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# Mammoth and other proboscideans in China during the Late Pleistocene

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In China during the Late Pleistocene four genera of proboscideans (*Mammuthus*, *Stegodon*, *Elephas* and *Palaeoloxodon*), containing six species, were present. *Mammuthus primigenius* is the most verified species, because of its easily identified tooth morphology. *Stegodon orientalis* is also a species widely accepted and easily to recognise. However, the presence of *Palaeoloxodon naumanni* (*Palaeoloxodon* can be considered as an independent genus or as a subgenus of *Elephas*) is open to question, because its distinction from *Elephas maximus* is not remarkable. Chronologically, mammoth had a very short history in China. It lived during the time span between 34.000 - 11.800 yBP. *Stegodon* originated in China at the beginning of the Pliocene. Its 'golden age' was the Middle and Late Pleistocene; it even survived into the Holocene (5.000 yBP). *Elephas* immigrated into China in the Late Pliocene; its localities were widely distributed in China during the Pleistocene. This genus too survived into the Holocene. More than ten Holocene localities have been reported. Today there still is a small herd of *Elephas* near the southwestern border of China. Geographically, *Mammuthus* was limited to the north-eastern part, while some fossils were fished from the bottom of the most northern part of the Yellow Sea. *Palaeoloxodon* and *Elephas* are the most widely distributed groups during the Late Pleistocene: from North to South, more than 50 localities have been reported in formal publications. *Stegodon* is also well represented during the Late Pleistocene, more than 20 localities have been reported, limited to southern China.

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## INTRODUCTION

During the Late Pleistocene Proboscidean taxa were quite common in continental China. Mammoth is known from at least 157 localities according to Liu & Li (1984), or even more than 200 according to Jiang (1990). Taxonomically, proboscideans were

also very diversified during the Late Pleistocene. However, within a short period the proboscideans became almost completely extinct or moved out of the area. This phenomenon is still an evolutionary and ecological mystery.

## LATE PLEISTOCENE PROBOSCIDEANS

Family Stegodontidae OSBORN, 1918

*Stegodon* FALCONER, 1857

*Stegodon orientalis* OWEN, 1870

Family Elephantidae GRAY, 1821

*Palaeoloxodon* MATSUMOTO, 1924

*Palaeoloxodon naumanni* MAKIYAMA, 1924

*Palaeoloxodon naumanni huaihoensis* LIU, 1977

*Elephas* LINNAEUS, 1758

*Elephas kiangnanensis* PEI, 1987

*Elephas maximus* LINNAEUS, 1758

*Elephas maximus sichiaoshanensis* WANG, 1978

*Mammuthus* BROOKES, 1828

*Mammuthus primigenius* (BLUMENBACH, 1799)

*Mammuthus primigenius primigenius* (BLUMENBACH, 1799)

*Mammuthus primigenius liupanshanensis* ZHOU ET ZHANG, 1974

*Mammuthus sungari* CHOW ET CHANG, 1959

A total of at least four Late Pleistocene genera and six species were published. *Mammuthus primigenius*, *Palaeoloxodon naumanni* and *Elephas maximus* were the most important ones. Remains of *Stegodon orientalis* were also frequently encountered in Late Pleistocene localities. *Mammuthus primigenius primigenius* is the most verified species, because of its easily identified dental morphology. *Mammuthus primigenius liupanshanensis* is known from only one locality and was stratigraphically older than *Mammuthus primigenius primigenius*. Reports about *Mammuthus sungari* are very rare. So, the mammoth fauna was actually dominated by the subspecies *Mammuthus primigenius primigenius* only.

The genus name *Palaeoloxodon* was generally used for the species *naumanni*, and is sometimes considered a subgenus within *Elephas* [*Elephas (Palaeoloxodon naumanni)*]. As the distinction between the genera *Elephas* and *Palaeoloxodon* is not so easy, disagreements existed for a long time concerning the issue to what genus the species *naumanni* should be attributed. From the 1950's, different opinions were proposed. Pei

(1958) thought that the genus *Palaeoloxodon* is almost identical with the genus *Elephas* and for that reason the species *naumanni* of Late Pleistocene from north China should be attributed to the genus *Elephas*. Shoshani & Tassy (1996) are of the same opinion. Qi (1999) proposed that *Palaeoloxodon* should be retained as a generic name (this opinion is followed in this paper) and promoted the subspecies *P. n. huaihoensis* to a specific rank. Once ten species and subspecies were attributed to this genus. However, Zhang & Zong (1983) considered that in the Late Pleistocene only one species, *naumanni*, survived.

