

# The Origins and Development of Animal Domestication in China

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Research on the origins and development of animal domestication is one of the most important topics in Chinese zooarchaeology. In recent years, faunal remains from a large number of sites have been subjected to zooarchaeological analysis and many new results have come from this research (Yuan Jing 2002, 2007). Here we first explain the methods used to identify domesticated animals and then present preliminary positions on the origins of six important domestic animal taxa. In conclusion, we present a model of the origins of domestication in China and discuss the different patterns of meat acquisition in the Yellow River and Yangzi River basins during the Neolithic period.

## Methods for Identifying Domesticated

### Animals

We believe that identifying domesticated animals is a complicated task for zooarchaeologists that should not depend on any single criterion or method to establish the status of animal remains recovered from archaeological contexts. Instead, it is important that one systematically uses multiple criteria and research and from multiple directions approach the question in order to achieve confident results. We rely on the following criteria in our evaluations:

First, one important line of evidence related to the identification of domestic animals is the evaluation of morphological differences. Many mammal taxa became smaller during the process of domestication. Furthermore, the transition also resulted in morphological changes in the teeth of some animals, as well as the development of some bone pathologies. Therefore, it is possible in many cases to identify evidence of domesti-

cation through metric analyses of bone and teeth.

Second, when animal bones of a particular taxon in a faunal assemblage can be shown to be mostly from a single age category, this may be evidence for selective culling practices related to herd maintenance and frequently reflects domestication.

Third, using frequency statistics, when a particular mammal taxon is clearly the most common in an assemblage and does not match the frequency of that taxon relative to others in the wild, this may be evidence for domestication. Furthermore, when the ratio of males to females is out of proportion this may also signify animal rearing.

Fourth, when a new domesticate taxon suddenly appears in a region that has no native population of that animal, we can be certain that this is due to cultural processes which brought an animal that was previously domesticated somewhere else into a new area.

Fifth, research at archaeological sites that identifies enclosures that may have been used to raise animals are a line of evidence that may relate to domestication. Likewise, similar conclusions can be drawn from evidence for the conscious burial of certain animals or parts of animals either by themselves or as burial goods in graves.

Sixth, the fodder provided to certain domesticated animals tends to include the stalks, husks and shells of plants in addition to those parts consumed by humans. Therefore, by conducting isotopic analysis of  $C^{13}$  and  $N^{15}$  signatures in both animal and human bones from a certain archaeological context and comparing them, we can assess the level of domestication by scientific means.

Seventh, there is a considerable amount of recent re-

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search that examines the genetic diversity of modern domesticated animals. This is a useful corpus of evidence for understanding early domestication patterns (Yuan Jing 2007).

Without question, when determining whether animal bones recovered from archaeological sites represent domesticates or not, the above methods are all very important and are all related to one another. Among them, the most basic zooarchaeological techniques are those that emphasize the metric and morphological characteristics of excavated animal bones. However, when examining the origin of domestication for each animal taxon, the analysis becomes more persuasive when one first considers the archaeological context from which bones are excavated and only then evaluates the significance of metric and morphological aspects of the animal bones. This is because it can be very difficult to establish definitive changes in the shape and size of animal bones during the process of domestication that clearly denote a transformation. When wild animals first start to be raised or otherwise controlled by humans the bones of the animal will not suddenly change to a new form but instead will gradually change over time. This is particularly true of elements like teeth, which tend to change very slowly relative to other bones and therefore require a long period of time to undergo consistent morphological change. Consequently, in terms of metric characteristics, these animals will appear more similar to wild individuals than they would to domesticated animals. Therefore, techniques that focus on metric and morphological attributes are effective and appropriate for identifying domesticates in situations where the domestication process has already taken place over a period of time. However, they are not effective at identifying differences among animals when the process of domestication has just begun. For this reason, when we are evaluating the presence of domestication, we must use a series of criteria. The more we can use, the more objective our interpretations will be.

### **The Origin of Various Domesticated Animals**

According to present evidence, the Neolithic period in China began more than 12,000 years ago. Representative sites from the beginning of this era include Yuchanyan in Daoxian County, Hu'nan, Xianrendong and Diaotonghuan in Wannian County, Jiangxi, and others (Huang Wanbo et al. 1963; Yuan Jiarong 2000). Now we can confidently date crop cultivation and pottery production back to more than 12,000 years ago. We must

note, however, that all of the animal bones from these sites exhibit wild animal characteristics and from none is there any evidence that can prove animal husbandry. The earliest evidence for domesticated animal use dates to about 10,000 BP. In the following section we discuss several taxa in the order of domestication according to current evidence.

