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TWO NEW DEER FROM THE PLEISTOCENE OF WANHSIEN, SZECHWAN, CHINA

By Dirk Albert Hooijer[1]

In 1923 Matthew and Granger published a description of a new mammalian fauna from limestone pits at Yenchingkou, near Wanhsien, eastern Szechwan province, China. The collection had been made by Dr. Walter Granger during the winter of 1921–1922. The supposedly new genera and species, dealt with only in a preliminary way, were:

Rhinopithecus tingianus
Bunopithecus sericus
Rhizomys troglodytes
Cyon antiquus
Ursus kokeni
"*Aeluropus*" (= *Ailuropoda*) *fovealis*
Arctonyx rostratus
Tapirus (*Megatapirus*) *augustus*

These species, *Rhinopithecus tingianus* and *Cyon antiquus* excepted, have been reported since from other Pleistocene sites in China; *Tapirus augustus* is also known from Indo-China. The Yenchingkou fauna is now known to belong to a post-Villafranchian complex of faunas in southern China, Indo-China, Burma, and Java, and therefore is regarded as of Middle Pleistocene age (Colbert, 1940, p. 9).[2] Though the collection was greatly

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[2] Teilhard de Chardin and Leroy (1942), who place the Villafranchian in the Upper Pliocene, list all elements to the Yenchingkou fauna as Lower Pleistocene with the exception (p. 57) of the chalicothere to which a Villafranchian age is tentatively assigned. Young (1935, 1936, 1939), reporting upon further material from the same locality, also accepts the Yenchingkou fauna to be Lower Pleistocene in age.

enriched by subsequent collecting by Dr. Granger in the winters of 1922–1923 and 1925–1926, no further scientific reports on the Yenchingkou fauna were published by its first describers. Osborn (1929, p. 16) made the stegodon from Yenchingkou the type of a new subspecies, *Stegodon orientalis grangeri*, while Colbert (1934, p. 384) redescribed and figured the single chalicothere tooth found in the first collection. More recently, I have made a comparative study of the tiger remains in this collection (Hooijer, 1947). In the meantime Colbert had been working on the collection, and arrived at the conclusion (Colbert, 1949, p. 128) that, except for completely extinct genera, the Yenchingkou mammals are very closely related to their modern counterparts in the same region. In fact, he states, it is difficult if not impossible in most cases to establish distinctive specific differences between the fossil and the recent mammals of this region. Generally the fossil specimens, however, average larger than the corresponding recent ones.

This is a phenomenon of which numerous instances can be given, not only for southeastern Asia but all over the world (see the references in Hooijer, 1949; 1950, pp. 10, 147–148). This widespread diminution in size in the course of the Quaternary is difficult to explain just because it is so universal, though the general warming-up of the climates since the Pleistocene may have much to do with it. Some notable exceptions to this rule found in the prehistoric fauna of Denmark (Degerbøl, 1933, p. 640) and in that of Celebes (Hooijer, 1950, p. 117) strongly suggest that, apart from adaptive responses to climatic changes, internal factors are here also involved.

For some time I have been engaged in the study of the Yenchingkou collection, and the present paper deals with two subspecies of deer that have not yet been described from the collection and that are unknown from other localities.

The photographs were taken in the American Museum of Natural History. All measurements are in millimeters.

MUNTIACUS RAFINESQUE

RAFINESQUE, C. S., 1815, Analyse de la nature, p. 56.

GENERIC TYPE: *Cervus muntjak* Zimmermann.

DIAGNOSIS: Small deer with antlers in the male only, borne on long pedicles and having a main beam and a usually short brow tine; the pedicles are continued anteriorly as prominent converg-

FIG. 1. *Muntiacus muntjak margae*, new subspecies. A.M.N.H. No. 39166, right and left antlers and pedicles. Front view. Two-thirds natural size.

ing ridges on the frontals; large depression on lacrimal; tusk-like upper canines in the male, turned outward at tip; P_4 of a "primitive" type (metaconid separated from paraconid).

Muntiacus muntjak margae,[1] new subspecies

TYPE: A.M.N.H. No. 39166, right and left antlers and pedicles, probably associated and complete.