*Elephas maximus* lived also in the Late Pleistocene. Some authors prefer to use the species name *indicus*, this is, however, a junior synonym of *maximus*. Pei (1987) created a new species, *Elephas kiangnanensis*. This species was thought to be stratigraphically older and its name was not commonly used. *Elephas maximus sichiaoshanensis* is a subfossil subspecies, which is found in one locality only. These latter species and subspecies have to be verified. The genus *Stegodon* was a typical element in East Asia. Twenty species were erected within this genus, but Zong

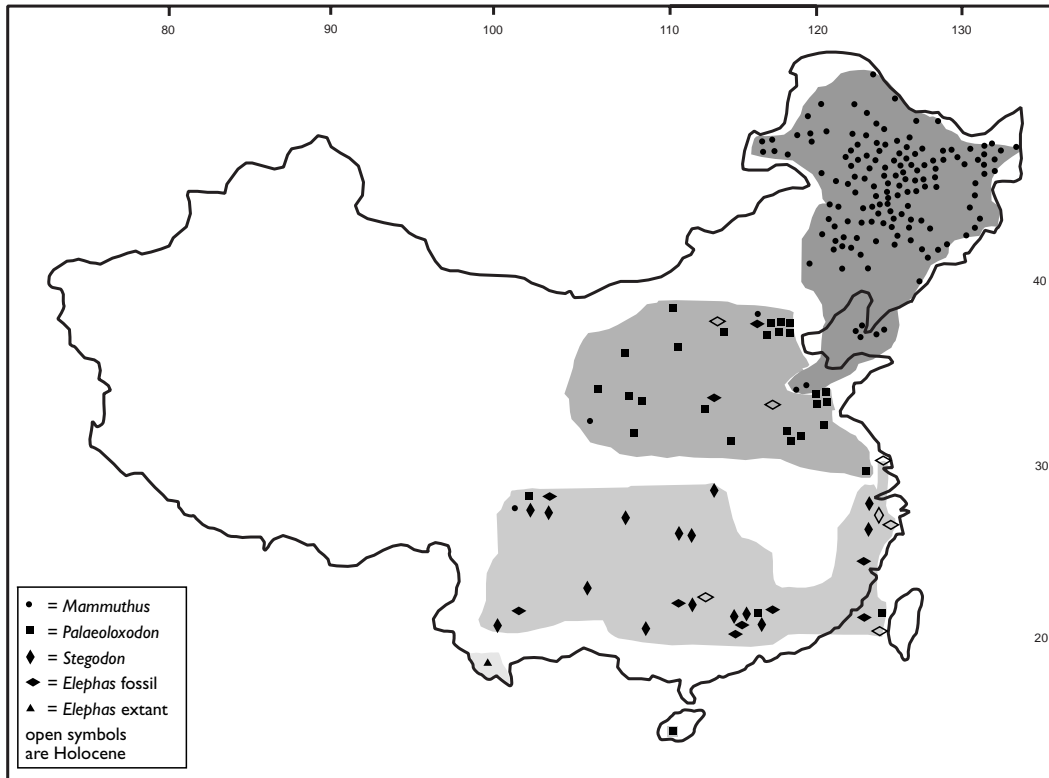


Figure 1 Fossil and subfossil localities of mammoth and other proboscidean fauna in Late Pleistocene in China.

(1995) proposed that in the Late Pleistocene only one species, *Stegodon orientalis*, existed. This species is easily distinguished from *Elephas* by the low-crowned molars.

#### **PUBLISHED LATE PLEISTOCENE PROBOSCIDEAN SITES**

Up to now, around 200 localities for *Mammuthus* have been discovered (Wei 1963; Chang 1964; Jiang 1975, 1977, 1990; Zhen *et al.* 1979). However, not all of them were reported formally. Liu & Li (1984) recorded 157 localities. Most of the localities are concentrated in the great plain of northeastern China (Fig. 1). Some localities are located at the bottom of the sea (Zhang 1980). A few new localities were reported from Shandong Province, which are located between 35°N

and 40°N (You *et al.* 1989, 1996). Two other isolated localities are Tongwei in Gansu Province (Zhou & Zhang 1974) and Ziyang in Sichuan Province (Pei & Woo 1957). The last one is the southernmost mammoth locality in China, its latitude is around 30°N. Normally, the distribution of mammoth is limited to north of 38°N, so it is necessary to re-examine the fossil material from the isolated localities. Some authors thought that the fossils did not belong to mammoth (Chow 1978). As it is found everywhere, also in China mammoth co-existed with *Coelodonta*, the woolly rhino. The *Mammuthus-Coelodonta* fauna is a very typical fauna of late Late Pleistocene in northeastern China.

