

## Chapter 5

### Notes on Early Oligocene Ursids (Carnivora, Mammalia) from Saint Jacques, Nei Mongol, China

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#### ABSTRACT

The ursid fossils collected from Saint Jacques include *Pachycynodon tedfordi*, new species, *Amphicynodon* sp., and *Cephalogale* sp. The distinctive features of *Pachycynodon tedfordi* are: short premolar series relative to molars, diastemata between c and p1 and among premolars very short or absent, distinct cingula on p1–p4, well-developed posterior accessory cusps on p2–p4, long and narrow m1 with relatively high protoconid, metaconid lower than paraconid, and relatively long m2 without distinct paraconid.

Four genera (*Amphicticeps*, *Amphicynodon*, *Pachycynodon*, and *Cephalogale*) representing two subfamilies (Amphicynodontinae and Hemicyoninae) have been discovered in the Oligocene of Asia. The last three are genera common to Asia and Europe, and indicate migration. Based on the ursid and other mammalian fossils, the deposits at Loc. 77046 near Saint Jacques are determined as Oligocene in age, and those at Loc. 77046.5 are late early Oligocene. Migration of ursids between Asia and Europe occurred in the early Oligocene, and migration of several taxa from Asia to North America likely occurred later, in the late Oligocene or early Miocene.

#### INTRODUCTION

Ursid fossils are very poorly known from the Paleogene of Asia (Matthew and Granger, 1924; Gabunia, 1964; Janovskaya, 1970; Tang and Qiu, 1979; Huang, 1993). The earliest record is late Eocene (Tang and Qiu, 1979; Tong, 1989). In 1977 a field team from the Institute of Vertebrate Paleontology and Paleoanthropology found a few ursid specimens near Saint-Jacques, Nei Mongol, China. These shed new light on the distributional history of the family. The authors wish to dedicate the present notes to Dr. R. H. Tedford to mark his great contribution to understanding Chinese Tertiary biostratigraphy and paleomammalogy.

ABBREVIATIONS: Abbreviations for repositories or localities are:

IVPP Institute of Vertebrate Paleontology and Paleoanthropology, Chinese Academy of Sciences  
IVPP Loc. locality number of IVPP  
IVPP V catalogue number of vertebrate fossils of IVPP

Measurements (in millimeters) of lower jaw and dentition use the following positional abbreviations:

