



A new Turolian species *Lophocricetus cimishliensis* (Rodentia, Zapodidae) from the Republic of Moldova

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ABSTRACT

A new species of *Lophocricetus*, *L. cimishliensis*, from three Late Miocene localities from the Republic of Moldova is described. All three Late Miocene localities (Chimishliya, Gura Galbene and Gradishte,) are located along the Kogylnik River, between the Dniester and Prut Rivers, Chimishliya District, southern Moldova. They yield diverse mammalian fossils, including several lagomorphs, rodents and insectivores: *Parasorex socialis* von Meyer, 1865; *Alilepus laskarewi* Khomenko, 1914; *Euroxenomys minutum* (Meyer, 1838); *Myomimus dehmi* (De Bruijn, 1966) / *maritsensis* De Bruijn et al. 1970 – group of species; *Vasseuromys* cf. *pannonicus* (Kretzoi, 1978); *Kowalskia progressa* Topachevski and Scorik, 1992; *Apodemus* aff. *barbarae* (Van de Weerd, 1976); etc.), which are characteristic in the Turolian age. *Lophocricetus cimishliensis* differs from the species of this genus by smaller sizes, better developed mesocone/mesoconid and style/stylids. Comparison of the new species with other species of *Lophocricetus* from Eastern Europe and Asia allows reconstructing their phylogenetic interrelationships during the Late Miocene of Europe. Our data suggest two possible scenarios: this species could descend from an East European ancestor or from an Asian population.

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Key words: *Rodentia*; *Zapodidae*; *Lophocricetus*; systematics; Turolian; Republic of Moldova

INTRODUCTION

Lophocricetus Schlosser, 1924, is a common genus in the Asian and Eastern Europe Late Miocene fossil record. It was originally described on fossil material from the Late Miocene Chinese localities Ertemte 1 and Harr Obo, as zapodid

rodents of large to medium size, marked by concave occlusal teeth surfaces (Schlosser, 1924). Schlosser (1924) included this taxon in the subfamily *Microtinae*. Later Schaub (1934) made a revision, including *Lophocricetus* in Cricetidae, and this was supported by Stehlin and Schaub (1951), Gromov (1962) and Vorontzov (1967). Later, Savi-

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PE Article Number: 17.3.35A

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Submission: 1 August 2013. Acceptance: 19 September 2014

nov (1970) described a new subfamily, *Lophocricetinae* with the single genus *Lophocricetus*, related to *Dipodidae*. Topachevsky et al. (1984) for the first time described *Lophocricetus* in Eastern Europe with three new species: *L. sarmaticum*, *L. maeoticus* and *L. complicidens*. The first two species were described based on a single tooth. Therefore, later Zazhigin et al. (2002) synonymized *L. sarmaticum* with *L. complicidens* and considered *L. maeoticus* as a junior synonym of *L. minusculus*.

Zazhigin et al. (2002) included *Lophocricetus* into the family Dipodidae and divided it in two subgenera: *Lophocricetus* s.str. including *L. minusculus* Savinov, 1977 (MN10-11 Kazakhstan and Ukraine), *L. complicidens* Topachevsky et al. 1984 (MN10, Ukraine), *L. vinogradovi* Savinov, 1970 (MN12-13, Kazakhstan), *L. grabau* Schlosser, 1924 (MN13, China), *L. reliquus* (MN13, Mongolia); *Paralophocricetus*, including *P. pussilus*, Schaub, 1934 (MN13-14, China and Mongolia), *P. intermedius* (MN13, Mongolia), *P. progressus* (MN14, Eastern Siberia); *P. afanasievi* Savinov, 1970 (MN13, Kazakhstan), *P. sibiricus* (MN14, Western Siberia), *P. ultimus* (MN14-15, Western Siberia).

