Past Human Migrations in East Asia

Matching archaeology, linguistics and genetics

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Routledge Studies in the Early History of Asia

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Routledge
Taylor & Francis Group
LONDON AND NEW YORK

First published 2008
by Routledge
2 Park Square, Milton Park, Abingdon, Oxon OX14 4RN

Simultaneously published in the USA and Canada
by Routledge
270 Madison Ave, New York, NY 10016

Routledge is an imprint of the Taylor & Francis Group, an informa business

Typeset in Times New Roman by
HWA Text and Data Management, London
Printed and bound in Great Britain by
MPG Books Ltd, Bodmin

British Library Cataloguing in Publication Data
A catalogue record for this book is available from the British Library

Library of Congress Cataloging-in-Publication Data
A catalog record for this book has been requested

ISBN13: 978–0–415–39923–4 (hbk)
ISBN13: 978–0–203–92678–9 (ebk)

ISBN10: 0–415–39923–8 (hbk)
ISBN10: 0–203–92678–1 (ebk)

3 Livestock in ancient China

An archaeozoological perspective

Jing Yuan, Han Jian-Lin, and Roger Blench

1. Introduction

Archaeologists working on animal domestication must assess the significance of bones excavated from archaeological sites. In ancient China, there are references to the 'harvest of abundant five crops and flourishing with six livestock species'. The 'six species' were horse, cow, sheep/goat, pig, dog and chicken (Shao 2003). This review introduces the methodology used to identify bones of ancient livestock, to estimate the time-depth and origins of the six livestock species and to discuss in detail recent research on the origins of pigs and horses. Epstein (1969) is an overall view of the livestock species and breeds kept in China.

There are two models to explain the origin of livestock in ancient China: one is the domestication of certain indigenous species from the Neolithic times through interacting with, controlling and taming the wild stocks, e.g. the domestic pig. Olsen (1993) believed that China was a centre for early animal domestication. The other is the introduction of an exotic, already domesticated species from another geographic area by exchange with other ancient, outside residents, for example, the horse.

2. Methodology used to identify bones of ancient livestock in China

Four criteria can be applied to determine if bones recovered from an archaeological site were those of domesticated animals. The first is the traditional technique of morphological observations and measurements on the skeleton, in particular the size of the teeth. If the age and sex structure of the remains deviate significantly from those expected in a wild species, indicating human manipulation, then the bones may well be of animals tamed and/or kept by ancient humans.

The second criterion is the abrupt appearance of a species not previously present in the area, usually an indicator of a human introduction.

The third criterion is the associated cultural material at archaeological sites. At Chinese Neolithic sites, full or partial skeletons of two animal species often occur, intentionally entombed together or as funerary accompaniments to human skeletons. Pigs, for example, frequently occur in different geographic locations

throughout Neolithic times. Dogs are confined to eastern China, although they are also found in all Neolithic periods. Other animals are seldom found at such sites and it is believed that these two species were selected due to their particular association with humans. This association was established over time through taming and rearing of the animals, thereby implying that the buried pigs and dogs were domestic.

The fourth strategy is the application of new technologies: diet composition analysis and DNA phylogeny. Domesticated animals were given feed that often included residues of the skins or shells of crops and vegetables, and also the leftovers of human meals. Analyses of stable isotopes of C^{13} and N^{15}, and trace elements in animal bones point to the diet composition and thus the relevant feed sources. Further comparison with human bones excavated at the same site can provide indicators as to the domestic status of animal remains. Similarly, the study of mitochondrial DNA retrieved from animal bones may allow us to establish the relationship between animal bones at different sites within varying time frames. This will eventually help reconstruct the phylogeny and relationships of domesticated animals, leading to a better understanding of their origin and also of the domestication process.

As far as the origin of domesticated animals is concerned, reliable conclusions can only be drawn if the archaeological context is taken into account *before* the observation and measurement of the bones. This is because the body conformation of animals does not change at the initial phase of domestication; in particular, tooth morphology is very conservative. They are the most stable part of an animal skeleton and take a long time to adapt to a new feeding regime. The teeth of primitive forms of domesticated animals can more closely resemble their direct wild ancestors than their later descendants.

In the initial phase of domestication, numbers of domesticated animals are too limited to demonstrate a typical sex and age structure. Hence the special association of humans with pigs and dogs at certain archaeological sites is used to argue for their domesticated status. In addition, the analysis and comparison of diet in the bodies of human and animal species using stable isotopes and trace elements will show whether they shared the same or similar foodstuffs. DNA analysis over a broad geographical area and on a large sample size is of great importance in elucidating the phylogenetic relationship of animals. With the development and greater use of modern approaches, archaeological research will attain more precise scientific results.

3. Estimated time and location of origins of the six livestock species in ancient China

The oldest known remains of silica bodies of rice, pottery, and stone and animal bone tools used for rice cultivation occur at the archaeological sites of Xianrendong and Diaotonghuan in Wannian county (N 28°41′, E 117°05′; 14,000–11,000 BP), Jiangxi Province (Yan 1997). Remains of pottery and tools made of animal bones and stones were also found at Zengpiyan site (N 25°12′, E 110°16′; 12,000–7000 BP)

in Guilin, Guangxi Province (Institute of Archaeology 2003). All these are evidence for crop cultivation and pottery-making as early as 12,000 BP (although see Fuller *et al.*, Chapter 2, this volume, for queries as to the domestic status of early rice findings). All of the bone tools were from wild animals as this period is far prior to domestication (Yuan 2001).

Dog was probably the earliest domesticated animal to appear in China. Dog remains have been found at Nanzhuangtou (N 39°7′12″, E 115°39′19″; 10,500–9700 BP; Li *et al.* 2000) in Xushui county, Hebei Province (Baoding Institute of Cultural Relic Management *et al.* 1992). Yuan *et al.* (unpublished) found that the dentition length of mandible of the dog remains at this site was 79.9 mm, shorter than the 90 mm of modern wolf specimens collected in the Institute of Vertebrate Paleontology and Paleoanthropology of Chinese Academy of Sciences. Presumably the history of dog keeping in China goes further back still, as by this time the teeth had already undergone significant changes.

