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**Title:** Isotopic analysis of dietary patterns in northern China from the Proto-Shang Period to the Qin Dynasty  
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3.1 A Brief Introduction to Chinese Prehistory and History

Modern China represents one of the earliest regions where civilization originated, and its culture and influence have had, and continue to have, an impact across the world (Schirokauer, 1991; Barnes, 1999; Loewe and Shaughnessy, 1999). Chinese civilization has its roots in different Neolithic cultures, and it has gradually developed in the context of warfare and territorial interactions until the formation of the Empire in 221 BC under the first Emperor Qin Shi Huang (Table 3.1) (Zhang et al., 2005; Yuan et al., 2012; Shelach-Lavi, 2015). Here I present a brief introduction to the chronology of Chinese prehistory and history that will be helpful for the understanding of the three publications that are discussed in chapters 4-6 of this thesis.

Table 3.1. A simplified historical sequence of China from the Neolithic to the Qin Dynasty.

3.2 Neolithic Culture

There were many different Neolithic cultures that existed across modern-day China, and these have been largely classified on the basis of their unique ceramic traditions (Figure 3.1) (Treistman, 1972; Zhang, 1986; Liu and Chen, 2012; Wilkinson, 2015). Most archaeologists have agreed to divide the Chinese Neolithic into four phases: Early, Middle, Late and Chalcolithic (Zhang, 2009; Ren and Wu, 2012), see Table 3.2.

Agriculture, pottery and stone polishing occurred both in north and south China at approximately the same time, around 10,000 BC (Ren and Wu, 2010). The most highly developed areas are found in the Yellow River Valleys of north China. While different regions produced their own separate and distinct cultures and chronologies, common elements coexist
as well, indicating that there was communication and exchange of ideas between these groups in northern China (Liu, 2004; Zhang and Wei, 2004). After 5000 BC various cultures flourished and became increasingly complex and finally transitioned to the Bronze Age by approximately 2000 BC (Dematte, 1999; Wang et al., 2007; Wang, 2013a; Liang, 2015).

![Figure 3.1. Map of the important Neolithic cultures of China and their territories](https://commons.wikimedia.org/wiki/File:Neolithic_china.svg#/media/File:Neolithic_china.svg)

Table 3.2. Chronology and dating of the Chinese Neolithic.

<table>
<thead>
<tr>
<th>Phase</th>
<th>Dating</th>
<th>Major Cultures</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Northern China</td>
</tr>
<tr>
<td>Early Neolithic</td>
<td>10000-7000 BC</td>
<td>Nanzhuangtou, Hutouliang</td>
</tr>
<tr>
<td>Middle Neolithic</td>
<td>7000-5000 BC</td>
<td>Cishan-Peiligang, laoguantaï, Xinglongwa</td>
</tr>
<tr>
<td>Late Neolithic</td>
<td>5000-3500 BC</td>
<td>Yangshao, Dawenkou, Hongshan</td>
</tr>
<tr>
<td>Chalcolithic</td>
<td>3500-2100 BC</td>
<td>Longshan</td>
</tr>
</tbody>
</table>
3.2.1 Yangshao culture (5000-3000 BC)

The Yangshao culture is the best documented and known of the Chinese Neolithic cultures (Gong, 2002). Its name comes from the village of Yangshao in Henan Province where the first remains of this culture were excavated and described by the Swedish archaeologist J.G. Andersson in 1921 (Zhang, 1986). More than a thousand archaeological sites of the Yangshao culture have been found scattered over a large area including modern-day Henan, Shaanxi, Gansu and Qinghai Provinces (NBCR, 1991; 1999). The Yangshao culture is distinguished by its distinctive red and black painted pottery, which is decorated with human faces, animals and fish, geometrical designs, and markings that resemble an early form of writing (Figure 3.2) (Underhill, 2002; Qiu, 2013).

The Yangshao culture has been divided into three different phases and these as well as important characteristics of the culture are listed in Table 3 (Li, 2013; Liu and Chen, 2012; Zhu, 2013; Zhang, 2005). For example, the Banpo site in Shaanxi Province is representative of the early phase of the Yangshao culture. This large circular site was enclosed by a deep defensive ditch with a plaza in the center, and all of the doors of the houses faced the plaza. The inhabitants of Banpo interred their dead in a special burial area and babies were buried in pottery jars around the living areas of their houses (Xi’an Banpo Museum, 1982).

Figure 3.2. A) Typical pottery of the Yangshao culture from the Banpo site. B) Typical drawings of fish and deer from Banpo pottery. C) Close up of the human face and fish from the
bowl in A (photo from the Banpo Museum, Xi’an, China).

Table 3.3. Chronology, sites and characteristics of the Yangshao culture.

<table>
<thead>
<tr>
<th>Phase</th>
<th>Dating</th>
<th>Examples of Major sites</th>
<th>Region</th>
<th>Social Organization</th>
</tr>
</thead>
<tbody>
<tr>
<td>Early</td>
<td>5000-4000 BC</td>
<td>Banpo, Jiangzhai</td>
<td>Wei River Valley in Shaanxi Province</td>
<td>Egalitarian</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Beishouling, Dadiwan</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Middle</td>
<td>4000-3500 BC</td>
<td>Miaodigou, Xipo</td>
<td>Expanded in all directions from the above</td>
<td>Development of social hierarchy in some areas such as western Henan Province</td>
</tr>
<tr>
<td>Late</td>
<td>3500-3000 BC</td>
<td>Xishan</td>
<td>Henan Province</td>
<td>Increased social hierarchies</td>
</tr>
</tbody>
</table>

