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***Brachyscirtetes tomidai*, a new Late Miocene dipodid (Rodentia, Mammalia) from Siziwang Qi, central Nei Mongol, China**

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Based on the dipodid materials collected from Siziwang Qi, Nei Mongol in 2009, a new species *Brachyscirtetes tomidai* **sp. nov.** is erected. It is characterised by its smaller size, more bunodont paracone on M2, more separate mesoloph and posteroloph on M2 and separate mesolophid on m2, more longitudinally symmetrical protoconid–metaconid complex diverging at an obtuse angle and elongated anterior part of ectolophid on m1 than existing species. It represents the most primitive known species of this genus. Judging from the associated mammals, the age of *Brachyscirtetes tomidai* should be late Late Miocene. *Brachyscirtetes* is possibly derived from a form of early Late Miocene *Paralactaga*. Its dental trends include increasing size and crown height, and increasing lophodonty of occlusal morphology, which is reflected as gradual fusion of mesoloph and posteroloph with paracone, metacone on M2 and of mesolophid with entoconid on m2, respectively; the protoconid–metaconid complex on m1 shifts from a longitudinally symmetrical position to an anterolabial orientation, and the anterior part of ectolophid on m1 is gradually shortened, shifting from a longitudinal to an oblique orientation. The appearance of *Brachyscirtetes* and abundant herbivores indicates an arid and steppe environment in late Late Miocene Siziwang Qi area.

Keywords: Dipodidae; Wulanhua Fauna; Nei Mongol; China; late Late Miocene

1. Introduction

The genus *Brachyscirtetes* is a large fossil dipodid with hypsodont and lophodont *Allactaga*-like occlusal pattern on cheek teeth. It is sporadically found in the Late Miocene to Pliocene strata and restricted in the area of central Nei Mongol (Ertemte, Harr Obo, Bilike and Gaotege), northwestern China (Jingchuan, Gansu Province), Mongolia (Khirgis-Nur) and Kazakhstan (Pavlodar) (Young 1927; Schaub 1934; Savinov 1970; Qiu and Storch 2000; Zazhigin and Lopatin 2000; Li et al. 2003; Qiu 2003). Due to the scarce specimens, we still know very little about this genus. It is thus fortunate that some new materials were recently collected from the late Miocene red clay bed in Siziwang Qi, Nei Mongol, which provides us with a chance to better understand the origin and evolution of *Brachyscirtetes*.

2. Geologic setting

The fossil locality (N 41°29'45.4", E 111°41'31.1') is located about 3 km south of Siziwang Qi county seat and 250 m west of provincial road S101 (Figure 1). This locality was first found by the Bureau of Geology and Mineral Resources of Nei Mongol Autonomous Region in 1991 and was continuously excavated by the government of Siziwang Qi during 1997–2005. Hou et al. (2007) first

reported a new anchitheriine species *Sinohippus robustus* from this locality. In 2009, colleagues from the Institute of Vertebrate Paleontology and Paleoanthropology (IVPP) and Hezheng Paleozoological Museum (Gansu Province) undertook an excavation in this area. Up to now, a total of 13 species of fossil mammals including one small mammal taxon (*Brachyscirtetes*) have been collected and reported as Wulanhua fauna (Deng et al. 2011). The fossil-bearing stratum is a series of ~23 m mottled mudstones and sandstones. All 12 known taxa of large mammals are concentrated in the bottom part of the section, while the material of *Brachyscirtetes* is stratigraphically ~7 m above the former to the level. For more stratigraphic and faunal details, see Deng et al. (2011).

3. Material, methods and terminology

The dipodid fossils were collected by Mr Chen Shan-Qin from Hezheng Paleozoological Museum, Gansu Province, and the matrix containing fossils was packed into a jacket. After laboratory preparation, the jacket produced remains possibly belonging to the same individual, including a fragment of left maxillary with M2–3, a fragment of right mandible with m3 and four isolated teeth (Figure 2). All the materials are housed in the IVPP in Beijing.

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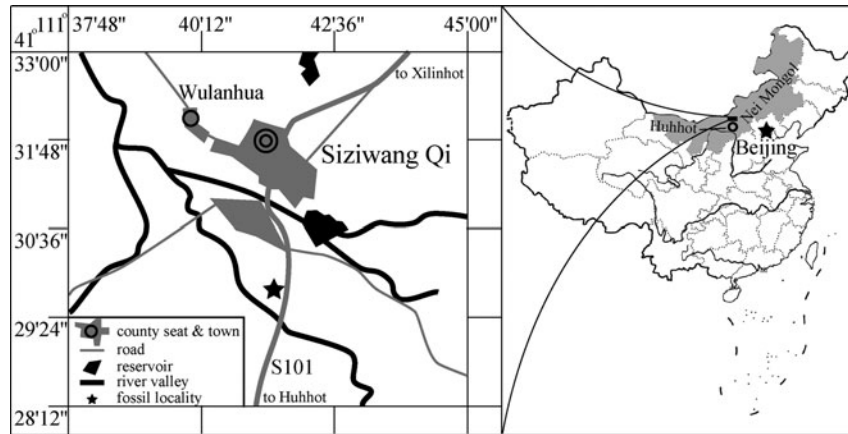


Figure 1. Geographic setting of fossil locality.

