yet been attempted.

In the 1930s, when the first chariot pits were discovered, the excavators merely collected the bones and the bronze fittings and tried to reconstruct the layout of the chariot later from the placement of the fittings. Since the wood of the vehicle had completely decayed, only to be replaced by finer soil from the surrounding compacted fill, they saw no hope of

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[44]The males buried with harnessed horses (without chariot) are usually young boys and could be interpreted as stableboys or squires (Guojiazhuang M51).

[45]These woodworking toolkits might have been used by chariot operators in the field to maintain and disassemble the chariot. If an axle broke in the field, the operator could cut down a tree, dress the timber, and attach a new axle before the next day's outing.

accurately reconstructing its original form. Then in the 1950s excavators of the Western Zhou chariot pit at Liulige employed a technique which allowed them to visualize the actual chariot. This technique consisted of slowly scraping away the rammed-earth fill which surrounded the chariot timbers until a change in soil color or texture was noticed. After many painstaking weeks of excavation, the true form of the chariot would be revealed.[46] The first Shang chariot excavated in this way was M175 at Dasikongcun. Chariot Xiaomintun M7, excavated in the 1970s, was also especially well extracted. Now, with each successive discovery, the technique is refined, so that recent examples such as Guojiazhuang M52 can be measured almost to a fraction of a centimeter.

C. Structure of the Shang Chariot

Scholars first attempted to reconstruct the Bronze Age chariot during the middle Qing Dynasty. Two noted *kaozheng* scholars of the Chinese classics, Dai Zhen 戴震 (A.D. 1723-77) and Ruan Yuan 阮元 (A.D. 1764-1849) used an exclusively textual approach, analyzing passages about chariots in the *Kaogongji* 考工記 , *Shuowen jiezi* 説文解字 , and other early texts to create composite diagrams. With the introduction of scientific archaeology to China during the excavations at Anyang, reconstructions began to focus on actual remains, but the identification of the various unearthed parts still owed much to the work of the Qing philologists. One of the leading figures in the excavation and publication of the first chariots unearthed at Anyang was Shi Zhangru 石璋如 . Over the years he attempted numerous reconstructions of the chariots he helped excavate from pits M20 and M40 near Xiaotun.[47] Other Western and Chinese scholars have also advanced site-specific and composite reconstructions over the years as new material became available which could shed light on problematic areas of reconstruction.[48]

Structurally, all of the excavated Anyang chariots are very similar. (Table 3 on page 93 lists the measurements of the best preserved examples.) Rather than analyze the structure of each chariot or give a composite depiction, I choose to reconstruct a specific

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[46]This technique was first employed in England during the 1939 excavations to recover the ship found at Sutton Hoo in East Anglia. The future director of the Chinese Institute of Archaeology, Xia Nai, a man who would later lead the first chariot excavation in China to utilize a similar technique, was still studying in England during the beginning of that year. I do not know whether he heard of or witnessed this new technique during his stay.

Shang chariot, the one excavated from Guojiazhuang M52, pointing out the function of the various parts and how they differ from other Shang and Near Eastern examples. This pit, excavated in the late 1980s, was expertly dug and reported in the minutest detail (see fig. 12 on page 21).[49] In my reconstruction, I have utilized the most advanced three-dimensional computer software to portray M52 as faithful as possible to its original shape, color, and decoration[50] (see plates 1-10). In some cases, I had to fill in missing details using later Chinese examples or in rare instances, Near Eastern prototypes. I hope that my reconstruction will convey the power and prestige of these luxury vehicles better than the flat and intentionally vague line-drawings of previous reconstructions.

Wheels

The chariots found at Anyang all had two, spoked-wheels, *lún* 輪 ,[51] mounted on a fixed axle, *zhóu* 軸 . The M52 chariot's wheels had eighteen spokes each.[52] The spokes themselves tapered from 4.5 cm to 2 cm in diameter as they entered the nave. The spokes

[47]Shi's latest and most detailed reconstruction is included in his volume, *Beizu muzang* 北組墓葬 . Early on, because of limitations of time and technique, Shi had to rely on photographs and drawings of the *in situ* bronze fittings and decorative buttons from M20 to draw his reconstruction. His early reconstructions of M20 were quite crude and mistakenly assumed that there was only one chariot in the pit, pulled by four horses. He revised this view in his later reconstructions to include a pit with one complete chariot and one partially disassembled one, both made with different construction techniques. His reconstruction of M40 drew a strong reaction from some (Yang Baocheng, Zhang Changshou) because Shi drew the chariot box opening to the front rather than the rear, a situation seen, not coincidentally, on the two chariots from Lchashen, Armenia. Still, Shi's reconstructions have been very influential and are often cited in Western literature by scholars like Li Ji, William Watson, and K.C. Chang.

[48]Among those scholars who have critiqued or attempted reconstructions of the Chinese chariot are William Watson, Magdalene von Dewall, Joseph Needham, Zhang Changshou, Yang Baocheng, Sun Ji, Hayashi Minao, and Barbara Stephen. For some of these specific efforts, See "References Cited and Additional Works Consulted" on page 75.

[49]Zhongguo Shehui Kexueyuan Kaogu Yanjiusuo Anyang Gongzuodui, ed., "Anyang Guojiazhuang xinan de Yin dai chema keng 安陽郭家庄西南的殷代車馬坑 " (Chariot pits of the Yin-era from Anyang, Guojiazhuang, SW locus), *Kaogu* (1988.10): 882-93; Zhongguo Shehui Kexueyuan Kaogu Yanjiusuo, ed., *Anyang Yinxu Guojiazhuang Shang dai muzuang* 安陽殷墟郭家莊商代墓葬 (Shang-era burials from the site of Guojiazhuang at the Ruins of Yin near Anyang) (Beijing: Zhongguo Dabaike Quanshu Chubanshe, 1998), chap. 4.

[50]The computer reconstruction was modeled on a Power Macintosh 6100 with 24 megabytes of RAM, using Stratavision 3D, version 4.0 software. The models were then rendered on a Power Macintosh 9500 with 64 megabytes of RAM using a raytracing algorithm. The files were then printed to 35mm slides at a resolution of four thousand DPI. The final printouts were produced on a Canon Color Laser Copier using a Cyclone Raster Image Pre-Processor.

[51]A large table of technical terms used in Chinese sources to discuss chariots and harnessing can be found in Table 2 on page 86. For definitions of Western terms for chariot parts and harnessing equipment, see the glossary in Littauer and Crouwel, *Wheeled Vehicles and Ridden Animals.*

were mortised into the wheel in a plane perpendicular to the axle, and show no signs of dishing.[53] The hub of the wheel or nave, *gǔ* 轂 , was made of a single cylinder of wood, 40 cm long, which was thickened in the middle to accept the mortising of the spokes. The inside diameter of the nave seems to have tapered as the axle traveled from the box towards the end-cap[54] (see plate 3). The felloe of the wheel, *wǎng* 輞 , was probably made of two or more pieces of wood,[55] heat-bent to conform to the round shape and then bound together in overlapping scarf joints, which were secured with clasps.[56] The felloe was trapezoidal

[52]Eighteen seems to be the standard number of spokes for a Shang chariot, although Xiaomintun M2 has twenty-six spokes and M7 had twenty-two spokes. Throughout the Western Zhou and later periods the number of spokes continued to increase, reaching a peak of thirty with the Qin dynasty. The normal number of spokes for Near Eastern chariots was four or six, though Assyrian chariots began to carry more, possibly under influence from Chinese and Central Asian traditions.

[53]Dishing is the technology where spokes are angled in to the hub to provide greater durability for the wheel in case of side impacts on the felloe. Dishing of wheels seems to have been a Chinese invention, for it first appears on Chinese chariot wheels discovered from Warring States period sites and is mentioned as a specific skill in technical passages of the *Kaogongji*. In contrast, dishing does not appear in Europe until the sixteenth century A.D. For details, see Joseph Needham and Wang Ling, *Physics and Physical Technology*, vol. 4, part 2 of *Science and Civilsation in China* (Cambridge: Cambridge University Press, 1965), 77.

[54]The inside diameter narrowed from about 10 cm as the axle entered the hub to about 5 cm as it entered the end-cap. This was probably done to secure the wheel in a lateral direction. Just as the axle end-cap prevented the wheel from sliding off in that direction, the taper of the hub prevented the wheel from traveling towards the box. The inside of the nave must have been heavily lubricated with animal grease, for conical rotation can lead to tremendous friction. It is also possible that the inside of the nave was of uniform diameter, like the wheel hubs from Nomhon. If this was the case, the axle must have stepped down in diameter just as it entered the nave, creating a collar of sorts to prevent slippage of the wheel. This would have created its own problems, increasing the likelihood that shearing forces would break the axle. Later Zhou chariots used bronze bands and other devices on the axle to prevent wheel incursions toward the box. The only detailed model hub we possess, from the bronze carriage #2 of Qin Shihuang, shows a different configuration from any of those just suggested. In the Qin wheel, the axle does indeed narrow as it travels through the nave, but at the center of the hub it suddenly widens, fitting neatly into an enlarged cavity in the middle of the hub. This prevents the wheel from sliding in either direction and forms an excellent reservoir to fill with lubricating grease. However, I do not know if this solution could have worked for wooden wheels (the Qin chariot is cast in bronze), for how would one pass this "axle bulge" through the smaller side apertures of the nave?

[55]It is not known what kind of wood the Shang and Zhou used to construct their chariots. The rotted traces of wood in the ground provide no clue. As was seen above, the only preserved wooden vehicle parts ever discovered, the hubs from Nomhon, were made of pine. Pine, however, is a very soft wood and not ideally suited to wheeled vehicles. In the *Book of Poetry* there is a poem (#236) which claims that the chariots the Zhou employed at the pivotal battle against the Shang were made of sandalwood, *tán* 檀 . This is probably just a later poetic convention and thus would not represent true vehicle design.

[56]It is not clear how many individual felloe segments composed the composite felloe of the M52 chariot wheels, for no traces of the clasps were found. Undoubtedly, these were made of some perishable substance. My model is composed of two equal length segments, but I have left out any kind of clasp. In Zhou chariots, such as those from Xincun, bronze clasps were being used to hold the wheel felloe segments together.

in cross section, with the inner surface that accepted the spokes being thicker and somewhat concave. It is not known whether the wheel originally carried a tire for wear-resistance and traction.[57] The total diameter of the wheel was approximately 140 cm.[58]

Axle and Axle End-cap

The axle of chariot M52 was 308 cm in length. It was 12 centimeters in diameter at its mid-point, but this gradually tapered toward the ends.[59] At the end of the axle, there was placed a bronze axle end-cap, *wèi* 轄 . The end-cap was 19.5 cm long and 5.3 cm in diameter and had two apertures through which a linchpin, *xiá* 轄 , was inserted (see plates 4-5). The linchpin on M52 was made of wood, but the pin had a bronze finial. The purpose of the end-cap and linchpin was to prevent the wheel from falling off and to provide easy disassembly of the chariot when not in use.[60] The end-cap was decorated with two *kuí* 夔

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[57]I have provided my reconstruction with a tire of leather. There a suggestion of leather tires from some Zhou chariot pits, but there is no evidence for this yet from Shang examples.

[58]Due to the distorting effects of ramming the earth into the grave, the wheels of M52 were actually oval when unearthed. Shang chariot wheels could range from 120 cm to 150 cm in diameter, which is relatively large compared to the 100 cm maximum from known Near Eastern examples.

[59]Shang chariots almost uniformly have 300 cm axles. This size is fairly large compared to Western prototypes, which were not able to carry as many people. According to later texts, the Chinese chariot was capable of carrying three, or on rare occasions, four adult males. The gauge, or distance between the wheels, of most Shang chariots varies between 220-30 cm, though some are as wide as 240-60 cm. David Keightley has pointed out that this (230 cm) would be exactly 10 Chinese feet, *chǐ* 尺 , according to the later dimension systems of the Zhou, suggesting that the Shang possessed a standard ruler for carpentry. See David N. Keightley, "A Measure of Man in Early China: In Search of the Neolithic Inch," *Chinese Science* (1995.12): 18-40. There are some problems, however, with the theory of the standard carpentry ruler used for Shang chariot construction. First, a recent chariot pit from Meiyuanzhuang (M40) contained two chariots of different dimensions. All of the parts of the smaller chariot seemed to be made exactly 15% smaller than its companion. It may have been made smaller to reflect the lower status of its owner (perhaps a consort). Second, the wheels of the midden cart from Huayuanzhuang had a gauge of 150 cm, or six and one-half Chinese feet. Wheel gauges were standardized in some of the Zhou period states because travelling in uniform road ruts meant less stress on the wheels. During the Shang, however, there was probably not enough regular vehicle traffic on roads to make non-standard gauges a problem. Shang chariots were probably designed by craftsmen to be as large as they could be to accomplish their task without structural damage.

[60]The form of axle end-caps evolved during the subsequent Zhou period. The linchpins were sometimes integrally cast, and the overall length of the end-cap became less. One exception was the "scythe" end-caps found in the Marquis Yi of Zeng's tomb, dating from the early Warring States period. These were long blades which spun on the axle, cutting down any men in their path. Similar scythe end-caps are mentioned by Xenophon on chariots from the Near East. See Hubei Sheng Bowuguan, Hubei Sheng Wenwu Kaogu Yanjiusuo, eds., *Zhanguo dixia yuegong: Hubei Suixian Zeng Hou Yi mu* 戰國地下樂宮：湖北隨縣曾侯乙墓 " (Underground musical palace from the Warring States Period), vol. 5 of *Zhongguo kaogu wenwu zhi mei* (Beijing: Wenwu Chubanshe, 1994); Littauer and Crouwel, *Wheeled Vehicles and Ridden Animals*, 152.

dragons, crouching on either side of the linchpin aperture, and banana-leaf spikes circling the top. (An uncataloged, identical axle end-cap is in the Freer Gallery of Art, Washington D.C.) The bronze, linchpin finial was a fully-sculpted animal with horns, mirroring the horned-animal theme seen throughout the bronze decor on M52. As is the case with the dozens of other bronze linchpins housed in Western collections, this animal is backing up to the wheel, using his rear end to buttress the wheel. The axles of all known Chinese chariots of the Shang and Zhou periods were centrally placed directly beneath the chariot box.[61] This is in direct contrast to mature chariots from the Near East which all situated the axle at the rear of the box. Central placement is viewed by some as a backward feature which made the Chinese chariot unstable in sharp turns. It could also be viewed, however, as a logical adaptation to accommodate the larger box and the weight of three adult male riders. A centrally-placed axle allowed the wheels to bear more of the weight of the box, relieving some of the pressure from the horses' necks.

Draught Pole and Yoke Bar

The draught pole, *yúan* 轅 , of M52 was 261 cm long and had a square cross section of 12 cm to a side. The draught pole lay directly atop the axle in a cross-shaped formation, and the two were probably lashed together with leather straps.[62] As the pole traveled out from under the chariot box it began to curve upwards at about 12.5°, gaining 33 cm in elevation by the time it reached the front of the vehicle. This was necessary so that the yoke would be tall enough to fit on the horses' shoulders.[63] At the back of the chariot the draught

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[61]The axle of the chariot from Meiyuanzhuang M1 seems to be placed further toward the rear, but this could have been caused by dislocation of the axle during the ramming of the tomb fill.

[62]The excavators of M52 were unclear exactly how the axle and the draught pole were situated or fastened, due to the nature and location of the rotted wooden remains. Later chariots have notches in the two members, used to secure the connection and make it not quite so tall. Looking at the #2 carriage from Qin Shihuang's mausoleum, one sees that straps were indeed used to secure the two together. The Qin carriage also shows evidence of a cross-shaped bronze reinforcing element at this junction, referred to in texts as a *dāng tù* 當兔 . I depict a simplified leather lash at this junction on M52. The actual lashing pattern would have been more complex, but limitations in computer technique prevented depicting any more loops in the strap.

[63]Shang chariots usually show this same slow increase in pole elevation. By the Western Zhou period, the pole remains level much longer, then suddenly curves upward. Two recently excavated Shang examples (Meiyuanzhuang M40/M41) demonstrate that this feature had already been introduced by the end of the Anyang period. If the draught pole did not curve up in some fashion, the yoke would never be high enough to sit on the horses' withers, while still maintaining a level box at the rear of the vehicle.

pole was fixed with a heel, *zhǒng* 踵 (see plate 9). The heel was composed of two bronze elements joined into one. One bronze piece accepted the tapered end of the pole, while the other secured the pole to the back of the chariot-box baseboard, *zhěn* 軫.[64] At the front of the vehicle the draught pole was surmounted by a horizontal yoke bar, *héng* 衡. The yoke bar of M52 was 216 cm long and was probably lashed to the draught pole by leather bindings.[65] It was curved at the terminals, giving the appearance of a bull's horns.[66] Hanging from the yoke bar were two bronze yoke saddles, *è* 軛. These were made of three pieces of bronze, a cylindrical finial and two half-tubes of bronze which bent outward[67] (see plate

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[64]Heels from Shang chariots show a great deal of variability, even in contemporaneous side-by-side chariot pits. M52's heel is very close in design to the heel form Xiaotun M20, for that particular piece was also composed of two elements. Shi Zhangru's comprehensive reconstruction of M20 shows that he believed the two pieces were held together by cords which travelled through ringlets on both parts. I have not depicted the ringlets in my computer reconstruction, but they did exist in the original.

[65]Evidence for these bindings comes in the form of small shells or bronze discs distributed around the coupling. These would have been decorations on the original leather or rope bindings. A certain amount of flexibility was required in this linkage so that the horses could travel in a different direction than the chariot and not deliver that shock directly to the rider's box. Yang Baocheng believes that the yoke was actually separated from the draught pole by as much as 40 cm and connected by some kind of chain or rope. He cites certain bronze inscriptions which depict chariots with such an arrangement. His argument gains credence when you realize that in many cases if the yoke bar was directly lashed to the pole, it would not have been tall enough for even the smallest of ponies to fit under. However, for my reconstruction, I have placed them directly in contact, since that seems to be the most common depiction seen in bronze inscriptions and the most common *in situ* arrangement. Nevertheless, the horses of M52 would have been very small ponies, approximately 110-130 cm tall at the withers. No measurements of the horses buried in pits are usually given, but one can obtain an approximation by scaling-up the dimensions (by a factor of two) on the horses from the #2 carriage from Qin Shihuang's mausoleum. This gives a withers height of 130 cm, the average height of Mongolian ponies. Soon after the Qin period, Han China imported horses from Central Asia which were much larger and more robust than these Mongolian ponies. At about the same time, radical alterations in the yoke system were being made, leading to the invention of the "double-shaft with horse collar" harnessing system.

[66]This chariot was the first excavated example with the curved yoke bar. This shape of bar had often been seen in bronze inscriptions mentioning chariots. Since then, more curved yoke bars have been found on Shang chariots (Meiyuanzhuang M1/M41). Curved yoke bars also seem to have been very popular on Egyptian chariots (See Littauer and Crouwel, *Wheeled Vehicles and Ridden Animals*, plates 42-3). The horn-shaped finials on the curved yoke of M52 suggest that the chariot was designed to create the impression of a charging, horned-beast when viewed from the front (See plate 2).

[67] The bronze yoke saddles from M52 are very similar to the yoke saddles from Dasikongcun M175. The bronze tubes used to fashion the yoke saddles of the M52 chariot seem to me particularly brittle, a fact born out by their fractured state upon excavation. Recent excavations of similar yoke saddles have shown that the bronze parts were actually a reinforcing frame for a more substantial piece of wood (Meiyuanzhuang M1/M40). How much of the wooden saddle was reinforced by bronze varied from vehicle to vehicle. The wooden yoke saddle was probably lined with a neck pad of some sort to buffer the horse's spine. A complete yoke saddle with bronze frame, wooden saddle, and collar pad can be seen on the #2 carriage from the Qin mausoleum.

6). The yoke saddles were placed over the neck of the horse and strapped around the lower throat and the belly. They probably bore the bulk of the harnessed draught.[68]

Chariot Box

The shape of the chariot box, *xiāng* 箱 or *yú* 輿, probably experienced the most formal variation of any chariot part during the Shang. In most cases they were roughly rectangular, but in others they were trapezoidal (Meiyuanzhuang M40/M41). Some were oval in shape and fashioned from wicker (Xiaotun M20, M40). The box of chariot M52 was a somewhat bulging rectangle, 142 cm at front, 161 cm at middle, and 146 cm broad at back (see plate 2). As on nearly all Shang chariots, the entrance to the box was provided by a break in the wall at the rear (see plate 7).[69] The bottom of the box was composed of four baseboards, *zhěn* 軫, forming a rectangular frame. Into these were mortised twenty-two round posts of 6 cm radius and approximately 50 cm in height.[70] Judging from red stains

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[68]The yoke saddle is a curious piece of equipment which seems to be an anachronistic holdover from the yoke technology used on cattle. It is very poorly suited to a horse's anatomy, since a horse does not have the tremendous spinal processes that an ox uses to carry the yoke. Thus, it is thought that the horse ends up pulling the chariot with his windpipe and not his bones. M.A. Littauer believes that even though the yoke saddle was inefficient, it probably did manage to deliver most of the force to the horse's bones and not its windpipe. As man became more experienced with the horse's anatomy, the yoke saddle gradually evolved into the modern rigid horse collar, which first appeared in China around the start of the Western Han, yet did not arrive in Europe until the eighth century A.D. See "Harnessing" on page 31. Also, Mary Aiken Littauer, "The Function of the Yoke Saddle in Ancient Harnessing," *Antiquity* 42 (1968): 27-31; Needham and Ling, *Physics and Physical Technology*; Sun Ji, "Zhongguo gudai mache de jijia fa," 169-76.

[69]In one notable reconstruction, Shi Zhangru depicted the box of Xiaotun M40 opening to the front. He defends this reconstruction in Shi Zhangru 石璋如, "Yin che fuyuan shuoming 殷車復原說明" (An explanation of the reconstruction of the Yin-era chariot), *BIHP* 58 (1987): 253-80.

[70]The excavators of M52 did not find the top rail and had to estimate the final height. Some excavators of more recent finds (Guojiazhuang 146/167; Meiyuanzhuang M1) were able to recover the topmost rail of their chariots, confirming that 50-55 cm was indeed the maximum height of the box in Shang times, rarely surpassing the top of the wheels. The very short nature of Shang chariot boxes has led some scholars to suggest that these chariots could only have been ridden while kneeling, for it would be impossible to ride a horse-drawn vehicle at top speed when your only support came up to your knee. In contrast, many Near Eastern chariot boxes rose all the way to the hip. In fact, the oracle-bone graph taken to represent the original form of the modern graph, *yù* 御 "to drive a horse-drawn vehicle," shows a kneeling man holding what is taken to be a riding whip. During the Western Zhou, however, there is ample evidence for the presence of a handrail, *shì* 軾, which was higher than the side rails and traveled laterally across the box. Recent Anyang excavations (Liujiazhuang M348; Meiyuanzhuang M1/M40) have shown that the handrail was already present in the late Anyang period. Based on Meiyuanzhuang M40, it was about 5 cm thick and was connected to the side rails, arching up and traversing the chariot box. It received further support from a flying buttress connected to the front rail. It may have risen as high as 25-35 cm above the side rails, allowing the driver to travel in a standing posture.

in the soil, these posts were probably covered at one time in red lacquer. Connecting these posts were two or three railings which circled the box, except at the opening in the rear. Though most Shang chariots probably had leather straps across the bottom of the box for shock absorption, M52 seems to have been laid with wooden planks. These were decorated in alternating 1 cm stripes of red and black lacquer. On top of these boards was placed a reed mat (see plate 8). Furthermore, there is evidence that the front of the chariot box of M52 was decorated by a red, cloth-covered board, inlaid with small bronze chips (see plate 2). This board may have protected the rider from slipping forward. The chariot box rested directly on the draught pole at the front and rear and indirectly[71] on the axle to the left and right (see plate 9).

