

# THE ZOOGEOGRAPHICAL DIVISIONS OF QUATERNARY MAMMALIAN FAUNAS IN CHINA

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## I. INTRODUCTION

In China the study of mammalian fossils, including human fossils, has a long and interesting history. About 2,000 years ago in Han dynasty Chinese people had begun to collect mammalian fossils, which generally were called "Dragon Bone" and used as medicament. The eminent physician Tao Hung-ching of Liang Dynasty (452—536 A. D.) had described the geographical condition in which they could be found. The eleventh century scientist Shen Kuo explained how animal bones became fossilized. Li Shih-chen (1518—1593), the great Chinese pharmacologist of Ming dynasty, gave a detailed analysis of their nature and function in his "Pen Tsao Kang Mu" (*Compendium of Materia Medica*). But the Chinese investigators of that feudal time were limited by contemporary conditions and beliefs. They got sidetracked into discussions on the nature of the mythical "dragon", the symbol of imperial authority, which had never existed in life. Therefore, they could not classify these fossils according to the zoological orders.

The true nature of the "Dragon bone" became known only in 1870 when R. Owen published his article of mammalian fossils which were purchased from Chinese drug-store. This was followed by both the French and German scientists, A. Gaudry and E. Koken, who also made a study of animal fossils collected from Chinese medicine, "dragon bone".

The first discovery of hominid fossil among the "dragon bones" was made in 1903 by Marx Schlosser who investigated a collection of mammalian fossils from the Chinese medical shop.

Interested by the discovery of human fossils, palaeontologists of different nationalities such as R. C. Andrews and W. Granger of U. S. A., E. Licent and P. Teilhard de Chardin of France, J. G. Andersson and O. Zdansky of Sweden, and H. Matsumoto and S. Tokunaga of Japan gathered into China, made studies in the field and collected vertebrate fossils in the place during the years 1912—1937.

In 1930, Cenozoic Research Laboratory was organized as a department of the former National Geological Survey of China and Chinese vertebrate paleontologists, except carrying on the excavation work in the rich fossiliferous place at Choukoutien, also began their

own work in cooperation with certain foreign scientists in this country, especially in North China.

Up to the time of Japanese invasion in China in 1937, a sketch of our knowledge on Chinese vertebrate fossils could be given. However it was too little in proportion to the vastness of Chinese territory.

After the liberation of Chinese continent in 1949, our knowledge of the paleontological science made much progress because new material of fossils was rapidly and greatly increased during the construction work of New China. Cenozoic Research Laboratory was re-organized and is now nominated as Laboratory of Vertebrate Paleontology in Academia Sinica.

During the time of construction in the region of the Huai River, rich mammalia fossils came to light particularly in North Kiangsu and Anhuai, where such scientific material was entirely unknown before.

Our work was also extended to the South of Yangtze River where fossiliferous cave deposits were investigated since 1935. By the exploration of South China Caves, it increases profoundly our understanding of the nature of South China mammals of Quaternary period.

As much more findings of Quaternary mammalian fossils had been made in north-eastern part of Inner Mongolia, Kirin and Heilungkiang Provinces, we now possess sufficient data to establish a separate province of Quaternary mammalian life (*vide infra*).

We are now able to give an account of the Quaternary mammals in most part of China, as for the province Taiwan and districts of Tibet and Sinkiang exploration has not well been made.

So far as the Quaternary mammalian fauna is concerned, it seems that China of to-day can well be subdivided into two main zoological provinces: North and South China. Another province of Huai River can also be added as the transitional zone in between the two. The fourth one, actually being a side branch of North China Province, includes the north-eastern part of Inner Mongolian Autonomous District, Heilungkiang and Kirin Provinces, or the North-East of China of the former time, or Northern Manchuria usually called by some foreigners.

Such a zoogeographical subdivision of China in Quaternary time is but tentative and subject to revision when our knowledge of this part increases.

## II. NORTH CHINA PROVINCE

The North China Province of Quaternary mammals of China is the already studied in detail and well known to the vertebrate paleontologists. It occupies the area of Provinces Hopei, Shantung, Shansi, Shensi, Kansu, Northern part of Honan, and South-western part

of Inner Mongolian Autonomous District, and extends approximately from 95° to 120° longitude east and from 35° to 42° latitude north.

