第 41 卷 第 3 期
2003 年 7 月

古 脊 椎 动 物 学 报
VERTEBRATA PALASIATICA

pp. 211～219
figs. 1～2

内蒙古脑木根地区渐新世啮齿类及相关地层问题[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 描述了脑木根敖包顶部岩层中所产的啮齿类化石:阿尔泰查干鼠(*Tsaganomys altaicus*)和中间圆柱鼠(*Cyclomylus intermedius*)。脑木根敖包顶部地层最初被归入巴润索组。研究表明该层共含 5 种哺乳动物化石(*Tsaganomys altaicus*、*Cyclomylus intermedius*、*Paraceratherium transouralicum*、*Ardynia kazachstanensis* 和 *Entelodon gobiensis*),其时代为早渐新世晚期。巴润索组的层型是巴润索平台顶部的砂砾岩,其时代为晚始新世。脑木根敖包顶部岩层不应归入巴润索组,而与额尔登敖包顶部的上脑岗代组在岩性上接近,时代相同,因此应归入上脑岗代组。

关键词 内蒙古二连盆地,渐新世,始新世,巴润索组,上脑岗代组,啮齿类
中图法分类号 Q915.873,P534.611

内蒙古二连盆地脑木根地区的脑木根敖包(Nom Khong Obo),又称脑木根希热(Nom Khong Shireh)、脑木根平台[即神圣高地(Holy Mesa)],是亚洲古近系的经典地区之一。该地区的古近纪地层和哺乳动物化石最早是纽约美国自然历史博物馆中亚考察团于 1928 年发现的。当时他们将该地区的地层分成晚始新世沙拉木仑组、渐新世乌兰戈楚组和巴润索组三层(Osborn,1929; Berkey et al., 1929)。这套岩层组的命名是通过与其西南的沙拉木仑地区的地层对比确立的。但脑木根敖包为一孤丘,与上述地层典型地点相距约 90 km,其顶部归入巴润索组的砂砾岩是否应该归入该组一直没有得到进一步的证实。对陆相沉积地层来说,在缺少连续露头和其他证据的情况下要进行对比是有困难的,而且该地区有关地层的岩性变化较大,这一划分在后来的工作中造成了不少混乱。

应美国自然历史博物馆 D. R. Tedford 博士的邀请,笔者于 2001 年 5～6 月间访问了该博物馆,有机会看到中亚考察团采集的哺乳动物化石标本、有关地点和地层的档案资料。经过对原始资料的核对和对脑木根敖包顶部岩层所产化石的研究,使笔者相信原来对脑木根敖包顶部岩层的时代鉴定和定名都应予以更正。

文中描述的标本是中亚考察团 1928 年采集的,均产自我国内蒙古二连盆地的脑木根敖包顶部所谓的"巴润索组"。描述所用术语和颊齿的测量方位依 Wang (2001)。文中缩写:AMNH,美国自然历史博物馆。

1) 国家自然科学基金重点项目(编号:40232023)和中国科学院知识创新工程项目(编号:KZCX2-103)资助。
收稿日期:2003 - 03 - 27

1 系统描述

查干鼠科 Tsaganomyidae Matthew et Granger, 1923

查干鼠属 Tsaganomys **Matthew et Granger, 1923**

阿尔泰查干鼠 Tsaganomys altaicus **Matthew et Granger, 1923**

(图 1)

标本 一段右下颌骨具 m1～3 (AMNH 26185, **野外编号**: 777)。

地点和层位 内蒙古二连盆地脑木根敖包; 早渐新世晚期, 上脑岗代组(?)。

记述 下颌角由下门齿齿槽颊侧伸出, 为豪猪型下颌骨。颊齿约为椭圆柱形, 稍向前舌侧弯, 由下门齿的颊侧伸出。颊齿为强烈的单面高冠齿, 釉质层主要覆盖在齿的后面和颊面, 其外表面似有薄的白垩质层覆盖。齿根开放, 髓腔较短, 往齿冠方向明显变窄、变尖。冠面为卵圆形, 磨蚀后表面较光滑、稍凹, 中未见齿芯。这些特征都与 *Tsaganomys altaicus* 的一致, 而且颊齿的尺寸也在该种的变异范围内。测量(单位: mm): ml～3 长(L), 15.4; 臼齿[长(L) ×宽(W)]: m1, 4.8 ×6.7; m2, 4.1 ×6; m3, 3.7 ×—。

