

# 记内蒙古新发现的始新世恐角目 (哺乳动物纲)化石<sup>1)</sup>

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**摘要:**记述了采自内蒙古二连盆地努和廷勃尔和始新世的 *Uintatherium* sp. 和 *Gobiatherium mirificum* 两件较破碎的下颌标本。*Uintatherium* sp. 下颌粗壮,下颌突明显,下门齿双叶形,m3 下后附尖很小且紧靠下三角座,下次小尖膨大,不与下跟座后脊分离,不具下次小尖脊和下内尖脊。新标本的产出层位在脑木根组的顶部,时代为早始新世早期,是目前已知最早的 *Uintatherium* 的代表。*Gobiatherium mirificum* 标本产自阿山头组底部,其下颌水平支长且浅,无下颌突,整个下颌显得纤细,m3 下后附尖和下后尖距离较远,下后附尖有一脊延伸到下后脊。到目前为止,在内蒙古该种仅分布在阿山头组。

**关键词:**内蒙古二连盆地,始新世,脑木根组,阿山头组,恐角目

**中图法分类号:**Q915.873 **文献标识码:**A **文章编号:**1000-3118(2006)03-0250-12

恐角目(Dinocerata)分布于亚洲和北美的晚古新世-中始新世晚期的地层中,在我国的山东、河南、湖北、江西、内蒙古、新疆都有发现(周明镇、童永生,1962;童永生,1978,1979,1989;翟人杰,1978;童永生、王景文,1981;Qi,1987;程捷、马安成,1990)。恐角目的分类一直是一个争论的问题,Flerov (1956, 1957)将恐角目分为3个科:Prodinoceratidae Flerov, 1952、*Uintatheriidae* Flower, 1876、*Gobiatheriidae* Flerov, 1952。Schoch 和 Lucas (1985)分为两个科:Prodinoceratidae Flerov, 1952、*Uintatheriidae* Flower, 1876。Wheeler (1961)以及 McKenna 和 Bell (1997)认为只有一个科 *Uintatheriidae* Flower, 1876。恐角目的各种动物,它们彼此之间在头骨和头后骨骼上的不同点,不少于长颈鹿、鹿、叉角羚羊和牛科之间的不同点,所以分为3个科是较为合适的(Flerov, 1956)。本文采用 Flerov (1956, 1957)科一级的分类,牙齿描述依据 Wheeler (1961)。文中描述的标本于2004年夏采自内蒙古二连盆地努和廷勃尔和附近的始新统,为两件较破碎的下颌标本,分属 *Uintatheriidae* 和 *Gobiatheriidae*。

**机构缩写:**YPM: Peabody Museum of Natural History, Yale University, New Haven; US-NM: United States National Museum of Natural History, Smithsonian Institution, Washington, D. C.; IVPP: Institute of Vertebrate Paleontology and Paleoanthropology, Beijing。

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# 1 标本记述

## 恐角目 *Dinocerata* Marsh, 1873

### 尤因他兽科 *Uintatheriidae* Flower, 1876

#### 尤因他兽属 *Uintatherium* Leidy, 1872

#### 尤因他兽(未定种) *Uintatherium* sp.

(图 1)

**标本** 为一成年个体的左右下颌,缺垂直支;保留有较完整的右 p3、m3,破损的右 p4、m2,以及 3 颗只保存了齿质和齿根的下门齿或下犬齿;可能属于同一个体的一根肋骨。中国科学院古脊椎动物与古人类研究所标本编号:IVPP V 14620。

**产地和层位** 内蒙古二连盆地努和廷勃尔和,脑木根组顶部。

**描述** 左下颌由于挤压稍高于右下颌。下颌较深,下颌前端具明显的下颌突(infra-mandibular process),下颌突前缘陡直,前缘和下缘所成的夹角略大于 90°,下缘终于 p3 后部之下,从前侧视下颌突形成宽阔的“∩”形;破损的角突保留了水平支下缘后部急剧下降的一小部分;下颌垂直支前缘与 m3 之间有一明显的近于四边形的凹坑,垂直支前缘脊粗壮,仅下端保存,构成咬肌窝的前缘(图 1A)。从右下颌保存的齿根来看,p3 ~ m2 均具有前后两个齿根,p2 可能具有一个齿根,并且非常小。从只保存了齿质和齿根的一颗下门齿来看,下门齿分为明显的两叶,前叶大而高,后叶小而低。另外两颗下门齿(或下犬齿)也具有类似的特征。p3 前后不伸长,下三角座明显高于下跟座。从下原尖向前齿带中部延伸出一弱的小棱,为退化的下前脊,下后脊粗壮。下次尖明显低于下后附尖,斜脊延伸到下后附尖基部。下跟座后脊退化,比斜脊的位置低,舌侧可见瘤状小尖。具有弱的前齿带,后外侧齿带向上延伸与下跟座后脊的唇侧会合(图 1C)。p4 破损,基本形态与 p3 一致,比 p3 稍大。下跟座后脊舌侧可见若干瘤状小尖。m2 的前外侧和后内侧破损。下后尖高耸,下后附尖与下后尖分开。下次尖略呈圆锥状,比下后附尖稍低,斜脊延伸到下后附尖基部。下跟座后脊几乎与下次尖等高,平直向前向内延伸,舌侧和唇侧均可见不太明显的瘤状小尖。后外侧齿带稍向上延伸,但没有与下跟座后脊会合。m3 保存时沿前后方向的一条锯齿状裂缝左右裂开。m3 较宽,前后不伸长,几乎没有磨损。靠近前齿带中部有一弱的小尖,为退化的下前尖,下前脊弱。下原尖和下后尖明显,下后脊为粗壮的横脊。下后附尖很小且靠近下三角座。下次尖明显,略成圆锥状,向下后附尖基部延伸出斜脊。下跟座后脊圆弧形,向前向内延伸。下次小尖膨大,不与下跟座后脊分离,且下跟座后脊舌侧的部分分裂成若干个瘤状小尖,无下次小尖脊和下内尖脊。下中凹较宽阔,下跟座较狭窄。前齿带明显,外齿带在下次尖的位置较明显,而在下中凹的位置较弱。无后齿带和内齿带(图 1B)。m3 齿冠高度与其下的下颌深度之比约为 1:4。颊齿测量数据见表 1。

