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食虫类和翼手类化石在内蒙古上始新统首次发现[1)]

王 伴 月
（中国科学院古脊椎动物与古人类研究所 北京 100044）

摘要：描述了2种食虫类化石（*Anatolechinos neimongolensis* gen. et sp. nov., *Ictopidium lechei*），1刺猬科（属、种未定）（Erinaceidae gen. et sp. indet.）和2类属、种未定的蝙蝠化石（Microchiroptera gen. et sp. indet. A和B）。*Anatolechinos* gen. nov.的主要特点是：个体较小；具pI/1；颊齿齿冠低，主齿尖低钝；P3－M3前附尖低小；P3－M2的后附尖脊短而低，次尖与后齿带有棱相连，舌侧无齿带；P3－4舌叶较长，次尖大；P3次尖与原尖有棱相连；M1原小尖和后小尖的前、后棱均较短，次尖前棱很弱；M3后小尖后棱长；下臼齿下内尖棱短等。认为原归入齿鼩猬的*Tupaiodon huadianensis*也应归入*Anatolechinos*新属。新种*A. neimongolensis*与*A. huadianensis*的主要区别是其个体较小，齿冠稍高，p4无下前边尖，外齿带弱而不完全等。将*Anatolechinos*归入Erinaceidae的Tupaiodontinae。讨论了内蒙古中－西部在晚始新世的古生态环境。

关键词：内蒙古，晚始新世，食虫类，翼手类
中图法分类号：Q915.873 **文献标识码**：A **文章编号**：1000－3118(2008)04－0249－16

20世纪80－90年代，中国科学院古脊椎动物与古人类研究所与内蒙古二连恐龙博物馆和中国人民解放军84994部队分别联合组队在内蒙古一些地点考察时，在二连浩特、额尔登敖包和豪斯布尔都盆地等地区晚始新世地层中采集到许多小哺乳动物化石。除已陆续发表的兔形类、啮齿类和灵长类化石外（王伴月，2001，2007a，b，2008a，b），还有一些食虫类和翼手类的化石尚未研究。尽管过去在内蒙古古近系中发现过不少食虫类化石，但在上始新统中发现这类化石尚属首次。而翼手类化石在内蒙古古近系中则是首次发现。这次发现不但扩大了食虫类和翼手类的分布范围，增加了新的属、种和有关动物群的种类，而且对内蒙古的古气候环境也提供了新的佐证。

文中描述所用术语依王伴月、李春田（1990）。文中缩写：IVPP，中国科学院古脊椎动物与古人类研究所；IVPP Loc，中国科学院古脊椎动物与古人类研究所野外地点号；IVPP V中国科学院古脊椎动物与古人类研究所脊椎动物化石编号。

1）中国科学院知识创新工程重要方向项目（编号：KZCX2－YW－120）和国家自然科学基金重点项目（编号：40730210）资助。

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1 系统描述

刺猬目 Erinaceomorpha Gregory, 1910

刺猬科 Erinaceidae Fischer de Waldheim, 1817

齿鼩猬亚科 Tupaiodontinae Butler, 1988

东方猬(新属)*Anatolechinos* gen. nov.

属型种 *Anatolechinos neimongolensis* sp. nov.。

归入种 *Tupaiodon huadianensis* Wang & Li, 1990。

地理和地质时代分布 中国内蒙古自治区和吉林省,中-晚始新世。

属的特征 一种较 *Tupaiodon* 稍小的猬类。颏孔位于 p3 前齿根下方。齿式:3? ·1·4·3/3? ·1·4·3。颊齿齿冠低,主齿尖低钝。P3-M3 前附尖低小。P3-M2 的后附尖脊短而低;次尖与后齿带有棱相连;舌侧无齿带。P3-4 舌叶较长,具较大次尖。P3 次尖与原尖有棱相连。M1 的中央棱不完全;原小尖和后小尖的前、后棱短,后小尖后棱不达后齿带;次尖前颊侧棱很弱。M3 原小尖和后小尖明显,后小尖后棱长。下臼齿下内尖棱短,不达下后尖。m3 下次小尖靠近下内尖。

名称来源 Anatole,希腊文,东方的;echinos,希腊文,刺猬。

内蒙东方猬(新属、新种) *Anatolechinos neimongolensis* gen. et sp. nov.

(图 1-2;表 1)

正型标本 左 M1(IVPP V 15532.1)。

归入标本 2 C1(V 15533.1-2),右 P1/2(V 15532.2),右 P3(V 15532.3),左 P4 的舌部(V 15532.4),3 M1(V 15532.5-7),右 M3(V 15532.8),一段右下颌骨具 p3-m3 (V 15532.9),2 i2/3(V 15532.10-11),左 c1? (V 15532.12),右 p2(V 15533.3),3 p3(V 15532.13-14, V 15533.4),5 p4(V 15532.15-18, V 15533.5),4 m1(V 15532.19-20, V 15533.6, V 15534)和 4 m2(V 15532.21-24)。

地点和层位 内蒙古二连浩特火车站东 IVPP Loc. 1988001,上始新统呼尔井组(V 15532);乌兰察布盟四子王旗额尔登敖包 IVPP Loc. 1991004,上始新统乌兰戈楚组"下白层"(V 15533);阿拉善左旗豪斯布尔都盆地绿根扎大盖 IVPP Loc. 1974097(1994-1),上始新统查干布拉格组第三层 (V 15534)。

特征 个体较小的东方猬。下颌骨水平支下缘在颊齿下方稍圆凸,下颌骨在 m1 处最高。颊齿齿冠稍高。p4 无下前边尖;外齿带弱,不完全。

名称来源 种名来自化石产出地区内蒙古。

描述 V 15532.9 下颌骨主要保存有水平支大部分,c1 及其前的部分缺失。水平支低而平直。水平支下缘在颊齿的下方为稍向下凸的圆弧形,其高度在 m1 处最高,约 2.3 mm,从 m3 往后下缘较明显向后上方伸。颏孔位于 p3 前齿根下方,水平支中部。咬肌窝深,其前缘在 m3 之后(图 1)。

V 15532.9 的 p3 之前保存有 2 个齿槽。该 2 齿槽存在 3 种可能性。其一是 2 齿槽均

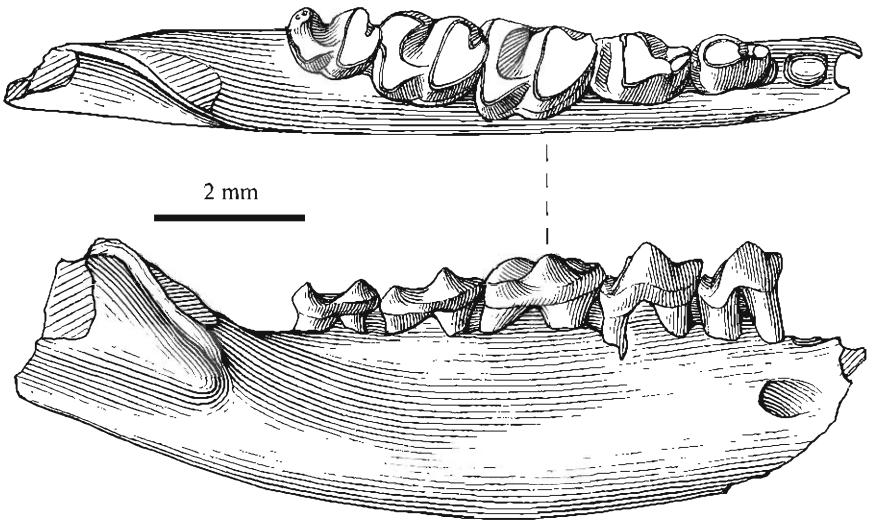

图 1　内蒙东方猬（新属、新种）右下颌骨具 p3–m3（V 15532.9）

Fig. 1　Right lower jaw with p3–m3 (V 15532.9) of *Anatolechinos neimongolensis* gen. et sp. nov.