Qiu et al. (2008), accepted the systematics proposed by Zazhigin et al. (2002), but they included *Lophocricetus* into Zapodidae and completed the list of *Lophocricetus* s.s. with the species “*gansus*” and “*saraicus*”, initially described by Zheng (1982) and Zazhigin et al. (2002) as *Heterosminthus*. Unfortunately Qiu did not justify the usage of Zapodidae, for which reason I continue to attribute *Lophocricetus* to Dipodidae.

In Republic of Moldova, Lungu (1981) reported the first zapodids from Buzhor (MN9), including two new genera *Bujoromys* (wrongly related to Muridae) and *Sarmatosminthus*. Later, Topachevsky et al. (1984) validated genera *Sarmatosminthus*, which has been attributed to *Lophocricetinae*. Revising the Eastern European and Asian dipodids, Zazhigin and Lopatin (2000) concluded that both *Bujoromys* and *Sarmatosminthus* are synonyms of *Heterosminthus*. In a recent work Lungu and Rzebik-Kowalska (2011), do not support the taxonomy proposed by Zazhigin and Lopatin (2000) and continue to assign the name *Sarmatosminthus* for the zapodids from Buzhor and Keinar (MN10). The fossil collections at Tiraspol State University (Kisinev) allow redescription of the material from Keinar (M1, m2) as *Lophocricetus* sp., based on presence of following characters: strong development of ridges, the pro-

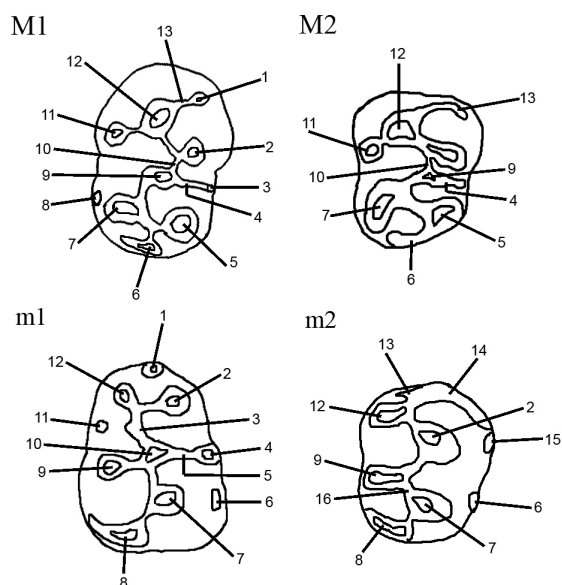


FIGURE 1. Dental terminology used in this paper (after Zazhigin and Lopatin, 2000, modified by author). Right M1-M2: 1. anterostyle; 2. anterocone; 3. anteroloph; 4. protocone; 5. protostyle; 6. anterior endoloph; 7. mesoloph; 8. hipocone; 9. posterostyle; 10. posterior endosinus; 11. posteroloph; 12. metacone; 13. mesoloph; 14. mesostyle; 15. paracone; Left m1-m2: 1. anteroconid; 2. metaconid; 3. mesostilid; 4. mesoconid; 5. entoconid; 6. posterolophid; 7. hypoconid; 8. posterostylid; 9. ectomesolophid; 10. ectostylid; 11. ectolophid; 12. protoconid; 13. labial arm of the anterolophid; 14. lingual arm of anterolophid; 15. posterior ectosinusid; 16. posterior ectolophid; 17. anterostylid

tocone is connected to the paracone and the hypocone joins the metacone on M1.

MATERIAL AND METHODS

A main part of the fossil material, described here as *Lophocricetus*, was collected during fieldwork in 2000-2012 from the Late Miocene deposits of the Republic of Moldova. The fossil materials were extracted from sediments by dry screening. They are stored in the paleontological collections of the National Museum of Ethnography and Natural History of Moldova (abbreviated: NMENHM). The teeth measurements are given in millimeters. The measurements were done by digital microscope LEICA DVM 5000 in the Institute for Geoscience, Eberhard Karls University Tübingen, Germany. The images were performed on scanning electron microscope in same institute. The dental nomenclature and measurements follow Qiu (1985) and Zazhigin and Lopatin (2000) (Figure 1).