肋骨(V 14620-1)两端都未保存,但肋骨体都有向两端变宽的趋势;肋骨体外侧边界几乎平直,内侧边界稍微弯曲;紧靠下颌保存,可能属于同一个体。

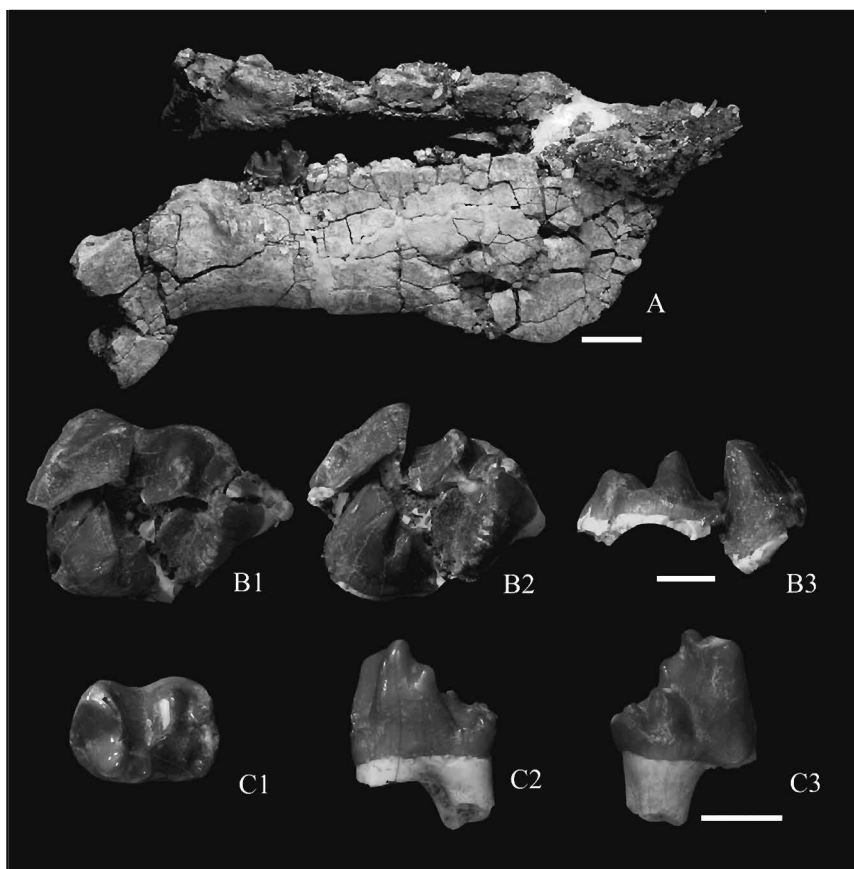


图1 尤因他兽(未定种)(V 14620)

Fig. 1 *Uintatherium* sp. (V 14620)

A. 下颌骨右侧视 right view of lower jaw, scale bar = 4 cm;

B. 右 right m3, scale bar = 1 cm,

B1. 冠面视 occlusal view; B2. 舌-冠面视 lingual-crown view;

B3. 颊侧视 buccal view; C. 右 right p3, scale bar = 1 cm, C1. 冠面视 occlusal view;

C2. 舌侧视 lingual view; C3. 颊侧视 buccal view

表1 *Uintatherium* sp. (V 14620) 和 *Gobiatherium mirificum* (V 14621) 的颊齿测量数据  
Table 1 Measurements of cheek teeth of *Uintatherium* sp. (V 14620) and  
*Gobiatherium mirificum* (V 14621) (mm)

	p3			p4			m2		m3		
	L	W (trd)	W (tad)	L	W (trd)	W (tad)	L	W (tad)	L	W (trd)	W (tad)
V 14620	18.2	11.9	12.8	19.1	13.4*	13.8*	28.0*	20.9*	38.6	26.2	23.7
V 14621	-	-	-	-	-	-	-	21.4	41.5	30.1	26.6

\* 近似值 estimated value.