图 1 阿尔泰查干鼠右下颌骨具 m1～3 (AMNH 26185)

Fig. 1 Right lower jaw with m1～3 (AMNH 26185) of *Tsaganomys altaicus*

A. **冠面观** occlusal view; B. **前面观** anterior view; C. **舌面观** lingual view, **标尺** scale = 1 cm

圆柱鼠属 Cyclomylus **Matthew et Granger,1923**

中间圆柱鼠 Cyclomylus intermedius **Wang,2001**

(图 2)

标本　同一个体的左下颌骨具下门齿和 p4～m3,和右下颌骨具下门齿和 p4～m2 (AMNH 26186,野外编号:778);一段左下颌骨具 m1～3 (AMNH 26187,野外编号:779)。

产地和层位　内蒙古二连盆地脑木根敖包;早渐新世晚期,上脑岗代组 (?)。

记述　下颌骨颏孔位于 p4 前下方。下颌角从下门齿颊侧伸出,属豪猪型下颌骨。下颌骨齿式:/1013。p4 位于下门齿之上,下臼齿的齿根起于门齿的颊侧。颊齿为单面高冠齿,具 2 封闭的齿根:前舌侧齿根小,后颊侧的大。AMNH 26187 为一幼年个体,m3 刚萌出,m1 和 m2 虽受磨蚀,但仍可见冠面结构。它的下臼齿的尖和脊都较明显,具 4 脊,下后脊 I 明显,下次尖大,下外凹向后舌侧伸等。这些特征都与 *Cyclomylus* 属的一致。

图 2　**中间圆柱鼠左下颌骨具** m1～3 (AMNH 26187)

Fig. 2　Left lower jaw with m1～3 (AMNH 26187) of *Cyclomylus intermedius*

A1,A2. **冠面观,立体照片** occlusal view(in stereo); B. **舌面观** lingual view; C. **颊面观** buccal view, **标尺** scale = 1 cm

Cyclomylus **属目前已知包括** 3 **种**: *C. lohensis* Matthew et Granger, 1923、*C. intermedius* Wang,2001 **和** *C. biforatus* Wang,2001 。**脑木根标本的颊齿的齿冠为中等高度,比** *C. lohensis* **的高, 而比** *C. biforatus* **的低,与** *C. intermedius* **的相近。颊齿萌出间隔的时间较** *C. lohensis* **的长,在** m3 **萌出时,**m1 **的冠面已磨蚀较深,这也与** *C. intermedius* **的相似。**AMNH 26186 **为一成年个体,其颊齿均受磨蚀,冠面形态不清,但它的** p4 **具** 2 **齿根,而且其磨蚀程度和年龄也与归入** *C. intermedius* **种的** AMNH 81235 **的很相近。此外,**AMNH 26186 **和** 26187 **的颊齿的尺寸也在** *C. intermedius* **的变异范围内(见表** 1)。**这** 2 **件标本似应归入** *C. intermedius* 。

表 1 Cyclomylus intermedius 颊齿测量

Table 1 Measurements of cheek teeth of Cyclomylus intermedius (mm)

	AMNH 26186		AMNH 26187
	左 (left)	右 (right)	左 (left)
p4～m3L	19.6		
m1～3 L	15		11.5
p4 L	4.3	4.3	
p4 W	5	4.5	
m1 L	4	4.5	3.9
m1 W	5.4e	6.1	3.5
m2 L	4.5	4.5	3.9
m2 W	5.3e	6	3.5
m3 L	3.3		3.4
m3 W	3.6e		3.1