PARATYPES: A.M.N.H. Nos. 39165, right antler and portion of pedicle; 18682, mandibular rami, probably associated, with right P_4–M_3 and left P_{2-3}, M_{1-3}.

REFERRED SPECIMENS: A.M.N.H. Nos. 18684, left mandibular ramus with P_{2-4}; 18685, mandibular rami, probably associated, with right P_4–M_2 and left P_2–M_2; 18686, right mandibular ramus with P_3–M_3; 18818, mandibular rami, probably associated, with right P_{2-4}, M_{2-3}, and left P_{3-4}, M_1; 21793, left antler and portion of pedicle; 39154a, b, two mandibular rami; a, right P_3–M_3; b, left P_2–M_3; 39155a–c, three mandibular rami; a, left P_4–M_3; b, right P_4–M_3; c, right P_3–M_1; 39156, right mandibular ramus with P_3–M_3; 39157a, b, two mandibular rami; a, right P_3–M_3; b, left P_3–M_3; 39158, left mandibular ramus with P_2–M_1; 39159a, b, two mandibular rami; a, right P_4–M_2; b, left P_3–M_2; 39161, right antler; 39162, right antler; 39163, left antler and portion of pedicle; 39164, right antler and portion of pedicle.

TABLE 1

MEASUREMENTS OF RECENT AND FOSSIL ANTLERS AND PEDICLES OF *Muntiacus*

	Muntiacus reevesi	Yenchingkou
Length of pedicle (inner side)	30–71	*ca.* 73–*ca.* 78
Ant. post. diameter of pedicle	13–18	17–30
Length of antler (in straight line, burr included)	56–92	48+–93+
Height of fork above burr (included)	8–20	14–26
Length of brow tine above burr (included)	9–25	22–41

HORIZON: Pleistocene.

LOCALITY: Yenchingkou, Wanhsien, Szechwan, China.

DIAGNOSIS: Like modern *Muntiacus muntjak* (Zimmermann) but larger; antler rather short and but slightly curved; brow tine small and close to the burr.

DESCRIPTION: The antlers are quite typical of the genus *Muntiacus* (*Cervulus* auct.) but decidedly larger than those of recent *Muntiacus reevesi* (Ogilby) inhabiting a large part of China including Szechwan (see table 1).

[1] The name has been given in honor of my wife.

On the other hand, the antlers do not differ much in size from those of larger modern forms of *Muntiacus*, e.g., *Muntiacus muntjak vaginalis* (Boddaert), which nowadays just reaches the southern border of China in Yunnan and Kwangsi (Allen, 1940, p. 1149). In the two complete Yenchingkou specimens the antler is shorter than the pedicle, while in recent *Muntiacus* the antler usually is longer than the pedicle. The variation that can be found within one species is shown by the series of skulls of *Muntiacus reevesi* in the American Museum of Natural History. The antler index, which is

$$\frac{\text{Length of pedicle} \times 100}{\text{Length of antler}}$$

varies in this species from 39 to 127; in the average, 58.

The fossil antlers vary greatly in size; A.M.N.H. No. 39165 is particularly large. The antler is but slightly curved, and the brow tine is always close to the burr and is rather small.

There are also a number of jaw fragments with teeth referable to the muntjak. Without doubt there are more specimens in the Yenchingkou collection than those listed above. However, as shown by some incomplete skulls to be referred to below, the tufted deer, *Elaphodus*, also forms part of the Yenchingkou fauna. This animal is of about the same size as the Yenchingkou muntjak, and after comparison of the cheek teeth in series of skulls of both genera the only difference I can find is in the last lower premolar, P_4. And even this difference is not constant.

In *Muntiacus* P_4 has as a rule the metaconid separated from the paraconid, leaving the trigonid open on the lingual side. In the *Elaphodus* P_4 metaconid and paraconid are fused, and there is consequently a closed anterior fossette. In the P_4 of a female *Muntiacus muntjak vaginalis* from Yunnan (A.M.N.H. [Dept. Mammals] No. 43056) paraconid and metaconid form a complete inner wall to the anterior fossette. There is no doubt that the mandible belongs to the skull, which with its heavy frontal ridges, comparatively small lacrimal fossa, and unexpanded upper end of the premaxillary in contact with the nasal[1] is correctly identi-

[1] In the skull of *Muntiacus crinifrons* (Sclater) from Chekiang in the American Museum of Natural History (A.M.N.H. [Dept. Mammals] No. 56991, the third specimen known of this species), a narrow tongue of the maxillary separates the nasal from the premaxillary as in *M. reevesi*, a difference from *Muntiacus muntjak vaginalis* not noticed by Allen (1940, p. 1160).