3.2.2 Longshan culture (3000-2000 BC)

The Longshan culture was named after the site found at Longshan village in Shandong Province, by Wu Jinding in 1928 (Zhang and Wang, 1993). It is generally agreed that in some areas the Longshan culture was derived from the Yangshao culture (Shaanxi and Henan Province) whereas in other areas it originated from the Dawenkou culture (Shandong), and that is flourished along the Yellow River Valleys (Sun, 2013; Zhao, 2013). The Longshan culture is noted for its highly polished black pottery, which is also known as egg-shell pottery (Figure 3.3), which was developed with the use of the potter’s wheel (Craig, 2007). The population greatly expanded during this period and many settlements were built using walls of stamped earth, with some sites becoming large political and economic centers. Violence and warfare increased and became more widespread and human sacrifice became more common during the late Longshan period (Liu, 2004; Shao, 2000; Zhang, 2000; Zhao, 2013). The complexity and wealth of the grave goods found buried with some individuals indicates the existence of social hierarchy within the population (Underhill, 2008; Cohen and Murowchick, 2014; Han, 2015).
The practices of divination, by applying heat to animal bones and turtle shells (oracle bones), strongly suggests that the Longshan people shared common beliefs and possibly religion, and writing systems may have also been practiced (Gao, 2009; Shao, 2005). There is evidence of the beginning of metallurgy during the Longshan period, and copper and bronze were used for making small implements and ornaments (Linduff et al., 2000). By approximately 2000 BC, the Longshan culture of the Yellow River Valleys declined and was replaced by the Erlitou culture (which many scholars believe represents the Xia Dynasty) and the Yueshi culture in Shandong (ca. 1900-1500 BC) (IA CASS, 2003; Liu and Chen, 2003; 2006; Xu, 2009; 2014).

3.3 Shang Dynasty (1600-1046 BC)

Most Chinese historians believed that the Xia Dynasty (ca. 2100-1600) was the earliest civilization in China, with the Erlitou site regarded as its capital (Zou, 1980; IA CASS, 1999; 2014; Chen, 2004; Allan, 2007). However, this topic is the subject of intense academic debate and some scholars consider the Xia Dynasty a legend or a myth (Allan, 1984; Thorp, 1991; Liu and Xu, 2007). As a result of these controversies, the Xia Dynasty will not be discussed here. Yet, there is no doubt that China entered a significant phase of civilization and technological
advancement with the establishment of the Shang Dynasty at approximately 1600 BC (Zhang, 1980; Thorp, 2005; Zhang et al., 2007).

Originally, the Shang were a tribe who lived mainly along the lower reaches of the Yellow River in Hebei Province, but rapidly extended their territory to include northern and central Henan Province (Ding, 1988; Wang, 2011b; 2005). It is believed that the Shang banded together several tribes to defeat the Xia, and this allowed them to become the dominant power in the Yellow River Valleys for over seven centuries (Zhang, 2008; Huang, 2010). Various Chinese texts, such as: Mencius (孟子), Zuo Zhuan (左传), Shi Ji (史记), and the Bamboo Annals (竹书纪年) mention important events of the Shang (Sima, 2006a; Anonymous, 2009; Mencius, 2012; Zuo, 2015), but these works were written hundreds of years later than the actual events and their veracity is debated. However, much of this textual evidence has been confirmed by archaeological evidence (XSZCP Group, 2000; Wang, 2015a), with more than 20,000 divinations inscribed on oracle bones recovered at the site of Yinxu near the town of Anyang in Henan Province (Figure 3.4).

Figure 3.4. A) Oracle bone inscriptions on turtle shells from the Shang Dynasty site of Yinxu, Henan Province. B) Excavation pit of oracle bones from the Shang Dynasty site of Yinxu, Henan Province (photos from the Yinxu Museum, Anyang, China).
These inscriptions on ox scapulae or turtle shells represent the earliest confirmed Chinese writing and detail important information such as: the complete royal genealogy of the Shang Dynasty, divination practices, and rituals of the late Shang Dynasty court (Keightley, 1978; Wang, 2007a). Thus, rites, divination, and ceremonies were of vital importance to Shang society, and ancestor worship played a particularly prominent role (Allan, 2010; Song, 2010). There was a large amount of human and animal sacrifice at Shang Dynasty sites, and this practice was used to aid communication and as tribute to the dead (Huang, 2004; Tang, 2004; Wu, 2012). Sophisticated bronze manufacturing techniques were fully developed during the Shang period. Various types of cast-bronze artifacts were found at excavated sites, which were used by the upper classes both as ritual vessels and grave goods (China National Museum, 2009a; Li, 2007a).

The Shang Dynasty can be divided into two phases: an early phase (known as Erligang, ca. 1500-1300 BC) and a late phase (known as Anyang, ca. 1300-1050 BC) (AIHP, 2001; IA CASS, 2003; Sun, 2015). As a result of raids from northwestern tribes and due to the fact that the political power of the Dynasty was insecure in the early phase, the Shang moved their capital five times (Chen, 2001; Zhu, 2007; Sun and Lin, 2010). With the final move to Yin, the modern city of Anyang, Henan Province, the Shang state grew strong and inaugurated the golden age of the Dynasty. Today the site is known as the ruins of Yin, or Yinxu, and is known for large-scale palace foundations, ritual temples, enormous royal and elite tombs, chariot burials, and countless sacrificial burials (Figure 3.5). In addition, beside the large number of oracle bones, thousands of exquisite bronze, jade and ceramic artifacts have been unearthed at Yinxu. These objects clearly demonstrate that the Shang were a technically advanced civilization (IA CASS, 2007; Li, 2007b; Tang, 2009; Campbell, 2014).
Figure 3.5. Aerial view of the royal tombs at the site of Yinxu, Henan Province, China (photo from the Yinxu Museum, Anyang, China).

