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壮鼠化石在中国的首次发现

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摘要 在我国北京长辛店和内蒙古四子王旗发现了壮鼠亚科的化石：杨氏东方壮鼠 *Eosischyromys youngi* 新属种。它的齿冠较低，齿脊亦较低，齿尖较明显等特点表明它比北美目前已知的壮鼠都原始。这是壮鼠亚科化石在亚洲首次发现，扩大了壮鼠亚科的分布范围。特别是由于它比较原始，可能它出现的时代较早，进一步确认长辛店组的时代为中始新世晚期。

关键词 华北，中始新世，长辛店组，壮鼠亚科

中图法分类号 Q915.873

壮鼠亚科(Ischyromyinae)是壮鼠科(Ischyromyidae)中最进步的一类。它们的化石在北美很丰富，从晚中始新世到中渐新世的地层中都有发现，但是在北美以外的地区还从未发现过。我们在华北地区发现了两段下颌骨。标本虽少，但它们的下颌骨和牙齿的基本形态与壮鼠亚科的是一致的，显然应归入该亚科。它们在中国的发现证明壮鼠亚科也曾在亚洲生存，为亚洲与北美间动物群的交流增加了新的门类。

本文记述的壮鼠化石发现于两个地点，一个是内蒙古四子王旗，另一个是北京长辛店。四子王旗是个新地点。长辛店的化石产于长辛店组。早在本世纪二十年代，地质学作为一门科学引入我国之初，瑞典人安特生就调查过长辛店组(原称长辛店砾石层)地层，根据岩性和产状将其时代定为始新世(Andersson，1923)。第一次根据哺乳动物化石为长辛店组断代的则是杨钟健教授。他三十年代初根据在长辛店车站附近发现的哺乳动物化石，判断长辛店组的时代是始新世或渐新世(Young，1934)。此后，周明镇(1953)和翟人杰(1977)根据后来发现的化石对其时代作了进一步讨论。这次在长辛店组中发现壮鼠化石为进一步确定长辛店组的时代提供了新的证据。本文献给我国著名的古生物学家杨钟健教授诞辰一百周年。

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系 统 描 述

壮鼠科 Ischyromyidae Alston, 1876

壮鼠亚科 Ischyromyinae Schlosser, 1911

杨氏东方壮鼠 *Eosischyromys youngi* gen. et sp. nov.

(Fig. 1, Pl. I-II)

正型标本 一段幼年个体的右下颌骨具 i2 和 p4—m2, p4 未完全萌出(古脊椎动物与古人类研究所化石编号: V 11376)。

正型标本产出地点和层位 北京长辛店高佃村,晚中始新世长辛店组。

归入标本 一段右下颌骨具 i2 和 m1—m3(V 11377)。

归入标本产出地点和层位 内蒙古乌兰察布盟四子王旗巴彦乌兰,上部红层(? = 晚中始新世沙拉木仑组)。

鉴定特征 个体大小中等;颊齿低冠;主尖明显,高于连接它们的脊,下前边脊长,下外脊较低,下次脊完全,但低而细,并向后弯凸,中凹开阔,外凹浅而长。门齿珐琅质外层较厚。

属名和种名由来 Eos, 希腊语: 东方; Ischyromys, 希腊语: 壮鼠。youngi, 纪念中国科学院古脊椎动物与古人类研究所的创始人、前所长、北京自然博物馆前馆长、为我国古脊椎动物学作出卓越贡献的、杰出的古生物学家、尊敬的杨钟健教授。

描述 正型标本(V 11376)为一幼年个体。下颌骨的前部下缘圆凸。颏孔大,位于齿缺后部近上缘处。齿缺上缘呈较锐的脊,稍凹。咬肌窝浅,前端达 m2 的下方,前无明显的界线或结节。

门齿侧扁,内面平,外面圆凸,唇缘狭窄。珐琅质层很薄,在外侧面上覆盖的面宽,约达外面的 2 / 3 左右,在内侧面较窄。珐琅质微细结构为单系,每条施氏明暗带 [Hunter-Schreger band (HSB)]为单个釉柱宽,偶尔为双釉柱宽。每带平均宽约 4.5μ。珐琅质层厚约 80μ。内层厚约 40μ。内层 HSB 带约与珐琅质齿质界面垂直。柱间质与釉柱平行。内层在近牙轴部可分为上、下两部。内部最厚可达 8μ。外层厚约 40μ。其釉柱的倾斜度为 40°—50°。