上 upper. 冠面 occlusal view; 下 lower. 颊侧 buccal view

是 p2 的，此 2 齿根的总长大致与 p3 的相近，这样不但表明 p2 具有 2 个齿根，而且其大小也与 p3 的相近，笔者认为这种可能性很小。其二是后一齿槽是 p2 的，即 p2 为单齿根，前一齿槽也存在两种可能性：属 c1 或 p1 的。前齿槽究竟属 c1 或 p1 的？这里只能借助其尺寸进行推测。p2 齿槽断面的长为 0.5 mm，宽为 0.4 mm。可惜前一齿槽前半部已破损，无法准确地判断其大小。从保存的后半部看，该齿槽宽约 0.45 mm（稍宽于 p2 的），但其舌侧缘的弯曲程度要比 p2 的大，这表明该齿槽的长度不大会大于 p2 的，也就是说，前一齿槽的尺寸有可能比 p2 的要小些，至少不会明显大于 p2 的。因此前齿槽属于 p1 的可能性比较大。另外，该前齿槽几乎与下颌骨的齿槽缘垂直，不向后下方伸，而 *Tupaiodon*、*Ictopidium* 和 *Zaraalestes* 等 c1 的齿冠通常向前匍匐，齿根通常都是向后下方伸的，这似乎也进一步佐证了前一齿槽是 p1 的可能性。因此笔者倾向于最后一种可能性：该 2 齿槽分属 p1 和 p2 的，即 p1 和 p2 均为单齿根，亦即 V 15532.9 是具 4 枚前臼齿的。其齿式可能为 3？ ·1·4·3。

这次采集到的食虫类标本，除了 V 15532.9 为下颌骨具 p3–m3 外，其余均为单个牙齿，P2/p2 及其前的牙齿在颌骨上的位置只是根据相关种类（如 *Tupaiodon*，*Ictopidium* 和 *Zaraalestes* 等）的形态进行推测的，并不很确定，有待发现较完整的材料给予验证。

未见上门齿，上齿式也可能为：3？ ·1·4·3。C1 为扁锥形（图 2A）。主尖锐而高，位置较靠前。其颊侧圆凸，舌侧纵向微凸，垂向稍凹。主尖的前棱直；后棱较长，稍凹，伸达后基部小尖。齿带在舌侧连续，无明显的外齿带。单齿根，但其舌侧仍可见明显的纵沟将其分为前、后两部分。V 15533.2 的冠面和齿根的形态均与 V 15533.1 的相似，但尺寸较小，主尖较低。这可能与磨损和破损有关，暂时也作为 C1 归入此类。

颊齿齿冠低，主尖低而钝。因无法确定 V 15532.2 是 P1 或 P2，暂称其为 P1/2。P1/2 为扁锥形（图 2B）。主尖钝，位于齿的前部。主尖前、后棱弱。其前棱稍圆凸，较短而陡，伸达

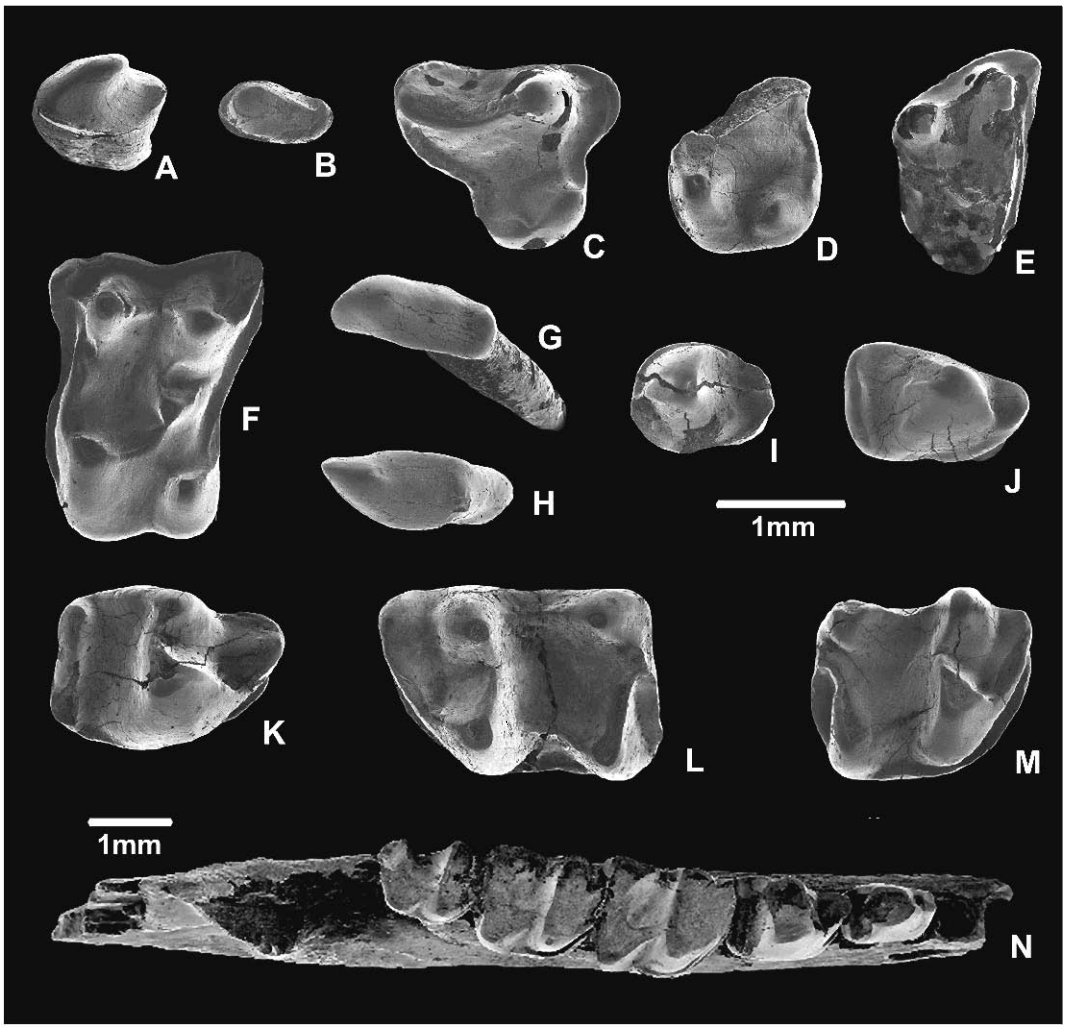

图 2 内蒙东方猬(新属、新种)下颌骨和牙齿冠面

Fig. 2 Occlusal view of lower jaw and teeth of *Anatolechinos neimongolensis* gen. et sp. nov.