3.4 Zhou Dynasty (1046-221 BC)

The state to the west of the Shang, along the Wei River Valleys, was known as the Zhou. King Wu of the Zhou conquered the Shang at the Battle of Muye around 1046 BC and founded the Zhou Dynasty (Li, 2002; Bai, 2010a). The Zhou maintained their old capital, Feng, for the religious and ceremonial significance of its royal temples, but they built a new capital and administration center at the site of Hao, near the present day city of Xi’an (Jun, 2005; Tian, 2009). The Zhou Dynasty lasted until the foundation of the Qin Dynasty in 221 BC. However, the actual political and military control of China by the Zhou court only lasted until 771 BC (Yang, 1999). Historians divided this era into two periods: the Western Zhou (1046-771 BC) and the Eastern Zhou (771-221 BC) (Shaughnessy, 1999; Lee, 2002).

3.4.1 Western Zhou (1046-771 BC)

The historical events and deeds of the early Zhou kings are recorded in a number of works, which date back to the Western Zhou period. These documents include: Shang Shu (Book of Documents, also known as Shu Jing, 书经), a collection of historical texts which are believed to be the earliest writings of China’s traditional literature, and the Shi Jing (Book of Songs, 诗经), a collection of poetry (Cai, 1987; Yang, 2010; Wang, 2015b). New archaeological
sources from this period are being constantly discovered in the form of inscriptions on bronze vessels and artifacts, some of which are hundreds of characters long, and these provide extensive details about the life and times of the Zhou Dynasty (Figure 3.6) (Zhang, 1983; Rawson, 1999; SACH et al., 2011). The Zhou Kings took the title of Son of Heaven (Tian zi, 天子), and they legitimized their rule by invoking the “Mandate of Heaven”. This change of perspective had important repercussions on all aspects of society from ceremonies to rituals, and the practice of human sacrifice declined during this period (Zhao and Guo, 2004; Zhang, 2007; Xu, 2012). In contrast to the Shang who had their main seats of political power in modern-day Henan and parts of Shanxi and Hubei Provinces (the so called Central Plains), the main center of the Western Zhou were located in Shaanxi Province (Figure 3.7) (NBCR, 1999; Li, 2007c; Sino Maps Press. 2014a).

Figure 3.6. The San Family Plate from the Late Western Zhou Dynasty, Shaanxi Province, China. Text inside of the plate describes a land contracts between two small states (photo from http://blog.sina.com.cn/s/blog_133387d7e0102vlde.html).
The state structure of the Zhou was more complex compared to the Shang Dynasty. When they established the Dynasty, the Zhou invested members of the royal family, favored adherents, and allies with the authority to rule over more than 100 separate territories of the conquered land. Later, those hereditary fiefs, so called Zhuhou (诸侯) became increasingly powerful and independent of the Zhou court (Sima, 2006b; Li, 2007d; Chao, 2016). These subordinate rulers were given ranks that were later systematized into a hierarchic order. During the late Western Zhou period, the Zhou were frequently attacked by the Quanrong barbarians, and were forced to move their capital east to Luoyang in 770 BC. After this move, the Zhou continued to reign nominally for another 500 years even though the court no longer had real military, political, or economic power and authority (Wang, 1994; Li, 2007c). It was during this period that China entered into an age of struggle for hegemony between the great states and feudal lords (Sima, 2006b; Huang, 2015).
3.4.2 Eastern Zhou (771-221 BC)

The Eastern Zhou Dynasty is divided into two phases (Li, 1956; Lv, 2009). The early phase is known as the Spring and Autumn period (770-475 BC), which is named for the work: *Spring and Autumn Annals* (Chunqiu, 春秋), a chronicle of the state Lu (the birthplace of Confucius) between 722 to 481 BC (Gu, 2015). The later phase is called the Warring States period (475-221 BC), and this derives its name from *Zhanguoce* (Record of the Warring States, 战国策), a historic work compiled in the 1st century BC of the Han Dynasty (Liu, 2007).

During the Eastern Zhou period, the more powerful states began to annex the smaller states, and as the lords gained power, they unlawfully declared themselves to be kings (王) of their territory (Li, 2007c; 2007d; Feng, 2009; Zuo, 2105). By the 5th century BC, most of the small states had disappeared and only a few larger states were left. In 453 BC, one of the largest states Jin (晋) was split into three parts, which became the states of Han (韩), Zhao (赵), and Wei (魏), and this marks the beginning of the Warring States period (Sima, 2009; Lv, 2011; Zuo, 2001). The main location of the activities and battles during the Spring and Autumn period was on the Yellow River Plain and the Shandong Peninsula as well as the Huai and Han River Valleys (Sino Maps Press. 2014b). The territory eventually expanded to include the present-day Provinces of Shaanxi, Shanxi, Hebei and the Yangzi River Valley in south (Tong, 2009; Qin, 2013; Chen, 2014).