The second domesticated animal in China was the pig. The remains of pig mandibles are found at Kuahuqiao (N 30°9′34″, E 120°13′53″; 8200–7000 BP in Zhejiang Provincial Institute and Xiaoshan Museum 2004) in Xiaoshan county, Zhejiang Province. The teeth were significantly distorted, indicating domestic pigs (Yuan and Yang 2004). By analogy, these changes in body conformation imply that the domestication of pigs should be dated still further back (also see section on pig domestication).

Skeletons of cattle (Figure 3.1) were discovered in a pit at Shantaisi site (4500–4200 BP) in Zhecheng county (N 34°04′, E 115°18′), Henan Province (Zhang and Zhang 1997). These are the earliest domesticated cattle in the area along the middle to lower reaches of the Yellow River. However, it is not possible to analyse evidence for changes in their body conformation due to a very limited comparative sample.

Sheep and goat remains also appear around 4400 BP along the middle to lower reaches of the Yellow River (Yuan unpublished). There is almost no sheep/goat bone at sites older than 4400 BP, but they abruptly appear in abundance at almost every site after this date. As with cattle, further investigation of changes in body conformation based on the excavated skeletal materials need to be conducted.

The pattern for horses is similar to sheep/goat and cattle (section 4). They are first recorded at the Yinxu site (N 36°8′, E 114°17′; 3300–3050 BP) in Anyang city, Henan Province (Yuan 2004).

The date of chicken domestication in China has remained controversial despite the many measurements that have been made on bones excavated at various sites. However, the results are not easy to sort out. Based on historical records, domestic chickens may be as recent as 3300 BP. Inscriptions on cattle scapulas or tortoise shells of the late Shang Dynasty (3300–3050 BP) excavated at Yingxu refer to chickens used for sacrifice by the kings. Sacrifice was an important activity in the Shang era and the kings used both humans and domestic animals.

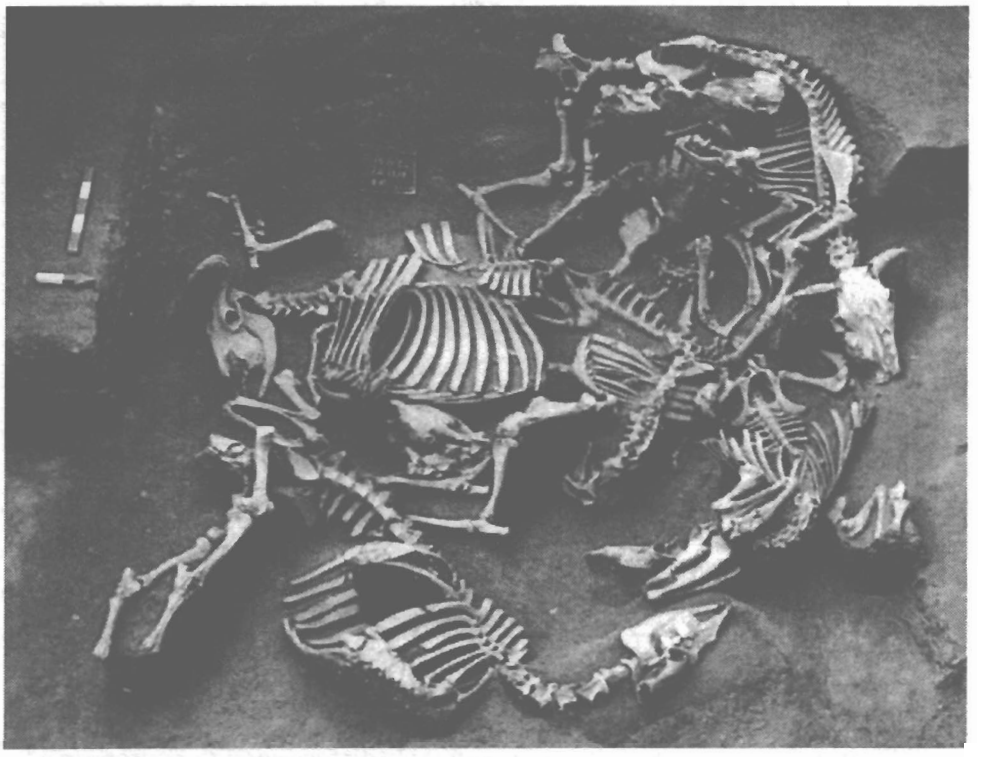

Figure 3.1 Complete skeletons of cows excavated at Shantaisi (Longshan culture), Zhecheng county, Henan Province.

4. Origin of domestic pigs in China

Archaeological excavations in the 1920s provided the evidence for the long history of pig keeping in China. A relatively high proportion of pig bones among the total mammal materials, paintings of pigs on the pottery and/or pottery of pigs were excavated in the third and fourth layers at Hemudu site. Other early and middle Neolithic sites in Guangdong Province also support pig keeping in southern China as early as 6000 BP (Zhang *et al.* 1986; Bo 1994). Table 3.1 presents the main relevant findings. New findings of pigs at archaeological sites in Inner Mongolia, northern China and the Yangtze River delta areas appear to push back the domestication process still further and are discussed in more detail below.

Larson *et al.* (2005) analysed the mtDNA sequences of 686 samples (362 wild and feral boars and 324 domestic pigs) and proposed multiple centres of pig domestication in Eurasia with at least one in south-eastern Asia. A number of subspecies of *Sus scrofa* occur in China (Table 3.2).

