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CHAPTER 1 Aims and Objectives of this Thesis

1.1 Introduction

Over 30 years have passed since stable isotope ratio analysis was first used to investigate paleodiet in China (Cai and Qiu, 1984). Since this pioneering study, there has been uneven but significant progress in the application of isotopic techniques to investigate Chinese archaeological material. However, there are many time periods, regions and topics which have yet to be examined in detail with stable isotopes in China.

Most of the previously published isotopic research focused on the Neolithic period (e.g. Zhang et al., 2003; Pechenkina et al., 2005; Hu et al., 2008; Barton et al. 2009; Lanehart et al., 2011), and later periods such as the early Bronze/Iron Ages that pre-date the formation of the Chinese Empire during the Qin Dynasty (221-206 BC), have been neglected. This is unfortunate as these pre-Empire periods are highly important to understand the formation processes of the first “Chinese” states and society. In addition, despite historical texts and archaeological evidence for social stratification in ancient Chinese society, only a handful of small scale isotopic studies have attempted to examine this topic in the past (Ling et al., 2010; Zhang et al, 2012; Zhang et al, 2014; Wang et al., 2014). Further, isotopic studies that investigate animal husbandry patterns and human mobility are uncommon in China. Thus, there exist significant gaps in our understanding and knowledge of the human lifeways and social patterns in pre-Qin Dynasty archaeological sites in China. Here my thesis will address this lack of information about these periods and topics by using three large and important site studies, where questions related to: stable isotope ratio analysis and dietary patterns, social stratification, animal husbandry practices and human mobility can be investigated.

1.2 Study Sites and Research Questions Investigated in this Thesis

In this dissertation three different archaeological locations from the Yellow River Valleys of north China are isotopically investigated (Figure 1.1). Each of these sites represents a different period of Chinese archaeology, spanning the late Longshan (ca. 2000 BC), or the terminal Neolithic/Early Bronze Age, to the Qin Dynasty (221-206 BC). These sites were selected from
a practical standpoint (access was granted for sampling, which can be difficult to obtain in China) as well as to provide more information about the dietary practices and social stratification of these understudied populations and time periods.

1.2.1 The Nancheng site

The earliest site is that of Nancheng (Figure 1.1), located in Hebei Province, and attributed to the Proto-Shang Culture (2000-1600 BC) of the Shang people before they founded the Shang Dynasty (1600-1046 BC). While many archaeological sites dating to the Proto-Shang culture have been excavated over the last decades in Henan and southern Hebei Province, knowledge about the lifeways, diet and social stratification during this period remains limited. The archaeological evidence and historical sources suggest that this group practiced a varied subsistence strategy based upon hunting, animal husbandry and agriculture (Zhang, 2002; Chen, 2007; Zhu, 2007; Hou et al. 2009; 2013). However, little direct research has explored the diet and social complexity of the Proto-Shang people, and only a single isotopic study has been previously published on a Proto-Shang archaeological site (Hou et al. 2013). This earlier work at the site of Liuzhuang found that the human diet was based on millets, pigs, cattle and dogs, and no differences related to age, sex or burial type (pit, stone coffin, and wooden coffin) were found. However, this research was limited in scope as only a small number of individuals were analyzed (n=21).

In chapter 4 of my thesis, I analyze the stable isotope ratios of carbon ($\delta^{13}$C), nitrogen ($\delta^{15}$N) and sulfur ($\delta^{34}$S) of bone collagen from humans ($n=83$) at the Nancheng site and animals from the nearby (~3 km) and contemporaneous site of Baicun (Table 1.1). The findings of this work were published in the American Journal of Physical Anthropology, and the full citation is listed below:


The main goals of this research are as follows:
1. Reconstruct the subsistence patterns and animal husbandry practices of this site to determine if the type of animal protein consumed was mainly centered on certain species of domestic animals such as pigs and cattle (as found by Hou et al. 2013), as opposed to other domestic animals (sheep/goats) and wild animals.

2. Investigate if there are unique dietary patterns that are linked to sex, age, and burial direction/position in the population.

3. Examine if dietary differences are linked to perceived social status, as inferred from the type of grave goods interred with the deceased. The goal of this type of analysis is to provide information about possible social hierarchy in a pre-state level society in China that was transitioning from an egalitarian to a hierarchical society.

1.2.2 The Xishan site

The second site investigated in this thesis is Xishan, which is located in eastern Gansu Province (Figure 1.1), and dates to the Late Western Zhou to Warring States Periods (ca. 700-400 BC). It is a typical Qin culture site, the ancestors of those that established the Qin Dynasty, and was believed to have had a well-developed and rigid social structure (Sun, 2009). As the Qin can be viewed as the founders of Imperial China, a large volume of research has been devoted to their early history, culture and formation as a society (Duan, 1982; Ma, 1982; Xu, 2003). Past research has yielded conflicting results in terms of the subsistence strategies (nomadic pastoral vs. agriculture) of the early Qin, and this is an area of active debate (Zhang, 2001; Wang, 2007). Only a single small scale study that combined isotopic results and dental health patterns has been previously published for the Xishan site (Wei, 2008; Wei et al., 2009), but as no animal results were analyzed to act as a baseline to the human isotopic values, this study was limited in its ability to determine the type of animal protein consumed at the site. Thus, the dietary practices of the early Qin have yet to be fully investigated and resolved.