Bronze Fittings and Decorations

In addition to the bronze reinforcing elements outlined above, chariot M52 also exhibited several purely decorative bronze ornaments. These are certainly common on Shang chariots, but can never compare with the amount of ornamentation displayed by later Western Zhou chariots. On both ends of the yoke bar were pie-wedge shaped bronze finials decorated with facing, humped-back *kuí* 夔 dragons on a bed of *leiwen* spirals (see plate 2). *Kui* dragons are ubiquitous on this chariot, and on Shang chariots in general, appearing on nearly every part. They remain a common chariot decorative motif even until the Qin period.[72] William Watson has shown that this motif is actually much more common on chariot fittings than on bronze vessels, and he believes it is closely associated with the Northern Zone decorative tradition.[73] Also located on the yoke bar, on either side of the draught pole linkage, sit two decorative animal masks of bronze, displaying a horned beast with bulging eyes

[71]The excavators of M52 were unclear how the chariot box rested on the axle. If one follows their reconstruction of the bottom of the box, then the box would float some 9-10 centimeters above the level of the axle. In Western Zhou chariots, and indeed in later textual sources 《周禮・考工記》, there is something called a "crouching rabbit" *fú tù* 伏兔, which is actually a wooden axle-pad that supports the chariot box. It can be clearly seen on the #2 carriage from the Qin mausoleum. A recently excavated Anyang chariot (Meiyuanzhuang M41) has revealed indirect evidence that the axle-pad was already in use during the Anyang period. This came in the form of decorated wooden axle fittings shaped very much like Western Zhou bronze axle fittings. It is thought that these fittings' main purpose was to hold the "crouching rabbit" in place. I have included the *fú tù* in my reconstruction to resolve the inconsistency with the dimensions.

[72]The dragons represented on the Qin carriage #2 have evolved to the point where they look more like cloud formations than dragons. The one foot and the humped-back, the calling cards of this *kuí*, are still clearly visible.

(see plate 6). He also appears on the heel, directly below two more *kuí* dragons (see plate 7). Within the box, thirteen simple bronze tabs were discovered, entirely undecorated and in no particular order. These were probably inlaid onto the cloth-covered board in some unrecoverable design.

The overall decorative program on chariot M52 was probably designed to convey the image of luxury, power, and speed. The lacquered walls and floor of M52 are certainly more sumptuous than the decidedly more military chariots found at Xiaotun (M20, M40). Also, the horn-shaped yoke-bar and the horned animals on the bronze decorations help to convey the image of a fast-charging beast. The excavators suggest that M52 was a vehicle for elite conveyance and not a war chariot. I would tend to agree. The complete absence of weapons, the sumptuous decoration, and the hard floorboards all suggest to me that this vehicle was ridden in slow parade or not at all.

Harnessing

The Shang harnessing system is still poorly understood. Given the delicate and corruptible nature of ropes and leather, there is very little evidence to use in reconstructing harness technology. And because later harness technology evolved so quickly, it is not advisable to use complete models from the tomb of Qin Shihuang as an analogy. What we can be certain of is that the horses carried a bit, *xián* 銜 , in their mouths which was connected to cheek pieces, *biāo* 鑣 , that were part of an overall bridle. The structure of the headstall, *luò tóu* 絡頭 , can often be inferred because it was sometimes strung with small bronze discs or shells (M52) which left a trail of their original location. The reins, *pèi* 轡 , connected to the bit, and in some cases travelled through a rein guide, *yǐ* 轙 , placed on the yoke bar before travelling to the driver.[74] The driver may have also used a bronze bow-shaped object tied around his waist to hold the end of the reins.[75]

There is some debate as to how the horse was actually harnessed to the chariot to provide the draught. Needham believed that the Shang employed a throat and girth harness

[73]Watson, "The Chinese Chariot," 9-12. He thinks it may actually be a Shang interpretation of a wolf or other beast common to Northern Zone art. His theory accords very well with the discussion of chariot origins discussed below.

[74]It was thought that the rein guide, *yǐ* 轙 ,was an invention of the Western Zhou until the discovery of crude rein guides on the disarticulated yoke bar from Meiyuanzhuang M40.

[75]See note 98 on page 41.

as was used in the Near East. One band went around the horse's throat and a second went around its belly. These were joined on top of the horse's neck and fastened to the yoke bar. He believed that the yoke saddle itself was a completely useless vestige and merely served to guide the reins to the driver.[76] Littauer argued that the yoke saddle actually bore the majority of the draught of the vehicle. It tilted back and rested firmly on the horse's neck, in front of the withers. Throat strap as well as girth strap were secured from its ends.[77] The mainland scholar Sun Ji has argued on the basis of bronze inscriptional forms and the later Qin carriages that the inner arm of the yoke saddle was connected to the draught pole by means of a trace, *yǐn* 靷. This would have helped distribute the force of the draught more evenly to the vehicle's frame. He further argues that this unique arrangement proves that the Chinese chariot did not evolve from Western wheeled-vehicles with their exclusively throat and girth harnesses.[78] No evidence of such a trace has yet been found on a Shang chariot.

D. Function of the Shang Chariot

Burial Ritual

Common to nearly all Bronze Age societies which employed the chariot was a burial ritual involving the interment of the vehicle with the deceased owner. This is seen throughout southern Russia, the Caucasus, Egypt, and Europe. It is explicitly stated in the Egyptian case and inferred in the others that the chariot was intended to be used by the deceased in the next life. It also may be the case that it was simply buried with the owner as a mark of his status in this life and his ability to destroy wealth upon his death. It should be noted that attendant human sacrifice is much more common in the Chinese burials, where from one to three men were slaughtered and placed in the pit with the horses and the chariot. These young men (age 20-35), who are often found in association with weapons, bronze rein-holders, and jade or bronze whip-handles, were probably the actual warriors

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[76]Needham and Ling, *Physics and Physical Technology*.

[77]Littauer, "The Function of the Yoke Saddle." This is the arrangement I have followed in my abbreviated reconstruction of the harness of M52. Indirect evidence for just such a girth strap connected to a throat strap comes from Guojiazhuang M147 where bronze discs clearly track the path of a strap around and underneath each horse's belly and up to the neck area.

[78]See Sun Ji, "Zhongguo gudai mache de jijia fa."

and drivers who operated the chariots. European and Near Eastern burials are more likely to contain just the chariot, perhaps the horses, and the tomb lord alone.

As was mentioned previously, the chariot burials of the Shang period take several forms. In some of the earlier examples, such as the large tomb M1001, the chariots are buried alone, without horses, in the tomb of a deceased king. This ritual was obviously performed at the time of the inhumation and intended as part of the overall ceremony for the dead. Later, in the same royal burial ground at Anyang, another type of chariot burial was performed, wherein twenty-five chariots were buried as a group.[79] This pit was not associated with any particular tomb, but seemed to be a general sacrifice. It may have been performed to appease one or more angry former kings buried in the cemetery, preventing them from vexing the living king here on earth. This can be extrapolated from documented examples in the oracle bones of the Shang, wherein humans were sacrificed in large numbers to remove curses caused by troublesome ancestors.[80] Another type of burial ritual is suggested by the group of chariots buried in the Xiaotun palace foundation area.[81] These chariots seem to have been buried, along with horses and warriors, in some sort of coordinated sacrifice.[82] The final type of burial ritual seems to be one in which the chariot is intended as an accompanying interment near the tomb of a noble, rather than a king. These are often found in pairs in the so-called "clan" cemeteries at Xiaomintun, Guojiazhuang, and Dasikongcun.

One textual reference in the corpus of the Shang dynasty oracle bones may actually describe a chariot sacrifice. Shaughnessy reads the brief inscription as "Let it be the right *charioteer* who will perform the ritual to Brother Xin."[83] But, the inscription (*Heji* #27628)[84] could also be read, "If in the ritual to Brother Xin,[85] we sacrifice the Chariot

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[79]Zheng Ruokui, "Shilun Shang dai de chema zang," 462. This find was hastily excavated and poorly reported. It is thought that the twenty-five chariots were placed in five groups of five vehicles each. The shape of the box from one of the vehicles was roughly similar to Xiaotun M20.

[80]David N. Keightley, *Sources of Shang History: The Oracle-Bone Inscriptions of Bronze Age China* (Berkeley: University of California Press, 1978).

[81]Shi Zhangru 石璋如, "Yinxu zuijin zhi zhongyao faxian 殷墟最近之重要發現" (Important recent discoveries from the Ruins of Yin), *Zhongguo kaogu xuebao* 2 (1947): 1-81.

[82]The meaning behind the configuration of these burials has intrigued scholars for years. Shi Zhangru has at various times speculated that they represent the battle formation of a chariot squadron or an enormous diagram of the pictograph for chariot.

[83]Shaughnessy, "Historical Perspectives," table 1.

Squadron of the Right, this will be correct."「其？兄辛，惟右車用，有正」. The ambiguity of the character (有：右祐又) also leaves this inscription open to other interpretations.

According to current evidence, the ritual burial of horses and chariots was not practised during the earlier Erlitou or Erligang cultures. It appears quite suddenly with the founding of Anyang and the turbulent era of the Shang king, Wu Ding (reign *c.* 1200-1181 B.C.). In fact, the chariot found in the southeastern corner of large tomb M1001 at Xibeigang, arguably identified as the tomb of Wu Ding, could be the first intentional chariot burial of any kind in China. In the next section, I will discuss how the chariot and its attendant rituals first came to China, possibly during the reign of Wu Ding. In Bronze Age China, the ritual of burying chariots and horses along with their grooms evolved significantly over time. I will leave a discussion of that evolution until the final section of this paper.

Royal Hunt

We know that the Shang king used his chariots for hunting. Several oracle-bone inscriptions (Table 4 on page 97) specifically mention the king riding in his chariot in pursuit of rhinoceros or horses. In the lengthiest and most detailed of these inscriptions (*Heji* #10405 obverse and #10406 ob.) the king is said to "have been going off in pursuit of rhinoceros" when the Junior Servitor harmed the king's chariot in some way and sent it flying. Another inscription (*Heji* #584 ob.) states that the king was capturing errant horses from his chariot.

The royal hunt is a common theme in Egypt and the Near East. The tomb of Tutankhamun contains a scene of the young king hunting lion from his chariot,[86] and the walls of later Mesopotamian palaces come alive with depictions of royal lion hunts, such as the famous reliefs of the Royal Hunt of Assurbanipal at Nineveh.[87] In the Eastern Zhou period

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[84]All succeeding oracle-bone references are given as serial numbers of the rubbings in Guo Moruo 郭沫若, ed., *Jiaguwen heji* 甲骨文合集 (Collection of oracle-bone inscriptions), 13 vols. (Beijing: Zhonghua Shuju, 1978-83).

[85]The Brother Xin mentioned in this inscription could be the Shang king Lin Xin 廩辛 (reign *c.* 1150 B.C.). He was the only king after Wu Ding who could have been called by this name. Therefore, the king who performed the sacrifice to him would have to be Geng Ding 庚丁 (reign *c.* 1150-1121), who was a brother to Lin Xin and a grandson of Wu Ding. Dates are those estimates calculated as the "revised short chronology" given in Keightley, *Sources of Shang History*, table 38.

[86]Howard Carter, *The Tomb of Tutankhamen: Discovered by the Late Earl of Carnarvon and Howard Carter*, 2 vols. (London: Cassell and Company, Ltd, 1927).

in China, royal hunts took place within special parks which were set aside for the king, much as was the case in medieval Europe. I doubt, however, that the Shang king had a royal park specifically set up for his hunt. His hunts were probably free roaming and may have served several purposes. One would have been to garner food for royal feasting, thus reinforcing his image as provider for the court.[88] The second would have been the acquisition of wild horses for taming. A third may have been merely to show his athletic prowess to those at court as he rode in his low-walled chariot over the uneven ground in pursuit of mighty animals such as the rhinoceros or tiger. Finally, the royal hunt could have served as a military inspection mission. By riding out with armed men into uncontrolled territory, he could spy on the neighboring statelets and project his power into the hinterland.

Ritual Display

The chariots of the Shang may have also been used as high-status objects for display. In the Western Zhou, some chariots were certainly being used for this purpose (See "Status" on page 65). Since only the king, and presumably higher-ranking nobles and members of the royal lineage, were allowed (or could afford) to own chariots, the possession of one indicated the high rank of its owner. The chariots found at Anyang vary greatly with respect to quality of design and workmanship. Chariot M52 in particular, seems to have been lavishly decorated with red and black lacquer panels and sumptuous bronze decoration.[89] This chariot, with its hard, wood floor and fragile yoke saddles, may never have been ridden into battle or taken out into the field to hunt. It may have been used only for ritual parade in state ceremonies, if it was ridden at all.

Warfare

Other chariots found at Anyang convey a much more martial character and may have actually been used in battle. Chariot M175 from Dasikongcun was accompanied by

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[87]Eva Strommenger and Max Hirmer, *5000 Years of the Art of Mesopotamia* (New York: Abrams, 1964).

[88]Some oracle-bone inscriptions mention hunts which garnered hundreds of wild animals. (*Heji* #10197/10198).

[89]I fear that my reconstruction is still a pale imitation of the original vehicle's dazzling display. Western Zhou inscriptions mention such showroom extras as gilded-leather bindings and tiger-skin canopies.

one human who possessed a stone halberd, twenty-two bronze arrows, a bronze knife, and ten bone arrows. He also had a knot-detangler, *xī* 觿 , (possibly a tool used by a charioteer to unharness the horses), an adze, and an ax.[90] The chariots from Xiaotun M20 were buried with three humans. In close proximity to these men were three halberds, ten stone arrows and thirty bronze arrows, three knives, four whetstones, and a jade whip-handle. A very similar assemblage is repeated in other chariots pits (Xiaotun M40, Dasikongcun 292, Baijiafen 43) and seems to represent the standard equipment of a chariot riding team. In the case of Xiaotun M20, Shi Zhangru noticed a difference in quality between the weapons located near the box (top-quality bronze) and the weapons surrounding the box (lower-quality bronze and bone). From this he inferred that the chariot crew consisted of a master and two defenders (a driver and an archer).[91] There is, however, very little textual evidence for the use of chariots in battle during the Shang. Only one inscription (*Heji* #36481 ob.) mentions chariots in a decidedly military context, and it seems to refer to the Shang capturing chariots from an enemy group.

There is also a serious question as to whether the Shang chariot itself or its weapons were structurally fit for battle. As was mentioned above, the Shang chariots possessed a rigid axle centered under the box. This would have made the chariot liable to flip over in tight turns. A much more logical layout was employed by contemporary Egyptian and Hittite war chariots where the axle was placed at the rear of the box for maximum turning efficiency in battle. In addition, Yang Hong has convincingly argued that the halberd weapons, *gē* 戈 , of the Shang were too short to have been used from a moving chariot and could only have been used for hand-to-hand combat.[92] He bases this argument on the preserved lengths of halberd handles from Shang tombs around Anyang. These handles are

[90]Yang Baocheng, "Yin dai chezi de faxian yu fuyuan," 505-27.

[91]Shi Zhangru, "Yinxu zuijin zhi zhongyao faxian," 20. Historically, Chinese chariots were manned by three men, and this tomb would seem to project that formation back into the Shang. Shi tried to go even further in his interpretation. He tried to interpret the entire Xiaotun area northern graveyard as a military layout, analogous to the terracotta army of the first emperor of Qin. Each of the five chariots found in the graveyard he saw as leading a squad of twenty-five infantrymen. There is actually very little basis for his interpretation. In fact, there is a confusion of hundreds of graves in this area, mostly sacrifices, and their overlap indicates different dates for interment. Some graves are clearly contemporary with the chariot burials near them, but their mutual association and the order of the overall sacrificial program is unclear.

[92]Yang Hong 楊泓 , "Shang dai de bingqi yu zhanche 商代的兵器與戰車 " (Shang-era weaponry and the war chariot), in *Zhongguo Shang wenhua guoji xueshu taolunhui* 中國商文化國際學術討論會 (Yanshi, China, 1995), 119-26.

only 80-100 cm in length. After holding the handle under one's armpit, the projecting length is only 50-60 cm, far too short too lash out at foot soldiers from a moving chariot. Later Zhou halberds became increasingly longer and much more suited to mounted, slashing warfare. For instance, the halberd shafts in the Marquis Yi of Zeng's tomb are three to four meters long.[93]

Thus, the military function of the Shang chariots seems to have been rather limited in scope. It was probably used as a mobile command platform for nobles to survey the battle and possibly as a fast conveyance for moving heavily-armed, halberd-carrying warriors to the front of the battle. The presence of numerous arrows in the arsenal, of course, does not rule out the possibility that they were launched from a moving chariot in battle.

E. Origins of the Shang Chariot

Since the two-horse chariot appears so suddenly in the archaeological record of China around 1200 B.C. at Anyang, this has raised the inevitable question of its ultimate origins. Given the absence of compelling data detailing a previous indigenous evolutionary sequence of more primitive equid-drawn chariots leading up to the sophisticated Anyang type, the lack of evidence for horse domestication prior to Anyang, and the near seven-hundred-year head-start of Near Eastern prototypes, one must conclude that the horse-drawn chariot was diffused to China from outside in its fully-developed state. Claims of diffusion should be substantiated by citing positive evidence, not just by pointing out a dearth of evidence supporting independent invention. Thus, in this section, I will present several lines of evidence which support the theory that the chariot of the Shang was diffused from Central Asia around the reign of Wu Ding of the Shang Dynasty, that is around 1200 B.C.

Structural Evidence

The structural details of the Chinese chariot outlined above do not match very closely with those of chariots from Egypt and the Near East, which usually have four or six spokes and a much smaller box and wheelbase.[94] The Chinese chariots do, however, match closely with several chariots recently unearthed in Kazakhstan and Armenia which date

[93]Hubei Sheng Bowuguan, Hubei Sheng Wenwu Kaogu Yanjiusuo, eds., *Zhanguo dixia yuegong: Hubei Suixian Zeng Hou Yi mu,* 150-2.
[94]Littauer and Crouwel, *Wheeled Vehicles and Ridden Animals*, 74-81.

from 2000 B.C. and 1500 B.C., respectively, centuries older than the earliest Chinese examples.[95] The Kazakh chariots, possibly the earliest in the world, were buried in sacrificial pits belonging to the Sintashta-Petrovka culture, a proto-Aryan culture situated just east of the Ural Mountains in northern Kazakhstan/southern Russia (see fig. 5). At the type-sites of Sintashta and Petrovka over twenty burials showing evidence of chariots have been found. The rotted traces of their wheels show that they had eight to twelve spokes per wheel and that the distance between the wheels was approximately one meter. Much further to the southwest in the Caucasus, on the shores of Lake Sevan in Armenia (see fig. 5), the site of Lchashen has yielded the remains of two complete chariots of very similar construction to those of Anyang. The Lchashen chariots, as reconstructed, have wheels of 98 cm in diameter and a two-piece bent-wood felloe. The draught pole is estimated at 3.5 meters. Most important, the Lchashen chariots' wheels have twenty-eight spokes, a number unheard of anywhere else outside China. The chariot boxes of the Lchashen vehicles are also similar to the Anyang chariots. The Lchashen's rider-box is both wide (1.10 m) and shallow (0.51 m). Curiously, the Lchashen boxes only had rails to the sides and rear and were open at the front. This feature is very rare in known Bronze Age chariots and its only analog is found on the chariot from Xiaotun M40 at Anyang. The Lchashen axles were also centrally placed below the box, unlike Near Eastern chariots, but identical to all Chinese examples. Beyond these important structural similarities, it should not be overlooked that the ritual burial context of the southern Russian and Chinese chariots is very similar, involving the burial of horses and chariot together.

What this structural evidence suggests is that after the invention of the spoke-wheeled chariot around 2000 B.C. in southern Russia, it diffused in two directions, geographically and structurally. As it entered the Near East with the Aryan incursions into India and Anatolia, and with the Hyksos into Egypt, the chariot evolved along lines which kept it small like its predecessor. This variant evolved to have only four spokes, formed in pairs by 90° bent-wood pieces passed through the nave. The southern Russian and Central Asian tradition, seen at Lchashen and in China, shows an evolution towards a larger, three-

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[95]For a summary of the Armenian finds see, Stuart Piggott, "Chariots in the Caucasus and China," *Antiquity* 48 (1974): 16-24. For a summary of the Kazakhstan finds, see: Piggott, "Bronze Age Chariot Burials in the Urals"; Anthony and Vinogradov, "Birth of the Chariot."

person vehicle. This tradition favors wheels with twenty to thirty spokes, formed by mortising straight segments directly into the nave. These different evolutions probably represent different woodworking traditions or simply different needs for the use of the vehicle.

Stylistic Evidence

Several lines of stylistic evidence suggest that the Shang chariot was diffused from Central Asian prototypes. All throughout Central Asia, from the Caucasus to Mongolia, rock carvings have been found which depict humans riding in chariots (see fig. 14).[96] In all of these carvings, the chariot is depicted schematically from above, with the wheels laid flat rather than seen edge-on. This is exactly how wheels are depicted in the Shang oracle-bone pictograph for chariot (see fig. 13). Western Asian depictions of chariots, in contrast, are almost always seen from the side. It should also be noted that many of these depictions show the axle centrally placed beneath the box. These rock carvings are inherently difficult to date, and excavators have given them dates ranging from 1500 to 500 B.C. Regardless, they suggest that Chinese and Central Asian representations of the chariot were part of a shared visual conception.

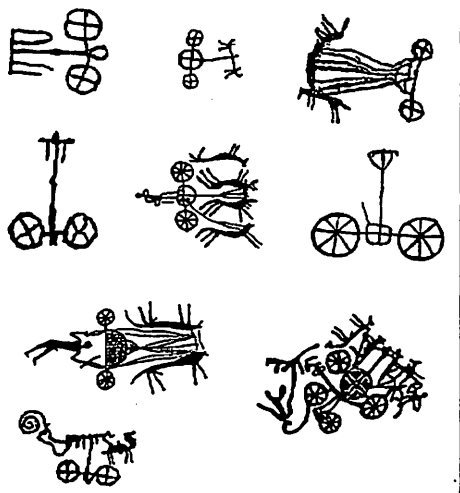


Figure 14. Rock carvings of chariots from Central Asia and Mongolia. From Littauer, "Rock Carvings of Chariots."

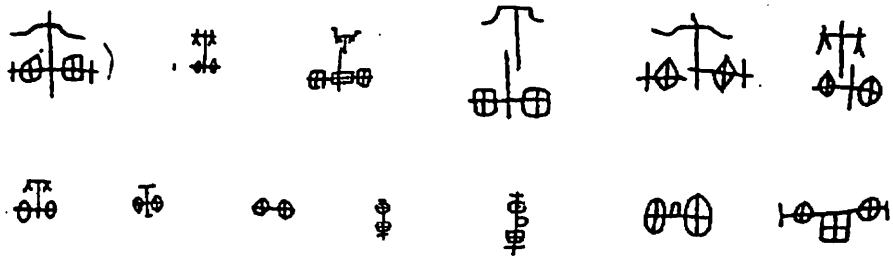
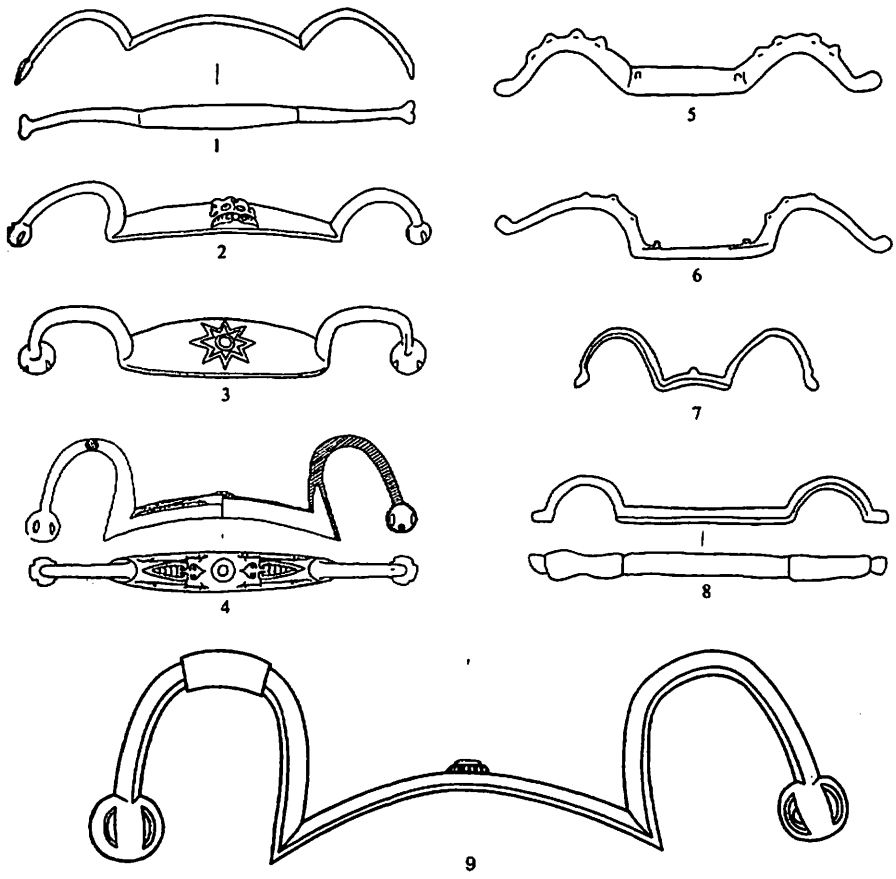


Figure 13. Various forms of the Shang graph for chariot. From Shaughnessy, "Historical Perspectives."