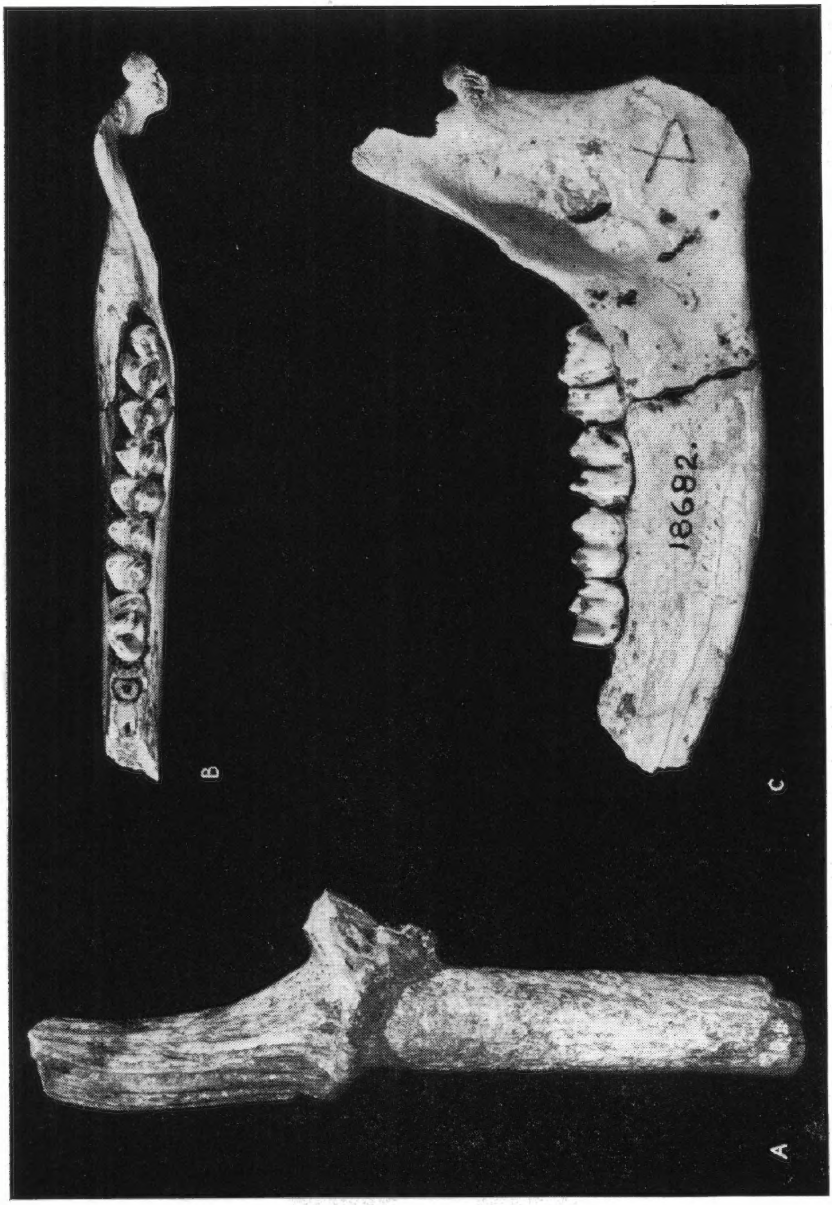

FIG. 2. *Muntiacus muntjak margae*, new subspecies. A. A.M.N.H. No. 39165, right antler and portion of pedicle, front view. B, C. A.M.N.H. No. 18682, right mandibular ramus; B, crown view; C, inner view. All figures two-thirds natural size.

fied. This recent specimen is figured here (fig. 4C, D). The mandibular rami referred to the present form all possess a P_4 of the simple type commonly found in recent *Muntiacus*. There is a tendency for the anterior fossette to close; some fossil specimens (A.M.N.H. Nos. 39154 and 39155) have projections from both paraconid and metaconid constricting the entrance to the inner valley.[1]

The measurements of the teeth of the Yenchingkou muntjak are larger than those of the recent *Muntiacus reevesi* inhabiting the same region, and most of the fossil specimens are larger than those of *Muntiacus muntjak vaginalis*, the large Indian muntjak extending northward into China (see table 2).