PE Note: Erratum to Delinschi, 2014
18 January 2015

The caption of Figure 1 was misprinted in Delinschi, A. 2014. A new Turolian species *Lophocricetus cimishliensis* (Rodentia, Zapodidae) from the Republic of Moldova. *Palaeontologia Electronica* Vol. 17, Issue 3;35A; 13p (palaeo-electronica.org/content/2014/923-new-dipodid-from-moldova). The following is the correct caption.

FIGURE 1. Figure 1. Dental terminology used in this paper (after Zazhigin and Lopatin 2000, modified by author). **Upper dentition:** 1. antercone; 2. paracone; 3. mesostyle; 4. mesoloph; 5. metacone; 6. posteroloph; 7. hypocone; 8. posterostyle (hypostyle); 9. mesocone; 10. anterior endoloph; 11. protostyle; 12. protocone; 13. anteroloph. **Lower dentition:** 1. anteroconid; 2. protoconid; 3. ectolophid; 4. ectostilylid; 5. ectomesolophid; 6. posterostylid; 7. hypococonid; 8. posterolophid; 9. entoconid; 10. mezoconid; 11. mesostylid; 12. metaconid; 13. lingual arm of the anterolophid; 14. labial arm of the anterolophid; 15. anterostylid; 16. posterior ectolophid.