[96]Mary Aiken Littauer, "Rock Carvings of Chariots in Transcaucasia, Central Asia, and Outer Mongolia," *Proceedings of the Prehistoric Society* 43 (1977): 243-62.

In addition, two items often found in context with Shang chariots were probably imported from or heavily influenced by the cultures of the Northern Zone, the geographical area to the north and west of the Shang domain. First, in at least ten of the best preserved chariot pits at Anyang and Qianzhangda, a peculiar bow-shaped object is found[97] (see fig.

Figure 15. Bow-shaped bronze objects from East Asia and Siberia. Composite diagram compiled from Lin Yun, "The Northern Zone," and *Anyang Yinxu Guojiazhuang Shang dai muzang*.



1. From Anyang, YM238.
2. From Anyang, Wuguancun, E9.
3. From Anyang, Dasikongcun M175.
4. From Baocaopo M2, Gansu. W. Zhou.
5. From tomb 3, Askyz, South Siberia.
6. From Tomb 28, Big Cape, Tomsk.
7. From ancient tomb at Raikov.
8. From tomb #3, Sargov.
9. From Anyang, Guojiazhuang M1.

[97]The term, "bow-shaped object," describes a peculiar bronze which is found in graves covering a north/south range from Siberia to Henan and an east/west range from Bohai to Gansu. It has a flat or gently arching middle section, left and right segments with a more pronounced arch, and finials with round or sometimes horse-headed terminals housing jingle-bells. These artifacts first appear during the Anyang period and disappear at the end of the Western Zhou. During this time, the shape of the object underwent a consistent evolution towards a more exaggerated curvature.

15). In archaeological publications, it is referred to as the 弓 -shaped object, after the graph for a composite bow. There are many opinions as to the function of this curious relic.[98] In

[98] The function of this object has preoccupied scholars since the Song Dynasty. Song antiquarians thought that it was a jingle-bell ornament for a horse or perhaps part of a military standard. Shi Zhangru, Tang Lan, and William Watson all reconstructed it as a bow-clamp which would have been attached to a composite bow, reinforcing its shape when strung (Shi) or only when unstrung (Tang, Watson). Emma Bunker, citing its association with chariot burials of the Shang, speculated that it was part of the chariot structure, used to attach the reins to the vehicle. Lin Yun also believed that it was used to hold the reins, but insisted that it was attached to the driver, not to the vehicle. See "References Cited and Additional Works Consulted" on page 75 for these scholars' arguments.

In an earlier version of this paper, I tended to side with Tang Lan, but after reviewing all the evidence, I now believe that the bow-shaped object was a reins-holder, or the bronze frame of a wooden "waist yoke" which would have been strapped to the chariot driver's waist, allowing him to guide the reins with his body, or at least tie off their ends to prevent losing them during the ride. My reasoning is as follows:

Shi Zhangru's argument that the bow-shaped object was attached to the strung bow can be dismissed out of hand. If such a piece of bronze was attached to the flexible body of a bow, it would impede the flexion of the bow and its breadth would block the arrow's path. Tang Lan and W. Watson's modification of this argument, which maintains that the clamp was only used on the unstrung bow to preserve its shape, also does not follow reason. Why would such an expensive, high-status device, complete with bells, only be used on a object which was not in use? Also, nearly all of the Siberian examples have nearly flat middle sections. What kind of bow could possibly match that contour? Tang Lan's identification of the bow-shaped object as a bow-clamp is mainly based upon a convoluted and tenuous philological argument. He also cites archaeological evidence which shows that, when they were discovered, some of the bow-shaped objects were connected to wooden objects by means of bindings. This wooden armature could be a bow as Tang argues, but it could also be a wooden "waist yoke."

In many of the Siberian examples, and several of the Anyang finds, the bow-shaped object is found lying across the waist of a man. Further, it is often found near a bronze or jade whip-handle, even when the objects are within a regular grave and not a chariot pit (Guojiazhuang M160/M1). It is not consistently found near the caches of arrows in these same tombs.

The curvature of the arms in the object would have served to hook the ends of the reins and hold them secure as the driver's body turned. The increased curvature of this portion over the centuries would have only enhanced this function, rather than impeded it. These arching arms of the object would have also undergone the most structural stress during use. Occasionally excavators and looters only find the bronze arms of the object, suggesting that the progenitor of the reins-holder was originally fashioned of wood. Only later, were key elements reinforced with bronze, much as the yoke saddles on the chariots themselves. A recently excavated bow-shaped object from a tomb at Guojiazhuang (M1) carries a bronze patch on exactly the spot which would have cracked under the stress of holding the reins (see fig. 15). Finally, a suggestive piece of stylistic evidence can be found by considering the horse-head terminals on some examples. When the reins were attached to the reins-holder, they would wrap around these horses' necks, providing a logical visual analogy to the true horse attachment at the other end of the reins. In fact, the shape of the bow-shaped object appears to draw its inspiration not from the composite bow, but from the shape of wooden yokes seen on carts from the barrows at Lchashen. Because it appears to be a yoke-in-miniature, with the similar function of harnessing the driver, I have coined the term "waist yoke" to rename the bow-shaped object.

If such an object were used in Siberia and China during the Shang and Western Zhou to control the reins of the horse team, what happened to it after that time? One can still see the remnants of such an object on the #2 carriage from the Qin mausoleum. Attached to the front of the carriage, excavators found an object with four hooked talons (appropriate for a four-horse team) which still held some of the reins. Apparently the "waist yoke" eventually became attached to the vehicle.

Shang chariot pits, they are often found in or near the box, and occasionally at the waist of one of the humans. Formally similar objects have been found in related burial contexts in Mongolia and southern Siberia, yet nowhere south of Anyang, prompting one expert to conclude that the bow-shaped object was an invention of the nomadic pastoralists of the Northern Zone, who later introduced it into the Yinxu metropolitan area, where it was first cast in bronze and decorated with Shang motifs. Later it was reintroduced in bronze form into the Northern Zone.[99] Regardless of its exact function and its relationship to the chariot, this object points to another shared cultural trait between the Anyang chariot assemblage and the peoples of Central Asia and southern Russia.

Another object found with some of the chariots at Anyang is the animal-style knife (see fig. 16). This is a semilunar-shaped knife which is topped by a ring or a fully-sculpted animal figure.[100] In comparison to the motifs of mainstream Shang bronze-vessel decoration, these knives look very foreign. Their animal-style art is very common, however, in the Northern Zone which stretches to the north and west of Anyang.[101] Pointing to the is-

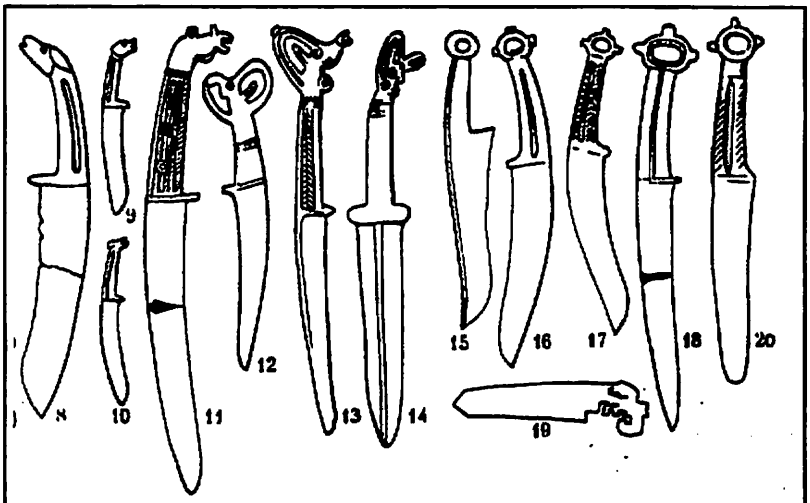


Figure 16. Bronze animal-style knives from Xiaotun, Anyang. From Watson, "The Chinese Chariot."

[99]Lin, "The Northern Zone," 263-6.

[100]Another part of the chariot which often used fully-sculpted, realistic animal figures was the linchpin of the axle. These sometimes take the form of rabbits, buffalo, or even human servants. Even down to Western Zhou times, bronze chariot parts were more likely to portray sculpted animal or human forms than other bronze objects of Shaanxi/Henan origin. For Western Zhou examples, see Lu Liancheng 盧連成 and Hu Zhisheng 胡智生, *Baoji Yuguo mudi* 寶雞虢國墓地 (The cemetery of the state of Yu at Baoji), 2 vols. (Beijing: Wenwu Chubanshe, 1988).

[101]Lin, "The Northern Zone," 250-8.

sue of technology, the shape and texture of some of these knives suggest that they were cast using a lost-wax casting method.[102] Shang vessels were usually cast using the piece-mold casting method. Thus, these knives also seem to be part of an assemblage of items used by the Shang charioteer which trace their origin to the steppe zones and not to the Central Plain.

Textual Evidence

The oracle bones found at the Shang capital at Yinxu provide a few clues relating to the origin and date of the Chinese chariot. According to one count, there are at most twenty-two oracle records in the entire Shang corpus which use the graph for chariot (modern character 車).[103] Table 4 on page 97 provides a listing and rough translation of these inscriptions. As Shaughnessy has noted, the earliest inscriptions, dated according to the diviner who performed the inscriptions, are from the end of the reign of Wu Ding (reign *c.* 1200-1181 B.C.). These early inscriptions all deal with the king's personal use of the chariot in performing the royal hunt. Some scholars have commented that the concept of the royal hunt has a very long history in the Near East and may have been imported into China along with the chariot.[104] It is only in the later period that we see one inscription that refers to the use of the chariot in warfare, and in this inscription, it is a nomadic enemy of the Shang located in the northwest who is using the chariots.[105] Furthermore, there is a very long inscription which relates the story of a chariot accident during a rhinoceros hunt (*Heji* #10405 obverse) in which the king and a prince are sent flying from the chariot box. This accident suggests that perhaps the royal family did not yet have that much experience using the unwieldy chariot.

Additional information can be garnered by examining the different graphs used to represent chariots in the oracle-bone corpus (see fig. 13). At least thirteen distinct varia-

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[102]Watson, "The Chinese Chariot," 6-9.

[103]One modern concordance has over twenty inscriptions in its database containing this graph, but many of these inscriptions are merely the single character for chariot, found on badly fragmented pieces. Several others appear to refer to the same event. There is also one contested inscription which might actually reveal a Shang military use of the chariot. The graph in this inscription (*Heji* #6834), however, is so different from the rest that some scholars (David Keightley, Li Xueqin) have suggested that it does not even signify a chariot.

[104]Piggott, *Wagon, Chariot, and Carriage,* 67-8; So and Bunker, *Traders and Raiders*, 27.

[105]Shaughnessy, "Historical Perspectives," 213-21.

tions on the graph for chariot are seen among the extant inscriptions. Shaughnessy suggested that the instability of the graph signifies that the scribe has not been accustomed to writing that character for very long and that no standard depiction has arisen, much as foreign loan-words into modern languages have various forms until they are standardized.[106]

Linguistic Evidence

During this century there has been an attempt to reconstruct the actual pronunciation of earlier forms of Chinese, beginning with the work of Bernhard Karlgren and Henri Maspero and continuing with the work of E.G. Pulleyblank, Li Fanggui and Axel Schuessler. Originally, scholars only sought to reconstruct the language of the Tang dynasty (Ancient Chinese), utilizing rhyming dictionaries from the Sui and Tang and examining loan words into languages like Japanese, which are written with syllabaries. Later, scholars pushed their reconstructions back even further, using rhymes found in the *Shijing* 詩經 in an attempt to recreate the sounds of Archaic Chinese (Old Sinitic), or the language spoken around 600 B.C. Recently, there has been an attempt to reconstruct the pronunciation of the parent language of Chinese, namely Sino-Tibetan. Though many of the reconstructions are highly theoretical and fiercely debated among experts, these Archaic Chinese (and Sino-Tibetan) reconstructions may be able to provide another piece of evidence in our search for the origins of the Shang chariot.

In an article published in 1990, Victor Mair attempted to show that certain key Shang words were actually derived from Indo-Iranian roots.[107] He claimed that the Chinese word for shaman, *wū* 巫 , was pronounced **m^{y}ag* in the Old Sinitic tongue. He further hypothesized that this word was derived from the parent word of the Old Persian *magus*, and was thus related to the modern English word *magician*. In passing, he also mentioned that he had found Indo-Iranian roots for many Chinese words dealing with chariot parts, horses, and cattle types. The only word that he elaborated on in that article was the word for chariot, 車 , pronounced *chē* in modern Mandarin. According to Mair, this word was

[106]Ibid., 215. Not all of these various forms Shaughnessy has reproduced represent the same word, chariot. In one inscription (*Heji* #10405), two of these forms appear simultaneously. From the context, one clearly indicates the entire vehicle, while the other merely represents the box, or rear portion of the vehicle in which the king was riding. See note 40 on page 19.

[107]Victor H. Mair, "Old Sinitic *Myag, Old Persian Magus, and English 'Magician'," *Early China* 15 (1990): 27-48.

formerly pronounced **kl^{y}ag* in Old Sinitic, which he claims was borrowed directly from the Proto-Iranian stem **caxra-* ("wheel"), ultimately descended from the Indo-European root-word *k^{w}ék^{w}lo-* ("wheel").

In 1994, Robert Bauer followed up on the work of Mair in tracing the Western roots of Chinese words dealing with chariots.[108] In that article, Bauer compared the word for wheel in various northern Chinese and Bodic (Tibetan) dialects to form the Sino-Tibetan root-word, **kolo*. In his research, he found that various northern dialects of Modern Chinese contain words like 轂轆 (mod. *gū lu*) which mean "wheel" or "to turn." The written form of this word is unfixed, for various graphs are used in northern dialects to represent these sounds, prompting Bauer to believe that it is actually a transliteration of an ancient two-syllable word descended from an Indo-European root, *k^{w}olo-s* ("wheel"). Furthermore, he points out that no southern dialect of Chinese contains this compound, a point which also confirms its northern origins.

The linguistic arguments put forth by Mair and Bauer are very complex and difficult for non-experts to follow. Mair admits that current reconstructions of Old Sinitic are crude compared to those generated for more phonetic scripts. In fact, he notes in passing that scholars do not even agree that the word for shaman (**m^{y}ag*) ended in the velar '*g*' sound. Especially in Baur's case, it seems that there is an *a priori* assumption of a linguistic connection, which may only arise from coincidence. This assumption seems to guide his reconstruction of the Sino-Tibetan root for wheel and his selection of its Chinese descendants. Yet, some of the two scholars' assumptions are quite reasonable. If the Chinese imported the chariot from the peoples of Central Asia, then they could have also transliterated the pronunciation of words used to describe this object and its attendant parts.[109] The current state of linguistic reconstruction does not yet allow us to know those pronunciations or their origins with any certainty.

Route & Method of Transmission

If the horse-drawn chariot was diffused to China from the outside during the second millennium B.C., what route would it have followed to get there? On this point, scholars have proposed two alternatives (see fig. 5 on page 5). The southern route starts in the Cau-

[108]Robert S. Bauer, "Sino-Tibetan *kolo 'Wheel'," *Sino-Platonic Papers* 47 (1994): 1-11.

casus, near the site of the chariot finds at Lchashen, then travels south of the Caspian Sea through northern Iran. Then it travels through the passes of eastern Afghanistan, into the Pamirs, skirts the Takla Makan desert, squeezes through the Gansu corridor into China, and finally traverses Shaanxi into Henan. Part of this route is historically documented in later times as the famous Silk Road. A variation on this route would be to go north from Afghanistan through Tashkent and Ferghana, meeting the other route at the end of the Takla Makan near Dunhuang.[110] The northern route travels along the wooded steppe of southern Russia, starting in the Urals near the sites of Sintashta-Petrovka. It then crosses through the passes of the Altai mountains, travels south of Lake Baikal, and finally traverses Mongolia and the Ordos to enter the Central Plain of China.[111]

All of these routes, especially the more likely northern variation, cover more than 6000 km of very difficult terrain and traverse some very high mountain passes. Yet if one considers that all of Asia was warmer and wetter in the second millennium, then the road conditions do not seem so daunting. Furthermore, this journey was presumably not made in one year or by one group of people. The chariot had eight hundred years to reach China from its origin in the Urals, a manageable 7.5 km/year rate of diffusion. It was likely transmitted as nomadic pastoralists living along the wooded stepped moved in search of new resources. It was also passed from one group of people to another through the dual methods of war and trade. The chariot could have been transmitted even faster through Central Asia if it had traveled as an idea in the minds of skilled craftsmen who knew how to construct it.

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[109]If, as I have argued earlier in this paper, the Shang had experience with wheeled vehicles prior to the introduction of the chariot, then they must have had an earlier word than *chē mǎ* 車馬 (the full Shang appellation) to describe it. This might possibly be the word, *liàng* 輛 , one of the earliest measure-words for counting the number of chariots. Its etymology seems to be related to *liǎng* 兩 , signifying the number two or any pair of objects. It would thus seem to indicate any two-wheeled vehicle, whereas *chē mǎ* or *chē* specifically refers to the horse-drawn chariot. Another measure-word for chariots appears in the Western Zhou bronze inscriptions and received texts. This is *shèng* 乘 , morphologically related to the word *chéng* 乘 , to ride. It indicates objects which can be ridden by a man, represented pictographically by a man riding up on something. These measure-words are not hard and fast categories, for the usage of the two words often overlap, but their semantic domains would seem to suggest that earlier wheeled vehicles were two-wheeled carts which were not meant to be ridden in by humans, corresponding well with the evidence for small-gauge wheeled carts at Yanshi and at Anyang.

[110]Piggott, "Chariots in the Caucasus and China," 20-1.

[111]Wang Wei 王巍 , "Shang dai mache yuanyuan lice 商代馬車淵源蠡測 " (A tentative estimate of the origin of the Shang-era chariot), in *Zhongguo Shang wenhua guoji xueshu taolunhui* 中國商文化國際學術討論會 (Yanshi, China, 1995), 28.

After mapping out the possible routes of diffusion for the chariot, let us now turn to the question of the actual, final transmission into China. How did the Shang court get its hands on this lethal piece of high-status technology which had traveled the steppe region for centuries? One possible method is suggested by the oracle-bone inscriptions mentioned earlier (see Table 4 on page 97). In one inscription (*Heji* #36481 ob.) the Shang capture two chariots from an enemy group along with other weapons and prisoners. Could such a raid have been the initial means of acquiring the chariot? I do not believe that this is likely. The chariot is a complex piece of technology, which as several scholars have pointed out, requires a massive infrastructure to operate and maintain. Presumably, one needs drivers, horse-grooms, veterinary specialists, wheelwrights, carpenters, stable managers, etc. It would be as if a group of Native Americans in the 18th century were to have stolen a British Navy warship during a raid. Though they may have had experience with dugout canoes, there is no way that they could have smoothly operated and maintained so complex a piece of machinery without assistance.

Another possible method of direct transmission of the chariot is suggested by Emma Bunker. She proposes that the Shang acquired the chariot through a marriage alliance to a non-Chinese group to the northwest. Fu Hao, one of several consorts to the Shang king Wu Ding, was a warrior queen and, according to the interpretation of her name as a toponym, a native of a non-Chinese group. Perhaps she brought the chariot to court as her dowry. Her tomb certainly contains many artifacts such as mirrors, animal-style knives, and bow-shaped objects which were imported from or influenced by the culture of the Northern Zone.[112] Regardless of exactly how it was given, I concur with Bunker that the chariot was probably given to the Shang kings as part of an amicable exchange with a non-Chinese group to the northwest. Either by trade, tribute, or dowry, the Shang court around the year 1200 B.C. was able to acquire several Central Asian-style chariots, as well as the manpower and expertise necessary to use and to maintain them. This material and manual assistance, combined with their previous experience constructing small carts, allowed the Shang to take up the chariot quickly and smoothly and adapt it to their ritual and military needs. In a very short time, its construction and decorative program were all adapted to fit smoothly with existing technologies and motifs.

[112]So and Bunker, *Traders and Raiders*, 27.

Summary

In this section I have presented various lines of evidence which suggest that the horse-drawn chariot found in elite burials of the Anyang period in China was not an independent invention of the Shang, but rather was descended from Central Asian prototypes. Structurally, the Chinese chariot exhibits many traits identical to those of much older chariots found in the Caucasus mountains. Stylistically, the motifs and form of several distinctive artifacts found in conjunction with Shang chariots also bespeak an ancestry of non-Shang sources. Historically, the oracle-bone inscriptions refer to only limited (and sometimes inept) uses of the chariot by the Shang royal house, and one record specifically mentions capturing some from an enemy group.

The diffusion of the Central Asian chariot to China was merely one stop on the chariot's whirlwind transmission through the ancient world. As a machine of war, it was a symbol of the increased violence which engulfed all of the settled civilizations of Eurasia during this time, violence often perpetrated by nomadic groups from the chariot's Russian homeland. As a symbol of status, it was chosen as a marker of rank by ruling aristocrats from Greece to China to convey the pomp and wealth of royalty and the lightning speed of gods. As a tool and an idea, it bespoke the flux and ferment that was Central Asia, the superhighway of interaction and diffusion during the second millennium B.C.

IV. Other Wheeled Vehicles at Anyang

All the attention paid to the chariots should not be allowed to obscure the growing evidence which suggests that there were other forms of vehicles at Anyang. Because the high-status chariots were buried intentionally in rammed-earth pits, they have been preserved in large numbers, whereas the day-to-day vehicles of the capital would not have received such lavish treatment nor benefitted from such excellent preservation. In fact, no actual remains of vehicles other than chariots have been excavated at Anyang, but there are several pieces of indirect and inscriptional evidence which can help to add some vehicular variety to this picture.

A. Small Carts

There is evidence in the form of wheel ruts preserved in a midden pit which suggests that the Shang used small carts for utilitarian tasks, similar to the vehicles inferred at Nomhon and Yanshi. From 1986 to 1987, excavations took place at the site of Huayuanzhuang, just south of Xiaotun village, Anyang.[113] During these excavations a large garbage pit was unearthed that contained over 300,000 cattle bones (98% of the total) as well as some pig, deer, dog, and human bones. Atop one layer of the pit, excavators found fourteen small trenches (see fig. 17), varying in width from 10 to 15 cm and about 5 cm deep. The longest of the tracks measured 19.3 meters, while the shortest was only 2 meters. The bottoms of the gullies are concave and the surrounding matter is compressed and has a sort of sheen from repeated passage of wheels. The longest track consists of two parallel ruts 1.5 meters apart which track perfectly as they steer. Most of the other tracks are single ruts.