2 讨论

关于巴润索组 巴润索组 (Baron Sog Formation) 是中亚考察团于 1925 年建立的。其层型地点位于沙拉木仑地区的巴润索平台 (Baron Sog Mesa),主要岩性为灰白色长石砂岩、浅绿 - 白色粘土和具交错层理的粗砾岩。同时他们也将双敖包 (Twin Oboes)、额尔登敖包 (= 乌尔丁敖包 Urtyn Obo) 和脑木根敖包顶部的浅色砂砾岩层统称为巴润索组。他们认为巴润索组中产有巨犀等化石,无雷兽化石,其下的乌兰戈楚组产有雷兽 (*Embolotherium*),而无巨犀化石 (Osborn,1929)。实际上,在层型地点 (巴润索平台) 的巴润索组确有雷兽化石 (Granger,1925)[1],不过只产有一种雷兽化石[*Embolotherium ultimum* [AMNH 21604 (野外编号:591);见 Granger and Gregory,1943]。Russell and Zhai (1987) 列举的巴润索组所产的 3 种化石,除了 *Embolotherium ultimum* 外,其余 2 种 (*Schizotherium avitum* 和 *Schizotherium* sp.) 并不产自巴润索平台,而是产自额尔登敖包 (Coombs,1978;见下)。

关于巴润索组的时代,最早被认为是早和中渐新世 (Osborn,1929;Berkey et al.,1929)。Li and Ting (1983) 将巴润索地点的 *Embolotherium ultimum* 作为呼尔井组所产动物群的成员,未提及巴润索组,认为其时代为中 - 晚渐新世。江浩贤 (1983) 统称中亚考察团的呼尔井组和巴润索组为上脑岗代组,其时代为晚渐新世。稍后,巴润索组的时代被认为是早渐新世 (Russell and Zhai 1987;Wang,1992),或晚始新世 (王伴月,1997)。

就哺乳动物化石而言,巴润索平台的巴润索组中除了 *Embolotherium ultimum* 外,还产有 *Zaisanamynodon borisovi* [AMNH 21602 (野外编号; 587);见 Lucas et al., 1996] 和 *Lophiomeryx anagare* [AMNH 22113 (野外编号:593)] (见 Granger,1925)。这样巴润索层型地点的巴润索组中共产有 3 种哺乳动物化石。就哺乳动物化石的地质时代分布看, *Embolotherium ultimum*、*Zaisanamynodon borisovi* 和 *Lophiomeryx anagare* 目前已知均限于晚始新世,这似乎进一步证实了巴润索层型地点的巴润索组的时代的确是晚始新世。

1) Granger W,1925 (MS). Records of fossils collected in Mongolia in 1925. The American Museum of Natural History, New York. 1～67

脑木根敖包顶部岩层的时代　脑木根敖包顶部的白色、黄色具交错层理的砂砾岩夹粘土透镜体的岩层被美国自然历史博物馆中亚考察团也称为巴润索组,其时代最早被估计为早和中渐新世(Spock,1928[1];Osborn,1929;Berkey et al.,1929)。根据 Granger(1928)[2]的有关"化石记录(Record of fossils)",除了上述的 *Tsaganomys altaicus* 和 *Cyclomylus intermedius* 外,脑木根敖包顶部被称为"巴润索组"的岩层中还产有 *Paraceratherium transouralicum* [标本包括 AMNH 26168 和 26189(野外编号:779)、AMNH 26169(野外编号:780)和 AMNH 26172(野外编号:790);见 Granger and Gregory,1936],*Ardynia kazachstanensis* [标本为 AMNH 26183(野外编号:776);见 Radinsky,1967,p.34]和 *Entelodon gobiensis* [标本为 AMNH 26184(野外编号:781);见 Lucas and Emry,1996,p.398]等哺乳动物化石。Colbert(1934)曾认为一枚属 *Schizotherium* sp. 的第三掌骨(AMNH 26188)也产自脑木根敖包的"巴润索组",但根据 Granger(1928)的"化石记录"记载,AMNH 26188 的野外编号为 734,而不是 774,其产地不是脑木根敖包,而是额尔登敖包。这样,产自脑木根敖包顶部岩层的哺乳动物化石共有 5 种: *Tsaganomys altaicus*、*Cyclomylus intermedius*、*Paraceratherium transouralicum*、*Ardynia kazachstanensis* 和 *Entelodon gobiensis*。其中 *Tsaganomys altaicus* 目前已知的时代分布为早渐新世晚期至晚渐新世或稍晚,而 *Cyclomylus intermedius* 的已知时代为早渐新世(Wang,2001)。*Paraceratherium transouralicum* 和 *Ardynia kazachstanensis* 的时代分布已知均限于早渐新世,*Entelodon gobiensis* 的已知时代分布为晚始新世 - 早渐新世(Russell and Zhai,1987;Lucas and Sobus,1989)。就该层所产的哺乳动物化石而言,脑木根敖包顶部岩层的时代以早渐新世晚期为宜。