TABLE 2

MEASUREMENTS OF TEETH OF RECENT AND FOSSIL *Muntiacus*

	Muntiacus reevesi	Yenchingkou	*M. m. vaginalis*
Length P_2-M_3	49–61	70–86	63–74
Length M_1-M_3	31–38	40–50	37–44

Thus the fossil muntjak from Yenchingkou is characterized by its large size, like so many of the other elements of the fauna. The fossil forms of *Muntiacus* from China thus far described are not especially large. *Muntiacus bohlini* (Teilhard de Chardin, 1940, p. 79) from the lower Pleistocene of Nihowan (Teilhard de Chardin and Piveteau, 1930, p. 44, as *Cervulus* cf. *sinensis*[2]) and from the middle Pleistocene of Choukoutien, to which probably also belongs the left mandibular ramus figured as "?*Hydropotes* sp." by Young (1932, p. 23, fig. 5a), fills the gap that exists between *Muntiacus reevesi* and the Yenchingkou specimens as far as tooth size is concerned. The character that would distinguish *Muntiacus bohlini* is that the antler index stays between 45 and 50, which is a rather, but not impossibly, low figure for a recent muntjak. In

[1] Teilhard de Chardin and Leroy (1942, p. 68) tentatively refer the material from Choukoutien identified as "?*Hydropotes* sp." by Young (1932, p. 22) to *Cervulus* (= *Muntiacus*), but these specimens have the P_4 with paraconid and metaconid fused as in recent *Hydropotes*. One mandible (Young, *ibid.*, p. 23, fig. 5a) differs from the others in the simpler shape of P_4 (metaconid not fused with paraconid), and this particular specimen might belong to *Muntiacus*.

[2] The figure of the antler and pedicle given by these authors (*ibid.*, fig. 16) is two-thirds natural size and not natural size as stated in the legend to the figure.

Muntiacus lacustris (Teilhard de Chardin and Trassaert, 1937, p. 21) from the Pliocene of Yushê, Shansi, the pedicle is again shorter, and the antler index is lower than 30. Teilhard de Chardin (1940, p. 85) concludes that, from the Pliocene upward, the muntjaks have acquired (relatively) longer pedicles. As stated above, the Yenchingkou muntjak has a relatively long pedicle, or rather a short antler, but there is much variation in this character.

Muntiacus kendengensis (Stremme, 1911, p. 106, pl. 20, fig. 2) from the Pleistocene of Java is characterized mainly by the great length of its brow tine. Better specimens have been figured by von Koenigswald (1933, p. 59, pl. 19, figs. 1–2). Tokunaga and Takai (1939, p. 246) refer *M. kendengensis* to the genus *Metacervulus* Teilhard de Chardin and Trassaert (1937, p. 13), which would differ from *Muntiacus* by the presence of a second, posteriorly directed, tine. However, the beam of Stremme's type specimen is not complete, and von Koenigswald's specimens do not show this second bifurcation at all. The measurements of the recent and fossil antlers and teeth of *Muntiacus* are given in tables 3 and 4.

TABLE 3

MEASUREMENTS OF ANTLERS OF RECENT AND FOSSIL *Muntiacus*

	Length Pedicle	Ant. Post. Pedicle	Length Antler	Height Fork	Length Brow Tine	Antler Index
Muntiacus reevesi						
A.M.N.H. (Dept. Mammals) No.						
45341	36	13	70	14	15	51
47857	35	18	90	—	—	39
45343	—	14	—	—	—	—
45345	42	14	60	8	9	70
41474	61	14	69	—	—	88
45570	35	17	74	15	19	47
43044	38	16	68+	17	19	56−
45564	30	17	—	12	—	—
55963	71	15	56	9	10	127
59325	40	13	71	10	12	56
57356	35	15	85	—	—	41
59327	41	15	82	—	—	50
60165	33	14	72	20	25	46
60168	34	17	—	—	—	—
60169	31	15	58	—	—	53
84456	40	14	73	17	18	55
84340	33	18	71	16	24	46
89855	41	15	92	14	20	45