Photographs were taken with SEM (NEC S-3700N). The measurements are given in millimetres. Dental nomenclature follows Qiu (2003).

4. Systematic palaeontology

Order **Rodentia** Bowdich, 1821

Family **Dipodidae** Fischer de Waldhem, 1817

Subfamily **Allactaginae** Vinogradov, 1925

Genus **Brachyscirtetes** Schaub, 1934

Type species: *Brachyscirtetes wimani* (Schlosser, 1924).

Referred species: Brachyscirtetes robustus Savinov, 1970 and *Brachyscirtetes tomidai* **sp. nov.** in this text.

Diagnosis (emended): Larger allactagine rodent with poorly developed P4, strongly lophodont and hypsodont molars. Lower molars with *Allactaga*-like pattern, but upper molars with more simplified occlusal pattern. Mesoloph and posteroloph on M1–2 highly reduced or completely fused with paracone and metacone, respectively. Anteroloph on M1–2 well developed. Protoconid joined with metaconid on m1. Mesolophid reduced or completely fused with entoconid on m2 (based on Qiu 2003).

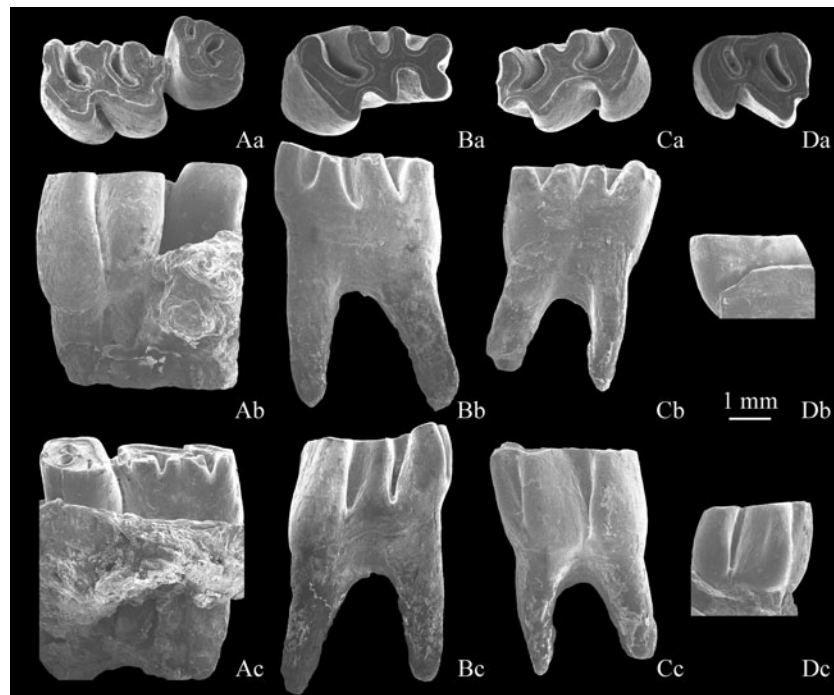


Figure 2. Molars of *Brachyscirtetes tomidai* **sp. nov.** (holotype, V 17731) from Siziwang Qi, Nei Mongol. (A) V 17731.1, left M2–3; (B) V 17731.4, right m1; (C) V 17731.5, left m2; (D) V 17731.2, right m3. a, b, c = occlusal, lingual and labial view, respectively. All in the same scale.

Table 1. Molar measurements of *Brachyscirtetes tomidai* sp. nov. from Siziwang Qi, Nei Mongol (in mm).

Teeth	Inventory number	Wear surface		Tooth occlusal	
		Length	Width	Max length	Max width
P4	V 17731.3	0.91	0.79	1.21	1.18
M2	V 17731.1	3.12	2.02	3.25	2.48
M3	V 17731.1	1.78	1.80	1.99	2.00
m1	V 17731.4	3.74	2.22	4.09	2.56
m2	V 17731.5	3.55	2.51	3.75	2.81
m3	V 17731.2	2.60	2.02	2.81	2.45
m3	V 17731.6	2.76	2.27	2.76	2.34

Distribution: *Brachyscirtetes wimani*: late Late Miocene to Early Pliocene, North China; Early Pliocene, Khirgis-Nur, Mongolia; *Brachyscirtetes robustus*: late Late Miocene to Early Pliocene, Kazakhstan; *Brachyscirtetes tomidai* sp. nov., late Late Miocene, Siziwang Qi, Nei Mongol; *Brachyscirtetes* cf. *Brachyscirtetes robustus*: Early Pliocene, Bilike, Nei Mongol; *Brachyscirtetes* sp.: Early Pliocene, Gaotege, Nei Mongol.

***Brachyscirtetes tomidai* sp. nov.**

(Figure 2, Table 1)

Holotype: IVPP V 17731.1, a fragment of left maxillary with M2–3 (Figure 2(A)), IVPP V 17731.2, a fragment of right mandible with m3 (Figure 2(D)), and four isolated teeth (V 17731.3, left P4; V 17731.4, right m1, Figure 2(B); V 17731.5, left m2, Figure 2(C); V 17731.6, left m3), the materials possibly belong to the same individual.

Etymology: Dedicated to Professor Yukimitsu Tomida, in recognition of his outstanding work on Neogene Asian small mammals.