Over the course of the Warring States period, seven major states fought each other for supremacy: the three Jins (on the Shanxi plateau), the Qi (齐) (in the east of China, centered on Shandong Peninsula), the Qin (秦) (in the far west, with its core in the Wei River Valley and Guanzhong Plains), the Chu (楚) (in the South of China), and the Yan (燕) (in the northeast, near modern Beijing). Additional areas such as present-day Sichuan (Shu, 蜀) and present-day Zhejiang (Yue, 越) were also brought under the control of Chinese culture during this period (Figure 3.8) (Sino Maps Press. 2014c). This period was an era of intensive warfare, and all of these states were in competition with each other in military, social and political spheres (Yang, 2003; Su, 2014; Yu, 2015).
The Eastern Zhou Dynasty is also known as the Golden Age of Chinese philosophy, and a broad range of thoughts and ideas flourished during this period. Confucius (considered the greatest Chinese philosopher and founder of Confucianism), Laozi (founder of Taoism), Mozi (founder of Mohism), Shang Yang and Han Feizi (who developed of ancient Chinese legal system), and many other theorists emerged during this period (Waley, 1994; Confucius, 2006; Yao and Wang, 2015). These thoughts and ideas, known as the Hundred Schools, have profoundly influenced the lifestyle and social consciousness of China as well as the rest of Asia for thousands of years (Lv, 2009; LHPEO, 2011).

There was also an unprecedented development of technology during this period (IA CASS, 2004; Needham, 2015). New manufacturing techniques and processes were introduced, and bronze art reached a high level of excellence during the late Western Zhou period (Rawson, 1995; CBV EB, 1996; Li, 2005). Between the 6th to 5th centuries BC, the casting of iron and steel replaced bronze as the dominant metal used in warfare and farming, and this led to
considerable advances in productivity (China National Museum, 2009b; Liu, 2010). Large economic projects such as the building of canals, dams and defensive walls were also completed during this period. For example, the Dujiangyan Dam, which controlled the Min River in Sichuan Province, and the Zhengguo Canal, which irrigated a large area of the Guanzhong Plain, both were implemented by the state of Qin, to increase agricultural output (Li, 1956; Chen, 2002; Ye, 2014).

3.5 The First Empire: The Qin Dynasty (221-206 BC)

With advances in political and military organization, the Qin were able to conquer the six other rival states (Li, 2007e; Yang, 2015). The first Emperor, Qin Shi Huang (260-210 BC), successful unified China in 221 BC, and created an Imperial state, which lasted for over 2000 years (Twitchett and Loewe, 2007; Jin, 2012). During his reign, the territory greatly expanded to include: the Gansu and Qinghai Plateaus to the west, modern-day Guangdong and Guangxi Provinces to the south, beyond the Yellow River and the Liaodong Peninsula to the north, and all the way to the ocean in the east (Figure 3.9) (Sino Maps Press, 2014d; Feng, 2015).

The first Emperor introduced a series of reforms to consolidate his central power. He completely abolished feudalism, and deprived the power of many old and prominent families and moved them to the capital, Xianyang (near present-day Xi’an), in order to prevent the revival of feudalism (Lv, 2005; Chang, 2007). The Empire was divided into administrative units: 36 commanderies or prefectures (jun) which were subdivided into a variable number of counties (xian), then further divided into districts (xiang), and finally into hundred-family units (li). Administration duties were entrusted to officials that were nominated by the Emperor (Yang, 2003; Lewis, 2007). The Emperor eliminated all of the Hundred Schools and embraced Legalism, or a system that required people to follow laws or be punished as the ideology of the Empire (Jian, 2001; Bai, 2010b). Some of the Qin laws we know today came from the Shuihudi Qin Bamboo texts (睡虎地秦简, sometimes called Yunmeng Qin Jian), which are early Chinese texts written on bamboo slips that were discovered in 1975 in a tomb belonging to a Qin administrator at Shuihudi, Hubei Province. It contained important information about the law, government organization, military affairs and also many aspects of people's private lives during the late Warring States to Qin Dynasty periods (Shuihudi Qin Bamboo Slips Group, 2001). Further, the Emperor standardization the system of weights and measures and established a
uniform system for writing and currency. These changes had the effect of promoting significant political and economic unity through the Empire (Ban, 2007; China National Museum, 2009c).

Figure 3.9. Map of the territory controlled by the Qin Dynasty around 200 BC (from https://commons.wikimedia.org/wiki/File:Territories_of_Dynasties_in_China.gif#/media/File:Territories_of_Dynasties_in_China.gif).

A number of public work projects were undertaken by the Qin (Cotterell, 1981; Teng, 2002; Zhao, 2002). An impressive road system tying together different regions, with a total length of 6800 km, was built for both military and economic activities. In addition, the Ling Canal was constructed for irrigation as well as commerce, and this connection between the north and south aided the political expansion into the southwest of China (Chen, 2002; Ye, 2014). One of the most spectacular structures, the Great Wall, was completed as the demarcation line between China and the various nomadic groups by connecting the numerous walls that had been built by the former states (Li, 1975; Yang, 2014). Millions of laborers were employed on these large scale construction projects mentioned above, as well as in the building of the Imperial Palace and the Emperor’s enormous mausoleum (Sima, 1961; Gao and Xu, 2013). Although the tomb
itself has not yet been excavated, various sites surrounding the tomb have been uncovered. The most famous of these discoveries is the Terracotta Army or Warriors. Over 6000 life-sized and intricately detailed statues equipped with weapons, horses and chariots, which were supposed to protect the Emperor in the afterlife, have been discovered (Figure 3.10) (Yuan, 1986; 2002; Duan, 2011).