There are another three subspecies including *S. s. ussuricus* in far north-eastern China, *S. s. raddeanus* in southern Mongolia and Chinese Inner Mongolia, and *S. s. nigripes* in far north-western China. All indigenous Chinese pigs are classified into six major geographic groups spanning northern China, southern China, central China, south-eastern China, south-western China and Qinghai-Tibetan Plateau.

Table 3.1 Evidence for early pig-rearing in China

Site	*County*	*Province*	*Map reference*	*Date*	*Material*	*Reference*
Yangshao	Mianchi	Henan	N 34°76′ E 111°75′	6800–5000 BP	Bones	Zhang *et al.* 1986; Su 2006
Banpo	Xi'an	Shaanxi	N 34°27′ E 108°95′	5600 ± 105 – 6640 ± 105a BP	Bones	Zhang *et al.* 1986; Li 2004
Hemudu	Yuyang	Zhejiang	N 30°4′ E 121°16′	6780 ± 90 BP	Bones	Zhong 1976; Zheng *et al.* 1994
Luojiajiao	Tongxiang	Zhejiang	N 30°37′ E 120°28′	7040 ± 130 BP; or 7170–6890 BP	Bones	Excavation team for Luojiajiao Site 1981; Tang *et al.* 1999

Table 3.2 Subspecies of *Sus scrofa* in China

Subspecies	*Ancestor of domestic pigs in:*
S. s. chirodontus	southern China including Hainan Island
S. s. taivanus	contributed to the gene pool of small-eared miniature pigs in Taiwan
S. s. moupinensis	northern China
S. s. leucomystax	partially contributed to the gene pool in northeastern China
S. s. salvanius	miniature pigs in southwestern China

Each group has its unique morphological, productive, adaptive and historical background (Zhang 1980; Zhang *et al.* 1986). Archaeology also favours multiple origins for domesticated pigs within China. There is no present evidence for cultural exchanges between the three archaeological sites mentioned above, and pig-keeping activities may therefore have originated and evolved independently.

Dobney *et al.* (2006), using the protocol for recording linear enamel hypoplasia (Dobney and Ervynck 2004), examined 377 pig molars excavated at six archaeological sites[1] in China and compared them with modern Chinese wild boars in museums in Europe and USA. The index of linear enamel hypoplasia of modern Chinese wild boars was low and similar to modern and ancient European wild boars. All six sites demonstrated a high hypoplasia index that supports domesticated individuals.

In particular, Zengpiyan was the earliest archaeological site, where 65 per cent of the pig bones were estimated to come from individuals at 1–2 years old, and were therefore considered as domestic (Guangxi Provincial Working Group and Guilin Committee 1976; Li and Han 1978; Tan 1984; Zhang *et al.* 1986). This was challenged by evidence that the average length of the third cheek tooth was longer than 40 mm and pigs constituted less than 5 per cent of the total mammals at this

site, although the proportion of pigs >2.5 years was more than 40 per cent of all suid remains, and thus they were possibly not domesticated. However, the re-examination of the specimens for linear enamel hypoplasia shows that the index of this site was similar to other younger sites such as Jiahu site (N 33°37′, E 113°39′; Chen 2001) in Wuyang county, Henan Province, Yuchisi site (Zhang, A.B. 2004) in Mengcheng (N 33°17′, E 116°32′), Anhui Province, and Huayuanzhuang site in Anyang (N 36°7′, E 114°22′), Henan Province, but was significantly higher than that of the modern wild boars. No final conclusion can be drawn as to the presence of domesticated pigs at this site based on a single observation and because of its range of dates spanning 5000 years (Dobney *et al.* 2006).

4.1 Xinglongwa site in Chifeng city, Inner Mongolia Autonomous Region

Xinglongwa (N 41°56′ and E 118°42′) is dated to 8200–7000 BP. It is divided into three phases: the first phase is 8200–8000 BP, the second 8000–7400 BP and the third 7400–7000 BP (Inner Mongolian Team 1997). Observation and measurement of the structure and change of the tooth morphology in the pig remains showed that more than 65 per cent of individuals had a third cheek tooth longer than 40 mm and that this proportion increased to 90 per cent in phase III, a character typical of wild boars. Age structure was also similar to wild boars. The proportion of bones ascribed to pigs among the total mammals was 42.9 per cent in phase I, 14.4 per cent in phase II and 22.5 per cent in phase III. In contrast, proportions of cervids were greater than pigs in phases II and III but lower in phase I. Hence most suid remains at this site were probably wild boars (Yuan and Yang unpublished).

However, there were some exceptions. In the phase II tombs, an adult male human was laid out fully extended, with a male pig and a female pig placed one side of the dead person (Figure 3.2). The pigs' legs were twisted together, probably indicating that they were bound prior to burial (Inner Mongolian Team 1997). In addition, in a settlement at Xinglonggou, some 10 km from Xinglongwa and similar to Xinglongwa phase II in date, some 15 animal skulls were recovered, of which 12 were of pigs and 3 red deer (Figure 3.3). In most skulls, there was an artificial hole in the forehead (Figure 3.4) (Inner Mongolian Team 2002). The burial of skulls, predominantly pigs, first occurs in Xinglongwa phase I, but the complete excavation report remains to be published.

For three reasons, the findings at both Xinglongwa and Xinglonggou sites point to domestic pigs in limited numbers:

(1) Suid bones were present with a reduced third cheek tooth approximately 34 mm long at Xinglongwa site (Yuan and Yang unpublished).
(2) The majority of the bones of 17 mammalian species unearthed at the Xinglongwa site were red and roe deer, but only a small proportion were pig bones. However, only pigs were buried together with humans, an indication of a unique connection between pigs and humans.

Figure 3.2 Pigs and human buried together at Xinglongwa.

