Some Pliocene Mammalian Fossils from Songshan 2 and 3 (Tianzhu, Gansu) and the Songshan Fauna

by

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Abstract

The description of material in this text from Localities 80007 and 80008 of Songshan is a continuation of the paleontological documentation of this region. A third collection of material is described subsequent to the first locality (80006) and the second locality (80007). A relatively detailed description is conducted on taxa including *Chilotherium tianzhuense* sp. nov., the rare *Percrocuta gigantea*, *Indarctos atticus*, *Chalicotherium* sp., and others. A taxonomic list from these localities is also presented (containing 5 orders, 17 families, 27 genera, and 33 species and subspecies). A brief discussion is conducted regarding the age of the Tianzhu fauna and its associated paleoecology.

Introduction

The material described in this text represents a continuation of reports on the third collection of fossil mammals subsequent to the rodents and lagomorphs from Locality 1 (80006) and Locality 2 (80007). In addition to the small mammals from Locality 3 (80008), there are important faunal elements acquired from a Songshan drug store. Because this material was produced from two neighboring localities in close proximity, these specimens supplement comprehension of the Tianzhu Pliocene* mammalian assemblage. Based upon the preservation of the specimens, the two localities may be distinguished as representing two taphonomic conditions. Locality 2 is predominantly a calcareous concretionary unit with specimens generally being white. Locality 3 is composed of red clays, with the color of the specimens black. The geographic position of Locality 3 is lat. 3657"37" N, long. 103 16'46" E, at Yingpanju, Nanshanpuo, at an elevation of 2660m (7980 ft).

Description of Specimens

Rodentia

Prosiphneus licenti tianzhuensis Zheng and Li, 1982

Material: Two right m1 (V6404.1, V6404 2) and one right M1 (V6404.3).

Prosiphneus sinensis Teilhard and Young, 1931

Material: One left m1 (V6405.1), one right m1 (V6405.2), one left m2 (V6405.3), and one right M1 (V6405 4).

Castoridae gen. et sp. indet.

Material: A single distal piece of incisor (V6406) only represents the presence of this family.

Lagomorpha

Ochotona lagrelii minor Bohlin, 1942

Material: One left ramus containing p3-m3 (V6407 1) and three isolated p3 (V6407 2,3,4).

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* Age is now regarded Upper Miocene (WD).

Carnivora

Ictitherium hipparionum hyaenoides (Zdansky, 1924)

Material: includes one left P4 M1 (V6408.1) and one right P4 (V6408.2), one left m1 (V6408.3), and four right P3 (V6408.4,5,6,7).

Table 1. Dental measurements of *Ictitherium hipparionum hyaenoides* (Zdansky, 1924) (mm)

	P3	P4	M1	m1
Length	17.5-18.2	26.5-27.0	7.8	23.0
Width	9.0-9.9	14.2	15.3	10.8

Adcrocuta eximia variabilis (Zdansky, 1924)

Material: one left P2 (V6409.1); three right P2 (V6409.2,3,4); one left P3 (V6409.5); three right P3 (V6409.6,7,8); two right P4 (V6409.9,10); two left p3 (V6409.12,13), one left p4 (V6409.14); one right p4 (V4609.15); and one right m1 (V4609.16).

Table 2. Dental measurements of *Adcrocuta eximia variabilis* (Zdansky, 1924) (mm).

