

内蒙古始新世梳趾鼠类化石¹⁾

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摘要 描述了4属10种梳趾鼠类化石(*Gobiomys neimongolensis*, *G. exiguus*(新种), *G. cf. G. exiguus*, *G. asiaticus*(新种), *Gobiomys?* spp., *Advenimus cf. A. bohlini*, *A. cf. A. burkei*, *Yuomys* sp.和 *Protataromys* sp.)。以 *Mergenomys neimongolensis* 作属型种建了一新属, *Gobiomys*。其特征是:门齿孔大;具P3;颊齿齿冠低,主尖明显,但不膨大,齿凹开阔;P4/p4非白齿化;上白齿宽大于长,后脊较发育;M1和M2具内脊;下外脊和下次小尖位置偏外。*G. exiguus*的特点是:个体较小,上颌骨颧突根在P3之前,下白齿缺下原尖后臂舌部,下内尖臂和下前齿带。*G. asiaticus*的上颌骨颧突后缘在P3的外方;白齿具较发达的齿脊;上白齿较宽短,后小尖较弱;下白齿具较发达的内尖臂和前齿带。

Gobiomyidae 新科包括 *Gobiomys*, *Mergenomys*, *Youngomys* 和哈萨克斯坦的未命名的新属等4属,组成与梳趾鼠科相对的姐妹群。其主要特征是,下颌骨缺咬肌窝上嵴。颊齿低冠,近于丘形齿。P3存在。P4/p4非白齿化,上白齿后脊伸向原尖或无,后小尖通常发育,无原小尖。p4无下后脊。下白齿下原尖后臂较向后伸,下内尖臂弱或无,下外脊约位于齿的纵中轴处,缺下中尖。

关键词 内蒙古,始新世,梳趾鼠类

中图法分类号 Q915.873

1 系统描述

梳趾鼠超科 *Ctenodactyloidea* Tullberg, 1899

戈壁鼠科(新科) *Gobiomyidae* fam. nov.

正型属 *Gobiomys* gen. nov. .

包括属 *Mergenomys*, *Youngomys* 和哈萨克斯坦的 *Ctenodactyloidea* gen. nov. [见 Wang et al., (MS)]。

地质时代分布 中-晚始新世。

地理分布 中国、蒙古和哈萨克斯坦。

特征 具豪猪型头骨和松鼠型下颌骨的梳趾鼠类。下颌骨咬肌窝伸达m2前缘或m1下方,具明显的下嵴,无明显的上嵴。齿式 1/1, 0/0, 2(1?)/1, 3/3。颊齿齿冠低,主尖发

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育, 齿脊较细弱。第四前臼齿非臼齿化。上臼齿无原小尖, 后脊向原尖方向斜伸或无, 后小尖通常明显, 内脊较低弱或无。p4 无下后脊。下臼齿下原尖后臂较明显后伸, 其舌部弱小或无; 下三角凹向后开口; 下外脊约位于齿的纵中轴处; 无下中尖; 下次尖臂通常较弱或无。m1~2 下次小尖发育, 位于齿的后缘中部。

比较 *Gobiomyidae* 与 *Ctenodactylidae* 的区别是, 颊齿齿冠较低, 齿尖较发育, 齿脊较弱。P3 通常存在。上臼齿后脊向原尖斜伸或无, 后小尖通常发育。p4 无下后脊。下臼齿下内尖臂通常弱或缺等。与 *Cocomyidae*, *Tamquammyidae*, *Chapattimyidae* 和 *Yuomyidae* 的区别在于下颌骨缺咬肌窝上嵴, 上臼齿具较高的前齿带, 下臼齿具较长的三角座和较向后伸的下原尖后臂, 下外脊约位于齿的纵中轴处, 下中凹与下外凹约等宽, 下次小尖大等。此外, *Gobiomyidae* 不同于 *Cocomyidae* 在于具豪猪型的头骨; 不同于 *Cocomyidae*, *Tamquammyidae* 和 *Chapattimyidae* 在于上臼齿缺原小尖, 下臼齿缺下中尖; 与 *Chapattimyidae* 和 *Yuomyidae* 的区别在于具非臼齿化的 P4/p4。

戈壁鼠(新属) *Gobiomys* gen. nov.

属型种 *Mergenomys neimongolensis* Meng, Ye, Huang, 1999.

归入种 *Gobiomys exiguus* sp. nov. 和 *G. asiaticus* sp. nov..

地质和地理分布 中-晚始新世, 中国内蒙古。

特征 中-小型梳趾鼠。上颌骨颧突后缘位于 P3 外方或稍前, 门齿孔大, 后端达 P4 舌侧。齿式: 1/1, 0/0, 2/1, 3/3。颊齿从前往后增大, 齿尖明显, 但不膨大, 齿凹较开阔; P4 前尖和原尖圆锥形, 后脊弱或无, 前、后齿带发育, 具三齿根; 上臼齿宽大于长, 从 M1 到 M3 后小尖逐渐变弱小, 而后脊由无到完全发育; M1 和 M2 具弱的内脊; p4 下外脊靠近颊侧; 下臼齿下外脊位于齿的纵中轴偏颊侧, 下外凹横向稍窄; m1~2 下次小尖位于齿后缘中部; m3 无明显下次小尖。

名称来源 Gobi, 英文, 戈壁, 沙漠; mys, 希腊文, 鼠类。

内蒙古戈壁鼠 *Gobiomys neimongolensis* (Meng, Ye, and Huang, 1999)

(图版 I, 1~8)

Mergenomys neimongolensis 孟, 叶, 黄, 1999: 166~167, 图版 I, 图 1~3.

Ctenodactylidae gen. et sp. nov., 王, 王, 1997: 122, 124, 128.