A. 左 left C1(V 15533.1);B. 右 right P1/2(V 15532.2);C. 右 right P3(V 15532.3);D. 左 left P4 舌部 lingual part (V 15532.4);E. 右 right M3(V 15532.8);F. 左 left M1 正型标本 holotype (V 15532.1);G. 右 right i2/3(V 15532.10);H. 左 left c1? (V 15532.12);I. 右 right p2(V 15533.3);J. 右 right p3 (V 15532.13); K. 右 right p4(V 15532.15);L. 左 left m1(V 15534);M. 右 right m2(V 15532.21);N. 右下颌骨 right lower jaw with p3-m3(V 15532.9); A-M are in one of the same scale

微弱的前基部小尖;主尖后棱较直而长,伸达后基部小尖。后基部小尖形成小的跟座,与主尖有弱的沟分开。未见明显的齿带。具 2 齿根。

P3(图 2C)冠面约为等边三角形,前内和后内缘凹入。前尖为扁锥形。前尖前棱伸达明显的前附尖。前尖后棱圆缓地伸达齿的后外角,形成后附尖脊,中间未见裂凹。原尖钝圆,低矮,位于前尖前舌方,具原尖前棱。次尖在原尖之后紧贴原尖,并有棱与原尖连。前、后齿

带发育,前齿带较短,由原尖前棱伸达前附尖;后齿带由次尖伸达齿的后外角,近后附尖处。外齿带仅在外侧缘前、后端发育,在前尖外侧缺失。原尖前侧和舌侧无齿带。可能有 3 齿根。

P4(图 2D)仅保存了舌部。可见高的原尖,具明显的原尖前棱。次尖较低矮,为丘形,与原尖无棱相连,而是以明显的沟分开。原尖和次尖舌侧未见齿带。

M1(图 2F)冠面约为横宽的长方形,四侧缘各有不同程度的凹入。前尖和后尖均靠近颊侧,外架很窄。前尖低钝,前尖前棱较前尖后棱弱,伸达前附尖。后尖稍大于前尖,后尖前棱与前尖后棱同样发育,彼此相对,很接近,但不相连形成完全的中央棱。后尖后棱最发达,伸达齿的后外角,形成后附尖脊,但无明显的裂凹。原尖位于前尖舌侧,较颊侧二主尖大,但高度相近,其舌侧基部稍膨大。原尖前棱较原尖后棱高而短。原尖后棱较低而长。原小尖小;原小尖前棱伸达前尖前舌基部,后棱很弱、很短,与前尖以沟分开。后小尖较原小尖发达;其前、后棱也较发达,分别伸达后尖舌侧基部。次尖是主尖中最低小者,位于原尖后方,其舌侧不如原尖的向舌侧凸。次尖前颊侧棱很弱,伸达原尖后棱;次尖后棱与后齿带连。齿带沿齿的前、外、后缘发育,但在齿的舌侧和后外角缺失。

M3(图 2E)冠面为横宽的三角形。其前部的形态与 M1 的很相似,但后部明显退化。后尖比前尖低小,位于齿的后外角,既无后尖后棱,也无后附尖或后附尖脊的痕迹。原尖比 M1 的原尖小,前后较压缩。后小尖虽仍较原小尖明显,但其前棱较短,而后棱向后伸达后尖的后方。未见次尖的痕迹。齿带同 M1,但后齿带和外齿带相对较弱。具 3 齿根。

下门齿 2 枚,可能为 i2 或 i3(被称为 i2/3)(图 2G)。冠面为长卵圆形,唇侧圆凸度较舌侧的明显,其前端较尖窄。齿冠向前匍匐,单齿根斜向后下方伸。主尖较低扁,位于齿冠前端,齿根之前。主尖前棱短而圆缓;后棱长而直,但较低弱,与后缘基部小尖以弱沟相隔;经磨损,主尖后棱消失,使该处形成平的磨损面。唇侧有时有弱的齿带。

V 15532.12(图 2H)的齿冠形态与 i2/3 的很相似,也向前匍匐;单齿根也斜向后下方伸。所不同的是其齿冠比例上较宽短、稍粗壮些,后基部小尖较小,未见明显的齿带。V 15532.12可能为 c1,也可能为 i3,但从其齿冠较粗壮判断,它为 c1 的可能性较大。

p2(图 2I)下原尖为较高锐的三角锥形,颊面较圆凸。下跟座为低矮的横脊形,与主尖有横沟相隔。齿带很发达,围绕齿冠。具单齿根。

p3(图 2J)冠面为前窄的三角形。下原尖为浑圆的三角锥形,较钝而直立;具明显的前、后棱。下原尖后棱舌侧有明显的与上牙的磨损面。下前尖较发达,横向延伸,与下原尖前棱有沟分开。下三角凹很浅。下跟座为较发达横脊状,其中部有一明显的小尖,可能为下次小尖。下跟凹也为横向延伸的沟。齿带很弱,仅在下前尖的外侧存在。具 2 齿根。

p4(图 2K)冠面也为浑圆的三角形。下三角座已形成,较下跟座稍宽。下原尖最高大,下后尖较下原尖低小,位于下原尖舌侧。在较少磨损的 p4 中,下原尖舌侧有一棱与下后尖颊侧的棱相应,形成 V 形谷,但不相连形成完全的下后脊。磨损较深时,下原尖与下后尖相连形成横的后脊。下后尖具一向后伸的后侧棱。下前尖最低。下前脊为向前舌侧伸的弧形,往舌侧逐渐变低;与下原尖前棱有弱的裂凹分开;无下前边尖的痕迹。下三角

座凹较开阔。下跟座仍为横脊形,但较明显向外下方倾;其颊端稍向前弯,封闭横沟状下跟凹的颊端;其舌端有一明显的小尖,可能为下内尖。齿带仅在齿的前缘下前脊的下方发育。齿的外、后和内缘无齿带。

m1(图 2L)冠面约为长方形,舌缘长于颊缘,前缘斜向前舌方伸,稍长于后缘。下三角座的长小于宽,但其宽度与下跟座者相近。下后尖约位于下原尖舌侧或稍前,大小与下原尖的相近。下后脊与 p4 的相似。无下后尖后棱的痕迹。下前脊水平地向前舌侧伸达齿前舌角,形成切割脊。在未磨蚀的标本上下前边尖稍明显,与下后尖和下内尖约在同一纵线上。下次尖大小与下原尖者相近或稍小,但为主尖中最低者,呈 V 形。下斜脊伸达下原尖后基部,近颊侧的 1/3 处。下后边脊较下斜脊高,经下次小尖伸达下内尖。下内尖较下后尖低小,具短的下内尖棱。下次小尖小而明显,约位于下后边脊近内侧 1/3 处。齿带在齿的前、外和后缘发育,在齿的舌侧缘、下内尖后缘和下次尖的外基部缺失。后齿带由下次小尖向外下方伸,不与外齿带连。

m2(图 2M)与 m1 的相似。所不同的是下前边脊横向较短,不达下后尖的水平;其舌端较少前伸,而是稍向舌侧弯,并逐渐变低;无下前边尖的痕迹;下三角座显得更短些。m3(图 1, 2N)与 m2 相似,只是下跟座较窄,后缘较向后圆凸,下次小尖较向舌侧移,与下内尖连。