前面的讨论已表明,巴润索平台的巴润索组的时代为晚始新世,显然要比要脑木根敖包顶部岩层(所谓的巴润索组)的时代(早渐新世)早得多。同样,额尔登敖包顶部被称为巴润索组的浅色砂砾岩层产有 *Paraceratherium transouralicum*(早渐新世)、*Entelodon gobiensis*(晚始新世 - 早渐新世)、*Schizotherium avitum*(晚始新世 - 早渐新世)和 *Schizotherium* sp.(晚始新世 - 晚渐新世),时代也应以早渐新世为宜,也比巴润索平台的巴润索组的时代晚。这样脑木根敖包和额尔登敖包地点顶部岩层的时代相同,同为早渐新世,而不同于巴润索平台的巴润索组的时代。前面的叙述已表明,脑木根敖包顶部岩层的岩性与巴润索平台的巴润索组的岩性是不同的。显然,脑木根敖包(或者包括额尔登敖包)顶部岩层不是巴润索组,而代表另一岩组。这一套岩层实际上并未被中亚考察团命名过。额尔登敖包顶部的岩层后来被江浩贤(1983)命名为上脑岗代组。它的典型地点是额尔登敖包附近的脑岗代,其时代原定为晚渐新世。这一命名已被 Russell and Zhai(1987)采纳。但齐陶(1990)称上述地层为呼尔井组,认为其时代为中渐新世,而称其下伏的红色岩层(即中亚考察团的"上部红层")为巴润索组。笔者认为,齐陶的这种划分有两点值得质疑:1)呼尔井组本身的问题比较复杂,有些化石的时代是始新世的(王伴月,1997),将额尔登敖包顶部的岩层命名为呼尔井组显然不合适;2)前面已提到过,在层型地点(巴润索平台)的巴润

1) Spock Jr L E, 1928 (MS). Field Notes of Central Asiatic Expeditions of American Museum of Natural History, Book III. New York. 1～119

2) Granger W, 1928 (MS). Records of fossils collected in Mongolia in 1928. The American Museum of Natural History, New York. 1～77

索组的岩性为浅色砂砾岩层,将额尔登敖包的"上部红层"称为巴润索组显然不符合关于岩石地层单位——组——的概念。笔者赞同江浩贤(1983)的意见,称其为上脑岗代组,但时代应为早渐新世。该组在层型地点(额尔登敖包)的岩性为灰白色、黄色粗砂岩,猪肝色泥岩以及松散的黄色砂砾岩(江浩贤,1983)。这样,脑木根敖包和额尔登敖包顶部的岩层不但在地质时代上相同,而且彼此的岩性也很相似,很可能二者同属一岩组——上脑岗代组。但因脑木根敖包和额尔登敖包两地相距较远(约 80km),它们顶部的岩层是否确属同一岩层,还有待进一步考察才能确定。因此,笔者暂称脑木根敖包顶部岩层为上脑岗代组。

致谢 纽约美国自然历史博物馆 D. R. Tedford 博士邀请笔者赴该馆访问,Tedford 和孟津博士允许笔者借阅该馆有关标本、档案资料和提供参考文献,并毫无保留地同意笔者对这批标本进行研究和在我国的刊物上发表;笔者赴美国自然历史博物馆的访问由该馆卡特基金资助;笔者在纽约停留期间,得到美国洛杉矶自然历史博物馆王晓鸣博士多方面的帮助;照片由邱占祥教授摄制,诚致谢意!

