

**Mammalian Fossils from Early Pleistocene Cave Deposits
of Yanshan Mountain, Peking Vicinity**

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Abstract

Publications on fossil mammals from caves in the Yanshan Mountain region have appeared continuously for the past 30 years. Most of the assemblages, however, consist of Middle Pleistocene, Late Pleistocene, or Holocene material, as there is a paucity of slightly older localities in this region. The discovery of the Longya Cave mammalian fauna at Huangkan Commune in the Yanshan Mountains is the third cave deposit locality found since the 1938 report on Locality 12 at Choukoutien (Zhoukoudian). Despite the small amount of fossil data, this assemblage supplements the knowledge of Quaternary cave depositional sequences and mammalian faunal evolution of the Yanshan Mountain vicinity neighboring Peking.

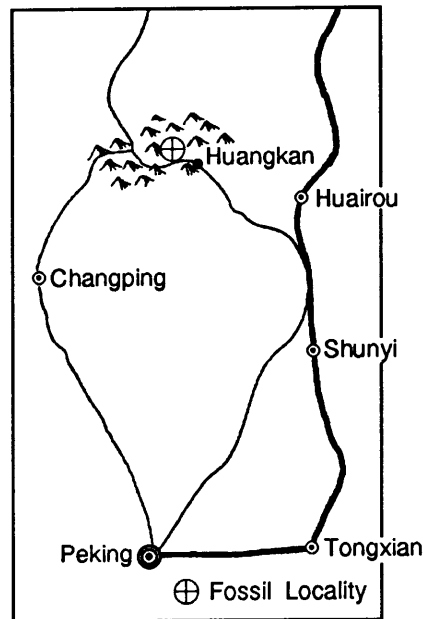


Figure 1. The location of Longya Cave

1. A Synopsis of Cave Deposition and Former Discoveries

Longya Cave is located approximately five kilometers west of Huangkan Commune in Huairou County, approximately 25 miles north of Peking (Figure 1). It was discovered by a commune member in the Spring of 1979 during the mining of limestone. Subsequent to the transferral of the news, comrade Fangji Chen from the initial Peking Hydrologic Survey conducted a local investigation. Soon afterwards, the authors of this paper conducted excavations in the cave with Yuzhu Long, Moya Shi, and Yi Li, when several fossil mammals were collected.

Longya Cave is eroded out of Ordovician limestone, with eight depositional events recognized. The cross-section of the west wall of the excavation is displayed in Fig. 2 as follows:

8. Unfossiliferous yellow sandy soil with calcareous cement.....1-1.5m
7. Unfossiliferous light yellow calcareous sandy mudstone..... 15cm
6. Fossiliferous calcareously cemented yellow sandy soil..... 30cm
5. Thinly laminated microcrystalline calcite.....15 cm

4. Fossiliferous calcareously cemented angular gravels in a sandy mudstone..... 10-15cm
3. Unfossiliferous light yellow calcareous mudstones bearing microcrystalline calcite.
Thinly laminated and conforms to the morphology of the cave floor..... 10-15cm
2. Thinly laminated microcrystalline calcite..... 15cm
1. Calcareously cemented yellow-red sandy mudstones and angular gravels40 cm