Type locality: Siziwang Qi, Nei Mongol Autonomous Region, China.

Stratum typicum: late Late Miocene (early Baodean Chinese Land Mammalian Stage/Age, equivalent to European middle Turolian age, MN12).

Diagnosis: Small-sized species of *Brachyscirtetes*; paracone on M2 more bunodont than those of *Brachyscirtetes wimani* and *Brachyscirtetes robustus*; mesoloph and posteroloph not completely fused with paracone and metacone on M2, respectively; mesolophid not completely fused with entoconid on m2; protoconid and metaconid on m1 diverge nearly symmetrically along the longitudinal axis, anterior part of ectolophid on m1 nearly longitudinal and elongated.

Referred material: ‘Only the holotype’.

Measurements: See Table 1.

4.1 Description

The P4 has a very simple occlusal pattern formed by a strong ‘C’ type loph. It is single rooted.

Molars are unilaterally hypsodont with flat occlusal surface. The occlusal pattern is similar to that of *Allactaga* but simpler and more lophodont (Figure 2).

The M2 has flat anterior contact facet. The protocone and hypocone are posterolingually prolonged, while the paracone and metacone are relative round and bunodont. The subtriangular antercone is fused with the bulging anterostyle and anteroloph to form a very strong transverse loph. The posterolabially directed mesoloph is not completely fused with the paracone. The paracone is posterolingually connected to the middle part of mesoloph. The posteroloph is also not fully fused with the metacone. The metacone is connected to the posterior arm of hypocone. The endoloph is very strong and anterolabial–posterolingually directed. The sinus is deep and open, and reaches nearly the base of teeth, while the parasinus and posterosinus are nearly enclosed and rather shallow. Due to the separated mesoloph and posteroloph, a small and open mesosinus and posterosinus can be observed. The tooth has four roots (Figure 2(A)).

The M3 has a short and wide occlusal outline. The hypocone and metacone are reduced. The anteroloph is well developed and inflated. Different from those on M2, the paracone is connected to protocone through protoloph, and the protocone is directly connected to hypocone, which leads to a reduced sinus; the mesoloph is absent. Both parasinus and metasinus are closed; the former is small and shallow, whereas the latter is wide and deep. A distinct subtriangular protuberance can be observed on the anterior wall of the metacone. The tooth has three roots (Figure 2(A)).

The m1 has no anteroconid. The protoconid and metaconid are both prolonged and nearly longitudinally symmetrical; their posterior parts are joined with an obtuse angle of about 104°. The protoconid and the metaconid are anterolabially and anterolingually directed, respectively. The protoconid–metaconid complex is connected to mesolophid and mesoconid through a long and strong longitudinal loph – the anterior part of ectolophid. The mesolophid is strong and transverse, and well separated from the protoconid. The subtriangular-shaped ectomesolophid is developed and fused with entoconid into a very strong and anterolabial–posterolingually directed loph. The hypoconid is anteriorly connected to the mesoconid through the slim posterior part of ectolophid. The posterolophid is very strong and fused with the posterior arm of hypoconid into a robust loph at end of the tooth. The labial sinusids are deeper than the lingual sinusids. The labial sinusid is shallow and anteriorly open. The mesosinusid, metasinusid, ectosinusid and hyposinusid are rather transverse, and the mesosinusid is slightly anterior to the ectosinusid. The posterosinusid is distinctly posterolingually open. The tooth has two roots (Figure 2(B)).

The m2 has a small anteroconid, which is fused with the bulging metaconid into a strong oblique loph at the

anterior position of the tooth. The anterolophid is nearly longitudinally directed and through it the protoconid is connected to the anteroconid. The posterolabially directed mesolophid is distinctly separated from the entoconid. The entoconid and the posterior arm of protoconid fuse into a second robust and oblique loph at the middle part of the tooth. The ectolophid is continuous and nearly longitudinal, and through it the hypoconid is connected to the posterior arm of the protocone. The posteroloph is well developed and fused with the posterior arm of hypoconid into a robust posterior oblique loph. The protosinusid is shallow, whereas the ectosinusid is set deep into the occlusal surface and strongly posterolingually oblique. The mesosinusid and posterosinusid are almost closed, but the metasinusid is small and open. The tooth has two strong roots (Figure 2(C)).

The m3 has a small and reduced anteroconid. The metaconid is transversely stretched. The protoconid, entoconid and mesolophid combine into a robust middle oblique loph of the tooth. The short but wide ectolophid is continuous and nearly longitudinally seated. The posterolophid is fused with posterior arm of hypoconid into a strong posterior oblique loph of the tooth. The protosinusid is small and shallow. The ectosinusid is anteriorly open, whereas the two lingual sinusids are both closed (Figure 2(D)).

4.2 Comparisons

The material described here is notably large-sized, hypsodont teeth, with *Allactaga*-like morphology, but more lophodont and simpler occlusal pattern, e.g. the mesoloph and posteroloph on M2 are partially fused with paracone and metacone, respectively. These characters are consistent with the generic diagnosis of *Brachyscirtetes* Schaub, 1934, as emended by Qiu (2003).

