SCIENTIA SINICA
Vol. XII, No. 2, 1963

PALAEONTOLOGY

QUATERNARY MAMMALS FROM THE LIUCHENG *GIGANTOPITHECUS* CAVE AND OTHER CAVES OF KWANGSI*

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I. INTRODUCTION

Since 1956 a team of palaeontologists and other scientists of the Institute of Vertebrate Palaeontology and Palaeoanthropology, Academia Sinica, has been exploring the limestone caves and excavating the Pleistocene mammalian fossils in the Kwangsi Chuang Autonomous Region. One of the purposes of the team is to collect more materials and field information concerning the problematic giant fossil ape, *Gigantopithecus*, first recorded in 1935 by von Koenigswald from a Chinese drugstore in Hongkong.

As a result of the regular excavation of the cave deposits in Liucheng and other districts, three mandibles and a large number of isolated teeth of *Gigantopithecus* have been recovered. Some preliminary reports on them have been published (Pei, 1957; Pei and Li, 1958; Pei and Woo, 1958).

In addition, many mammalian fossils other than those of the *Gigantopithecus* have also been unearthed. Studies of these materials are now in progress; the present paper gives a short account of this work (Pei, 1962a & 1962b).

During the field work of the last five years we have investigated 300 caves in Kwangsi of which 180 have yielded mammalian fossils. For the geological studies of these caves the reader is referred to a memoir which will be published later (Pei, 1962a).

II. THE COMPLEXITY OF THE KWANGSI QUATERNARY MAMMALIAN FOSSILS

The most striking feature of the mammalian fossils from the Kwangsi caves, as well as those from other southern provinces, such as Kwangtung and Yunnan, is that almost all these fossils were destroyed by rodents, chiefly by porcupines. Consequently nearly all of the Kwangsi cave fossils are badly preserved, being

* First published in Chinese in *Vertebrata Palasiatica*, Vol. 6, No. 3, pp. 211—218, 1962.

chiefly isolated teeth without root. In the more northern provinces, such as Szechwan, Hupeh, however, the cave fossils are generally found in a better condition, and sometimes complete skulls and skeletons might be encountered.

The caves and caverns in Kwangsi, generally speaking, may be classified into three zones, according to the height of their location. The highest located caves are those like the Liucheng *Gigantopithecus* cave, which is about 90 metres above the adjacent ground surface. The deposits found in this kind of caves are chiefly consolidated yellowish brown sand and clay, overlying a layer of red clay. Fossils occur richly on the upper layer of hard sand and clay. A nearly horizontal layer of stalagmitic crust is frequently found at the very base of the whole deposit just above the limestone cave floor with another layer capping the hard yellow deposits on the top. The age of the deposits is now suggested to be Early Pleistocene or Villafranchian.

The second and third zones of the Kwangsi caves are about 30—50 m and 5—15 m respectively above the present level of the nearby water in the Liuchow area, where the Liucheng *Gigantopithecus* cave is located. The hollows of the caves of these two zones are usually merged inside. The deposits in these caves generally consist of red clay at the base underlying a layer of slightly consolidated yellowish red or yellowish gray sand and clay. Several layers of thin stalagmitic crust are often found inserted between them. According to geological studies, the deposition took place in the Middle and Late Pleistocene. Around the stalagmite and stalactite or above and underneath the stalagmitic crust, particularly in the caves of the third, or the lowest zone, there is often an accumulation of the refuses left by the Neolithic people such as ashes and big gastropod shells.

The caves and fissure deposits in South China were usually classified by previous workers into two kinds: "yellow deposits" and "gray deposits" (Teilhard and others, 1934). But after a long time of field observation, we have come to the conclusion that things are not so simple, so far as the time and mode of sedimentation of the deposits are concerned.

Except for *Hyaena* and *Hystrix*, most of the species of the fossil animals did not live in caves. It seems that their remains were introduced into caves by water action together with the sand and clay from the outside of the caves when they became dismembered. Up to now, we have found that only a very small portion of the fossil animals was carried into the caves by human beings with the exception of those of the Neolithic age.

The most common fossils of Mammalia known in the Kwangsi caves, no matter to what stage of Pleistocene they may belong, can be simply listed as follows:

Primate	Carnivora
Pongo sp.	*Ursus thibetanus*
Rhinopithecus sp.	*Arctonyx collaris*
Maccaca sp.	*Ailuropoda* sp. or *A. melanoleuca*
	Hyaena sp. (=*H. sinensis*)

Rodentia

Hystrix sp.
Rattus sp.