比较讨论 在恐角目中,就下颌而言,下颌突、m3 和下门齿的特征在分类上占有相

对重要的地位。新标本下颌粗壮且具有明显的下颌突,  $m_3$  下后附尖靠近下三角座, 不具有下次小尖脊等特点与 *Gobiotheriidae* 相区别 (Osborn and Granger, 1932; Wheeler, 1961)。与 *Prodinoceratidae* 相比较, 新标本个体和牙齿大, 下门齿双叶形,  $m_3$  较宽且前后不伸长, 下前脊极度退化, 下次小尖膨大, 下内尖不明显且不与下跟座后脊分离, 不具下次小尖脊和下内尖脊, 所以新标本与 *Prodinoceratidae* 不同 (Wheeler, 1961; Schoch and Lucas, 1985; Thewissen and Gingerich, 1987)。Uintatheriidae 科中包括 4 个属: *Bathyopsis*、*Uintatherium*、*Tetheopsis* 和 *Eobasileus*。V 14620 下后附尖靠近下三角座的特征与北美的 *Bathyopsis* 相似, 但 *Bathyopsis* 在北美作为比 *Uintatherium* 更原始的类型 (Lucas and Schoch, 1998), 两者的区别主要在于尺寸大小、头骨上 3 对“角”的发育程度 (Osborn, 1913; Wheeler, 1961) 以及下颌突的形状。新标本和 Wasatchian 最晚期 (Wa7) 的 *Bathyopsis fissidens* 相比有以下明显不同之处: 1) 两者的下颌突都是前缘急剧下降, 下缘缓慢上升, 但新标本下缘逐渐上升到  $p_3$  后部之下, 而 *B. fissidens* 一直延伸到  $m_3$  跟座之下 (Dorr, 1958); 2) 新标本  $m_3$  下后附尖小, 下内尖不明显, 但 *B. fissidens* 的下后附尖大, 下内尖较明显 (Wheeler, 1961); 3) 新标本下门齿双叶, 而 *B. fissidens* 下门齿单尖 (Cope, 1884, pl. 58a); 4) 新标本的牙齿和下颌长度都明显大于 *B. fissidens* (表 2); 5) 从前侧视新标本下颌突形成宽阔的“ $\cap$ ”形, 而 *B. fissidens* 下颌突形成狭窄的“ $\wedge$ ”形 (Cope, 1884, pl. 29a)。Gazin (1952) 描述的可能属于雌性个体的 *Bathyopsis* cf. *B. fissidens* 以不具下颌突、个体小和新标本相区别。综合下颌突、牙齿和个体大小的特征, 新标本不应归入 *Bathyopsis*。需要指出的是, Bridgerian 早期的 *B. middleswarti* 的头骨长 51 cm (Wheeler, 1961), 但因没有下颌无法与新材料直接比较。根据其头骨长度, 推测 *B. middleswarti* 下颌长度大约是 42 cm, 与 V 14620 接近。但童永生、王景文 (1981, p. 212) 根据 *B. middleswarti* 顶骨、上颌骨和鼻骨突起相当发育, 认为其“形似个体较小的尤因他兽”, 所以 *B. middleswarti* 的归属还存在争议。

Wheeler (1961) 将北美的 *Uintatherium* 都归入到一个种 *Uintatherium anceps* 中。新标本与它有很多相似之处, 如下门齿双叶;  $m_3$  下前脊极度退化, 下内尖不明显 (北美的标本中仅有 USNM 18603 具明显的下内尖), 不具下次小尖脊和下内尖脊, 下跟座后脊圆弧形; 下颌突的后端都位于  $p_3$  或  $p_4$  之下, 从前侧视下颌突都形成宽阔的“ $\cap$ ”形。*Uintatherium*、*Tetheopsis* 和 *Eobasileus* 的区别主要在于头骨特征和大小, 从大小上比较, 新标本下颊齿的长度约 133.6 mm, 与北美 *Uintatherium anceps* 的变化范围 140 ~ 172 mm 接近, 而与 *Tetheopsis speirianus* 的 168 ~ 192 mm、*Eobasileus cornutus* 的 196 mm (Wheeler, 1961) 相差较远, 下颊齿长度比 *T. speirianus* 约小 26%, 比 *E. cornutus* 约小 32%, 而且 *Tetheopsis*、*Eobasileus* 的时代从 Bridgerian 的中晚期到 Uintan 的早期, 比新标本的时代早始新世早期 (见下文) 晚很多。综上所述, 新标本不应归入 *Tetheopsis* 或 *Eobasileus*, 它代表了一种个体较小的 *Uintatherium*。但与北美的 *Uintatherium anceps* 相比又有不同之处: 新标本  $m_3$  下后附尖很小且靠近下三角座, 下次小尖膨大, 下颌突不如北美的发育, 下颌突下缘逐渐上升; 北美的  $m_3$  下后附尖比下后尖略小, 下颌突发育, 下颌突下缘急剧上升。