#### **1. Dog**

So far we can be sure that domesticated dogs were present 10,000 years ago, at Nanzhuangtou in Xushui County, Hebei. The evidence for this is primarily the presence of a mandible 79.4mm in length, which is shorter than the mandible of a wolf. A study of wolf specimens kept in the collection of the Institute of Vertebrate Paleontology and Paleoanthropology determined that wolf mandibles are around 90mm long on average. The specimens are all clearly larger than the Nanzhuangtou mandible and therefore we believe that the Nanzhuangtou specimen comes from a domesticated dog (Yuan Jing et al. Forthcoming). At the site of Jiahu in Wuyang, Henan, which dates to ca. 9000 BP, excavators discovered 11 dogs that had been buried in residences and burials (Zhang Juzhong 1999). These finds demonstrate a specific symbolic association attributed to dogs at the time. Clearly people at Jiahu had an intimate relationship with dogs and this is verified by the size of the dog mandibles, which are even shorter than those from Nanzhuangtou. We can see that over the course of time the dentition of dogs shortened and at the same time we realize that the Nanzhuangtou dog mandible was already in the process of changing. It was clearly different from the mandibles of wolves, and we can therefore surmise that the domestication of dogs began at least as early as the Nanzhuangtou period, and possibly even earlier.

#### **2. Pig**

To date, the earliest evidence of domesticated pigs comes from the 9000 year old remains at Jiahu in Wuyang, Henan. This identification is based on several lines of evidence (Luo and Chang 2008). First, three mandibles from Phases I–III at the site have convoluted dentition. Also, the molars in these mandibles have an overrepresentation of underdeveloped enamel lines. Third, 4/5 of the pigs at the site are under 2 years in age. Furthermore, pigs make up about 1/3 of the mammals used for meat at the site. Additionally, people had already begun to place pig mandibles in graves as offerings at Jiahu.

Furthermore the pigs from Jiahu which date to about

8000 years BP are similar in terms of measurements to those found elsewhere in the north, such as at the site of Cishan in Wu'an, Hebei, dated to 8200 years BP whereas they differ considerably from the measurements of pigs from the southern site of Kuahuqiao in Xiaoshan, Zhejiang. This demonstrates the differences that may exist between the characteristics of domesticates in different regions. This is one reason why some Chinese zooarchaeologists have suggested that the domestication of pigs in China might have had multiple centers (Luo and Chang 2008; Guo 1999). After subjecting pre-8000 years BP domesticated pig remains from multiple sites to analysis, I have suggested elsewhere that the domestication of pigs in China may have had multiple origins (Yuan Jing 2006).

### 3. Sheep and Goats

According to present data it appears that the earliest domesticated sheep in China appear around 3600–3000 BC in the area of Gansu and Qinghai. These data include caprid mandibles discovered in the M5 burial at the Majiayao culture, Shilingxia type site of Shizhaocun in Tianshui and the sheep skeleton found in a burial at of the Majiayao-culture, Majiayao-type site of Hetaozhuang in Minhe, Qinghai. For various reasons, these sheep bones were not subjected to other analyses at the time of their excavation and we can now only use the nature of the archaeological context in which they were buried to infer whether the sheep were domesticated. Because all other caprid bones from the same time period that have been carefully examined have been identified as sheep bones, we believe that the taxa represented at Shizhaocun and Hetaozhuang were sheep as well. It remains possible that they were goats, however (Yuan et al. 2007).

The introduction of domesticated sheep into the Central Plains probably took place between 2500 and 2000 BC. The evidence for this includes the following. First, there appears to be a dramatic transition in the number of sites with sheep bones at about 2500 BC. At sites that predate 2500 BC there are basically no sites that have sheep bones whereas sites that post-date 2500 BC it is very common to find sheep bones in sites. Secondly, at the Longshan sites of Baiying in Tangyin, Henan and Dongxiafeng in Xiaxian, Shanxi excavators discovered sheep skeletons with trussed up legs in a burial indicating intentional treatment of these animals. The intentional burial of sheep occurred as early as 5000 years ago in the Gansu region and starting at around 4000 years BP is discovered in Henan and Shanxi. In the subse-