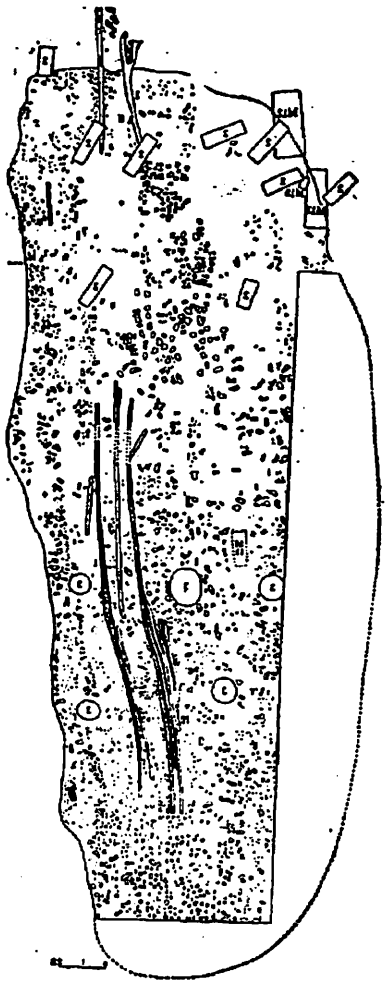

Figure 17. Wheel tracks from the midden pit at Anyang, Huayuanzhuang. From *Kaogu xuebao* (1992.1).

From this evidence we can construct a picture of this vehicle and its probable use.[114] First of

[113]Zhongguo Shehui Kexueyuan Kaogu Yanjiusuo Anyang Gongzuodui, ed., "Anyang Huayuanzhuang nandi fajue baogao 1986-1987 年安陽花園庄南地發掘報告 " (Report of the excavations at the Huayuanzhuang locus of Anyang, 1986-1987), *Kaogu xuebao* (1992.1): 97-128.

[114]It is possible that these ruts were made by a travois or other sledge and not a wheeled vehicle, though such a device would probably get bogged down in a pit full of carcasses and other refuse. Scholars of European wheeled vehicles have determined through experimentation that a wheeled vehicle leaves a different kind of rut than a sledge. In a wheel rut, there is a wavy appearance to the bottom of the trench. The Chinese archaeological report on Huayuanzhuang did not attempt to make such a determination. For European wheel ruts from the late fourth millennium, see Jan Albert Bakker et al., "The Earliest Evidence of Wheeled Vehicles in Europe and the Near East," *Antiquity* 73 (1999): 783-4.

all, this vehicle was not a chariot. The 1.5 m gauge of the tracks is a full 80 cm narrower than the average Anyang chariot gauge. Furthermore, the king would not be riding his chariot halfway into a garbage dump, stopping, and then backing out, as the layout of the parallel tracks suggest. This vehicle was probably a utility cart, similar to the 1.2 m gauge cart which made the tracks at Yanshi. Its purpose was to carry refuse into the garbage pit from some unknown abattoir. While it cannot be determined for certain whether it had four wheels or two, I would guess that it had two wheels centered below a carrying box, much like a rickshaw, and was pulled or pushed by human power.

The single ruts in the Huayuanzhuang dump bring up another intriguing possibility. Is it possible that there was also a single-wheeled cart present at Anyang? According to current scholarship the wheelbarrow was invented around the end of the Han dynasty in the area of Sichuan. It does not show up in Europe until the 12th century A.D. Traditionally, its invention is attributed to Zhuge Liang 諸葛亮 , a general of the kingdom of Shu (*c.* A.D. 230). Actually, there are depictions of wheelbarrows in use, including one in the famous Wu Liang shrine in Shandong, which date to the middle of the Eastern Han.[115] But, as I will explain in the next section, recently unearthed inscriptional evidence suggests that the wheelbarrow was already in use by the middle of the Western Zhou. Could the single ruts in the Huayuanzhuang dump also have been made by wheelbarrows? This is very hard to tell. Single ruts could obviously have once had a partner which had become obscured by the tramping of feet or running water. Nevertheless, there is a very long single track which runs up the middle of the two paired tracks mentioned earlier which has no trace of any partner track for the ten or so meters of its course. This track could point to the use of a single-wheeled cart at Anyang, used by servants and laborers to transport materials within the capital area.

B. Quadrigae

Even chariots at Anyang apparently had a second popular configuration, the quadriga, or four-horse chariot. Long ago Shi Zhangru interpreted the vehicle in Xiaotun M20 as a four-horse chariot.[116] Later Li Ji and other scholars corrected him by pointing out that

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[115]Needham and Ling, *Physics and Physical Technology*, 258-78.
[116]Shi Zhangru, "Yinxu zuijin zhi zhongyao faxian."

the number of disassembled chariot parts in the grave pointed instead to two chariots and four horses. There are, however, some bronze-inscriptional graphs of chariots which unmistakably show four yoke saddles dangling from an extended yoke bar. One such inscription is on a *gu* beaker in the Freer Gallery of Art, Washington D.C. (accession # 43.9).[117] Chariots from the Western Zhou, such as that found in pit #2 at Zhangjiapo, already have very advanced four-horse riggings.[118] And, some of the rock carvings mentioned previously, specifically those from Jamani Us in the Mongolian Altai and another from Kobdo Somon, Outer Mongolia, depict four-horse chariot teams.[119] Judging from the bronze inscriptional depictions of quadrigae, it is only a matter of time before an actual Shang example is unearthed.

C. Human-Powered Chariots

For another piece of vehicular variance, there is a single inscriptional passage which suggests that the Shang sometimes had their chariots pulled around by men rather than horses. This, of course, would be completely in line with later imperial palanquins, for kings are never loath to have men do the work of animals. The inscription (*Heji* #29693) reads 「其呼𠂤輦，有正」. I read this inscription as saying, "If we were to perhaps call out to Yin to bear the chariot, then there would be correctness in this." I take the character, *niàn* 輦, as a verb in this case because the usual oracle-bone pattern is to "call out to [name], to [verb]." The complex graph in the inscription consists of the standard pictograph for chariot in the lower part, with three (or possibly four) men holding on to the yoke bar and pushing it. A very clear depiction of the early form of this character also appears on at least one bronze inscription (see fig. 18). This same character is used in the *Shijing* (#227,2) 「我任我輦」. In this line it probably is used as a noun, as in, "we load our handcarts." From the Han onwards, this character is used to indicate the carriage of the emperor.

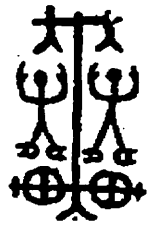

Figure 18. Rubbing of the character *nian*. From Rong Geng, *Jinwen bian*.

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[117]John A. Pope et al., *The Freer Chinese Bronzes*, vol. 1, *Catalog* (Washington, D.C.: Smithsonian Institution 1967), 64-7. This chariot graph also displays two eyelets on top of the yoke bar which may represent either rein guides or jingle-bells.

[118]Zhongguo Kexueyuan Kaogu Yanjiusuo, ed., *Fengxi fajue baogao* 澧西發掘報告 (Report of the excavations at Fengxi) (Beijing: Wenwu Chubanshe, 1962).

[119]Littauer, "Rock Carvings."

D. Sheep-Drawn Carts

A final variation on the wheeled vehicle from the Anyang period will serve to provide some comic relief. During excavations at the clan cemetery at Anyang, Guojiazhuang excavators found a sacrificial pit which contained two sheep and a human, associated with the nearby chariot pits M146/M147.[120] This would not be so strange, since sheep sacrifices had been found before, except that these sheep were found wearing complete bronze harnesses and yoke saddles (see fig. 19).

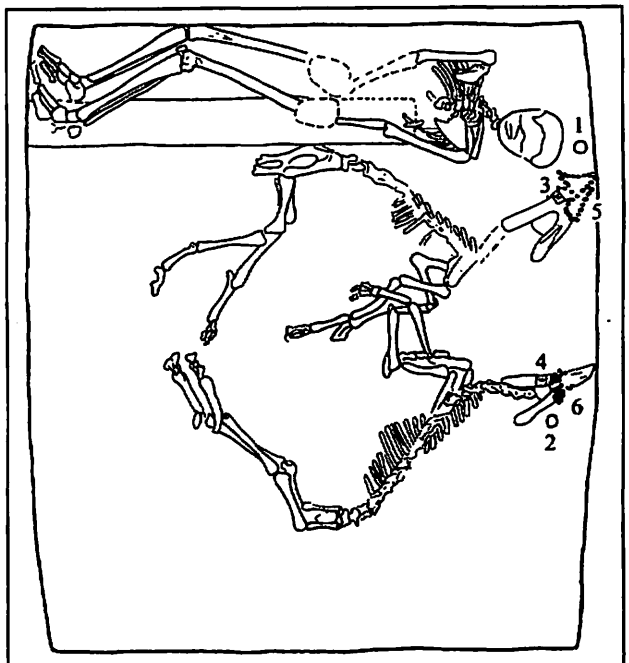

Figure 19. Harnessed sheep and sacrificed human from Anyang, Guojiazhuang M148. Illustration from *Anyang Yinxu Guojiazhuang Shang dai muzang.*

At the left cheek of each sheep was found a bronze cheek piece, similar to the horse model, but cast to almost one-half scale. Around the head was the same kind of bronze-disc-adorned headstall found on Anyang horses. Above the neck of each beast was a bronze yoke-saddle finial, also cast to one-half scale. The wooden yoke saddle to which this was attached had completely decayed. Excavators also recovered a ringlet made of shell, similar to those believed to guide reins and channel harnesses on chariot horses.

This find is more than peculiar. Were sheep really used by the Shang to draw high-status wheeled vehicles or was this some elaborate joke on the part of an eccentric nobleman? As any farmer will tell you, sheep are not as bright as horses and can be very unruly. They also generate less traction than a dog. Any vehicle pulled by sheep would have to be small, and if it carried a person, he would have to be light. Perhaps sheep were used to pull

[120] *Anyang Yinxu Guojiazhuang Shang dai muzang*, 147-50. Sheep pit M148 was part of a coordinated sacrifice to the tomb lord of Guojiazhuang M160, which also included parallel chariot pits (M146/M147) and a horse/human pit, M143. Tomb M160 has become famous because, like the tomb of Fu Hao, it is a wealthy tomb which has not been plundered. M160 was loaded with weapons, including over two hundred halberds or spears and over nine hundred arrowheads. Based on inscriptions found on ritual vessels within the tomb, the individual was probably a military officer of the Shang belonging to the Zhi clan.

the small carts seen at Yanshi and Huayuanzhuang, and this burial represents the bronze-adorned, high-status version of the traditional sheep rigging. Maybe the noble's young son rode in it to the funeral. One wonders why a culture so familiar with the anatomy of the ox through its use of ritual scapulimancy and ox-bone implements would choose not to harness them instead of sheep. Perhaps the choice was cultural and not practical. Maybe oxen were seen as sacred animals, suitable for ritual, consumption, and raw materials, but never considered as candidates for draught.

V. Wheeled Transportation Outside Anyang

The literature of the last few decades placed enormous attention on the material culture of Anyang. This is partly justified by the awe-inspiring richness of the finds, but is due more to its position in the geographic heartland of Chinese civilization and the discovery at Anyang of texts written in the Chinese language. During the Anyang period, there were dozens of other state-level societies vying for power in this area of East Asia.[121] Many of these states shared a great deal of material culture traits with the Shang and have often been interpreted as part of a Shang "empire." Others are so fantastically different so as to call for other influences and explanations. What follows is a review of the evidence for wheeled vehicles outside of the last Shang capital.

A. Shaanxi

The area of the Wei River valley in modern Shaanxi province has long been known to be the homeland of the group that were to conquer the Shang and found the Zhou dynasty. Evidence of their pre-dynastic capitals has been found at the Zhouyuan sites in Qishan and Fufeng counties to the west of modern Xi'an. In 1986 a cemetery dating to the Anyang period was found at the site of Laoniupo, 27 km east of Xi'an.[122] The cemetery contained forty graves and one nearby chariot pit (M27). The burials closely followed Shang customs

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[121]For a revisionist view of the Bronze Age in China, see Robert W. Bagley, "Shang Archaeology," in *The Cambridge History of Ancient China*, ed. Michael Loewe and Edward L. Shaughnessy (Cambridge: Cambridge University Press, 1999), 124-231.

[122]Xibei Daxue Lishi Xi Kaogu Zhuanye, ed., "Xi'an Laoniupo Shang dai mudi de fajue 西安老牛坡商代墓地的發掘 " (Excavation of the Shang-era cemetery at Xi'an, Laoniupo), *Wenwu* (1988.6): 1-22; Liu Shi'e 劉士莪 , "Xi'an Laoniupo Shang dai mudi chulun 西安老牛坡商代墓地初論 " (Preliminary discussion of the Shang-era cemetery at Xi'an, Laoniupo), *Wenwu* (1988.6): 23-7.

(second-level ledge, waist pit with dog, human sacrifice) and the bronzes found in the tombs were indistinguishable from Anyang examples. The pottery of the site, however, shows strong differences from Anyang contemporaries. Based on the style of the bronzes, the beginning of the cemetery seems to date from the first or second phase of Yinxu, or about 1200 B.C., during the reign of Wu Ding.

The chariot from pit M27 is nearly identical to the type found at the various Anyang loci. The wheels were 140 cm in diameter with a gauge of 2.25 m. The sixteen-spoked wheels were connected to an axle of 3.15 m and capped with a bronze axle end-cap which was identical in style to one found at Guojiazhuang M58. The chariot box was rectangular, and the bottom was fashioned of leather straps. Traces of lacquering were found in the box. The yoke bar was found out of position on the horses' backs, and no sign of yoke saddles was found. Two horses were sacrificed with the chariot, facing each other, but no humans or weapons were interred with the vehicle. The vehicle's decoration tends to point to a parade chariot or burial chariot rather than a warfare model. The decoration is fine, but the quality of the bronzes and the amount of decoration is not quite as lavish as Guojiazhuang M52.

This chariot and the surrounding cemetery bring up some interesting questions. Was the site of Laoniupo an actual outpost of the Shang state? If so, it would surely mark its westernmost expansion. Because the bronzes from the graves are identical to Anyang types, but the pottery is of local manufacture, one can posit a situation in which an intrusive nobility had set up a colony of the Shang state on the Wei River and used local artisans to fashion their pottery, while importing their bronzes from home. The situation could also be explained by interpreting the site as that of a local state which belonged to a shared Shang cultural sphere, but not the Shang political sphere. Therefore, they subscribed to a set of beliefs and elite rituals which were shared across all of northern China at this time, but they were still an independent political entity.

B. Shandong

Anyang-period chariots have been found from two sites in the province of Shandong. At the site of Qianzhangda in south-central Shandong, an Anyang-period cemetery was found which contained seventy tombs and three separate chariot pits (M40/M41/

M45).[123] Grave M18 also contained a disassembled chariot along with the tomb owner and some bronze vessels. The presence of the ritual bronzes indicates that the occupant of M18 was probably a high-status person being buried with his chariot, rather than a sacrificial victim. As for the independent pits, M40 contained a complete chariot with a sacrificial victim placed under the box. Pieces of armor were found in the chariot box, along with golden flakes which may once have covered a wooden bowl. Chariot pit M41 was located just 5 m from M40 and contained a whole chariot, two horses, and two sacrificial victims. It also contained two bronze vessels (*jue* and *gu*), objects not typically found in a chariot pit. The box was rectangular and showed traces of lacquer and painted decoration. A unique bronze disc covered in cowrie shells was also found in the box. Pit M45 contained the best preserved chariot, revealing wheels of 140 cm diameter and twenty spokes. Its complete measurements are fully in line with Anyang prototypes (see Table 3 on page 93). All of the Qianzhangda chariots were accompanied by weapons, including halberds, arrows, and shields.

These Qianzhangda chariots present an interesting dilemma. Whereas the Laoniupo chariot was structurally and ritually identical to Anyang examples, the Qianzhangda examples are structurally similar, but the method of burial and the decoration show some important differences. First of all, many of the pits have trapezoidal openings rather than rectangular ones. Also, the combined chariot sacrifice/ritual bronze burial of M41 has never been seen at Shang sites elsewhere. Finally, the lavish decoration of the chariot box, the wooden shields, and the gold bowls are definitely unique local features.

The excavators believe that the cemetery at Qianzhangda belonged to an independent state from the Anyang period which was populated by people of the Eastern Yi tribe, a group known historically to have clashed with the Shang. According to the *Zuozhuan*, the state of Xue 薛 was enfeoffed in this exact area during the early Western Zhou, and the the descendants of the mythical inventor of the chariot, Xi Zhong, were said to have settled in Xue. See "A. Legendary Origins" on page 9.

The second site in Shandong to reveal the presence of Anyang-era wheeled vehicles is the site of Sufutun, near modern Qingzhou. The site was discovered in 1931 and four

[123]Jiao Tianlong 焦天龍, "Chariots, Lacquer, and Bronze" (a paper given at the Harvard East Asian Archaeology Seminar, Cambridge, MA, January 1997).

tombs and a chariot burial (unpublished) were uncovered from 1965 to 1966. Six more tombs were excavated in 1986. One of the tombs (M1) was remarkable because of its cruciform shape and massive size, features similar to the graves in the Xibeigang burial ground at Anyang. Recently, a whole array of chariot fittings was published that had been unscientifically collected during the 1970s near the southern ramp of this tomb.[124] Based on the number of parts, it appears that four chariots and eight horses were in the pits. The most fascinating feature about these chariot fittings is that they are so advanced. There are some pieces such as the yoke-saddle finials and the yoke-bar terminals which are identical to Anyang models, but there are also certain decorations, such as the *luán* 鑾 jingle-bells and the bronze ends to chariot-umbrella stays, which were previously thought to have originated in the Western Zhou.

In sum, the chariots and chariots parts unearthed in Shandong dating to the latter part of the Anyang period show a level of sophistication and innovation in decoration which outstrips most of the Anyang examples. This fact and the presence of the Anyang-imitating cemetery at Sufutun point to the existence of a state in Shandong which was independent from Anyang and which had aspirations to surpass it.

C. Sichuan

No Anyang period site has caused more excitement than Sanxingdui 三星堆 in Guanghan county, Sichuan. In 1986, excavators discovered two large sacrificial pits filled with strange bronze heads and a life-sized bronze human statue, artifacts of a type never seen before anywhere in the ancient world. They also found jades which indicate early contact with the Bronze Age ritual complexes far to the northeast (Erlitou) and bronze ritual vessels which point to later contacts with the middle Yangzi region. The pits seem to date to the last generations at Anyang.

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[124]Xia Mingcai 夏名采 and Liu Huaguo 劉華國, "Shandong Qingzhou Sufutun muqun chutu de qingtongqi 山東青州蘇埠屯墓群出土的青銅器" (Bronzes from tombs at Sufutun, Qingzhou county, Shandong province), *Kaogu* (1996.5): 21-8.

Two extremely curious objects were found in the second sacrificial pit which suggest the presence of a wheeled-vehicle technology in Sichuan which belonged to an entirely different tradition from that of the Central Plain. These two objects (see fig. 20) are large discs measuring 85 cm in diameter, with five radial spokes and a central bulge which is a hollow dome. At the junction of each spoke and the outer rim is a small hole, probably used for affixing the object to something else. Traces of red paint were also found on parts of one of the discs.[125]

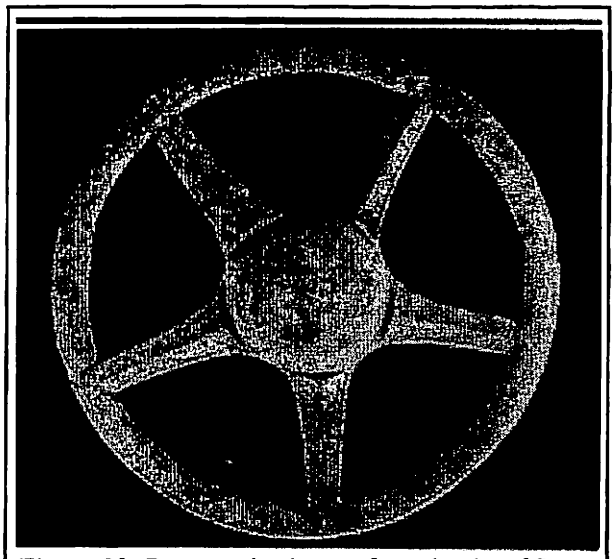

Figure 20. Bronze wheel cover from the site of Sanxingdui, Sichuan province. From *Shang dai Shu ren mibao.*

In the original site report, the excavators labeled these objects as "wheel-shaped" objects, but in later publications they changed their interpretation.[126] Currently, Chinese archaeologists interpret these discs as "sun-shaped" objects, thought to represent actual icons of solar worship. They surmise that the holes were used to affix the objects to some temple wall. I would speculate that these unique objects can be interpreted as bronze wheel- covers for a five-spoked wheel. The type of wheel these covers would fit is very different in structure from Anyang chariot wheels. The parabolic arc between the spokes and the raised ridge in the middle of each spoke suggest to me a technology of composite, bent-spoke design, such as is seen on the Egyptian chariots from King Tutankhamun's tomb.[127] Shang chariot wheels were usually formed by mortising straight spokes of round

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[125]Chen De'an 陳德安, *Shang dai Shu ren mibao, Sichuan Guanghan Sanxingdui yiji* 商代蜀人秘寶：四川廣漢三星堆遺蹟 (Secret treasure of the Shang-era Shu people: the Sanxingdui site in Guanghan county, Sichuan province), vol. 11 of *Zhongguo kaogu wenwu zhi mei* 中國考古文物之美 (Beijing: Wenwu Chubanshe, 1994), 124.

[126]Sichuan Sheng Wenwu Guanli Weiyuanhui, Sichuan Sheng Wenwu Kaogu Yanjiusuo, Guanghan Shi Wenhua Ju, Wenguansuo, eds., "Guanghan Sanxingdui yizhi er'hao jisikeng fajue jianbao 廣漢三星堆遺址二號祭祀坑發掘簡報" (Preliminary report on the excavation of sacrificial pit #2 from the site of Sanxingdui in Guanghan county), *Wenwu* (1989.5): 1-20.

[127]Littauer and Crouwel, *Wheeled Vehicles and Ridden Animals*, 78-9. In composite, bent spokes each spoke is formed by the union of two pieces of wood bent into the shape of boomerangs.

or square cross section directly into the nave and the felloe. Furthermore, the middle of the Sanxingdui wheel covers is raised, so as to make room for a nave. The bronze cover was probably affixed to the wooden wheel by nails through the apertures at the end of each spoke. What kind of vehicle these wheels could have driven is a complete mystery. They could have been attached to a chariot, or possibly to a ritual parade-cart used to carry the great bronze statue found in the same pit. This interpretation is, of course, pure conjecture on my part, for no similar object exists anywhere else in the world.

As to the derivation of this "non-Shang" wheel technology, I believe the source can be sought in the direction of India. In the 1960s Stuart Piggott reconstructed the second millennium chariots of India mentioned in the *Rig Veda*. He estimated that the wheels of Indian chariots would have been from 76 to 90 cm in diameter, nicely framing the dimensions of the Sanxingdui wheel covers (85 cm). This long distance connection would seem far-fetched if there were not evidence from the historical period for trade contact between Sichuan and India. The *Shiji* 史記 of Sima Qian relates that during the reign of the Western Han emperor Wu Di (*c.* 138 B.C.), a man named Zhang Qian was sent to the area west of modern Xinjiang to explore the territory. When he was in Da Xia (Bactria) he saw some products which he recognized as being fashioned in Sichuan. When he asked the people of Da Xia how they had come across these items, they replied that they had bought them in India, called Shendu 身毒 during the Han.[128] As further suggestive evidence, Tong Enzheng once pointed out many similarities between the cultures of ancient India and southwestern China (Sichuan, Yunnan). In a 1996 talk, he listed more than a dozen traits shared by cultures in Sichuan or Yunnan and those of India. These included serpent worship, the motif of winged tigers, images of dancers with cymbals, and the presence of etched carnelian beads.[129]

VI. Wheeled Vehicles in the Western Zhou

Sometime in the middle of the eleventh century, a people known as the Zhou formed a coalition of states and conquered the Shang. In their own documents and in their

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[128]Burton Watson, trans., *Records of the Grand Historian of China: Translated from the Shi-chi of Ssu-ma Ch'ien* (New York & London: Columbia University Press, 1961), 1:269.