Perisodactyla

Tapirus (=*Megatapirus*) sp.
Rhinoceros sp. (=*Rh. sinensis.*)

Artiodactyla

Sus scrofa
Rusa sp. and *Muntiacus* sp.
Bubulus sp., *Bibos* sp.

Proboscidea

Stegodon orientalis
Elephantidae (i.e. *Elephas namadicus*)

Some of the above-listed names were first established by various authors on the basis of only very fragmentary materials and were later referred to the same species by palaeontologists who also had no better evidences than some poor specimens. Good examples are *Hyaena sinensis, Rhinoceros sinensis,* etc.

Furthermore, there are also many conservative members, such as the bear, the boar, and the badger of the Kwangsi cave fauna, whose characters showed little change throughout the whole Pleistocene time.

For the reasons mentioned above, when we come to an actual work, the mammalian fauna of Kwangsi caves is usually regarded by authors as a single one, *Stegodon-Ailuropoda* fauna, and assumed to be simply Middle Pleistocene in age (Teilhard and others, 1934; Pei, 1935; Bien and Chia, 1938; Colbert and Hooijer, 1953).

However, in the present studies based upon a large collection of specimens, we have found that it is advisable to subdivide the so-called *Stegodon-Ailuropoda* fauna into three stages or fauna zones of Pleistocene by some characteristic but rare elements.

III. The Problem of Sub-Divisions of the *Stegodon-Ailuropoda* Fauna

The mammalian fossils collected from the Liucheng *Gigantopithecus* cave, though essentially of the same members as the so-called *Stegodon-Ailuropoda* fauna, consist of, in addition, at least two forms of archaic animals, such as *Stegodon praeorientalis* and *Trilophodon serridenstoides* Pei (sp. nov.). Besides, in this fauna there are also the gigantic ape, *Gigantopithecus,* and the dwarf giant-panda, *Ailuropoda microta* Pei (sp. nov.). According to the statistical analysis of this fauna (Table 1), there are seventeen modern species or about 42.2% of the whole fauna. At the same time, it contains also the Yunnan horse (*Equus yunnanensis*) (Pei, 1961). Considering all these facts, we, therefore, suggest that the age of the mammalian fauna of Liucheng *Gigantopithecus* cave is Early Pleistocene, not Pliocene, nor Middle Pleistocene.

In view of the fact that, though there are seven forms or 19.4% common to the *Stegodon-Ailuropoda* fauna of the Middle and Late Pleistocene from the other Kwangsi caves, there exist at any rate nine forms or 25% special to the fauna found in association with the giant ape. Chow has proposed, consequently, to separate the latter from the others and thus given it a special name "*Gigantopithecus fauna*" (Chow, 1957).

Table 1

Numbers and Percentages of Species of Kwangsi Mammalian Fossils Known in Different Stages (or Zones) of Pleistocene

Species	Pleistocene			Holocene (Neolithic)
	Early	Middle	Late	
Total number of species determined*	36	45	40	28
Species occurring in all 3 stages				
Total number	7	7	7	—
Percentage	19.4	15.5	17.0	—
Species occurring in Early & Middle stages				
Total number	6	6	—	—
Percentage	16.6	13.3	—	—
Species occurring in Middle & Late Stages				
Total number	—	17	17	—
Percentage	—	37.7	42.5	—
Species special to Early stage				
Total number	9	—	—	—
Percentage	25.0	—	—	—
Species special to Middle stage				
Total number	—	1	—	—
Percentage	—	2.2	—	—
Species special to Late stage				
Total number	—	—	3	—
Percentage	—	—	7.0	—
Recent species occurring in all 3 stages				
Total number	17	26	28	—
Percentage	42.2	57.7	70.0	—

* Since the study of the mammalian fossils from the *Gigantopithecus* cave and others in Kwangsi is still in progress, the numbers of species is rendered but tentatively so that the readers may have some ideas about the stages or zones of the *Ailuropoda-Stegodon* fauna of Kwangsi.