Based on fragmentary materials of '*Alcataga*' (= *Allactaga*) *wimani* from Ertemte and '*Paralactaga*' *major* from Wayaobu (= Wa-Yao-Po, or Wayaobao), Jingchuan, Gansu (Schlosser 1924; Young 1927), Schaub (1934) established the genus *Brachyscirtetes* and referred them to the type species *Brachyscirtetes wimani*. Later, Savinov (1970) erected another species *Brachyscirtetes robustus* based on the dipodid materials from the Late Miocene Pavlodar Formation in Kazakhstan. He considered *Brachyscirtetes major* as a valid species differing from *Brachyscirtetes wimani* of Ertemte by the former having an anteroconid and anterolingually directed metaconid on m1. Zazhigin and Lopatin (2000) agreed with him and referred materials from Pavlodar, Kazakhstan and Khirgis-Nur, Mongolia to *Brachyscirtetes robustus* and *Brachyscirtetes wimani*, respectively. Qiu and Storch (2000) assigned materials from Early Pliocene locality of Bilike, Nei Mongol to *Brachyscirtetes* cf. *Brachyscirtetes robustus*. Later, scattered material of *Brachyscirtetes* was also found in

the Early Pliocene locality Gaotege, Nei Mongol (Li et al. 2003). Moreover, Qiu (2003) described new materials of *Brachyscirtetes wimani* from its type locality Ertemte and a neighbouring site Harr Obo, Nei Mongol. Considering the morphological variation of the protoconid–metaconid complex on m1 from his new additional specimens, he regarded the m1 of *Brachyscirtetes major* from Wayaobu to be well within the range of variation of *Brachyscirtetes wimani* from Ertemte both in size and morphology. Based on the Ertemte fossils, only one difference exists between *Brachyscirtetes major* and *Brachyscirtetes wimani*, i.e. the former has an anteroconid on m1. However, in view of extant dipodids, the development of an anteroconid is variable (Li and Qiu, 2005). I agree with Qiu's view that *Brachyscirtetes major* is a synonym of *Brachyscirtetes wimani*.

Considering that the occlusal surface is variable with different degrees of wear, measurements are made at the base of cheek teeth for comparison among different samples of *Brachyscirtetes*. According to the scale in the figures or plates given by other authors, I re-measured *Brachyscirtetes wimani* from Wayaobu, Ertemte and Kirgis-Nur, and *Brachyscirtetes robustus* from Pavlodar (Schlosser 1924, plate II, figures 3 and 3(a); Young 1927, tafel 1, figure 15(a); Savinov 1970, figure 7; Zazhigin and Lopatin 2000, figures 4 and 5). Zazhigin and Lopatin (2000) mentioned that the specimens of *Brachyscirtetes robustus* from Pavlodar were slightly smaller than those originally described by Savinov (1970). However, our measurements show that they are both in the same size range. The material from Siziwang Qi is distinctly smaller than any known species of *Brachyscirtetes* (Figure 3).

Zazhigin and Lopatin (2000) emphasised the importance of orientation of metaconid and the angle between protoconid and metaconid on m1. However, Qiu (2003) pointed out that the angle between protoconid and metaconid on m1 of *Brachyscirtetes* was variable and not suitable for specific diagnosis. In fact, the metaconid orientation also varies and is closely associated with wear. On young individuals of *Brachyscirtetes wimani* such as the m1s from Ertemte (Figure 4(E),(F)), the mesosinusid is set deep into the occlusal surface, and the metaconid is anterolingually directed. On an adult one (Figure 4(D)), on the other hand, the mesosinusid is shallow, and the metaconid is nearly anteriorly directed. Finally, on older individuals (Figure 4(A),(B),(G)), the mesosinusid is almost absent, the posterosinusid is nearly or already closed, and the metaconid is anterolabially directed. It is thus obvious that the orientation of metaconid is not suitable for specific diagnosis. In this study, I reckon that the most significant differences of the m1s between *Brachyscirtetes wimani* and *Brachyscirtetes robustus* are the latter having more posterolingually directed mesolophid, more lingually seated ectolophid between mesolophid and