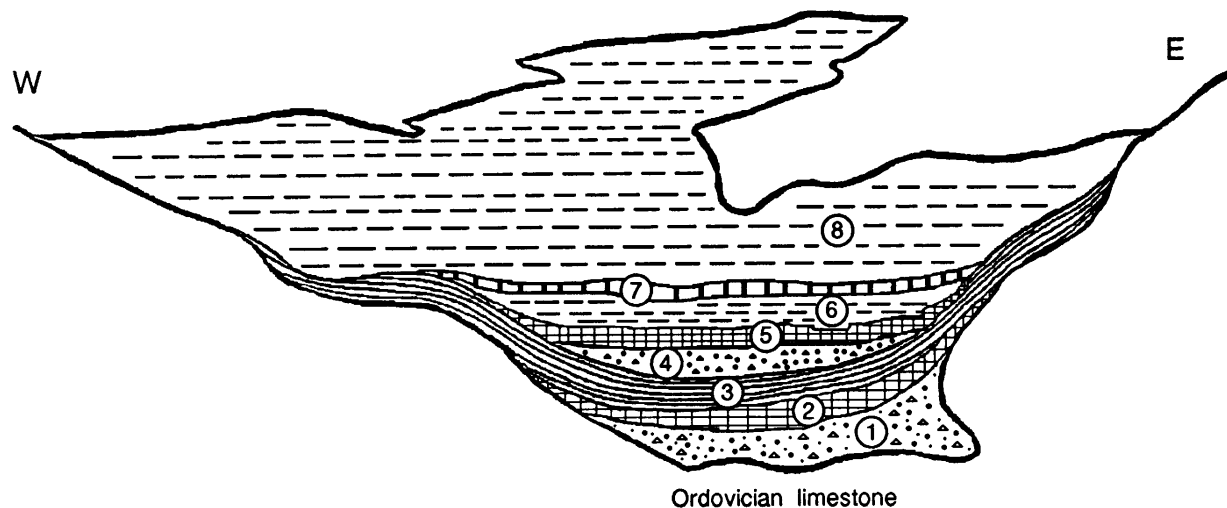


Figure 2. Cross-section of Longya Cave

2. Fossil Mammals

Hyperacrius yenshanensis sp. nov.
Arvicola terrae-rubrae Teilhard
Prosiphneus youngi Teilhard
Hystrix lagrelii Lonnberg
Hyaena sp.
Ursus sp.

Dicerorhinus sp.
Equus sanmeniensis Teilhard and Piveteau
Gazella sp.
Cervus sp.
 Bovidae gen. and sp. indet.

A description of relatively well-preserved material of biostratigraphic significance is undertaken below.

Hyperacrius yenshanensis sp. nov.

Material: A broken left mandible with an M_1 (V6192; Plate I, Fig. 4)

Diagnosis: Three rounded and non confluent salient angles lie between the anterior and posterior loops. Tooth roots are absent, as are accessory reentrant folds (Fig. 3).

Description and discussion: The first salient angle is perpendicular to the long axis of the M_1 . The second and third salient angles are obliquely inclined to form parallelograms. The angles are sharply pointed, with their degree of breadth equivalent to their length. These characters are consistent with the Genus *Hyperacrius*.

Specimen V6192 displays an anterior loop lacking any labial accessory reentrants. The posterior margin of the posterior loop is flat and straight. A thin band of cementum lies within the reentrant folds. The crown length is 2.6 mm; breadth is 1.1 mm; and height is 2.8 mm.

The genus *Hyperacrius* is principally distributed in the mountains of Kashmir and this paper constitutes the first record of the taxon in China. The specimen is differentiated from *H. wynnei* by its lack of anterolabial accessory folds. Compared to *Pitymys* from Longyadong Cave there are even greater differences, whereas *P. simplicidens* from Choukoutien Locality 3 possesses five salient angles, the Longya Cave specimen only maintains three. Based upon these features, the Longya Cave specimen is assigned to *Hyperacrius*. Careful consideration to the differences between it and *H. wynnei* suggest it should be erected as the new species *Hyperacrius yenshanensis* sp. nov., with the species etymology derived from its type locality.

Arvicola terrae-rubrae Teilhard

Material: Right mandible with a broken incisor and lacking the section posterior to the M₃, and bearing only the M₁-M₂ (V6193; Plate I, Fig. 3).

Description and comparison: Specimen V6193 displays an M₁ with three obliquely inclined and nonconfluent salient angles of equivalent size between the anterior and posterior loops. Reentrant folds are open to the base of the crown with cementum filling. The M₂ displays two nonconfluent salient angles with cementum also infilling the reentrant folds. These characters conform to *A. terrae-rubrae* from Choukoutien Locality 18 (Huiyu). The specimen from Longya Cave displays distinct tooth roots, but as the specimen from Locality 18 has been lost, a comparison or determination of whether it maintained roots is not possible. Recent workers have synonymized *Arvicola* with *Mimomys* on based on the presence of tooth roots.

Measurements of *Arvicola terrae-rubrae* Teilhard (mm)

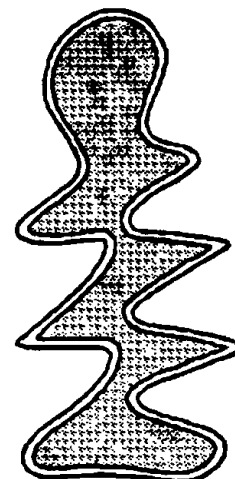
	Longya Cave	Choukoutien Loc. 18
M ₁ -M ₃ Length	4.7	4.7
M ₁ Length	3.5/1.3	-
M ₁ Width	1.2/1.1	-

Prosiphneus youngi Teilhard

Material: Right and left mandibles (V6194, 6195; Plate I,5).