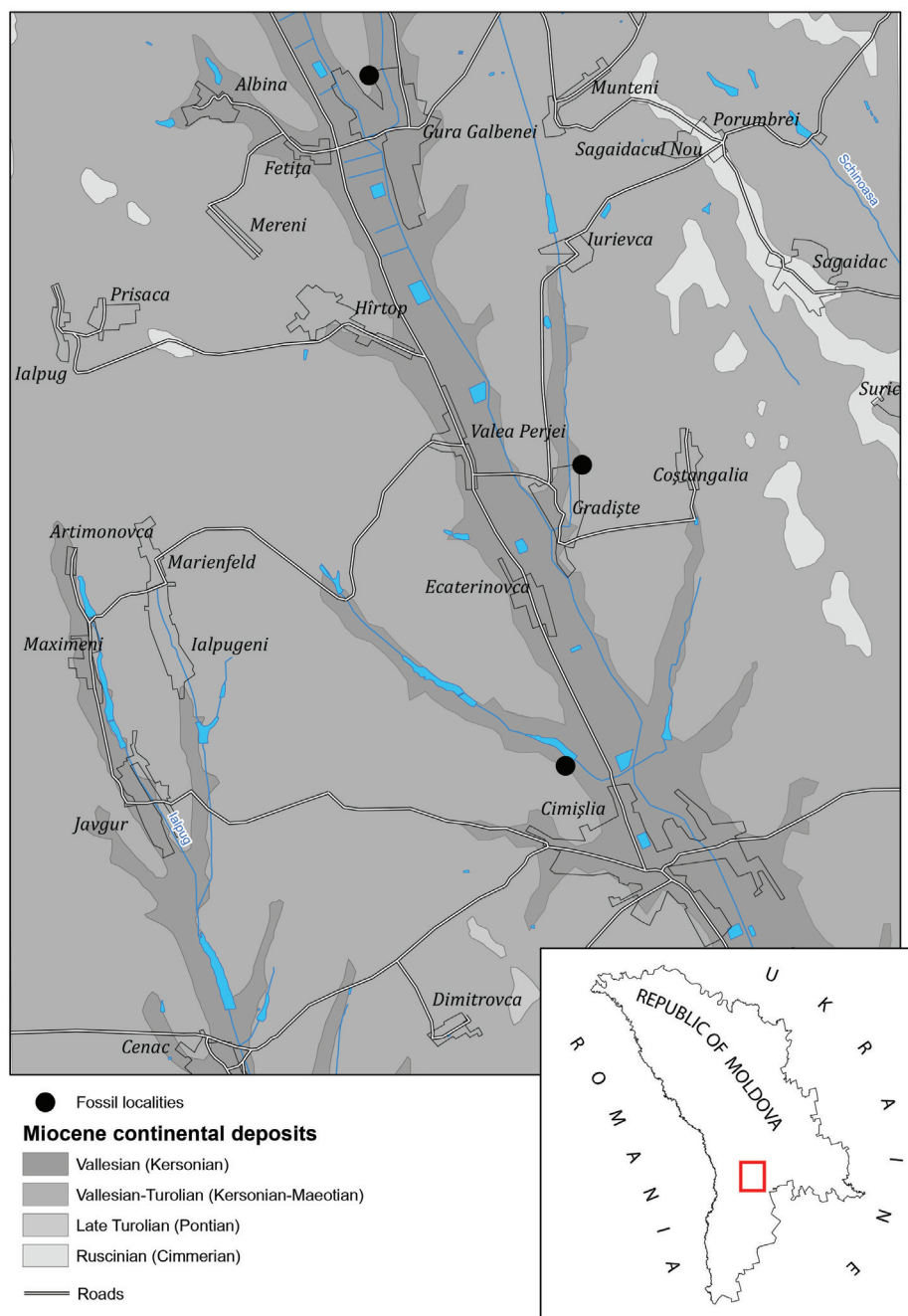


FIGURE 2. Geological map of the Late Miocene terrestrial sediments of the Balta Formation exposed in Cimishlia District, showing the location of the paleontological localities Chimishlia, Gradishte, Gura Galbenei.

GEOLOGICAL SETTINGS

The material was collected from the Balta Formation (Barbot de Marny, 1869) (named Balta-Paun in Ionesi et al., 2005), Chimishliya District, Republic of Moldova (Figure 2).

The sediments of the Balta Formation are common in the central and southern areas on Prut-Dniester interfluve. According to Khubka (1967,

1968), the Balta Formation is built by Late Miocene continental deposits. Lithologic it is represented by clay and sand, with cyclic structure. Each cycle starts with middle grain sand, with coarse sand lenses and rudite where most fossil material was found. The middle part is composed of medium to fine sand, with oblique and cross lamination. The top of the cycle is composed of silt and scaly clay.

The thickness of each cycle ranges from 4 to 20 m. Overall, 11 to 12 cycles are recorded from the Prut-Dniester interfluvium, while only 3 to 4 rhythms are present in the Kogylnik Valley. Genetically, each cycle begins with alluvial riverbed deposits followed by a transition from the riverbed to meadow deposits, and finally meadow and lacustrine deposits. The cross laminations are typical for these deposits. Each cycle is situated above the eroded surface of the previous cycle. Cyclic structure of these deposits, expressed by vertical changes of granulometric content, is related to the periodic change of the level of the erosion base of the fluvial network, leading to increased fluvial erosion (gravel and coarse sand lenses), or alternatively, to the decreasing erosion (clays).

SYSTEMATIC PALEONTOLOGY

Order RODENTIA Bowdich, 1821

Family DIPODIDAE Fischer von Waldheim, 1817

Subfamily LOPHOCRICETINAE, Savinov, 1970

Genus *LOPHOCRICETUS* Schlosser, 1924

Type species *Lophocricetus grabau* Schlosser, 1924

Diagnosis of the genus. The upper molars of *Lophocricetus* are generally characterized by the presence of the main (protocone, paracone, mesocone, metacone, hypocone) and the secondary (anterostyle, protostyle, mesostyle, posterostyle) cusps, as well as loph-like anteroloph, endoloph, mesoloph and posteroloph. The lower molars of *Lophocricetus* are characterized by the presence of the main (anteroconid, protoconid, metaconid, hypoconid, entoconid), secondary cusps (anterostylid, ectostylid, posterostylid) and lophids (anterolophid, ectolophid, posterolophid).