[129]Tong Enzheng, "Evidence for a SW China to India Trade Route" (a paper given at the Harvard East Asian Archaeology Seminar, Cambridge, MA, May 3, 1996).

words inscribed on bronze, they claim that the Shang were defeated because they were corrupt and had lost the sanction of Heaven to rule its land below. The final battle for control of the Central Plain took place at Muye. At this battle, the Zhou were said to have amassed three hundred chariots. Whether chariots were the crucial factor in this famous battle cannot be known, but what is clear from the archaeological and textual evidence is that the Zhou nobility valued the chariot as a great symbol of power and status. During the Western Zhou period (*c.* 1050-771 B.C.), the use of chariots and the ritual of chariot burials expanded dramatically, both geographically and socially. Furthermore, the received written record of the Zhou is more extensive as well, allowing us to see more clearly the function of chariots in society and the disposition of other, less glamorous vehicles during this period.

A. Archaeological Examples

Nearly every major Western Zhou cemetery site has revealed chariot and horse pits, and these are not just associated with the large tombs of feudal lords but with the medium size tombs of ministers and nobles as well. Instead of the custom of single or paired chariot burials common in the Shang, the Western Zhou tended to bury two, three, or even twelve chariots in a single pit along with the horses. Thus, Western Zhou pits are often a confused jumble of horse bones, chariots, and wheels. It was not only the ritual of burial that underwent elaboration during the Western Zhou, for the structure of the vehicle and its decoration also experienced significant refinements during this period. What follows here is a brief introduction to the four most important Western Zhou chariot finds and the design modifications and technological advances discovered therein.

Beijing, Liulihe

Discovered in the 1940s and first excavated in the 1970s, the site of Liulihe in Beijing municipality has revealed a capital city of the Western Zhou state of Yan.[130] Just outside the large moated wall, excavators found a large cemetery containing over one hundred graves and twenty-one chariot and horse pits. The chariot pits were attached to the largest graves and a certain portion of the mid-sized graves. While the mid-sized pits had as few as two chariots, the largest pit (M1100) contained fourteen horses and five chariots (see fig. 21). It probably belonged to the tomb lord of grave M1046, the largest at the site. Pit M1100 measured 6.1 m x 5.7 m and was 1.9 m deep. On its floor were placed the skeletons of fourteen horses, all lying on their sides on top of some sort of mat. All of their harnessing equipment had been removed. After the horses were laid in the pit, the chariot wheels were all removed and lined up along three walls of the pit. Finally, the wheel-less chariots were placed on top of the horses. Curiously, no human sacrifices were placed with the chariots.

Figure 21. Chariot pit M1100 from the site of Beijing, Liulihe. From *Kaogu* (1984.5).

The wheels in pit M1100 have spoke counts ranging from eighteen to twenty-four, though the wheel diameter is a fairly consistent 135-140 cm. Significantly, two of the wheels along the east wall have bronze collars on their hubs, while two of the wheels along the south wall have lead collars. Oddly, none of the chariots has a complete complement of parts. Only one still carries its axle end-caps and only two yoke saddles are present in the pit. The chariot boxes are all rectangular and each contains a special railing, *shì* 軾, midway in the box, which the driver could lean on for support. Furthermore, the chariot in

[130]Zhongguo Shehui Kexueyuan Kaogu Yanjiusuo, Beijing Shi Wenwu Gongzuodui, Liulihe Kaogudui, eds.,"1981-1983 nian Liulihe Xi Zhou Yanguo mudi fajue jianbao 1981-1983 年琉璃河西周燕國墓地發掘簡報" (Brief report of the excavation from 1981-1983 of the Western Zhou-era cemetery of the state of Yan), *Kaogu* (1984.5): 404-16.

the northeast corner has a bronze fitting on the yoke bar, *yǐ* 轙 , which was used to channel the reins to the driver. Finally, the chariot in the middle of the pit has traces of an umbrella/ sun-shade assembly directly over the middle of the box.

The chariots from Liulihe-M1100 point to some significant technological innovations in the Western Zhou. First, this is one of the first known instances of hub reinforcement with metal parts. On a chariot, the hub is the most vulnerable part, bearing most of the weight of the vehicle and the friction of the axle. By placing a metal collar around the ends of the hub, or rings around the body of the hub, the usable life of the wheel could be extended. Interestingly, only four of the ten wheels of pit M1100 have been reinforced in this way. This suggests an early stage of experimentation in metal-reinforced wheel design. The second major innovation seen at Liulihe is the adornment of chariots with umbrellas. This is also seen on one of the bronze carriages of Qin Shihuang and probably indicates that this chariot, at least, was the noble's personal carriage and not a machine of war.

Henan, Xincun

The site of Xincun, located in Henan province, was excavated in the 1930s. It was an elite cemetery of the Western Zhou state of Wei. In total, eighty-two graves and fourteen chariot pits were excavated at the site.[131] The largest grave, M17, probably belonged to the first Marquis of Wei and was accompanied by twelve chariots and seventy-two horses. Unfortunately, this excavation took place in the era of poor technique for chariot excavation, and accurate reconstruction of these vehicles was not possible. We do know from one chariot at the site, M1, that the wheels were 136 cm in diameter and carried eighteen spokes and that the axle and draught pole were slightly longer than Shang predecessors. We also know that the wheelwrights in the state of Wei, like those of Yan, were concerned with hub and wheel reinforcement. On the chariots in pit M5 we see three separate bronze rings encircling the hub to prevent it from falling apart, and in pit M3 we see these same three rings cast as one unit. Another innovation seen at Xincun is the use of bronze clasps to hold the two felloe segments of the wheel together. The shape of these clasps reveals that the felloes were trapezoidal in cross section, with the outer surface narrower than the inner one.

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[131] Guo Baojun 郭寶鈞 , *Junxian Xincun* 濬縣辛村 (Report of the site of Xincun in Jun county) (Beijing: Kexue Chubanshe, 1964).

Fengxi, Zhangjiapo

The site of Fengxi is located southwest of the modern city of Xi'an in Shaanxi province.[132] It was surveyed in the 1930s and excavations began in 1951. The site is huge and covers over ten square kilometers. The occupation of the site dates from the very beginnings of the Western Zhou in the eleventh century B.C. to the move of the capital to the east in 770 B.C. The site has revealed cemeteries, rammed earth foundations, dwellings, and a complex sewage system. The cemetery at Fengxi, which is concentrated in the area of Zhangjiapo, contains over one thousand individual graves.

The earliest chariot burials at the site date from the early Western Zhou. Seven chariot pits were found from this period, of which four were excavated. Two had been thoroughly looted for bronze parts, but the other two were in excellent condition and provide valuable information about technological innovations in the early Western Zhou.

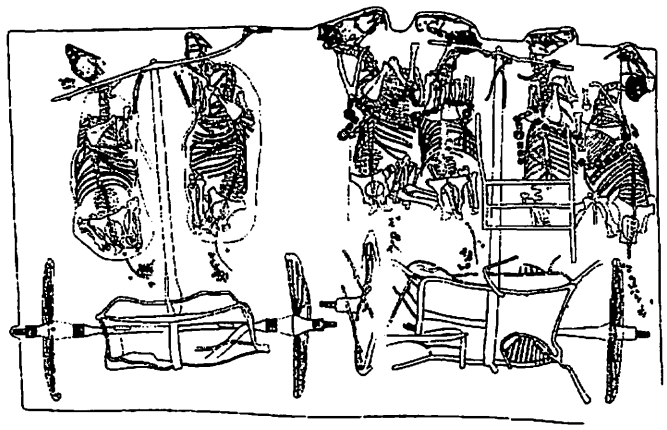

Figure 22. Chariot pit #2 from the site of Fengxi, Zhangjiapo. From *Fengxi fajue baogao.*

The best preserved and most informative of the four Zhangjiapo pits was pit #2, also known as M168. It measured 5.6 by 3.4 m and contained two chariots, six horses and one human sacrifice (see fig. 22). The chariot on the right had wheels with twenty-one spokes and a wheel diameter of 136 cm. The axle measured 307 cm in length and the draught pole was 298 cm long. The most interesting feature of this chariot is the harnessing. Four horses were rigged up to this vehicle and each had its own yoke saddle. The two outriding horses, however, were not under the yoke bar. In addition, the horses carried full harnessing equipment, bridles, and decorative masks, *mǎ guān* 馬冠 , allowing excavators to reconstruct the harnessing system of this period. On top of the yoke bar, above the yoke saddles, were positioned decorative bells, *luán* 鑾 , another feature prevalent on later Zhou chariots.

[132]Zhongguo Kexueyuan Kaogu Yanjiusuo, ed., *Fengxi fajue baogao* 澧西發掘報告 (Report of the excavations at Fengxi) (Beijing: Wenwu Chubanshe, 1962), 141-55.

The chariot found on the left of this pit is technically very different from its companion. It had wheels of 135 cm diameter and twenty-one spokes, but each of their hubs was reinforced by two metal collars, *guǎn* 錧 . Its yoke saddle was curved up high at the ends and some sort of decoration hung from the ends. The box of the left chariot was very low (20 cm), but it had a riding rail to support the driver. This chariot also showed traces of axle pads, *fú tù* 伏兔 , serving to support the box above the axle. This variation in wheel, yoke, and box technology within the same burial probably points to a stage of experimentation with design and reinforcement or may even reflect regional or even workshop differences in the cartwright's craft.

Many of the largest tombs in the Zhangjiapo cemetery belonged to a noble family of the Jing clan, which served at the court of Zhou. These date from the middle of the Western Zhou, around 900-850 B.C. M157 was one such tomb and the largest Western Zhou tomb ever found. It was over 35 m long and the northern and southern ramps contained as many as fifteen disassembled chariots. The horses, however, were not buried with the chariots. They were buried in a separate pit a few yards away.

Baoji, Rujiazhuang

The site of Baoji, Rujiazhuang in Shaanxi province was excavated from 1974 to 1975.[133] It was the noble cemetery of the lords of the state of Yu. Two chariot and horse pits were found in conjunction with the largest tomb (BRM1) and they are labeled BRCH1 and BRCH3. Both pits were combined horse and chariot burials containing six horses and three chariots. These chariots show many of the same technological features seen in the previously mentioned examples (rein guides, nave collars, riding rails). But what makes the wheels of the Rujiazhuang chariots most revolutionary is the use of nave bands, *qí* 軝 , to reinforce the hub where the spokes are mortised (see fig. 23). Similar bronze-sheathed naves show up in Hallstatt D graves in Europe dating from about 700-500 B.C.[134] On one of the chariots of BRCH3, there is a complex set of hub reinforcements which involves (moving from the wheel toward the box) a nave collar, followed by an a nave ring, then the

[133]Lu Liancheng 盧連成 and Hu Zhisheng 胡智生 , *Baoji Yuguo mudi* 寶雞虢國墓地 (The cemetery of the state of Yu at Baoji), 2 vols. (Beijing: Wenwu Chubanshe, 1988.), 388-407.
[134]Piggott, *The Earliest Wheeled Transport*, 164-6.

nave band, then another ring and collar, finally followed by a special axle-protector (see

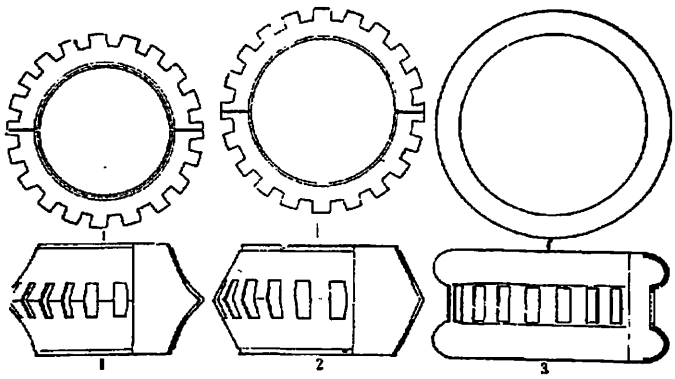

Figure 23. Metal nave bands from the site of Baoji, Rujiazhuang. From Lu and Hu, *Baoji Yuguo mudi.*

fig. 24). Such a complex setup was surely the result of decades of experimentation in hub reinforcement.

In sum, what one sees archaeologically from Western Zhou chariot pits is a series of technological and design trends which would continue to accelerate in the following Spring and Autumn and Warring States periods. First, the number of spokes in the wheels began to increase from a Shang "standard" of 16-18 to a range of 20-24. During the Spring and Autumn period, this number would increase to 24-28, and finally during the Warring States, many chariots would have 30-32 spokes. Second, the Western Zhou vehicles show a series of experiments with hub reinforcements ranging from simple collars of lead or bronze to the complex collar and band assemblages of the Rujiazhuang vehicles. Third,

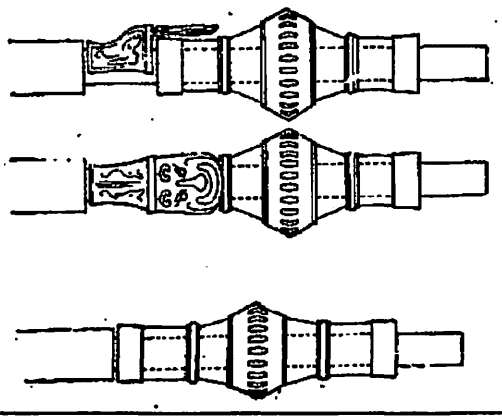

Figure 24. Metal hub reinforcements from the site of Baoji, Rujiazhuang. From Lu and Hu, *Baoji Yuguo mudi.*

there is a trend towards more bronze finials, bells, tassels, and other forms of status conscious decoration. This is undoubtedly a reflection of the chariot's role in the hierarchy of the nobility of the Western Zhou.

B. Function of the Western Zhou Chariot

Status

The principal function served by the chariot during the Western Zhou period was to mark the status of the owner. Chariots were expensive items to maintain. They each required two or four horses, continual structural reinforcement, and expensive decoration. What the archaeology of this period demonstrates is that the larger the tomb of the deceased, the more chariots will be buried next to it. Middling nobles buried two or three chariots, but major lords of feudal states buried as many as fifteen or more. But where did the nobles get all those chariots? On this point, the inscribed bronze vessels of the Western Zhou are helpful. During the Western Zhou, members of the aristocracy often cast large inscribed bronzes to commemorate some great boon which their family received from the Zhou king in exchange for past service and future loyalty. At the end of these inscriptions, the recipient would list all of the gifts he received. These would include such valuable things as metal, serfs, land, cowrie shells, jades, and wine. In addition, the person might also receive emblems of rank from the king. These would include colored pennants, leather knee-pads used in ritual kneeling in the ancestral temple, and various chariots, horses, or chariot paraphernalia. Shaughnessy cites that fully one-third of the attested inscriptions from King Mu's reign onward which deal with appointments to office or enfeoffment involved the conferral of chariot paraphernalia. The most famous inscription which confers chariots is that of the "Mao Gong *ding*" 毛公鼎. It reads in part:

> I confer on you...a chariot with bronze fittings (金車), with a decorated cover on the handrail; a front-rail and breast trappings of soft leather, painted scarlet, for the horses; a canopy of tiger skin, with a reddish brown lining; yoke-bar bindings and axle couplings of painted leather; bronze jingle bells for the yoke bar; a mainshaft and rear-end fitting and brake fittings, bound with leather and painted gilt; a gilt bow-press and a fish-skin quiver; a team of four horses, with bits and bridles, bronze fontlets, and gilt girthstraps; a scarlet banner with two bells.[135]

If one believes the received literature and the inscriptions alone, then these items of chariot paraphernalia came exclusively from the king and placed the recipient in a particular rank position in society based on the color, size, or amount of the trappings. It is true that they often are given concurrently with some great enfeoffment of land or appointment to high office (such as in the *"Da* Yu *ding"* 大盂鼎 inscription) and might thus be seen as an insignia of that position.

But, one wrinkle in this picture of royal exclusivity of chariot production comes from the unmistakable variety of vehicles seen archaeologically within the same pit in several Western Zhou cemeteries. As was seen above, the vehicles varied greatly with respect to number of horses, hub reinforcement technology, number of spokes, etc. While some of the variation could be attributed to different functions of the vehicles or possibly to different time periods of manufacture, the variety would be more easily explained by assuming that the lords could construct their own chariots in official workshops, trade vehicles with other lords, purchase them from different workshops, or capture them in battle. Bronze inscriptions such as that on the "Qiu Wei *he"* 裘衛盉 show that nobles were able to engage in significant financial transactions, involving insignia of rank as well as land, without the permission of the king.

Ritual

The elite of the Western Zhou continued the tradition started in the Shang of burying chariots to accompany the deceased.[136] The ritual of the early Western Zhou, exemplified by the chariot pits at Xincun and Zhangjiapo, involved the Shang-like practice of burying chariots with their horses in one or two pits adjacent to the main tomb. In the middle Western Zhou (*c.* 900-850 B.C.), this ritual changed somewhat. Large caches of chariots were buried (such as in Liulihe M1100) and little attention was paid to orderly arrangement. Often they were partially disassembled to facilitate the crowding of multiple

[135]Translated in Edward L. Shaughnessy, *Sources of Western Zhou History* (Berkeley: University of California Press, 1991), 81. The lavish decorations described for the chariot given to Mao Gong clearly show that our reconstructions of Western Zhou chariots are pale reflections of the real article. Such items as leather bindings and tiger-skin canopies would surely have decayed in the ground, leaving no trace. It is also possible that they were stripped from the vehicle and not included in the grave.

[136]Lu Liancheng 盧連成, "Chariot and Horse Burials in Ancient China," *Antiquity* 67 (1993): 824-38.

vehicles. What seems to have mattered most was the sumptuous display of wealth. Also, during the mid-Western Zhou period, the harnesses of the horses were more likely to be removed to the tomb proper. Another burial tradition also existed in the mid-Zhou wherein disassembled chariots were placed in the ramp of the main tomb and the horses were buried elsewhere. This is exemplified by the Jing family tombs of Zhangjiapo (M157, M170). This tradition was probably also inherited from the Shang, for it was already seen at Xibeigang M1001/M1003. The sacrifice of humans also seems far less prevalent in Zhou chariot pits, with several of the large ostentatious pits (Liulihe M1100) containing none at all.

Warfare

Just as we saw with the Shang chariot, there is considerable debate as to how the Western Zhou chariots were used in warfare. For the Shang period, archaeology amply demonstrates the military potential of the chariot, with interments such as Xiaotun M20 displaying potent arsenals and hardy soldiers. Yet, at the same time, the inscriptional evidence of the Shang fails to corroborate this artifactual evidence with references to actual chariot use in battles. In the Western Zhou period, the situation is almost reversed. The inscriptional accounts speak of up to one hundred chariots used in battle, and the received literature delights in descriptions of military chariots and their beautiful trappings. Yet, the archaeology outlined above clearly shows that the burial traditions did not emphasize this martial aspect. Though some Zhou burials have armed drivers and some chariots have sharpened reinforcements, the main thrust of the burial ritual is the display of wealth and status, not military power.

Based on this conflicting evidence and the structural liabilities outlined above for Shang chariots, Western scholars such as M. von Dewall and H.G. Creel have concluded that the Western Zhou chariots could never have been effective weapons and were always used just as mobile command platforms in battle. H.G. Creel flatly states that "as a weapon, the war chariot would have been rather worse than useless."[137] Creel is convinced that infantry was a far more crucial element in Western Zhou armies. Edward Shaughnessy dif-

[137]Herrlee G. Creel, *Origins of Statecraft in China: The Western Chou Empire* (Chicago: University of Chicago Press, 1970), 270.

fers from this tradition and contends that the chariot was indeed a very potent weapon during the Western Zhou. Chinese scholars tend to rely on the dramatic later accounts of chariot battles found in the *Zuozhuan* and to project this kind of military structure back into the Western Zhou.

The most famous bronze inscription which tells of chariot warfare is that of the "Yu *ding*" 禹鼎, which dates to the reign of King Li (857-842 B.C.), relatively late in the Western Zhou. It involves a battle against the Huai Yi, a perennial enemy of the Zhou located in the Huai River basin. After the Huai Yi had thoroughly routed the Zhou armies, an independent duke sent a contingent to help out the king's cause. The inscription reads in part:

> The troops (of Zhou) greatly feared and trembled, and were not successful in their attack on E. Duke Wu therefore dispatched Yu to lead one hundred of the duke's chariots, two hundred charioteers, and one thousand infantry.[138]

This inscription provides several pieces of valuable information. First, it suggests that there were two drivers, or possibly two total occupants in Western Zhou chariots. Second, the ratio of chariots to infantry suggests that each chariot supervised ten infantrymen. Finally, the large number of chariots involved point to a pivotal role of the chariot in the battle, not just as a mobile command platform. It is also important to note that the owner of these chariots was not the king, but a regional lord.

In addition, chariots were also some of the prizes captured on the field of battle. In the "Shi Tong *ding*" 師同鼎 inscription, a raiding party against the Guifang (a perennial Zhou enemy from the Ordos region) successfully captured five chariots with horse teams, twenty wheelbarrow/carts, along with several prisoners who were subsequently beheaded. This inscription shows unambiguously that the "barbarian" enemies of the Zhou were fighting in chariots as well.[139]

C. Other Western Zhou Vehicles

Because of the importance placed on the chariot by Western Zhou nobility, both in their writings and in their burial rituals, very little knowledge of other vehicle types has

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[138]Shaughnessy, "Historical Perspectives," 224.

[139]Shaanxi Zhouyuan Fufeng Wenguansuo, ed., "Zhouyuan faxian Shi Tong *ding* 周原發現師同鼎" (The "Shi Tong *ding*" discovered on the Plains of Zhou), *Wenwu* (1982.12): 43-6.

been transmitted to us. Some other vehicles are named in received Zhou texts (see note 25 on page 9), but we have no way of determining what these looked like. We may, however, be able to infer some information about different vehicles from epigraphic and contextual study of some key bronze inscriptions along with the pleasant arrival of our first available miniature vehicle model.

One type of vehicle which is mentioned both in roughly contemporary writings (*Shijing)* and in one bronze inscription is referred to as the *dà chē* 大車 , or big cart. The first reference to the *dà chē* is found on the previously cited "Shi Tong *ding,*" a bronze cauldron unearthed in 1981 in Fufeng county, Shaanxi province. The inscription tells of a raid into enemy territory to cut off heads and the capture of enemy vehicles numbering five chariots with horses and twenty *dà chē.* 「俘車馬五乘，大車廿」. What makes this inscription so intriguing is the different way the two characters for cart are written (see fig. 25).

Figure 25. Rubbing of the inscription on the "Shi Tong *ding*." From *Wenwu* (1982.12).

The first graph (second from the bottom in the second line) is written in the standard way for Shang and Zhou horse chariots, with full draught pole, yoke bar, and yoke saddles depicted. The second graph (the fourth from the top in the third line) is written without a pole, bar, or saddles, and has a very different depiction of wheels and box. In fact, it looks almost like the modern version of the character. What kind of vehicle is this? If one looks at the standard Shang and Zhou graph for chariot (see fig. 13 on page 39), one can see that the wheels are represented laid out on their sides, even though the depiction is from above. Beyond each wheel, one can see the linchpin holding the wheel in place. If this same design convention applies to the second "chariot" character in this inscription, then the only kind of vehicle it could represent would be a wheelbarrow. The presence of sheep in the spoils of the raid also suggests that this was some kind of cart used in an agricultural context.