OLIGOCENE RODENTS FROM THE NOMOGEN (= NOM KHONG) AREA OF NEI MONGOL, CHINA, AND COMMENTS ON RELATED STRATIGRAPHY

WANG Banr-Yue
(*Institute of Vertebrate Paleontology and Paleoanthropology, Chinese Academy of Sciences* Beijing 100044)

Key words Erlian Basin of Nei Mongol, Oligocene, Eocene, Baron Sog Formation, Upper Naogangdai Formation, Rodentia

Summary

The Baron Sog Formation, one of the classic Paleogene formations in Asia, was established by the Central Asiatic Expedition of the American Museum of Natural History (AMNH) in 1925 based on beds at the top of the Baron Sog Mesa. The Baron Sog Formation was also applied to some tope beds of other mesas, such as East Mesa, Erden Obo (= Urtyn Obo) and Nom Khong Obo (= Nom Khong Shireh or Holy Mesa) of the Nomogen (= Nom Khong or Naomugen) area in the Erlian Basin, Nei Mongol, China (Osborn, 1929; Berkey et al., 1929). However, the wide application of this formation to so vast an area has never been seriously tested. While visiting the AMNH in May and June, 2001, invited by Dr. D. R. Tedford of AMNH, the author was able to observe the specimens collected by the Central Asiatic Expedition and read the related parts of the AMNH archives. Having studied and checked the specimens against the original archives, the author proposes that the age and name of the top bed at the Nom Khong Obo are to be corrected. In this paper, some rodent specimens from the top bed on the Nom Khong Obo are described and the age of the Baron Sog Formation is discussed.

All the specimens described here were collected by the Central Asiatic Expedition in 1928. The terminology of the cheek teeth and the direction of the measurements follow Wang (2001).

1 Systematics

Tsaganomyidae Matthew et Granger, 1923

Tsaganomys **Matthew et Granger, 1923**

Tsaganomys altaicus **Matthew et Granger, 1923**

(Fig. 1)

Specimen A segment of right lower jaw with m1～3 (AMNH 26185, Field no. 777).

Locality and horizon Nom Khong Obo, Erlian Basin, Nei Mongol; late early Oligocene, Upper Naogangdai Formation (?).

Remarks The lower jaw is hystricognathous. The cylindrical lower cheek teeth are concave anterolingually and grow buccally to lower incisor. Ther cheek teeth are strongly unilaterally hypsodont, and have open roots and conic pulp cavities with pointed apex, and have enamel on the posterobuccal wall. The occlusal surfaces of the worn cheek teeth are smooth, slightly concave and have no core. All of the features are identical with those of *Tsaganomys altaicus*. In addition, the size of the cheek teeth of AMNH 26185 is within the range of the variation of the species. (Dimensions see in Chinese text).

Cyclomylus **Matthew et Granger, 1923**

Cyclomylus intermedius **Wang, 2001**

(Fig. 2)

Specimens A segment of left lower jaw with i2 and p4～m3 and a segment of right lower jaw with i2 and p4～m2 belonging to one same individual (AMNH 26186, Field no. 778), and a segment of left lower jaw with m1～3 (AMNH 26187, Field no. 779)

Locality and horizon Nom Khong Obo, Erlian Basin, Nei Mongol; late early Oligocene, Upper Naogangdai Formation (?).

Remarks The lower jaw is hystricognathous, with the mental foramen located anteriorly to the p4. Lower dentition formula: / 1013. The p4 grows above the lower incisor, and the lower molars extend from the buccal side of the lower incisor. The cheek teeth are unilateral hypsodont, with 2 closed roots. Of the young individual the lower molars have 4 lophids, distinct metalophid I, hypertrophic hypoconid and posterolingually oblique external valley. All of the features are identical with *Cyclomylus*.