In the ordinary case, the *Stegodon-Ailuropoda* fauna from the other caves in Kwangsi can not be classified into the Middle and Late Pleistocene ages. But those found in company with human fossils, both *Homo* sp. and *Homo sapiens,* should be considered otherwise. According to the evolutionary stages of human family known in the world, both the genus *Homo* and the species *Homo sapiens* generally appeared in Late Pleistocene. Therefore, the *Stegodon-Ailuropoda* fauna found together with the human fossils, such as the Maba man (*Homo* sp.) in Shaokwan, Kwangtung, and the Liukiang man (*Homo sapiens fossilis*) is Late Pleistocene in age, and ought to be differentiated from the Middle Pleistocene fauna.

As the well-known localities of fossiliferous fissures and caves, e.g. Yenchingkuo of Wanhsien in Szechwan (Colbert and Hooijer 1953), Hoshangtung

of Fumin in Yunnan (Bien and Chia, 1938), and the Cave E of Hsingan in Kwangsi (Teilhard and others, 1934) bear neither archaic form nor human fossils, it is advisable to consider their age as Middle Pleistocene[1]. From the foregoing analysis, it seems better to name the mammalian fauna found in these fissures or caves "the typical *Stegodon-Ailuropoda* fauna" or "*Stegodon-Ailuropoda* fauna *sensu stricto*". And only this typical *Stegodon-Ailuropoda* fauna is Middle Pleistocene in age.

As far as we have learned up to the present time, the typical *Stegodon-Ailuropoda* fauna was widely distributed in South China, or south of the Yangtze. It extended to Taiwan, Chekiang on the east and Szechwan and Yunnan on the west. The northern limit of this fauna possibly lies on the southern foot of the Tsinling Range where we have but little knowledge of these mammalian fossils[2]. This fauna is also known in Burma and Vietnam, but not in India and Pakistan.

During the epoch of Late Pleistocene, the members of the *Stegodon-Ailuropoda* fauna seem to have been gathered in certain limited areas and later they became rarer and rarer. Up to the present, some elements that survived like the giant panda, seek refuge only in special districts such as the western part of Szechwan; the majority of them either become extinct or migrate to the southeastern Asia, Vietnam, Malaya, Sumatra, etc.

IV. The Change of Body Size of the Kwangsi Quaternary Mammals

The increase in body size of Quaternary mammals has long been noticed by vertebrate palaeontologists, but the case of the Kwangsi fossils seems to be more complicated. A short paper dealing with this subject is appearing in this issue[3] and here only a brief account is given.

From the observation on the Kwangsi Quaternary mammals, we find that during the Pleistocene time, from the early through middle to late stages, different animals became maximum or minimum in size in different stages. For example, some animals like the giant ape (*Gigantopithecus*), the red dog (*Cuon*), the hunting leopard (*Cynaieurus*), the porcupine (*Hystrix*) appeared to be the largest in dentition in Early Pleistocene, and some others such as the giant Panda, were of the biggest size in Middle and Late Pleistocene. The large primate like the orang-utan (*Pongo* sp.) persisted in its largest size during the whole Pleistocene, but the small Chinese bear (*Ursus thibetanus*), the wild boar (*Sus scrofa*), the

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1) Calicotheriid (*Nestoritherum*) was formerly considered by Matthew and Granger (1923) and Colbert and Hooijer (1953) as an archaic form too. But it seems that this interesting fossil known in the Kwangsi caves is also known in the Middle Pleistocene age.

2) After the manuscript of the present paper is put into print, one article on the Quaternary mammalian fossils found on the southern slope of Tsinting Range is published (*vide*, Y. H. Li: Reconnaissance of some mammalian fossil localities in the region of upper Han River, *Vertebrata Palasiatica*, 6(3), 280—290, 1962).

3) See this issue pp. 231.

badger (*Arctonyx collaris*), and some small felines showed no change in body size as proved so far by their teeth.

There are also some animals evolved into their largest size in Middle or Late Pleistocene, e.g., *Paguma* and *Viverricula.*

How to explain the change of body size in Pleistocene animals is certainly an important problem, which may interest all the students of the Quaternary investigation.

V. The Geographical Distribution of the Kwangsi Quaternary Mammals

Another interesting problem, as we have observed, is the change of geographical distribution of the Kwangsi mammals during the Quaternary epoch as compared with that of the present time.

The geographical distribution of the primates is interesting to note first of all.