Description and comparison: The degree of occlusal wear on each specimen differs, with one deeply worn and the other slightly worn. Obviously, these belong to two different individuals. There is a slight curvature of the tooth crown, tooth roots are straight, salient angles are rounded, and reentrant grooves are open to the base.

P. youngi was first described by Teilhard (1940). Subsequently new material has been continuously discovered, with the specimens of this text consistent with the diagnosis for the species. This constitutes the third Early Pleistocene cave deposit locality found in North China that contains *Prosiphneus*.



1mm
Figure 3.
Hyperacrius
yenshanensis sp.
 nov. Occlusal
 view of right M₁

Measurements and comparison of *Prosiphneus youngi* Teilhard (mm)

	Longya Cave, Huangkan	Loc. 18 Choukoutien
M ₁ -M ₃ Length	9.0	9.0
M ₁ Length	3.8	3.5
M ₁ Width	2.5	2.4

Hystrix lagrelii Lonnberg

Material: A left mandible bearing M₁-M₃ (V6196), and a right mandible with P₄-M₂ (V6197; Plate I, Fig. 2).

Description and Comparison: The molars are small and oval in shape, but the P₄ is nearly circular. The M₁-M₃ maintain 2-4 long enamel loops. The labial reentrant folds are shallow. At the M₁ the height of the mandible is 19 mm and it is 13 mm thick.

Four species of *Hystrix* are recognized in China, *H. magna*, *H. lagrelii*, *H. subcristata*, and *H. hodgsoni*. The *H. lagrelii* of this text is distributed predominantly in North China. At Choukoutien it is recovered from localities 9 and 13. The specimens of this text differ from the other hystricids and *H. lagrelii* by being smaller and possessing smaller enamel loops.

Dicerorhinus sp.

Material: A mandible fragment with M₃ (V6198) and several isolated teeth

The dentition is hypsodont and lacks labial striations. On the upper molars the ectoloph is parallel to the protoloph, and it displays a relatively well-developed anterior cingulum. A crochet is well developed, but the antecrochet is absent. On the lower molars the anterior lobe is shorter than the posterior lobe. The anterior lobe is slightly quadrangular in shape, but the posterior lobe is nearly crescentic. These characters equate to *D. merckii* which is distributed throughout North China, however, due to the fragmentary and sparse nature of fossil specimens from Longya Cave, it is difficult to determine the species assignment with certainty.

Equus sanmeniensis Teilhard and Piveteau

Material: Two mandibular cheek teeth in a partial jaw (V6199).

Description and comparison: The sizes of the metaconid and metastylid on the P₂ are equivalent, with a "V" shaped configuration between the two nonconfluent lobes. The preflexid outline is flat and straight with the labial margin directed slightly toward the interior reentrant. The postflexid displays an anterolabial margin that is plicated. On the P₃ there is also a V shaped and nearly 90° configuration between the metaconid and the metastylid, both of which are confluent.

Conclusions

1. The earliest account of Pleistocene cave deposition in the neighboring Peking region of the Yanshan Mountains was made by Teilhard in 1938, when he described Locality 12 of Choukoutien. Later, in 1940, he conducted another description of Locality 18 of Choukoutien (Huiyu). The material from Longya Cave by Huangkan Commune, Huairou, is the first of this nature recovered in forty years and provides a supplemental increase in data for a thorough study of the Early Pleistocene cave history in North China, in addition to displaying the extensive geographic distribution of Early Pleistocene cave deposition.

2. After study of the Longya Cave mammalian fauna, 10 genera and 5 species are recognized, one species of which is new. This mammalian complex is generally consistent with those from Locality 18 of Choukoutien and Jiashiashan Mt., Tangshan, Hebei Province, as expressed by the following table

	Longya Cave Huairou	Loc. 18, Choukoutien Teilhard, 1940	Jiashiashan, Tangshan W.Z. Pei, 1930
<i>Hyperacrius yenshanensis</i> sp. nov	*	-	-
<i>Arvicola terrae-rubrae</i>	*	*	-
<i>Prosiphneus youngi</i>	*	*	*
<i>Hystrix lagrelii</i>	*	-	-
<i>Hyaena</i> sp.	*	*	*
<i>Ursus</i> sp.	*	-	*
<i>Dicerorhinus</i> sp.	*	-	-
<i>Equus sanmeniensis</i>	*	*	*
<i>Gazella</i> sp.	*	-	-
<i>Cervus</i> sp.	*	*	*

Additionally, a vast majority of taxa in Longya Cave are extinct species. The presence of *Prosiphneus* is a particular indicator that the age of these deposits at Longya, Huangkan, cannot be very late, and at the very least is equivalent to Locality 18 of Choukoutien. Furthermore, Longya Cave depositional conditions suggest its condition is also similar to that of Locality 18, whereas *H. yenshanensis* and *P. youngi* are both recovered from low stratigraphic positions, as in the lower deposits of Longya Cave.