		P2	P3	P4	p3	p4	m1
Count		4	4	3	2	2	1
Length	Max.	18.0	21.0	39.0	20.2	22.9	
	Mean	17.7	20.0	27.3	19.9	22.0	29.3
	Min.	17.3	19.3	35.4	19.5	21.1	
Width	Max.	12.2	14.4	16.5	13.3	13.1	
	Mean	11.9	13.6	16.3	12.9	13.0	13.4
	Min.	11.6	12.5	16.0	12.5	12.9	

Referring to the size and morphological characters of *Adcrocuta eximia variabilis* described by Zdansky (1924), variation in size appears as presented in Table 2, such that it may encompass *A. henanensis* (Pei 1934; Kurten 1957). This species was first considered to lie belong to the genus *Hyaena*. In 1931 Pilgrim reassigned it to the genus *Crocuta*. Kurten (1957) erected it as a subspecies based only upon the minute dental differences between this species and the European *Crocuta eximia*, and began applying the subgenus designation *Crocuta* (*Percrocuta*) initiated by Kretzoi (1938). Schmidt Kittler (1976) also adopted the nomenclature of *Adcrocuta* Kretzoi (1938) based upon *C.* (*Percrocuta*) *eximia.* Zhanxiang Qiu (1979) initially adopted the concept of a Chinese species, or a local species of the European taxon. This is the nomenclature adopted here.

Percrocuta (*Dinocrocuta*) *gigantea* (Schlosser, 1903)

(Plate I fig. 1,1a)

Represented by a section of left mandible containing the p2-p4 (V6410); the p2 crown is quadrilateral with the anterior section more narrow than the posterior section. An anterior cusp is absent but there is a conspicuous anterior cingulum and shallow anterior angle. The posterior cusp

appears in the form of a vertical ridge and a posterior cingulum is not very well developed. The p3 is also quadrilateral in form, however, the anterior section is relatively broader. It maintains a conical shaped anterior cusp equivalent in size to the posterior cusp of the p2. The posterior cusp is broken but there is a well developed posterior cingulum on the posterior lingual side. There is an approximate 150° obtuse angle between the p3 and p4. The p4 is narrower than both the p2 and p3 with an anterior cusp larger than the posterior cusp and both appearing as vertical ridges. The labial morphology of the molar is precociously trifoliate. There exists a relatively expansive region on the lingual side of the posterior cusp with an extremely well developed cingulum at its posterior side. This taxon exceeds the size of all other known fossil hyaenids as well as extant species. Specimens are extremely rare and to date, a precise locality and understanding of its exact stratigraphic position is unknown. Unfortunately the specimens from Tianzhu are inadequate with respect to solving this difficulty. Schlosser (1903) erected this genus on the basis of several fragmentary teeth (these specimens are currently housed in the Institute of Paleontology and Historical Geology, Munich, West Germany). With regard to other related material, Kurten (1957) cited Chinese specimens in a collection of G.H.R. von Koenigswald that includes a P3, p3 and m1 (currently housed in Utrecht, Holland). A single m1 is also housed in the British Museum (Natural History). The current author described a mandible collected from the Bulong Basin, Tibet, (Zheng, 1980) maintaining a canine and the first and second premolar that have well developed anterior and posterior cusps, equivalent lengths of the p2 and p3, and the p4 and m1 correspondingly narrow. However, because of such characters as being a small individual, the cingulum being not well developed, and the presence of a single cusped talonid basin, it was considered a justifiable subspecies. It is also appropriate to note here that the nomenclature of the prior literature should be amended to conform to the nomenclature of this text.

Table 3. Dental measurements of *Percrocuta* (*Dinocrocuta*) *gigantea* (Schlosser, 1903) (mm)

	p2		p3		p4	
	L	W	L	W	L	W
Tianzhu	29.2	19.1	30.5	21.3	34.3	18.4
Schlosser	24.0?	17.5	28.0	19.0	34.0	19.0
Kurten			28.0-28.3	19.3-19.5		
Bulong	25,5	16.0	25.5	17.5	30.5	17.5

Machairodus sp.

Specimens include a section of upper canine (V6412.1). The length at the base is approximately 35 mm and width 15.5 mm. There is also one right DP3 (V6412.2) with a length of 24.5 and width of 9.9 mm.

***Indarctos atticus lagrelii* (Zdansky, 1924)**

Material: One right M2 (V6413.1), one left m/1 (V6413.2), one left m2 (V6413.3), and one left m3 (V6413.4) which may represent a single individual.