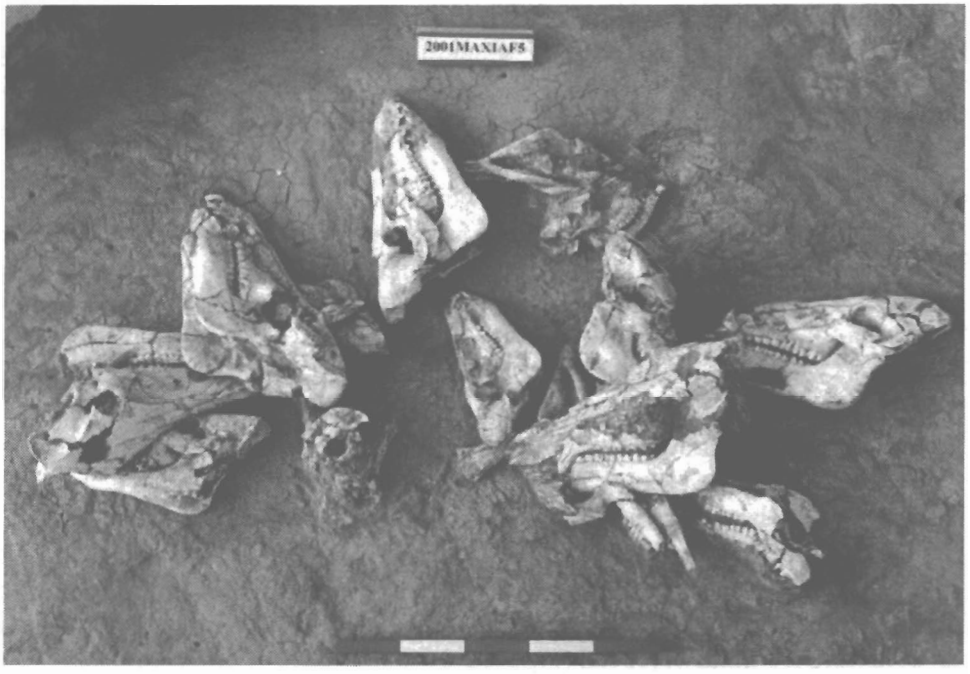

Figure 3.3 Group of animal skulls excavated from a house at Xinglonggou.

(3) Pigs predominate in the animal skulls at Xinglonggou and unpublished data suggest this is also true at Xinglongwa.

The percentage of pig bones among the total of mammals excavated at Xinglongwa phase I was 42.9 per cent, double that of red deer (20.1 per cent). It falls to 14.4 and 22.5 per cent, not significantly different from red deer (16.7 and 20 per cent), in phases II and III (Yuan and Yang unpublished). These figures do not reflect the ratios of pigs to red deer in the groups of animal skulls, where pigs predominate.

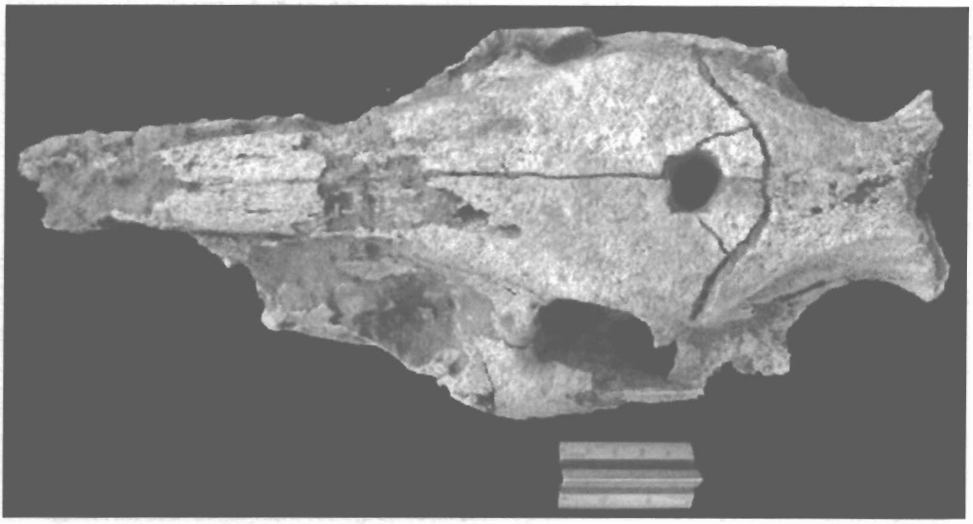

Figure 3.4 Pig skull with an artificial hole in the forehead.

This either implies that domesticated pigs were already kept in the Inner Mongolian area 8200–7000 BP, or that wild boars were favoured for cultural reasons.

There is further circumstantial evidence. Foxtail and broomcorn millets were excavated at Xinglonggou and they are dated to about 8000 BP (Zhao 2004). Observation and measurement of samples of these millets showed that they retained basic ancestral characteristics of their wild relatives. The upper reaches of the Xiliao river where the Xinglonggou site is located may have been a centre of domestication of these two millet species and a nucleus of the arid agriculture in northern China with these two millet species as staple food crops. The proto-domestication of millets may be related to the importance of pigs in this zone.

4.2 Cishan site in Wu'an county, Hebei Province

Cishan (N 36°43′ and E 114°12′) is dated to approximately 8000 BP (Hebei Provincial Institute and Handan Institute 1981). Pig bones were excavated at this site. The average length of the third cheek tooth of the lower jaw is 41.4 mm and the average width 18.3 mm. More than 60 per cent of the pigs discovered at this site were slaughtered between six months and one year old. Among the 186 pits excavated, there were two pigs in the bottom of H5, and one pig each in H12, H14 and H265. A dog was also found in H107. All these animal bones were covered in carbonized millet grains (Hebei Provincial Institute and Handan Institute 1981).

The data on this site were published in 1980 and the animal bones were identified without comment; it is therefore hard to be sure that the pigs were domestic. However, the limited measurements of the third cheek tooth of the lower jaw do seem to match the proposed criteria for domestic pig remains. The age structure of these pigs was different from a sample of those being hunted and presumably a result of human interference. All the complete pig skeletons excavated in the four pits were covered with millet grains, a clear marker of

intentionality. This does strongly suggest the presence of domestic pigs around 8000 BP at this site. Furthermore, the excavation of animal bones at sites younger than Cishan indicates a gradual expansion of domestic pig keeping in this area (Zhou 1981; Yuan and Flad 2002).