标本 6 个上颌骨 (IVPP V 12518.1~5, V 12519.1), 10 下颌骨 (V 12518.7~15, V 12519.19), 1 dP4 (V 12519.2), 2 P4 (V 12519.3~4), 5 M1 (V 12519.5~9), 6 M2 (V 12519.10~14, V 12520), 5 M3 (V 12518.6, V 12519.15~18), 2 p4 (V 12519.20~21), 3 m1 (V 12519.22~24), 9 m2 (V 12519.25~33) 和 3 m3 (V 12518.16~17, V 12519.34)。

地点和层位 内蒙古阿拉善左旗豪斯布尔都盆地绿根扎大盖, IVPP Loc. 74097 (94-1) (V 12518), 上始新统查干布拉格组第三层; 二连浩特火车站东 IVPP Loc. 88001 (V 12519) 和二连盐池西南陡坎 IVPP Loc. 88003 (V 12520), 上始新统呼尔井

组。

修订特征 上颌骨颧突后缘与 P3 相对。M1 具较发育的后小尖,但无后脊。下臼齿具游离的下原尖后臂舌部,下前齿带很弱或无,无明显的下内尖臂。

比较与讨论 上述标本在下颌骨的咬肌窝及其上、下嵴和前嵴的形状和位置,颊孔的位置,颊齿为低冠,丘形齿,下臼齿具短的下原尖后臂舌部,下外脊和下次小尖位于齿的纵中轴稍偏颊侧,下内尖臂不发育等特点都与 *Mergenomys neimongolensis* 的相似。而且上述标本的尺寸也与该种的相近。显然,上述标本应归入 *M. neimongolensis* 种。

孟津等(1999)认为 *M. neimongolensis* 与 *Mergenomys* 属的属型种 *M. orientalis* 的区别在于个体较大,下外脊和下次小尖的位置偏外等。较多的标本表明, *M. orientalis* 的尺寸是在 *M. neimongolensis* 的变异范围内。但两者在颊齿的冠面形态结构上的确有明显的区别。除了下外脊和下次小尖位置不同外, *M. neimongolensis* 在齿冠较低、下臼齿具下原尖后臂的舌部、下后尖和下内尖不膨大、而且向前倾、齿凹较开阔、下次小尖不膨大等特点都与 *M. orientalis* 的不同。此外,归入 *neimongolensis* 种的上颊齿与 *M. orientalis* 的也有明显区别:如上臼齿后小尖不膨大,从 M1 往 M3 逐渐变小;后脊往后由无变得较发育;中凹和后凹较开阔;M1 和 M2 具内脊等。笔者认为 *neimongolensis* 应代表一不同于 *Mergenomys* 的新属,定名为戈壁鼠 *Gobiomys*。 *Gobiomys* 与 *Youngomys* 的区别在于颊齿较宽短,上臼齿后脊和内脊较发育,后小尖较弱小;与哈萨克斯坦的 *Ctenodactyloidea* gen. nov.[见 Wang et al., (MS)]的区别是颊齿冠面结构较简单。

小戈壁鼠(新种) *Gobiomys exiguus* sp. nov.

(图版 II, 3~8)

正型标本 一段左上颌骨具 M1~M2 (IVPP V 12521.1)。

归入标本 三段上颌骨 (V 12521.2~4), 2 P4 (V 12521.5, V 12522.1), 1 M1 (V 12522.2), 1 M2 (V 12522.3), 1 M3 (V 12522.4), 1 p4 (V 12521.6) 和 3 m1/2 (V 12522.5~7)。

地点和层位 四子王旗额尔登敖包 IVPP Loc. 91004 (V 12521), 中始新统萨拉木伦组“下白层”;二连浩特火车站东 IVPP Loc. 88001 (V 12522), 上始新统呼尔井组。

特征 小型的戈壁鼠,比 *G. neimongolensis* 约小 1/3。上颌骨颧突后缘在 P3 之前,其腹侧供咬肌附着的位置靠近后缘,下臼齿缺下原尖后臂舌部、下内尖臂和下前齿带。

名称来源 *Exiguus*, 拉丁文,小,稀少。意寓该种个体小,发现的化石标本较稀少。

比较 上述标本在颊齿为低冠,丘形齿;主尖、后小尖和下次小尖不膨大;P4/p4 非臼齿化;具 P3; P4 前尖和原尖为丘形,具三齿根;M1~2 具低弱的内脊;M3 后脊发育,后小尖退化; p4 下原尖和下后尖为丘形,无下后脊,下次尖与下内尖有沟分开;下臼齿下外脊和下次小尖的位置偏颊侧等特征都与 *Gobiomys neimongolensis* 的相似,而与 *Mergenomys* 的不同,应归入 *Gobiomys* 属。但它们比 *G. neimongolensis* 小得多。其尺寸仅为后者的 2/3 左右。此外,它们的颧弓的位置较靠前,颧弓腹侧的棱的位置相对靠后,颊齿齿冠相对较低, M1 具弱的后脊, m1/2 的下外脊较明显靠颊侧和缺下原尖后臂舌部等。这些特点除了颧弓位置稍靠前外,其余的均较 *G. neimongolensis* 的原始,它们很可能代表比 *G.*

neimongolensis 较小、较原始的新种,称为 *G. exiguus*。

亚洲戈壁鼠(新种) *Gobiomys asiaticus* sp. nov.

(图版 II, 12~14)

正型标本 一段左上颌骨具 M1~2 (IVPP V 12524.1)。

归入标本 一段左上颌骨具 M1 (IVPP V 12524.2), 1 P4 (V 12524.3), 一段右下颌骨具 m1~2 (V 12524.4) 和 1 m1/2 (V 12524.5)。

地点和层位 四子王旗额尔登敖包 IVPP Loc. 91004, 中始新统沙拉木伦组“下白层”。

特征 小型的戈壁鼠。上颌骨颧突后缘位于 P3 的颊方。上臼齿较宽短,后小尖较弱,后脊较发达。下臼齿前齿带较发育,下内尖臂完全,伸达下次尖。

名称来源 Asiaticus, 拉丁文, Asia, 亚洲。

比较 上述标本在上颌骨颧突、门齿孔和下颌骨的形态结构上都与 *G. neimongolensis* 的一致。其齿式和颊齿的结构形态也与 *Gobiomys* 的相似。它们与 *G. neimongolensis* 和 *G. exiguus* 的区别是:上臼齿的后小尖较弱小,后脊较发达,下臼齿具完全的下内尖臂和发达的下前齿带。此外,它们比 *G. neimongolensis* 的尺寸小,下臼齿缺明显的下原尖后臂舌部;它们的上颌骨颧突后缘的位置较 *G. exiguus* 的靠后,上臼齿比例上较宽短等。