Qi (1987) 记述了产自乌兰勃尔和 (Ulan Bulak 即为 Wulanboerhe) 野外地点为  $1P_5H_8$  的 cf. *Uintatherium* sp. 的  $m_3$  (V 5711), 其与新标本的相同之处在于: 下次小尖 (原文为下

内尖)有些膨大,大小(L: 35.7 mm; W: 25 mm (trd), 22 mm (tad))与新标本相近,而且产出层位可能也是脑木根组,所以 V 5711 很可能和新标本是同一种。

我国其他地点发现的尤因他兽化石,一是河南卢氏县卢氏组下部的 *U. insperatus*, 标本为较完整的头骨,头长 61 cm,是一种个体较小的尤因他兽,有与 *Bathyopsis middleswarti* 相同的一些特征(童永生、王景文,1981);二是新疆准噶尔盆地北缘三个泉地区(Üqbulak)依希白拉组 B 层的 *Uintatherium* cf. *U. insperatus*, 采到 P4 ~ M3、m2、m3、i3、腓骨、距骨等(童永生,1989);三是山东新泰县西周官庄组的 cf. *Uintatherium* sp., 仅知 M3 和上犬齿(周明镇、童永生,1962)。新疆三个泉标本 M3 的形态和尺寸与山东新泰标本最为接近,尺寸上略大于河南卢氏标本(童永生,1989)。三个泉标本的 m3 下次小尖锥状、高耸,与 V 14620 有些相似,但其下前尖位置很低且明显,下后附尖与下后尖距离较大,前者有一脊延伸到下后脊,下次小尖脊明显,向前向内延伸,后齿带包围下次小尖而与 *Uintatherium* 相区别,这些特征倒与 *Gobiatherium* 的特征一致,所以三个泉标本是否都归入 *Uintatherium* 还是值得商榷的。如果仅考虑牙齿,标本 V 7929 (左 P4 ~ M3)、V 7929. 2 (右 M3)和 V 7929. 6 (右 i3)应归入到 *Uintatherium*, 而将 V 7929. 1 (左 P4)、V 7929. 3 (左 m2)、V 7929. 4 (右 m3)和 V 7929. 5 (左 m3)归入 *Gobiatherium* 则更合适。新疆三个泉地区依希白拉组 B 层哺乳动物群、河南卢氏组下部动物群和山东新泰动物群都和内蒙古阿山头动物群相类似或接近(童永生,1989;童永生、王景文,1981;周明镇、齐陶,1982),但新标本的产出层位是脑木根组顶部(Meng et al., in preparation),与上覆的阿山头组不整合接触,其产出的时代相对较晚,为早始新世早期(见下文)。卢氏标本的头骨和二连标本的下颌较北美的属种小(表 2),而且都有一些与 *Bathyopsis* 相近的特征,所以我国的尤因他兽属种可能代表比北美的 *Uintatherium anceps* 略为原始的类型。虽然新标本材料较少、保存较为破损,但归入 *Uintatherium* 应无疑问,所以定为未定种。

表 2 *Uintatherium* 和 *Bathyopsis* 部分测量数据的比较

Table 2 Comparison of measurements of some *Uintatherium* and *Bathyopsis* specimens (mm)

	二连 (Erlian) V 14620	三个泉 (Üqbulak) V 7929	卢氏 (Lushi) V 6379	新泰 (Xintai) V 2667	<i>B. fissidens</i>	<i>U. anceps</i>
M3 (L)	-	37.4	33.9 (ca.)	37 (ca.)	-	37
M3 (W)	-	37.2	30.4 (ca.)	38 (ca.)	-	36
m2(L)	28.0	30.2	-	-	21	28(X)
m3 (L)	38.6	40.4	-	-	26	45.0
m3 (W) trd	26.2	-	-	-	18	30.0
m3 (W) tad	23.7	27.5	-	-	-	27.0
Skull (L)	-	-	610	-	330	640 ~ 810
Mandible (L)	408 (ca.)	-	-	-	244 (ca.)	490
P2 ~ M3 (L)	-	-	125	-	-	143 ~ 170
p2 ~ m3 (L)	133.6	-	-	-	117	140 ~ 172
DMP	107.0	-	-	-	100 (ca.)	170.0

注:卢氏标本 M3 为重新测量,其余数据依童永生和王景文(1981);新泰标本的测量来自对周明镇、童永生(1962)图版复原图的测量;*B. fissidens* 下颌长度和下颌突深度依 Osborn (1913)图版的测量,其余数据依 Cope (1884), Lucas 和 Schoch (1998);*U. anceps* 的 m3 的测量来自 Marsh (1884)的 YPM 11039 的图版, M3 尺寸来自标本 USNM 18599 (Wheeler, 1961), 下颌长度和下颌突深度来自标本 YPM 11194 (Marsh, 1884), 其余数据来自 Wheeler (1961), Lucas 和 Schoch (1998)。

Measurements of Lushi specimens are cited from Tong and Wang (1981) except M3, which is remeasured. Xintai speci-

men is measured and calculated from plate (Chow and Tung, 1962). In *B. fissidens*, the length of mandible and DMP are measured and calculated from plate (Osborn, 1913), other data are cited from Cope (1884) and Lucas and Schoch (1998). In *U. anceps*, m3 is measured on the plate of YPM 11039 (Marsh, 1884); measurements of M3 correspond with USNM 18599 (Wheeler, 1961); length of the mandible and DMP correspond with YPM 11194 (Marsh, 1884); other measurements are cited from Wheeler (1961) and Lucas and Schoch (1998).