颊齿齿冠低,具明显的主尖,较低弱的脊。

p4 尚未完全萌出,经修理后完全暴露。嚼面约呈三角形。三角座很窄小,下后尖与较小的下原尖彼此紧靠。其间的三角座盆呈一前后向的裂隙,向前开口。在齿的前基部有很低弱的下前边尖。跟座较宽大,仅比三角座稍低。下外脊长而弯曲呈折线:前部直,约位于齿的中部,与齿的纵轴近于平行;后部呈前舌—后唇方向延伸。下次尖最大。下内尖清晰,比下次尖和下后尖小而低。下次脊完全,伸达下外脊,但较低而细,并向后圆凸。下后边脊比下次脊高。下次小尖明显,与下次尖有沟分开。

m1 冠面约呈矩形,长大于宽。三角座约与跟座等宽。主尖都很明显,呈丘形。三角座短。下原尖和下后尖大小相近。下前边脊完全,较长。前边尖明显。下后脊完全,由下原尖顶伸达下后尖的顶,封闭短宽的三角座盆。下后附尖很小,以沟与下内尖分开。下次尖

约与下原尖等大，下内尖为主尖中最低小者。下外脊低，位置靠近唇侧，像 p4 的下外脊，也呈折线，前部直，但不与齿的纵轴平行，而是由下原尖斜向后舌方伸。有下中尖的痕迹。下次脊完全，但低而细，向后弯凸。下后边脊比下次脊高而粗，伸达下内尖的基部。下次小尖明显，有沟与下次尖分开。下外凹浅而长。下中凹开阔，其长约为下后凹长之两倍。

m2 与 m1 不同处在于牙齿比例上较宽短些，后部稍窄于前部，三角座盆更宽短些，呈横向延伸的狭谷。下中尖和下次小尖都较弱小。

V 11377 的下颌骨、i2 和 m1—2的形态都与正型标本(V 11376)的基本一致，所不同的是它的颊齿齿冠稍高些，主齿尖较粗壮，无下中尖的痕迹。这些区别可能代表进化的不同阶段，也可能为种内个体变异，笔者趋向后一种可能性。

表1　*Eosischyromys youngi* 牙齿测量(单位：毫米)

Table 1　Measurements of teeth of *Eosischyromys youngi* (in mm)

	V 11376	V 11377
m1处下颌骨高(H)		8.43
p4长(L)	2.74	
p4后宽(PW)	2.74	
m1长(L)	3.22	2.74+
m1前宽(AW)	2.87	
m1后宽(PW)	2.90	3.00
m2长(L)	3.14	3.22
m2前宽(AW)	3.19	
m2后宽(PW)	2.90	3.38
m3长(L)		3.54
m3前宽(AW)		3.22
m3后宽(PW)		2.87
i2唇-舌长(L)	3.22	
i2横宽(W)	1.45	

只有 V 11377 保留有 m3。它的嚼面约呈四边形，前面宽于后面，颊侧长于舌侧。三角

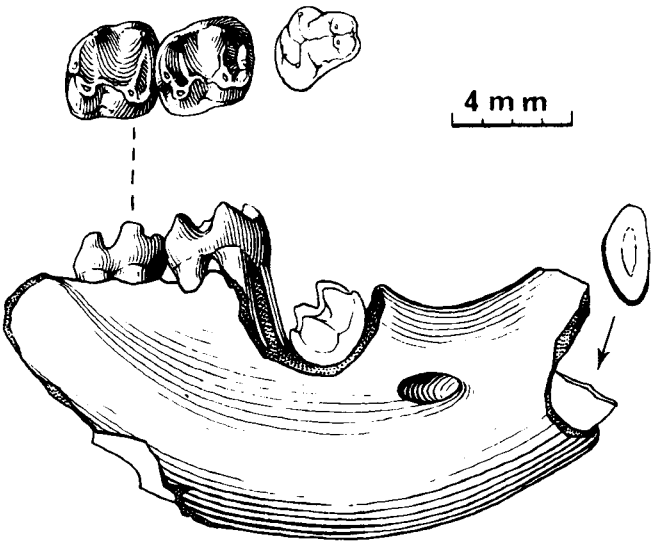

图 1　*Eosischyromys youngi* 右下颌骨具 i2，p4-m2(正型标本，V 11376)
下颌骨颊侧观(下)，p4-m2 冠面观(上)和 i2 横断面(右上)