H height  
T thickness  
L length  
TrL length of trigonid  
W width

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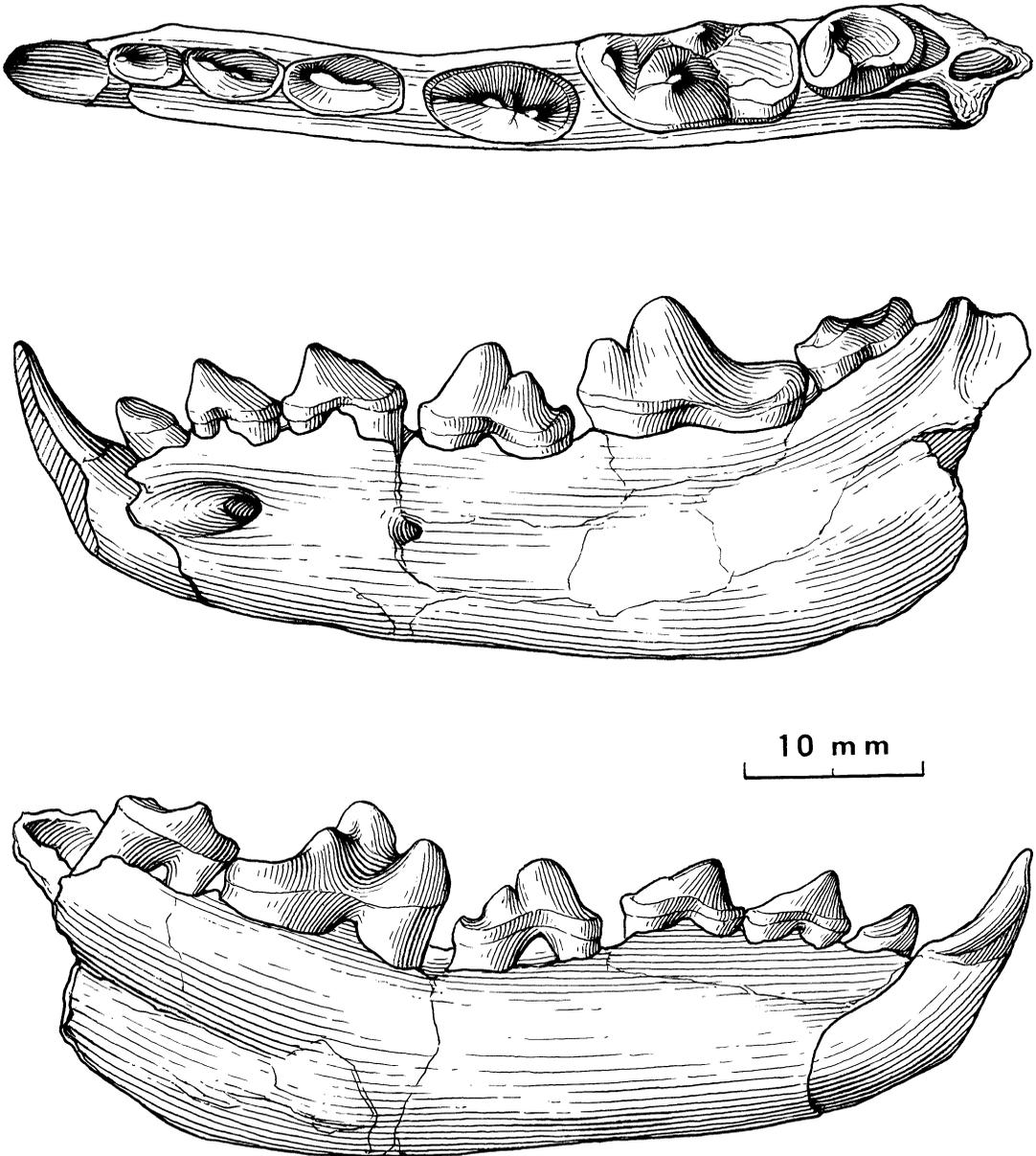


Fig. 5.1. Left lower jaw with c-m2 (IVPP V 12426) of *Pachycynodon tedfordi*, new species. Occlusal view (above), buccal view (middle), lingual view (below).

#### SYSTEMATICS

AMPHICYNODONTINAE SIMPSON, 1945

*Pachycynodon* Schlosser, 1887

*Pachycynodon tedfordi*, new species

Figure 5.1

HOLOTYPE: Left ramus of mandible with c-m2 (IVPP V 12426).

REFERRED SPECIMEN: Trigonid of a right m1 (V 12427).

LOCALITY AND HORIZON: IVPP Loc. 77046, Ulanmannei, east of Saint-Jacques, Luobuzhao, Hanggin Qi (Banner), Ih Ju Meng (League), Nei Mongol, China; Wulanbulage Formation, early Oligocene.

DIAGNOSIS: Medium-sized *Pachycynodon*;

mandible slender; premolar series short relative to molars, diastemata from c and p1 and among premolars absent or very short; p1–p4 with distinct cingulum, posterior accessory cusps from vestigial on p2 to well developed on p4; m1 relatively long, narrow, and subequal to p4 in height, with relatively high protoconid, metaconid lower than paraconid; m2 relatively long, without distinct paraconid.

**ETYMOLOGY:** In honor of Dr. R. H. Tedford for his great contribution to the study of carnivorans, particularly Ursidae.

**DESCRIPTION:** The horizontal ramus is slim, with its lower border slightly convex. There are two mental foramina: the anterior one is larger and located below the posterior root of p2, the posterior one is between p3 and p4. The anterior ridge of the masseteric fossa is below the anterior margin of m3.