测量 见表 1。

表 1 内蒙东方猬(新属、新种)牙齿测量

Table 1 Measurements of teeth of *Anatolechinos neimongolensis* gen. et sp. nov. (mm)

Upper teeth	N	R	Lower teeth	N	R
C1 L	2	0.76 ~ 0.8	p3 - m3 L	1	9.5
C1 W	2	0.45 ~ 0.65	m1 - m3 L	1	4.2
P1/2 L	1	0.8	i2/3 L	2	1.0 ~ 1.05
P1/2 W	1	0.44	i2/3 W	2	0.45 ~ 0.5
P3 L	1	1.6	c1 L	1	0.95
P3 Ll	1	0.8	c1 W	1	1.05
P3 W	1	1.3	p2 L	1	1
P4 Ll	2	1.0 ~ 1.1	p2 W	1	0.8
M1 L	1	1.55	p3 L	4	1.1 ~ 1.25
M1 Ll	1	1.26	p3 W	4	0.65 ~ 0.8
M1 W	1	2.1	p4 L	5	1.4 ~ 1.65
M3 L	1	1	p4 W	4	0.95 ~ 1.35
M3 W	1	1.65	m1 L	4	1.6 ~ 1.9
			m1 W(tr)	4	1.25 ~ 1.65
			m1 W(ta)	4	1.3 ~ 1.6
			m2 L	3	1.45 ~ 1.56
			m2 W(tr)	3	1.2 ~ 1.3
			m2 W(ta)	2	1.15 ~ 1.2
			m3 L	1	1.3
			m3 W(tr)	1	0.9
			m3 W(ta)	1	0.8

缩写 Abbreviations: L. length 长; Ll. lingual length 舌侧长; W. width 宽; W(tr). width of trigonid 下三角座宽; W(ta). width of talonid 下跟座宽; N. number 标本数; R. range 变异范围.

比较　由描述和表 1 可以看出上述标本的基本特征，如：臼齿比例上较宽短，尺寸由前往后逐渐变小；上臼齿宽大于长，次尖较小；下臼齿的下斜脊较低，位置靠近颊侧，达下原尖后基部；m1 下三角座之长小于宽，其下前脊为切割形；m1－2 下次小尖较小，位置较靠近舌侧，后齿带由下次小尖向外伸；p1 和 p2 小，为单齿根；p3 近三角形，具双齿根；p4 具明显的下三角座和横脊状的下跟座等，均与齿鼩猬亚科（Tupaiodontinae）的一致。

Butler（1988）在建齿鼩猬亚科时，将齿鼩猬（*Tupaiodon*）和鼬鼩（*Ictopidium*），还有北美的 *Entomolestes* 归入该亚科。后来，Storch and Dashzeveg（1997）将他们新建的猬兽属（*Zaraalestes*）也归入该亚科。他们把 *Entomolestes* 排除在该亚科之外。McKenna and Bell（1997）将昌乐鼩属（*Changlelestes*）也归入 Tupaiodontinae，而童永生（1997）仅将 *Tupaiodon* 和 *Ictopidium* 二属包括在该亚科。笔者赞同 Storch and Dashzeveg（1997）的意见，认为齿鼩猬亚科目前比较确定地应包括 *Tupaiodon*、*Ictopidium* 和 *Zaraalestes* 三个属。

内蒙的标本与上述三属都有明显的区别：P3－M3 的前附尖较低小，较靠近前尖；P4 次尖较大。此外，内蒙的标本与 *Tupaiodon* 和 *Ictopidium* 的主要区别还在于颊齿尺寸较小；齿冠较低，主齿尖较低钝，P3－M2 的后附尖脊也相对低短。它的颏孔的位置较 *Ictopidium* 和 *Zaraalestes* 的靠前，位于 p3 前齿根的下方。

与 *Tupaiodon* 的区别还有：P3 前缘凹入较浅，舌叶较长，次尖较发达，并有棱与原尖和后齿带连；M1 后小尖后棱不伸达后齿带；M3 的原小尖和后小尖较明显；m3 下次小尖较靠近下内尖。

与 *Ictopidium* 的区别还有：P3 前尖后棱与后附尖脊间无裂凹；P4－M1 无舌侧齿带；M3 后小尖后棱较长；p4 外齿带不发育。

与 *Zaraalestes* 的区别还有：具 p1；P4 舌叶较长；M1 未形成完全的中央棱，原小尖前棱较短，不达前尖前棱；后小尖前、后棱也都较短；次尖前棱很弱；m1－2 下内尖棱不达下后尖；m3 下次小尖靠近下内尖。

内蒙的标本显然代表不同于 Tupaiodontinae 的已知属的新属、种，被称为内蒙东方猬（*Anatolechinos neimongolensis*）。

讨论　关于桦甸齿鼩猬的归属　产自吉林省桦甸盆地的桦甸齿鼩猬（*Tupaiodon huadianensis*）是王伴月、李春田（1990）描述的。Lopatin（2006）认为 *Tupaiodon huadianensis* 不同于 *Tupaiodon* 属，甚至不同于 Tupaiodontinae 亚科，有可能属 Galericinae 亚科。笔者认为该种在下臼齿较宽短（m1 的宽/长为 1.44 mm/1.84 mm = 0.783，与 *Ictopidium lechei* 的 0.80* 相近）和 m1 下三角座的长（1 mm）明显小于其宽（1.44 mm）的特征与 Galericinae 的明显不同，而是与 Tupaiodontinae 的一致（见 Butler，1988；Storch and Dashzeveg，1997；*依童永生，1997）。显然 *Tupaiodon huadianensis* 仍应归入 Tupaiodontinae亚科。而在 Tupaiodontinae 亚科的已知 4 属中，该种在颏孔位于 p3 前齿根的下方，颊齿齿冠较低，齿尖较钝，p1 和 p2 均为单齿根等特征上均与 *Anatolechinos* 的很相似，而与 *Tupaiodon* 明显不同，也与 *Ictopidium* 和 *Zaraalestes* 各有不同（详见上面 *Anatolechinos* 与该 3 属的区别）。将该种由 *Tupaiodon* 属改归入 *Anatolechinos* 属似乎更合适些，称其为桦甸东方猬（*A. huadianensis*）。*A. huadianensis* 与 *A. neimongolensis* 的区别在于：下颌骨水平支高度由前往后逐渐增高，在 m3 处最高，其下缘在 m2 之前较平