4.3 Kuahuqiao site in Xiaoshan city, Zhejiang Province

Kuahuqiao (N 30°9′34″, E 120°13′53″) is dated to 8200–7000 BP (Zhejiang Provincial Institute and Xiaoshan Museum 2004). It is further divided into the first, second and third phases at 8200–7800 BP, 7700–7300 BP and 7300–7000 BP (Zhejiang Provincial Institute and Xiaoshan Museum 2004).

In all phases at this site, the dentition of the pig jaws was significantly twisted (Figure 3.5) and the teeth were disordered due to a shortened lower jaw, evidence for domestication.

In terms of size, there were six measurements of the third cheek tooth in phase I. Three of them were > 42 mm but the other three were < 40 mm. All three measurements of the cheek tooth in phase II were below 40 mm. Among the four measurements of the cheek tooth in phase III, one was 40.96 mm and the rest of three were below 38 mm. The three measurements > 42 mm were probably of wild pigs, but all the other 10 specimens fall within the range of domesticated pigs. The gradual reduction in size of the cheek tooth over time is a characteristic of domestication. From the age structure, pigs aged 2.5 years or above fell from

Figure 3.5 Significantly twisted dentition of pig jaw excavated at Kuahuqiao.

87.5 per cent in phase I to 45 per cent in phase II. The average age was 4.6 years in phase I, 3.5 years in phase II and 2.9 years in phase III. From the ratio of suid bones to all mammals present at this site, the percentages ascribed to pigs were 22.6, 12.2 and 8 per cent in the early, middle and late phases (Yuan and Yang 2004).

Since the pig jaws in the early phase at Kuahuqiao already had disordered dentition and individuals with a third cheek tooth smaller than 40 mm were on the increase, these morphological changes almost certainly reflect a regime of human captivity and feeding. It is therefore likely that domestic pigs are present at Kuahuqiao by 8200 BP. Despite this, the excavation at Kuahuqiao requires further careful interpretation as pigs were only 15 per cent of all mammals (Yuan and Yang 2004). This is the reverse of the process of a gradual increase of the proportion of pigs against other mammals at all other Neolithic sites in northern China (Yuan 1999). This is a pattern very specific to the Neolithic sites of the Yangtze River delta. In an important literary reference of the early Qin Dynasty (221–206 BC) the *Zhou Li – Zhifangshi*, it states that 'In the town called Huiji of Yangzhou in south-western China, birds and mammals were hunted and rice was used as crop' (Anonymous 1979). Until the pre-Qin Dynasty times, rice was planted, but meat was still obtained from hunting birds and wild animals. It may well be that there was a relative limited number of livestock, if any, present in the Yangtze River delta in the pre-Qin Dynasty. If Kuahuqiao has been correctly interpreted, the history of pig keeping in southern China may be older than 8200 years BP. This reduces the gap in dates between China and south-east Anatolia (Hongo and Meadow 1998).

5. Origin of domestic horse in ancient China

The horse used to be considered the first among the six livestock species in ancient China as an administration system for horse management was established over 3000 years ago (Shao 2003). The system played an important role in transport for administration, military purposes and also cultural exchanges (Xie 1986; Xie *et al.* 1986). For the origin of the domestic horse in China, there are three different views:

(1) Olsen (1984) suggested an origin of the domestic horse in China from the mid-Neolithic period.
(2) Zhou (1984), Xie (1986), Wang (1998) and Wang and Song (2001) proposed the presence of the domestic horse from the Longshan culture (4350–3950 BP).
(3) Yuan and An (1997) and Chen (1999) believed that domesticated horses were introduced into the areas along the middle and lower reaches of the Yellow River during the late Shang Dynasty (3300–3050 BP).

Kong (1994) and Gong (2003) have also reviewed the history of introduction of horse chariot and carriage from and/or through western Asia into China.

The major differences on the issue of origin of the domestic horse and its domestication in ancient China is whether the domesticated horse was introduced together with the chariot/carriage from the pastoral area around the Black and Caspian Seas and when this took place; or if there was an indigenous, independent origin of the domesticated horse within China and if so, when and where (Chen 1999). The last view was argued by C.S. Zhang (2004) who claimed that it is hard to imagine horses being used only for draught purposes because almost all of the archaeological evidence from the late Shang Dynasty derives from excavations at sites with horse and chariots/carriages. It is probable that horse riding took place prior to the use of the horse as a draught animal and that this helped establish a special connection between humans and horses. The horse would then have been treated as a special sacrifice after the death of its owner. Thus the domesticated horse was possibly kept in the areas along the Yellow River from the Xia Dynasty onwards (4000–3600 BP). Although rock art representing the herding and riding of horses is found in northern China at dates prior to the Shang Dynasty, the horse may well have been domesticated independently and possibly at a later date in northern Asia. This section will present the discoveries of horse bones in ancient China and their distribution.

5.1. Late Pleistocene

Horse bones occur at 32 late Pleistocene sites in China, of which one site is located each in Helongjiang, Guizhou and Sichuan Provinces and Xinjiang Uigur Autonomous Region, two each in Yunnan Province and Inner Mongolian Autonomous Region, three each in Jilin and Shaanxi Provinces, four in Liaoning Province, and seven each in Shanxi and Gansu Provinces (Han and Xu 1989; Qi 1989).