X. Mean 平均值; L. Length 长; W. Width 宽; trd. trigonid 下三角座; tad. talonid 下跟座; DMP. depth of mandibular process 下颌突深度。

### 戈壁兽科 *Gobiatheriidae* Flerov, 1952

#### 戈壁兽属 *Gobiatherium* Osborn & Granger, 1932

#### 奇异戈壁兽 *Gobiatherium mirificum* Osborn & Granger, 1932

(图2)

**标本** 残破的左下颌,缺垂直支,保存几乎完整的 m3 以及 m2 的后部。中国科学院古脊椎动物与古人类研究所标本编号:IVPP V 14621。

**产地和层位** 内蒙古二连盆地努和廷勃尔和,阿山头组底部。

**标本描述** 下颌水平支长且浅,无下颌突,整个下颌显得纤细(图2A)。m3 下三角座较长,下前尖位置很低,位于舌侧且明显,紧靠 m2 的下跟座后脊。下原尖、下后尖粗壮,下后脊为明显的横脊。下后附尖和下后尖距离较远,前者有一脊延伸到下后脊。下次尖、斜脊明显,斜脊从下次尖一直延伸到下后附尖的基部并与下跟座后脊平行。下跟座后脊分裂成若干个瘤状小尖,下次小尖脊明显。具有弱的前、后齿带,无外齿带(图2B)。m2 下跟座明显缩小,下跟座后脊与斜脊平行。m3 齿冠高度与其下的下颌深度的比是 1:2。标本测量数据见表 1。

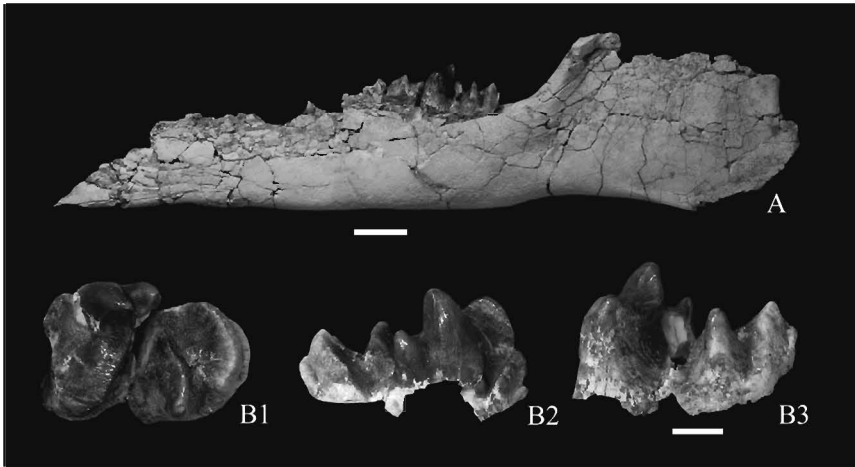


图2 奇异戈壁兽 (V 14621)

Fig. 2 *Gobiatherium mirificum* (V 14621)

A. 左侧下颌具 m3 和 m2 跟座 left mandible with m3 and talonid of m2, scale bar = 3 cm;

B. 左 left m3, scale bar = 1 cm, B1. 冠面视 occlusal view;

B2. 舌侧视 lingual view; B3. 颊侧视 buccal view

**比较讨论** V 14621 下颌水平支长且浅,不具下颌突,且  $m_3$  下后附尖和下后尖距离较远,下后附尖有一脊延伸到下后脊,下次小尖脊明显。这些特征和 *Prodinoceratidae* 和 *Uintatheriidae* 区别明显,而与 *Gobiatheriidae* 的特征一致。*Gobiatheriidae* 共有二个属两个有效种,即 *Gobiatherium mirificum* Osborn & Granger, 1932 和 *Gobiatherium minutum* Cheng & Ma, 1990。前一种除在我国内蒙古发现以外,在哈萨克斯坦的 Zaysan 盆地 Chakpaktas 组和吉尔吉斯斯坦的 Toru-Aygyr 地点 Chonkurchak 组也有发现 (Lucas, 2001; Agadjanian and Kondrashov, 1999)。后一种仅发现于秦岭东段李官桥盆地(程捷、马安成,1990)。

