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HAL Id: hal-01813422
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Submitted on 13 Jun 2018

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Abstract: The Oligocene deposits of the Ulantatal area in Inner Mongolia (China) contain among the richest mammalian faunas from Asia. To date, only some parts of the rodent faunas have been described. Here, we propose to review the rodent faunal lists for each site, including the description of a few new rodent specimens. We describe three additional rodent species: the Cylindrodonidae Anomoemys lohiculus, the Eomyidae Asianeomys sp., and the Dipodidae Litodonomys huangheensis. This study allows us to constrain the stratigraphic range of Anomoemys lohiculus, which ranged from the late Early Oligocene to the early Late Oligocene in this area. Asianeomys sp. and Litodonomys huangheensis are dated from the latest Oligocene. These Oligocene deposits consist of more than 70 species of mammals, and this difference can be partly explained by sampling and description biases regarding macro-mammals. This study also shows that variations existed between the Ulantatal area and could be dated biochronologically from the earliest Oligocene. When compared to the faunas from the Valley of Lakes in Central Mongolia, the Ulantatal faunas present a great majority of rodents, and this difference can be partly explained by sampling and description biases regarding macro-mammals. This study also shows that variations existed between Inner and Central Mongolia, especially regarding the composition of the rodent paleocommunities. However, the assessment of their evolutionary history in this part of Asia with respect to the important climate and environment changes, require further precisions and more material than current data allow.

Keywords: Rodentia, Mammalia, Systematics, late Paleogene, Mongolian Plateau

Submitted 27 March 2014, Accepted 26 May 2014
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INTRODUCTION

Historical context of the Ulantatal area

The Ulantatal area is well-known for its Oligocene deposits including some of the most diversified and richest mammalian faunas (Huang, 1982). This area also encompasses Pliocene and Pleistocene deposits. Ulantatal is located about 60 km north of the small town Bayanhaote, Alxa Zuoqi County. This latter belongs to the Jilantai Basin, which is situated in Inner Mongolia (China; Fig. 1).

The first mammal fossils were unearthed in 1977 by a team of local geologists. The next year, a field campaign, led by scientists from the Institute of Vertebrate Palaeontology and Paleoanthropology of Beijing (IVPP, China), established an important collection of fossils involving more than a hundred specimens (Huang, 1982). They were collected on both sides of the small valley of Ulantatal (i.e., “red river” in Mongolian), which consists of mesas alternating with isolated hills. The first relative datings indicated a “Middle Oligocene” age according to comparisons drawn with similar lithological content from the Qingshuiying Formation (Ningxia, China; Huang, 1982) and similar faunal content from the Hsanda Gol Formation (Valley of Lakes, Central Mongolia; Russell & Zhai, 1987).

In 1987, a second important expedition joining Chinese and German scientists supported by the Academia Sinica (China) and the Max Planck-Gesellschaft (Germany) allowed to investigate the Ulantatal area with precision. This expedition contributed to setting up a more accurate geological map of the region. Three stratigraphical units were defined (Ulan I, II and III), which clearly delineate the stratigraphical position of eight new localities (UTL1-8; Huang, 1992; Fig. 1). Subsequently, the study of the rodent faunas, especially the Ctenodactyliidae (Vianey-Liaud et al., 2006) has allowed for a correlation with the contemporaneous faunas from the Valley of Lakes where deposits are dated radiometrically ($^{40}$Ar/$^{39}$Ar method; HÖCK et al., 1999; DAXNER-HÖCK & BADAMGARAV, 2007). In this context, the different stratigraphical units of the Ulantatal area were dated (Schmidt-Kittler et al., 2007). The stratigraphical sequence of Ulantatal encompasses a series of deposits of about 60 meters in thickness, and it would extend from the late Early Oligocene to the Late Oligocene, thereby corresponding to about 8 Myr of record (see Vianey-Liaud et al., 2006 for more details about the geological context).