Cyclomylus is known to include 3 species: *C. lohensis*, *C. intermedius* and *C. biforatus*. The cheek teeth from Nom Khong Obo are moderately unilaterally hypsodont, higher than those of *C. lohensis*, lower than those of *C. biforatus*, but similar to those of *C. intermedius* in the crown. The interval of the eruption of the cheek teeth is similar to that of *C. intermedius*, longer than in *C. lohensis*. In addition, the size of the cheek teeth of the specimens from Nom Khong Obo is within the range of the variation of *C. intermedius*. It seems that AMNH 26186 and 26187 belong to *C. intermedius*. Dimensions see Table 1 in Chinese text.

2 Discussion

The Baron Sog Formation erected by the Central Asiatic Expedition in 1925 is composed of white arkosic sand, greenish-white clay, and coarse, crossbeded gravel on the top of the Baron Sog Mesa (Granger, 1925). Its geological age was first considered as early and middle Oligocene (Osborn, 1929; Berkey et al., 1929). Later it was thought to be early Oligocene (Russell and Zhai, 1987; Wang, 1992), or later Eocene (Wang, 1997).

The mammalian fossils from the classic locality of the Baron Sog Formation (Baron Sog Mesa) include *Embolotherium ultimum* [represented by AMNH 21604 (Field no. 591)], *Zaisanamynodon borisovi* [AMNH 21602 (Field no. 587)] and *Lophiomeryx anagare* [AMNH 22113 (Field no.

593)]. The 3 species are known to appear only in late Eocene. Therefore, the Baron Sog Formation on the Baron Sog Mesa is of late Eocene in the age.

The top bed on the Nom Khong Obo, called also the Baron Sog Formation by the Central Asiatic Expedition, bears 5 species. In addition to *Tsaganomys altaicus* and *Cyclomylus intermedius* described above, the other 3 species are *Paraceratherium transouralicum* [the specimens include AMNH 26168 and 26189 (Field no. 779)、AMNH 26169 (Field no. 780) and AMNH 26172 (Field no. 790); Granger and Gregory, 1936], *Ardynia kazachstanensis* [AMNH 26183 (Field no. 776); Radinsky, 1976, p. 34] and *Entelodon gobiensis* [AMNH 26184 (Field no. 781); Lucas and Emry, 1996, p. 398]. A right third metacarpal (AMNH 26188) described as *Schizotherium* sp. was thought from the Baron Sog Formation at the Nom Khong Obo by Colbert (1934). Having checked the specimen against the archive the author found that the field number of AMNH 26188 was 734, rather than 774, and the specimen was collected from the Urtyn Obo, not the Nom Khong Obo. Among the 5 species mentioned above *Tsaganomys altaicus* is known to range from late early Oligocene through late Oligocene, or slightly later, *Cyclomylus intermedius*, *Paraceratherium transouralicum* and *Ardynia kazachstanensis* are known only from early Oligocene, and *Entelodon gobiensis* ranged from late Eocene through early Oligocene. It appears that the top bed at the Nom Khong Obo is of late early Oligocene in age. Obviously, it is much later than that of the Baron Sog Formation at the Baron Sog Mesa. Likewise, the top bed on the Erden Obo is also of early Oligocene, because it has been known to yield 4 species of mammalian fossils: *Paraceratherium transouralicum*, *Entelodon gobiensis*, *Schizotherium avitum* and *Schizotherium* sp., all of which are known to appear in early Oligocene. Thus, the top beds of both the Nom Khong Obo and Erden Obo are of early Oligocene, much later than that of the Baron Sog Formation at the Baron Sog Mesa in age. In addition, the top bed on the Nom Khong Obo is composed of cross bedded white and yellow sand and gravel with intercalated lenses of clay, which are different from the Baron Sog Formation on the Baron Sog Mesa *(vide ante)*. It is inappropriate to call the top beds of Nom Khong Obo (or and Erden Obo) the Baron Sog Formation further.