Description: The Tianzhu specimens are assigned to *I. lagrelii*, a small individual described by Zdansky (1924). Particularly notable is the general consistency of the m2 trigonid/talonid ratio (7:5) which differs from that of the large species *I. sinensis*, with a ratio of 1:1. There are differing hypotheses regarding the relationships of the two species of *Indarctos* in China. Pilgrim (1931) chose to use recognize *I. lagrelii*, but Erdbrink (1953) believed there were sufficient differences to describe two species. Tobien (1955) believed certain characters of the two species, such as the style lying between the protoconid and hypoconid in the m1, corresponded to *I. arctoides* from Samos, Greece, whereupon he erected the *I. arctoides* complex. Kurten (1952) initially recognized both species, but later, based upon sexual dimorphic characters in other species

of ursids, and particularly upon the close proximity of the fossil localities, decided the differences were due to sexual dimorphism. The small form represented the female and the large form the male. He moreover regarded them as a subspecies of the European taxon *I. ponticus*. Thenius (1959) agreed with Kurten's sexual dimorphic hypothesis, but disagreed with the taxonomic assignment to the *arctoides* clade, regarding it as a subspecies of *I. atticus.* Thus, the specimens from Wenquan, Xinjiang (Li and Qi 1964) and those from Ningxian, Gansu* should be considered male individuals, while the Tianzhu specimens should be considered female individuals.

Perissodactyla
Chalicotherium sp.

(Plate I, Fig. 2,3)

Material: One left M2(?) with a damaged protoloph and paracone (V6414 1), one-third of a posterior right M3(?) (V6414 2), and one left DP1-DP3 (V6415).

Description: The molars are square and brachydont with the labial side higher than the lingual side. The ectoloph is sinuous and exceeds the long axis of the tooth to descend abruptly to the base of the molar at the lingual side. There is a robust mesostyle, but a metastyle is absent. Well developed ribbing occurs on the lingual side of the metacone. There is a small spur projected off the lingual side of the ectoloph that is directed toward the medifossette. The hypocone is thin, narrow, and is directly connected to the metaloph. The protocone is conical and isolated. There is a well developed cingulum at the base of the labial side. The M2(?) width is 41.7 mm, and the M3(?) is 44 mm. The DP1-3 are deeply worn and the permanent molars have begun to erupt. The DP1 is triangular. The protocone is small and loph shaped but not connected to the protoloph. The hypocone is large. The anterior and posterior curvature of the ectoloph is not well developed. Molar length is 13.8 mm and width is 14.4 mm. The DP2 is quadrilateral with a relatively more observable anterior and posterior curving ectoloph. The molar length is 18.3 mm and width is 21.3 mm. DP3 initiates molariform morphology on the dentition with a length of 25.3 mm. The DP1-3 has a length of 55.6 mm. All three premolars maintain three roots. Judging from the condition of the erupting permanent molars, this species of chalicothere will have lost the P1 upon maturity.

Chilotherium (*Acerorhinus*) *tianzhuensis* sp. nov.

(Plate I, Figs. 5, 6; Plate II, Fig. 1)

Type: One damaged maxilla containing left and right P2-M2 (V6416).

Paratype: One left M3 (V6417).

Hypodigm: One right P2-P4 (V6418.1), one left P4-M1 (V6418.2), one right M1-M2 (V6418.3), one left DP2 (V6418.4), one left DP2-DP4 (V6418.5), one right DP1 (V6418.6), two left M1 (V6418.7,8), one left M2 (V6418.9), two right P3 (V6418.10,11), one left P3 (V6418.12), one left P4 (V6418.13), and one right P4 (V6418.14).