Conflicting evidence for the identity of the *dà chē* comes from the received literature. In the *Book of Poetry*, there is a poem called 大車 (#73) in which a young noble has gone out in his *dà chē* to try to convince a woman to elope with him. Preening like a modern-day lady-killer in his shiny red corvette, he boasts:

> My great carriage is rumbling. 「大車檻檻」
> My felt sash is like the young sedge.
> Do I not long for you?
> But I fear you do not dare.[140]

In the commentary to this section, a *dà chē* is glossed by the commentator as being the "cart of a great minister" 「大車，大夫之車」. It is obviously a lavish vehicle, for a young man would surely not go-a-courting in a wheelbarrow. This poem (and its commentary) come from a later time period than the "Shi Tong *ding*," and thus cannot be entirely trusted to identify the type of vehicle. It is entirely possible that the very common characters of 大 and 車 were combined at different times to signify different things to different people.

Another type of vehicle is suggested by a famous bronze inscription. The "Jin Jiang *ding*" 晉姜鼎 was a vessel recorded during the Song dynasty and subsequently lost. It records an expedition sent around 741 B.C. from the Jin state (near modern Houma, Shanxi province) to Fanyang, an area along the Ru River, a tributary of the Huai, in modern southeastern Henan. The inscription reads in part:

> 嘉遣我易 （賜）鹵責 （積）千兩 （輛），勿灋（廢）文侯顯（顯）令（命），俾貫通弘 （？），征繁湯 （陽）原 （？）取厥吉金，用作寶隣 （尊）鼎。
> Well did we send our gift of salt, one thousand transport carriages worth. We did not discard the perspicacious commands of the cultured Marquis of Jin. They were completely carried out (?) for the expedition went to the plains of Fantang (Fanyang) and obtained their auspicious metal. Some of it was used to cast this valuable sacrificial tripod.

This inscription has recently received corroboration from a set of bells acquired by the Baoli Museum in Hong Kong.[141] The "Rong Sheng *bianzhong*" 戎生編鐘 inscription,

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[140]Translated in Bernhard Karlgren, *The Book of Odes* (Stockholm: Museum of Far Eastern Antiquities, 1974), 49.

[141]Li Xueqin 李學勤, "Rong Sheng *bianzhong* lunshi 戎生編鐘論釋" (Discussion and translation of the inscription on the Rong Sheng bells), *Wenwu* (1999.9): 75-82.

which is divided up among all eight of the bells, seems to refer to the same event, an expedition to Fanyang to trade salt for bronze. It reads in part:

> 劼（嘉）遣鹵責（積），俾譖（參）征繁湯（陽），取厥吉金，用作寶鼙（協）鐘。
> Well did (the Marquis of Jin) send forth the his reserves of salt. I was made to take part in the expedition to Fantang (Fanyang) and obtained their auspicious metal. Some of it was used to cast this valuable set of harmonized bells.

Apparently the state of Jin, famous for its later mass-production foundries near Houma, did not have easy access to the copper and tin it needed to make the ritual vessels and bells it desired.[142] The area was plentiful in salt mines, however, which produced a brine suitable for making food-grade salt. Sometime before 740 B.C. (when the vessel and bells were both cast), the marquis sent out his accumulated reserves of this valuable commodity, the inscription says one thousand two-wheeled carriages worth,[143] as a "gift" to Fanyang in exchange for high quality metal.[144] The area around ancient Fanyang, near the modern city of Xincai, Henan is not plentiful in copper resources. Its position near the confluence of the Ru and Huai Rivers, however, would have made it an ideal trading port for copper and tin resources coming from further south and east, from Hubei, Anhui, and Jiangxi, where numerous ancient mines have been found. Another inscription from the Spring and Autumn period refers to Fanyang as "the road to copper and tin" 金道錫行 , also suggesting its key position for access to these metals.

The distance between the Jin capital and Fanyang is an incredible 350 km as the crow flies. It has always been assumed that in ancient China cargo transported that far would have traveled by boat, not wheeled vehicle. Such a long journey would have been quite stressful on a thousand, heavily laden carts and their draught animals. The Jin convoy would also have had to travel through the Eastern Zhou capital at Chengzhou (Luoyang) as well as through the territory of several intervening states (Zheng, Cai) to reach Fanyang. It

[142]Perhaps this shortage of metal was a direct result of the recent collapse of the Western Zhou capital at Zongzhou and the subsequent flight to the eastern capital at Chengzhou in 770 B.C. Perhaps, Jin's usual supply line of metal was cut off during the chaos and thus required an alternate source. Or Fanyang could have always been the Jin source for bronze.

[143]The round figure '1000' may only mean that the convoy was large.

[144]The nature of this exchange could also provide valuable data for writing the economic history of this period. Apparently, such transactions were still viewed as an exchange of gifts between equals and not a direct monetary or barter transaction.

is more likely that the transport carts carried the salt to the headwaters of the Ru River and floated it downstream on barges to Fanyang. This itinerary still would have meant an overland journey of at least 150 km.

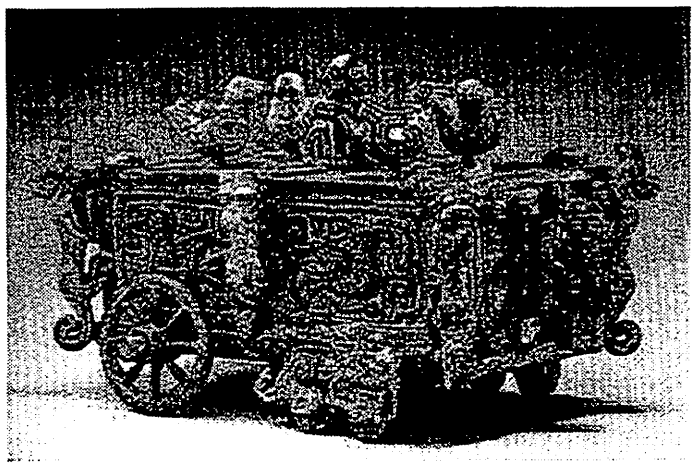

Figure 26. Bronze miniature treasure-cart, unearthed in 1989 at Shangguo village, Shanxi province. From *China: 5000 years.*

What would such transport carts have looked like? We can surmise that they would have been enclosed, or at least covered, because the salt would have to be protected from the elements and the metal would have to be safeguarded. We can also infer from the measure word, *liàng* 輛, used to count the vehicles that they had two wheels. They would also have been more robust than the average chariot to carry such a heavy load. The axle was probably thicker and the wheels would have had fewer, and thicker spokes. Beyond that, it might be useful to turn to a recently unearthed bronze model of a heavily guarded carriage (see fig. 26). It was discovered in Shangguo village, Wenxi county, Shanxi province, fairly close to the old Jin capital and dating to the late Western Zhou period. It represents a two-wheeled, enclosed carriage, supported by two eight-spoked wheels and drawn by crouching tigers whose paws contain rolling disc-wheels. The carriage has a brick-like superstructure which affords access through doors on the top and to the front. Each of these is guarded by human and animal sentries. The vehicle has sixteen moving parts and would have rolled freely on the ground, pulled on a string from a ring cast on the back.

It is difficult to separate the fantastic elements on this model from those which represent real features, but certain things can be deduced. The full-size correlate to the miniature cart would have been a two-wheeler drawn by two animals. Because it was heavily guarded and enclosed, it must represent a vehicle for transporting valuable cargo or important people. The model itself probably served a similar function by carrying valuable baubles for its owner. This model vehicle just might represent one of the treasure transport

carts, sent by the Marquis of Jin to the ancient trading post of Fanyang to obtain the valuable metals for his bronze foundries.

VII. Conclusion

During the Spring and Autumn period (722-484 B.C.) which followed the Western Zhou, the chariot continued to gain force as an object of status and an implement in war. The very worth and power of states in this period was measured by how many chariots they could field in battle. During one battle in 632 B.C., the armies of Jin marshalled seven hundred chariots, the armies of Chu six hundred. By the end of this period, however, the mounted warrior on horseback started to gain importance in Chinese armies.[145] The chariot's full decline came during the Warring States period (453-221 B.C.) when infantry divisions swelled to immense size and wars were fought in bloody protracted fashion. The goal of battle was to annihilate the other state at any cost. There was no more room for the petty chariot raids seen in the Western Zhou bronze inscriptions or the chivalrous battles known from the *Zuozhuan*. Chariots did continue to be used, however, in idealized battle formations as command platforms. For example, each column of infantry in the terracotta army of the first emperor of Qin was led by a four-horse chariot. During the Qin as well, one sees that the carriage and horse team still had a symbolic status as the vehicle of choice of royalty to accompany them to the grave. The lavishly decorated bronze carriages and horse teams found in the mausoleum of the first emperor attest to this as well.

In conclusion, it is shown that the function of wheeled vehicles in China evolved along roughly similar lines as those in the West. Beginning around the start of the second millennium B.C., wheel vehicles were used in China in utilitarian contexts by nomadic pastoralists, separate from any pomp or royalty. By about 1600 B.C., we see similar utility carts being used in the first Bronze Age cities. Then, during the Anyang period, during the reign of Wu Ding (*c.* 1200 B.C.), the chariot was imported from Central Asia, perhaps accompanied by its traditions of royal hunts and status marking. The Shang fully exploited these functions of the chariot, yet they do not appear to have used the chariot extensively in warfare. Next, during the Western Zhou period, the chariot became a central icon in the society: a marker of rank for nobles, a indicator of wealth in burial rituals, and seemingly

[145]Shaughnessy, "Historical Perspectives," 227.

an important tool in battle. Finally, in the Warring States period, the rise of cavalry and infantry signalled the end of chariot's heyday.

One must not forget that behind the gleaming surface of the chariot, which dominates the received literature and the archaeological record, there was an entire collection of other vehicles which were a vital part of the daily lives of the common people in this period. While nobles rode around and fought in their chariots, the real work of building and maintaining a complex society of human beings was performed by countless laborers and peasants, assisted by their handcarts, wagons, and wheelbarrows. We can only gain glimpses and suggestions of these vehicles through the mists of time, but their primary contribution to wheeled technology in the Bronze Age of China cannot be overlooked.

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Zhongguo wenwu bao 中國文物報, 8 December 1996.

Table 1: Location and Summary of Major Anyang Chariot Finds

Year of Excavation	Anyang Locus	Summary of Find
1934, eighth-ninth season of excavation	Hougang, west section	A chariot pit was found in the southern ramp of a 中 -shaped tomb.[a]
1935, eleventh-twelfth season of excavation	Xibeigang, royal cemetery	Partial remains of a chariot box was found in the southeastern corner of the large M1001 tomb.
	Xibeigang, royal cemetery	In southern ramp of M1003, excavators found remains of two chariot boxes, with bronze fittings in place.
	Xibeigang, royal cemetery	A large pit with possibly twenty-five or more chariots was found.
	Xibeigang, royal cemetery (east section)	Two pits containing probably two chariots each were found in context with tombs M1136 and M1137.
1936, thirteenth season of excavation	Xiaotun, northern group of tombs in area C74	YM20 (M20): A pit containing four horses, three people, and two chariots.
	Northern group of tombs in area C73	YM40 (M40): A pit containing one chariot, two horses, and three humans.
	Northern group of tombs in area C72	YM45 (M45): A pit containing only traces of a chariot and horse burial, disturbed by contemporary and later graves.
	Northern group of tombs in area C120	YM202 (M202): A pit containing possibly a chariot, two horses, and two humans, disturbed by contemporary and later graves.
	Northern group of tombs in area C120	YM204 (M204): A pit containing just fragments of people, horses, and chariot parts, disturbed by contemporary and later graves.
1953	Dasikongcun	M175: A pit containing one chariot, two horses, and one human.
1959	Xiaomintun nandi	M1: A pit containing one chariot, two horses, and one human.

Table 1: Location and Summary of Major Anyang Chariot Finds

Year of Excavation	Anyang Locus	Summary of Find
	Xiaomintun nandi	M2: A pit containing one chariot and two horses.
1966	Dasikongcun	M292: A pit containing one chariot, two horses, and one human.
1972	Xiaomintun nandi	M7: A pit containing one chariot, two horses, and one human.
1969-1977	Xiaomintun nandi	M698: In ramp of tomb, found one chariot, two horses, and one human.
1969-1977	Baijiafen	M43: A pit containing one chariot and two horses
1969-1977	Baijiafen	M151: A pit containing one chariot and two horses
1981	Xiaomintun nandi	M1613: A pit containing one chariot, two horses.
1987	Guojiazhuang	M58: Traces of one chariot and part of one horse found, disturbed by later Tang tomb.[b]
	Guojiazhuang	M52: A pit containing one chariot, two horses, and two people.[c]
1989	Guojiazhuang	M146:A pit containing one chariot and two horses.[d]
	Guojiazhuang	M147: A pit containing one chariot and two horses.[e]
1992	Liujiazhuang	M339: A pit containing one chariot (disassembled) and two horses.[f]
	Liujiazhuang	M348: A pit containing one chariot, two horses, and one person.[g]
1993	Meiyuanzhuang	M1: A pit containing one chariot, two horses, and one person.[h]
1995	Meiyuanzhuang	M40: A pit containing one complete chariot with two horses, one smaller disassembled chariot, and two people.[i]

Table 1: Location and Summary of Major Anyang Chariot Finds

Year of Excavation	Anyang Locus	Summary of Find
	Meiyuanzhuang	M41: A pit containing one complete chariot, two horses and one person.[j]

[a]All the original references for those finds dating before 1987 can be found in the two following summary reports: Yang Baocheng 楊寶成, "Yin dai chezi de faxian yu fuyuan 殷代車子的發現與復原" (The discovery and reconstruction of the Shang-era chariot), *Kaogu* (1984.6): 546-55; Zheng Ruokui 鄭若葵, "Shilun Shang dai de chema zang 試論商代的車馬葬" (A preliminary discussion of the chariot and horse burials of the Shang Dynasty), *Kaogu* (1987.5): 462-9.

[b]Zhongguo Shehui Kexueyuan Kaogu Yanjiusuo, ed., *Anyang Yinxu Guojiazhuang Shang dai muzuang* 安陽殷墟郭家莊商代墓葬 (Shang-era burials from the site of Guojiazhuang at the Ruins of Yin near Anyang) (Beijing: Zhongguo Dabaike Quanshu Chubanshe, 1998), chap. 4.

[c]Ibid.

[d]Ibid.

[e]Ibid.

[f]Liu Yiman 劉一曼, "Anyang Yinxu Liujiazhuang beidi chemakeng 安陽殷墟劉家莊北地車馬坑" (Chariot and horse pit from north of Liujiazhuang at the Ruins of Yin near Anyang), in *Zhongguo kaoguxue nianjian 1993* (Beijing: Wenwu Chubanshe 1995), 177-8.

[g]Ibid.

[h]Anyang Shi Wenwu Gongzuodui, "Anyang Meiyuanzhuang Yin dai chema keng fajue jianbao 安陽梅園莊殷代車馬坑發掘簡報" (Simplified report of the chariot and horse pit of the Yin era excavated at Anyang, Meiyuanzhuang), *Huaxia kaogu* (1997.2): 56-63.

[i]Zhongguo Shehui Kexueyuan Kaogu Yanjiusuo Anyang Gongzuodui, ed., "Henan Anyang Shi Meiyuanzhuang dongnan de Yin dai chema keng 河南安陽市梅園莊東南的殷代車馬坑" (Chariot pits of the Yin era from Anyang Meiyuanzhuang, SE locus), *Kaogu* (1998.10): 48-65.

[j]Ibid.

Table 2: Translation of Key Technical Terms for Chinese Chariotry[a]

Traditional Form	Mainland Form	Pronunciation in Mandarin	Definition
鑣	镳	*biāo*	Cheek pieces to the bridle which are attached to the bit.
驂馬	骖马	*cān mǎ*	The far left and right horses in a quadriga.
策	策	cè	A riding whip, often with a carved jade handle. Found in some chariot pits.
軔	轫	*chūn*	In some modern reports, a metal ring placed on the hub for external reinforcement, between the outer collar and nave band. In early texts this term also refers to a device used to attach things to the front rail of the chariot box.
當顱	当颅	*dāng lú*	A decoration placed directly on the horse's forehead and a functional part of the headstall assembly.
當兔	当兔	*dāng tù*	A coupling placed at the junction of the axle and the draught pole, with notches above and below. It was bound in place to secure the intersection.
軛	轭	*è*	A yoke saddle placed over the horse's neck and connected to the yoke bar. Shaped like the character 人.
軓	轨	*fàn*	A bronze ornament on the front baseboard of the chariot box, at the junction with the draught pole. A counterpart to the heel ornament.
輻	辐	*fú*	Spoke of a wheel.
伏兔	伏兔	*fú tù*	A axle pad on which the chariot box would rest.
服馬	服马	*fú mǎ*	The two inner horses of a quadriga, responsible for the majority of the draught.

Table 2: Translation of Key Technical Terms for Chinese Chariotry[a]

Traditional Form	Mainland Form	Pronunciation in Mandarin	Definition
釭	钭	*gāng*	A metal bushing inserted into the hub for internal reinforcement.
弓形器	弓形器	*gōng xíng qì*	A bow-shaped object found in some chariot pits. Function uncertain.
轂	毂	*gǔ*	The central hub of a spoked wheel. The nave.
錧	馆	*guǎn*	Metal collar fitted around the ends of the hub, providing external reinforcement. Also written with cart radical on left.
桄木	桄木	*guāng mù*	Wooden planks forming the support for the bottom of the chariot box, running parallel to the sideboards and draught pole.
軌	轨	*guǐ*	Gauge; distance between wheels.
衡	衡	*héng*	The yoke. A horizontal cross-bar attached at the end of the draught pole.
韁繩	缰绳	*jiāng shéng*	A general term designating the bridle of a horse. Occasionally refers just to the reins.
頸靼	颈靼	*jǐng dá*	A rope tied to the ends of the yoke saddle around the horse's neck.
橛	橛	*jué*	A thorned peg placed in the mouth of the outriding horse in addition to the metal bit.
較	较	*jué*	Wooden (or metal) rails on the left and right of the box. A higher rail in addition to the *regular side rails.*
闌	阑	*lán*	Wooden rails forming the upper outline of the box. Sometimes just referring to the front and rear rails.
礪	砺	*lì*	A whetstone, used to sharpen metal cutting edges. Sometimes found with chariots in pit.

Table 2: Translation of Key Technical Terms for Chinese Chariotry[a]

Traditional Form	Mainland Form	Pronunciation in Mandarin	Definition
鈴	铃	*líng*	Small bronze bell often found dangling from the neck of chariot horses.
軨	轭	*líng*	Another name for the wooden rails forming the upper outline of the box.
鑾	銮	*luán*	A decorative bell, placed on the yoke, near the attachment for the yoke saddle.
輪	轮	*lún*	The wheel.
絡頭	络头	*luò tóu*	The halter around the horse's head.
馬冠	马冠	*mǎ guān*	A decoration for the draught animal's forehead. A frontlet. A chamfron.
軜	轼	*nà*	A rein connected to the outriding horses of a quadriga.
轡	辔	*pèi*	The reins.
軹	轵	*qí*	A nave band. A metal reinforcing band around the center of the hub with perforations for the spokes.
軥	軥	*qú*	The hooked end of a yoke saddle to which a trace is often attached which leads to the draught pole or axle to distribute the draught.
軾	轼	*shì*	A support to lean on while driving the chariot. Also used to attach reins and hang weaponry. Located near the middle of the box and spanning its width, it is usually higher than the other rails.
輞	辋	*wǎng*	The felloe of a wheel (tire).
轄	害	*wèi*	A chariot axle end-cap.
轄	辖	*xiá*	An axle-pin or linchpin used to hold the wheel on the axle.
賢端	贤端	*xián duān*	The inner side of the hub, toward the box.

Table 2: Translation of Key Technical Terms for Chinese Chariotry[a]

Traditional Form	Mainland Form	Pronunciation in Mandarin	Definition
銜	衔	*xián*	A bit placed between the horse's teeth to control the direction of the ride. Part of the bridle assembly.
轐	辖	*xiǎn*	The girth strap. Connected to the yoke bar or yoke saddle, this strap goes around the horse's belly.
箱	箱	*xiāng*	The box or cage which holds the rider or riders.
脅驅	胁驱	*xié qū*	A prod tied to the belly of the inner horses of a quadriga to keep them separated from the outriding horses.
鞙	鞙	*xuàn*	A strap used to fasten the yoke saddles to the yoke bar.
牙	牙	*yá*	Another name for the felloe or tire of the wheel.
鞅	鞅	*yāng*	Part of the harnessing system. A strap around the lower neck, possibly connected through the girth strap to the trace.
轙	轶	*yǐ*	A metal ring attached to the yoke bar for channeling reins. A terret.
輢	辒	*yǐ*	The left and right rails of the chariot box. Or by some identifications, a post to the left and right where the higher *jué* rail is secured.
靷	靷	*yǐn*	A trace. A key part of the Chinese harnessing system. On the inner horses, it is a strap or rope connecting the yoke saddles to the structure of the chariot itself. For the outriding horses, it connects a chest-strap to the axle of the chariot.
鍪勒	攸勒	*yōu lè*	Collective term for the bridle, including the bit and cheek pieces.

Table 2: Translation of Key Technical Terms for Chinese Chariotry[a]

Traditional Form	Mainland Form	Pronunciation in Mandarin	Definition
輿	舆	*yú*	The box or cage which holds the rider or riders.
轅	辕	*yuán*	The draught pole.
軏	轨	*yuè*	A decoration placed at the intersection of the draught pole and yoke.
鑿	凿	*záo*	The holes in the felloe and nave where the spokes are inserted.
軫	轸	*zhěn*	The baseboards forming the frame of the chariot box.
軹端	轵端	*zhǐ duān*	The outer side of the hub.
踵	踵	*zhǒng*	A decoration and reinforcement placed at the tail end of the draught pole; The heel.
輈	辀	*zhōu*	Another name for the draught pole assembly.
軸	轴	*zhóu*	The axle. The axle tree.

[a]Among the Shang graphs known to us which concern chariotry, the most prevalent is the word for the whole chariot, which unlike the modern graph, 車 , is drawn complete with yoke bar, and draught pole. Because of the nature and scope of the oracle bone inscriptions it cannot be known at this time if the Shang had specific written graphs for the other parts of the vehicle. There is a hint of an attempt to indicate various parts in a famous oracle bone inscription (*Heji* #10405). When the entire chariot is referred to, the complete graph is drawn. To indicate that the king's axle had broken during the course of his ride, the line comprising the axle is broken in the middle. Later in the inscription, when the scribe wanted to emphasize the portion of the chariot containing the king, he dispensed with drawing the yoke saddles and draught pole and only drew the chariot box and wheels. Spoken words obviously existed for all parts of the vehicle. These would have been derived from previous usage with other wheeled vehicles, or would have been borrowed from Central Asian languages.

Very specialized terms for the various parts of the chariot and harness begin to appear in bronze inscriptions dating from the end of the Western Zhou period, where they are part of elaborate lists of gifts given to the owner of the vessel as part of an official appointment. Many of these items are modified by adjectives suggesting gilding or decoration with rare materials. Some of these characters have been in common use until the current day, but others became obsolete and had to be reconstructed from references in later Classical texts.

Excluding the phrases coined by modern archaeologists, such as "bow-shaped object," most of the terms identified in this table are first defined in Warring States or Han texts. A source of many identifications is the problematic *Kaogongji* 考工記 , part of the current text of the *Zhouli* 周禮 , but probably a creation of the late Warring States which was inserted into the *Zhouli* during the Western Han period. The section of the *Kaogongji* dealing with chariots provides a wealth of information about names and dimensions of parts, but this information is of little practical use. The nature of the text is very systematizing, concerned more with numerology and symmetry than with objective technical definitions. Since the current *Kaogongji* lacks original illustrations, Qing scholars like Dai Zhen 戴震 (A.D. 1723-77) and Ruan Yuan 阮元(A.D. 1764-1849) tried to use the vague and pithy text to create a reconstruction of the Zhou chariot.