Qi (1987)除了描述了大部分产自呼和勃尔和 77036-2 的 *Gobiatherium mirificum*,还命名了 *Gobiatherium* 的两个新种:一是采自乌兰勃尔和  $1P_5H_8$  的 *Gobiatherium ? major* (V 5712),另一个是采自巴彦乌兰  $1P_{25}H_3$  与呼和勃尔和 77036-2 的 *Gobiatherium? monolobotum* (V 5713)。Lucas (2001)认为这两个新种分别是 *Gobiatherium mirificum* 和 *Eudinoceras mongoliensis* 的主观同物异名。程捷和马安成(1990)描述了产自秦岭东段李官桥盆地湖北省丹江口市黄营乡张沟村东中始新世玉皇顶组顶部的 *Gobiatherium minutum*,以个体小为主要特征( $m_1:20.4 \times 16.4$  mm),且  $m_1$  下前尖更为显著, $dp_3 \sim dp_4$  具有明显的下前脊。新标本个体大,下颌水平支长且浅,不具下颌突, $m_3$  下后附尖与下后尖距离较远,下后附尖上有一脊延伸到下后脊,与 *Gobiatherium mirificum* 的特征一致。

## 2 二连盆地 *Uintatherium* sp. 和 *Gobiatherium mirificum* 产出层位

V 14620 的产出层位是脑木根组顶部。在努和廷勃尔和剖面上,脑木根组的厚度约为 55 m,阿山头组的厚度约 13 m,两者之间为不整合接触(Meng et al., in preparation)。在 *Uintatherium* sp. 产出层位之下约 7 m 发现有啮形类 *Gomphos*。*Gomphos* 是一种典型的早始新世 Bumbanian 类型,目前仅分布在蒙古和我国的内蒙古(Dashzeveg, 1988; Meng et al., 2004),在内蒙古除在努和廷勃尔和有发现外,在乌兰勃尔和(Meng et al., 2004)、巴彦乌兰(Meng et al., 2005)也有发现,在二连盆地 *Gomphos* 层被作为重要的标志层。在努和廷勃尔和剖面的脑木根组下部,发现有 *Palaeostylops*、*Lambdopsalis* 和 *Prionessus* 等典型的晚古新世的化石。根据最新的古地磁资料,本文描述的 *Uintatherium* 产出地层处于 C24r 之内(Bowen et al., 2005),所以 V 14620 的时代很可能是早始新世早期,早于北美 Wasatchian 最晚期 Wa7 (Lostcabinian)的 *Bathyopsis fissidens*。北美的 *Uintatherium* 只出现在 Bridgerian 的中晚期,我国其他产 *Uintatherium* 的层位大致与阿山头期相当,而阿山头期又通常和北美的 Bridgerian 相对比(童永生等,1995),时代为早始新世晚期至中始新世早期(Luterbacher et al., 2004)。所以在脑木根组顶部发现的早始新世早期的 *Uintatherium* 是该属已知最早的代表,而且它也具有较北美 *Uintatherium anceps* 原始的特征。

Osborn 和 Granger (1932)描述的 *Gobiatherium mirificum* 产于距 Iren Dabasu 西南 25 英里的伊尔丁曼哈组,该地点后来称为马捷茨营地(孟津,1990),根据 Granger 1930 年所绘制的马捷茨营地剖面,顶部的“Houldjin”由黄色、灰色砂和砂岩组成,底部“Irdin Manha”由上部的灰色泥岩和下部的红色泥岩组成(孟津,1990,图 4)。而现在通常认为 Granger

的“Houldjin”和“Irdin Manha”大体上相当于伊尔丁曼哈层与阿山头层(Radinsky, 1964; Qi, 1987; 孟津, 1990),最近的工作证实了上述推测(Meng et al., in preparatioin)。据此,应该认为 *Gobiatherium mirificum* 的产出层位是阿山头组。

Qi (1987)描述的 *Gobiatherium mirificum* 标本大部分产自呼和勃尔和,还有少数产自乌兰勃尔和与阿山头敖包。在呼和勃尔和的产出层位是阿山头层的顶部第 10 层,与上覆的伊尔丁曼哈层第 11 层不整合接触。在乌兰勃尔和与阿山头敖包的产出层位也很可能是阿山头组。而在努和廷勃尔和的阿山头组底部采集的新标本也证实了 *Gobiatherium mirificum* 的产出层位是阿山头组。在阿山头组之下的脑木根组和阿山头组之上的伊尔丁曼哈组未曾发现有 *Gobiatherium mirificum*。

### 3 结语

在内蒙古二连盆地努和廷勃尔和脑木根组顶部发现的早始新世早期的恐角兽类标本,虽然仅有下颌,头骨方面许多重要的特征无法获得,但将其归入到 *Uintatherium* 应无疑问。它是目前已知最早的 *Uintatherium* 的代表,甚至比产于北美 Wasatchian 最晚期(Wa7)的 *Bathyopsis fissidens* 还要早。新标本为恐角目的系统发育关系和古动物地理提供了新的信息,但是相关问题的深入讨论还有待于发现更好的材料。

自从 Osborn 和 Granger (1932)描述 *Gobiatherium mirificum* 以来,再也没有在伊尔丁曼哈组中发现该种标本,而正型标本的产出层位也被怀疑为阿山头组(Radinsky, 1964; Qi, 1987; 孟津, 1990)。此次在阿山头组底部以及 Qi (1987)在阿山头组顶部发现的 *Gobiatherium mirificum* 则证实了该种在阿山头组的存在。由于在下伏的脑木根组尚未发现 *Gobiatherium mirificum*,因此目前可以认为该种仅产于阿山头组及与其相当的地层中。

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## NEW MATERIALS OF EOCENE DINOCERATA (MAMMALIA) FROM THE ERLIAN BASIN, NEI MONGOL (INNER MONGOLIA)

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**Key words** Erlian Basin, Nei Mongol, Eocene, Nomogen Formation, Arshanto Formation, Dinocerata



## Summary

In 2004 two broken mandibles of Dinocerata were unearthed from the Eocene deposits at Nuhetingboerhe, Erlian Basin, Nei Mongol, China. They represent two different genera and species, and are reported in this paper. Classification of Dinocerata at family level follows Flerov (1956, 1957).