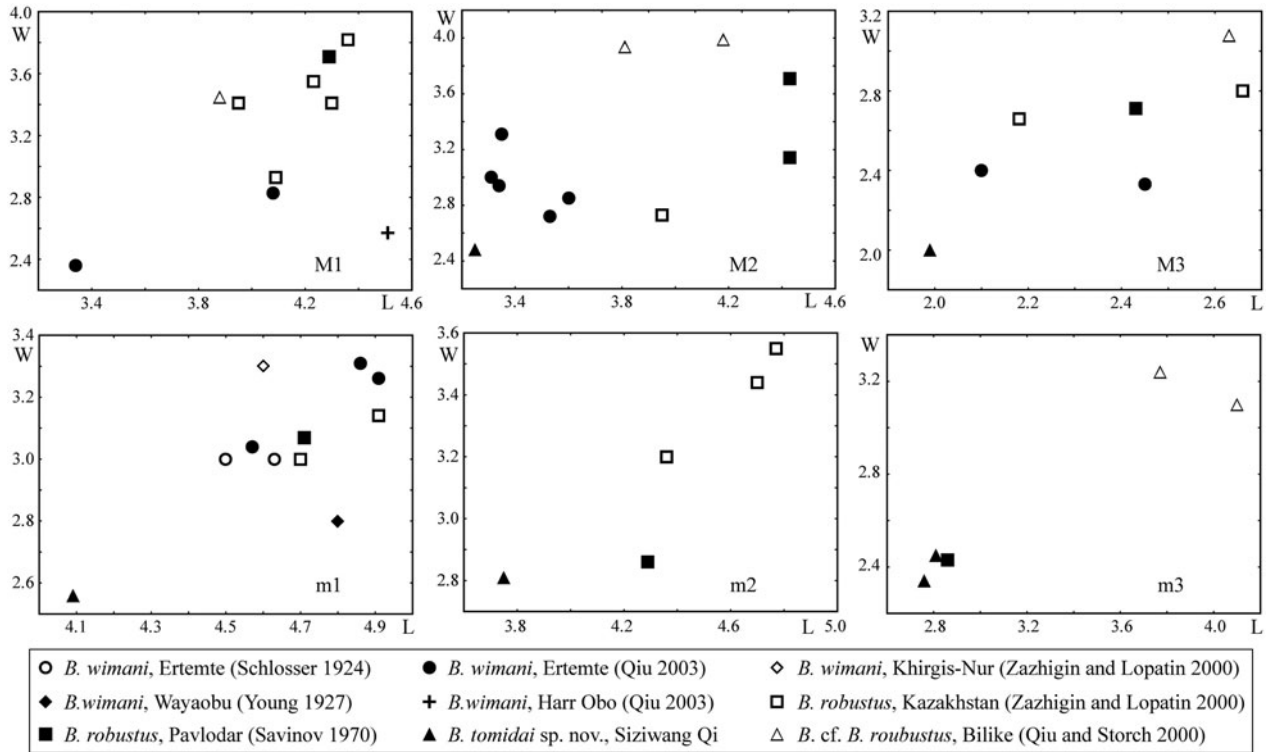


Figure 3. Scatter diagram showing maximum basal length (L) and width (W) of molars of species of *Brachyscirtetes*.

mesoconid, and more transversely located middle loph fused by entoconid and ectomesolophid. In overall morphology, the material from Siziwang Qi differs from other known species by its more slim teeth with less

lophodont occlusal pattern, i.e. more bunodont paracone on M2, and distinctly separate mesoloph and posteroloph on M2 and mesolophid on m2. Moreover, the Siziwang Qi sample can be easily distinguished by its m1 having nearly

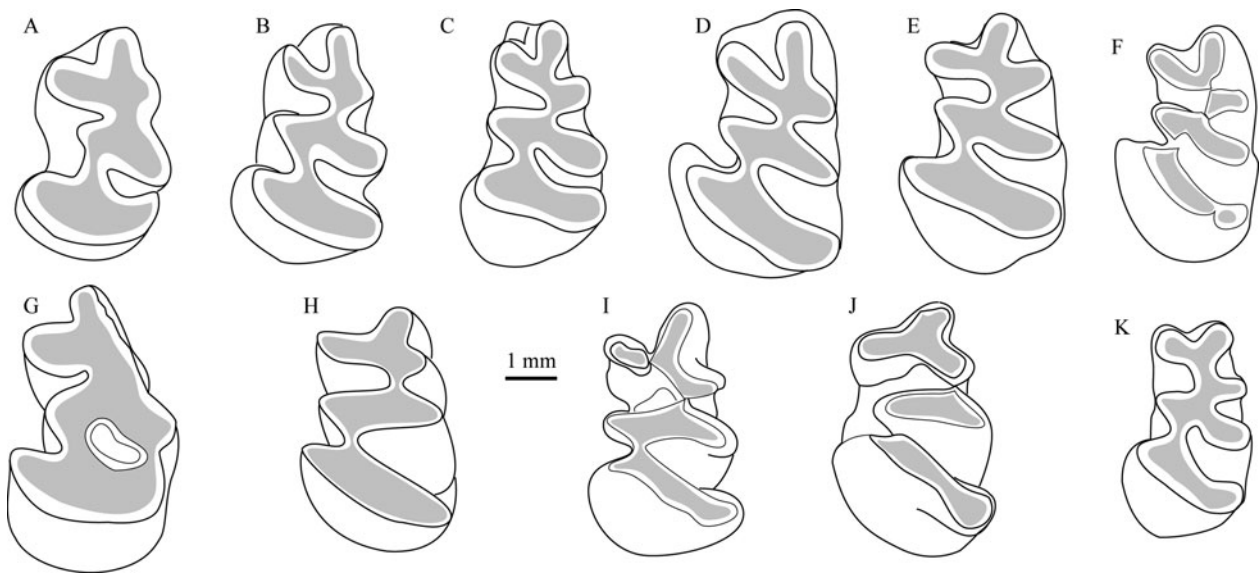


Figure 4. Morphology of protoconid–metaconid complex on m1 among known species of *Brachyscirtetes*. (A–G) *Brachyscirtetes wimani*: (A, B) Ertemte (Schlosser 1924, plate II, figures 3 and 3(a)); (C) Wayabu (Schaub 1934, tafel(22)); (D–F) Ertemte (Qiu 2003, plate II, figures 4–6); (G) Khirgis-Nur, Mongolia (Zazhigin and Lopatin 2000, figure 5). (H–J). *Brachyscirtetes robustus*: (H) Pavlodar (Savinov 1970, figure 7); (I, J) Kazakhstan (Zazhigin and Lopatin, 2000, figures 4(i),(s)); (K) *Brachyscirtetes tomidai* sp. nov., Siziwang Qi. A–C, H, J and K are reverse.

longitudinally symmetrical protoconid–metaconid complex, and a long and longitudinal ectolophid between the complex and mesolophid. Furthermore, it has a more transverse mesolophid and a more oblique ectomesolophid–entoconid loph than seen in *Brachyscirtetes robustus*. Considering its smaller size and less lophodont dental structure, the materials from Siziwang Qi seem to belong to a new and more primitive species of *Brachyscirtetes*.