quent Three Dynasties period it became a very common practice. Third, there was a clear increase in sheep bones at sites starting at around 2500 BC showing that around that time sheep became an increasingly important animal taxon. Fourth, sheep bones from many sites dating to 2500 years BP and later have undergone metric analysis, and the results fairly consistently show that they are nearly the same size as the bones from the Shang / Zhou period, which are certainly from domesticated sheep. There seems to be a clear trend from West to East reflected in the earlier domesticated sheep remains in the Gansu and Qinghai area and the later sheep remains in the Central Plains (Yuan et al. 2007). Relative to sheep, our research on goats is underdeveloped. At the moment we can only say that the appearance of goat remains in the Central Plains may date to around 3800 year BP (Yang Jie 2006).

### 4. Cattle

Because sites from every period in the last 10,000 years have been found to include cattle bones and many zooarchaeological research reports do not concretely explain the context of cattle bones it is very difficult to use published reports to examine the beginnings of cattle domestication (Lü Peng 2007). Based on our own primary data we believe that domesticated cattle are present at least as early as 2500–2000 BC in the Upper, Middle, and Lower reaches of the Yellow River valley. We base this opinion on several lines of evidence. First, nine relatively complete cattle were deposited in a burial at the Longshan culture site of Shantaisi in Zhecheng, Henan dating to between 2500 and 2100 BC. Similarly, individual cattle were buried at the Longshan-culture site of Pingliangtai in Huaiyang, Henan. At the Qijia-culture site of Dahezhuang in Yongjing, Gansu a decapitated cow skeleton was found on the edge of a stone enclosure with a calf skeleton in its stomach area. These examples of intentional burial of cattle suggest to us that by that time domesticated cattle were already present. The practice of burying cattle emerged during the Longshan period more than 4000 years ago. Subsequently, during the Three Dynasties period the burial of cattle became quite common. A second line of evidence that dates to the 2500–2000 BC period is the consistently numerous cattle bones at archaeological sites. From that point onward cattle comprise a notable fraction of mammal bones at sites and there is a recognizable increase in cattle bones over time. This also demonstrates that cattle were already relatively common at this time. Third, we have conducted metric analyses

of cattle bones from several sites dating to the 2500–2000 BC period and discovered relatively consistent results which show that they are very similar to the bones of cattle from later, Shang / Zhou sites, which certainly belonged to domesticated animals. These lines of evidence and our own analyses all give us direct evidence related to the origins of domesticated cattle. It seems that the situation is similar to that with pigs and that there is little evidence for a single, small area to which origins can be traced.

#### 5. Horses

According to present data, the discovery of three horse mandibles in a burial from the site of Dahezhuang and the horse bones from burials at the site of Qinweijia in Yongjing, Gansu dating to ca. 3700 years BP are the earliest data related to horse domestication (Zhongguo 1974, 1975). Because these data were recovered in the 1970s, specific information concerning their morphology and metric attributes were not provided. Nevertheless, these data remain an important thread of evidence for the beginnings of domesticated horse use. More careful work needs to be done on the zooarchaeological evidence from this region from approximately the same time period.

During the period between 1370 and 1050 BC, many late Shang period horse chariots have been discovered at the site of Yinxu in Anyang, Henan, most with one or two horses. Furthermore, in the northwest section of Yinxu more than 100 horse pits have been excavated or located through coring. Pits include between 1 and 37 horses, with most containing 2 horses. These horses were most likely associated with sacrificial practices. This pattern is similar to the horse chariots and horse pits found at the late Shang site of Laoniupo in Xi'an Shaanxi and the terminal Shang and early Zhou site of Qianzhangda in Tengzhou, Shandong. These data are incontrovertible evidence of the presence of domesticated horses in the lower Yellow River valley dating to ca. 1370 BC. Since there are essentially no horse bones that predate 1370 BC and suddenly, around this date, there are large numbers of horses in pits and horse chariot pits we believe that they were introduced around this time (Yuan and Flad 2006).

#### 6. Chicken

The timing of chicken domestication is still poorly understood. The reason for this situation, despite the discovery of chicken bones at a large number of archaeological sites, concerns the difficulty of distinguishing domesticates in the data. According to data collected so

far we can only state that by 141 BC domesticated chickens were already present. This evidence comes from the Yangling tombs in Xianyang, Shaanxi where large numbers of terracotta models of domesticated animals such as pigs, cattle, sheep, goats, dogs, and roosters and chickens were discovered buried in a pit adjacent to the tomb of Jingdi of Han. Since Emperor Jingdi died in 141 BC, we can date these pits to this year and be sure that domesticated chickens were common by that time (Yuan Jing 2007).