The cheek teeth are low-crowned, with obtuse cusps. The anterior part of the lower canine is broken. It is conical, with its top bending posteriorly. The transverse section is oval, with the major diameter extending longitudinally. The anterolingual crest is distinct and continuous with the lingual cingulum. No distinct buccal cingulum can be seen. No diastema is present between c and p1. The p1 is single cusped and was heavily worn on the anterior and buccal sides. The crown is conical, with the main cusp standing anteriorly. The short anterior crest is steep and the long posterior crest slopes gently. A cingulum is present on the lingual and posterior sides. The tooth has a single root, stretching posteriorly. There is a tiny gap between the p1 and p2 (0.2 mm). The p2 and p3 are crowded and similar in structure. As in p1, the main cusp stands anteriorly, with a short, steep anterior crest and a long, gently sloping posterior one. The anterior crest is slightly more concave on p3 than on p2. The accessory cuspid on the posterior crest is vestigial on p2, but distinct on p3. A cingulum runs around the teeth. Each has two roots. The p4 is larger and higher than p3 and separated from p3 by a tiny diastema (1 mm). The main cusp is high and stands vertically. The anterior longitudinal crest is distinct and the posterior crest is short. The posterior accessory cuspid is well developed and separated from the posterior crest of the main cusp by

a distinct notch. The cingulum encircles the tooth. It meets the anterior crest of the main cusp to form a small cuspid at the anterior end of the tooth. The posterior cingulum thickens and forms a talonid-like crest. The m1 is low crowned and long. The trigonid is subequal to p4 in height. The three main cusps are obtuse. The protoconid is the highest. The paraconid extends anterolingually, is separated from the protoconid by a notch and is higher than the metaconid. The metaconid stands posterolingual to the protoconid, is separated from the latter by a shallow notch, and can hardly be seen from the buccal side. The talonid is low and round. The hypoconid is large, extending longitudinally. Due to wear, its height is unknown. The entoconid is distinct on the lingual cingulum. The anterior cingulum is on the anterobuccal base of the trigonid. The posterior cingulum extends from the posterior end of the hypoconid to the posterior base of the metaconid, closing the talonid basin at the posterolingual corner. The m2 is oval in occlusal view. The protoconid and metaconid are subequal in size, opposite to each other and connected by a transverse crest. Along the anterior margin a low crest extends from the anterior base of the protoconid lingually. No distinct paraconid is present. The talonid is similar to that of m1, but slightly narrower. The hypoconid is developed. The cingulum extends around the talonid and closes the talonid basin. No distinct entoconid can be seen. The missing m3 had an alveolus for one root.

**DIMENSIONS:** Lower jaw below m1 (H × T): 11.5 × 5.7; p1–m2 (L): 42.3; p1–p4 (L): 24.5; cheek teeth (L × W): p1, 2.8 × 1.9; p2, 5.6 × 2.8; p3, 6.5 × 3.2; m2, 6.7 × 4.5; m1 (L × TrL × W × H), 12.1 × 7.5 × 5.3 × 6.2.

**COMPARISON AND DISCUSSION:** V 12426 matches other species of *Pachycynodon* in having nearly unvaried height of the horizontal branch of the lower jaw, cheek teeth being low crowned, thick and obtuse cusps, lower height of the trigonid and the posterior position of the metaconid, rounded and concave talonid basin on m1, relatively large and flat m2, and one root on m3.

The genus *Pachycynodon* includes five species named previously: *P. tenuis*, *P. filholi*, *P. crassirostris*, *P. dubius*, and *P. bor-*

*iei*. V 12426 is smaller than *P. boriei*, but larger than the other four species. It differs from all known species of *Pachycynodon* in having a lower metaconid on m1. It differs from the four smaller species in having higher protoconid on m1. Further it differs from *P. tenuis* in having more obtuse cusps and longer m2, but lacking sharp lophids and diastema between c and p1; from *P. filholi* in having posterior accessory cuspid on p3, higher crowned m1 and m2 without distinct paraconid; from *P. crassirostris* in having a relatively slender lower jaw and a tiny gap between p1 and p2, and lacking diastema between c and p1; from *P. dubius* in having tiny or a lack of diastemata from c to p3, relatively shorter premolar series, higher crown of m1. It differs from *P. boriei* in having tiny or a lack of diastemata among the cheek teeth anterior to p4, having a narrower c, a more procumbent p1, more anteriorly located main cusps on p2–3, and a more developed posterior accessory cuspid on p4.