TABLE 3—*Continued*

	Length Pedicle	Ant. Post. Pedicle	Length Antler	Height Fork	Length Brow Tine	Antler Index
Yenchingkou						
A.M.N.H. No.						
21793	—	20	—	26	41	—
39161	—	—	93+	17	—	—
39162	—	—	59	17	23	—
39163	—	17	48+	14	19+	—
39164	—	24	—	23	34+	—
39165	—	30	—	20	—	—
39166 (right)	*ca.* 78	19	76	17	23	*ca.* 103
39166 (left)	*ca.* 73	19	67	15	22	*ca.* 109
Muntiacus muntjak vaginalis						
A.M.N.H. (Dept. Mammals) No.						
54595	71	15	87	19	32	82
54596	67	15	102	—	—	66
54957	—	21	—	—	—	—
87604	87	17	98	—	—	89
M. crinifrons						
A.M.N.H. (Dept. Mammals) No.						
56991	44	14	64	21	21	69
M. kendengensis						
After Stremme, 1911	34	25	115+	36	107	32−
After von Koenigswald, 1933	—	28	*ca.* 183	39	101	—
After von Koenigswald, 1933	84+	24	*ca.* 160	24	92	53+

TABLE 4

MEASUREMENTS OF TEETH OF RECENT AND FOSSIL *Muntiacus*

	P_2–M_3	M_1–M_3	P^2–M^3	M^1–M^3
Muntiacus reevesi				
(A.M.N.H. (Dept. Mammals) No.				
45341	51	31	47	28
47857	55	34	48	29
45343	53	32	—	27
45345	53	33	49	29
43049	56	34	50	29
59326	56	34	50	30
45342	54	32	50	29
45565	55	35	50	30
41474	53	32	50	28

TABLE 4—*Continued*

	P_2–M_3	M_1–M_3	P^2–M^3	M^1–M^3
45570	52	33	48	28
43044	—	—	50	29
45564	52	33	48	28
55963	61	38	54	31
59325	58	37	55	32
57356	49	31	46	26
59327	57	34	50	30
60165	52	32	47	28
60168	54	33	50	29
84456	56	34	52	29
89855	57	36	52	30
45569	52	33	47	28
45567	51	33	46	27
44779	58	35	52	31
56988	51	31	43	24
56989	55	34	50	29
56992	57	34	52	29
57335	53	32	48	28
84454	57	35	52	31
84457	53	33	50	29
60169	56	34	51	29
84340	53	34	48	29
Muntiacus muntjak vaginalis				
A.M.N.H. (Dept. Mammals) No.				
43052	64	39	59	34
43056	69	41	63	36
54594	—	—	58	33
54595	63	37	58	32
54596[a]	68	42	62	37
54957	74	44	68	39
87604	68	43	62	37
M. crinifrons				
A.M.N.H. (Dept. Mammals) No.				
56991	67	40	60	34
Muntiacus muntjak margae, new subspecies				
A.M.N.H. No.				
18682	86	50	—	—
18686	—	45	—	—
18818	83	—	—	—
39154b	78	46	—	—
39155a	—	48	—	—
39155b	—	42	—	—
39156	70	43	—	—
39157a	—	50	—	—
39157b	—	40	—	—

[a] In this skull the right M^3 is not developed.

The Yenchingkou muntjak, though far less distinctive than the fossil Javan *Muntiacus kendengensis* with its long brow tine, nevertheless might be given a special name on account of its large size. Its occurrence beyond the range of recent *Muntiacus muntjak* and within the region now roamed by the smallest species, *Muntiacus reevesi*, gives this form additional interest. It is also larger than the other Chinese fossil muntjaks thus far described. I regard the Yenchingkou muntjak provisionally as a subspecies of *Muntiacus muntjak;* better material of the skull might eventually prove that its affinities are rather with *Muntiacus reevesi* or *M. crinifrons*, but this must remain unsettled for the moment.

ELAPHODUS MILNE EDWARDS

MILNE EDWARDS, A., 1871, Bull. Nouv. Arch. Mus. Paris, vol. 7, p. 93.