Faunal content of the Oligocene deposits from Ulantatal

The preliminary study of fossil mammals presented by Huang (1982) mentioned 30 species belonging to 18 genera, representing 16 families distributed among 7 distinct orders, and were found mainly by surface collecting. This list already emphasized the exceptional faunal richness of Oligocene sites from the Ulantatal area, which consist of a wide range of macro and micro-mammals. Since that time, many studies have significantly enhanced the number of species, and have also refined the first descriptions (e.g., Huang, 1984, 1985, 1986, 1987), but the age remains imprecise, especially concerning macro-mammals. Only some rodent faunas were described and accurately dated according to the screen-washing campaign of the eight dated sites performed during the 80’s. These faunas included Dipodidae (Huang, 1992; GOMES RODRIGUES et al., 2011), Ctenodactyliidae (Vianey-Liaud et al., 2006, 2010), Muroidea
Order RODENTIA Bowdich, 1821
Family CYLINDRODONTIDAE Miller & Gidley, 1918

Anomoemys Wang, 1986
Anomoemys lohiculus (Matthew & Granger, 1923)
(Fig. 3A-L)

Holotype. AMNH 19100, left maxillary with P3-M2.

Type Locality. Oligocene, Hsanda Gol Formation, Loh, Mongolia.

Emended Diagnosis. Cheek teeth unilaterally hypsodont; on upper molars, main transverse lophs salient and almost equal in height to each other; protocone mesio-distally elongated, hypocone small and nearly indistinct from the protocone within the primitive endoloph; paracone and metacone incorporated in transverse lophs; metaloph retroverse and incomplete; presence of longitudinal crests connecting the protocone, metacone and posteroloph; P4 with strong parastyle; dp4 with complete metalophulid II, ectolophid straight, entolophid connected to...

SYSTEMATIC PALEONTOLOGY

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MATERIAL AND METHODS

The dental material was described following the classical rodent nomenclature of Wood & Wilson (1936) involving a few modifications depending on the group investigated (Wang & Emry, 1991; Marivaux et al., 2004; Gomes Rodrigues et al., 2012a; Fig. 2). Specimens were listed according to the IVPP system. Measurements were made at 0.01 mm with a measurement Nikon 10 linked to a digital counter Nikon CM-6S.

(Gomes Rodrigues et al., 2012a), and a few Aplodontoidea and Sciuridae (Vianey-Liaud et al., 2013). To date, no revised faunal lists have been erected since the description of these new fossils, including specimens from Kekeamu, which is a small branch of the Ulantatal valley investigated twice by Chinese scientists in 1988 and 1989 (Wang & Wang, 1991).

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mesoconid or to hypoconulid, hypoconid salient and developed mesio-externally, hypoconulid distinct.

Material. see Table 1.

Stratigraphical Range. UTL1 (Ulan I) and UTL4 (Ulan II), late Early Oligocene and early Late Oligocene, respectively.

Description

The lower and the upper cheek teeth are lophodont and high crowned except deciduous premolars.

Lower teeth

On dp4, the protoconid and metaconid are both small (Fig. 3A, D). They are linked by a low anterocingulid and by a well-developed metalophulid II. The metaconid is mesially located compared to the protoconid. A large postmetacristid, probably including an indistinct mesostylid because of high wear, starts from the distal part of the metaconid and extends along the lingual side of the tooth toward the entoconid. The mesolophid is very low and reduced. A low spur starts from the mesial part of the metalophulid II and runs toward this mesolophid. The entolophid meets the mesoconid distally. It includes a hardly distinct entoconid, which is mesiodistally compressed and as high as the hypoconid, and is located on the distal border of the tooth. The hypoconid continues as a strong posterolophid, which is dominated by a mesiodistally compressed and moderately high hypoconulid. The posterosynclindis is open lingually between the hypoconulid and entoconid. Central synclindis are wide and deep.

The p4s are wider than large due to the asymmetrical hypsodonty affecting mostly the region of the hypoconid (Fig. 3B-C, E-F). These teeth are also strongly heavily worn as shown by their smoothed border. They have two roots. Lophids include faintly protruding cuspids. The protoconid and metaconid are linked by a short anterolophid. The observation of dp4 is important for the interpretation of homologies, especially for the mesial part of p4. As a result, a complex cristid constituted by a reverse lingual branch of the mesolophid joins the mesial most part of the metalophulid II. A lingual cristid starting from the mesial border of the entoconid reaches the mesostylid. In the talonid of one tooth (Fig. 3B), the entolophid is connected to the central part of the ectolophid. On the other one (Fig. 3C), the entoconid is more distal, and the entolophid does not reach the ectolophid, but it is connected to a reduced hypoconulid via a mesio-distal cristid dividing the posterior synclindis in two parts. The posterolophid closes the posterosynclindis and joins the entoconid.