As a result of palace intrigue and a large scale peasant rebellion, the Qin Dynasty quickly collapsed with the death of the first Emperor, Qin Shi Huang in 210 BC (Sima, 1961; Yang, 2015). Although the Qin Dynasty only survived for a short time, it had a profound effect on the administrative, economic and social structure of the Chinese Empire for thousands of years. The successors to the Qin were the Han Dynasty (202 BC to 220 AD) (Han and Zhao, 2010; Liu and Bai, 2010), but as this and the subsequent Dynasties are not the focus of the three published papers presented in chapters 4-6, they will not be discussed in this thesis.
3.6 Dietary Trends in Ancient China

3.6.1 Agriculture division between north and south China

Chinese civilization was based on intensive farming (Scarre, 2007; 2013), but geographic boundaries between north and south China have given rise to different agriculture practices as far back to 5th millennium BC (Wang and Xu, 2003; Liu and Xiang, 2005). The outstanding geographic feature of north China is the Yellow River, which generally flows eastward from the Qinghai-Tibetan Plateau and together with its tributary, the Wei River crosses through the
Central Plains to empty into Bohai Bay (Figure 3.11) (Zhao, 1995; Wang and Li, 2009; Lv, 2012).

Figure 3.11. Map showing the division between North and South China, as well as, different geographical features.

As mentioned above, the middle and lower Yellow River Valleys were the origins of the ancient Chinese civilization, and these areas were the most prosperous regions during the Neolithic to the early Imperial period (SACH, 2009; Wang, 2013b). Geographically, this region consisted of uplands in the west, large fertile plains in the center and a combination of highland and riverine basins in the east. It is a region suitable for growing millet, sorghum, wheat and beans (Chen, 2002; Zhou, 2007). In modern China, northern people have a diet that is centered on wheat-based foods including various types of noodles, dumplings and breads (Huang, 2014). However, millet was the predominant staple food in northern China for thousands of years since the emergence of agriculture (Zhang, 1998; Yan, 2000), and this has been confirmed by numerous archaeological findings (Zhao, 2005; China National Museum, 2009d). For example, at the Cishan site (Hebei Province), dating to 5300 BC, millet remains were found in over a hundred different storage pits with a capacity of 50 tons, evidence that a mature form of millet
agriculture was practiced in north China at this time (Figure 3.12) (Sun et al., 1981; Tong, 1984; Qiao and Liu, 2006).

Figure 3.12. A) Neolithic grinding stone and B) millet storage pits from the Cishan, Hebei Province (photos from the Cishan Cultural Sites Museum, Wu’an, China).

In contrast, different agricultural practices prevailed in the south of China which is separated from the north by the Qinling Mountains and the Huai River, and the main watershed in this region is Yangzi River (Wang and Li, 2009; Lv, 2012). Compared to northern China, the climate is warm and humid, and this proved ideal for intensive rice cultivation (An, 1989; Chen, 2005; Lu, 2006). The earliest domesticated rice remains in this region were found at the Shangshan
site (9000 to 11000 BP) in Zhejiang Province (AIZP and Pujiang Museum, 2007). In modern times, rice is still the preferred crop of the people of southern China. Thus, there has existed a north-south divide in terms of diet in China that goes as far back to the Neolithic period.

3.6.2 Reviewing subsistence patterns from the Neolithic to Qin Dynasty

Although the timing and reasons for the transition from hunting and gathering have not been fully elucidated, archaeological evidence from north China (charred millet grains and farming tools) indicates that millet cultivation was practiced at early Neolithic sites such as: Xinglongwa (ca. 8100-7200 BP) in the northeast, Peiligang (ca. 7500-6900 BP) in the central Yellow River Valleys and Laoguantai (ca. 6000-5000 BP) and Dadiwan (7500-6800 BP) in the northwest (Underhill, 1997; Li, 2003; You, 2008). For example, at the Baijia site of the Laoguantai culture (7500-6500 BP) in the Wei River Valley of Shaanxi Province, human diet included millet and probably aquatic foods such as fish and shellfish (IA CASS, 1994). In contrast, at the Jiahu site (ca. 9000-7800 BP) in the southern part of the Yellow River Valleys, rice was found to be an important staple crop (Chen et al., 1995; Zhao and Zhang, 2009). Additional studies have found that dogs and pigs were the focus of animal husbandry practices with pigs likely to have been domesticated by 8000 BP (Lu, 1999; Yuan, 2015). However, due to the fact that numerous remains of butchered wild animals were found at the above mentioned sites, most archaeologists believe that early agriculture was an occasional or temporary activity with hunting and fishing being the dominant subsistence practices during the Middle Neolithic (Yan, 1992; Wang, 2004a).

During the Late Neolithic, millet based agricultural practices became more efficient and important to the people of northern China (Zhang, 2004; You, 2008). At many Yangshao cultural sites, large storage pits filled with millet were discovered, indicating that millet was a significant component of the diet. The Yangshao people mainly grew foxtail millet, but also broomcorn millet, sorghum, rice and possibly hemp and canola (An, 1989; Gong, 2002). Dogs and pigs were commonly kept and fed a substantial quantity of millet (Yuan and Flad, 2002). In addition, domesticated chickens were present at a number of sites during this period (Peters et al., 2015; Xiang et al., 2014; Yuan, 2015). However, while many individuals of the Yangshao culture ate large quantities of millet with only small amounts of animal protein, other Yangshao period sites such as Jiangzhai, in Shaanxi Province, still relied on hunting and gathering for sustenance (Luo, 2009).
Archaeological excavations found that millet continued as the primary grain during the terminal Neolithic or Chalcolithic. Foxtail millet was grown more widely in north China, whereas, broomcorn millet seems to have been more abundant in the drier regions, such as the central area of modern-day Henan Province (Lee et al., 2007, You, 2008). Rice and wheat (introduced from the West) have also been found at some Longshan sites in the Provinces of Shandong and southern Henan (Betts et al., 2014; Crawford et al., 2006; Zhao, 2007; Liu and Fang, 2010). For example, at Liangchengzhen, the largest Longshan site so far discovered in Shandong, the researchers found that millet was the primarily crop for animal fodder, whereas, rice increased in importance for human diets (Crawford et al., 2005; Lanehart et al., 2011). Pigs were the most common source of meat for humans, but domestic cattle, sheep and goats were (introduced from the West) also present during this period at sites along the Yellow River Valleys (Cai et al., 2014; Zhang et al., 2013).