The protostyle on M1 is generally strong and connected to protocone in all *Lophocricetus* species.

The anteroconid on m1 is generally weak or absent and is isolated or connected to metaconid in all *Lophocricetus* species. A strong mesoconid is triangular in shape and is fused with the long ectomesolophid in majority of *Lophocricetus* species. More detailed in Schlosser (1924, p. 41), Savinov (1970, p. 102), Qiu (1985, p. 42) and Zazhigin et al. (2002, p. 64).

Lophocricetus cimishliensis sp. nov.

Figure 3.1-23

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2009 - *Lophocricetus minuscilus* Delinschi, p. 393

Type locality. Gura Galbene, Chimishliya District, Republic of Moldova.

Holotype. MNEIN Loph/GG-1, jaw fragment with P4-M2. National Museum of Ethnography and Natural History of Moldova.

Type horizon. Middle grained sand, with coarse sand lenses and rudite, upper part of the Balta Formation

Geological age. Middle Turolian, Late Miocene, MN12.

Measurements: see Table 1 and Figure 4, 5, 6, 7

Diagnosis: small sized species of *Lophocricetus* with well-developed protostyle on M1 and M2 and strong stylids on m1-m2. The protocone on M1 are well developed, and in most teeth, is connected to small anterostyle through weak anteroloph, the mesoloph in most cases is short, the endoloph connected to paracone, the ridge-like posteroloph, usually is connected to the metacone; M2 with single anteroloph, long mesoloph, long posteroloph in some cases is connected to metacone; m1 in most cases with isolated weak anteroconid, usually strong ectomesolophid, ectostylid and posterostylid, the hypoconid connected to entoconid or entoconid-mesoconid ridge connection; m2 protoconid connected with metaconid or anterolophid, anterostylid and protostylid are presented or not.

Differential diagnosis. *Lophocricetus cimishliensis* sp. nov. differs from:

Lophocricetus minuscilus by 1. better developed of lingual posteroloph on M1; 2. anteroconid on m1 is small to medium sized in most cases isolated; 3. better developed mesoconid on m1; 4. strong developed posterolophid on m1; 5. better developed stylids on m1-m2.

Lophocricetus complicidens by 1. smaller size (Figure 8, 9); 2. better development of mesoloph on M1; 3. lack of connection between the paracone and mesocone on M2; 4. in some cases the hypoconid is connected directly to mesoconid; 5. on m2 posterolophid is connected to the labial part of hypoconid (on *L. complicidens* this connection is in lingual part of hypoconide, or posterolophid is isolated).

Lophocricetus vinogradovi by 1. smaller size (Figure 8, 9); 2. less developed anteroloph; 3. better developed mesoloph; 4. more lingual posteroloph (*L. vinogradovi* usually has double branch); 5. presence of mesocone on M2; 6. usually isolated anteroconid on m1 (in *L. vinogradovi*, anteroconid is usually connected to metaconid).

Lophocricetus reliquus by 1. smaller size (Figure 8, 9); 2. better developed mesoloph; 3. less developed