在二连浩特火车站东 IVPP Loc. 88001 呼尔井组中还发现了 10 来枚单个牙齿。它们分属似小戈壁鼠 (*Gobiomys* cf. *G. exiguus*)、戈壁鼠? (未订种) (*Gobiomys?* spp.)、似步林陌生鼠 (*Advenimus* cf. *A. bohlini* Dawson, 1964)、似贝克陌生鼠 (*Advenimus* cf. *A. burkei* Dawson, 1964)、原塔塔鼠 (未订种) (*Protataromys* sp.) 和豫鼠 (未订种) (*Yuomys* sp.)。

2 讨论

关于 *Gobiomys* 的分类位置 用 PAUP 3.1.1 对 *Gobiomys* 的分类位置进行了分析。图 1 显示了 Ctenodactyloids 最简约的合意树的一部分。图 1 表明 *Gobiomys* 与 *Mergenomys*、*Youngomys* 和哈萨克斯坦的 Ctenodactyloidea gen. nov. 组成一个科,戈壁鼠科 *Gobiomyidae*。该科组成 Ctenodactylidae 的姐妹组。

额尔登敖包产梳趾鼠化石地层的层位和时代 额尔登敖包地点的梳趾鼠化石产自灰白色含砾砂岩,系中亚考察团额尔登敖包剖面“下白层”的下部,或江浩贤(1983)的第 10 层。与沙拉木伦地区典型地点的乌兰戈楚组和沙拉木伦组的岩性比较,笔者认为“下白层”似应为沙拉木伦组的上部。根据该层所产的哺乳动物化石,“下白层”的时代很可能为中始新世。

呼尔井组的时代长时期被认为是渐新世,现被认为是晚始新世(王伴月,1997a)。上述梳趾鼠类的化石表明,二连浩特附近的呼尔井组中还产有原仅在中始新世地层中发现

的种类: *Advenimus* cf. *A. bohlini*, *A.* cf. *A. burkei*, *Yuomys* sp. 和 *Protataromys* sp.。由于它们的材料都比较零星,对它们的性质还无法确切地判断。如果上述种类的归属是合理的话,有二种可能性:1) 表明这些种类的分布时代比原来认为的要长些,可延续到晚始新世;2) 它们有可能是从较老的地层中冲刷出来后再沉积的。

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EOCENE CTENODACTYLOIDS (RODENTIA, MAMMALIA) FROM NEI MONGOL, CHINA

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Abstract The ctenodactyls from the Eocene of Nei Mongol include 10 species representing 4 genera (*Gobiomys neimongolensis*, *G. exiguus* sp. nov., *G.* cf. *G. exiguus*, *G. asiaticus* sp. nov., *Gobiomys?* spp., *Advenimus* cf. *A. bohlini*, *A.* cf. *A. burkei*, *Yuomys* sp. and *Protataromys* sp.). The new genus, *Gobiomys*, is erected based on the species, *neimongolensis*, which has previously been referred to *Mergenomys*. The main characters of *Gobiomys* are: incisive foramen large; P3 present; cheek teeth lower crowned, with distinct but not swollen main cusps and broad sinuses; P4/p4 non-molariform; upper molars wider than long, with rather developed metaloph; M1 and M2 with entoloph; on lower molars metaconid and entoconid inclining forwards and ectolophid and hypoconulid slightly buccally located. The main features of *G. exiguus* include small size, zygomatic process of maxillary anterior to P3, absence of lingual part of posterior arm of protoconid, arm of entoconid and anterior cingulum on lower molars. In *G. asiaticus* the posterior edge of the zygomatic process of maxillary is buccal to P3; the molars have more developed loph; the upper molars are relatively wide and have weaker metaconule; and the lower molars have more developed arm of entoconid and anterior cingulum.

The new family, *Gobiomyidae*, includes *Gobiomys*, *Mergenomys*, *Youngomys* and *Ctenodactyloidea* gen. nov. from Kazakhstan [see Wang et al., (MS)]. In the family the lower jaw lacks upper crest of masseteric fossa. The cheek teeth are brachydont and more bunodont than lophodont. P3 is usually present. P4/p4 are nonmolariform. On the upper molars the protoconule is absent, the metaloph extends towards protocone or absent and the metaconule is usually well-developed. The p4 has no metalophid. On lower molars the posterior arm of protoconid extends rather posteriorly and the arm of entoconid is weak or

absent. The ectolophid is near centrally located and has no mesoconid. The Gobiomyidae represent the sister group to the Ctenodactylidae.

Key words Nei Mongol, Eocene, Ctenodactyloidea

The living forms of the Ctenodactyloidea are restricted to North and Eastern Africa. However, from Paleogene through early Miocene they lived exclusively in Asia, where they flourished and were widely diverse, becoming dominant rodent group. Because of the abundance in fossils, high diversity, and rapid evolution, they are particularly important for the biostratigraphy of the Paleogene and Miocene in Asia. Up to now the study of the Ctenodactyloidea has been mostly concentrated on the fossils from the early and middle Eocene, Oligocene and Miocene. Only very few papers (Wang, 1984, 2001; Dashzeveg and Meng, 1998) have dealt with the late Eocene ctenodactyloids. In 1988, 1991 and 1994 teams of the IVPP conducted geologic survey in the vicinity of Erenhot (= Iren), Erden Obo (= Urtyn Obo) of Siziwang Qi, and Haosibuldu Basin of Alxa Zuoqi, in Nei Mongol, China, and collected a variety of mammal fossils from middle and upper Eocene, mainly by screening method. Among the fossils the ctenodactyloids from middle and upper Eocene are abundant and important. The discovery of the ctenodactyloids furnishes important information on the evolution of the group during the middle and late Eocene.

The terms used in this paper mainly follow Wang (1997b).