Fig. 1　Lower jaw with i2, p4-m2 of *Eosischyromys youngi* (holotype, V 11376) buccal view of lower jaw (lower), occlusal view of p4-m2 (upper), and cross section of i2 (right upper)

座与 m1—2的相似，只是下后脊较短，只达下后尖的后唇基部，不封闭下三角座盆，跟座较窄，下次脊和下后脊也较短。但下次小尖仍明显，与下次尖由沟分开。

比较 我们还不知道这类动物的上颌和上颊齿，但它的下颌骨和下牙的特点确与北美的 Ischyromyinae 相同。它们共有的特点是：颏孔位于齿缺下方；咬肌窝浅，伸达 m2 的下方，无明显的前界；下门齿窄扁，具窄的前缘和薄的珐琅质，微细结构为单系；颊齿低冠，具四横脊，下内尖与后边脊明显分开；p4 三角座很窄等。

Ischyromyinae 目前已知包括两属：*Ischyromys* 和 *Titanotheriomys*。关于这两属的分类地位，各家意见不一：有人认为这两个属都有效（Miller 和 Gidley，1920；Wood，1937，1976，1980）；Black（1968）认为后者是前者的同物异名；还有的人则将 *Titanotheriomys* 作为 *Ischyromys* 的亚属（Matthew，1910；Heaton，1996）。无论如何，两者在牙齿上的区别甚微。而中国的标本与北美的属种有明显的区别：颊齿齿冠更低些，主尖明显呈丘形，脊明显低于主尖，特别是下外脊和下次脊很低细，前边脊较长，中凹开阔等。这些都是较原始的特点。显然 V 11376 等代表不同于 *Ischyromys* 和 *Titanotheriomys* 的种类。我们将其命名为杨氏东方壮鼠 *Eosischyromys youngi*。

讨 论

关于长辛店组的时代 对长辛店组的研究已有 70 多年的历史了。关于它的时代，过去通常认为是始新世或早第三纪（Andersson，1923；Hsieh，1933；Young，1934；周明镇，1953）。翟人杰（1977）分析了所产的哺乳动物化石，认为可与内蒙古的伊尔丁曼哈动物群、沙拉木仑动物群、河南的五里墩动物群等比较，确定其时代为晚始新世。童永生（1989）命名了那读哺乳动物期，认为其时代早于乌兰戈楚期，晚于沙拉木仑期，相当北美的 Duchesnean 哺乳动物期，并认为亚洲的伊尔丁曼哈期和沙拉木仑期的时代与北美的 Uintan 期相当。他还推测长辛店组至少有一部分是在那读期形成的，其时代可能相当那读期—沙拉木仑期。现在北美的 Chadronian，Duchesnean 和 Uintan 等哺乳动物期的时代已分别被改归为晚始新世、最晚中始新世和晚—中中始新世（Berggren 和 Prothero，1992；Berggren 等，1995；Prothero 和 Swisher，1992）。童永生等（1995）认为亚洲的那读期与北美的 Duchesnean–Chadronian期相当，其时代为最晚中始新世—晚始新世，而沙拉木仑期的时代与 Uintan 晚期相当，为中始新世晚期。他们明确表示长辛店动物群不属沙拉木仑期，而代表那读期的较早期，大致与 Duchesnean 期相当，其时代为中始新世最晚期，而暂将蔡家冲动物群作为那读期的较晚期的动物群的代表，与 Chadronian 期相当。王伴月（1997）认为乌兰戈楚期的时代可与北美的 Chadronian 期比较，为晚始新世，而不是原认为的渐新世，而且认为蔡家冲哺乳动物群与乌兰戈楚哺乳动物群相似，应属乌兰戈楚期，而不属那读期。这样长辛店动物群实际上与整个那读期相当，都为中始新世最晚期。

长辛店哺乳动物群已知包括 ?*Tupaiodon* sp.、?*Eudinoceras* sp.、*Hypsimylus beijingensis*、*Miacis* sp.、Canidae indet.、*Imequincisoria* sp. 和 Amynodontidae indet.。翟人杰（1977）已对有关种属的地史分布作了分析，这里仅稍作修改和补充。?*Eudinoceras* sp. 是杨钟健根据裴文中（1930）采集的一枚上前臼齿和腰带化石鉴定的，但王景文认为该上