Two Han period texts have been central to efforts to come up with terms to name the various parts of the Bronze Age chariot. These are the Han dictionaries *Shuowen jiezi* 說文解字 by Xu Shen 許慎 (A.D. 30-124) and *Shiming* 釋名 by Liu Xi 劉熙 . These texts are more helpful than the *Kaogongji*, but they also have severe limitations. The definitions in *Shuowen* are often circular and the phonology and etymology of *Shiming* is more dictated by rhyme and cosmology than by history or reason.

Because these terms used by craftsmen and soldiers were colloquial and varied significantly from region to region, the preceding texts are often in conflict regarding the orthography, pronunciation, and definition of specific terms. It has been the practice of modern archaeologists to try and pin each part and artifact they find in the ground to a specific term found in the Classical texts. They have reached a consensus about the identification of most of these technical terms, but others are still subject to varying interpretations. A sobering reminder of these limitations was provided by the inscribed terms etched onto some parts of the bronze carriage #2 from the tomb of Qin Shihuang. These names for reins and the specific horses of a quadriga team do not match those in any Han or pre-Han text.

With these reservations in mind, this list is provided, along with the accompanying diagram, chiefly because these are the terms used in modern archaeological site reports of major chariot finds.

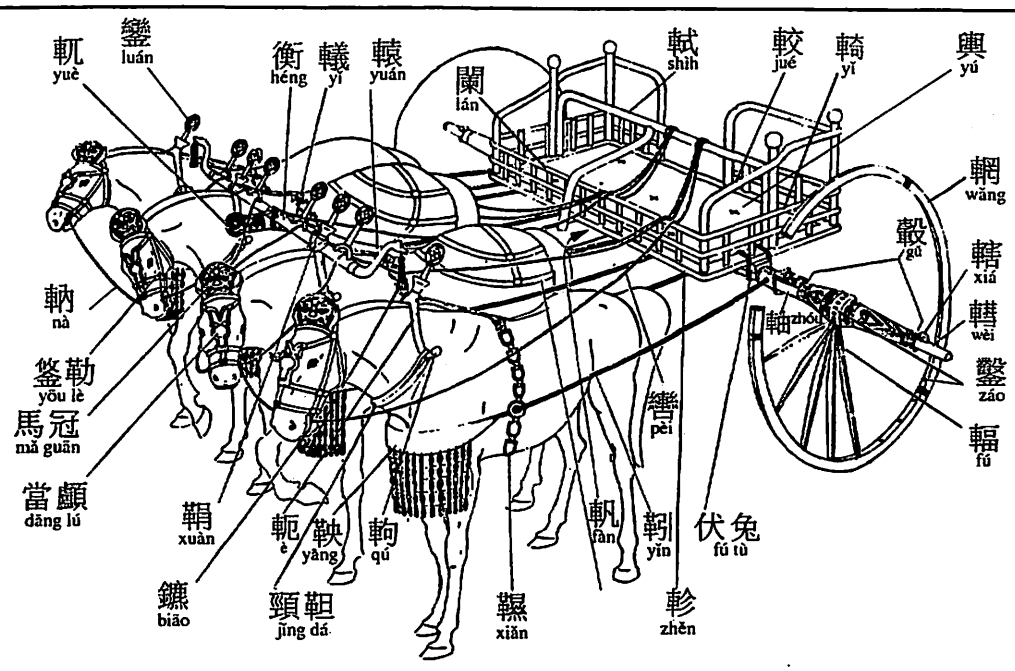


Figure 27. Illustration from Sun Ji, "Zhongguo gudai mache de jijia fa," with substantial modifications.

Table 3: Key Measurements of Anyang-Period Chariots[a]

Site, chariot number.	diameter of wheel	no. of spokes	gauge	width of box	length of box	height of box	length of draught pole	diameter of draught pole	length of axle	diameter of axle	length of yoke	no. of horses	no. of humans	Associated burial goods
Anyang Yinxu														
Xiaotun M20[b]							265	5-7	290	5.5-7.3	170	4	3	Stone halberd, 2 bronze halberds, 10 stone arrows, 30 bronze arrows, 2 bow-shaped objects, 3 animal-style knives, 4 whetstones, 2 jade whip handles.
Xiaotun M40			225				255	10	290		210	2	3	Bronze knife, 20 bronze arrows, bow-shaped object, 11 bone arrows, 2 bone awls, whetstone.
Xiaotun M45												?	?	Bronze arrow, bone arrow, whetstone.
Xiaotun M202												2	3	Whetstone.
Xiaotun M204												?	?	
Xiaomintun M1	122	?	240	134	83	40	268	5-8	310	5-8	?	2	1	
Xiaomintun M2	122	26	?	100	?	41	260	6-9	?	5-8	?	2		Bow-shaped object.
Xiaomintun M7	133-144	22	217	129-133	74	45	256	9-15	306	13-15	110	2	1	
Xiaomintun M698	140-156	18	240	?	?	?	?	?	298	10	?	2	1	
Xiaomintun M1613	126-145	18	224	150	107	45	290	12-13	294	10	113	2		

Table 3: Key Measurements of Anyang-Period Chariots[a]

Site, chariot number.	diameter of wheel	no. of spokes	gauge	width of box	length of box	height of box	length of draught pole	diameter of draught pole	length of axle	diameter of axle	length of yoke	no. of horses	no. of humans	Associated burial goods
Dasikongcun M175	146	18	227	94	75	?	280	11	300	4.1-7	120	2	1	Stone halberd, 2 bow-shaped objects, 22 bronze arrows, 10 bone arrows, bronze knife, 1 adze, 1 square-holed axe 斨, one bronze knot-un-tier 觿.
Dasikongcun M292												2	1	Bronze halberd, 10 bronze arrows, bow-shaped object, animal-style knife, adze, whip handle.
Baijiafen NW M43	134-147	18	223	137	73	22	292	10	309	9.5-10	?	2		Two bronze halberds, bow-shaped object, arrow quiver with arrows inside, knife, awl, whip handle.
Baijiafen NW M151	139	18	?	?	?	?	?	?	?	?	?	2		
Guojiazhuang M58[c]														Disturbed by Tang grave; only part of one horse and axle end-cap and part of yoke saddle found.
Guojiazhuang M52	140	18	230	142-161	94-103	50 (est)	261/268	12	308	10	216/235	2	2	Cinnabar and traces of a mat under horses. No weapons found.
Guojiazhuang M146	131 (avg)	16	223	168-172	106-109	47-49	266	11.5	300-312	12	220	2	0	Two bronze halberds, bone tube, shell rings, one bronze arrowhead.
Guojiazhuang M147	135 (avg)	20	226	149-151	90-94	48-49	272	11	308-312	12	140	2	0	Bronze bow-shaped object, 12 arrowheads, two halberds, shell rings and bone tube.

Table 3: Key Measurements of Anyang-Period Chariots[a]

Site, chariot number.	diameter of wheel	no. of spokes	gauge	width of box	length of box	height of box	length of draught pole	diameter of draught pole	length of axle	diameter of axle	length of yoke	no. of horses	no. of humans	Associated burial goods
Meiyuanzhuang M1[d]	143 (avg)	22	220	164	113	55	274	10	302	10	135	2	1	Traces of gold foil in and near box, horse whip handle, two bronze arrowheads, second yoke bar (?), chariot brakes (?), lacquer traces around box.
Meiyuanzhuang M40a (complete)[e]	143 (avg)	18	240	134-146	82-94	39-50	265	10-12	310	10.5	114	2	2	Traces of mat under horses. Lacquer traces in box. Stone hammer.
Meiyuanzhuang M40b (disassembled)	N/A	N/A	N/A	105-132	75-80	30-41	200 sum of 2 parts	7.5-8	280 est.	5-7.5	130 est.			
Meiyuanzhuang M41	135 avg.	18	217	128-144	70-75	43-44	280 partial	11	305	9-10	200 est.	2	1	bronze bow-shaped object, spade, whip handle, arrowheads, ring-handled knife, adze, finials, chisel, stone hammer, bone knot-detangler, bone tube.
Other Anyang Period Chariots														
Shandong Qianzhangda M40[f]	120-140	?	?	130-160	80-100	25-35	?	8-12	310	6-7	?	2	1	Bronze halberds, bronze helmet, bronze arrows, bow-shaped object, bronze knife, ax, chisel, gold foil bowl impression, jade pieces, bone tools, leather and wood shield.
Shandong Qianzhangda M41	145-150	?	260	140	97-105	?	266	8-9	?	?	185	2	2	Bronze platter with cowrie inlay, bronze halberds, chisel, scraper, gold-foil covered bowl, shield, bronze *gu* beaker, bronze *jue* pitcher.

Table 3: Key Measurements of Anyang-Period Chariots[a]

Site, chariot number.	diameter of wheel	no. of spokes	gauge	width of box	length of box	height of box	length of draught pole	diameter of draught pole	length of axle	diameter of axle	length of yoke	no. of horses	no. of humans	Associated burial goods
Shandong Qianzhangda M45	142-145	20	220	123-140	77-80	?	245	5-9	307	?	183	2	1	Bronze ling bell, bronze halberd, gold bowl remains, shield, bow-shaped object, bronze arrows, quiver, scraper, long bronze object of unknown use.
Shaanxi-Xi'an Laoniupo M27[g]	140	16	225	160	72	14	240	7	315	?	?	2	0	

[a]A certain amount of caution needs to be exercised when using this table to make generalizations or comparisons based on dimensions. First of all, despite the excellent technical virtuosity of recent chariot excavations, the dimensions taken are still only estimates based on the decayed traces in the soil of the original wooden parts. Further, because of the deleterious effects of the rammed earthed fill of the pit, there is often severe distortion and breakage of various parts, especially the wheels and the chariot box. For example, wheels often appear oval, not round, and sometimes it is unclear in early reports what dimension of the misshapen wheels is being presented. Other times, parts such as the draught pole might be intentionally dislocated and moved forward to accommodate the bodies of the horses, thus skewing their apparent length. There is also some ambiguity with the length dimensions reported for curved parts such as the draught pole as to whether the straight length or actual length is reported. All dimensions are given in centimeters.

[b]The measurements for all the chariots up to the next footnote can be found in Yang Baocheng 楊寶成, "Yindai chezi de faxian yu fuyuan 殷代車子的發現與復原" (The discovery and reconstruction of the Shang-era chariot), *Kaogu* (1984.6): 546-55; Lu Liancheng 盧連成, "Chariot and Horse Burials in Ancient China," *Antiquity* 67 (1993): 824-38.

[c]The measurements of the four Guojiazhuang chariots can be found in: Zhongguo Shehui Kexueyuan Kaogu Yanjiusuo, ed., *Anyang Yinxu Guojiazhuang Shang dai muzuang* 安陽殷墟郭家莊商代墓葬 (Shang-era burials from the site of Guojiazhuang at the Ruins of Yin near Anyang) (Beijing: Zhongguo Dabaike Quanshu Chubanshe, 1998).

[d]Anyang Shi Wenwu Gongzuodui, "Anyang Meiyuanzhuang Yin dai chema keng fajue jianbao 安陽梅園莊殷代車馬坑發掘簡報" (Simplified report of the chariot and horse pit of the Yin era excavated at Anyang, Meiyuanzhuang), *Huaxia kaogu* (1997.2): 56-63.

[e]The Meiyuanzhuang M40, M41 chariot dimensions are from: Zhongguo Shehui Kexueyuan Kaogu Yanjiusuo Anyang Gongzuodui, ed., "Henan Anyang Shi Meiyuanzhuang dongnan de Yin dai chema keng 河南安陽市梅園莊東南的殷代車馬坑" (Chariot pits of the Yin-era from Anyang Meiyuanzhuang, SE locus), *Kaogu* (1998.10): 48-65.

[f]The Qianzhangda chariots await publication. The measurements were made available to the author through a personal communication with one of the excavators in April, 1997.

[g]Xibei Daxue Lishi Xi Kaogu Zhuanye, ed., "Xi'an Laoniupo Shang dai mudi de fajue 西安老牛坡商代墓地的發掘" (Excavation of the Shang-era cemetery at Xi'an, Laoniupo), *Wenwu* (1988.6): 1-22.

Table 4: Translations of Oracle-Bone Inscriptions Containing Forms of the Graph 車

Inscription	Source of Rubbing
Crack-making on [*gui*]*hai* day, Que divines, "In the upcoming ten-day week there will be no harm." The king, reading the cracks, prognosticated...on *dingmao* day the king went hunting in the land of Bi, Yong(?) harmed the chariot (breaking the draught pole)...from within another chariot [the king] recaptured the horses, also...	*Heji* #584 (obverse)
Crack-making on *guichou* day, Zheng divines, "From today to *dingsi*, we will harm the Zhou." The king, reading the cracks, said, "Down to *dingsi*, we should not perhaps harm them; on the coming *jiazi* day we will harm them." On the eleventh day, *guihai*, our chariots (or a man named Che?) did not harm them; in the period between that night and the *jiazi* day, we really harmed them.	Heji #6834 (obverse)
Crack-making on *guisi* day, Que divines,"In the ten-day week there will be no harm." The king, reading the cracks, prognosticated saying: "Then this also has danger. It is as if I am being judged from above(?)." On *jiawu*, the king went out in chase of rhinoceros. The Junior Servitor Zai(?) harmed the chariot and horse, breaking the axle and overturning the king's box; Prince Yang also fell out.	*Heji* #10405 (obverse), 10406 (obverse).
As for Che (personal name), will he perhaps not bring ten strings of cowries.	*Heji* #11442
...[in the ten-day week there will be] no harm." The king, reading the cracks, prognosticated, "There is danger."...[hunting] in the land of Bi, Yong harmed the chariot (breaking the draught pole)...(in) a chariot they recaptured the horses...also there was a foot injury(?)...	*Heji* #11446
...on the [5th?] day, *dingmao*...Yong harmed the chariot and horse team (breaking the draught pole)...	*Heji* #11448
...Yong harmed the chariot (breaking the draught pole)...there was also a foot injury...	*Heji* #11449
...chariot and horses of the palace moat...capital.	*Heji* #11450
...day...chariot(?)...indeed...	*Heji* #11451
Crack-making on *bingwu* day, Gong(?) [divined]...six chariots...	*Heji* #11452 (obverse)

Table 4: Translations of Oracle-Bone Inscriptions Containing Forms of the Graph 車

Inscription	Source of Rubbing
...chariot...	*Heji* #11453
...chariot (with broken draught pole)...	*Heji* #11454
...crackmaking...I personally...chariot...	*Heji* #11455
...chariot. Two reports.	*Heji* #11456
...chariot...not...harm	*Heji* #11457
chariot...Xin(?)...	*Heji* #11458
at Che (place name) perform dance ritual.	*Heji* #13624 (obverse)
Crack-making on *jiachen* day, Che (personal name)...indeed ?..., from today up until...	*Heji* #21622
...chariot box...	*Heji* #21778
If in the ritual to Brother Xin, we sacrifice the Chariot Squadron of the Right, this will be correct.	*Heji* #27628
...Junior Servitor Qiang allied and attacked, capturing Qiang prisoners of Wei, twenty men, four... men, 570 men, 100 (?)... ...horses, two chariots, 183 shields, fifty quivers, and...arrows. They sacrificed Earl Du to Da...,....sacrificed Earl Mao of Shen... ...to Ancestor Yi, and sacrificed the Qiang to Ancestor Ding. Ran Gan Jing (?) awarded...	*Heji* #36481 (obverse)

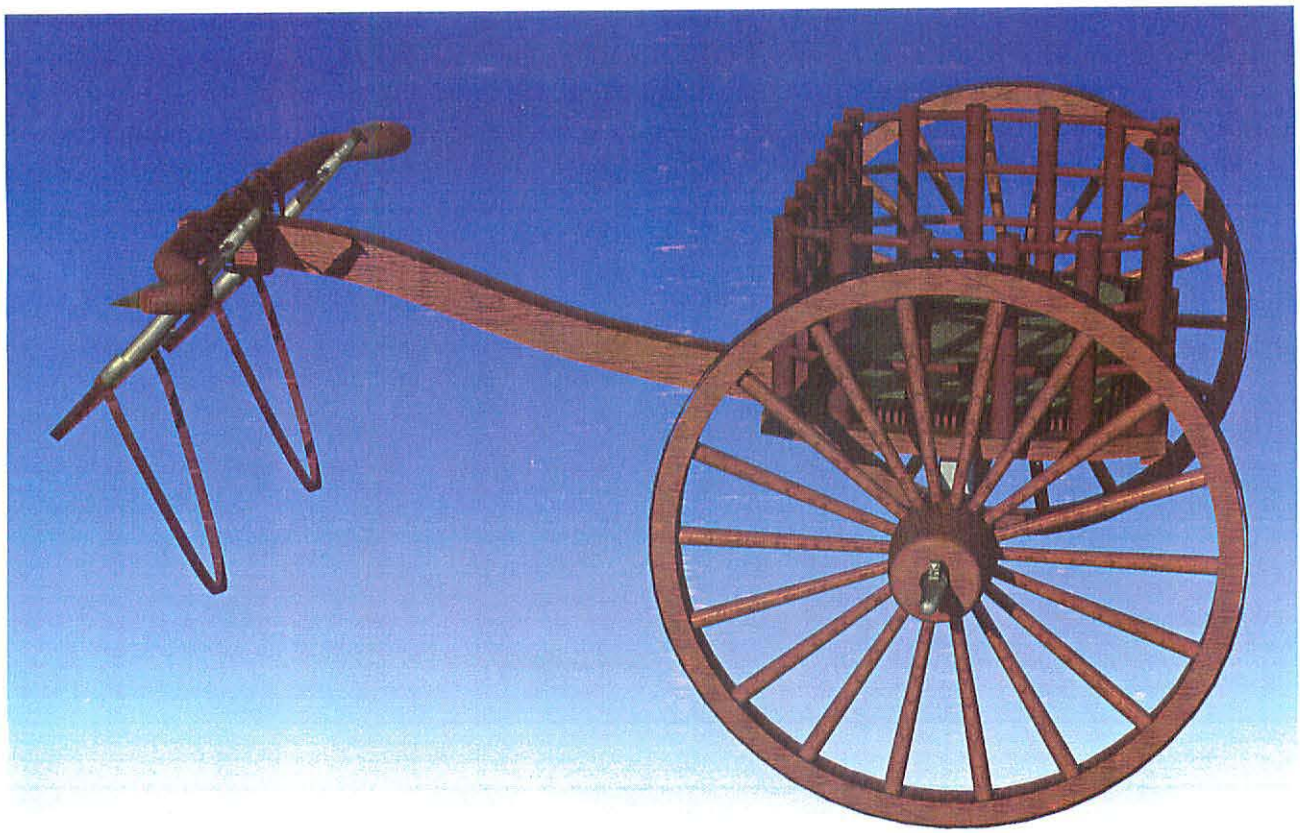


Plate # 1: Chariot M52, side view.

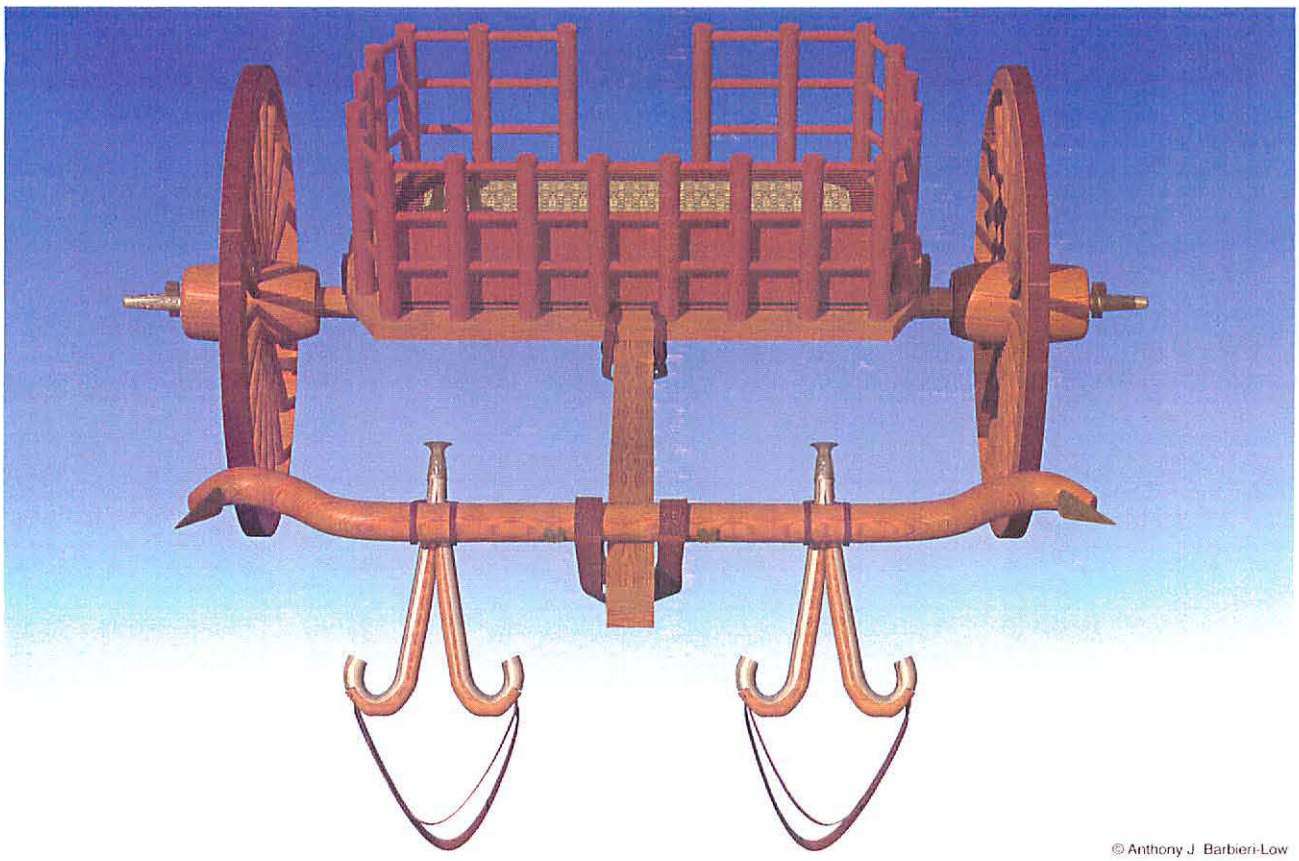


Plate # 2: Chariot M52 (front view).