GENERIC TYPE: *Elaphodus cephalophus* Milne Edwards.

DIAGNOSIS: Like *Muntiacus*, but with very small antlers, no frontal ridges, premaxilla expanded posteriorly, male upper C not turned outward at tip, P_4 of the "advanced" type (metaconid fused with paraconid).

Elaphodus cephalophus megalodon, new subspecies

TYPE: A.M.N.H. No. 18828, front of a female skull with right M^{1-3} and left P^2, P^4–M^2.

PARATYPES: A.M.N.H. Nos. 18829, front of subadult male skull on the right side with C, DM^{2-4}, M^{1-2}; 18508, right mandibular ramus with P_2–M_1.

REFERRED SPECIMENS: A.M.N.H. Nos. 18830, right maxilla with DM^{2-4}, M^{1-2}; 18831, right maxilla with DM^{2-4}; 18832, right mandibular ramus with P_4–M_2; 18833, right pedicle and antler; 18837, left mandibular ramus with P_4–M_2; 39186, left pedicle; 21786, crushed skull with right M^{1-3} and left DM^4, M^{1-3}; 39187, left mandibular ramus with P_3–M_1.

HORIZON: Pleistocene.

LOCALITY: Yenchingkou, Wanhsien, Szechwan, China.

DIAGNOSIS: Like modern *Elaphodus cephalophus* Milne Edwards but larger; nasals broad and less compressed posteriorly than in the recent forms; lacrimal fossa large, its long axis set obliquely to that of the orbit; teeth relatively, as well as absolutely, larger than the recent.

DESCRIPTION: The present fossil material is the first to be recorded indicating the presence of the tufted deer, *Elaphodus*, in the