Up to the present, four Quaternary faunas of successive geological ages are known in this province. Their character can be summarized as follows.

### 1. *Proboscideipparion-Equus* Fauna of Lower Sanmenian

The type locality of this fauna is known in the lacustrine deposit at Nihowan of Sangkanho in Northern part of Hopei and the fossils were well studied by Teilhard and Piveteau. Similar deposits with similar fauna are also known in Sanmen region on the banks of Huangho (the Yellow River) and in the lower part of Fenho valley of Shansi province. Bearing the same fauna, deposits of reddish clay (zone B of Teilhard and Young) are moreover widely distributed in Shansi, N. Shensi and S. Mongolia. Cave deposit with the same fauna is only found at Tongshan and Nanyehli of Hopei.

The *Proboscideipparion-Equus* fauna was fundamentally the offspring of the *Hipparion* fauna of Lower Pliocene age in North China.

(1) But with the disappearance of archaic and southern (or African) elements, such as several genera of Giraffidae created by Bohlin, primitive Cervidae, *Cervocerus*, *Dicrocerus*, primitive Suidae, *Chleuastochoerus* and many Carnivora and Rodentia as *Indarctos*, *Melodon*, *Ichtherium*, *Prosiphneus* etc. The Pliocene survivals are: *Machairodus*, *Chalicotherium*, and *Hipparion* (*Proboscideipparion*), probably also *Elasmotherium*.

(2) Developed from older forms but more or less modified are: *Hyaena*, *Rhinoceros*, *Ochotonoides*, *Stegodon*, etc.

(3) In this fauna, there is a good number of recent genera appeared for the first time, such as *Elephas*, *Equus*, *Canis*, *Ursus*, *Gazella*, *Ovis*, *Bison*.

(4) Characteristic for this fauna are the forms: *Siphneus tingi*, *Cervus* (*Elephurus*) *bifurcatus* T. and P., *Cervus* (*Eucladuceros*) *boulei* T. and P., *Cervus* (*Rusa*) *elegans* T. and P.

Considering as a whole, the *Proboscideipparion-Equus* fauna of lower Sanmenian in N. China, we can safely say, marks the closure of Tertiary and the beginning of Quaternary, since a great part of the Tertiary archaic mammals became extinct and many recent genera came into existence. Having almost no southern elements known in this fauna, it represents actually the true northern forms of Lower Pleistocene period of China.

Compared with the faunas of Europe and other part of Asia, it is evident that the Chinese lower Pleistocene fauna is equivalent to Villafranchian of Europe, Upper Sivaliks of India and Upper Irrawaddian of Burma.

### 2. *Sinanthropus-pachyosteus* Fauna of Upper Sanmenian

The type locality of the *Sinanthropus-pachyosteus* fauna of North China is the famous Choukoutien site (Loc. 1) where it is found in cave deposits. In the same Choukoutien region there are also several other localities of fissure or cave deposits with more or less the same fauna.

This fauna is found in fissure deposit at Chingshiling, Chingsingshien, of Hopei Province, and in all the other place, it is found so far as it is known, only in reddish clay (Zone C of Teilhard and Young) on the plain and in the mountainous region of N. China.

Lacustrine sandy and gravel sediments with the same fauna occur in the Sanmen region of middle Huangho valley and in the lowest part of Fenho valley, but they are not well studied yet.

(1) As it is named, this fauna is characterized by the 1st arrival of *Hominid*, *Sinanthropus pekinensis* Zdansky and Black and by the most astonishing thick jaw deer *Sinomegaceros pachyosteus* Young.

(2) Coming to the upper Sanmenian period or Middle Pleistocene time, all archaic mammals of Tertiary time in North China became extinct with the only exception of *Machairodus*. Numerous recent genera and even species began to make their first appearance; they are: *Scaptochirus*, *Neomys*, *Erinaceus*, *Canis lupus* L., *Nyctereutes*, *Felis pardus* L., *Felis microtis*, *Cricetulus*, *Meles leucurus* Hodgson, *Microtus*, *Mus rattus*, *Moschus*, *Macacus*, etc.