前臼齿可能是一种大型的石炭兽的 P4(童永生，1989，P.665)。根据杨钟键所绘的插图(1934，Fig.4)，我们赞同王景文的意见。特别是它的个体大小和具较发达的前、后附尖等特点与 *Anthrocothema rubricae* 的很相似，它有可能属此种。*A. rubricae* 目前已知产于我国广西的那读组和缅甸的邦当组。如果根据石炭兽，长辛店组的时代有可能和它们的相当，为最晚中始新世。但 *Imequincisoria* 目前已知仅发现于河南桐柏五里墩组，其时代与沙拉木仑期相当，为中始新世晚期。长辛店的 *Imequincisoria* sp. 显然比那读组中所产的真犀 *Guixia simplex* 小而原始。如果根据不等门齿犀化石，长辛店组的时代则早于那读期，而相当于沙拉木仑期，应为中始新世晚期。

Lucas(1996)对将长辛店的标本(IVPP V 5241)归入 *Imequincisoria* sp. 表示怀疑。他认为 V 5341 的个体很小和 M3 具明显的后尖，应归入 *Forstercooperia grandis*。因此，他认为长辛店哺乳动物群的时代为伊尔丁曼哈期。这次，我们将长辛店的 V 5241 与 *Imequincisoria*，*Juxia* 和 *Forstercooperia* 等有关属的标本进行了比较。我们发现 V 5241 的颊齿形态更象 *Juxia* 和 *Imequincisoria*，而不象 *Forstercooperia*。如它的 M3 后尖与 *Juxia* 和 *Imequincisoria* 的是一样的不发育，比 *Forstercooperia* 的弱得多。它的 p4[1)] 的臼齿化的程度较高，具有下内尖和下次尖横脊等。这与 *Forstercooperia* 的未臼齿化的前臼齿的区别很明显。所不同的是与 *Juxia sharamurunense* 和 *Imequincisoria mazhuangensis* 的正型标本比较，它的个体稍小，P2 的原尖和次尖的相对位置稍有不同。如果 *Imequincisoria* 是 *Juxia* 的后出同物异名，我们认为目前将长辛店的标本归入 *Juxia* sp. 为好。根据 *Juxia* 在亚洲已知的时代分布，长辛点组的时代可能为沙拉木仑期，而不是伊尔丁曼哈期。

这次在长辛店组中首次发现了壮鼠，不但扩大了壮属的分布范围，也增加了长辛店动物群的门类。Ischyromyinae 过去已知在北美的地史分布为 Duchesnean-Whitneyan期。由上面的描述比较可以看出 *Eosischyromys* 代表较原始的 Ischyromyinae，它的牙齿形态比目前已知的北美的壮鼠都原始，很可能时代较早，早于 Duchesnean 期，也就是说早于那读期，即它可能在沙拉木仑期时就出现了。最近，Tabrum 等(1996)报道了在北美 Sage Creek 盆地 Uintan 晚期的?*Ischyromys* sp.。将 *Eosischyromys* 与北美 Uintan 晚期的?*Ischyromys* sp. 比较，两者的齿冠高低相近，m3 的形态相似，但 *Eosischyromys* 的 m1—2的横脊较细，低而长，中凹较开阔，下前边脊较长等。很可能 *Eosischyromys* 代表与?*Ischyromys* sp. 进化程度大致相当或稍原始的种类。可能它们的时代相近。这显然支持根据犀类对长辛店组时代的推论。因此长辛店组的时代很可能属沙拉木仑期，即为中始新世晚期。

亚洲和北美的壮鼠间的关系　关于 *Eosischyromys youngi* 与北美的 ischyromyines 的关系，由于我们的材料有限，而北美早期的壮鼠的材料也比较零星，彼此的确切关系还不清楚。但壮鼠在我国始新世的发现，至少表明当时亚洲和北美之间是存在哺乳动物的交流的。如果上面关于长辛店组的时代的分析是有道理的话，壮鼠在亚洲出现的时代也为中始新世晚期。*Eosischyromys youngi* 与北美 Uintan 晚期的?*Ischyromys* sp. 已有明显区别。若 *Eosischyromys* 代表比?*Ischyromys* sp. 较原始的种类，壮鼠有可能是在亚洲起源，然后再迁到北美的。若两者的确属于同一时代，而且进化水平大致相同，它们的区别表明，