In chapter 5 of my thesis, I analyzed bone collagen $\delta^{13}C$ and $\delta^{15}N$ results from humans (n=33) and animals (n=58) excavated at the Xishan site (Table 1.1). The findings of this work were published in the International Journal of Osteoarchaeology, and the full citation is listed below:

The central research questions of this work include:

1. Determine the human subsistence and animal husbandry practices at the Xishan site to see if they were engaged in nomadic pastoral activities, agriculture or a mixture of both practices.

2. Investigate if diets were different as a result of the well-defined social status (based on the number and quality of grave goods) during this period.

3. Examine if there were differences between tomb owners and sacrificial victims to again investigate differences related to social status.

4. Determine if there were dietary differences related to sex (males vs. females) which can also be related to social status since the early Qin were a male dominated society.

1.2.3 The Qin Shi Huang Mausoleum

The last site that is investigated is from the world famous Qin Shi Huang Mausoleum (Terra Cotta Warriors), located near the modern city of Xi’an in Shaanxi Province (Figure 1.1). Here two separate and contemporary archaeological sites associated with the Qin Shi Huang Mausoleum complex were investigated. The first is the public cemetery of Liyi, which was a city built specifically as a supply base for the construction of the Qin Shi Huang Mausoleum. The second is the Shanren site, which is a mass grave containing the bodies of workers and/or slaves that died during the construction of the Qin Shi Huang Mausoleum (SPIA and EQTWHM, 2007). It is believed that over 700,000 individuals from all over China were used to build the mausoleum complex during the 39 years of its construction (Sima, 1961; Li, 1975; Yuan, 1986). However, the identities and origins of these workers and/or conscripts have not been fully elucidated. In recent years, this has become an important focus of archaeological investigation with scholars in China studying grave goods, inscriptions and mtDNA to gain a better understanding of these individuals (Zhang, 2001; Xu, 2008).
In chapter 6 of my thesis, I analyzed bone collagen $\delta^{13}C$ and $\delta^{15}N$ results from humans (n=223) and animals (n=9) from the Liyi site. In addition, I analyzed bone collagen $\delta^{13}C$ and $\delta^{15}N$ results from humans (n=19) at the Shanren site (Table 1.1). The findings of this work were published in *Scientific Reports*, and the full citation is listed below:

Ma Y., Fuller B.T., Sun W., Hu S., Chen L., Hu Y., Richards M.P. Tracing the locality of prisoners and workers at the Mausoleum of Qin Shi Huang: First Emperor of China (259-210 BC) *Scientific Reports* 6, 26731 (DOI: 10.1038/srep26731)

The main research questions addressed here are:

1. Determine the dietary habits of the workers/craftsmen from the public cemetery of Liyi and the prisoners from the mass grave at Shanren that constructed the Qin Shi Huang Mausoleum for the first Emperor of China. Do dietary differences exist between these two populations and are these related to status or geography?

2. Review and examine the previously published isotopic studies of north (millet eating) and south (rice eating) China, and use these results to better understand the diets and possible geographic origins of these individuals found at Liyi and Shanren.

Table 1.1. Summary information about human and faunal bone samples used in this thesis.

<table>
<thead>
<tr>
<th>Site</th>
<th>Region</th>
<th>Culture</th>
<th>Period</th>
<th>Society</th>
<th>Humans</th>
<th>Fauna</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nancheng</td>
<td>Southern Hebei Province</td>
<td>Pro-Shang</td>
<td>Late Longshan period</td>
<td>Primary hierarchy</td>
<td>83</td>
<td>36 (6 species)</td>
</tr>
<tr>
<td>Xishan</td>
<td>Eastern Gansu Province</td>
<td>Proto-Qin</td>
<td>Late Western Zhou to Warring States</td>
<td>Highly hierarchy (with human sacrifice)</td>
<td>33</td>
<td>58 (8 species)</td>
</tr>
<tr>
<td>Liyi</td>
<td>Central Shaanxi Province</td>
<td>Qin</td>
<td>Late Warring States to Qin Dynasty</td>
<td>Highly hierarchy</td>
<td>223</td>
<td>9 (7 species)</td>
</tr>
<tr>
<td>Shanren</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>19</td>
<td></td>
</tr>
</tbody>
</table>
Figure 1.1. Map showing the 34 Provinces of China and the location of the three archaeological sites that are the focus of these thesis.

1.3 Structure of this Thesis

The structure of this thesis is as follows:

Chapter 1 – Introduction
Chapter 2 – Paleodiet Reconstruction and Stable Isotope Ratio Analysis
Chapter 3 – Introduction to the Cultural Prehistory and History of China
Chapter 4 – The Nancheng Site: published in the *American Journal of Physical Anthropology*
Chapter 5 – The Xishan Site: published in the *International Journal of Osteoarchaeology*
Chapter 6 – The Qin Shi Huang Mausoleum: published in *Scientific Reports*
Chapter 7 – Conclusions and Future Work
In chapter 2, I briefly summarize paleodietary studies, as well as, review stable isotope ratio analysis as this is the main investigative technique that is used in this thesis. Chapter 3 presents and overview of the cultural prehistory and history of China as this is a topic that may not be as familiar to western archeologists. Chapters 4-6 present the results of my thesis research as described above, and finally, in chapter 7, I summarize the key findings of my work and outline areas of future research.