The m1s and m2s are tetralophodont and possess two mesial roots and one distal (Fig. 3G-H). The anterior synclindis is the most elongated, while the others are equal in size. Homologies can be observed between a pristine tooth (Fig. 3H) and dp4 and p4 morphologies. The mesial synclindis is closed lingually by a cristid linking the metaconid to the mesostylid. Mesially, the anterolophid links both the protoconid and metaconid. The second lophid could be the result of the addition of the posterior arm of the protoconid and the lingual part of a lingual mesolophid. The central and distal synclindis are opened lingually. The entoconid is included in the entolophid, as the metaconid in the anterolophid. The ectolophid is complete and the entolophid reaches a minute mesoconid labially. On the pristine tooth, the hypoconulid is clearly visible on the posterolophid. This lophid does not reach the distal base of the entoconid.

Figure 2. Dental nomenclatures used in this study. A: dp4 and P4 for cylindrodontids. B: m2 and M2 for dipodids and eomyids. SI to SIV correspond to synclines I to IV.
Upper teeth

P4s have a strong parastyle, which is elongated transversally (Fig. 3I). The main four lophs have nearly the same height. A short anteroloph joins the prominent protocone. This latter is larger than wide, and it is fused with a minute hypocone on which the posteroconule is connected. The protoconule is reduced and only developed in its mesial part. The metalophid is interrupted in its lingual part, since there is no connection between the hypocone and metaloph. All the synclines are deep and open, except the more distal position. Labially, there is neither ectoloph nor mesostyle, but only a weak mesio-labial crest starting from the metacone and reaching the base of the paracone.

The morphology of M1s and M2s (Fig. 3J-K) is close to that of P4s. However, the parastyle is reduced, elongated, and included in the anteroloph. The paracone and metacne are less distinct. The protocone and metalophid are less distinct. The protolophid is central and reaches the lingual part of the elongated protoconule. The metalophid can be either missing or merged with the strong posteroloph. The metaconule is wider and more distally protruding, while the mesolophid is missing. The metaloph is marked but included in the posterolophid, which is fused with the entolophid.

Remarks. These specimens can be attributed to the species *Litodonomys huangheensis*, because there is no significant difference with respect to the first fossils described from Shangxigou (Eastern Gansu, Xianshuihe Formation; Walsh & Qiu, 2000), except the presence of anterolophid on m3. However, the M3 from UTL 6 differs from other material from the Valley of Lakes (Daxner-Höck et al., 2014) in having a mure, and its lingual part of the anteroloph clearly separated from the protocone. In general, the specimens found in the Valley of Lakes appear slightly smaller than most of the hypodigm. Such differences could also represent an intraspecific variation, which is of doubtful significance but is generally important for third molars in rodents. These m3 and M3 from UTL 6 also differ from those of *Litodonomys xishuiensis* (Wang, 2003). *Litodonomys xishuiensis* is larger, its lingual part of the anteroloph clearly separated from the protocone. In general, the specimens found in the Valley of Lakes appear slightly smaller than most of the hypodigm. These differences could also represent an intraspecific variation, which is of doubtful significance but is generally important for third molars in rodents. These m3 and M3 from UTL 6 also differ from those of *Litodonomys xishuiensis* (Wang, 2003). *Litodonomys xishuiensis* is larger, its lingual part of the anteroloph clearly separated from the protocone. In general, the specimens found in the Valley of Lakes appear slightly smaller than most of the hypodigm. These differences could also represent an intraspecific variation, which is of doubtful significance but is generally important for third molars in rodents. These m3 and M3 from UTL 6 also differ from those of *Litodonomys xishuiensis* (Wang, 2003). *Litodonomys xishuiensis* is larger, its lingual part of the anteroloph clearly separated from the protocone.

Family EOMYIDAE Winge, 1887

*Asianeomys* Wu et al., 2006
*Asianeomys* sp.