Abbreviations: IVPP, Institute of Vertebrate Paleontology and Paleoanthropology, Chinese Academy of Sciences; IVPP Loc., locality of IVPP; IVPP V, catalogue number of the vertebrate fossils of IVPP.

1 Systematics

Ctenodactyloidea Tullberg, 1899

Gobiomyidae fam. nov.

Type genus *Gobiomys* gen. nov.

Included genera *Mergenomys*, *Youngomys* and Ctenodactyloidea gen. nov. from Kazakhstan [see Wang et al., (MS)].

Geological range Middle-late Eocene.

Geographic distribution China, Mongolia and Kazakhstan.

Diagnosis Ctenodactyloids with hystricomorphous skull and sciurognathous mandible; masseteric fossa on mandible extending to below anterior edge of m2 or m1, with distinct lower crest, but without distinct upper crest; dental formula 1/1, 0/0, 2(1?)/1, 3/3; cheek teeth brachydont and more bunodont than lophodont; fourth premolar non-molariform; on upper molars protoconule absent, metaloph extending towards protocone or absent, metaconule usually distinct, entoloph weak or absent; p4 without metalophid; on lower molars posterior arm of protoconid extending rather posteriorly,

with or without weak lingual part, trigonid basin open posteriorly, ectolophid located near middle longitudinal line, mesoconid absent, arm of entoconid usually weak or absent; distinct hypoconulid located on the middle of posterior margin of m1~2.

Comparison The Gobiomyidae are different from the Ctenodactylidae in tooth morphology. Their cheek teeth are lower crowned, with more distinct cusps but weaker loph. P3 is present. On the upper molars the metaloph extends towards the protocone or absent, and the metaconule is usually well developed. The p4 lacks metalophid. The arm of entoconid is usually weak or absent on the lower molars. The Gobiomyidae differ from Cocomyidae, Tamquammyidae, Chapattimyidae and Yuomyidae in lacking upper crest of masseteric fossa of lower jaw, having higher anterior cingulum on upper molar, lower molar having a longer trigonid, a rather posteriorly extended posterior arm of protoconid, centrally located ectolophid and subequal mesosinusid and sinusid in width and a large hypoconulid; furthermore from the Cocomyidae in having a hystricomorphous skull; from the Cocomyidae, Tamquammyidae and Chapattimyidae in lacking protoconule on upper molars and mesoconid on lower molars; from Chapattimyidae and Yuomyidae in having non-molariform P4/p4.

***Gobiomys* gen. nov.**

Type species *Mergenomys neimongolensis* Meng, Ye, Huang, 1999.

Included species *Gobiomys exiguus* sp. nov. and *G. asiaticus* sp. nov.

Geological range and geographic distribution Middle-late Eocene; Nei Mongol, China.

Diagnosis Middle- and small-sized ctenodactyloids; posterior edge of zygomatic process of maxillary located buccally to P3 or more anteriorly; large incisive foramen reaching posteriorly to P4; dental formula 1/1, 0/0, 2/1, 3/3; cheek teeth increasing backwards in size, with distinct, but not swollen main cusps, and broad sinuses; P4 with conic paracone and protocone, weak or absent metaloph, well-developed anterior and posterior cingula and three roots; upper molars wider than long, from M1 to M3 metaconule varies from distinct to weak and metaloph from absent to complete; M1 and M2 with weak entoloph; ectolophid located buccally on p4; lower molars with ectolophid located slightly buccally to middle longitudinal line and narrow sinusid; hypoconulid located at middle of posterior margin of m1~2 and absent on m3.

Etymology Gobi, English, desert, and mys, Greek, mouse.

Remarks The type species, *Gobiomys neimongolensis*, was referred to the genus *Mergenomys* by Meng et al. (1999). It seems to me that the species represents a new genus distinct from *Mergenomys*, here named as *Gobiomys* (detail see below).

***Gobiomys neimongolensis* (Meng, Ye, and Huang, 1999)**

(pl. I, 1~8)

Mergenomys neimongolensis Meng, Ye, Huang, 1999: 166~167, pl. I, figs. 1~3.

Ctenodactylidae gen. et sp. nov., Wang, Wang, 1997: 122, 124, 128.

Specimens 6 upper jaws (IVPP V 12518.1~5, V 12519.1), 10 lower jaws (V 12518. 7~15, V 12519.19), 1 dP4 (V 12519.2), 2 P4 (V 12519.3~4), 5 M1 (V 12519.5~9), 6 M2 (V 12519.10~14, V 12520), 5 M3 (V 12518.6, V 12519.15~18), 2 p4 (V 12519.20~21), 3 m1 (V 12519.22~24), 9 m2 (V 12519.25~33) and 3 m3 (V 12518.16~17, V 12519.34).

Localities and horizons IVPP Loc. 74097 (94-1) (V 12518), Lügenzhadagai, Haosibuldu Basin, Alxa Zuoqi, 3rd layer of upper Eocene Qagan Bulag (=Chaganbulage) Formation; IVPP Loc. 88001 (V 12519), east to the Railway Station of Erenhot and IVPP Loc. 88003 (V 12520), the front of the scarp southwest to Eren Dabasu (=Eren salt marsh), upper Eocene Houldjin Formation.

Emended diagnosis Posterior edge of zygomatic process of maxillary opposite to P3; M1 with well-developed metaconule but without metaloph; lower molars with free lingual part of posterior arm of protoconid, anterior cingulum weak or absent, and without distinct arm of entoconid.

Remarks The above listed specimens are almost identical with those of *Mergenomys neimongolensis* of Meng et al. (1999) in both size and morphology. The common features are the following. The large masseteric fossa of the lower jaw extends to the level of anterior edge of the m2 or even more anteriorly, and has a well-developed lower crest, but no distinct upper crest. The crest anterior to the masseteric fossa extends obliquely to below the posterior root of p4. The mental foramen is under the anterior root of p4. The lower cheek teeth have weak metalophid I and short lingual part of posterior arm of protoconid. The metaconid and entoconid are not swollen but incline forwards. The ectolophid and hypoconulid are situated slightly buccal to the middle longitudinal line. The arm of entoconid is weak. The size of the holotype (V 11701) of *M. neimongolensis* is within the range of variation of the specimens from Nei Mongol. The specimens mentioned above belong to the species, *M. neimongolensis*.