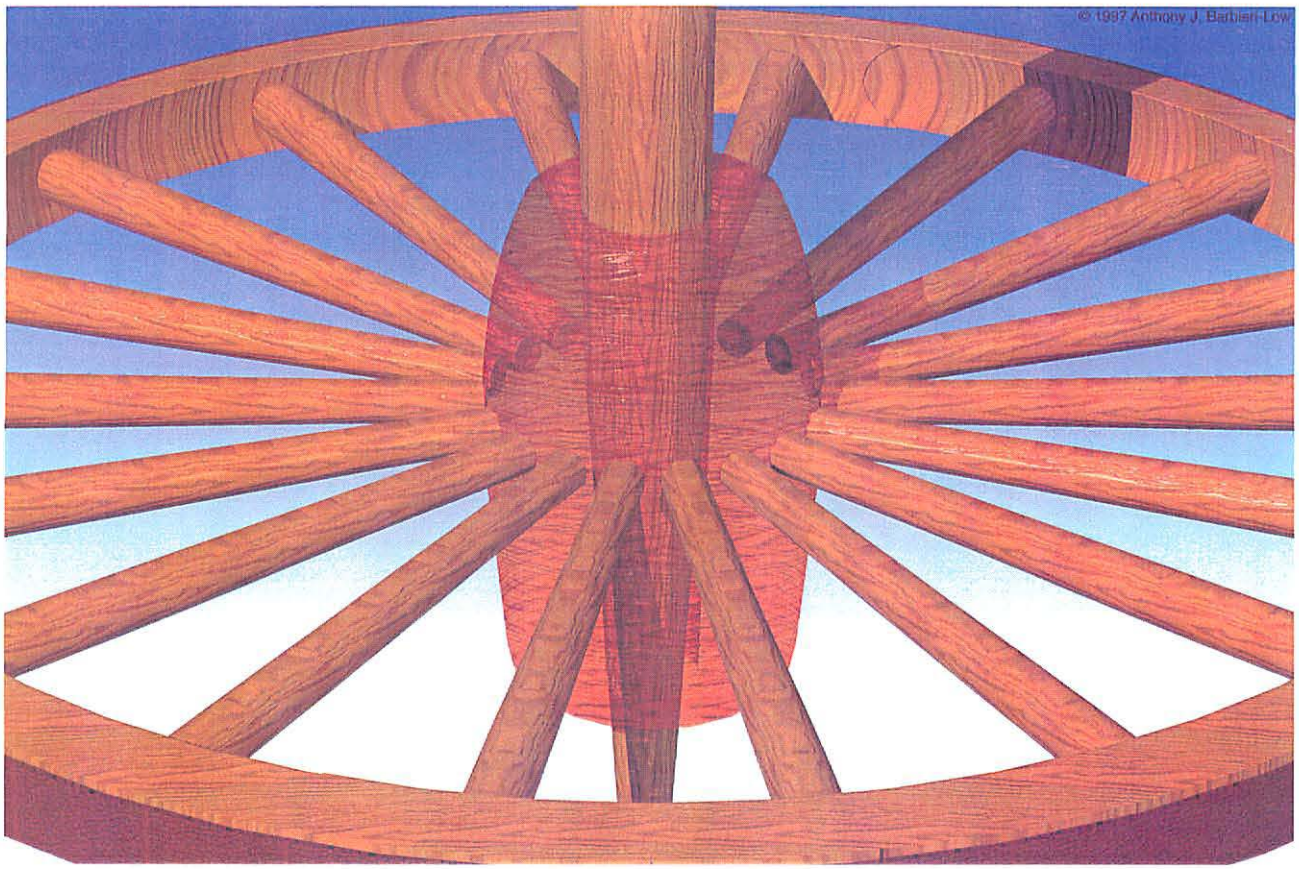
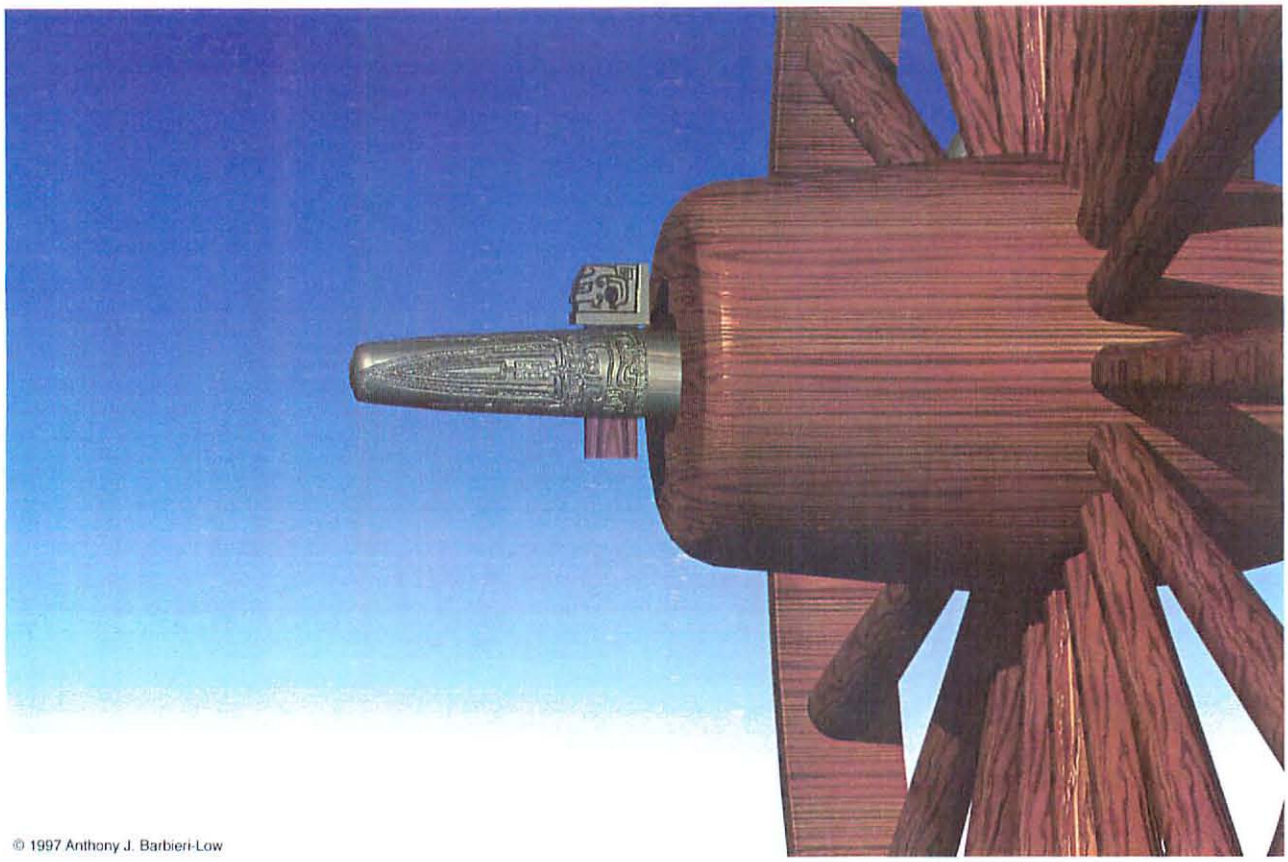


Plate # 3: Wheel with transparent nave. (demonstrates narrowing of axle.)

Plate # 4: Axle end-cap and linchpin assembly.

Plate # 5: Axle end-cap and pin assembly of left wheel affixed to axle tree.



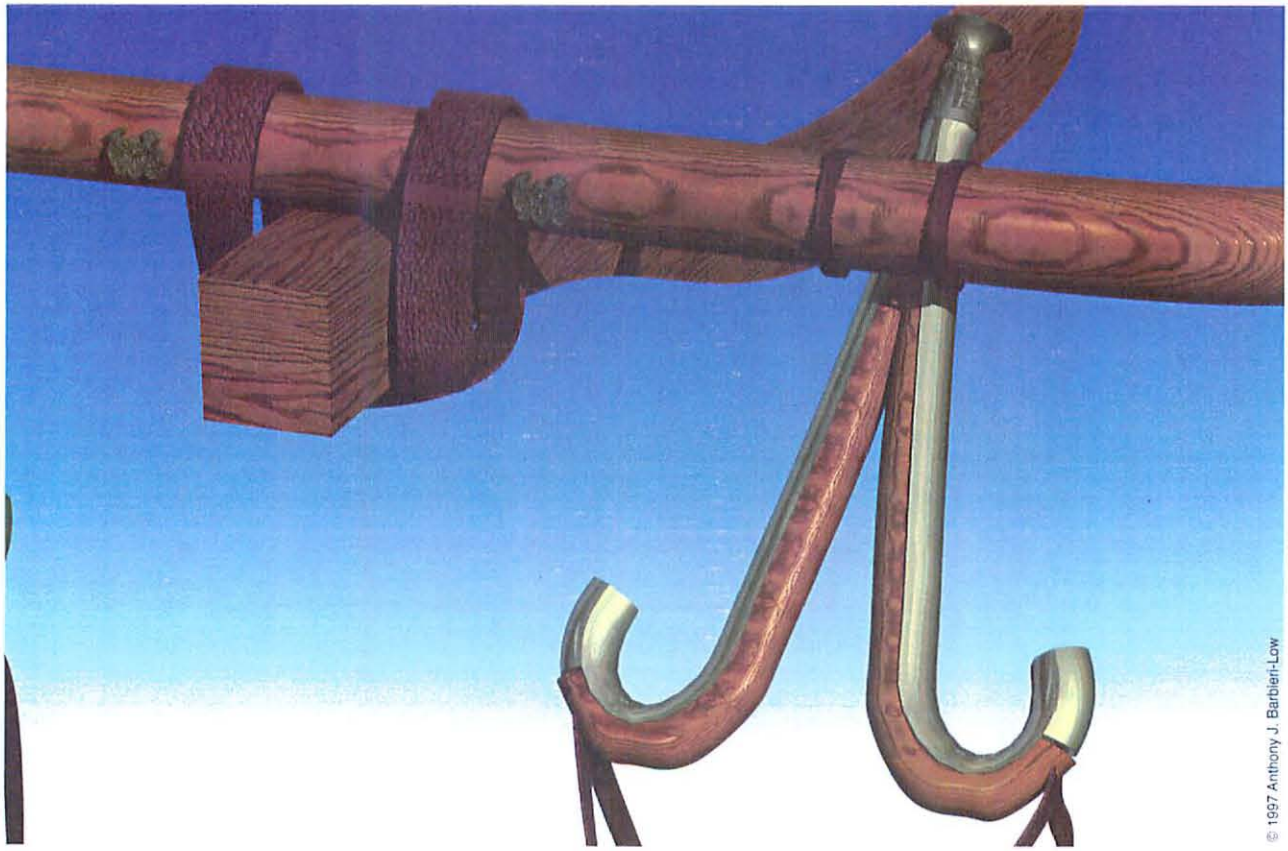


Plate # 6: Yoke bar/pole linkage; yoke saddle; yoke decorations.

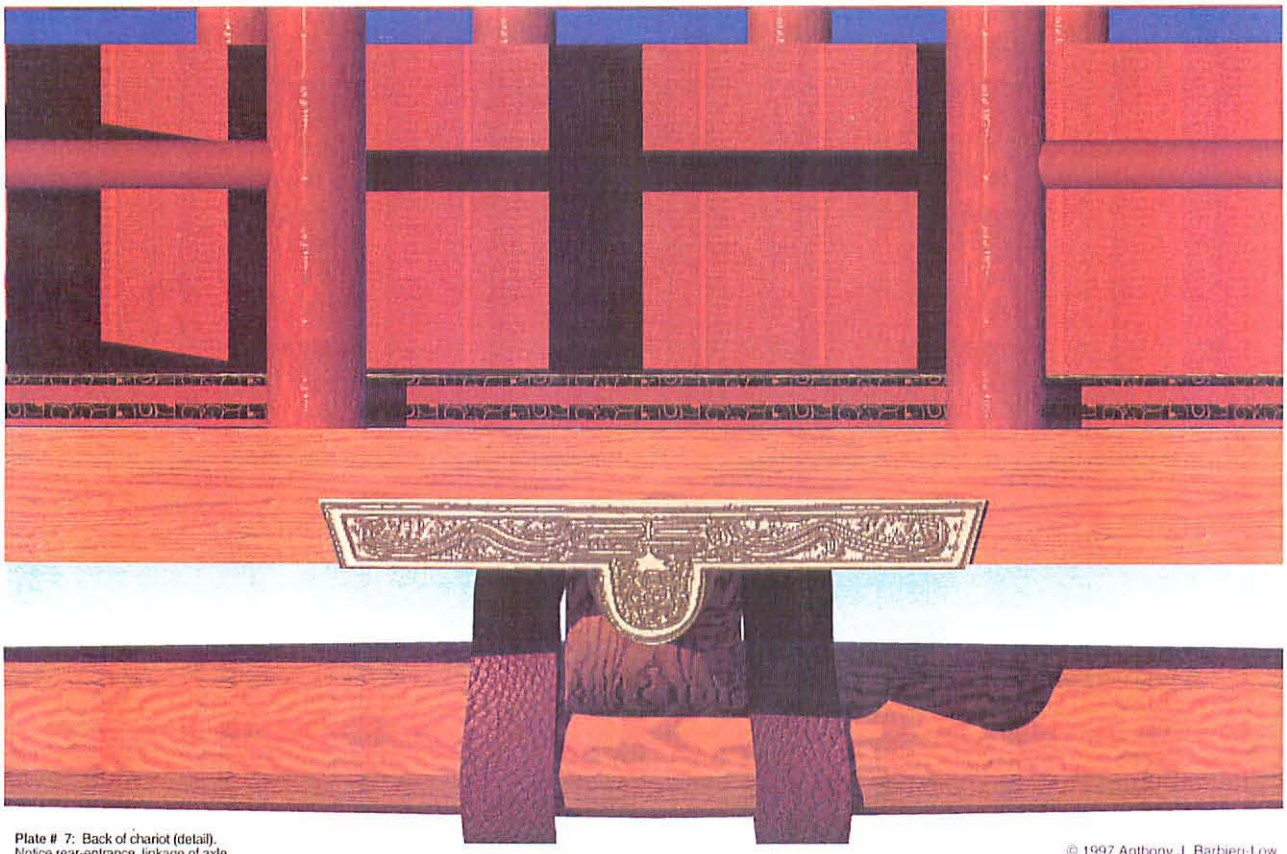


Plate # 7: Back of chariot (detail). Notice rear-entrance, linkage of axle and pole, bronze heel.

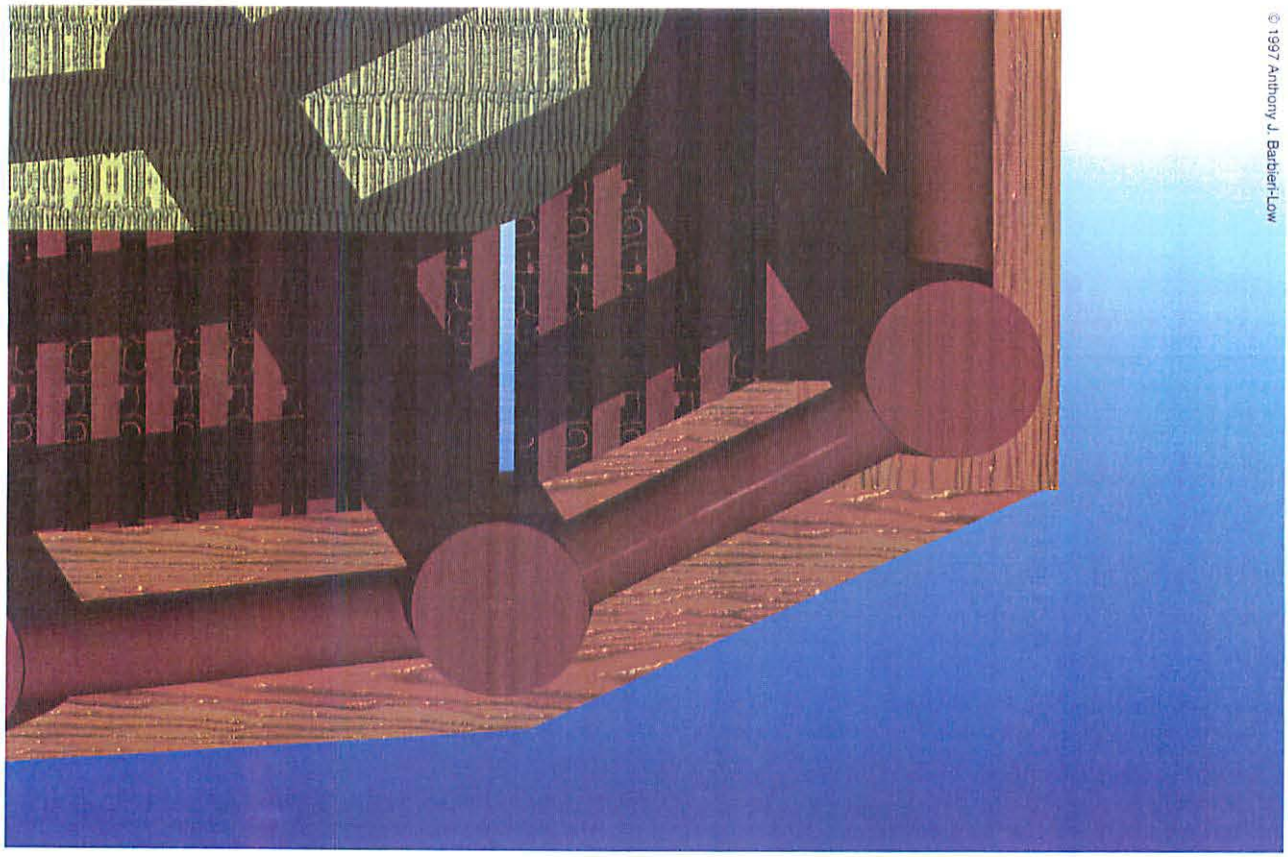


Plate # 8: Closeup of bottom of box. Notice striped lacquer boards, tatami mat.

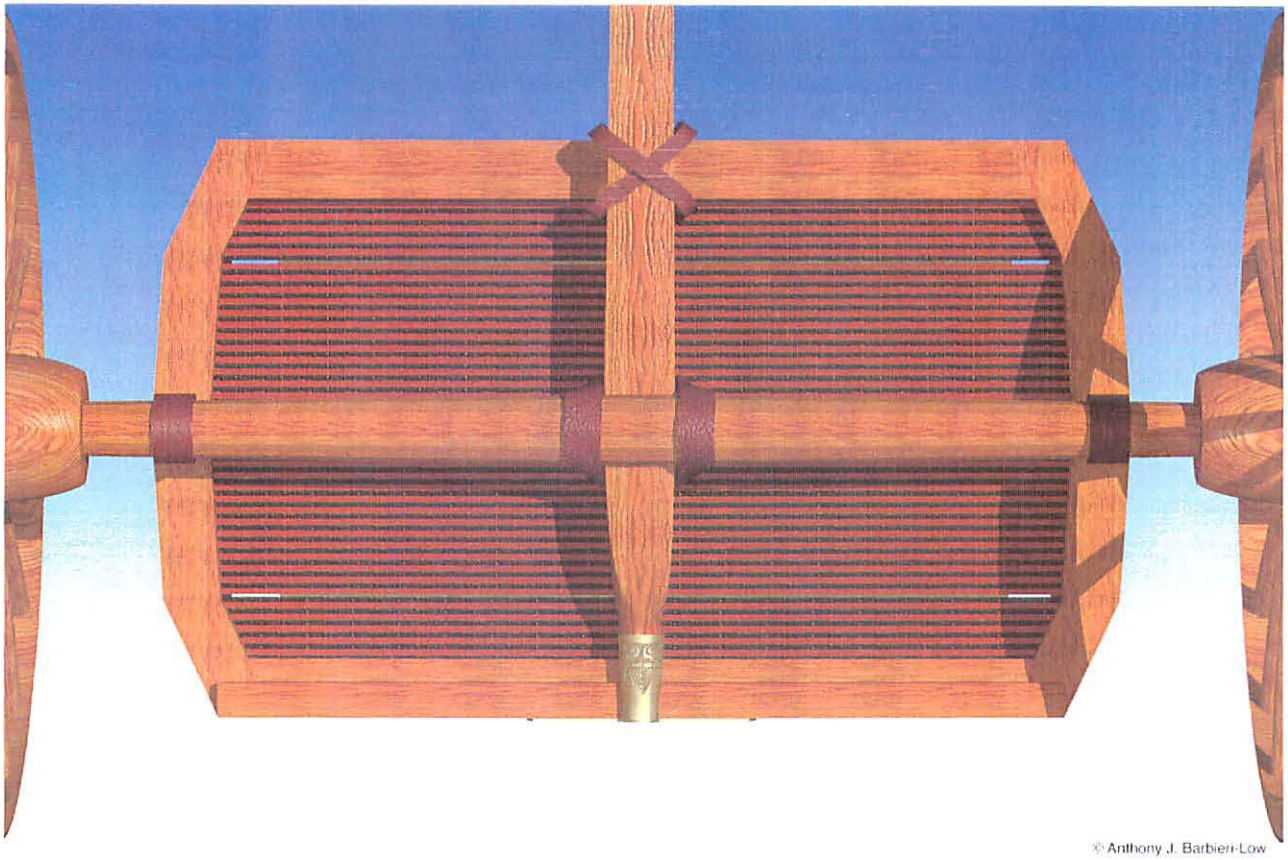


Plate # 9: View from bottom of box. Notice various linkages holding box tc axle and pole.

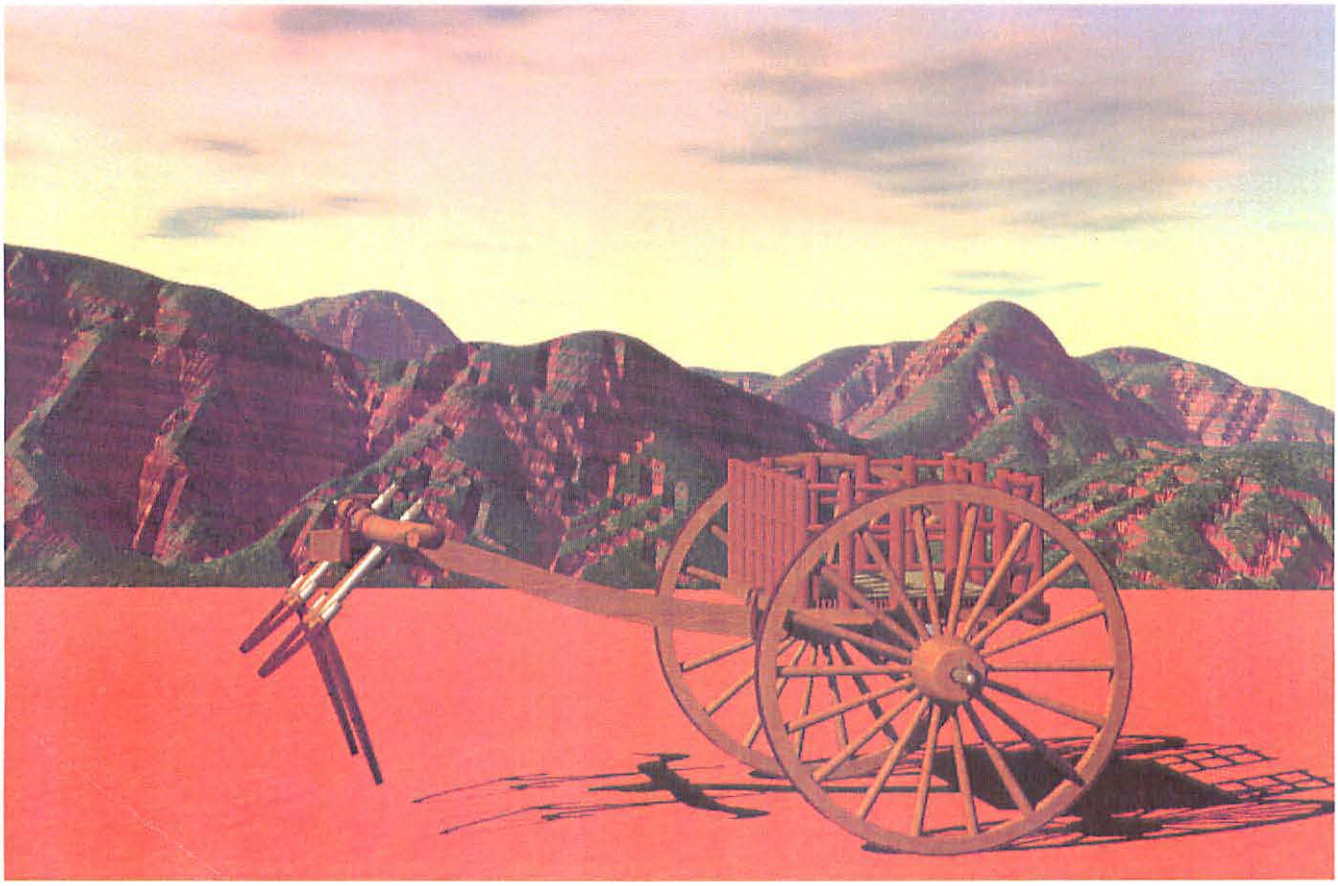


Plate # 10: Imaginary Bronze Age landscape of Shang domains with chariot in foreground.

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