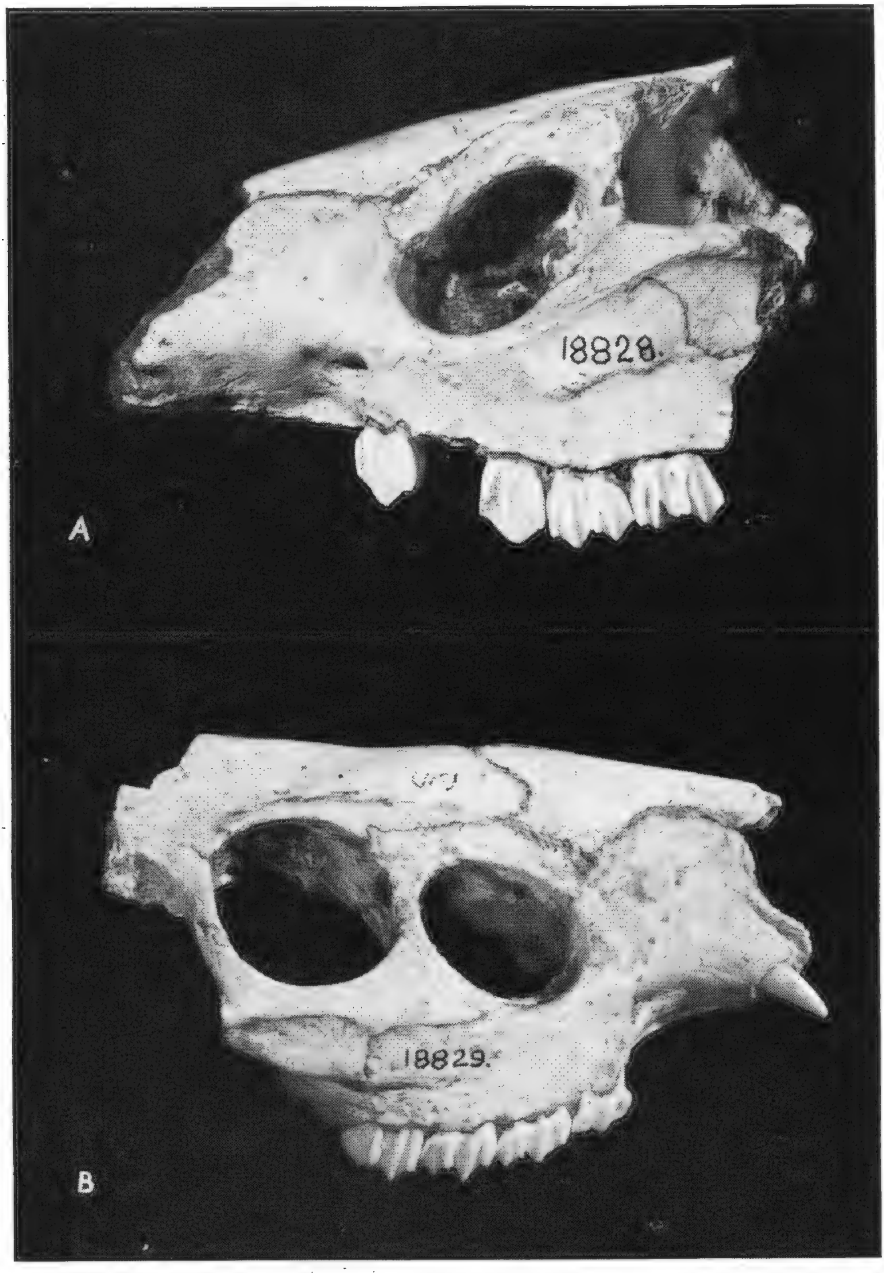

FIG. 3. *Elaphodus cephalophus megalodon*, new subspecies. A. A.M.N.H. No. 18828, front of female skull, left view. B. A.M.N.H. No. 18829, front of subadult male skull, right view. Both figures four-fifths natural size.

Pleistocene fauna of China. The recent species is confined to China and has been divided into several subspecies.

The cranial differences between the Chinese races accepted by Allen (1940, p. 1143) are very slight. *Elaphodus cephalophus ichangensis*, within the range of which the fossil material was found, differs from the typical subspecies (which is confined to the highlands of southwestern China) in its smaller size, relatively shorter nasals, and in the shape of the lacrimal fossa which is more regularly oval, smaller, and deeper than that in *E. c. cephalophus* and has the long axis set more obliquely to that of the orbit. *Elaphodus cephalophus michianus*, the range of which lies between that of *E. c. ichangensis* and the coast, is also smaller than the typical race, and the lacrimal fossa has its long axis not far removed from that of the orbit (Lydekker, 1915, pp. 34–39). Allen (1940, p. 1143) adds that in *E. c. michianus* the nasals are narrower and more compressed posteriorly than in *E. c. ichangensis*.

The adult fossil skull (A.M.N.H. No. 18828) is nearest in size to that of *E. c. cephalophus* and the lacrimal fossa is large and irregularly oval. Its long axis, however, is set very obliquely as in *E. c. ichangensis*. The nasals are broader and less compressed than those in any of the recent skulls. The small canine alveoli just visible in front (the premaxillaries are lost) indicate that the skull belonged to a female.

The subadult skull (A.M.N.H. No. 18829) has a decidedly smaller lacrimal fossa, with its long axis less oblique than that in the adult fossil skull, apparently an age difference only. It belonged to a male.

The crushed skull (A.M.N.H. No. 21786) is inadequate for comparison, but the lacrimal fossa seems to be as large as that in A.M.N.H. No. 18828.

In the size of the teeth, the fossil tufted deer considerably exceeds the recent. The teeth are decidedly larger relative to the size of the skull in the fossil *Elaphodus* than in the recent. The mandibular rami, all with the P_4 showing the fusion of metaconid and paraconid, likewise exceed the recent in the size of the teeth. The male skull of *E. c. cephalophus* figured by Milne Edwards (1868–1874, pl. 67) exceeds the recent skulls I had at my disposal in size but is still inferior in dimensions, especially as regards the teeth, to the Yenchingkou material.

The single pedicle and antler referable to the present form (A.M.N.H. No. 18833) is larger than in any of the recent skulls.

FIG. 4. A, B. *Elaphodus cephalophus megalodon*, new subspecies. A.M.N.H. No. 18508, right mandibular ramus; A, crown view; B, inner view. Natural size. C, D. *Muntiacus muntjak vaginalis* (Boddaert). A.M.N.H. (Dept. Mammals) No. 43056, right mandibular ramus; C, crown view; D, inner view. Twice natural size.