直,只是在 m3 的下方较圆凸,再往后转向后上方延伸;颊齿尺寸较大,但齿尖显得更低钝些;p4 具较明显的下前边尖和外齿带等。

关于 Tupaiodontinae 的分类位置 Tupaiodontinae 亚科究竟属猬形亚目还是属鼩形亚目? 现有两种不同的看法。Butler (1988)在建该亚科时明确地将其归入刺猬科(Erinaceidae)。Butler 的观点得到一些研究者的赞同(王伴月、李春田,1990;McKenna and Bell, 1997; Storch and Dashzeveg, 1997; Lopatin, 2006)。但童永生、王景文(1993)则将 *Tupaiodon* 和 *Ictopidium* 归入他们所建的昌乐鼩科(Changlelestidae),并将该科归入鼩形亚目(Soricomorpha)。此后,童永生等在讨论该亚科的分类位置时,一再重申他们的这一观点(童永生,1997;童永生、王景文,2006)。他们的主要论据有两点:1) *Tupaiodon* 和 *Ictopidium*颊齿形态与 *Changlelestes* 有一些相似;2) Novacek et al. (1985)认为 *Ictopidium* 有可能与 palaeoryctids 或 soricomorphs 有较近关系。事实上,Butler (1988:124)在将 Tupaiodontinae归属 Erinaceidae 时,就对 Novacek et al. (1985)的观点提出了异议,认为 Tupaiodontinae 颊齿的基本特征与 Erinaceidae 的相似。

笔者认为,要真正了解食虫类有关属的分类位置,需要有较好的标本(如头骨等),而齿鼩猬亚科所包括属的已知材料主要为颊齿和部分上、下颌骨,这对讨论其分类位置确有一定困难。好在 Novacek et al. (1985)对猬形亚目的牙齿形态特征进行了综合分析。笔者在研究 *Anatolechinos* 时,用 Novacek 等所总结的猬形亚目和刺猬科的牙齿鉴定特征,对 *Tupaiodon*、*Ictopidium* 和 *Changlelestes* 等属的有关标本或模型进行了观察对比,也对比了 *Zaraalestes* 的插图。笔者基本赞同 Butler (1988)的观点,在此仅作如下补充。

1) Novacek et al. (1985)认为 *Ictopidium* 的 m1 与 m2 的长度相等。但童永生等根据 *Ictopidium* 正型标本和后来发现的标本均证明,*Ictopidium* 的臼齿尺寸是由 M1/m1 往 M3/m3 逐渐变小的(见童永生、王景文,1993;童永生,1997)。笔者赞同童永生等的意见。事实上,*Tupaiodon*、*Zaraalestes* 和 *Anatolechinos* 等属的臼齿也是由前往后逐渐变小的。

2) Novacek et al. (1985)认为 *Ictopidium* 的 m2 的下次小尖很小,而且位于齿的舌侧,与下内尖邻近。但这种观点与实际情况并不相符。本文图 3B[根据 *Ictopidium lechei* 正型标本的模型(PIUM 3433)摄制]清楚地显示了 *I. lechei* 的 m2 具有很明显的下次小尖,而且齿的纵中线通过该尖。Tupaiodontinae 其余三属的 m1-2 也都具或多或少明显的下次小尖,其位置虽较 *I. lechei* 的稍向舌侧移些,但仍靠近齿的纵中线,而远离下内尖。

3) Tupaiodontinae 各属的 M1-2 均具明显次尖和后舌齿带,其次尖并有或多或少明显的前颊侧棱伸达原尖后棱,而后者也为 Erinaceidae 所特有的特点。

上述特征都与 Novacek et al. (1985:3,10)所总结的猬形亚目(特别是刺猬科)的牙齿鉴定特征一致。事实上,童永生、王景文(2006:30)也承认:"*Tupaiodon* 和 *Ictopidium* 的颊齿形态与始新世猬形动物比较接近,与已知的始新世鼩形动物区别较大。"基于以上分析,笔者赞同 Butler (1988)将齿鼩猬亚科归入刺猬科的建议。至于 Tupaiodontinae 和 Changlelestinae 关系,童永生(1997)和童永生、王景文(2006)已对两者的区别作了较详细的比较和讨论。笔者认为它们的许多区别有较高分类阶元上的意义。因我们在内蒙古采集的标本中,无与 *Changlelestes* 有关材料,这里暂不详细讨论。

鼬鼩属 *Ictopidium* Zdansky, 1930

莱氏鼬鼩 *Ictopidium lechei* Zdansky, 1930

(图3)

标本　左 p3(V 15535)。

地点和层位　二连浩特火车站东 IVPP Loc. 1988001,上始新统呼尔井组。

记述　p3(图 3A)齿冠形态虽与 *Anatolechinos neimongolensis* 的相似,但其下原尖显然比 *A. neimongolensis* 的高得多,其高度约为后者的 1.5 倍,而且其顶端并稍向后弯。无明显的下原尖前棱,下原尖后棱也很弱,仅在下原尖后基部显现。下前尖很低小,与下原尖之间有浅的横沟相隔,但不形成下三角凹。下跟座虽也为横脊状,也有下次小尖,但下次小尖的位置靠近下跟座的舌侧,约位于近舌侧的 1/3 处等。V 15535 的这些特征均与 *Ictopidium lechei* 的很相似,而且 p3 的尺寸(长:1.26 mm,宽:0.8 mm)也接近 *I. lechei* 的小个体者(见童永生,1997:19,表 1)。

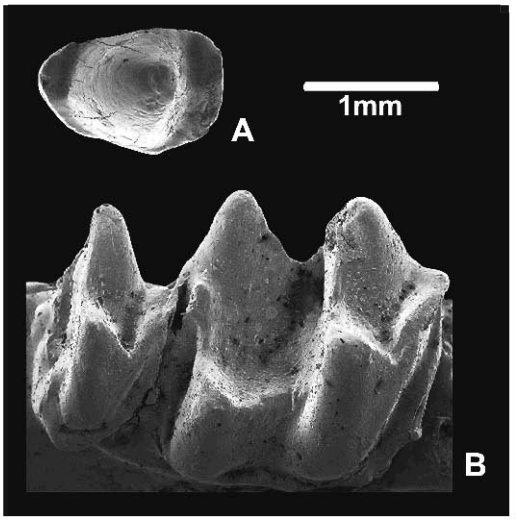

图3　莱氏鼬鼩下颊齿冠面

Fig. 3　Occlusal view of lower cheek teeth of *Ictopidium lechei*

A. 左 left p3 (V 15535);B. 部分正型标本 part of holotype (右 right m2 和 m3 前半部 anterior part)

(根据模型 PIUM 3433 摄制)

刺猬科(属、种未定) Erinaceidae gen. et sp. indet.

(图4)

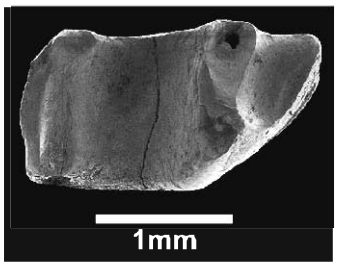

图4　刺猬科(属、种未定)右 m2(V 15536)冠面

Fig. 4　Occlusal view of right m2 (V 15536) of Erinaceidae gen. et sp. indet.