(3) There are also a few forms survived from *Proboscideipparion-Equus* fauna of the same zoogeographical province; they consist of *Hyaena sinensis*, *Spirocerus*, *Rhinoceros*, *Paracamelus gigas* Schlosser, *Elephas namadicus*, *Equus sanmenensis* etc.

(4) Special for Pleistocene, but not only for Middle Pleistocene, the distinguish members of this fauna, besides those mentioned above in (3), are: *Trogotherium cuvieri*, *Ursus spelaeus*, *Felis youngi*, *Rhinoceros mercki*, *Rh. tichorhinus*, *Pseudaxis grayi* Zdansky, *Bubalus teilhardi*; Young, etc.

(5) A few points are interesting to note:

(a) In this fauna there are certain southern forms, such as *Bubablus*, *Hystrix*, *Cynailarus*<sup>1)</sup>.

(b) This fauna began from another one which are closely connected with that of older age, or lower Sanmenian. Such a relation is well demonstrated by Localities 13 and 18 of Choukoutien. For example, in the deposits of Loc. 13, we have found *Siphneus epitingi* Teilhard and Pei, which is very close to the typical form *S. tingi* Young of Nihowan.

1) And also *Austriolithus* (fossil Austrich) of Aves.

And at the same locality we have met with *Sinomegaceros flabellatus* Teilhard which is the ancestral form of *S. pachyotus* Young, typical for this fauna.

(c) So far as the *Sinomegaceros* is concerned, its successors, less thick in jaw-bones, were descended to a little later deposits as Locs. 3 and 15 of the same Choukoutien region and to those of Late Pleistocene as Sjara-osso-gol and Tingtsun of Shansi.

Compared with the European Pleistocene faunas, the Middle Pleistocene mammalian fauna of China is by no means different, in general character, from that of Forest bed in England, Abbeville (Champs de Mars) in France, Val d'Arno in Italy and Mosbach in Germany.

### 3. *Elaphus-ultima* Fauna of Loessic Time

In North China the "Loess"<sup>1)</sup> of late Pleistocene spreads widely over on all plains and low hilly regions. Unfortunately, only very few badly preserved mammalian fossils were found in this loessic deposits. Except Shuaitungkuo, Yiaofangtou, etc., we know only the contemporary fauna in the sandy facies along certain rivers. The Sjara-osso-gol fauna has been known since 1923 and the Tingtsun one, only since 1954.

In the loessic deposits, only some fossils of *Elephas* cf. *namadicus*, *Bos primigenius*, *Rhinoceros tichorhinus*, *Cervus elaphus* are known<sup>2)</sup>. Up to the present the determination of two forms out of the four mentioned above is still uncertain, namely *Elephas* and *Rhinoceros*.

So the type locality of the present fauna is therefore unavoidably falling on the Sjara-osso-gol one, the lacustrine facies equivalent to the North China loess.

(1) The Late Pleistocene fauna of Sjara-osso-gol is highly characterized by the presence of the following forms: *Sinomegaceros ordosianus* Young, *Bubalus wansjocki* Boule and Teilhard, *Bos primigenius*.

(2) A great number of living mammals developed, such as *Homo sapiens*, *Canis (Nycterentes) procyonoides*, *Siphneus fontanieri*, *Equus przewalskyi*, *E. hemionus*, *Cervus elaphus*, *Pseudaxis hortulorum* Swinhoe, *Gazella przewalskyi*, *Camelus knoblochi*.

(3) Survived from Middle Pleistocene with little modification are the forms: *Hyaena ulima* (= *H. spelaea*), *Sinomegaceros*, *Elephas* cf. *namadicus*, *Rhinoceros tichorhinus*, *Spirocerus*.

One cave deposit, the Upper Cave of Choukoutien, bears almost the same fauna, generally regarded as being slightly later in age.