1) Lucas认为它是 m1(1996，Pl. I，fig. 7)，我们仍同意翟人杰(1977)的意见，它是左p4，而不是 m1。

它们已开始向不同方向发展。这样，壮鼠是从何处，由那一类原始的鼠类起源的，有待于发现更多、更完好的材料。

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DISCOVERY OF ISCHYROMYINAE (RODENTIA, MAMMALIA) FROM THE MIDDLE EOCENE OF NORTH CHINA

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Summary

Members of the subfamily Ischyromyinae, the most derived of the Paleogene rodent family Ischyromyidae, have previously been reported only from North America, where they are relatively abundant in deposits ranging in age from late Middle Eocene through Middle Oligocene. The two lower jaws from North China described here are the first record of the subfamily in Asia. This discovery both provides another example of faunal exchange between Asia and North America during the Middle Eocene and assists us in determining the age of the Changxindian Formation.

Systematics

Family Ischyromyidae Alston, 1876

Subfamily Ischyromyinae Schlosser, 1911

Eosischyromys youngi gen. et sp. nov.

(Fig. 1; pl. I–II)

Holotype　Incomplete right mandible with i2, m1–2 and erupting p4 (IVPP V 11376).

Locality and horizon of holotype　Gaodian village, Changxindian, Beijing, China; late Middle Eocene Changxindian Formation.

Referred specimen　Incomplete right mandible with i2 and m1–3 (V 11377), from Bayanulan, Siziwang Qi, Ulanqab Meng, Nei Mongol, China; upper red beds (? = late Middle Eocene Shara Murun Formation).

Diagnosis　Ischyromyine of medium size. Cheek teeth brachydont, with main cusps prominent, higher than lophids, anterolophid long, ectolophid low, complete hypolophid

low, slender, and convex posteriorly, central valley broad, buccal valley shallow and long. Incisor has thick portion externa.

Etymology *Eos*, Greek: east; *Ischyromys*, Greek: a well known genus name of the Ischyromyidae. *youngi*: in honor of the late Professor C. C. Young, the distinguished scholar who was the founder of the Institute of Vertebrate Paleontology and Paleoanthropology, AS (IVPP), late director of IVPP and of the Beijing Natural History Museum.

Description The type specimen, V 11376, is from an immature individual. The lower jaw has a convex anterior lower margin, a large mental foramen below the diastema, which is shallow and has a ridged dorsal margin. The shallow masseteric fossa extends to below m2, and lacks a distinct anterior border or knob.

i2 is transversely compressed, with convex lateral, flat medial, and narrow anterior surfaces. The thin enamel of uniserial microstructure covers about two-thirds of the lateral surface and a narrow band of the medial side. The orientation of the Hunter-Schreger band (HSB) is vertical to the enamel dental junction (EDJ). The interprismatic matrix (IPM) is parallel to the prism of HSB. The portion interna (40μ) is half of the total thickness of the enamel (80μ) and includes two parts: a narrow inner part (ca. 8μ) and a wide outer part. The portion externa (PE) is 40μ thick. The inclination of the prism of PE is 40°—50°.

Cheek teeth are brachydont, with prominent main cusps and low weak lophids.

p4 is just erupting. It is triangular in occlusal view, with a very narrow trigonid. The protoconid is smaller than the metaconid. These cusps are closely linked; between them the trigonid basin forms a narrow, anteroposterior fissure that opens anteriorly. There is a very small anteroconid on the base of the anterior side. The talonid is wide and slightly lower than the trigonid. The ectolophid is long, low and curved with a straight anterior segment near the middle of the long axis of the tooth and a posterior segment that extends posterobuccally. The hypoconid is the largest of the main cusps. The entoconid is distinct, but smaller and lower than the hypoconid and metaconid. The complete hypolophid is low, slender and convex posteriorly. The posterolophid is higher than the hypolophid. The distinct hypoconulid is separated from the hypoconid by a groove.