(Fig. 3O-P)

Material. 1 P4 (IVPP V17671.1, 0.91x0.97), 1 M1 or M2 (IVPP V17671.2, 0.92x1.14)

Stratigraphical Range. UTL6 (Ulan III), latest Oligocene.
Figure 3. Dental illustrations of *Anomoemys lohiculus*, *Litodonomys huangheensis* and *Asianeomys* sp. **A-L**: *Anomoemys lohiculus* UTL1. A, occlusal and D, lingual sides of right dp4; B, occlusal and E, lingual sides of left p4; C, occlusal and F, labial sides of left p4; G-H, occlusal sides of left M1 or M2; I, occlusal side of right P4; J, occlusal side of left M1 or M2; K, occlusal side of right M1 or M2; L, occlusal side of left M3. **M-N**: *Litodonomys huangheensis*, UTL6; occlusal sides of left M3 and m3. **O-P**: *Asianeomys* sp., UTL6; occlusal sides of left DP4 and M1.
Description

Upper teeth

The P4 is worn. The anteroloph is rudimentary and the syncline I is absent. The protolophule I, which links the protocone and paracone, is curved mesiodistally. The mesoloph is moderately enlarged and distally curved. It extends the mesial part of the mure. The syncline II is narrow. The mesostyle is distinct but poorly developed. The transverse metaloph links the anterior arm of the hypocone. The paracone and metalocane are transversally elongated. The posteroloph joins the base of the metacone and closes the syncline IV. The sinus is slightly provers.

The M1 or M2 (extremely worn) is wider than large. The anteroloph reaches the labial side. The syncline I is open. The protoloph I joins the protocone and paracone. A crest distally starting from the paracone follows the labial margin toward the metacone. The mesoloph is curved toward the distal part of the tooth. The mesostyle is absent. The transverse metaloph meets the anterior arm of the hypocone. The metacone is distinct, but included in the stride metaloph. The posteroloph does not reach the base of the metacone and the syncline IV remains open as a result.

Remarks. Asianeomys sp., like other Asianeomys samples, has a bunolophodont pattern with highly developed lophs, with rudimentary to absent anteroloph and syncline I on P4, and with the mure connected to the distal arm of the the protoloph. It presents the same size as the Chinese Asianeomys asiaticus (Wang & Emry, 1991), Asianeomys dangheensis (Wang, 2002; Maridet et al., in press) and Asianeomys junggarensis (Wu et al., 2006), while it is slightly smaller than Asianeomys engesseri (Wu et al., 2006), and greater than Asianeomys fahlschui (Wu et al., 2006) and the Kazak Asianeomys bolligeri (Lopatin 2000, 2004; Maridet et al., in press). It differs from Asianeomys asiaticus in having a shorter prelobe and a mesoloph on P4, and in the presence of a distal paracone crest and the absence of mesostyle on M1-2. It differs from Asianeomys junggarensis and Asianeomys dangheensis in having a syncline I absent on P4 and shorter mesoloph. It differs from Asianeomys engesseri and fahlschui in having a transverse metaloph on M1 or M2. It also differs from Asianeomys bolligeri in having a curved mesoloph, and in not having a lingual arm of anteroloph on M1-2. Most of the characters discussed here are frequently highly variable, and it cannot be excluded that Asianeomys sp. actually belongs to one of these species, an issue which can be addressed only when additional material will be found.

DISCUSSION

Updated mammalian faunal lists of Ulantatal

Kekeamu corresponds to the basal part of the Ulantatal Formation (Wang & Wang, 1991). This fauna includes 11 species encompassing 10 families (Tables 2 and 3). Among them, rodents are predominantly represented and include one cylindroodontid, one aplodontid, one dipodid, two muroids, and two ctenodactyloids, which need re-examination because some species were not precisely assigned. Two Kekeamu taxa have been described: the ctenodactyloid, Ageitonomys neimongoliensis (Wang, 2010) and Ardynomys sp. (Wang & Meng, 2009). According to the presence of Karakoromys, which is a rodent typical of these biozones (Schmidt-Kittler et al., 2007), it could be dated from the Early Oligocene. But, it could more precisely be from the earliest part of the Oligocene due to the occurrence of Ardynomys (Wang & Meng, 2009). Even if it is a genus more frequently found in Eocene strata, it is also found in the informal biozone A of the Valley of Lakes (Fig. 4).