Diagnosis: The protocone is more robust than the hypocone, the protoloph is longer than the metaloph, and there is a deep anterior protocone fold. The lingual cingulum on the premolars is not continuous; a well developed crochet and antecrochet surround the medifossette and there is a secondary inflection within this fossette. The molars lack a lingual cingulum but maintain an

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* Zheng, S.H. (in preparation); A Plio-Pleistocene mammalian fauna from Ningxian Co., Gansu Province.

antecrochet that is even with the ectoloph. The M3 maintains a flat and thin triangular shaped talon basin, and the lengths of the protoloph and ectoloph are equivalent. The length of the DP1-DP4 is equivalent to the length of the M1-M3.

Description: DP1: This molar is relatively brachydont, maintaining a weak protoloph, strong antecrochet, and lacking a crochet. The metaloph is correspondingly well developed with a large and deep postfossette. There are two roots.

DP2: The parastyle is strong with a broad and shallow parastyle fold. There is conspicuous ribbing on the metacone. The protocone and hypocone faces are reduced and the hypocone is relatively weak. The lingual wall of the anterior fold on the hypocone intersects the posterior fold of the protocone. The crochet is long, flat, and level with the ectoloph and there is a crista descended from the ectoloph and intersecting the medifossette. There is a well developed secondary inflection within this fossette. The anterior, lingual, and posterior cingula are connected.

DP3: Aside from a relatively narrow and deep anterostyle fold and relatively weak lingual cingulum, this premolar is similar to the DP2.

DP4: There is a relatively spacious entosinus, the lingual cingulum is nearly lost, the metacone lacks conspicuous ribbing, and the secondary inflections within the medifossette are weak.

P2: The anterostyle is projected with a weak anterostyle fold. The degree of protocone reduction is weaker than on the teeth succeeding it. The protoloph is shorter than the metaloph. The crochet and crista are well developed to form a medifossette. An antecrochet is absent.

P3 and P4: There is a well developed parastyle fold and paracone ribbing. The protocone is larger than the hypocone but still strongly reduced. The anterior fold of the protocone is large and deep, which together with the anterior cingulum unites to form an accessory fossette. The protoloph is much longer than the metaloph. There is a well-developed crochet and crista, and some specimens possess a secondary crista. Within the fossette are inflections of varying degrees. The lingual cingulum breaks open at the protocone and forms a thin wall at the mouth of the entosinus. There is a high and broad bridge connecting the protocone and hypocone.

M2 and M2: The labial wall is slightly elongated. The anterostyle fold is relatively conspicuous. The crochet and antecrochet are short, thick, level with the ectoloph, and additionally block the entosinus. The protoloph is longer than the metaloph, both being at equivalent levels and both perpendicular to the ectoloph. The crista and lingual cingulum have become lost.

M3: The anterostyle fold is relatively weak. The crochet is relatively strong but does not come in direct contact with the protoloph. The crista is flat and thin but does not connect with the crochet to form a medifossette. The lengths of the protoloph and ectoloph are generally consistent. There is a flat and thin talon that is triangular in shape. The boundary between the ectoloph and metaloph is manifested by the appearance of a thin and weak angle.

Comparison: The Tianzhu specimens share certain dental characters with "*Chilotherium*" *xizangensis* (Ji et al. 1980) from Jilong, Tibet and *C.* (*Acerorhinus*) *cornutum* (Qiu and Yan 1982) from the Yushe I Zone of Shanxi. These characters include molariform premolars, extremely well-developed crochet and crista that unite to form a medifossette, labial wall of the molars slightly extended, a relatively weak parastyle and parastyle fold, protoloph and metaloph perpendicular to the ectoloph, a robust crochet and antecrochet that are level with the ectoloph, M3 with a generally equivalent protoloph and ectoloph length, and a flat and thin triangular-shaped talon.