在乌兰察布盟四子王旗额尔登敖包 IVPP Loc. 1991004,上始新统乌兰戈楚组"下白层"中还发现了一枚右 m2(V 15536)。其冠面约为长方形,下三角座的宽度与下跟座的相近。下原尖为最高的尖,下后尖位于其舌侧。下前尖呈脊形,向前舌侧伸。下跟座明显低于下三角座。下次尖与下内尖彼此相对。具下内尖棱。下斜脊主要向前、仅稍稍向舌侧伸达下原尖后基部。具前、后齿带。V 15536 的上述特征均与 Erinaceidae 的一致,而特别与 Erinaceinae 的一些属如 *Amphechinus*、*Miechinus* 和 *Erinaceus* 等的相近。m2 的长:1.9 mm;前宽:1.15 mm;后宽:1 mm。因材料太少,无法确定其确切归属。

翼手目 Chiroptera Blumenbach,1799

小蝙蝠亚目 Microchiroptera Dobson,1875

小蝙蝠亚目(属、种未定 A,B) Microchiroptera gen. et sp. indet. A, B

(图5)

标本 1段左下颌骨具 m2 的跟座(V 15584)和右 m1/2 的跟座(V 15585)。

地点和层位 乌兰察布盟四子王旗额尔登敖包 IVPP Loc. 1991004,上始新统乌兰戈楚组"下白层"(V 15584);二连浩特火车站东 IVPP Loc. 1988001,上始新统呼尔井组(V 15585)。

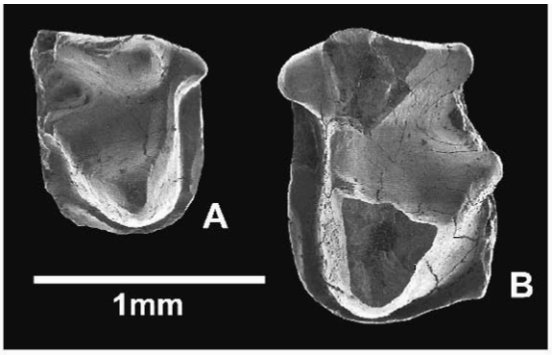

图5 小蝙蝠亚目(属、种未定)臼齿冠面

Fig. 5 Occlusal view of molars of Microchiroptera gen. et sp. indet.

A. gen. et sp. A,左 m2 的跟座 talonid of left m2 (V 15584);B. gen. et sp. B,右 m1/2 的跟座 talonid of right m1/2(V 15585)

记述 两枚下臼齿的下次尖均较高。下斜脊向前舌侧延伸约至齿的中部。下次小尖位于齿的舌侧,较低,向后凸。外齿带和后齿带均较发育。但从下次尖后臂与下次小尖和下内尖的连接方式看,V 15584 与 V 15585 分属两种不同的类型。V 15584(图5A)的下次尖后臂连接下次小尖,形成下后边脊,与下内尖有沟相隔,下内尖孤立,似属山蝠型(Nyctalodontie)(依 Menu and Sigé, 1971)。V 15584 的特征与 Rich et al. (1983)所描述的采自云南省曲靖蔡家冲组中的 Vespertilionidae? 的 m1/2(V 7211)的形态是一致的。而且 V 15584 的尺寸(下跟座宽:0.75 mm)也与 V 7211 的相近,本文称 V 15584 为未定种 A。而 V15585(图5B)下内尖的齿尖虽部分破损,但从其保存部分看,还是明显较下次小尖的高大,下次尖后臂与下内尖连,而不与下次小尖连,V 15585 似属鼠耳蝠型(Myotodontie)。此外,V 15585 的尺寸也较 V 15584 的大(下跟座宽为 1.3 mm),笔者称 V 15585 为未定种 B。

童永生(1997)曾报道了产自河南渑池仟村河堤组仟村段的未定属、种的小蝙蝠类的下臼齿化石。它们也分属两种不同的类型:山蝠型(V 10215)和鼠耳蝠型(V 10213, V 10214)。它们的下跟座宽度:V 10215 的为0.78 mm,V 10213 的为1.5 mm, V 10214 的为0.95 mm。V 15584 的尺寸也与属山蝠型的 V 10215 的相近,而 V 15585 则在属鼠耳蝠型的 V 10213 和 V 10214 的尺寸之间。

2 讨 论

2.1 内蒙古上始新统发现食虫类和翼手类化石的意义

食虫类在亚洲始新世时分布很广,在东亚和南亚的始新统中都发现过不少食虫类化

石(Rich et al., 1983;Russell and Zhai, 1987;王伴月、李春田,1990;童永生,1997;童永生、王景文,2006)。在蒙古国从早始新世到晚始新世的地层中也都发现过食虫类的化石(Russell and Dashzeveg, 1986;Russell and Zhai, 1987;Storch and Dashzeveg, 1997)。然而,在我国内蒙古,除了在中始新统中发现少量的食虫类化石外(Qi, 1987),至今还未见在上始新统发现食虫类的报道。这次发现证明在晚始新世时食虫类在内蒙古也广泛分布。

在亚洲古近纪地层中发现翼手类化石的报道就更少,目前已知仅在我国云南曲靖、山西垣曲和河南李官桥等地区的中－晚始新世,以及泰国晚始新世地层中发现过(Rich et al., 1983; 童永生,1997;McKenna and Bell, 1997:295),在亚洲北纬35°以北地区还未见有报道。这次在内蒙古上始新统中发现翼手类化石,不但在内蒙古是首次,在亚洲北纬35°以北地区古近系中也是首次。

2.2　晚始新世内蒙古中－西部的生态环境

邱占祥、王伴月(2007)和王伴月(2008b)曾根据巨犀化石和灵长类化石推论内蒙古二连地区中始新世晚期至晚始新世时属亚热带气候,并可能有较茂盛的树林。尽管食虫类的地理分布和生态适应的范围较广,但 *Anatolechinos* 属过去已知发现于吉林省桦甸盆地的桦甸组的灰色、灰绿色泥岩、泥质粉砂岩夹可采油页岩和褐煤层中。而油页岩和褐煤层的形成,以及与 *Anatolechinos huadianensis* 共生的化石除哺乳动物外,还有大量的鱼类、爬行类、属涉禽和游禽鸟类、大量的腹足类和孢粉化石,都证明了当时桦甸盆地的气候较温暖潮湿,为森林沼泽湖泊景观(王伴月、李春田,1990)。在内蒙古发现了 *Anatolechinos* 的化石,虽不能表明内蒙古当时的气候环境与桦甸盆地完全相同,但至少说明 *Anatolechinos* 是一类能适应较温暖和潮湿的食虫类,还有灵长类和巨犀类等同时生存,至少论证了在内蒙古不但在二连地区,而且在整个中－西部地区(包括阿拉善左旗的豪斯布尔都盆地)在中－晚始新世时都可能属亚热带气候,并可能有较茂盛的树林。

致谢　中国科学院古脊椎动物与古人类研究所的齐陶研究员和毕初珍女士,内蒙古二连恐龙博物馆的吴丽君、张全中和宁培杰,中国人民解放军84994部队的王培玉、吴立传、栗泽喜和田东胜等同志参加了野外考察和采集标本;本文得益于与古脊椎动物与古人类研究所的李传夔、童永生、邱铸鼎、邱占祥和倪喜军等先生的讨论;童永生和倪喜军先生还帮助提供了有关参考文献和参考对比的标本或照片;图版由张文定先生摄制,插图由沈文龙先生绘制,在此一并表示诚挚的谢意!