More than 30 localities have been reported for the Late Pleistocene *Palaeoloxodon*. They are mainly located in northern China and associated with *Coelodonta* too (Boule *et al.* 1928; Chow 1957; Pei & Woo 1957; Pei *et al.* 1958; Pei 1959; Zhen 1960; Wang 1961; Ting *et al.* 1962, 1965; Chang 1964; Changchou Museum 1973; Qi 1975; Gu 1978; Huang 1979; Jia *et al.* 1979; Liu & Zhen 1981; Nigedule 1983; Shi 1983; Li & Jin 1988; You *et al.* 1996). Some localities were also reported from the most southern part of continental China (Song *et al.* 1981; Woo & Peng 1959; Hao & Wang 1994) and even from the bottom of the Yellow Sea (Gao 1982). The distribution pattern mosaics with that of *Elephas maximus*, but whether this is a natural pattern or only caused by improper taxonomic work, is still an open question.

Up to now, more than 20 Late Pleistocene localities in southern China were reported with *Stegodon orientalis* (Chia 1957; Pei & Woo 1957; Woo 1959; Woo & Peng 1959;

Liu 1962; Wu *et al.* 1962; Huang 1963; Chen & Qi 1978; Han & Zhang 1978; Song *et al.* 1981; Zhao *et al.* 1981; Wang *et al.* 1982; Zhang *et al.* 1982; Zhang & Zong 1983; Luo 1984; Zhang 1984; Chen 1986; Zong 1995).

*Elephas maximus* is present in the Late Pleistocene. Among 19 localities with this species, ten are of Holocene age (Teilhard & Young 1936; Hsu 1959; Qi 1977; Huang & Cao 1978; Li & Han 1978; Wang 1978; Jia & Wei 1980; Wei *et al.* 1990). The species is mainly distributed in southern China (Hopwood 1935; Song *et al.* 1981; Zhao *et al.* 1981; Zhang *et al.* 1982; Zong *et al.* 1996). However, there are four localities reported from northern China (Pei 1940, 1958; Pei *et al.* 1958) and some fossils from the bottom of the Yellow Sea (Gao 1982; You *et al.* 1995).

Ecologically, three zones can be recognised in late Late Pleistocene (Fig. 1): (1) the north-eastern Chinese zone (north of 38°N), which



Figure 2 Chronological distributions of proboscideans of Late Pleistocene in China.

is typical for the *Mammuthus-Coelodonta* fauna; (2) the northern Chinese zone (between 38°N and 28°N) is represented by *Coelodonta-Elephas (Palaeoloxodon)*; (3) the southern Chinese zone (south of Yangtze River), which is dominated by *Stegodon-Elephas-Rhinoceros*. It can be observed that each ecological zone shares some of the major elements of the neighbouring faunal zone, i.e. the northeastern zone shares *Coelodonta* with the northern zone, while the northern zone shares *Elephas* with the southern zone. It means that the environment changed gradually from north to south.

### CHRONOLOGICAL DISTRIBUTION

In China the earliest record of the typical *Mammuthus primigenius* is 34 ky (Jin *et al.* 1998) (Fig. 2), while the most recent recorded fossil is 11.8 ky (Li 1984). Some authors believe that the mammoth disappeared from China before 20 ky (Liu & Li 1984). So, chronologically speaking, the mammoth had a very short history in China. *Stegodon orientalis* appeared in China at the beginning of the Pliocene (Saegusa 1996). It is a local faunal element in East Asia. In China, this taxon is present in many localities from north to south. However, Late Pleistocene localities are much less represented than Middle Pleistocene localities are. Based on only one record (Ma & Tang 1992), *Stegodon orientalis* survived probably into the Holocene (5.000 yBP). *Palaeoloxodon naumanni* is present in China from at least the Late Pliocene. The Middle and Late Pleistocene localities with this species are widely distributed over China. The species became extinct before the end of the Late Pleistocene. *Elephas maximus* is a typical Late Pleistocene species. It survived into the Holocene. More than ten Holocene localities have been reported. Today there is still a small herd of *Elephas maximus* near the southwestern border of China.

### CONCLUSION

From the above, it can be concluded that proboscideans were quite common in the Late Pleistocene in continental China. We even have quite a number of Holocene records. However, within a very short period almost all of the genera and species became extinct. We can explain the extinction of mammoth to the global warming up at the end of Pleistocene, but this is not an explanation for the extinction of the warmth-adapted genus *Palaeoloxodon*. So, the extinction at the end of the Pleistocene can not be explained by climatic changes only. Maybe the rapid rise of modern Man is the real cause for the extinction of those giant mammals.

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