m1 is roughly rectangular in occlusal view, longer than wide. The trigonid and talonid are about equal in width. The main cusps are prominent cones. The trigonid is short, with about equal sized protoconid and metaconid. The complete anterolophid is low, but long, with a distinct anteroconid. The complete metalophid connects the tops of the metaconid and protoconid, closing the wide, short trigonid basin. The tiny metastylid is separated from the entoconid by a valley. The hypoconid is about equal to the protoconid in size. The entoconid is the lowest cusp. The low ectolophid is near the

buccal margin. As in p4, the ectolophid is curved and has a straight anterior segment. Here, however, this segment is not parallel but oblique to the longitudinal axis of the tooth. There is a vestige of mesoconid. The complete hypolophid is low, slender, and convex posteriorly. The posterolophid is higher and stronger than the hypolophid, and reaches the base of the entoconid. The distinct hypoconulid is separated from the hypoconid. The buccal valley is shallow and long. The central valley is broad and about twice as long as the valley between hypolophid and posterolophid.

m2 differs from m1 in being relatively wider, with narrower posterior side, shorter and wider trigonid basin, weaker mesoconid and hypoconulid.

V 11377 is almost identical with V 11376 in basic features, differing from V 11376 in having a slightly higher crown, stronger main cusps and no vestige of mesoconid. These differences may represent either an advanced evolutionary stage, or merely intraspecific variation, the latter of which is here preferred.

m3 is present only in V11377. It is trapezoid in occlusal view, with a wider anterior than posterior side, and a longer buccal than the lingual side. The trigonid is similar to that of the m1–2, but the metalophid is shorter and does not reach the metaconid, resulting in a posteriorly open trigonid basin. The talonid is narrower, with shorter hypolophid and posterolophid. The hypoconulid is still distinct and separated from the hypoconid by a groove.

Comparison Although this new taxon is incompletely known, having no accompanying upper jaws and teeth, it shares characters of mandible and lower dentition with the North American Ischyromyinae. In common are: the mental foramen below the diastema; a shallow masseteric fossa that lacks a distinct anterior margin and extends forwards below m2; transversely compressed i2 with a narrow anterior side and uniserial enamel; brachydont cheek teeth with four transverse lophs, entoconid separated from posterolophid and a narrow trigonid on p4.

Two genera, *Ischyromys* and *Titanotheriomys*, have been included in the subfamily Ischyromyinae. Opinions differ, however, as to their status. Some consider both genera to be valid (Miller and Gidley, 1920; Wood, 1937, 1976, 1980); Black (1968) regards the latter as a junior synonym of the former; still others recognize *Titanotheriomys* as a subgenus of *Ischyromys* (Matthew, 1910; Heaton, 1996). The two taxa are similar in dental morphology. *Eosischyronys* differs from the North American ischyromyines in the following features; cheek teeth lower crowned; main cusps more prominent and elevated; lophs lower than the main cusps, especially the low, slender hypolophid and ectolophid; anterolophid long; and central valley broad. These are all primitive features in the Chinese ischyromyine.

Discussion

The age of the Changxindian Formation The age of the Changxindian

Formation was usually considered as Eocene or early Tertiary (Andersson, 1923; Hsien, 1933; Young, 1934; Chow, 1953). Zhai (1977) regarded its age as Late Eocene, after describing some mammalian fossils from the Changxindian Formation and comparing them with faunas of the Irdin Manha, Shara Murun, Wulidun etc. By recognizing the Naduan Mammal Age between the Sharamurunian and Ulangochuan, Tong (1989) considered the Naduan to be equivalent to the Duchesnean, and the Sharamurunian–Irdinmanhan equivalent to the Uintan in North America. He suggested that the age of the Changxindian Formation may be equivalent to the Naduan–Sharamurunian. Recently the Chadronian, Duchesnean and Uintan North American Land Mammal Ages have been reinterpreted as Late Eocene, latest Middle Eocene and late–middle Middle Eocene respectively (Berggren and Prothero, 1992; Berggren *et al.*, 1995; Prothero and Swisher, 1992). Tong, Qiu and Zheng (1995) equated the Naduan to the Duchesnean–Chadronian, latest Middle Eocene–Late Eocene, and the Sharamurunian, equivalent to the late Uintan, was late Middle Eocene in age. They considered the Changxindian mammalian fauna to represent only the earliest stage of the Naduan, later than Sharamurunian, and equivalent to the latest Middle Eocene Duchesnean. Meanwhile, they tentatively put the Caijiachong mammalian fauna in the Naduan as its later stage, which was equivalent to the late Eocene Chadronian. Wang (1997) thought that the Ulangochuan, equivalent to the Chadronian in North America, was Late Eocene instead of Early Oligocene as thought previously, and that the Caijiachong mammalian fauna belongs to the Late Eocene Ulangochuan rather than the Naduan. Thus, the Changxindian mammalian fauna is, in fact, equivalent to the whole Naduan, and is latest Middle Eocene in age.