3. The rodents and herbivorous mammals constitute a majority of the assemblage, with carnivores in a minority. This indicates a luxuriant and moist floral cover over a grassland plateau. *Hyperacrius* is a rodent adapted to frigid climate and is distributed in cold mountain elevations of 2500-3000 meters above sea-level. Whether or not the species of *Hyperacrius* in Longya Cave is an indicator of a climatic cold shift must await more advanced research.

Addendum

Two more fossil mammals have been recovered from caves in the Yanshan mountains neighboring Peking which warrant description.

1. A skull of *Meles leucurus* was recovered from deposits of Tienjiapan Cave, Haiding, Peking.

Material: A complete skull with mandibles BPV.250 (Peking Natural History Museum catalog number).

Description: The parietal and a portion of the occiput was damaged during excavation. The specimen is recognized as an adult but not an aged individual due to the shallow degree of dental wear, and the fusion of the cranial suture lines (Plate I, Figs. 1 and 6).

The skull is narrow and long, with a short oral region, and high and flat interorbital region. The suborbital fossa is moderate in size and situated beneath the anterior portion of the orbit. Its posterior margin is located anterior to the M¹. The orbit is nearly circular with its anterior margin situated above the main cusp of the M¹. The sagittal crest is well developed and a parietal crest is clearly noticeable. The posterior frontal is broad and flat, attenuating anteriorly to connect to the nasal.

Mandibles of this specimen are complete and undamaged. The mandibular body is short and low, with a ventral margin that is convex, thick, round, and glossy. The anterior end is formed in a “V” shape with a short symphysis. Three horizontally aligned mental foramina lie laterally along each of the mandibular bodies; the anterior and posterior foramina are large while the medial one is small. The anterior foramen is located beneath the P₂, while the posterior foramen is located beneath the anterior portion of the P₄. The coronoid process is high and nearly perpendicular to the body of the ramus. The angular process is relatively close to the articular process and also situated high. The left and right sides of the condylar process are extended in length. The posterior face maintains a rounded projection. The masseteric fossa is deep, and the inferior dental foramen is located beneath the articular process.

Three pairs of incisors are present, with the first and second pair small, and the third large. The upper canine is sharply pointed with a 3-4mm diastema separating the anterior margin of the canine from the third incisor. Only a short 2mm diastema separates the canine from the P². The P² tooth root is bifurcated, and the crown maintains a sharp anterolabial cusp and a relatively well-developed posterior cingulum. The crown of the P³ has been destroyed, but from the perspective of its cross-section it appears to be slightly larger than the P². The P⁴ is large, with a length equivalent to the P² and P³ added together. The labial side of the tooth crown is long, but the lingual side is short and stair-stepped in configuration. Four cusps are present, the second of which is prominent. The M¹ is rectangular with the lingual side longer than the labial side. The paracone is particularly well developed, being conical in shape. The metacone is smaller than the paracone. Conules are present posterior to the metacone and anterior to the protocone. The lingual cingulum erupts to form a crest-like feature. From a general perspective, the occlusal surface appears as an anterior-posteriorly directed complex of three crests.

Three pair of lower incisors are present, the morphology of which correspond to the upper incisors. The lower canine is recurved posteriorly, with a shallow groove present along the anterolingual side. The diastema between the canine and P₂ is small, and the P₂-M₂ tooth row is in tight alignment. The P₂-P₄ are unicuspid, with the P₄ the largest and the P₂ the smallest. All tooth roots are bifurcated. The trigonid and talonid basins on the M₁ are equivalent in size, with the protoconid higher than both the paraconid and metaconid. All three cusps are closely spaced to form a triangular configuration. The talonid is large and basin shaped with four to five individual cuspules upon its periphery that are mutually connected to form a crest. A cingulum is absent. The M₂ is small, nearly circular in shape, and maintains singular cusps approaching the lingual and labial sides of the tooth.