5. Discussion

Fauna correlation and age: Thus far, *Brachyscirtetes tomidai* sp. nov. is the only known species of small mammal from the Wulanhua fauna. In contrast, large mammals are more abundant and include 12 species, i.e. *Hyaenictitherium* sp., *Machairodus* sp., *Sinohippus robustus*, *Hipparion teilhardi*, *Hipparion platyodus*, *Chilotherium anderssoni*, *Cervavitus novorossiae*, *Palaeotragus microdon*, *Samotherium* sp., *Gazella gaudryi*, *Plesiaddax depereti* and ? *Tragoreas palaeosinensis* (Deng et al. 2011). Most of them

are typical elements of *Hipparion* faunas widespread in northern China during the Late Miocene. The composition of Wulanhua fauna is close to that of the *Hipparion* fauna from Baode, Shanxi by sharing nearly all the same genera, but the former differs by having some more derived forms, such as *Sinohippus robustus*, *Hipparion teilhardi*, *Hipparion platyodus*, *Plesiaddax depereti*, ?*Tragoreas palaeosinensis* and *Gazella gaudryi*. Compared to *Brachyscirtetes wimani* from the latest Miocene Ertemte fauna, Nei Mongol, *Brachyscirtetes tomidai* sp. nov. retains some distinctly primitive characters, such as its smaller size and less lophodont occlusal pattern, which indicates an older age. Based on the correlations mentioned above, the age of Siziwang Qi fauna should be intermediate between those of Baode and Ertemte faunas. The Siziwang Qi fauna is possibly contemporaneous with Baogeda Ula fauna due to their shared large mammals such as *Hyaenictitherium*, *Hipparion* and *Palaeotragus* (Qiu et al. 2006). I re-examined the unpublished fossil rodents collected from Baogeda Ula during past field seasons, and recognised that *Brachyscirtetes tomidai* sp. nov. also occurs