In Upper Cave of Choukoutien, the mammals survived from Middle Pleistocene are

1) In the sense of Teilhard and Young, not of Richthofen.  
2) Besides these fossils there is also fossil Austrich, very rich in egg shells.

only *Hyaena ultima*, *Ursus spelaeus*, *Elephas* sp.<sup>1)</sup> and the other living forms found here in fossil state are almost all common to Sjara-osso-gol, except the decidedly southern species as *Cynailurus* cf. *jubatus*, *Pagutma larvata*.

It is interesting to observe that during Late Pleistocene time, besides what may be regarded as southern forms, but since long time inhabited in North China, some-southern mammals, for instance, *Cynailurus* and *Paguma*, began to live in North China. By the existence of such meridional forms, therefore, it is advisable to divide the North-East Province from the present one.

#### 4. *davidianus* Fauna of Post Pleistocene Age

*Elaphurus davidianus* is a kind of living deer, known only in an half domesticated condition in the Royal Zoological Garden, Nanyuan near Peking, of Ching dynasty. So far we never found it in wild state.

In the famous archaeological site in Anyang of Honan, or usually called the "Yin Ruin", antler and bones of this animal are found in great quantity and were worked for making all sorts of artifacts.

During the recent years additional Yin sites are successively discovered in Chengchow, Loyang of Honan, and Ansin, Chuyang and Shingtai of Hopei. From most of these new Yin sites, Pere David's deer is common to find.

In the spring of 1956, a considerable number of materials, including several rather complete antlers with trace of cutting work done by stone implements, were unearthed from the peat layer or the layer above the peat, from 2 to 3 meters deep below the land surface at several places of Hopei. It is associated with *Cervus elaphus* and *Capreolus manchuricus* Lydecker. All these specimens are actually sub-fossils and not associated with any known extinct forms. What is the age of the *davidianus* fauna is now under investigation. Very likely it is Post Pleistocene in age.

If so, the interesting fact is that the Pere David's deer is known already in fossil state in the Huaiho region (*vide infra*) in Middle Pleistocene deposits. And in Post Pleistocene time it was widely distributed in wild state in North China, especially in Hopei. It again survived up to Yin dynasty and was bred by the Royal families. During about 2,000 years, it left no trace but reappeared in the Royal Zoological Park up to 17—18 centuries.

### III. SOUTH CHINA PROVINCE

From the point of view of Quaternary mammals, the present day provinces south of the Yangtze River naturally fall into a zoogeographical province, clearly separable from the North China Province noted above. The provinces are: Szechuan, Yunnan, Hupei,

1) There is also fossil Austrich of Aves.

Hunan, Kweichow, Kwangsi, Kiangsi, Kwangtung, Kiangsu, Chehkiang and Fukien and occupy the area about 100—122° longitude east and 20—32° latitude north.

It seems, a very homogeneous mammalian fauna was once existed in such a large area during Quaternary Period and the name "South China Province" is here adopted.

Mammalian fossils from this Province is known for a long time. It is understood that all the fossils described by Owen, Koken in the 19th century were coming from this province.

So far, all the mammalian fossils of this Province are coming from caves or fissures, and open-air station is known only at Tzeyang of Szechuan<sup>1)</sup>. This, however, does not mean that all the Quaternary mammals were inhabited in caves. On the contrary, a great number of these animals were brought in by human agency, running waters and certain other animals.

In this Province, we always supposed before that there is only one unique mammalian fauna during the whole Pleistocene period. After studying the Tzeyang mammalian fossils, we come to the opinion that at least in the river deposits at Tzeyang, the mammals are mixed of two ages: one older which is similar to that widely distributed in all the provinces south of the Yangtze River and the other, younger in age.

Besides, in some of the fossiliferous localities, for example, Yenchingkuo in Wanhsien, Koloshan near Chungching, some archaic forms as *Mastodon*, *Chalicotherium* and some doubtful elements (Koloshan) are collected, but these older animals are represented only by isolate teeth. Nevertheless, we are facing to have three faunas of different ages in South China Province. However the explanation that the older mammals were the survived ones from earlier time is not excluded.

#### 1. The *Pongo-Ailuropoda* Fauna of South China Caves.

The type locality of this fauna is Yenchingkuo in Wanhsien of Szechuan, where the fauna proves to be the richest. Members of the American Museum of Natural History in New York and of our Cenozoic Laboratory had well explored the site and the fossils were well studied successively by Matthew and Granger in 1923, by Young in 1935 & 1939 and by Colbert and Hooijer in 1953.