V 12427 is similar to V 12426 in the basic features of the trigonid of m1. It is considerably larger than V 12426 (TrL × W × H: 8.4 × 5.6 × 8.6) and may represent a species different from V 12426, but the specimen is insufficient to demonstrate this. It is temporarily referred to *P. tedfordi*.

*Pachycynodon* is known from the Oligocene of Europe (Schlosser, 1887; Teilhard de Chardin, 1914–1915). In Asia *Pachycynodon* of late Oligocene (Simpson, 1945) or early Oligocene age (McKenna and Bell, 1997) has been reported. One record listed as *Pachycynodon?*, sp. nov., was collected from the Nadu Formation, Guangxi, China, first considered early Oligocene (Tang and Qiu, 1979), but now late Eocene in age (Tong, 1989). This taxon remains undescribed, and it is uncertain whether it represents this genus. Another form described as *Cynodon* (*Pachycynodon*) *teilhardi* by Matthew and Granger (1924) was based on a specimen from the Hsanda Gol Formation. This taxon has been reassigned to *Amphicyonodon* (Mellet, 1968; Lange-Badre and Dashzeveg, 1989; Cirot and de Bonis, 1992). Thus, no record of *Pachycynodon* in Asia had been verified until the discovery of *Pachycynodon tedfordi*.

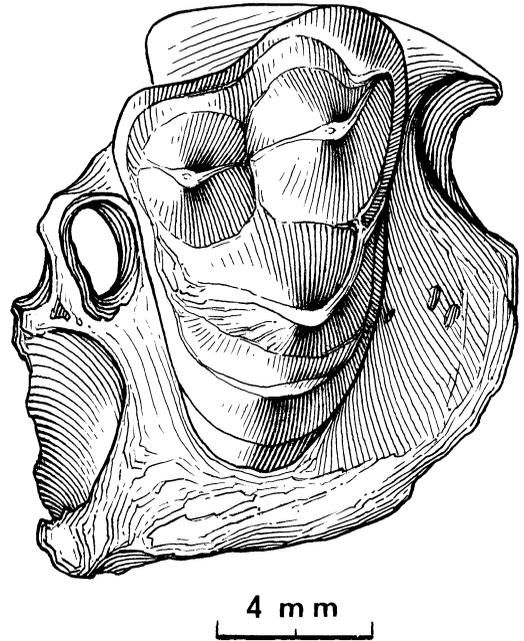


Fig. 5.2. Occlusal view of partial right maxilla with M1 (IVPP V 12428) of *Amphicyonodon* sp.

*Amphicyonodon* Filhol, 1882

*Amphicyonodon* sp.

Figure 5.2

**SPECIMEN:** Partial right maxilla with M1, roots of M2 and posterior root of P4 (IVPP V 12428).

**LOCALITY AND HORIZON:** IVPP Loc. 77046, Ulanmannei, east of Saint-Jacques, Luobuzhao, Hanggin Qi, Ih Ju Meng, Nei Mongol, China; Wulanbulage Formation, early Oligocene.