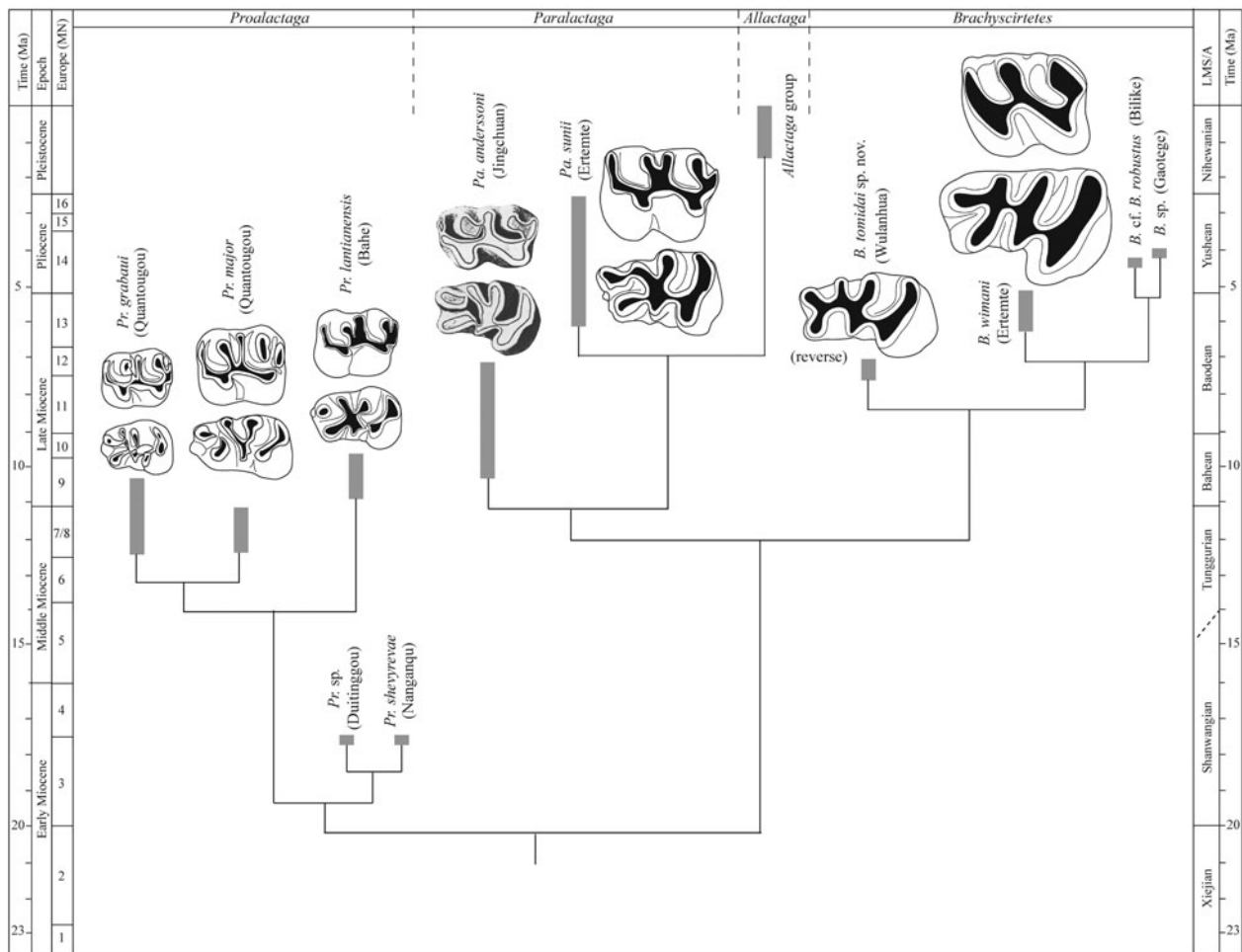


Figure 5. Species ranges and suggested phylogeny among the *Protalactaga*, *Paralactaga*, *Allactaga* and *Brachyscirtetes* in the Neogene China. Most of the species ranges are approximate. The first molars are scaled to their approximate relative size.

in that collection. The beds yielding the Baogeda Ula fauna is stratigraphically below a capping basalt, with published dates of 7.11 ± 0.48 Ma (Luo and Chen 1990) or 6.8 ± 0.2 to 6.3 ± 0.2 Ma (Li 2010, 55–56). The age of Wulanhua fauna is postulated to be around 7 Ma.

Evolution of Brachyscirtetes: Judging from the dental morphology, Zazhigin and Lopatin (2000) regarded the genus *Brachyscirtetes* as ‘a descendant of an early form of *Allactaga* (but not *Protalactaga*)’. However, it is worth remembering that the *Allactaga* they mentioned in fact contains the fossil genus *Paralactaga* Young, 1927. Russian palaeobiologists insist that *Paralactaga* was a synonym of *Allactaga* or treated the former as a subgenus of the latter (Senbrot 1984; Zazhigin and Lopatin 2000), whereas Chinese researchers emphasise dental morphologic differences between extant *Allactaga* and fossil *Paralactaga* and consider them as separated genera (Qiu 1996, 2003; Li and Zheng 2005). Although the argument of generic attribution continues, all researchers notice phylogenetic relationship among *Protalactaga*, *Paralactaga* and *Allactaga*. Qiu (1996, 2003) considered *Protalactaga*–*Paralactaga*–*Allactaga* as an evolutionary lineage.

Based on known data, the genus *Paralactaga* possibly is derived directly from *Protalactaga*, and thus far its first occurrence is represented as *Paralactaga* sp. in early Late Miocene Bahe Formation, Lantian, Shaanxi (Qiu 2003; Li and Zheng 2005). For the moment, *Brachyscirtetes tomidai* sp. nov. is the earliest member of *Brachyscirtetes* and in age slightly younger than that of the Bahe fauna. *Brachyscirtetes tomidai* sp. nov. still retains separated mesoloph(id) and posteroloph, which recalls the *Protalactaga*–*Paralactaga*–*Allactaga* lineage. Moreover, both *Brachyscirtetes* and *Paralactaga* have large-sized and hypsodont teeth, which are different from those of *Protalactaga*. I agree with Zazhigin and Lopatin (2000) that *Brachyscirtetes* is possibly directly derived from an early form of *Paralactaga* in the early Late Miocene, and does not evolve towards *Allactaga* but go in a different evolutionary direction, i.e. increasing size, heightening of tooth crown, and gradual fusion between mesoloph and paracone, posteroloph and metacone on M2, respectively, and between mesolophid and entoconid on m1, and from longitudinally symmetrical to anterolabially shifted protoconid–metaconid complex and shortening of the anterior part of ectolophid on m1 (Figure 5).

Palaeoenvironment: *Brachyscirtetes* often co-occurred with two other widespread dipodid genera, *Paralactaga* and *Dipus*, in the Late Miocene through Pliocene strata within and around the Mongolian Plateau (Figure 6). They are commonly considered living in arid steppe environment (Qiu and Storch 2000; Zazhigin and Lopatin 2000; Qiu 2003). The co-occurrence of these three genera indicates that the Mongolian Plateau area should be already arid steppe in the Late Miocene and Pliocene. It seems that, in late Late Miocene, the environment of



Figure 6. Co-occurrence of *Brachyscirtetes*, *Paralactaga* and *Dipus* around the Mongolian Plateau in Late Miocene through Pliocene. 1, Ertemte and Harr Obo, Nei Mongol, LM and EP, respectively; 2, Wayaobu, Gansu, LM; 3, Pavlodar, Kazakhstan, LM; 4, Bilike, Nei Mongol, EP; 5, Khirgis-Nur, Mongolia, EP; 6, Gaotege, Nei Mongol, EP; 7, Siziwang Qi, Nei Mongol, LM. LM, Late Miocene; EP, Early Pliocene.