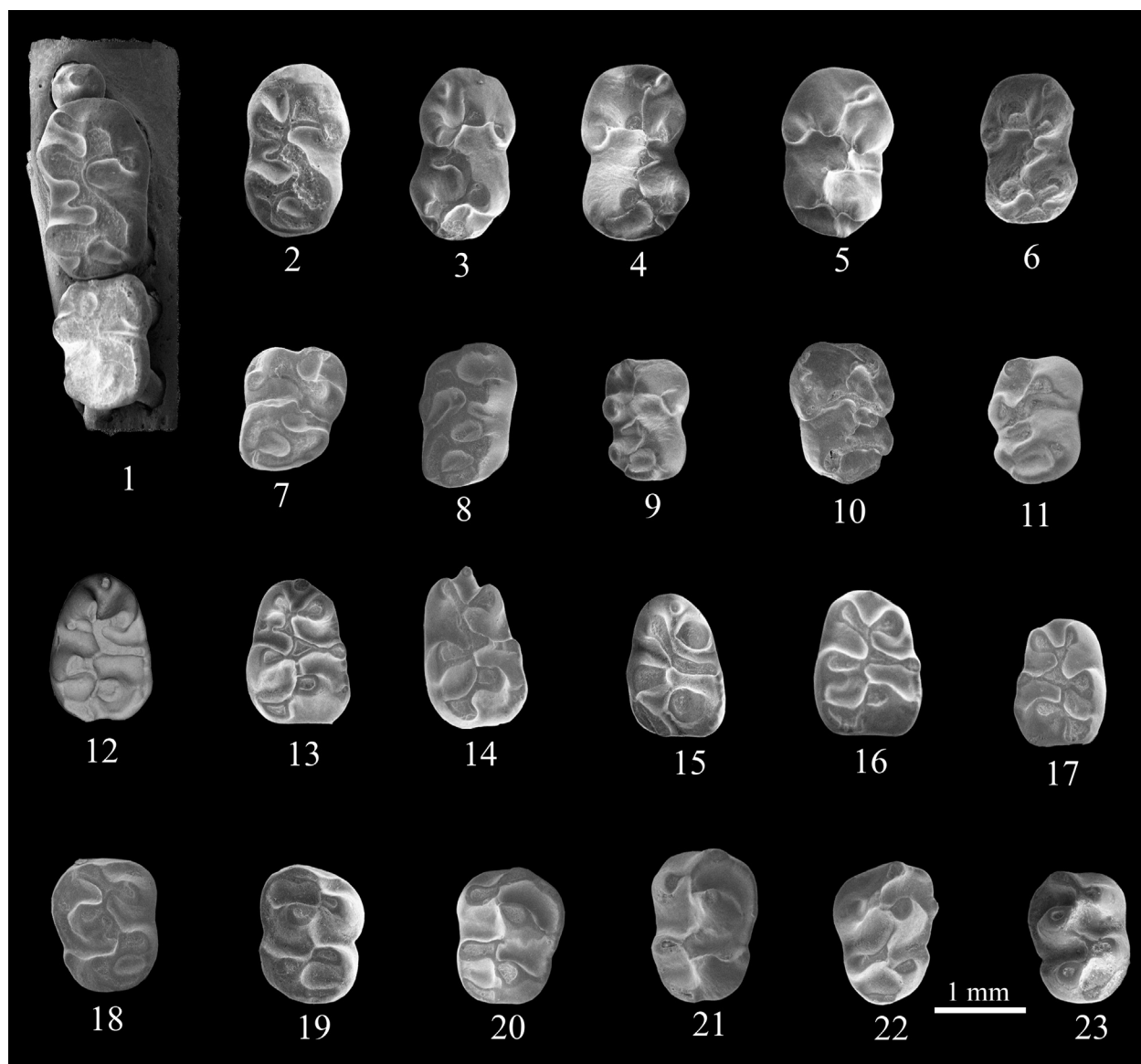


FIGURE 3. *Lophocricetus cimishliensis* sp. nov. (1-23) from the Turolian of Republic of Moldova: **1** – holotype, jaw fragment with P4-M2 (MNEIN Loph/GG-1); **2** – M1 (MNEIN Loph/Cim-1); **3** – M1 (MNEIN Loph/Gr-1); **4** – M1 (MNEIN Loph/Gr-2); **5** – M1 (MNEIN Loph/Gr-3); **6** – M1 (MNEIN Loph/Gr-4); **7** – M2 (MNEIN Loph/GG-3); **8** – M2 (MNEIN Loph/GG-4); **9** – M2 (MNEIN Loph/Gr-8); **10** – M2 (MNEIN Loph Gr-9); **11** – M2 (MNEIN Loph/Cim-4); **12** – m1 (MNEIN Loph/GG-5); **13** – m1 (MNEIN Loph/Gr-10); **14** – m1 (MNEIN Loph/Cim-5); **15** – m1 (MNEIN Loph/Gr-11); **16** – m1 (MNEIN Loph/Gr-12); **17** – m1(MNEIN Loph/GG-6); **18** – m2 (MNEIN Loph/GG-11); **19** – m2 (MNEIN Loph/Cim-8); **20** – m2 (MNEIN Loph/GG-12); **21** – m2 (MNEIN Loph/Cim-9); **22** – m2 (MNEIN Loph/Cim-610); **23** – m2 (MNEIN Loph/Cim-11). Scale= 1mm. Etymology: named after Chimishliya (= Cimişlia) District where fossils were found. Holotype: maxillary fragment with P4-M2 (MNEIN Loph/GG-1). Paratypes: Chimishliya: 3 M1, 2 M2, 2 m1, 6 m2 (MNEIN Loph/Cim1-13); Gura Galbene: 2 M1, 2 M2, 6 m1, 3 m2 (MNEIN Loph/GG 1-13); Gradishte: 7 M1, 2 M2, 7 m1 (MNEIN Loph/Gr 1-16).

of anterostyle; 4. shorter lingual branch of posteroloph on M1.

Lophocricetus grabau by 1. smaller size (Figure 8, 9); 2. more elongate M1 and m1; 3. weaker development of protostyle; 4. strongly shifted backward protostyle towards protocone; 4. presence of the mesoloph on M1.

Lophocricetus xianensis by 1. weaker developed protostyle; 2. endoloph joining protocone; 3. posteroloph connected to metacone on M1; 4. larger posterior endosinus on M2 (on *L. xianensis* posterior endosinus is smaller); 5. presence of styles and stylids.

TABLE 1. Measurements of upper and lower teeth (in mm) of *Lophocricetus* from Eastern Europe and Asia.