(1) Most characteristic for this fauna are the forms: *Pongo* cf. *satyrus*, *Gigantopithecus*, *Ailuropoda*, *Megatapirus*, *Rhinoceros sinensis*, *Stegodon orientalis* Owen, etc.

(2) This fauna is also characterized by the presence of some southern forms such as *Arctonyx*, *Hystrix*, *Rhizomys*, *Paguma* (Tanyang of Kiangsu), *Rusa*, *Muntiacus* and a few species of small primates.

(3) A few number of mammals common to the Pleistocene horizons of North China are *Hyaena ultima*, *Elephas* cf. *namadicus*, and probably *Pseudaxyls grayi* too.

1) There are also some isolate fossils known in Szechuan as in lacustrine deposits.

(4) There is also a considerable number of living forms common with the North China Province, such as *Felis tigris*, *Cuon* (*Cyon*), *Bubalus*, *Sus*, *Ursus* and many small Rodents.

(5) There is also the possibility of the presence of two Pliocene survivals, such as *Chalicotherium* and Mastodon. As stated above these two forms might represent one older fauna of the South China Province.

(6) If we compare this fauna with the *Sinanthropus-pachyosteus* fauna of North China, we can make the following table:

South China	North China equivalent	Europe equivalent
<i>Cervus</i> ( <i>Rusa</i> )	<i>Cervus</i> ( <i>Pseudaxis</i> )	<i>Megaceros</i>
<i>Muntiacus</i>	<i>Sinomegaceros</i>	
<i>Elephas</i> cf. <i>namadicus</i>	<i>Elephas namadicus</i>	<i>Elephas antiquus</i>
<i>Stegodon orientalis</i>	—————	—————
<i>Cuon</i> cf. <i>javanicus</i>	<i>Cuon</i> cf. <i>alpinus</i>	<i>Cuon alpinus</i>
<i>Arctonyx</i>	<i>Meles</i>	<i>Meles</i>

By the above comparison and by the general character of this fauna, its age is considered to be Middle Pleistocene.

It is interesting to note that there is some hint to subdivide this fauna into southern part and northern part. In the southern part as in Kwangsi caves, there are *Pongo* (abundant) and *Gigantopithecus* (rare), which are absent in Szechuan and Hupei, so far as we know at present.

If we compare the Quaternary mammalian fossils known in the adjacent countries, the *Pongo-Ailuropoda* fauna is practically the same as that of Tam Nang and Lang Son of Indo-China, and Mogok of Burma. In India, Indonesia and Malaya, the similar fauna is known but enriched by *Hippopotamus*.

## 2. The *sapiens-Mammonteus* Fauna of Tzeyang.

A later fauna with *Homo sapiens* and *Mammonteus primigenius* has been recognized in the Tzeyang deposits. Its age is Late Pleistocene. Our knowledge of this fauna is still quite limited.

Certainly the fauna is the descendant of the *Pongo-Ailuropoda* one but with great modifications: (1) extinction of many archaic forms, such as *Stegodon*, *Rhinoceros*, *Megatapirus*; (2) invasion of the mammoth very probably from the North into the northern part of South China; (3) High primates being much involved including *Homo sapiens*.



#### IV. HUAI RIVER PROVINCE

During the proceeding of foundations for construction work in the Huai River region Quaternary mammalian fossils were successively discovered at several localities, as Changshan in Shuyang of North Kiangsu, Hsiatsaowan in Szechung and Chitsuai in Wuho of North Anhui and Shintsai of South-east Honan. All these fossils were found in sandy and marly deposits several meters below the land surface and even usually below water level of the adjacent rivers. Without the construction work in this region they would hardly become known to the science.

The characteristic forms of the Huai River Quaternary mammals are: *Trogontherium cuvieri*, *Elaphurus davidianus*, *Elephas namadicus*, *Stegodon* sp. (sp. nov.)<sup>1)</sup> *Cervus* (*Rusa*), *Sinomegaceros*, and *Rhinoceros tichorhinus*. If we add the fossiliferous locality at Chentien in Yuhsien of Central Honan to the same Huai River Province, we can also add *Cuon* in this fauna.