The specimens from Nei Mongol show more features of *G. neimongolensis*. The skull is hystricomorphous. The infraorbital foramen is large. The posterior edge of the flat zygomatic process of the maxillary is opposite to P3. On its ventral surface there is a distinct crest near the anterior edge. The large incisive foramen extends posteriorly to the level of P4. The body of the mandible is high. The lower jaw is typical sciurognathous. The anterior end of the angular process arises from below the alveolus of the lower incisor. The high and large ascending ramus has higher coronoid process and condyle than the tooth row. The pterygoid fossa is large and deep. The mandible foramen is as high as the occlusal surface of the tooth row. The P3 is

present. The upper cheek teeth have distinct, but not swollen main cusps. The P4 is non-molariform and has conic paracone and protocone. The upper molars have broad sinuses and lack protoconule. From M1 to M3 the metaconule decreased and the metaloph varies from absent to developed. The M1 and M2 have entoloph.

Meng et al. (1999) pointed out that the differences of his material of *M. neimongolensis* from the type species, *M. orientalis* Dashzeveg and Meng (1998), are in being larger sized and having more buccally positioned ectolophid and hypoconulid. Additional specimens from Nei Mongol show that the size of *M. orientalis* is within the range of the variation of *M. neimongolensis*. But the occlusal pattern of the cheek teeth of the two species is quite different. Except those mentioned by Meng et al. (1999), in *M. neimongolensis* the cheek teeth are more lower-crowned than in *M. orientalis*. The posterior arm of protoconid has a lingual part. The metaconid, entoconid and hypoconulid are not so swollen as in *M. orientalis*, and the two former cuspids incline forwards. The sinuses are broad. The metaconule is not swollen, but decreases from M1 to M3. The metaloph varies from absent to developed backwards.

Table 1 Measurements of cheek teeth of *Gobiomys neimongolensis* * (mm)

	N	Min	Max	Aver	SD	CV
M1~3L	1			5.4		
P4 L	3	1.11	1.25	1.16	0.06	0.05
P4 W	3	1.4	1.5	1.47	0.05	0.03
M1 L	7	1.53	1.94	1.82	0.15	0.08
M1 W	7	1.7	2.18	1.95	0.14	0.07
M2 L	10	1.85	2.3	2.06	0.13	0.06
M2 W	9	2	2.46	2.17	0.15	0.07
M3 L	5	2.05	2.28	2.19	0.07	0.03
M3 W	5	1.9	2.2	2.08	0.11	0.05
dP4 L	1			1.17		
dP4 W	1			1.2		
p4~m3 L	1			6.46		
m1~3L	2	5.24	5.8	5.52	0.28	0.05
p4 L	2	1.13	1.17	1.15	0.02	0.02
p4 W	2	1	1	1	0	0
m1 L	7	1.5	1.9	1.74	0.14	0.08
m1 W	7	1.3	1.63	1.47	0.14	0.09
m2 L	12	1.8	2.45	2.04	0.19	0.1
m2 W	14	1.53	2.1	1.81	0.17	0.1
m3 L	5	1.91	2.2	2.11	0.11	0.05
m3 W	5	1.42	1.83	1.62	0.14	0.08

* Abbreviations: L, length; W width; N, number of specimens; Min, minimum; Max, maximum; Aver, average; SD, standard deviation; CV, coefficient of variation.

The M1 and M2 have entoloph. It seems that *neimongolensis* represents a new genus distinct from *Mergenomys*, *Gobiomys*.

Gobiomys differs from *Youngomys* in having wider upper cheek teeth, more developed metaloph, entoloph and weaker metaconule on upper molars; from *Ctenodactyloidea* gen. nov. from Kazakhstan [see Wang et al., (MS)] in having simpler occlusal pattern on cheek teeth.

***Gobiomys exiguus* sp. nov.**

(pl. II, 3~8)

Holotype One segment of left maxillary with M1~M2 (IVPP V 12521.1).

Referred specimens Three upper jaws (IVPP V 12521.2~4), 2 P4 (V 12521.5, V 12522.1), 1 M1 (V 12522.2), 1 M2 (V 12522.3), 1 M3 (V 12522.4), 1 p4 (V 12521.6) and 3 m1/2 (V 12522.5~7).

Localities and horizons IVPP Loc. 91004 (V 12521), Erden Obo, Siziwang Qi, "Lower White" of middle Eocene Shara Murun Formation; IVPP Loc. 88001 (V 12522), east to the Railway Station of Erenhot, upper Eocene Houldjin Formation.

Diagnosis Small-sized *Gobiomys*, one-third smaller than *G. neimongolensis*; zygomatic process of maxillary anterior to P3 and crest on its ventral surface near the posterior edge of zygomatic process; lower molars lack lingual part of posterior arm of protoconid, arm of entoconid and anterior cingulum.

Etymology *Exiguus*, Latin: little, meager.

Description The posterior edge of the flat zygomatic process of maxillary is slightly anterior to P3. The crest on its ventral surface is near the posterior edge of the zygomatic process. The large incisive foramen extends to opposite to the anterior side of P4 or more anteriorly. Based on the alveolus the P3 has single root.

On P4 the paracone and protocone are conic. The posterior arm of the paracone is weak and does not reach to the posterior cingulum. The protocone is larger than the paracone. Its anterior arm may be short (in one P4) or absent (in 2 P4). Its posterior arm reaches to the posterior cingulum. The protoloph is low and slender or absent. The anterior and posterior cingula are well developed, but low. P4 has three roots.

The M1 is somewhat trapezoidal in occlusal view, with narrower anterior side than posterior one. The subequal paracone and metacone are smaller than the protocone and hypocone. The hypocone is posterior to the protocone. The entoloph is complete but weak. The protoloph is complete and the protoconule is absent. The metaconule is subequal to and anterolingual to the metacone. The weak and slender metaloph extends to the protocone or entoloph and sometimes interrupted between the metacone and metaconule. The anterior cingulum is shorter than the posteroloph and joins with the protoloph. The anterocone is present. The mesosinus and posterosinus

are broad. The shallow sinus is transverse.