Up to the present, we have noticed that the giant fossil ape (*Gigantopithecus*) is known to inhabit only in Kwangsi. In the Quaternary period another large primate, the fossil orang-utan (*Pongo* sp.) spread all over the regions of the present day Kwangsi, Kwangtung, and Yunnan and had somewhat larger body size. But it did not live as north as Szechwan and Hupeh, or about 30°N. Entering the Holocene, it retreated as south as Sumatra and Malaya and disappeared entirely in Kwangsi.

The golden monkey (*Rhinopithecus*) is now living in South China from Kwangsi (22°N) to the Tsinling Range (33°N). Its Quaternary form had more or less the same geographical distribution. The small monkey (*Macaca* sp.) has a wide distribution at present and lives as north as Hopeh Province (Tungling or about 40°N). The fossil macaque of Quaternary time had almost the same geographical distribution as at present. It never went as north as our northeastern provinces (or north of 42°N).

The present geographical distribution of the tapir (*Tapirus*) is somewhat similar to that of the orang-utan as mentioned above, but during Quaternary time, it lived as north as Szechwan and Hupeh Provinces (or about 31°N). The modern forms are now inhabited in the southern part of the Southeast Asia.

Fossil *Rhinoceros* of Quaternary time occurs everywhere in China. Its southern species is generally determined as *Rh. sinensis.* However, recently the teeth of *Rh. sinensis* found in Hupeh caves have a quite modern appearance, as they contain still plenty of organic matter. According to the Chinese literature, *Rhinoceros* was hunted by the Chinese in the time of Warring States or about 500 B. C. (Chang, 1926).

According to the record of Chinese history the elephant existed also as late as about 500 B. C. in the districts along the Yangtze (Chang, 1926). At the

present time its presence is restricted to a small area in the southernmost part of Yunnan.

Elephant remains of the Quaternary period have been recorded from nearly all the provinces south of the Yangtze, but most of these fossils are identified as *Elephas namadicus,* an extinct species of Indian provenance. It seems to the present author that many of the fossil elephants of Kwangsi caves as well as those found in the other provinces south of the Yangtze, are practically indistinguishable from the living Indian species, *E. maximus.*

The geographical distribution of the giant panda is also very interesting to note. In the Middle Pleistocene it was flourishing in Southeast Asia, including not only all the provinces south of the Yangtze in China, but also Burma and Vietnam. In the Late Pleistocene it was restricted to certain isolated areas possibly in Szechwan and Kwangsi, and in the Neolithic time it was limited to a few small patches, such as those at Laiping of Kwangsi. It seems that possibly only up to the time of inscription in Chinese history it became perished in all the small patches and only a small group of it sought refuge in the western part of Szechwan, probably owing to the increasing influence of the human activity.

VI. General Conclusions

Since the Liberation in 1949 the studies of vertebrate palaeontology have made a rapid progress. From many new localities in the provinces south of the Yangtze, Quaternary fossil mammals have been collected. By the new knowledge and the present investigation of the Quaternary mammals from Kwangsi, it is possible for us to have some general ideas relating to the Quaternary mammalian fauna from the South China caves, which can be summarized as follows:

(1) During the entire Quaternary times the *Stegodon-Ailuropoda* fauna was flourishing in the whole area south of the Yangtze. By the present study of a large quantity of materials and of some characteristic fossils, we can differentiate this interesting fauna into three different stages or zones: the Early, the Middle, and the Late Pleistocene.

(2) Because in the Early Pleistocene fauna there are certain characteristic members, such as *Gigantopithecus,* and archaic forms such as *Trilophodon* and *Stegodon,* the present author agrees with Chow in naming the special fauna known in the Liucheng *Gigantopithecus* cave "the *Gigantopithecus* fauna". The faunas in the Middle and the Late Pleistocene have practically the same animal forms, with the only exception that in the Late Pleistocene we may expect to find fossils of *Homo* sp. or *Homo sapiens.* As to the fauna in the Middle Pleistocene the name *Stegodon-Ailuropoda* fauna may be inherited, but we may call it the typical fauna or the fauna *sensu stricto* in order to distinguish it from *Homo-Stegodon-Ailuropoda* fauna of Late Pleistocene.

(3) A considerable number of recent forms of mammals in the Early and the Middle Pleistocene appeared successively. The majority of them at the present day have migrated to the south, Vietnam and Malaya, while a smaller portion have retreated to the highlands of western China.

References

Allen, G. M. 1938 The mammals of China and Mongolia, *Natural History of Central Asia*, Vol. 11, pt. 1, New York, the American Museum of Natural History, pp. i-xxv, 1—620, pls. 1—9.