The *Trogontherium-Elaphurus* fauna of Huai River is composed of some forms common with the *Sinanthropus-pachyosteus* fauna of North China such as *Trogontherium*, *Elephas namadicus*, *Sinomegaceros* and with the *Pongo-Ailuropoda* fauna of South China such as *Stegodon* and *Cervus* (*Rusa*), probably *Cuon* too.

It seems that the Huai River region serves as a land bridge of South and North China and we may regard it as a distinct faunistic Province of Quaternary time. As judging by the mammalian species the geological age of *Trogontherium-Elaphurus* fauna is Middle Pleistocene, and partly Late Pleistocene.

It is worthy to remark that *Trogontherium cuvieri* is usually known in a more northern latitude, and that the interesting animal as the Pere David's deer had its ancestors flourishingly developed in this Province in Pleistocene period and later migrated to Hopei province and in our days bred by the royal family of Yin and Ching Dynasty.

#### V. NORTH-EAST PROVINCE

Since long time ago, Quaternary mammalian fossils, such as the mammoth and woolly rhinoceros, have been known in the provinces Heilungkiang, Kirin and north-eastern part of Mongolian Autonomous District, or the northern part of the former North East of China, but we always considered this part of China as a side branch of North China in zoogeographical divisions. After a preliminary survey of Quaternary geology and mammals in the summer of 1956, the present author was convinced in considering the North-East part of China as an independent faunistic province, so far as the Quaternary mammals are concerned.

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1) This is one species of large *Mastodon*-like *Stegodon* and is now being investigated by Chow Ming-chen of our Laboratory.

The most important localities of the *antiquitatis-primigenius* fauna of North-East China are Djalai-nor of Inner Mongolia, Kushiangtung near Harbin and Chowchiayufang Yushu, of Kirin.

1. It is characterized by a great number of Northern forms such as *Alces*, *Capreolus*, in addition to *Mammonteus primigenius*, *Rhinoceros tichorhinus* (*Coelodonta antiquitatis*).

2. Besides a number of the living species in this fauna there are a number of extinct mammals: *Bos primigenius*, *Hyaena ultima*, etc.

3. Two unexpected forms *Camelus*<sup>1)</sup> and *Bubalus* are present in this fauna of supposedly cold and damp climate.

Judging by its general characters the age of the *antiquitatis-primigenius* fauna of North-East China is Late Pleistocene.

This fauna is always found in black sands beneath a layer of black soil in the high river terrace but often re-deposited on the lower terrace or on the flood-plain together with many living species as *Equus* sp., *Homo sapiens*, *Canis familiaris* and Neolithic artifacts, etc. And that is the reason why some geologists had been mistaken to suppose that Quaternary fossils were found in association with the Neolithic artifacts.

So far, only one mandible of *Rhinoceros mercki* was found in the clayish sands on the slope of high range of Huangshan, near Harbin. This fossil, though very little indeed, would indicate the possibility of the presence of an older fauna of mild climate in the North-East Provinces of China.

With the faunas of North China, the present one is undoubtedly very close to the Late Pleistocene fauna, especially that known in Sjara-osso-gol. But toward the end of Pleistocene, the North China mammalian fauna, as represented by the Upper Cave of Choukoutien, is apparently separated from the North-East part of China, because the latter area was inhabited by cold elements, while the former by more southern species.

It is evident that the *primigenius-antiquitatis* fauna of North-East China is very much related to the contemporary one of Siberia in USSR.

## VI. CONCLUSION

In view of the mammalian fauna, we can figure the whole China as follows:

1. At the beginning of Pleistocene Period, in North China plain and low hilly land, the horse and the lastly survived *Hipparion* (*Proboscidihipparion*) galloped on the grass ground and many kinds of deer and carnivores wandered in the forest and mountainous regions. The climate of that time was not so warm and arid as in Pliocene epoch, since many Pontian animals of southern characters became extinct or migrated to further south.

1) In the Harbin Museum there is one mandible of *Camelus* coming from Kushiangtung.