The top bed at the Erden Obo was called the Upper Naogangdai Formation by the geologists of Nei Mongol (Jiang, 1983), which was adopted by Russell and Zhai (1987). Qi (1990) called the top bed at the Erden Obo the Houldjing Formation and the "upper red bed" the Baron Sog Formation. It seems that Qi's names are incorrect, because the Houldjing Formation is of late Eocene in age (Wang, 1997) and the lithology of the "upper red bed" is quite different from that of the Baron Sog Formation. The author agrees with Jiang (1983) that the top bed of the Erden Obo is the Upper Naogangdai Formation, but thinks that its age is early Oligocene rather than late Oligocene. The lithology of the Upper Naogangdai Formation on the Erden Obo is composed of gray, yellow coarse sand, brown clay and yellow porous sand and gravel, which is similar to that of the top bed on the Nom Khong Obo. Probably the top beds of both the Erden Obo and Nom Khong Obo belong to one same formation —Upper Naogangdai Formation. Since the Erden Obo lie about 80km southwest from the Nom Khong Obo, further field work should be done to test my suggestion. For the moment being, the author temporarily calls the top bed on the Nom Khong Obo the Upper Naogangdai Formation.

References

Berkey C P, Granger W, Morris F K, 1929. Additional new formations in the later sediments of Mongolia. Am Mus Novit, (385): 1～12

Colbert E D, 1934. Chalicotheres from Mongolia and China in the American Museum. Bull Am Mus Nat Hist, **67**(8): 353～387

Coombs M C, 1978. Additional *Schizotherium* material from China, and a review of *Schizotherium* dentitions (Perissodactyla, Chalicotheriidae). Am Mus Novit, (2647): 1～18

Granger W, Gregory W K, 1936. Further notes on the gigantic extinct rhinoceros, *Baluchitherium*, from the Oligocene of Mongolia. Bull Am Mus Nat Hist, **72**(1): 1～73

Granger W, Gregory W K,1943. A revision of the Mongolian titanotheres. Bull Am Mus Nat Hist, **80**(10):349～389

Jiang H X(**江浩贤**),1983. Division of the Paleogene strata in the Erlian Basin of Inner Mongolia. Nei Mongol Geol (**内蒙古地质**), (55):18～36(in Chinese)

Li C K, Ting S Y,1983. The Paleogene mammals of China. Bull Carnegie Mus Nat Hist, (21):1～93

Lucas S G, Emry R J, 1996. Late Eocene entelodonts (Mammalia: Artiodactyla) from Inner Mongolia, China. Proc Biol Soc Washington, **109**(2):397～405

Lucas S G, Emry R J, Bayshashov B U, 1996. *Zaisanamynodon*, a late Eocene amynodontid (Mammalia, Perissodactyla) from Kazakhstan and China. Tertiary Res, **17**(1/2):51～58

Lucas S G, Sobus J C, 1989. 19. The systematics of indricotheres. In: Prothero D R, Schoch R M eds. The evolution of perissodactyls. New York:Oxford Univ Press. 358～378

Osborn H F, 1929. *Embolotherium*, gen. nov., of the Ulan Gochu, Mongolia. Am Mus Novit, (353):1～20

Qi T(**齐陶**), 1990. A Paleogene section at Erden Obo, Nei Mongol and on the discovery of *Pastoralodon lacustris* (Pantodonta, Mammalia) in that area. Vert PalAsiat (**古脊椎动物学报**), **28**(1):25～33 (in Chinese with English summary)

Radinsky L B,1967. A review of the rhinocerotoid family Hyracodontidae (Perissodactyla). Bull Am Mus Nat Hist, **136**(1):1～45

Russell D E, Zhai R J, 1987. The Paleogene of Asia:mammals and stratigraphy. M m Mus Natl Hist Nat, S r C, Sci Terre, **52**: 1～488

Wang B Y,1992. The Chinese Oligocene: A preliminary review of mammalian localities and local faunas. In: Prothero D R, Berggren W A eds. Eocene-Oligocene climatic and biotic evolution. Princeton: Princeton Univ Press. 529～547

Wang B Y(**王伴月**),1997. Problem and recent advances in the division of the continental Oligocene. J Stratigr (**地层学杂志**), **21**(2):81～90(in Chinese with English abstract)

Wang B Y,2001. On Tsaganomyidae (Rodentia, Mammalia) of Asia. Am Mus Novit, (3317):1～50