**DESCRIPTION AND COMPARISON:** The posterior margin of the jugal process of the maxillary is opposite the middle of M1. The M1 is trapezoidal in occlusal view, wider than long. The anterior width is larger than the posterior one. The paracone is larger than the metacone and located more buccally. The parastyle is distinct, but small. The protocone is low, with pre- and postprotocristae. The preprotocrista extends to the anterior border of the paracone and joins with the anterior cingulum. Near the lingual base of the paracone, a small crest extends from the preprotocrista to the lingual wall

of the paracone. It may represent a vestigial paraconule. The postprotocrista extends rather longitudinally to the posterior margin. The metaconule on the postprotocrista shift lingually. The trigon basin is not closed by the postprotocrista, but opens posteriorly. The cingulum runs around the tooth, making the lingual part broad and high. Alveoli indicate that M2 has three roots. Its anterobuccal root is located posterior to the metacone of M1. Absence of an alveolus for M3 indicates that no M3 existed in this animal. Dimension of M1 (L × AW × PW, in millimeters): 7.4 × 10.95 × 9.5.

V 12428 is identical to M1 of *Amphicynodon* in its basic features, such as paracone larger than metacone, parastyle weak, metaconule shifted lingually and joined with protocone by a crest, and cingulum complete, with its lingual part particularly thick. *Amphicynodon* is rather abundantly represented in the early Oligocene of Europe, including eight species. Three Asian species have been reported from the early Oligocene: *A. teilhardi* and *A. mongoliensis* from Hsanda Gol Formation, Mongolia (Matthew and Granger, 1924; Mellet, 1968; Janovskaya, 1970; Lange-Badre and Dashzeveg, 1989), and ?*Amphicynodon* sp. from Ulanatal Formation, Nei Mongol, China (Huang, 1993). Unfortunately, upper teeth are known only for *A. velaunus* from the early Oligocene of Rozon, *A. leptorhynchus* from the early Oligocene of Itardies, and *A. mongoliensis*. V 12428 is more similar to the M1 of *A. velaunus* in size and occlusal pattern. It differs from the latter in having a vestigial protoconule and more longitudinally extended postprotocrista reaching the posterior margin. The Ulanmannei specimen differs from remains of the three Asian species in being larger in size. In addition, it differs from *A. mongoliensis* in having a larger paracone and more developed cingulum.

HEMICYONINAE FRICK, 1926

*Cephalogale* Jourdan, 1862

*Cephalogale* sp.

Figure 5.3

SPECIMEN: A left M2 (IVPP V 12429).

LOCALITY AND HORIZON: IVPP Loc. 77046.5, Ulanmannei, east of Saint-Jacques,

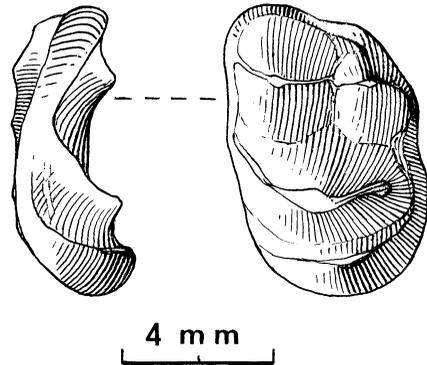


Fig. 5.3. Left M2 (IVPP V 12429) of *Cephalogale* sp. Anterior (left) and occlusal (right) views.

Luobuzhao, Hanggin Qi, Ih Ju Meng, Nei Mongol, China; Wulanbulage Formation, late early Oligocene.

REMARKS: The M2 is a rounded rectangle in occlusal view, wider than long, with slightly concave posterior margin. The paracone has a longitudinal crest. The reduced metacone is conical and smaller than the paracone. The protocone is crescentic. The long preprotocrista reaches the anterior cingulum. The postprotocrista joins with the small metaconule and does not reach the posterior border of the tooth. The protocone basin opens posteriorly, unclosed by the postprotocrista. The well-developed cingulum extends around the tooth almost completely, except at the posterobuccal corner of the metacone. The lingual cingulum is much higher and larger than the protocone. The occlusal surface is concave transversely. Dimensions of M2 (L × W): 5 × 7.7 mm. All of the features are similar in *Cephalogale*.