The M2 is larger than M1 and relatively wider and shorter. The anterior cingulum is more developed and reaches to the protoloph. But on V 12522.3 the anterior cingulum is much lower than the protoloph and does not join with the latter. The entoloph is weaker or absent.

Unlike M2, M3 has a reduced posterior part. The metacone is much smaller than the paracone. The well-developed metaloph extends to the protocone. The hypocone is much smaller than the protocone and closer to the latter in the position. The short posteroloph extends anterolingually. The entoloph is indistinct.

p4 is oval in occlusal view, with a narrower and higher trigonid than talonid. The weak anteroconid is near metaconid. The subequal and conic protoconid and metaconid are separated by a longitudinal groove. No metalophid is present. The posterior arm of the protoconid extends posterolingually. The low ectolophid is located slightly buccal to the middle longitudinal line. The lower hypoconid extends anterobuccally and separated from the conic entoconid by a groove.

The m1/2 (= m1 or m2) is oval in occlusal view, with wider posterior side. The subequal metaconid and entoconid are conic but not swollen, The protoconid and hypoconid are larger than the two lingual cuspids. The metalophid I is complete but low. The posterior arm of the protoconid extends rather posteriorly and has no distinct lingual part. The ectolophid is complete and located buccally to the middle longitudinal line. The arm of entoconid weakly extends posterobuccally or absent. The distinct hypoconulid is not swollen and located at the middle of the posterior side of the m1/2. The weak arm of the hypoconulid joins with the hypoconid. The well-developed posterolophid extends from the hypoconulid to both buccally and

Table 2 Measurements of cheek teeth of *Gobiomys exiguus* sp. nov. * (mm)

	N	Min	Max	Aver	SD	CV
P4 L	3	0.67	0.8	0.72	0.06	0.08
P4 W	3	0.92	1.1	0.99	0.08	0.08
M1 L	4	1	1.16	1.08	0.06	0.06
M1 W	4	1	1.2	1.08	0.08	0.07
M2 L	5	1.2	1.38	1.29	0.06	0.04
M2 W	5	1.2	1.4	1.33	0.07	0.05
M3 L	3	1.22	1.5	1.34	0.12	0.09
M3 W	3	1.23	1.53	1.35	0.13	0.1
p4 L	1			0.83		
p4 W	1			0.67		
m1/2 L	2	1.27	1.34	1.31	0.04	0.03
m1/2 W	2	1.2	1.22	1.21	0.01	0.008

* Abbreviations see table 1.

lingually. No distinct anterior cingulum is present. The trigonid basin, mesosinusid and posterosinusid are broad and communicated. The sinusid is transverse U-shaped and slightly oblique posterolingually. Two roots are present.

Comparison The specimens described above are similar to those of *Gobiomys neimongolensis* rather than *Mergenomys* in the following features. The cheek teeth are brachydont and bunodont. The main cusps, metaconule and hypoconulid are not swollen. The P4/p4 are non-molariform. The P3 is present. The P4 has conic paracoste and protocone and three roots. The M1~2 have weak and low entoloph. The M3 has rather developed metaloph and reduced metaconule. The p4 has conic protoconid and metaconid and separated entoconid and hypoconid, and lacks metalophid. The lower molars have slightly more buccally located ectolophid and hypoconulid, and lack anterior cingulum. However, they are smaller than those of *G. neimongolensis* in size. The posterior edge of the zygomatic process of maxillary is anterior to the P3. The ventral crest for the masseter muscle is more posteriorly located. The cheek teeth are lower crowned. The M1 has a weak metaloph. On m1/2 the ectolophid is more buccally located and the posterior arm of protoconid lacks lingual part. It seems that the specimens may represent a smaller and more primitive species than *G. neimongolensis*, here named as *G. exiguus*.

Gobiomys cf. *G. exiguus*

(pl. I, 9)

One P4 (IVPP V 12523) was collected from IVPP Loc. 88001, east to the Railway Station of Erenhot, upper Eocene Houldjin Formation. It is similar to *G. exiguus* in the basic pattern. But it is much smaller than P4 of *G. exiguus* in size ($L \times W: 0.5 \times 0.62$) and the posterior arm of the protocone is not developed.

Gobiomys asiaticus sp. nov.

(pl. II, 12~14)

Holotype One segment of left maxillary with M1~2 (IVPP V 12524.1).

Referred specimens A segment of left maxillary with M1 (IVPP V 12524.2), 1 P4 (V 12524.3), 1 right mandible with m1~2 (V 12524.4) and 1 m1/2 (V 12524.5).

Locality and horizon IVPP Loc. 91004, Erden Obo, Siziwang Qi; "Lower White" of middle Eocene Shara Murun Formation.

Diagnosis Small-sized *Gobiomys*; posterior edge of zygomatic process of maxillary opposite to P3; upper molars wide and short, with weak metaconule and relatively developed metaloph; lower molars with anterior cingulum, complete arm of entoconid reaching to hypoconid.

Etymology Asiaticus, Latin, Asia.

Description As in *G. neimongolensis* the zygomatic process of the maxillary is

flat and has a well-developed ventral crest for masseter muscle. The posterior edge of the zygomatic process is opposite to P3. The large incisive foramen reaches the level of P4. The upper and lower crests and anterior crest of the masseteric fossa are similar to those of *G. neimongolensis*, but the fossa extends anteriorly to the posterior part of m1. The P3 is present.

As in *Gobiomys* the P4 has conic and subequal paracone and protocone. The short posterior arm of paracone does not reach to the posterior cingulum. The two arms of the protocone are also short. The anterior arm is free and the posterior one reaches to the base of the posterior cingulum. The metaloph is weak. Both the anterior and posterior cingula are well developed.