### 1 Systematic paleontology

#### Dinocerata Marsh, 1873

#### Uintatheriidae Flower, 1876

#### *Uintatherium* Leidy, 1872

#### *Uintatherium* sp.

(Fig. 1)

**Material** A pair of lower jaws with almost complete right p3 and m3, broken right p4, m2 and several dentine and root of incisors (or canines) (IVPP V 14620).

**Locality and horizon** Nuhetingboerhe, Erlian Basin, Nei Mongol; upper part of the Nohogen Formation, about 7 m above the *Gomphos*-bearing bed (Meng et al., 2004).

**Description and comparison** The lower jaw is relatively short and robust. The inframandibular process extends down to the level slightly lower than the lower margin of horizontal ramus. Its lower border rises gradually posteriorly and ends beneath p3. The angle between its anterior and lower edges is slightly over 90° (Fig. 1A). Though only the dentine and root parts preserved, the lower incisor shows bilobate type. p3 is not anteroposteriorly elongated. The trigonid is much higher than the talonid. The paraconid is absent and the paralophid is reduced, while the metalophid is relatively strong. The metastylid is obviously higher than the hypoconid. The cristid obliqua extends to the base of the metastylid. The posterior talonid crest with tubercular internal parts is lower than the cristid obliqua. The posterolabial cingulum rises to the external part of the posterior talonid crest. The anterior cingulum is weak. The broken p4 is similar to p3 in morphology, but slightly larger. On m2, the anterolabial and posterolingual parts are broken. The metaconid is high and large. The metastylid is not closely appressed to the trigonid. The conical hypoconid which is as high as the posterior talonid crest is slightly lower than the metastylid. The cristid obliqua extends to the base of the metastylid. The posterior talonid crest, straightly extended in the anterolingual direction, is tubercular in both internal and external parts. The posterolabial cingulum rises slightly, but does not join the external part of the posterior talonid crest. On m3, the paraconid and paralophid are reduced. The metalophid is strong and transversely extended. The metastylid is much smaller than the metaconid and closely appressed to the trigonid. The hypoconid is distinct and conical. The posterior talonid crest is arched and the internal part is tubercular. The hypoconulid is somewhat swollen and not separated from the posterior talonid crest. No hypoconulid and entoconid crests are present on its talonid (Fig. 1B). All these characters indicate that V 14620 should be referred to Uintatheriidae. The measurements of V 14620 are listed in Table 1.

The present form is more similar to *Bathyopsis* and *Uintatherium* than to the other genera in the family Uintatheriidae. V 14620 resembles those of *Bathyopsis fissidens* in having a steep anterior edge of the inframandibular process and the metastylid of m3 closely appressed to the trigonid. However, they are different in some critical features. The posterior end of the inframandibular process on the present specimen is beneath p3, whereas it ends beneath m3 in *B. fissidens*. The metastylid of m3 in V 14620 is much smaller and the entoconid is less prominent than those in *B. fissidens*. The lower incisor of V 14620 is bilobate type, while that in *B. fissidens* is single-cusped (Cope, 1884, pl. 58a). By the tooth size and length of the lower jaw,

the species represented by the new specimen is distinctly larger than *B. fissidens* (Table 2). From the anterior view, the inframandibular processes on V 14620 form a wide “∩” shape, while they form a narrow “∧” shape in *B. fissidens*. On the other hand, V 14620 is nearly identical to *Uintatherium* specimens in many characters, e. g. the lower incisor is bilobate type; the m3 paraconid and paralophid are reduced; the posterior talonid crest is arched; the entoconid is not distinct; the hypoconulid and entoconid crests are absent on its talonid; the posterior end of the inframandibular process is beneath p3 or p4; from the anterior view the inframandibular processes form a broad “∩” shape; the length of lower cheek tooth row in V 14620 (133.6 mm) is close to that in *Uintatherium anceps* (140 ~ 172 mm). Therefore, V 14620 is probably a representative of *Uintatherium*. The length of the lower jaw of *Bathyopsis middleswarti*, about 42 cm estimated on the basis of its skull (51 cm long), is close to that of V 14620. However, Tong and Wang (1981) proposed that *B. middleswarti* is more similar to the small *Uintatherium* than to *Bathyopsis*.