Based on the above information it seems that the domestication of animals occurred thousands of years after the first cultivation of plants and the beginnings of pottery production. Animal domestication began around 10,000 years ago with dog, and continued with pig domestication around 9000 years ago, caprids 5000 years ago, cattle by 4000 years ago, horses before 3000 years ago and chickens at least 2000 years ago. Each of these taxa was domesticated at a different time and in a different region, but all seem to have been first domesticated in North China.

We believe that the origins of animal domestication in China involved two different models. One model involves the exploitation of certain indigenous taxa which, as necessity required a greater degree of control, encouraged their domestication. This was probably the case with dogs and pigs. A second model involved cultural exchange and the adoption from other regions of domesticated animals. Sheep and horses seem to be examples of this process.

### **The Difference in Meat Acquisition Strategies in the Yellow River and Yangzi River Valleys in China**

The study of economic form remains a weakness in historical research. The idealized version of ancient economy has been termed “The abundance of five grains and the flourishing of six domesticates.” This suggests that the acquisition of meat from domesticated animals is an important aspect of the idealized economic system. In the process of research we have discovered that the meat resources exploited by prehistoric individuals in the Yellow River and Yangzi River valleys were different. Here we provide a general overview of these differences.

In the Yellow River valley, 10,000 years ago all meat acquisition was based on hunting and collecting activities, but starting around 8000 years BP in the Middle Yellow River valley, two new meat resource

acquisition practices emerged. One involved the supplementing of hunted wild fauna with the raising of some domesticates. A second emphasized animal domesticates with hunting as a supplementary activity. In the latter case domesticates comprise about 60% of the mammals in faunal assemblages. By about 6000 years BP the raising of pigs increasingly was the most important meat acquisition strategy and pigs sometimes comprise over 80% of mammals.

In the Lower Yellow River valley starting before 7000 years BP most meat acquisition remained focused on fishing and hunting while domesticated animals were secondary. Starting around 6000 years BP domesticated animals became increasingly important sources of meat, and this remained the case throughout the remainder of the prehistoric period. We must emphasize, however, that in the Lower Yellow River valley, the domesticated animals never exceeded about 50–60% of the animals exploited and never reached the dominance that is seen in the Middle Yellow River region (Yuan Jing 1999).

We believe that from about 6000 years ago, the situation with regards to meat acquisition as it pertains to domesticated pigs in the Upper, Middle, and Lower reaches of the Yellow River valley were more or less identical. However, as time progressed, meat acquisition in the Middle and Upper reaches of the Yellow River became increasingly focused on domesticates whereas Lower Yellow River valley communities were relatively less focused on them.

At about 10,000 years BP in the Yangzi River valley, all meat was acquired through hunting, fishing, and the gathering of shellfish. By 7000 years ago domesticated pigs were exploited, but from that point until the beginning of the historical era about 4000 years ago every site in the region includes large numbers of fish bones in the faunal assemblages. This shows that fishing was an important and characteristic meat acquisition strategy in this region. Here we can relate an important phenomenon which illustrates this importance. Excavations at the site of Daxi, which dates to the period between 5500–5100 BC unearthed 69 burials and in several of them fish were interred as sacrificial offerings. An example is the M153, a tomb of a female which included a large fish skeleton nearly 50cm long, nearly as long as the arm of the deceased (Sichuan 1981). This phenomenon of using fish as burial goods is clearly indicative of the importance of fish in the society and is something that is almost never found in other regions of China. In addition to the fish bones collected from zooarchaeological

assemblages at sites in the Middle and Upper Yangzi River region, wild animals are also relatively frequent and among these, deer are the most common. From this information we can see that hunting activities remained important and that the principal targets of hunting were deer (Yuan Jing 2005). We can therefore assert that the rearing of domesticated animals took a secondary position to hunting in the process of acquiring meat resources in this region.