During the Shang Dynasty, oracle bone inscriptions and historical texts such as Shi Jing (诗经) recorded that foxtail millet was the staple crop for the Shang people (Wang, 1985; Chen, 2007; Wang, 2015b). Recent archaeobotanical evidence shows that wheat was the second most represented crop next to foxtail millet during the Shang period (Zhao, 2009). Although, rice remains have been found at Anyang, they constituted a negligible proportion of the dietary grains. Thus, most scholars believe that rice was a trade good rather than grown locally at the Yinxu site (Tao, 2006; Song, 2011; Wang, 2011a). The variety of animals offered for sacrifice indicated that extensive forms of animal husbandry were practiced. In addition, the raw materials found at the bone workshops of Yinxu came from a variety of different animals including: cattle, sheep, deer, pig, dog and horse. Some of these animals may have been captured by hunting, but it is believed that the majority were bred and domesticated by the Shang people (Song, 1999). In addition, inscriptions on oracle bones mentioned that some officers had names of “Many Dogs” (duo quan, 多犬) or “Many Horses” (duo ma, 多马) indicating that animal management was part of the duties of some government officials (Liu, 1994; Guo, 2015).

During the Zhou Dynasty, historical sources frequently mention that there were five farmed crops that were important during this period. The Five Grains (Wugu, 五谷) traditionally date back to the work, The Classic of Herbal Medicine (Shennong Bencaojing, 神农本草经), which
is reputed to be a record of an oral tradition compiled between about 200 and 250 AD (Gu, 2007). Although the identity of the five crops has varied over time, in most pre-Qin works, such as Liji (礼记) and Zhouli (周礼), the crops mentioned are: foxtail millet (稷), wheat (麦), soybean (豆), broomcorn millet (秈) and hemp (麻). However, in some versions hemp is replaced with rice (稻) (Dai, 2014; Duke of Zhou, 2014). In Qinmin Yaoshu (齐民要术), the famous Chinese book that described agricultural knowledge before the 6th century AD in northern China, it lists: millet, sorghum and beans as the most important in terms of human diet during the pre-Qin period (Jia, 2009). Animal husbandry was significantly developed during the Zhou period. Written records mentioned six kinds of animals such as pig, dog, cattle, sheep/goat, horse and chicken as being very important domestic breeds during the pre-Qin period. They were widely used for food sources, sacrificial or ritual killing and as sources of labor and for military purposes. Further, goose and duck were raised for supplementary food sources (Zuo, 2011; Duke of Zhou, 2014).

Historical and archaeological evidence indicates that millet continues to be a staple food in the main territory of the Qin state, the Loess Plateau including Gansu and Shaanxi Provinces, before the unification of the Empire in 221 BC (Fan, 1986; Zhang and Fan, 2007). In particular, the Shuihudi Qin Bamboo texts, described that the Qin state stored a large amount of millet in the capital’s granary (Shuihudi Qin Bamboo Slips Group, 2001). In Shiji (The Records of the Grand Historian, 史记, which is regarded as a monumental history of ancient China finished around 94 BC by the Han Dynasty official Sima Qian), Sima mentioned that the Qin people viewed soybeans as a crop for the poor, and thus they avoided eating these. Not until the Han Dynasty, under the encouragement of the government, did the cultivation of wheat became popular in this region (Sima, 1961; Wang, 2004b). In addition, Shiji and Hanshu (Book of Former Han, which was completed in 111 AD by Ban Gu) also recorded that it was common to eat dog meat during the Qin and Han Dynasties, since many people made their living by the butchering dogs (Sima, 1961; Ban, 2007). Fish and soft-shelled turtle were also the popular additional foodstuffs for daily life as well as wild animals such as: pheasant, quail, hare and deer (Yao, 2011).
3.7 Social Stratification in Prehistoric China

It is generally agreed that during the Early Neolithic period that societies were egalitarian and no social hierarchies have been observed (Ren and Wu, 2010). During the Late Neolithic period, the Yangshao culture rapidly increased in population and site size, but many of these sites show little evidence of social differences (Zhang and Wei, 2004). For example, at the Banpo site, the main houses and tombs were both of similar size and shape, suggesting that there were no major social distinctions in the individuals of this community (Lee, 1993). However, some sites do show evidence of emerging social hierarchy. For example, at Xipo in western Henan Province, some families or groups of individuals were buried with valuable objects (cinnabar, jade, etc.), and the large number of pig bones recovered suggests that they were able to hold large feasts (Ma, 2003; Liu, 2004). During the Longshan period, societies became more socially stratified (Liu and Chen, 2012; Pei, 2014). For example, at the Taosi site in southern Shanxi Province the large number of burials, more than a thousand, can be grouped into three classes on the basis of grave goods. The larger sized tombs, approximately 3 meters long and 2-2.7 meters wide contained 100 to 200 grave goods including: painted pottery with dragon designs, alligator drums, jade artifacts, giant chime stones and whole pigs. In contrast, some tombs were narrow pits with very few or no grave goods. It is notable that the majority of the high status burials were males, and it is speculated that this status could have been conferred through heroic acts related to warfare (Yan and He, 2005; Han, 2011). However, such burial differences are mainly present in the areas of Shandong and southern Shanxi Provinces, and this suggests that social stratification varied among regions during the Late Neolithic period (Zhu, 2014).