FIRST RECORD OF LATE EOCENE INSECTIVORES AND CHIROPTERES FROM NEI MONGOL, CHINA

WANG Ban-Yue

(*Institute of Vertebrate Paleontology and Paleoanthropology, Chinese Academy of Sciences* Beijing 100044 wangbanyue@ivpp.ac.cn)

Key words　Nei Mongol, Late Eocene, insectivores, chiropters

Summary

Some fossil insectivores and chiropteres were collected from the Upper Eocene of Nei Mongol. They represent the first records of their kinds in Late Eocene in Nei Mongol. The discovery has not only expanded the distribution of insectivores and chiropteres in Asia, added new elements to the Late Eocene fauna of Nei Mongol, but also provided new information on paleoenvironment of this area.

1 Systematics

Order Erinaceomorpha Gregory, 1910
Family Erinaceidae Fischer de Waldheim, 1817
Subfamily Tupaiodontinae Butler, 1988
Anatolechinos gen. nov.

Type species *Anatolechinos neimongolensis* sp. nov.

Referred species *Tupaiodon huadianensis* Wang & Li, 1990.

Geographic distribution and geological range Nei Mongol and Jilin, China; Middle–Late Eocene.

Diagnosis of genus Smaller than *Tupaiodon* in size. Mental foramen located below anterior root of p3. Dental formula: 3? ·1·4·3/3? ·1·4·3. Cheek teeth with low crown and obtuse cusps. P3–M3 with small and low parastyle. P3–M2 with short and low postmetacrista and hypocone joining with posterior cingulum, but without lingual cingulum. P3–4 with long lingual part and large hypocone. On P3 hypocone joined with protocone by a weak crista. M1 with incomplete centrocrista, short pre- and postcrista of both protoconule and metaconule, and week anterobuccal crista of hypocone. M3 with distinct protoconule and metaconule, long postmetaconucrista. On lower molars entocristid short. Hypoconulid located near entoconid on m3.

Etymology Anatole, Greek, east; echinos, Greek, hedgehog.

Anatolechinos neimongolensis gen. et sp. nov.
(Figs. 1–2; Table 1)

Holotype Left M1 (IVPP V 15532.1).

Referred specimens 2 C1 (V 15533.1–2), R P1/2 (V 15532.2), R P3 (V 15532.3), lingual part of L P4 (V 15532.4), 3 M1 (V 15532.5–7), R M3 (V 15532.8), one segment of right lower jaw with p3–m3 (V 15532.9), 2 i2/3 (V 15532.10–11), L c1? (V 15532.12), R p2 (V 15533.3), 3 p3 (V 15532.13–14, V 15533.4), 5 p4 (V 15532.15–18, V 15533.5), 4 m1 (V 15532.19–20, V 15533.6, V 15534), and 4 m2 (V 15532.21–24) (Abbreviations: L, left; R, right).

Localities and horizons IVPP Loc. 1988001, east to the Railway Station of Erenhot, Late Eocene Houldjin Formation (V 15532); IVPP Loc. 1991004, Urtyn Obo, Siziwang Qi; "Lower White" of Upper Eocene Ulan Gochu Formation (V 15533); and IVPP Loc. 1974097 (1994–1), Lügenzhadagai, Haosibuldu Basin, Alxa Zuoqi, 3rd layer of Upper Eocene Qagan Bulag (= Chaganbulage) Formation (V 15534).

Diagnosis Small-sized *Anatolechinos*; lower border of the horizontal ramus of lower jaw being convex; cheek teeth with higher crown; anteroconid absent, and buccal cingulum weak and incomplete on p4.

Etymology Neimongolensis, Neimongol + ensis, Nei Mongol: the area yielding the micromammal fossils; ensis: suffix of locality.

Description The lower border of the horizontal part of the lower jaw is slightly convex, with the highest part below m1. The mental foramen is under the anterior root of p3. The dental formula may be 3? ·1·4·3/3? ·1·4·3.

C1 has a sharp main cusp on its anterior part, with one short anterior crista and one long posterior crista reaching to posterior cusp. The cingulum is only present on the lingual side. The single root has one distinct longitudinal groove on the lingual side.

The cheek teeth have low crown, and low and obtuse main cusps. P1/2 is similar to C1 in shape, but has an obtuse main cusp and 2 roots. The anterior crista reaches to the anterior cusp, and the posterior crista is separated from the posterior cusp by a weak groove. No cingulum is seen. P3 is 3-rooted. The paracone is laterally compressed. The preparacrista reaches to the distinct parastyle. The postparacrista extends to the posterobuccal corner of P3 forming a metastylar crista, but without fissure. The protocone is located anterolingually to the paracone and has a preprotocrista. The hypocone nestles to and is connected with the protocone by a crista. The cingulum is absent on the anterior and lingual sides of the protocone. The lingual part of the P4 shows that the protocone is high and has preprotocrista. The hypocone is separated from the protocone by a groove. No cingulum is seen on the lingual side of P4. On M1 the stylar shelf is narrow. The paracone is smaller than the metacone. The preparacrista reaches to the parastyle. The premetacrista does not join with the postparacrista to form complete centrocrista. The metastylar crista is well-developed. The protocone has a swollen base. The preprotocrista is shorter and higher than the postprotocrista. The protoconule is smaller than the metaconule and has short pre- and postcrista. The pre- and postmetaconucrista are rather developed. The hypocone has a weak anterior buccal crista reaching to the postprotocrista, and a posterior crista joining with posterior cingulum. The cingulum is only present on the anterior, buccal and posterior sides. The anterior part of M3 is similar to that of M1. But the posterior part is much reduced. The metacone is smaller than paracone and shifts to the posterobuccal corner of M3. The postmetacrista, metastylar crista and hypocone are all disappeared. The cingulum is weaker.

The i2/3 is procumbent, with a low and oblate main cusp on the anterior end. The anterior crista is shorter than the posterior crista. There is a small cusp on the posterior end and a weak cingulum on buccal side. Single root extends posterodownwards. The c1? is similar to i2/3 in shape, but shorter and wider and without cingulum. On p2 the protoconid is triangular pyramid-shaped with a high and sharp top. The talonid is low transverse crested. The cingulum is well-developed. On p3 the protoconid is obtuse and paraconid extends transversely. The trigonid basin is a shallowly transverse groove. The talonid is formed of a transverse crest and with a hypoconulid at its middle part. On p4 the trigonid is wider than the talonid, with an open basin. The low and small metaconid is located lingually to the high protoconid. The paraconid is small and paralophid extends anterolingually. No anteroconid is seen. A small cuspid (entoconid?) is present at its lingual end of the transverse crested talonid. Only anterior cingulum is present. On the m1 the trigonid is wider than long, but nearly as wide as the talonid. The metaconid is subequal to the protoconid in size, and located lingually or slightly anterolingually to the latter. The paralophid extends anterolingually. On the less worn m1 the anteroconid is seen to be at the same longitudinal line of the metaconid and entoconid. The hypoconid is V-shaped. The cristid obliquely extends to the posterior side of the protoconid. The entoconid has a short entocristid. The hypoconulid is located at the lingual to the middle longitudinal line. The cingulum is present at its anterior, buccal and posterior sides. The posterior cingulum extends buccodownwards from the hypoconulid. The m2 is smaller in size and has shorter trigonid and paralophid than m1. No anteroconid is seen. The m3 is different from m2 in having narrower talonid and convex posterior side, and more lingually located hypoconulid. The p2 is single-rooted and the p3–m3 have two roots.