K. Heissig reevaluated the species of *Chilotherium* in 1975, distinguishing and assigning them to three genera: *Aprotodon, Chilotherium,* and *Hispanotherium*. He also distinguished three subgenera of *Chilotherium*: *Ch.* (*Chilotherium*), *Ch.* (*Acerorhinus*), and *Ch.* (*Subchilotherium*). He also preserved the species names of *Diceratherium palaeosinense, Aceratherium hipparionum,* and *Diceratherium tsaidamense,* but placed them in the subgenus *Ch.* (*Acerorhinus*). *Ch. habereri laticeps* and *Ch. planifrons* were synonymized with the species *Ch. anderssoni.*. While *Ch. gracile,* and *Ch. wimani* were synonymized with *Ch. habereri,* and together with the genus *Rhinoceros brancoi* were placed into the subgenus *Ch.* (*Chilotherium*). *Diceratherium palaeosinense* var. *minus* was assigned to the species *Ch. intermedium* and together with *Rhinoceros pygmaeus* were placed in the subgenus *Ch.* (*Subchilotherium*).

Ch. (*Acerorhinus*) from the Yushe I Zone is possibly a horned subgenus (Qiu and Yan 1982); as indicated by the aforementioned characters, the Tianzhu specimens and Tibetan specimens should also be included into this subgenus.

Compared to *Ch.* (*A.*) *cornutum* the DP1-P4 length of the Tianzhu specimens and Tibetan specimens are equivalent but not smaller than the M1-M3 tooth row length as found in the Yushe specimens (see Table 5). The lingual cingulum of the premolars on the Tianzhu specimens is not continuous, while it is continuous on the Yushe specimens. The Tianzhu specimens maintain a protocone larger than the hypocone with a deep anterior protocone fold, but the Yushe species is correspondingly relatively small with a shallow anterior protocone fold. The Tianzhu specimens display more well-developed secondary inflections with the premolar fossettes than the Yushe species.

Ch. (*A*).*xizangensis* is a small individual with a DP1-P4 length smaller than the M1-M3 length. The premolars maintain a continuous lingual cingulum and lack well-developed secondary inflections.

Ch. (*A*) *tsaidamense* maintains an unreduced premolar protocone with a weak crochet and undeveloped crista. The M3 has relatively well-pronounced paracone ribbing and a broad parastyle fold. The DP1-P4 length is smaller than the M1-M3 length.

Ch. (*A.*)*palaeosinense* has slightly broadened premolars, the protocone is not strongly reduced, the lingual cingulum is well developed and united, and there is an isolated enamel pillar at the mouth of the medisinus. The DP1-P4 length is longer than the M1-M3 length.

Ch (*A.*) *hipparionum* material consists of several isolated teeth. The lingual cingulum on the upper premolars is united and well developed. The protocone is strongly reduced. *Ch.*(*A.*) *zernowi* has a well-developed cingulum on the upper molars, the protocone fold and hypocone fold are slightly weak, but the paracone ribbing and parastyle fold are very conspicuous.

Table 5. *Ch.* (*Acerorhinus*) comparative dental measurements (mm).

	DP1-M3	DP1-P4	M1-M3	DP1-P4/ M1-M3 x 100
Ch. (A) tianzhuense sp. nov.	241	120	120	100
Ch. (A) cornutum	250	120	137	87.6
Ch. (A) palaeosinense	240-246	126-130	124-128	101.6
Ch. (A) tsaidamense	237-254	123-130	125-138	94.2-98.4
Ch. (A) xizangensis	197(?)	92(?)	106	86.8(?)

Discussion: As stated above, shared characters between the Tianzhu species, the Yushe species, and the Jilong species are noted; however, even though the skull of the Tianzhu species is

not known, it maintains genuinely valid individual characters. Moreover, a consideration of the extreme geographic distances between the three localities warrants the establishment of a new species. If complete skulls are excavated in the future that would display consistent diagnostic characters with the Yushe species, the possibility would then exist for the synonymy of these three species.

Chilotherium (*Chilotherium*) *anderssoni* (Ringstrom, 1924).