This pattern of distribution has three characteristics:

(1) Most sites are concentrated in north-eastern, northern and north-western China – 28 out of 32, with only four sites present in south-western China.
(2) All the horse bones excavated in northern China are assigned to the species *Equus caballus przewalskii*. Those bones found in south-western China remain unclassified.
(3) The numbers of bones excavated at each site are very different, as the majority are present at sites in northern China, with the Palaeolithic Siyu site (28,945 ± 1370 BP) (Institute of Archaeology 1977) in Shuozhou city (around N 39°19′, E 112°26′), Shanxi Province being the most abundant. Based on the counting of the third cheek teeth, there were approximately 120 horses at this site (Jia *et al.* 1972). In contrast, the record of horse bones in south-western China is sparse, with only one or two third cheek teeth per site.

5.2. Neolithic China

Although Neolithic sites in China have abundant animal remains, horse bones are scarce. Two pieces of horse teeth and one phalange were found in the culture layer at Banpo Neolithic site (5600 ± 105–6640 ± 105 BP; Li 2004) in Xi'an (N 34°27′, E 108°95′), Shaanxi Province. This site has a deep accumulation of cultural materials, ranging from 6000 to 2000 BP but concentrated within the 6000 to 5000 BP period (Li and Han 1959). Two complete horse skeletons were unearthed from a pit at Nanshacun site (4000 BP) in Hua county (N 34°53′, E 109°77′), Shaanxi Province (Wang 1998). Horse bones were present in the culture layer at Baiying site (4160 BP) in Tangyin county (N 35°92′, E 114°35′), Henan Province (Zhou 1983) and horse phalanges were also discovered at Chengziya site (4000 BP) in Zhangqiu county (N 36°72′, E 117°53′), Shandong Province (Liang 1934).

One horse tooth was discovered in the culture layer at Fujiamen site (5000 BP) in Wushan county (N 34°69′, E 104°88′) along the upper reaches of the Yellow River, Gansu Province (Yuan unpublished). At Dahezhuang site (3700 BP) in Yongjing county (N 35°97′, E 103°34′), Gansu Province, three lower jaws of horses were present (Gansu Team 1974). Qinweijia-Qijia cemetery in the Yongjing county has similar dates to Dahezhuang and a few fragments of horse bones were reported, but with unknown positions and numbers due to breakage (Gansu Team 1975). There is a report of horse bones at Dashanqian site (4000–3500 BP; Institute of Archaeology *et al.* 1998) in Chifeng city (N 41°56' and E 118°42'), Inner Mongolia (Cai *et al.* 2007).

Five specimens of ancient horse bones excavated at Dashanqian and four pieces of horse bones at the nearby Jinggouzhi site (2115 ± 65 BP) (Research Centre Jilin University and Inner Mongolian Regional Institute 2004) were recently characterized using mitochondrial DNA D-loop sequences (Cai *et al.* 2007). Three samples from Dashanqian shared one mutation with the cluster (A2) to which the *Equus caballus przewalskii* sequences belong and other six specimens from both sites were grouped into A, E and F clusters of modern horses according to the phylogenetic network established by Jansen *et al.* (2002). This result does not rule out *Equus caballus przewalskii* as the probable source for the ancient horse bones excavated 4000 BP in northern China.

Queries remain concerning excavations of this period. Because all mammal bones excavated at Banpo were treated as one single excavation unit but not sorted based on the stratigraphy, the horse bones found at this site might be dated to anywhere between 6000 and 2600 BP. No horse bone occurs in cultural layers at other sites of similar date (6000–5000 BP) to Banpo (Yuan and An 1997). Records of the horse bones at both Baiying and Chengziya sites were very plain, in particular at Baiying, with its few broken equid specimens, unknown positions and no clear explanation as to why they were assigned to horses. Again, no horse bone was present at other sites dating to about 4000 BP similar to Baiying and Chengziya along the Yellow River (Yuan and An 1997). There is no detailed excavation report on Nanshacun, but a brief publication indicated

there were horse bones present in the pit. However, without reference to cultural context, its dating remains suspect (Wang and Song 2001). These questionable materials may have to be put to one side at present. Equid bones excavated at sites in the area along the Yellow River were probably *Equus caballus przewalskii*.

Horse bones were also recorded at Fujiamen, Dahezhuang and Qinweijia-Qijia along the upper reaches of the Yellow River but the sparse specimens at Fujiamen and Qinweijia-Qijia and lack of detailed description of the three equid lower jaws recorded at Dahezhuang make further analysis problematic. The specimens were not preserved; further investigation is therefore impossible.

5.3. Shang Dynasty

By the early Shang Dynasty, numerous sites have been excavated. Sites with animal bones are limited and only a few have been sorted out properly. Fortunately, some important Shang Dynasty sites of different periods have been worked on and the situation can be summarized as follows.

Bones of pig, cattle, sheep, deer, dog and fish but no horse were excavated in the sacrificial place at the Shang walled-town site (3600–3400 BP) in Yanshi city (N 34°73′, E 112°77′), Henan Province (Shangcheng Team 2001). Similarly, bones of cattle, dog, pig, deer and crane as well as elephant's cheek tooth and clam shell were present at the sacrifice place at Xiaoshuangqiao site (3435–3410 BP) in Zhengzhou city (N 34°73′, E 112°77′), Henan Province, but again none of horse (Song *et al.* 1995). There were bones of herring, chicken, field mouse, dog, rhinoceros, pig, elk, cattle, buffalo and sheep, and clam shell, but no horse at Huanbei Shang walled-town site (around N 36°7′, E 114°22′; 3370–3220 BP) in Anyang, Henan Province (Yuan and Tang 2000).

A number of pits with carriages and horses, in general, one carriage with two horses (Figure 3.6), were excavated at Yinxu site (N 36°8′, E 114°17′; dated to 3300–3050 BP) in Anyang city, Henan Province (Yuan 2004).