Comparison of cranial and dental measurements (mm)

	Tianjiapan <i>M. leucurus</i>	Loc. 3, Choukoutien (Pei, 1934) <i>M. leucurus</i>
Skull length	100.9	(C.1915) 119.1
C-M ¹ length	35.0	(C.1915) 39.0
Canine length/width	5.0/3.5	(C.1916) 6.0/5.0
P ² length/width	4.0/2.6	(C.1915) 4.0/3.0
P ³ length/width	4.0/2.9	(C.1915) 5.6/3.6
P ⁴ length/width	8.0/6.1	(C.1915) 9.5/7.0
M ¹ length/width	10.5/9.5	(C.1915) 14.5/10.8

Comparison of mandible and dentition (mm)

	Tianjiapan <i>M. leucurus</i>	Loc. 3, Choukoutien (Pei, 1934) <i>M. leucurus</i>
Mandibular length	71.0	(C.1915) 80.0
Height of mandible at P ₄	12.3	-
I ₁ -M ₂ length/width	42.0	(C.1915) 49.9
P ₁ length/width	5.7/4.0	(C.1915) 8.0/6.3
P ₂ length/width	4.0/2.3	(C.1915) 3.5/2.2
P ₃ length/width	5.0/2.8	(C.1915) 5.0/3.0
P ₄ length/width	5.7/3.1	(C.1915) 6.8/3.6
M ₁ length/width	13.2/5.8	(C.1915) 15.8/7.5
M ₂ length/width	4.5/4.7	(C.1915) 5.5/5.5

Comparison and Discussion: The Tianjiapan specimen is distinguished from *Melogale moschata* by size ratio, cranial structure, and the rather different temporal crest. It is distinct from *Arctonyx collaris* in characters including the short oral region, and high flat and smooth interorbital region. At the specific level, this specimen differs from *Meles chiai* in its smaller size, a short P⁴, and the flat and vertical anterior section of the second cusp. Due to the extreme proximity in size and morphology to *M. leucurus* the Tianjiapan specimen is assigned as such. The genus *Meles* is distributed in North China, dwelling in caves, in dense forest habitats, and thick shrublands. Moreover, as their remains are easily preserved in caves, exceptional fossil material may be recovered from the Pleistocene to the Holocene. This condition facilitates the recognition of stratigraphic sequences in cave sediments in addition to research upon faunas.

2. A palate of *Nyctereutes sinensis* has been recovered from a rock quarry fissure deposit at Siliqing Commune, Haidian.

Material: An anterior portion of maxilla with C-M² (BPV.251; Pl. I, Fig. 7).

Description: Oral region narrow, suborbital foramen small and located 15mm beneath the orbit. The suture lines between the nasals and maxillae are essentially fused, and the dentition has undergone light occlusal wear, suggesting the specimen is a juvenile.

The left side of the dentition is preserved best. The canine is laterally compressed and recurved ventroposteriorly. The P¹ is small with a sharp cusp and a single root. The P² is large, approximately twice the size of the P¹, with a conically shaped single cusp and two roots. The P³ is slightly larger than the P² but maintains a consistent morphology. The P⁴ has a well-developed protocone that connects with the metacone to form a sharp carnassial. The paracone is small with a second conically shaped cusp. The length of the P⁴ is less than the combined lengths of the M¹ and M². A well-developed lingual cingulum is present. The morphology of the M¹ is an acute triangle. The two principle labial cusps (paracone and metacone) are large, while the two principle lingual cusps (protocone and hypocone) are small. A well-developed cingulum is present both lingual and labially, but is most pronounced lingually. The M² is smaller than the M¹. The protocone, paracone, and metacone are relatively well developed, and a cingulum is also present lingual and labially.

Comparison and discussion: Observations and measurements indicate that specimen BPV.251 displays discrepancies with *N. sinensis* from Locality 1 of Choukoutien, including the labial side of the M² being longer and the tooth cusps being less well developed. Despite these differences the Haidian specimen is still regarded as conspecific as the discrepancies fall within the expected range of variation. Measurements and comparisons are as follows:

Comparison of palate and dentition (mm)

	Sijiqing Caishichang check <i>N. sinensis</i>	Loc. 1, Choukoutien (Pei, 1934) <i>N. sinensis</i>
C-M ² length	55.9	-
M ¹ - M ² length	16.4	(C.1275) 17.3
Canine length/width	5.5/3.9	-
P ₁ length/width	3.0/2.0	-
P ₂ length/width	6.2/2.4	-
P ₃ length/width	7.5/3.0	-
P ₄ length/width	12.4/6.5	14.0/7.2
M ₁ length/width	9.6/11.0	10.4/11.4
M ₂ length/width	6.8/7.0	7.3/8.3

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