From the Shang Dynasty onwards, China became a highly bureaucratic and meticulously ordered society. The large distinctions of status and wealth among the living were increasingly applied to the dead (Song, 1994). Elites were usually buried in an underground chamber and were provided with numerous grave goods and human sacrifices. For example, the tomb of Lady Fu Hao, who was the wife of King Wu Ding of the Shang as well as an army general, is one of the most famous in China at the site of Yinxu near modern-day Anyang. Her tomb, a 5 meter long and 3.5 meter wide chamber contained a lacquered wooden coffin and 468 bronzes, 755 jades, and over 6880 cowry shells (Figure 3.13) (IA CASS, 1989). In addition to the royal tombs at Yinxu, burials can be identified into different categories which reflect the remarkable stratification of political and social life during the Shang Dynasty. Examples include: 1. Large
tombs with ramps; 2. Burials of individuals who followed their tomb owner to their death; some were buried in the chamber of the tomb owners while other were buried in the vicinity of the tomb; 3. Medium size pits; 4. Shallow pits; and 5. Burials in refuse pits and disused wells (Gong and Xu, 2011). Scholars have determined that a hierarchy existed among the sacrificed victims with three groups identified. The first group are individuals that are buried in waist pits (yaokeng, 腰坑; below the burial chamber) or in the four corners of the burial chamber.

Figure 3.13. The tomb of Lady Fuhao at the Yinxu site in Henan Province (photo from the Yinxu Museum, Anyang, China).

These individuals are buried with a bronze or jade dagger-axe and were supposed to guard the body of the deceased. The second class of individuals are those that are buried in their own coffins with grave goods, even with their own sacrificed victims or attendant dog, and are believed to be high status relatives, retainers or personal attendants of the deceased. The third type of individuals, were usually young males, between 15 to 35 years old, but some children have also been found. They appear to represent slaves or captured warriors in battle, and they were decapitated or dismembered, and their heads were frequently buried in the pits with their bodies in the ramps (Figure 3.14) (IA CASS, 2007; Tang, 2009).

In general, the large-scale human sacrifices of the Shang Dynasty declined during the Zhou
Period and were banned after the Qin Dynasty (Zhang, 2001). In place of human sacrifices, individuals from later periods were buried with “spirit objects” (明器). These included daily utensils, musical instruments, weapons, armor and intimate objects as well as figurines that acted as symbolic representations of soldiers, servants, musicians, houses and animals, rather than the real individuals or objects (Wu, 2016). The individual use of “spirit objects”, in particular the combination and total number of bronze ritual vessels Ding (鼎) and Gui (簋), was strictly according to the social rank during the Zhou period (Yu and Gao, 1978; Duke of Zhou, 2014).

![Figure 3.14. A) Decapitated bodies buried on the ramp of a royal tomb at Yinxu. B) Human skulls buried in the pit of a royal tomb at Yinxu. C) Burial of a sacrificed warrior at a royal tomb at Yinxu (photos from the Yinxu Museum, Anyang, China).](image)

For example, only a Zhou King could be buried with nine Ding and eight Gui (九鼎八簋) since this combination was a symbol of authority (Qin, 2013). However, this practice gradually disappeared during the Warring States period and was no longer used during the Qin Dynasty, as Imperial authority was represented by the Imperial Seal of China used by the Emperor (Yang,
In addition, historical texts also discuss other material differences between the nobility and the common people (Wang, 2007b; Yang, 2010). For example, bronze vessels and jade were reserved for nobles, and ordinary people were not allowed to use these in their daily life or as grave goods (Li, 2007e). The book, *Guoyu* (Discourses of the States, written by Zuo Qiuming who lived from 502 to 422 BC), describes how dietary habits were influenced by social status. A king could eat everything, the rulers of small states could eat cattle, senior officials could eat sheep, middle officials could eat pig, lower officials could eat fish and the common people could mainly eat only vegetables (Zuo, 2015). Further, during the Han Dynasty the book *Liji*, discusses how the number of dishes served at a meal was determined by an individual’s status and age during the pre-Qin period, with higher status and older individuals having more dishes and greater dietary options (Dai, 2013). Mencius (372–289 BC) also mentioned that the elders of the common people were given elevated status and were allowed to wear silk and eat meat (Mencius, 2012).

### 3.8 Stable Isotope Ratio Analysis in Chinese Archaeological Research

In 1984, Cai and Qiu were the first to introduce the stable isotope ratio analysis method into Chinese archaeological studies. They reported δ¹³C results of human and animal collagen from several famous Chinese Neolithic sites, such as Yangshao and Taosi (Cai and Qiu, 1984). Their study traced millet domestication in northern China to as early as 7000 BP and also found that there was a difference in subsistence patterns between north and south China since at least the Neolithic. North China had diets that were mainly based on millet (C₄ plant), whereas, southern China had diets based on rice (C₃ plant). However, after this pioneering study, there was little isotopic research on Chinese material for 20 years. Zhang et al. (2003) published δ¹³C and δ¹⁵N results from a number of important Chinese archaeological sites such as: Yinxu, Liulihe, Xinglongwa and Hemudu and explored differences in dietary patterns between north and south China as well as between farming and hunter-gather groups. In the last decade, there has been an explosion in the number of the stable isotope studies applied to Chinese human and animal archaeological materials and these will be briefly reviewed below.