The Changxindian mammalian fauna was known to include ? *Tupaiodon* sp., ? *Eudinoceras* sp., *Hypsimylus beijingensis*, *Miacis* sp., Canidae indet., *Imequincisoria* sp. and Amynodontidae indet. Zhai (1977) based his age determination on the above mammals. Some additional remarks regarding ? *Eudinoceras* sp. and *Imequincisoria* sp. are given below. ? *Eudinoceras* sp. was described by Young (1934) based on an upper premolar and a fragment of pelvis. Wang Jinweng suspected that the upper premolar is actually a P4 of some large anthracotheriid (Tong, 1989, p. 665). We agree with Wang. The tooth (Young, 1934, fig. 4) seems to be similar to that of *Anthrocothema rubricae* in size and morphology. *A. rubricae* is known from the Nadu Formation of Guangxi, China, and the Pondaung Formation of Burma. If this holds true, the Changxindian Formation may be equivalent to the two formations in age, i. e. latest Middle Eocene. However, *Imequincisoria* is known only from the Wulidun Formation, which is equivalent to the late Middle Eocene Sharamurunian in age. *Imequincisoria* sp. from Changxindian Formation is more primitive in morphology than *Guixia simplex* from the Naduan. This seems to indicate that the age of the Changxindian Formation is older

than the Naduan and equivalent to the Sharamurunian.

Lucas (1996) doubted Zhai's assignment of the Changxindian rhinoceros to *Imequincisoria* sp. He argued that the above mentioned specimens are smaller in size, and the M3 had a distinct metacone. He thus removed them to *Forstercooperia grandis*. This served the main argument to consider the Changxindian mammalian fauna as of Irdinmanhan in age. We compared the specimens from Changxindian with those of the related genera, *Imequincisoria*, *Juxia* and *Forstercooperia*. We found that V 5241 is more similar to *Juxia* and *Imequincisoria* than to *Forstercooperia* in the tooth morphology. The metacone on M3 in V 5241 is not strong at all, very similar to that in *Juxia* and *Imequincisoria*, much weaker than in *Forstercooperia* as evidenced by *F. grandis* and *F. minuta*. The same hold true for the p4 of Changxindian, which was mistaken by Lucas (1996, Pl. I, fig. 7) for m1. An entoconid and a transverse arm of hypoconid can be clearly seen on the p4. This differs widely from the nonmolariform lower premolars in *Forstercooperia*. However, V 5241 is slightly smaller than holotypes of *Juxia sharamurunense* and *Imequincisoria mazhuangensis*, and the P2 is slightly different in relative position of its protocone and hypocone. If *Imequincisoria* is considered as junior synonym of *Juxia*, it seems reasonable to refer them to *Juxia* sp. rather than to *Forstercooperia grandis*. According to the geological range of *Juxia* in Asia, the Changxindian Formation is of Sharamurunian age rather than Irdinmanhan age.

The Ischyromyinae were known from Duchesnean through Whitneyan in North America. As described above, *Eosischyromys youngi* appears to be an ischyromyine, more primitive than those from North America in tooth morphology. This suggests that *Eosischyromys* may appear a little earlier, prior to the Duchesnean, i. e., in the Sharamurenian. Recently Tabrum *et al.* (1996) reported ?*Ischyromys* sp. from the late Uintan of the Sage Creek Basin. *Eosischyromys* is similar to ?*Ischyromys* sp. in being lower in cheek tooth crown and in the morphology of m3, but differs from the latter in having slender, lower and longer transverse lophs, and broader middle valley on m1–2. *Eosischyromys* may be in the same evolutionary stage as or slightly more primitive than ?*Ischyromys* sp. Probably they are of the same age, late Uintan. This supports the opinion that the Changxindian Formation is of late Middle Eocene Sharamurunian Age.