The M1 is wide rectangular in occlusal view. As in *Gobiomys* the subequal paracone and metacone are smaller than the lingual cusps. The protoloph is complete and low, and has no protoconule. The slender metaloph extends obliquely to the protocone or entoloph. The metaconule is distinct. The entoloph is low and weak. A mesostyle is present. Both the anterior cingulum and posteroloph are well developed. The mesosinus and posterosinus are broad. The sinus is symmetric. The M2 is larger than M1 in size. The posterior side is narrower than the anterior one. The metacone and hypocone are smaller than the two anterior ones. The metaconule is small. The metaloph is well developed. The sinus shifts slightly posteriorly.

The m1 has wider posterior side than anterior one. The subequal and conic metaconid and entoconid incline anteriorly but are not swollen. The protoconid is larger than the metaconid and located slightly posteriorly. The metalophid I is low and short. The posterior arm of protoconid extends rather posteriorly to fuse with the ectolophid and has no distinct free lingual part. The trigonid basin is widely open posteriorly. The straight ectolophid is slightly buccal to the middle longitudinal line. The well-developed hypoconulid is not swollen and has a weak arm reaching to the hypoconid. One of the particular features is that the arm of entoconid is transverse and reaches to the hypoconid. The anterior cingulum is present. The posterolophid is short and does not much extend transversely. The mesosinusid is broad and communicates with the trigonid but separates from the posterosinusid. The broad sinusid is slightly narrower than the mesosinusid and slightly oblique posteriorly. The m2 is larger than m1. The trigonid is relatively wide. The posterior arm of protoconid is slightly oblique lingually and has a short lingual part. The posterolophid is well developed.

Dimensions (L × W): P4: 0.95 × 1.4; M1: 1.38 × 1.53, 1.33 × 1.6; M2: 1.53 × 1.77; m1: 1.15 × 0.96; m2: 1.28 × 1.12, 1.35 × 1.25.

Comparison As described above, the specimens described here are similar to those of *Gobiomys* in basal features. However, the upper molars have weaker metaconule and more developed metaloph than those of *G. neimongolensis* and *G.*

exiguus. The lower molars have complete arm of entoconid reaching to the hypoconid and a distinct anterior cingulum. In addition, their size is much smaller than those of *G. neimongolensis* and the posterior arm of protoconid of the lower molars lacks lingual part. They are different from those of *G. exiguus* in having wider and shorter upper molars and posteriorly located zygomatic process of the maxillary.

***Gobiomys?* spp.**

(pl. II, 1~2)

From the late Eocene Houldjin Formation at IVPP Loc. 88001, east to the Railway Station of Erenhot, three upper molars [1 M1/2 (IVPP V 12651) and 2 M3 (IVPP V 12652.1~2)] are close to *G. exiguus* in size (L×W: M1/2: 1.3×1.2; M3: 1.3×1.23, 1.22×1.28). But the M1/2 is longer than wide, and has a low anterior cingulum. The protocone is V-shaped. The metaconule is very weak. No distinct entoloph is present. There is an accessory crest at the entrance of the sinus. In M3 the longer protoloph bends posteriorly. The metacone is small. The posteroloph is more developed than the metaloph. The hypocone is not so close to protocone as in other *Gobiomys*.

***Advenimus* cf. *A. bohlini* Dawson, 1964**

(pl. II, 9~10)

Three lower molars [m1, m2 and m3 (IVPP V 12525.1~3)] were collected from the late Eocene Houldjin Formation at IVPP Loc. 88001, east to the Railway Station of Erenhot. They are similar to *Advenimus bohlini* in the basal pattern and size. But they have more developed posterolophid and smaller sized m1. Dimensions (L×W): m1: 1.28×1.02; m2: 1.65×1.36; m3: — ×1.33.

***Advenimus* cf. *A. burkei* Dawson, 1964**

(pl. II, 15)

From the late Eocene Houldjin Formation at IVPP Loc. 88001, east to the Railway Station of Erenhot, two lower molar (m1/2 and m3, IVPP V 12526.1~2) were collected. They are different from *A. burkei* of Dawson (1964) but similar to *A. cf. A. burkei* of Averianov (1996) in having rather developed ectolophid, more lingually extending posterior arm of protoconid, and no distinct mesoconid on m1/2. Dimension (L×W): m1/2: 2.3×1.86.

***Protataromys* sp.**

(pl. II, 11)

From the late Eocene Houldjin Formation at IVPP Loc. 88001, east to Railway Station of Erenhot, one P4 (IVPP V 12527) has a V-shaped paracone and protocone,

well-developed lophs and cingula, and two roots. All these features are similar to those of *Protataromys*. It differs from that of *P. mianchiensis* in having a weaker posterior arm of paracone and a posterior cingulum not joining with the protocone. Dimension (L × W): 0.95 × 1.4.

***Yuomys* sp.**

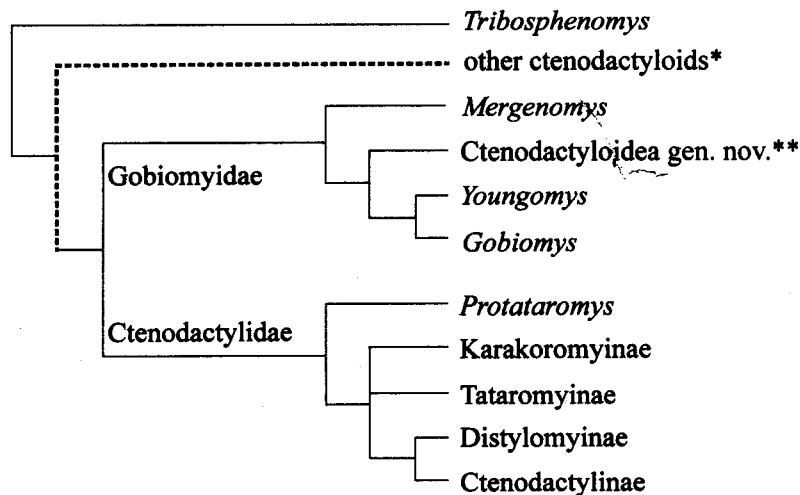
(pl. I, 10)

Two upper molars (M1/2, IVPP V 12528.1~2) were collected from the late Eocene Houldjin Formation at IVPP Loc. 88001, east to Railway Station of Erenhot. They are unilateral hypsodont, and have well-developed four lophs. The hypocone is large and the entoloph is high. All of these are similar to *Yuomys*. But it is smaller than known species of *Yuomys* in size. The metaloph is slender and the buccal part joining the metacone with the metaconule is long and parallel to the protoloph. The sinus is shallow and the short hypostria extends dorsally to 1/4 part of the lingual crown. Dimensions (L × W): 3.1 × 3.3; 3.0 × 3.4.