*Cephalogale* is known to be abundant and diversified in Europe from early Oligocene through early Miocene time. In North America it is known to occur only in the early Miocene. In Asia it is reported from the late Eocene Nadu Formation (*Cephalogale*, sp. nov., and cf. *Cephalogale* sp.) in China and late Oligocene Upper Pestrotsvet Svita (*C. meschethense*) in Georgia (Gabunia, 1964; Tang and Qiu, 1979). However, the late Eocene form listed by Tang and Qiu (1979) is undescribed and the assignment is uncertain. It is also difficult to compare V 12429 with *C. meschethense* because the latter is known

from one m1, two canines, and a fragmentary humerus. In comparison with species from Europe, V 124298 is close to *C. minor* in size.

## DISCUSSION

It is uncertain whether fossil ursids occurred in the late Eocene of Asia. However, it is certain that the family became rather diversified there during the Oligocene Epoch. Up to now four genera representing two subfamilies (Amphicyonodontinae and Hemicyoninae) have been discovered in the Oligocene of Asia: *Amphiticeps*, *Amphicyonodon*, *Pachycynodon*, and *Cephalogale*. *Amphiticeps* is an endemic form from Asia and the other three genera are common to both Asia and Europe in the Oligocene. Obviously the migration of ursids between Asia and Europe occurred during Oligocene time. Although *Amphiticeps* seems closely related to *Allocyon* and *Kolponomos* of North America, as pointed out by Hunt (1998), no single genus of the Ursidae is known to be common to Eurasia and North America. We agree with Hunt (1998) that there is no evidence of Oligocene migration of ursids between Eurasia and North America. However, *Cephalogale* is known to occur in the early Miocene in North America (Hunt, 1998). In addition, some rodents, such as *Plesiosminthus* (early Miocene; Green, 1977, 1992; Höck et al., 1999), *Palaeocastor* (Early Miocene; Bendukidze, 1993), *Haplomys* (late Oligocene; Wang, 1987), and *Pseudotheridomys* (late Oligocene; Wang and Emry, 1991), are common to Asia and North America. This tends to show that some sort of faunal exchange between Asia and North America took place in late Oligocene or early Miocene time, and ursids may have migrated then from Asia to North America.

**GEOLOGICAL AGE OF THE DEPOSITS, SAINT JACQUES AREA:** The Saint Jacques mammalian fauna was first discovered by Teilhard de Chardin and Licent in 1923 and named for the French Catholic mission Saint Jacques, which was located in the south of Dengkou County, Bayannur Meng, Nei Mongol, on the west bank of the Yellow River. However, the locality yielding the

mammalian fauna is actually located on the east bank of the Yellow River and belongs to Hangging Qi, Ih Ju Meng, Nei Mongol. The fossil-bearing deposits were first considered as Pliocene in age (Teilhard de Chardin and Licent, 1924a, 1924b), then as an equivalent to the Oligocene Hsanda Gol Formation (Teilhard de Chardin and Licent, 1924c; Teilhard de Chardin, 1926). Mellet (1968) compared the Hsanda Gol mammal fauna with the Oligocene faunas of North America and Europe and suggested that the Hsanda Gol Fauna was middle Oligocene. Since then Saint Jacques has been considered one of the classic Oligocene localities in Asia, representing middle or late middle Oligocene (Wang et al., 1981; Li and Ting, 1983; Russell and Zhai, 1987; Wang, 1992). In 1977 and 1978 an extensive geological exploration revealed that the beds explored previously by Teilhard de Chardin and Licent in 1923 represent only a small portion of a whole series of rocks. The deposits near Saint Jacques may be further subdivided into two parts, the upper part represented by Loc. 77048, likely of late Oligocene or latest middle Oligocene age, and the lower part represented by Locs. 77046 and 77049, probably of late middle Oligocene age in the traditional chronology (Wang and Emry, 1991). Recent advances in global research on the Eocene–Oligocene boundary place its age around 34 Ma, and North American biostratigraphy based on terrestrial mammal ages has been rearranged accordingly (Berggren and Prothero, 1992; Prothero and Swisher, 1992; Premoli Silva and Graham Jenkins, 1993). A close comparison of the Chinese Oligocene mammals with those of Europe and North America proves that the traditional Asian early Oligocene is late Eocene and the traditional Asian middle Oligocene is early Oligocene. Thus the Asian Oligocene includes only two subepochs, early and late Oligocene, and deposits near Saint Jacques would correlate to late early Oligocene below and late Oligocene above (Wang, 1997a, 1997b).