(Plate II, Fig. 2)

Material: One right M2 (V6419.1), one left M3 (V6419.2), one left P2 (V6419.3), one left P3 (V6419.4), and one left DP3-P4 (V6419.5). These items correspond exactly to the diagnostic characters of Ringstrom (1924) that define this species.

Table 6. Dental measurements of *Chilotherium* (*Chilotherium*) *anderssoni* (Ringstrom, 1924) (mm).

	DP3	DP4	P2	P3	M2	M3
Length	40.0	----	35.0	41.0	63.0	53.(?)
Width at protoloph	44.5	49.5	38.5	53.5	58.0	66.5
Width at metaloph	44.0	48.5	42.0	48.5	52.0	----

Ch. (*Ch.*) *habereri* (Schlosser, 1903)

(Plate I, Fig. 4)

Material: One left DP3-DP4 (V6420.1), one left P2-P3 (V6420.2), and one left P4 (V6420.3).

Table 7. Dental measurements of *Chilotherium* (*Ch.*) *habereri* (Schlosser, 1903) (mm).

	DP3	DP4	P2	P3	P4
Length	39.0	43.3	34.0	38.5	42.5
Width at protoloph	37.2	42.1	35.5	46.0	47.5
Width at metaloph	37.9	40.6	36.5	42.0	46.5

Chilotherium sp.

Material: One right P2 (V6421.1) and one right P3 (V6421.2). This is a small individual with a P2 length of 27.5 mm, breadth at the protoloph is 27.5 mm, and breadth at the metaloph is 32.5 mm. The P3 length is 28.0 mm, breadth at the protoloph is 31.0 mm, and breadth at the metaloph is 33.5 mm

Hipparion sp. 1

(Plate II, Fig. 3)

There is one right P4-M3 (V6422.1), one left M2-3 (V6422.2), and one left P4-M1 (V6422.3).

Hipparion sp. 2

Material consists of one left P3/ (V6423.1), one right P3 (V6423.2), one left P4 (V6423.3), and one left M1 (V6423.4).

Artiodactyla

Paleotragus microdon (Koken, 1885)

(Plate II, Fig. 5)

There is a left maxilla containing P4-M2 (V6424.1) and one left M3/ (V6424.2) representing this taxon.

Paleotragus coelophrys (Polder and Weithofer. 1890)

(Plate II, Fig. 6)

Material consists of one right M1-M2 (V6425.1), one left M1-M2 (V6425.2), one left M2 (V6425.3), and one right DP3-DP4 (V6425.4).

Samotherium sp.

There is one right p4 (V6426.1) and one right m1 (V6426.2).

Sinotragus sp.

There is one right M2-3 (V6427.1), three left M2 (V6427.2,3,4), and one left M3 (V6427.5).

Antilope sp.

(Plate II, Fig. 7,7a)

Material consists of one left tooth row containing P4-M3 (V6428.1), one left P2-P4 (V6428.2), one left M1-M2 (V6428.3) and one left m3 (V6428.4).

Dorcadoryx triquetriconris Teilhard and Trassaert, 1938

There is a piece of left basal horn core (V6429.1) and a piece of the right basal horn core (Y6429.2).

Gazella gaudryi Schlosser, 1903

There is one basal section of right horn core (V6430.1), one right m1-3 (V6431.2), a maxilla containing P3-M3/ (V6431.1), one right m1-3 (V6431.2), and a right m1-2 (V6431.3).

Pachygazella cf. *grangeri* Teilhard and Young, 1931

There is one right basal section of a horn core (V6432).

Gazella sp.

There is one right basal section of a horn core (V6433).

Muntiacus cf. *lacustris* Teilhard and Trassaert, 1937

(Plate II, Fig, 4)

Material consists of a fragmentary base of left horn at its bifurcation with its antler bracelet (V6434).