2 Discussion

2.1 Systematic position of *Gobiomys* in the Ctenodactyloidea

Systematic position of the *Gobiomys* in the Ctenodactyloidea is analyzed using PAUP 3.1.1. The character analysis and terminal taxa used follow Wang (2001). The 26 characters of *Gobiomys* are as follows: 1:1, 2:2, 3:1, 4:1, 5:0, 6:0, 7:0, 8:1, 9:0/1, 10:0, 11:1, 12:0, 13:3, 14:0, 15:0, 16:1, 17:0, 18:1, 19:1, 20:2, 21:0, 22:0/1, 23:1, 24:1, 25:1, 26:?. All characters are unordered and unweighted. The ACCTRAN



* Detail see Wang, 2001.

** Ctenodactyloidea gen. nov. from Kazakhstan [see Wang et al. (MS)].

Fig.1 Diagram of the part of the phylogenetic relationships of the Paleogene Ctenodactyloidea of Asia, showing the position of *Gobiomys*

optimization was used. Heuristic search yielded three equally most parsimonious trees as in Wang (2001), but the tree length is 95 steps. Each tree has the following properties: Consistency index (CI) = 0.589, Homoplasy index (HI) = 0.474, CI excluding uninformative characters = 0.545, HI excluding uninformative characters = 0.484, Retention index (RI) = 0.773 and Rescaled consistency index (RC) = 0.456. Part of the strict consensus of the three trees is illustrated in fig.1. The other part of the tree is seen in the complete tree in Wang (2001, fig.2). As fig.1 shows, *Gobiomys*, *Youngomys*, *Mergenomys* and *Ctenodactyloidea* gen. nov. from Kazakhstan [see Wang et al., (MS)] may belong to one family, which is named as the Gobiomyidae. The Gobiomyidae may form a sister group to the Ctenodactylidae.

2.2 The layer and age of the deposits yielding the ctenodactyloids in the Erden Obo area

— The ctenodactyloids from the Erden Obo area were collected from the “Lower White” of Central Asiatic Expedition (= the 10th layer of the Erden Obo section of Jiang, 1983). Originally the boundary between the Ulan Gochu Formation and the Shara Murun Formation was left unsettled as the Section 2 in Osborn (1929) shows. Later the lower part of the “Lower White” was considered to belong to the Ulan Gochu Formation (Chang, 1931; Qi, 1990) or Erden Obo Formation (Jiang, 1983). According to the original description at the type locality, the Shara Murun Formation included two parts: the upper one consists chiefly of white and light gray sandstone and the lower one is almost wholly sandy clay, richly variegated in color, in which red beds predominate (Berkey and Morris, 1927: 182, 209~210, 362, 371), and the Ulan Gochu Formation is composed of red clay (Berkey et al., 1929: 11). In comparison with the lithology of the classic localities it seems that the “Lower White” represents the upper part of the Shara Murun Formation rather than the lower part of the Ulan Gochu Formation. According to the mammalian fauna the “Lower White” is probably middle Eocene in age.

The age of the Houldjin Formation is considered as late Eocene (Wang, 1997a). As shown above, the Houldjin Formation near Erenhot bears some middle Eocene taxa: *Advenimus* cf. *A. bohlini*, *A.* cf. *A. burkei*, *Yuomys* sp. and *Protataromys* sp. However, the specimens of these taxa are too few to determine the age of the Houldjin Formation. There are two possibilities: 1) their geological age can last to late Eocene, thus longer than previously expected; or 2) the taxa found in the formation may be transported from some underlying deposits.

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Explanations of plates

Plate I

1~8. *Gobiomys neimongolensis*, 1. Occlusal view of right dP4 (V 12519.2), $\times 20$; 2. buccal view of right lower jaw with m1~3 (V 12518.8), $\times 3$; 3. occlusal view of left P4 (V 12519.4), $\times 20$; 4. occlusal view of left M1 (V 12519.5), $\times 20$; 5. occlusal view of right M2 (V 12519.13), $\times 20$; 6. occlusal view of right M3 (V 12519.18), $\times 20$; 7. occlusal view of right p4~m3 (V 12518.7), $\times 15$; 8. occlusal view of left M1~3 (V 12518.1), $\times 15$; 9. occlusal view of right P4 (V 12523) of *Gobiomys* cf. *G. exiguus*, $\times 30$; 10. occlusal view of left M1/2 (V 12528.1) of *Yuomys* sp., $\times 10$

Plate II

Occlusal view of cheek teeth of Eocene ctenodactyloids from Nei Mongol, scale = 1 mm 1. Left M1/2 (V 12651) of *Gobiomys?* sp., 2. right M3 (V 12652.2) of *Gobiomys?* sp., 3~8. *Gobiomys exiguus* sp. nov. 3. left P4 (V 12521.5), 4. right p4 (V 12521.6), 5. right M2 (V 12522.3), 6. left M1~2 (V 12521.1, holotype), 7. left M3 (V 12522.4), 8. left m1/2 (V 12522.5), 9~10. *Advenimus* cf. *A. bohlini*, 9. right m1 (V 12525.1), 10. left m2 (V 12525.2), 11. left P4 (V 12527) of *Protataromys* sp., 12~14. *Gobiomys asiaticus* sp. nov., 12. right m1~2 (V 12524.4), 13. right P4 (V 12524.3), 14. left M1~2 (V 12524.1, holotype), 15. right m1/2 (V 12526.1) of *A.* cf. *A. burkei*