Siziwang Qi area may be rather arid, which is borne out by the appearance of not only dipodid *Brachyscirtetes* but also abundant herbivores such as *Hipparion*, *Chilotherium*, *Palaeotragus*, *Samotherium* and *Gazella*, which are all typical elements adapted to the sparse forest grassland ecosystem.

6. Conclusions

- (1) New dipodid material found from Siziwang Qi, Nei Mongol was identified as a new and so far most primitive species of *Brachyscirtetes*, and is here named *Brachyscirtetes tomidai* sp. nov.
- (2) *Brachyscirtetes tomidai* sp. nov. is characterised by its smaller size and primitive morphology with less reduced mesoloph and posteroloph on M2 and mesolophid on m2, respectively, and having more nearly symmetrical protoconid and metaconid along the longitudinal axis, and more elongated anterior part of ectolophid on m1.
- (3) Judging from faunal correlations, the age of *Brachyscirtetes tomidai* sp. nov. was estimated as Late Miocene, early Baodean.
- (4) *Brachyscirtetes tomidai* sp. nov. is possibly derived from the genus *Paralactaga*.

Acknowledgements

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much to the knowledge of Neogene Asian small mammals. I thank colleagues who participated in the fieldworks of Siziwang Qi area, especially Prof. T. Deng and Dr S.Q. Wang from IVPP, and Mr S.Q. Chen from Hezheng Paleozoological Museum, Gansu Province. I express my gratitude to Prof. Z.D. Qiu for his valuable discussion of the subject. Many thanks are also given to Mr P. Wang for his preparation of specimens and Mr W.D. Zhang for SEM photographs.

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References

- Deng T, Liang Z, Wang SQ, Hou SK, Li Q. 2011. Discovery of a Late Miocene mammalian fauna from Siziwang Banner, Inner Mongolia and its paleogeographical significance. *Chin Sci Bull.* 56(6): 526–534.
- Hou SK, Deng T, Wang Y. 2007. New materials of *Sinohippus* from Gansu and Nei Mongol, China. *Vert PalAsiat.* 45(3):213–231 (in Chinese with English summary).
- Li Q. 2010. *Pararhizomys* (Rodentia, Mammalia) from the late Miocene of Baogeda Ula, central Nei Mongol. *Vert PalAsiat.* 48(1):48–62.
- Li Q, Qiu ZD. 2005. Restudies in *Sminthoides* Schlosser, a fossil genus of three-toed jerboa from China. *Vert PalAsiat.* 43(1):24–35 (in Chinese with English summary).
- Li Q, Wang XM, Qiu ZD. 2003. Pliocene mammalian fauna of Gaotege in Nei Mongol (Inner Mongolia), China. *Vert PalAsiat.* 41(2):104–114.
- Li Q, Zheng SH. 2005. Note on four species of dipodids (Dipodidae, Rodentia) from the Late Miocene Bahe Formation, Lantian, Shaanxi. *Vert PalAsiat.* 43(4):283–296 (in Chinese with English summary).
- Luo XQ, Chen QT. 1990. Preliminary study on geochronology for Cenozoic basalts from Inner Mongolia. *Acta Petrol Mineral.* 9: 37–46 (in Chinese).
- Qiu ZD. 1996. Middle Miocene Micromammalian Fauna from Tunggur, Nei Mongol. Beijing: Science Press (in Chinese with English summary).
- Qiu ZD. 2003. The Neogene mammalian faunas of Ertemte and Harr Obo in Inner Mongolia (Nei Mongol), China. – 12. Jerboas – Rodentia: Dipodidae. *Senckenbergiana Lethaea.* 83(1):135–147.
- Qiu ZD, Storch G. 2000. The early Pliocene micromammalian fauna of Bilike, Inner Mongolia, China (Mammalia: Lipotyphla, Chiroptera, Rodentia, Lagomorpha). *Senckenbergiana Lethaea.* 80(1):173–229.
- Qiu ZD, Wang XM, Li Q. 2006. Faunal succession and biochronology of the Miocene through Pliocene in Nei Mongol (Inner Mongolia). *Vert PalAsiat.* 44(2):164–181.
- Savinov PR. 1970. Jerboas (Dipodidae, Rodentia) from the Neogene of Kazakhstan. In: Material on evolution of terrestrial vertebrates. *Akad Nauk USSR Otd Obshch Biol.* 1970:91–134 (in Russian).
- Schaub S. 1934. Über einige fossile Simplicidentaten aus China und der Mongolei. [On some Simplicidentata from China and Mongolia]. *Abh Schweiz Palaont Ges.* 54:1–40.
- Schlosser M. 1924. Tertiary vertebrates from Mongolia. *Pal Sin C.* 1(1): 1–119.
- Senbrot GI. 1984. Dental morphology and phylogeny of five-toed jerboas of subfamily Allactaginae (Rodentia, Dipodidae). *Archives Zool Mus Moscow State Univ.* 22:61–92.
- Young CC. 1927. Fossile Nagetiere aus Nord-China [Fossil rodents from North China]. *Palaeont Sin.* 3(3):1–82.
- Zazhigin VS, Lopatin AV. 2000. The history of the Dipodoidea (Rodentia, Mammalia) in the Miocene of Asia: 3. Allactaginae. *Paleontol J.* 34(5):553–565.