The Tianzhu Miocene-Pliocene mammalian fauna

A taxonomic list of the fossil mammals occurring at the three localities of Songshan, Tianzhu, is present in Table 8. Because the stratigraphic positions of these three localities are in close proximity, and as there are a number of commonly occurring elements among them, from a macroscopic perspective they may be considered as a single fauna.

This fauna is composed of 5 orders, 17 families, 27 genera (subgenera), and 33 species (subspecies). There are many species of small mammals concentrated within this fauna that previously have not been noted from the Chinese "*Hipparion* fauna". Among these are the first occurrences of the eomyid, *Leptodontomys* and the cricetid *Kowalskia*.. *Ochotonoides* and *Protalactaga* are also now confirmed to exist in the *Hipparion* Red Clays. In this manner, it is not only possible to correlate the Tianzhu fauna to other Chinese Miocene-Pliocene faunas, but moreover these elements may be utilized to compare and correlate the fauna to its contemporaneous assemblages in Europe and North America. Its geologic age is equivalent to the Chinese Baode Stage, the European Turolian Stage, and the North American Hemphillian Stage.

The exposures at Songshan, Tianzhu, are extremely thick (approximately 200 m). These red clay deposits, indicating the presence of a *Hipparion* fauna, are relatively complicated. The distribution pattern of multistoried carbonate concretion deposits reflects alternate numerous drying and wetting climatic fluctuations. Locality 80008 described above was relatively wet, with a faunal complexion suggesting a dense forest. Localities 80006 and 80007 are relatively dry with a faunal complexion indicating dense forest to grasslands. Therefore, as expressed by Dongshen Liu et al. (1978), the suggestion that Kurten's (1952) observations of the North China *Hipparion* Red Clays being a single stratigraphic position with three environments represented by a dense forest, grasslands, or a mixed model between the two, solely upon the presence of hypsodont or brachydont bovids, is oversimplified. Therefore, from the complexion of each Chinese *Hipparion* fauna it is very possible that different stratigraphic positions at the same locality represent different ecological environments.

Table 8. Species distribution among the three localities at Tianzhu

Taxon	Locality		
	80006	80007	80008
Leptodontomys gansus Zheng and Li	x		
Spermophilinus minutus Zheng and Li	x		
Kowalskia gansunica Zheng and Li	x		
Prosiphneus licenti tianzhuensis Zhang and Li	x		x
P. sinensis Teilhard and Young			x
Paralactaga minor Zheng		x	
Heterosmitnthus gansus Zheng		x	
H. simplicidens Zheng		x	
Protalactaga cf. *tunggurensis* Wood		x	
Spalacinae gen. et sp. indet.		x	
Castoridae gen et sp. indet.			x
Ochotonoides primitivus Zheng and Li	x		
O. lagrelii minor Bohlin	x	x	x
Ictitherium hipparionum hyaenoides (Zdansky)		x	x
Adcrocuta eximia variabilis (Zdansky)		x	x
Percrocuta (*Dinocrocuta*) *gigantea* (Schlosser)		x	
Metailurus major Zdansky			x
Machairodus sp.		x	x
Indarctos atticus lagrelii (Zdansky)			x
Hipparion sp. 1			x
H. sp. 2			x
Chalicotherium sp.		x	
Chilotherium (*Acerorhinus*) *tianzhuense* sp. nov.		x	x
Ch. (*Chilotherium*)*anderssoni* (Ringström)		x	x
Ch. (*Ch.*) *habereri* (Schlosser)		x	x
Ch. sp.		x	
Paleotragus microdon (Koken)			x
P. coelophrys (Rodler and Weithofer)		x	x
Samotherium sp.		x	
Dorcadoryx triquetricornis Teilhard and Trassaert		x	
Gazella gaudryi Schlosser		x	x
G. sp.			x
Pachygazella cf. *grangeri* Teilhard and Young			x
Sinotragus sp.		x	x
Antilope sp.		x	x
Muntiacus cf. *lacustris* Teilhard and Trassaert		x	

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