Bien, M. N. & Chia, L. P. 1938 Cave and rock-shelter deposits in Yunnan, *Bull. Geol. Soc. China*, **18**, 3—4, 325—347.

Colbert, E. H. 1935 Siwalik mammals in the American Museum of Natural History, *Trans. Amer. Phil. Soc.*, new ser., **26**, i-x, 1—401.

Colbert, E. H. & Hooijer, D. A. 1953 Pleistocene mammals from the limestone fissures of Szechwan, China, *Bull. Am. Mus. Nat. Hist.*, **102**, 1—134.

Chang, H. T. 1926 On the question of the existence of elephants and rhinoceros in North China in historical times, *Bull. Geol. Soc. China*, **5**, 99—105.

Erdbrink, D. P. 1953 A review of fossil and recent bears of the old world, *Deventer-Drukkerij Jan de Lange*, **1**, 1—320; **2**, 321—597.

Hooijer, D. A. 1947 On fossil and pre-historic remains of *Tapirus* from Java, Sumatra and China, *Zool. Meded. Mus. Leiden*, **27**, 253—299, pls. 1—2.

———— 1948 Pre-historic teeth of man and of orang-utan from central Sumatra, with notes on the fossil orang-utan from Java and Southern China, *Zool. Med. Museum Leiden*, **29**, 175—301.

———— 1949 Mammalian evolution in the Quaternary of southern and eastern Asia, *Compte-Rendu XIII^e Congr. Internatl. Zool. Paris* (1948), 507—511; 1951 *Evolution*, **3**, 125—128.

Koenigswald, G. H. R. von 1935 Eine fossile Säugetierfauna mit *Simia* aus Südchina, *Proc. K. Nederlandsche Akad. Wetensch.*, (8), 872—879.

Matthew, W. D. & Granger, W. 1923 New fossil mammals from the Pliocene of Szechuan, China, *Bull. Amer. Mus. Nat. Hist.*, **48**, 563—598.

Pei, Wen-chung 1935 Fossil mammals from the Kwangsi caves. *Bull. Geol. Soc. China*, **14**(3), 413—425.

———— 1940 Note on a collection of mammal fossils from Tanyang in Kiangsu Province, *Ibid.*, **19**, 379—392.

———— 1957 Discovery of lower jaws of giant ape in Kwangsi, South China, *Science Record*, new ser. **1**, 49—52.

———— 1957 Discovery of *Gigantopithecus* mandibles and other materials in Liucheng district of central Kwangsi in South China, *Vertebrata Palasiatica*, **1** (2).

———— 1961 Fossil mammals of Early Pleistocene age from Yuanmo (Ma-Kai) of Yunnan, *Vertebrata Palasiatica*, (1), 16—30.

———— 1962a Excavation of the *Gigantopithecus* caves and exploration of other caves in Kwangsi (mss.).

———— 1962b Quaternary carnivores from Liucheng *Gigantopithecus* cave and other caves in Kwangsi (mss.).

Pei, Wen-chung & Li, Yiu-heng 1958 Discovery of a third mandible of *Gigantopithecus* in Liucheng, Kwangsi, South China, *Vertebrata Palasiatica*, **2**, 198—200.

Pei, Wen-chung & Woo, Ju-kang 1956 New materials of *Gigantopithecus* teeth from South China. *Acta Palaeontologica Sinica*, **4**, 489—490.

Teilhard de Chardin, P., Young, C. C., Pei, W. C. & Chang, H. C. 1935 On the Cenozoic formations of Kwangsi and Kwangtung, *Bull. Geol. Soc. China*, **14**, 179—205, pls. 1—2.

Teilhard de Chardin, P., & Piveteau, J. 1930 Les mammiferes fossiles de Nihowan (Chine), *Ann. de Paleont.*, **19**, 1—134, pls. 1—23.

Woo, Ju-kang 1960 New discoveries of palaeoanthropology in China, *Science Record*, new ser. **4**(2), 120—125.

———— 1962 *Gigantopithecus* and its phylogenetic significance, *Scientia Sinica*, **11**(3), 391—396.

Young, C. C. 1929 Notes on the mammalian remains from Kwangsi, *Bull. Geol. Soc. China*, **8**, 125—128.

———— 1939 New fossils from Wanhsien (Szechwan), *ibid.*, **19**, 317—331.