At some prehistoric sites in the Lower Yangzi River region many fish bones have also been found which demonstrate that fishing also played a significant role in the meat acquisition strategies of this region. Although domesticated pigs appear in the region as early as 8200 years ago, between this time and 5000 years BP few pig bones are found at archaeological sites in this area while wild animal bones, dominated by deer, comprise the majority. However, at Liangzhu-culture sites dated to the period between 5000–4000 years BP, pig bones suddenly become a dominant component (Yuan Jing 2005). This reveals that during this period pig raising was a significant meat acquisition practice. Nevertheless, a Maqiao-culture sites which follow the Liangzhu period in date return to the pattern of emphasizing hunting and fishing activities. If we treat the Liangzhu-culture as a special case, the Lower Yangzi River region during the prehistoric period follows the pattern of meat acquisition that focuses on hunting and fishing.

We believe that two patterns in the Upper, Middle and Lower reaches of the Yangzi River valley, namely that meat resource acquisition consistently relied on hunting and fishing and that pig rearing was not very important, are very similar. However, there are differences such as the tendency in the Upper and Middle Yangzi regions for the capture of large fish, which were typically not exploited in the Lower Yangzi region. Also, another difference is seen in occasional sudden surges in the importance of domesticated pigs to populations in the Lower Yangzi River region.

We have compared the differences between the acquisition of meat resources in the Yellow and Yangzi River valleys. This comparison shows that domesticated animals were exploited for a very long time by populations in the Yellow River valley, while fishing and hunting remained important strategies for much longer in the Yangzi River region.

The differences between meat acquisition strategies in these two areas lasted at least into the Qin Dynasty period. The pre-Qin document *Zhouli*, in the



“Zhifangshi” section, divides the world into nine sections which are said to have the following differences in their products: “The southeast is called ‘Yangzhou’... For meat there are birds and beasts, for grain there is rice. The south is called Jingzhou ...For meat there are birds and beasts, for grain there is rice. To the south of the River is ‘Yuzhou’... For meat there are six kinds of domestic animals, and for grains there are five kinds of crops. The east is called ‘Qingzhou’... For meat there are chickens and dogs, and for grains there are rice and wheat. East of the River is called ‘Yanzhou’... For meat there are six kinds of domestic animals and for grains there are four kinds of crops. The west is called ‘Yongzhou’... For meat there are cattle and horses and for grains there are foxtail millets and broomcorn millets. The northeast is called ‘Youzhou’... For meat there are four kinds of domestic animals and for grains there are three kinds of crops. The river center is called ‘Jizhou’... For meat there are cattle and sheep and for grains there are foxtail millets and broomcorn millets. The north is called ‘Bingzhou’... For meat there are five kinds of domestic animals, and for grains there are five kinds of crops” (Shisanjing Zhushu 1979).

The six kinds of domestic animals listed in the *Zhouli* passage include horse, cattle, sheep, pig, dog, and domestic fowl, while the five kinds of crops include millet, broom-corn millet, beans, wheat and rice. From this we see a record related to the agricultural activities in the various regions of Qin. However, when considering the nature of meat resources, in the Yellow River valley we see that all of the regions rely on domesticates – in some cases as many as six, and at least two in all cases. Only in the Yangzi River districts of Yangzhou and Jingzhou do we see a dependence on wild animals and birds. This data from historical records certainly relates to some degree to the differences that we observe in zooarchaeological materials from different regions.

The nature of meat acquisition strategies reflects an important aspect of economic structure. Beginning in prehistory, agricultural activities, including the rearing of livestock, took on different characters in the Yellow River and Yangzi River valleys. The independence of the economic development in these two relatively close river valleys owes a great deal to these differences in meat acquisition activities. This situation may be unique in world prehistory.

## Conclusion

In our construction of a series of standards with which

to evaluate the domestication status of animals, we consider both the methods that are commonly used in international zooarchaeological circles and also consider the special circumstances of the Chinese context. For example, we consider the practices of burying animals, frequently in mortuary contexts and sometimes individually, to be an important criterion. This is clearly a China-specific indication of domestication. In the process of research we have noticed that although the six principal domesticates of ancient China have origin points in different places and different times, nevertheless they all seem to have been first domesticated in the north. Throughout the Neolithic in the Yellow River valley the domestication of animals was related to the need to acquire meat whereas in the Yangzi River valley, over a long period of time, fishing and hunting remained dominant. We believe that the difference between the complex and simple meat acquisition strategies in the Yellow River valley and Yangzi River valley respectively, is connected to the fact that the dynastic states associated with the Xia, Shang, and Zhou of the Three Dynasties all had their origins in the Yellow River valley.

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