To date, the different faunas from the Oligocene deposits of Ulantatal include more than 70 species encompassing 8 orders of mammals. Among them, there is an impressive majority of micro-mammals, especially rodents, which encompass at least 50 species belonging to 9 different families (Tables 2 and 3). Some fossils, including notably macro-mammals (i.e., Perissodactyla, Cetartiodactyla, Carnivora and Creodonta) and some small squamates, still remain in the collection of the IVPP to be described and given accurate locality data. Indeed, macro-mammals and a few micro-mammals (i.e., Eulipotyphla, Lagomorpha and Didymocodonta) unearthed during the first expeditions (Huang, 1982) were dated imprecisely as “Middle Oligocene”, and thus need to be reconsidered (Table 3). The real total number of macro-mammals is low (12 species) and probably underestimated when compared to the number of rodents, which might be due to the differential sampling between the field campaigns. Moreover, although the number of all the Oligocene species of rodents is very close between the Ulantatal area and the Valley of Lakes (more than 50 and 60 species, respectively), the abundance of macro-mammals strongly differs (at least more than 10 and 40 species, respectively; Daxner-Höck et al., 2010, 2014; Maridet et al. 2014a, b, in press). For instance, Cetartiodactyla appear much more abundant in the Valley of Lakes (21 species; Daxner-Höck et al., 2010), than in Ulantatal (3). There are also strong differences regarding other micro-mammals such as Eulipotyphla and Lagomorpha. These observations are likely the result of incomplete data due to sampling bias, even if differential geographical distribution cannot be excluded for the moment.

The last point concerns the occurrence of some species during the Late Oligocene at Ulantatal (e.g., Anomoeomys loculus, Cricetops dormitor, Eucricetodon asiaticus, and Ulaancri- ceton badamae), which are only present during the Early Oligocene in the Valley of Lakes. Unfortunately, this issue will be tackled only when all the rodent faunas are described, in order to know if it is a question of dating of UTL sites from Unit II or a matter of differential stratigraphic ranges regarding rodents from Inner and Central Mongolia.

Compositions of rodent paleocommunities and ecological implications

Muroids, ctenodactyloids and dipodids are the most abundant forms among rodents at Ulantatal in representing about 98% of the rodent specimens described. Cylindroodontids are less frequent and far less represented, while aplodontoids, emyids and sciurids constitute the rarest groups. It appears difficult to address the case of the Tsaganomyidae from a temporal viewpoint, since there is no corresponding material known in UTL sites. The same tendencies can be observed in terms of specific richness in the Valley of Lakes, even though tsa- ganomyid species are as numerous as dipodids, muroids and ctenodactyloids (Schmidt-Kittler et al., 2007; Maridet et al., 2014a; Daxner-Höck et al., 2014). Nonetheless, information is so far only partial regarding the abundance of each species in this Mongolian area, since the whole rodent material is not yet accurately described (e.g.; Dipodidae at Ulantatal, Murideo and a few groups of rodents in the Valley of Lakes). However, while a clear biochronological framework is not yet defined for Central and Eastern Asian areas concerning the Oligocene, it is worth noting that the ctenodactyloid Karakoromys is typical from the Early Oligocene, while the eomyid Asianeomys, the dipodoid Litodonomys and the muroid Tachyoryctidae are
Table 2. Rodent faunal list of the Ulantatal area detailed for each UTL site. “?” means the material is not yet described.

<table>
<thead>
<tr>
<th>Genus indet.</th>
<th>UTL1</th>
<th>UTL3</th>
<th>UTL4</th>
<th>UTL5</th>
<th>UTL7</th>
<th>UTL6</th>
<th>UTL8</th>
<th>Description</th>
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<tr>
<td><strong>Aplodontidae</strong></td>
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<td>Prosciurus sp.</td>
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<td></td>
<td>Wang &amp; Wang, 1991</td>
</tr>
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<td><em>Ninamys arboraptus</em> (Shevyreva, 1967)</td>
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7
not found before the Late Oligocene.