In addition, another 20 pits with horses were discovered between autumn of 1934 and autumn of 1935 in Xibeigang at Yinxu. Each pit had 1–37 horses, with 2 horses per pit being most common. In spring 1978, more than a hundred square pits lined up together were detected using a probe shovel in the south-eastern part of the M1550 large tomb at this site. Forty of them were excavated, with 1–8 horses per pit and 2 horses per pit present in 12 out of the 40 pits (Figure 3.7), 6 horses per pit in 11 of the 40 pits as well as 2 horses and one man per pit in 3 of the 40 pits. These horses were probably used for sacrifices. Apart from these horse pits concentrated in one place, there were also cattle and pig pits scattered around the tombs at this site (Chen 1994).

Laoniupo site (3250–3050 BP) in Xi'an (N 34°27′, E 108°95′), Shaanxi Province, has radiocarbon dates similar to the late Shang Dynasty Yinxu site. There was one pit with a man, horse and dog entombed together, one pit with a horse alone, and one pit with a chariot and two horses (Department of History 1988). Qianzhangda site in Tengzhou (N 35°7′, E 117°8′), Shandong Province, is dated to between the late Shang and early Zhou Dynasties (3300–2900 BP), a bit later than Yinxu and a

number of pits with one chariot and two horses were also found there (Institute of Archaeology 1995). It seems probable that there were no domesticated horses in the early Shang Dynasty, but they have been present in China since the late Shang (3300 BP).

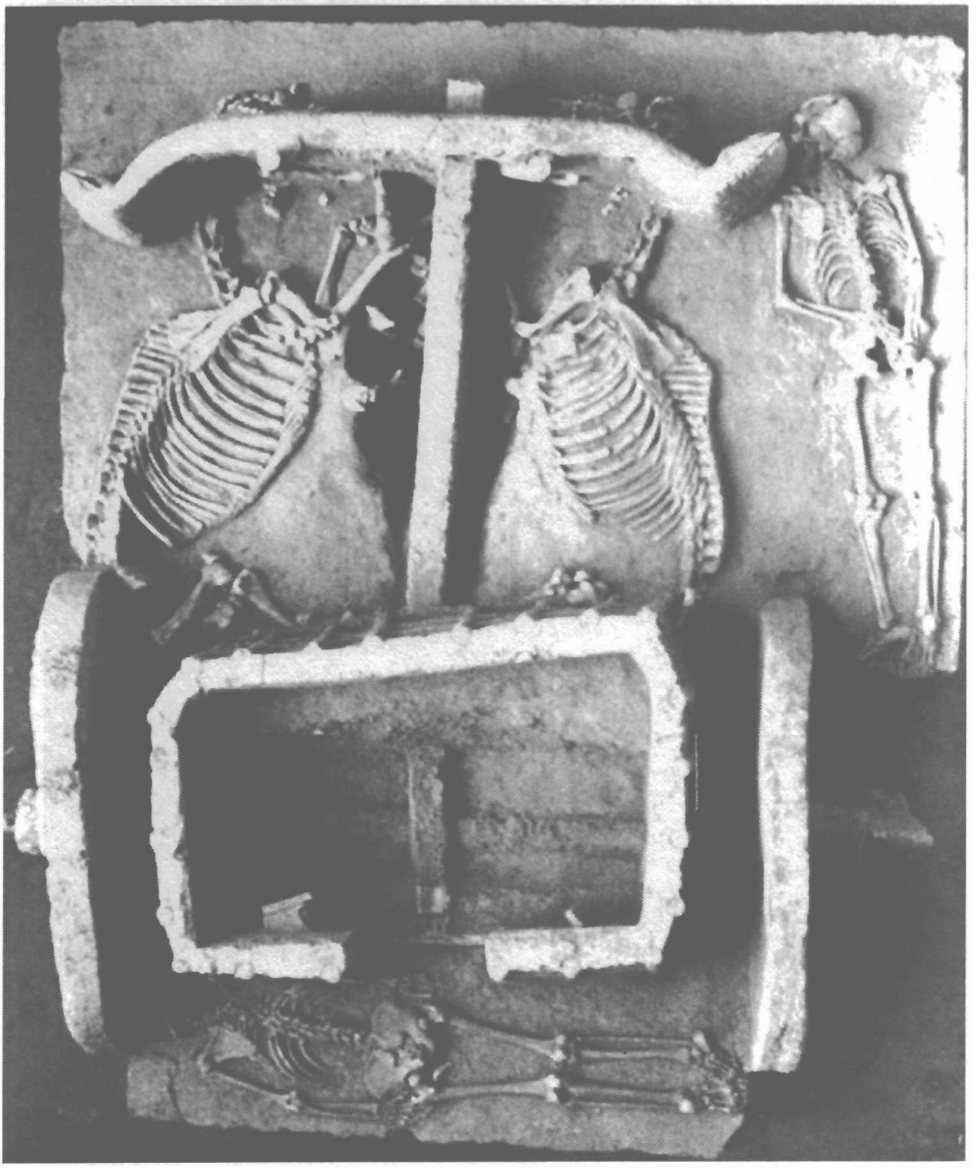

Figure 3.6 A pit with one carriage and two horses at Yinxu, Anyang city, Henan Province.