The relationships of Ischyromyinae of Asia and North America The relationships of *Eosischyromys youngi* with those of the North America are not clear because the material of both *Eosischyromys youngi* and the early ischyromyines of North America are poorly known. However, the discovery of the Ischyromyinae in China shows that a fauna exchange event occurred during the late Middle Eocene. If *Eosischyromys youngi* is a primitive ischyromyine of Sharamurunian age and more primitive than ?*Ischyromys* sp. from late Uintan of Sage Creek Basin, the Ischyromyinae may have originated in Asia and migrated to North America in late Middle Eocene. If

Eosischyromys and ? *Ischyromys* sp. are in the same evolutionary stage and of the same age, they may represent different lineages split off earlier. Where and which rodent group may the ischyromyines originate from awaits further discovery.

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图版说明(Explanations of plates)

图版 I(plate I)

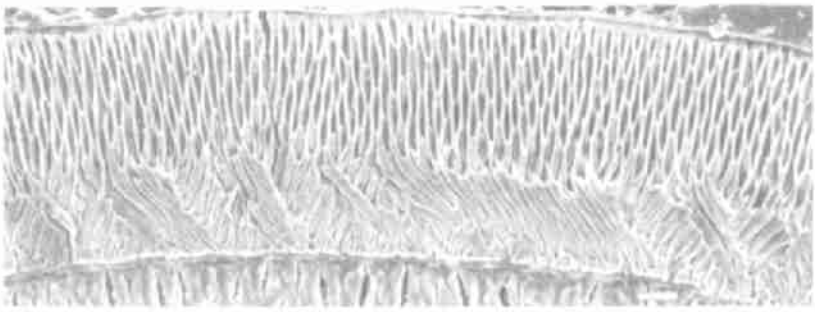
杨氏东方壮鼠(新属新种)*Eosischyromys youngi* gen. et sp. nov. 右下颌骨具 i2, p4—m2(Lower jaw with i2, p4—m2), 正型标本(holotype), V 11376 ×7

上(upper): 冠面观(occlusal view); 中(middle): 舌面观(lingual view); 下(Lower): 颊面观(buccal view)

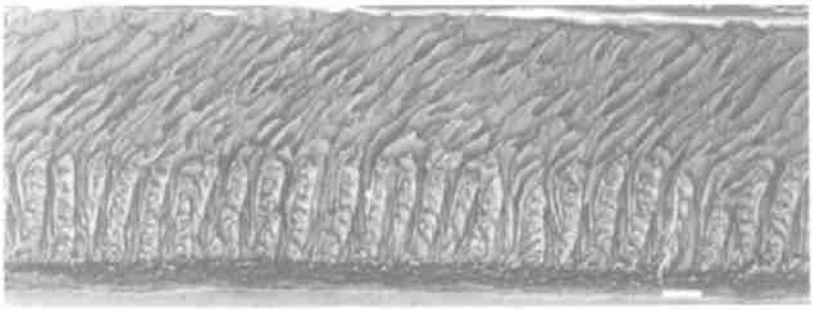
图版 II(plate II)

杨氏东方壮鼠(新属新种)*Eosischyromys youngi* gen. et sp. nov. 右下颌骨具 i2, m1—3(Lower jaw with i2, m1—3), V 11377

1. 下门齿珐琅质横切面(cross section of lower incisor enamel), 标尺: 10μ(scale bar = 10μ); 2. 下门齿珐琅质纵切面(Longitudinal section of lower incisor enamel), 标尺: 10μ(scale bar = 10μ); 3. 下颌骨冠面观(occlusal view of lower jaw), ×7; 4. 下颌骨颊侧观(buccal view of lower jaw), ×7



1



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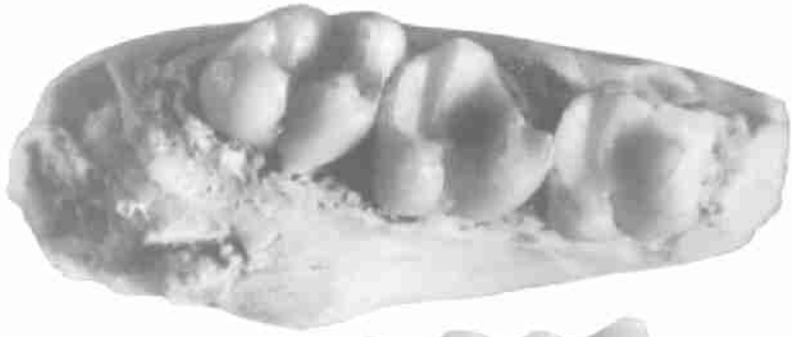

3

4