TABLE 5

MEASUREMENTS OF SKULL AND TEETH OF FOSSIL AND RECENT *Elaphodus*

	Nasals, Greatest Width	Maxillary, Greatest Height	Lacrimal Fossa, Longer Diameter	Width Over Inner Borders of Infra-orbital Foramina	Length P^2–M^3	Length M^1–M^3	Length DM^{2-4}	Length P_2–M_1	Length P_4–M_2
Yenchingkou									
A.M.N.H. No.									
18828, ♀	33	35	34	37	71	41	—	—	—
18829, ♂	29	33	27	—	—	—	35	—	—
18830	—	—	—	—	—	—	36	—	—
18831	—	—	—	—	—	—	34	—	—
18508	—	—	—	—	—	—	—	40	—
18837	—	—	—	—	—	—	—	43	—
39187	—	—	—	—	—	—	—	45	—
18832	—	—	—	—	—	—	—	—	36
18837	—	—	—	—	—	—	—	—	37
E. c. cephalophus									
After Milne Edwards, ♂	—	33	35	—	62	37	—	39	34
A.M.N.H. (Dept. Mammals) No.									
43060, ♀	30	30	31	35	58	32	—	36	31
E. c. ichangensis									
A.M.N.H. No.									
84337, ♀	—	—	30	—	—	—	33	—	—
55983, ♂	23	31	33	31	—	34	29	—	—
E. c. michianus									
A.M.N.H. No.									
43043, ♂	25	29	32	34	55	32	—	35	31
84462, ♂	25	30	29	34	59	33	—	35	32
84463, ♂	27	31	33	34	59	34	—	37	32

As compared with that figured by Milne Edwards (*loc. cit.*), the fossil pedicle is shorter (24 mm. against 26 mm.), but the antler is longer (19 mm. as opposed to 16 mm.) and the pedicle is somewhat stronger (diameter 10 mm. against 8 mm.). In a fossil pedicle (A.M.N.H. No. 39186) only 16 mm. long, the diameter is 9 mm.; in my recent skulls it is 7 mm. at the most.

The recent material for comparison is rather scanty; nevertheless it seems justifiable to coin a new subspecific name for the Yenchingkou fossils. They give evidence again of the diminution in size which this species has undergone in the course of the Quaternary. No fossil remains of *Elaphodus* have been previously recorded, and the only reference to this genus in the literature on the fossil mammals of China is a remark by Teilhard de Chardin and Trassaert (1937, p. 29) that *Elaphodus* might be a last representative of *Paracervulus*. *Paracervulus* is a genus created by Teilhard de Chardin and Trassaert (*ibid.*, p. 15) for the inclusion of a number of antlers from the Pliocene of Yushê, Shansi. The genus is defined as a "Cervulinae" with a brow tine in high position, antlers slightly curved backward and inward, and pedicles continued forward as a ridge on the frontal. Four species are proposed, whereby specific value is attached to differences in the position and degree of reduction of the brow tine. The species *Paracervulus simplex*, characterized by the reduction of the brow tine to a swelling along the lower third of the antler, is stated (*ibid.*, p. 21) to be probably related to *Elaphodus*. The difference is that in *P. simplex* the pedicle is relatively shorter, being only about one-fourth as long as the antler, while in *Elaphodus* pedicle and antler are approximately of the same length. The difference is considered to be an "adaptive" one, the increase in length of the pedicle in the Muntiacini being seemingly a general fact.

If *Elaphodus* evolved from a form with *Paracervulus simplex*-like antlers and pedicles, there is a reduction of the antler involved rather than an increase in length of the pedicle; the antlers in the Pliocene form are about five times as long as those in *Elaphodus*, while the pedicles in the Pliocene form are only one-third shorter and one-half greater in diameter, approximately, than in the recent. The fossil pedicles from Yenchingkou are somewhat stronger but shorter than the recent; the material does not, however, permit conclusions as to evolutionary trends in the antlers of *Elaphodus*.

Tokunaga and Takai (1939, p. 245) regard the antlers on which

the genus *Paracervulus* was based as young specimens of *Metacervulus*, and Simpson (1945, p. 153) also includes *Paracervulus* in the genus *Metacervulus*. If this be adopted, it is hardly possible to assume a direct phylogenetic relationship between the Muntiacini of the Pliocene of Yushê and the Pleistocene and recent genus *Elaphodus*.

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