Among all rodent paleocommunities, 9 families or superfamilies have been listed (Table 2). Except for aplodontoids, eomyids and sciurids, which are scarcely present, the other groups were well represented across the Mongolian Plateau, and their stratigraphic ranges cover the entire Oligocene period. Ctenodactylids, dipodids and muroids are the most diversified taxa. While the species richness of Muroidea does not vary significantly from one area to another (considering that *Ulanocricetodon* is a dipodid; see Gomes Rodrigues et al., 2011), there are more Dipodidae than Ctenodactylidae in the Valley of Lakes (20 and 8 species, respectively) contrary to what it is observed at Ulantatal (9 Dipodidae and 16 Ctenodactylidae). Apart from sampling variation, such differences can emphasize geographical disparities concerning the compositions of rodent communities in the Mongolian Plateau, which could be linked to partitioning of the ecological niches likely due to small local environmental variations. More generally, the size and shape variations are important in ctenodactylids and muroids (Vianey-Liaud et al., 2006; Gomes Rodrigues et al., 2012), and trends toward increasing crown height and more developed crests potentially indicate modifications of ecological niches in

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**Figure 4.** Location of the main Oligocene sites of Mongolia and Northern China, and biostratigraphic correlations according to local Mongolian biozones (modified after Daxner-Höck et al., 2010, 2014). Abbreviations: D, Dingdanggou; Ti, Tieersihabahe; Sh, Shargaltein; SJ, Saint-Jacques; UTL, Ulantatal; VL, Valley of Lakes (see Daxner-Höck et al., 2010 for the detail of each site); Ya, Yandantu; Yi, Yikebulage; Yu, Yuanjiawowo; X, Xianshuitue.
a general context of global cooling (Dupont-Nivet et al., 2007) and local aridification and opening of environments. This is supported by dental microwear analyses in these rodents, which show an increase of the potential consumption of abrasive and fibrous plants more frequently found in open habitats (Gomes Rodrigues et al., 2012b).

There are a lot of species that appeared during the latest Oligocene, especially at Ulantatal (i.e., UTL6 and 8) where nearly half of the species are new. That can be explained by a slight warming event recorded at the end of the Oligocene, which could have induced a moderate faunal turnover and a slight change of environments (de Man & Van Simayes, 2003; Wang & Emry, 2001). There is also a very close site from the Yikebulage Formation (Wang et al., 1981). Apart from Inner Mongolia, other Northern Chinese sites bear Oligocene faunas, such as the Yuanjiawowo fauna from the Haiyuan area located in Ningxia (Wang et al., 1994). Not far from there, in Eastern Gansu, the lower member of the Xianshuihe Formation, which is well-known for having yielded abundant mammal fossils (Wang et al., 1981). Among the vast number of sites, the best documented Chinese areas are generally sparse, and the relative abundance of each taxon is not always specified. In this context, even if it remains premature to draw comparisons with Ulantatal, it seems important to list them to show first their geographical and chronological interests for further studies (Fig. 4).

The nearest sites from Ulantatal are located at Saint-Jacques, belonging to the Wulanbulage Formation, which is well-known for yielding abundant mammal fossils (Wang et al., 1981). Among the vast number of sites, the best documented sites are 77046, 77046.5 and 77049.2 (Wang, 1981). Among the vast number of sites, the best documented sites are 77046, 77046.5 and 77049.2 (Wang, 1981). Among the vast number of sites, the best documented sites are 77046, 77046.5 and 77049.2 (Wang, 1981). Among the vast number of sites, the best documented sites are 77046, 77046.5 and 77049.2 (Wang, 1981). Among the vast number of sites, the best documented sites are 77046, 77046.5 and 77049.2 (Wang, 1981). Among the vast number of sites, the best documented sites are 77046, 77046.5 and 77049.2 (Wang, 1981). Among the vast number of sites, the best documented sites are 77046, 77046.5 and 77049.2 (Wang, 1981).

Contrary to the Valley of Lakes, faunal lists from other Northern Chinese areas are generally sparse, and the relative abundance of each taxon is not always specified. In this context, even if it remains premature to draw comparisons with Ulantatal, it seems important to list them to show first their geographical and chronological interests for further studies (Fig. 4). The nearest sites from Ulantatal are located at Saint-Jacques, belonging to the Wulanbulage Formation, which is well-known for yielding abundant mammal fossils (Wang et al., 1981). Among the vast number of sites, the best documented sites are 77046, 77046.5 and 77049.2 (Wang, 1981). Among the vast number of sites, the best documented sites are 77046, 77046.5 and 77049.2 (Wang, 1981). Among the vast number of sites, the best documented sites are 77046, 77046.5 and 77049.2 (Wang, 1981). Among the vast number of sites, the best documented sites are 77046, 77046.5 and 77049.2 (Wang, 1981). Among the vast number of sites, the best documented sites are 77046, 77046.5 and 77049.2 (Wang, 1981).