Wheeler (1961) referred all specimens of *Uintatherium* from North America to a single species, *U. anceps*. V 14620 differs from them in the following characters: 1) The metastylid of m3 is much smaller and more closely appressed to the trigonid; 2) The hypoconulid of m3 is somewhat swollen; 3) The inframandibular process is less developed, and its lower border arises gradually posteriorly and ends beneath p3, while it has an abrupt rise beneath p4 in *U. anceps*; These differences suggest that V 14620 should not be referred to *U. anceps*.

Asian *Uintatherium* were all known from China, including *U. insperatus* from the Middle Eocene Lushi Formation, Henan Province (Tong and Wang, 1981), *Uintatherium* cf. *U. insperatus* from the Middle Eocene bone bed B of the Üqbulak Formation, Xinjiang (Tong, 1989), cf. *Uintatherium* sp. from the Middle Eocene Guanzhuang Formation, Shandong Province (Chow and Tung, 1962) (Table 2), and cf. *Uintatherium* sp. from Wulanboerhe in Nei Mongol (Qi, 1987). The hypoconulid of m3 on *Uintatherium* cf. *U. insperatus* from Üqbulak Formation is pyramidic, somewhat similar to the new specimen. But it differs from V 14620 in the following characters: the paraconid is distinct; the distance between the metastylid and metaconid is large and a ridge exists between them; the hypoconulid crest is distinct. On the other hand, these characters in *Uintatherium* cf. *U. insperatus* reflect some *Gobiotherium* traits. Perhaps materials from bone bed B of the Üqbulak Formation include both *Uintatherium* and *Gobiotherium*. If only the teeth were concerned, V 7929 (left P4 ~ M3), V 7929.2 (right M3) and V 7929.6 (right i3) should be assigned to *Uintatherium*, whereas V 7929.1 (left P4), V 7929.3 (left m2), V 7929.4 (right m3) and V 7929.5 (left m3) should be *Gobiotherium* (Table 2). The m3 of cf. *Uintatherium* sp. from Wulanboerhe (Qi, 1987) is close to the present form in size and swollen hypoconulid. Thus, V 14620 cannot be referred to any known species with certainty. Because of the poor preservation, the specimen is identified as *Uintatherium* sp.

### Gobiotheriidae Flerov, 1952

#### *Gobiotherium* Osborn & Granger, 1932

#### *Gobiotherium mirificum* Osborn & Granger, 1932

(Fig. 2)

**Material** A left lower jaw with nearly complete m3 and posterior part of m2 (IVPP V 14621).

**Locality and horizon** Nuhetingboerhe, Erlian Basin, Nei Mongol; basal part of the Arshanto Formation.

**Description and comparison** The horizontal ramus is elongated and shallow without an inframandibular process (Fig. 2A). Paraconid of m3 is distinct and low. The transverse metalophid is strong. The metastylid is apart from the metaconid, and a ridge exists between them. The cristid obliqua parallels the posterior talonid crest. Hypoconulid crest is prominent (Fig. 2B, Table 1). These characters suggest that V 14621 should be assigned to *Gobiotherium mirificum*.

## 2 Stratigraphic position of dinoceratans in the Erlian Basin

In the Erlian Basin, 3 genera of dinoceratans have been reported from the Paleogene deposits: *Prodinoceras*, *Uintatherium*, and *Gobiatherium*. *Prodinoceras* is a common taxon typical of the Gashatan fauna in Asia (Wang et al., 1998; Meng et al., 2004), and was found from the layer below the *Gomphos*-bearing bed in the Nomogen Formation (Meng et al., in preparation). *Gomphos*, a gliriform mammal, was only reported from the Bumbanian deposits in Mongolian Plateau (Dashzeveg, 1988; Meng et al., 2004). From the bed about 7 m above the *Gomphos*-bearing horizon, *Uintatherium* sp., described in this paper, was collected. Paleomagnetic result correlated this bed with Chron 24r and suggested an early Early Eocene age (Bowen et al., 2005). Such correlation indicates that the *Uintatherium* sp. from the Nomogen Formation is the earliest representative of the genus. Cf. *Uintatherium* sp., described by Qi (1987), probably came from the Nomogen Formation at Wulanboerhe.

According to Osborn and Granger (1932), *Gobiatherium mirificum* was collected from the Irдин Manha Formation at Camp Margetts. However, the deposit yielding *Gobiatherium mirificum* was later reconsidered as the Arshanto Formation (Radinsky, 1964; Qi, 1987; Meng, 1990). The new discovery of *Gobiatherium mirificum* reconfirms its occurrence in the Arshanto Formation. This species only has its occurrence in the Arshanto Formation.

## 3 Concluding remarks

The early Early Eocene specimen of *Uintatherium* from the upper part of the Nomogen Formation at Nuhetingboerhe, Erlian Basin is the earliest representative of the genus, even earlier than the earliest *Bathyopsis* from the latest Wasatchian (Wa7) in North America.

No reliable evidence shows the occurrence of *Gobiatherium mirificum* in the Irдин Manha Formation. This species has not been reported from the Nomogen Formation either. In this case, *Gobiatherium mirificum* can be considered as an exclusive member of the Arshantan Asian Land Mammal Age.

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