Comparison As description above, the specimens from Nei Mongol are similar to those

of the Tupaiodontinae in basic features. According to Storch and Dashzeveg (1997) the Tupaiodontinae are known to include 3 genera: *Tupaiodon*, *Ictopidium* and *Zaraalestes*. The specimens from Nei Mongol differ from them in having lower and smaller parastyle close to paracone on P3-M3, and a larger hypocone on P4. In addition, they differ from *Tupaiodon* and *Ictopidium* in being smaller in size, having lower crown and obtuse main cusps in cheek teeth, having lower and shorter postmetastylar crista on P3-M2; from *Ictopidium* and *Zaraalestes* in having a more anteriorly located mental foramen. Furthermore, they differ from *Tupaiodon* in having longer lingual part and more developed hypocone connected with both the protocone and posterior cingulum by crests on P3, shorter postmetaconucrista on M1, distinct protoconule and metaconule on M3, and more lingually located hypoconulid on m3. They differ from *Ictopidium* in having no fissure between the postparacrista and metastylar crista on P3, no lingual cingulum on P4-M1, having longer postmetaconucrista on M3, and no distinct buccal cingulum on p4. They differ from *Zaraalestes* in having p1; having longer lingual part on P4; incomplete centrocrista, shorter precrista of protoconule, pre- and postmetaconucrista, and weaker anterior buccal crista of hypocone on M1; shorter entocristid on m1-2; and more lingually located hypoconulid on m3. It seems obvious that the specimens from Nei Mongol represent a genus and species distinguished from the above three genus, called as *Anatolechinos neimongolensis*.

Discussion Generic status of *Tupaiodon huadianensis* *Tupaiodon huadianensis* from Huadian Basin of Jilin Province was described by Wang and Li (1990). Lopatin (2006) referred it to the Gelericinae. It seems to me that *T. huadianensis* is morphologically closer to Tupaiodontinae rather than Gelericinae, because it has rather wide and short lower molars and the trigonid of m1 is wider than long. In the Tupaiodontinae, *T. huadianensis* is similar to *Anatolechinos* rather than *Tupaiodon*, *Ictopidium* or *Zaraalestes* in having anterior located mental foramen, cheek teeth having lower crown and obtuse main cusps, p1 and p2 being single rooted etc. It appears better to relocate *T. huadianensis* from *Tupaiodon* to *Anatolechinos*: *Anatolechinos huadianensis*.

Phylogenetic status of the Tupaiodontinae Butler (1988) referred the Tupaiodontinae to the Erinaceidae when the subfamily was established. His suggestion was supported by some authors (Wang and Li, 1990; McKenna and Bell, 1997; Storch and Dashzeveg, 1997; Lopatin, 2006). However, Tong and Wang thought that the Tupaiodontinae belonged to the family Changlelestidae, which were referred to the Soricomorpha (Tong and Wang 1993,2006; Tong, 1997). One of their reasons was that Novacek et al.'s opinion (1985) that *Ictopidium* had closer relationship with palaeoryctids or soricomorphs. In fact, Butler (1988) took Novacek et al.'s statement into consideration when he discussed the relationship between the Tupaiodontinae and the Erinaceidae in full detail. As corroborative evidences I may point out the following features commonly shared by Tupaiodontinae and Erinaceidae. 1) The molars decreased from M1/m1 to M3/m3 in size in all of the species of this subfamily. 2) The hypoconulid of m2 of the holotype of *Ictopidium lechei* is distinct and on the middle line (Fig. 3B). 3) M1-2 have distinct hypocone, posterior cingulum, and anterior buccal crista of hypocone joining with the postprotocrista. All these features are congruent with diagnosis of the Erinaceidae proposed by Novacek et al. (1985:10). In fact, Tong and Wang (2006:30) recognized that the cheek teeth of *Tupaiodon* and *Ictopidium* were closer to those of the Erinaceomorpha and quite different from those of Eocene Soricomorpha in the features. I agree with Butler to refer the Tupaiodontinae to the Erinaceidae.

Ictopidium lechei Zdansky, 1930

(Fig. 3)

One p3 (V 15535) was collected from IVPP Loc. 1988001, east to the Railway Station of Erenhot, Late Eocene Houldjin Formation. It is more similar to *Ictopidium lechei* than *Ana-*

tolechinos in the occlusal features and higher crown. The size (L, 1.26 mm; W, 0.8 mm) is closer to *Ictopidium lechei*.

Erinaceidae gen. et sp. indet.
(Fig. 4)

One right m2 was collected from IVPP Loc. 1991004, Urtyn Obo, Siziwang Qi; "Lower White" of Upper Eocene Ulan Gochu Formation. It is similar to Erinaceidae, especially *Amphechinus*, *Miechinus* and *Erinaceus* in basic features. The measurements of m2: L, 1.9 mm, W(tr), 1.15 mm and W(ta), 1 mm.

Chiroptera Blumenbach, 1799
Microchiroptera Dobson, 1875
Microchiroptera gen. et sp. indet. A, B
(Fig. 5)

Specimens One segment of left lower jaw with a talonid of m 2 (V 15584) and a talonid of right m1/2(V 15585).

Localities and horizons IVPP Loc. 1991004, Urtyn Obo, Siziwang Qi, "Lower White" of Upper Eocene Ulan Gochu Formation (V 15584) and IVPP Loc. 1988001, east to the Railway Station of Erenhot, Late Eocene Houldjin Formation (V 15585).

Remarks V 15584 is of nyctalodonty in features and called Form A here. V 15585 displays myotodonty features and is called as Form B here. The width of talonid of V 15584 is 0.75 mm and that of V 15585 is 1.3 mm.

2 Discussion

2.1 Paleogeographical meaning of the discovery of insectivores and chiropteres from Late Eocene of Nei Mongol

Fossil insectivores have been widely found throughout the Eocene in Mongolia, but only are sparsely known from Middle Eocene in Nei Mongol. This discovery from Late Eocene in three localities of Nei Mongol indicates that the insectivores widely distributed in Late Eocene of Nei Mongol as well.

The Paleogene chiropteres have been known to occur in three localities in Asia (Qujing of Yunnan, Liguanqiao Basin of Henan, China, and Thailand), all south to 35°N. The discovery of the chiropteres from Late Eocene of Nei Mongol indicates that their distribution extended far northward than so far known, reaching about 44°N at least in western and central parts of Nei Mongol in Late Eocene.

2.2 Paleoecologic environment of Nei Mongol in Late Eocene

Anatolechinos has been known to occur in the Middle Eocene Hua-dian Formation of Huadian Basin, Jilin Province, where the climate was warm and wet, and the woods were dense in the Middle Eocene. It means that *Anatolechinos* might adapted itself to the warm and wet climate. The discovery of *Anatolechinos* in western and central parts of Nei Mongol indicates that during the Late Eocene the Palaeoclimate of the western and central parts of Nei Mongol might be a warm and wet climate as well. This opinion is in accordance with those of Qiu and Wang (2007) and Wang (2008b).

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