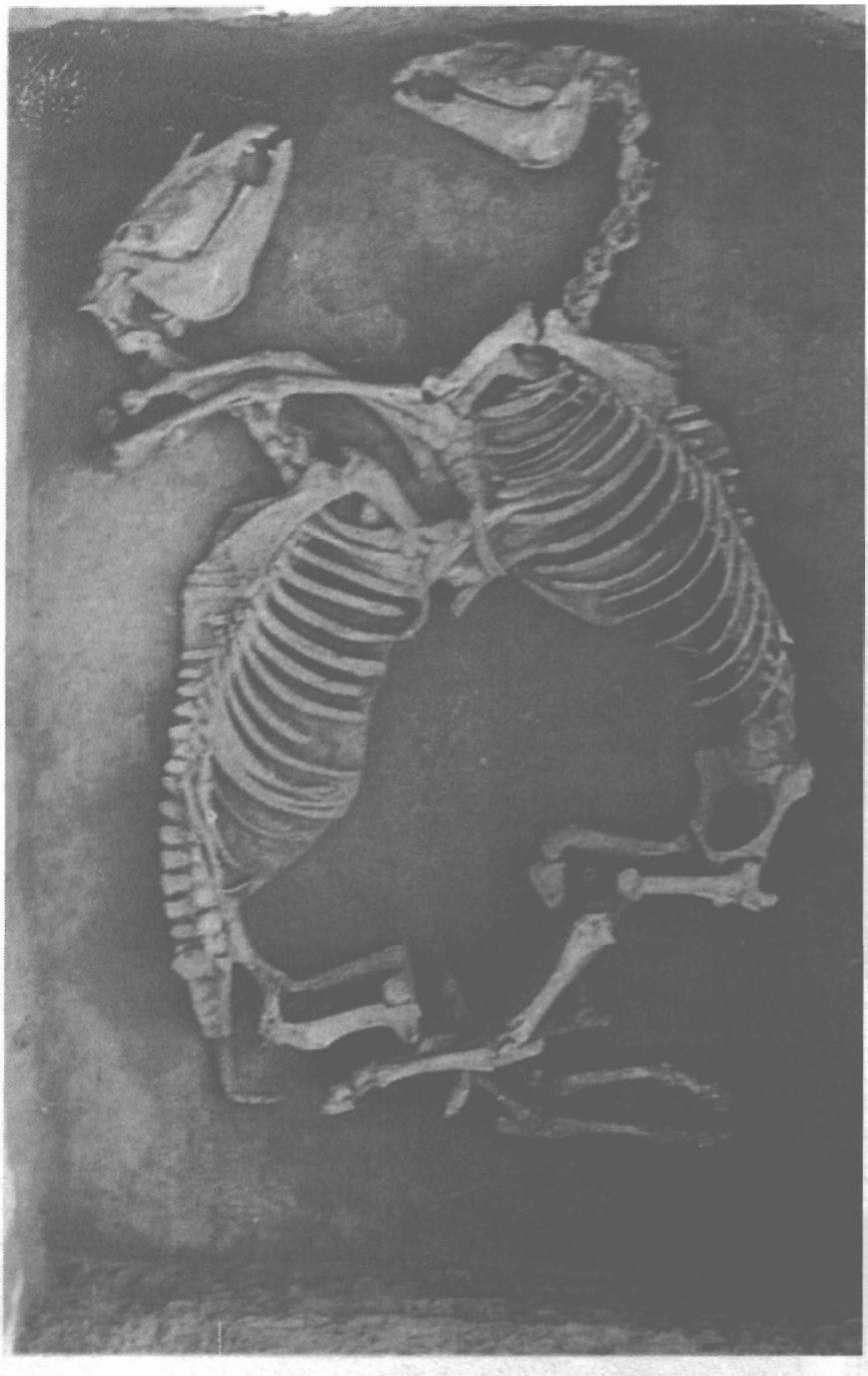

Figure 3.7 A pit with two horses at Yinxu, Anyang city, Henan Province.

5.4. Discussion

Archaeologists have found horses entombed in pits containing chariots with horses or horses alone at Yinxu, a clear indication that domesticated horses were used for sacrifices. However, no horse bone was present at early Shang Dynasty sites and in the sacrificial place, culture layer and pit of Huanbei Shang walled-town business site (late Shang). There could be two explanations for this: limited excavation of Shang Dynasty sites has yet to recover equids; or the horse was not present until late Shang times. The horse was treated as a special animal and they were owned only by the royal families or aristocracy of the Shang Dynasty. Horses were used for chariots or sacrifices when their owners were alive and then entombed with their owners after death. They were not used as a meat animal. This could be a reason why there was no horse at Huanbei Shang walled-town site. Chickens, dogs, pigs, cattle, sheep and goats were treated differently. In the oracle inscriptions on tortoiseshells or cattle scapulae, there were records of these species also used for sacrifices. There were bones of these animals present in both the culture layer and also the ashpits. They were believed to have been thrown out after human meals.

Research on ancient inscriptions gives us another line of evidence that we can use. While some oracle bones record the inscription "The king fed horses in the stables" (Institute of History 1981), no such inscriptions describing the king feeding cattle, sheep, dogs, chickens, or pigs have ever been identified. We believe that this oracle bone inscription concerning the king feeding horses highlights the importance of horses to the Shang Dynasty. Obviously, it is highly unlikely that the king personally raised horses, but the phrase itself probably refers to the symbolic role that the king once played in horse rearing. It is, however, just this sort of symbolic participation by the king in raising the horses that demonstrated its significance. Therefore possession of a horse had a specific social status in this period. The sudden appearance of the horse in the late Shang Dynasty along the middle and lower reaches of the Yellow River was probably associated with arrival of a foreign culture and/or commerce.

6. Conclusions

In summary, we proposed four criteria to analyse excavated animal bones in China and to determine their status as livestock. The probable time and location of presence of dog, pig, cattle, sheep, horse and chicken in ancient China have been reviewed and the origins of domesticated pig and horse discussed in detail. We believe that there are two different patterns of origin of livestock in ancient China: the first is the process of domestication since the Neolithic period by the inhabitants through their direct, long-term interaction with the wild relatives of livestock, e.g. the pig; the second is the late introduction of domesticated animals from another part of the world through exchange and interaction of culture and commerce, e.g. the case of horse introduction into the middle and lower reaches of the Yellow River.

Note

1 These were: 12,000–7000 BP at Zengpiyan site in Guilin, Guangxi Province, 9000–7000 BP at Jiahu site in Wuyang, Henan Province, 4800–4000 BP at Yuichisi site in Mengcheng, Anhui Province, 4000 BP at Dongguan site in Yuanqu, Shanxi Province, 3400 BP at Huayuanzhuang site in Anyang, Henan Province and 2900–2500 BP at Fengxi site in Chang'an, Shaanxi Province.

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