#### 3.8.1 Agricultural practices in China

During the Neolithic, millet and rice were the two most dominant eatable crops in northern and
southern China, respectively. It was not until the late Neolithic/early Bronze Age that wheat (a western crop) started to be consumed (Lu, 1999). Hu et al. (2006) investigated human and animal diets from the early Neolithic (9000 to 7800 BP) site of Jiahu in Henan Province. They found that the inhabitants of Jiahu mainly relied on hunting and gathering during the early periods of settlement, shifted to gathering and fishing during the middle period, and it was not until the late phase of occupation that rice and domestic animals made an increased contribution to the human diet. In another study, Hu et al. (2008) examined individuals from the early Neolithic site of Xiaojinshan in the lower Yellow River Valley, which is attributed to the Houli Culture and dates to about 8000 BP. Here the isotopic results indicate that humans were eating moderate amounts of millet, with other sources of protein coming from C3 plant and animals. In addition, Hu et al. (2008) compared their results with previous published studies (Zhang et al., 2003; Pechenkina et al., 2005) of isotopic results from later sites of the Yangshao Culture (7000-5000 BP), and concluded that millet became a staple food for humans by approximately 7000 BP in northern China. Barton et al. (2009) published an important isotopic paper about the Dadiwan site located in Gansu Province. During phase 1 (ca. 7900 to 7200 BP), millet only made a fairly small contribution to human diets, but during phase 2 of the occupation of Dadiwan (ca. 6500 to 4900 BP), both broomcorn and foxtail millets made a significant contribution to the diets of humans and animals, notably dogs and pigs. In addition, there has been a growing body of stable isotope studies that have been published on human and animals remains from China (Pechenkina et al., 2005; Cui et al., 2006; Hu et al., 2007; Ling et al., 2010; Atahan et al., 2011a; Atahan et al., 2011b; Lanehart et al., 2011; Liu et al., 2012; Wang et al., 2012; Dodson et al., 2013; Alison et al. 2014; Barton and An, 2014; Liu et al., 2014; Chen et al., 2015; Zhang et al., 2015a; Zhou and Garvie-Lok, 2015). These works have helped contributed to our understanding of the timing and location of millet, rice and wheat agriculture in China.

3.8.2 Animal husbandry strategies

Isotopic analysis has also been used to learn more about the timing and means of animal domestication in China. Guan et al. (2007) conducted an isotopic investigation of pig bones from the Eastern Zhou (771-256 BC) to Wei and Jin Dynasties (220-420 AD) at the Wanfabozi site in Jilin Province and found that both wild and domesticated pigs ate mainly C3 plants. However, the domestic pigs had much higher δ15N values than the wild pigs, indicating a high consumption of animal protein, likely from human leftovers or waste. They concluded that
these unique dietary differences could be used as a means to identify domestic vs. wild pigs. Hu et al. (2009) successfully distinguished domestic pigs from wild boars at two Houli Culture sites (ca. 8500-7500 BP) in Shandong Province by using δ¹³C and δ¹⁵N results. Animal husbandry studies from Neolithic and early Bronze Age sites in the Wei River Valley found different dietary patterns for the domestic animals (Chen et al., 2012; Chen et al., 2016). The majority of the pigs showed a heavy reliance on millet, suggesting they were possibly raised by an intensive foddering strategy, but some pigs consumed less millet, indicating that they were likely cared for by herding and foraging. The domestic sheep appear to have been allowed to graze on the nearby grassland since their isotopic signatures are similar to the wild ovicaprids. In contrast, cattle have more ¹³C-enriched results indicating an increased reliance on C₄ plants in their diet, and these elevated δ¹³C values can be used as a means to identify cattle husbandry in northern China.

3.8.3 Subsistence differences

Another widely used application of isotopic analysis in China is the detection of subsistence patterns and differences between time periods and cultural groups. In particular, past work has focused on how social interactions and communications caused nomadic tribes and hunter/gathers to adopt sedentary agricultural practices. Dong et al. (2007) analyzed δ¹³C and δ¹⁵N results from humans of the Lamadong site (265-420 AD), Liaoning Province, which is attributed to the pastoral Murong Xianbei Culture. The isotopic results showed that the people mainly relied on millet and were vegetarians. The authors concluded that this group of the Xianbei population was strongly influenced by the Han Culture and quickly changed from a nomadic to a settled agriculture lifestyle. However, later studies focused on the subsistence strategies of the Tuoba Xianbei (another group of the Xianbei population) found that this branch took much longer to transition from a pastoral to a farming economy (Zhang et al., 2010; Zhang et al., 2015b). Pei et al. (2008) studied the paleodiet of individuals from the Neihengyuan site, Shanxi Province. This site belongs to the Han Culture, and while the archaeological evidence indicates that the population was engaged in agriculture, the isotopic results revealed that the people mainly relied on stockbreeding, which could have been the result of influences from the nomadic Rongdi minority population in the region. Further, isotopic analysis of individuals from the Qinglongquan site, Hubei Province, spanning the Neolithic to Eastern Zhou period, found that there was a dietary shift to more millet consumption from the early
phase (3000 to 2600 BC) to the later phase of occupation (2600 to 2200 BC) (Guo et al., 2011; Zhang et al., 2012). These differences have the ability to investigate human interactions and migrations between regions of millet agriculture and rice agriculture in this special Rice-Millet Blended Zone region of central China (Guo et al., 2011).