Among the fossil ursids from Saint Jacques, *Pachycynodon tedfordi* and *Amphicyonodon* sp. were collected from Loc. 77046, and *Cephalogale* from Loc. 77046.5. The genus *Pachycynodon* is

TABLE 5.1  
Comparison of Mammal Faunas of Saint Jacques  
(Locs. 77046 and 77046.5) and Shargaltein Gol

Taxa	Localities		
	Saint Jacques		Shar- galtein Gol
	Loc. 77046	Loc. 77046.5	
<i>Palaeoscaptor</i>	X		X
<i>Amphechinus</i>	X	X	X
<i>Gobiosorex kingae</i>	X		
<i>Desmatolagus pusillus</i>	X	X	X
<i>D. robustus</i>	X	X	X
<i>D. gobiensis</i>	X	X	
<i>Sinolagomys kansuensis</i>	X	X	X
<i>S. major</i>			X
<i>S. gracilis</i>			X
<i>Ordolagus</i>	X	X	
<i>Prosciurus ordosicus</i>	X		
<i>Karakoromys decessus</i>	X		
<i>Tataromys plicidens</i>	X	X	
<i>T. sigmodon</i>	X	X	X
<i>T. minor</i>	X		
<i>T. parvus</i>			X
<i>Bounomys</i>	X	X	
<i>Yindirtemys deflexus</i>		X	
<i>Y. ambiguus</i>		X	X
<i>Tsaganomys altaicus</i>	X	X	X
<i>Cyclomytus</i>	X		
<i>Cricetops dormitor</i>	X	X	
<i>C. minor</i>	X		
<i>Eucricetodon caducus</i>	X		
<i>Selenomys mimicus</i>	X		
<i>Tachyoryctoides</i>		X	X
<i>Pachycynodon tedfordi</i>	X		
<i>Amphicynodon</i> sp.	X		
<i>Cephalogale</i> sp.		X	
<i>Didymoconus</i>	X	X	X
<i>Schizotherium</i>	X	X	
<i>Indricotherium</i>			X
<i>Paraceratherium</i>	X		
<i>Eumeryx</i>	X	X	X
<i>Lophiomeryx</i>	X		

known from the Oligocene, and *Amphicynodon* is early Oligocene in Europe. According to the ursid and other mammal fossils (see table 5.1), the deposits at Loc. 77046 are thus identified as early Oligocene. Loc. 77046.5 is stratigraphically higher than Loc. 77046. As is shown in table 5.1, Loc. 77046.5 differs from Loc. 77046 in lacking some early Oligocene forms (*Gobiosorex kingae*, *Prosciurus or-*

*dosicus*, *Karakoromys*, *Tataromys minor*, *Cyclomytus*, *Selenomys*, *Eucricetodon caducus*, *Pachycynodon*, and *Amphicynodon*) and in bearing some more advanced forms, such as *Tachyoryctoides*, *Yindirtemys deflexus*, and *Y. ambiguus*. On the other hand, although it shares with Shargaltein Gol, Gansu, China, such advanced forms as *Yindirtemys ambiguus* and *Tachyoryctoides*, Loc. 77046.5 is different from the latter in having more primitive taxa: *Desmatolagus gobiensis*, *Ordolagus*, *Cricetops dormitor*, *Tataromys plicidens*, *Bounomys*, and in lacking more advanced ones like *Sinolagomys major*, *S. gracilis*, and *Tataromys parvus*. In addition, *Cephalogale* is known to range throughout early Oligocene to early Miocene of Europe, and the late Oligocene in Asia. It seems that the deposits at Loc. 77046.5 are younger than those of Loc. 77046, but older than those at Shargaltein Gol, probably late early Oligocene.

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