PROSPECTS

The geological area of western Gansu originally described by Bohlin (1937, 1946) and including sites from Shargeltein (Wang & Qi, 2003; Wang et al., 2003; Wang et al., 2003) and including sites from Shargeltein (Wang & Qi, 2003; Wang et al., 2003; Wang et al., 2003) and including sites from Shargeltein (Wang & Qi, 2003; Wang et al., 2003; Wang et al., 2003) and including sites from Shargeltein (Wang & Qi, 2003; Wang et al., 2003; Wang et al., 2003). Not far from there, in Eastern Gansu, the lower member of the Xianshuihe Formation (Lanzhou Basin; Wang & Qi, 2000a, b) includes deposits, which are latest Oligocene in age (Xiagou and Shangxiou). The geological area of western Gansu originally described by Bohlin (1937, 1946) and including sites from Shargeltein (Wang & Qi, 2003; Wang et al., 2003; Wang et al., 2003; Wang et al., 2003) and including sites from Shargeltein (Wang & Qi, 2003; Wang et al., 2003; Wang et al., 2003; Wang et al., 2003) and including sites from Shargeltein (Wang & Qi, 2003; Wang et al., 2003; Wang et al., 2003) and including sites from Shargeltein (Wang & Qi, 2003; Wang et al., 2003; Wang et al., 2003; Wang et al., 2003). Not far from there, in Eastern Gansu, the lower member of the Xianshuihe Formation (Lanzhou Basin; Wang & Qi, 2000a, b) includes deposits, which are latest Oligocene in age (Xiagou and Shangxiou). The geological area of western Gansu originally described by Bohlin (1937, 1946) and including sites from Shargeltein (Wang & Qi, 2003; Wang et al., 2003; Wang et al., 2003; Wang et al., 2003) and including sites from Shargeltein (Wang & Qi, 2003; Wang et al., 2003; Wang et al., 2003; Wang et al., 2003) and including sites from Shargeltein (Wang & Qi, 2003; Wang et al., 2003; Wang et al., 2003; Wang et al., 2003). Not far from there, in Eastern Gansu, the lower member of the Xianshuihe Formation (Lanzhou Basin; Wang & Qi, 2000a, b) includes deposits, which are latest Oligocene in age (Xiagou and Shangxiou). The geological area of western Gansu originally described by Bohlin (1937, 1946) and including sites from Shargeltein (Wang & Qi, 2003; Wang et al., 2003; Wang et al., 2003; Wang et al., 2003) and including sites from Shargeltein (Wang & Qi, 2003; Wang et al., 2003; Wang et al., 2003; Wang et al., 2003) and including sites from Shargeltein (Wang & Qi, 2003; Wang et al., 2003; Wang et al., 2003; Wang et al., 2003). Not far from there, in Eastern Gansu, the lower member of the Xianshuihe Formation (Lanzhou Basin; Wang & Qi, 2000a, b) includes deposits, which are latest Oligocene in age (Xiagou and Shangxiou). The geological area of western Gansu originally described by Bohlin (1937, 1946) and including sites from Shargeltein (Wang & Qi, 2003; Wang et al., 2003; Wang et al., 2003; Wang et al., 2003) and including sites from Shargeltein (Wang & Qi, 2003; Wang et al., 2003; Wang et al., 2003; Wang et al., 2003).

Because of the importance of these different Oligocene sites with distinct ages, it appears crucial to update their stratigraph-
ic characteristics and to accurately date and describe their fauna in order to discuss the distribution of specific taxa in Central and Eastern Asia, and both the structure and evolution of the different mammal paleocommunities in a context of global climate change and local environment modifications.

ACKNOWLEDGMENTS

We are grateful to the Institute of Vertebrate Paleontology and Paleoanthropology (IVPP) in Beijing, which allowed us to study these rodent faunas that were collected during their last expedition in 1987, and to N. Schmidt-Kittler who involved us in this study. We also thank the Academia Sinica (China) and the Max Planck Gesellschaft (Germany) for their important contribution in this work through their financial support concerning the field campaigns at Ulantatal. We are grateful to the anonymous reviewers for their comments and suggestions, which permitted to improve the quality of this manuscript. This is ISE-M publication 2014-068.

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