	<i>Lophocricetus cimishliensis</i> himishliya MN12	<i>Lophocricetus vcimishliensis</i> Gura Galbene MN12	<i>Lophocricetus cimishliensis</i> Gradishte MN12	<i>L. minusculus</i> Savinov, 1977 Cherevichnoe MN12 Topacevski et al. (1984)	<i>L. minusculus</i> Savinov, 1977 Kazakhstan Petropavlovsk 1A MN10 Savinov (1977)	<i>Lophocricetus complicidens</i> Topacevski et al. 1984 Novoelzavetovka MN11 Topacevski et al. (1984)	<i>L. vinogradovi</i> Savinov, 1970 Gusinal Pelelet MN12 Savinov (1970)	<i>L. reliquus</i> , Zazhigin et al. 2002 Hirghis-Nur Mongolia, MN13 Zazhigin et al. (2002)	" <i>L. saraicus</i> " Zazhigin et al. 2002 Olkhon Island Irkutsk (MN 12) Zazhigin et al. (2002)	<i>L. grabaui</i> Schlosser, 1924 Ertemte 2 China, (MN13). Qiu (1985)	<i>L. xianensis</i> Qiu et al., 2008 Loc.19, Lantian Country, China Early Late Miocene Qiu et al. (2008)	" <i>L. gansus</i> " Zheng, 1982 Builstyn Khudag, Mongolia, Late Miocene Daxner-Hock(2001)
Length M1	1.40-1.43 n=3	1.79 n=2	1.40-1.63 n=7	-	1.50-1.55 n=2	2.0	1.6-2.0 n=53	1.675-1.75 n=3	1.85-2.0 n=6	1.60-2.35 n=168	1.55-1.65 n=5	1.48-1.95 n=66
Width	0.95-1.11	1.17-1.23	0.96-1.13	-	1.05 – 1.10	1.4	1.2-1.55;1.35	1.25-1.325	1.35-1.52	1.10-1.85	1.05-1.15	1.00-1.25
Length M2	1.24-1.33 n=2	1.33-1.55 n=3	1.36-1.51 n=2	-	-	1.65	1.25-1.70 n= 41	1.3	1.45-1.65 n=6	1.20-1.95 n=157	1.25-1.55 n=5	1.20-1.59;1.35 n=34
Width	0.82-0.90	1.04-1.17	1.05-1.10	-	-	1.35	1.0-1.4	1.15	1.2-1.32	1.08-1.60	0.95-1.10	0.86-1.14
Length M3	-	-	-	-	-	0.85	0.75-0.95 N=12	-	-	0.70-1.00 n=59	-	0.68-0.80;0.72 n=11
Width	-	-	-	-	-	1.00	0.5-1.15	-	-	0.85-1.15	-	0.66-0.77
Length m1	1.67 n=1	1.40-1.63 n=6	1.41-1.56 n=7	1.40	1.50	1.7-1.8	1.55-2.0 n=34	-	1.52-1.75 n=11	1.50-2.19 n=196	1.10 n=3	1.20-1.68;1.44 n=75
Width	1.01	1.03 – 1.16	1.03-1.13	1.00	0.95	1.2-1.3	1.05-1.35	-	1.15-1.325	1.01-1.69	1.05-1.10	0.86-1.14
Length m2	1.36-1.56 n=7	1.41-1.47 n=3	-	-	-	1.60-1.65	1.3-1.7 n=35	-	1.4-1.625 n=10	1.35-1.90 n=170	1.30-1.45 n=6	1.23-1.52 n=65
Width	1.03-1.27	1.15-1.20	-	-	-	1.3-1.4	1.1-1.5	-	1.2-1.4	1.20-1.64	0.95-1.10	0.86-1.36
Length m3	-	-	-	-	-	-	0.8-2.15 n=11	-	0.925-1.025 n=4	0.78-1.26 n=88	-	0.80-0.93;0.89 n=15
Width	-	-	-	-	-	-	0.8-0.95	-	0.825-0.95	0.72-1.10	-	0.68-0.77

"*Lophocricetus*".*gansus*: smaller size (Figure 8, 9), weaker developed anterocone, lack of connection between hypocone and posteroloph.

"*Lophocricetus*" *saraicus*: smaller size (Figure 8, 9), always lack of connection between hypocone and posteroloph on M1.

Description

M1 is elongated with relatively prominent cusps and weak crests. The protostyle is well developed, strongly shifted backward and always connected to protocone through a weak crest. The anterostyle in most teeth is connected to protocone (at two teeth from Gradishte, the anterocone is isolated and anteroloph lack), through weak anteroloph. The protocone is joined to large paracone. In nine out of twelve teeth, the anterior endoloph connects mesocone to paracone and to protocone-paracone yoke in three (*sensu* Qiu et al., 2008). The mesocone is relatively well developed, most mesolophs are short. In one tooth (Figure 3.5) mesoloph is long and ends with a small mesostyle

at the labial corner of the tooth. The posterostyle (*sensu* Qiu, 1985) or hypostyle (*sensu* Qiu et al., 2008) is missing. The ridge-like posteroloph, in ten of twelve determinable specimens, is connected to the metacone and to the hypocone-metacone yoke, in two. In one strong worn tooth from Chimishliya posterior endosinus is closed in fossette (Figure 3.2).

M2 is longer than wide, and slightly wider anteriorly than posteriorly. In five teeth the protostyle is well developed and connected to protocone, in one tooth (Chimishliya) the protostyle is very weak, like a small projecting spur attached to the protocone. The anteroloph is single in all cases. The weak anterior endoloph is present in three cases, connected to the paracone. In four of six determinable specimens the small mesocone is present. The long mesoloph reaches to the labial edge of the tooth and ends with a small mesostyl in three cases. The narrow and long posteroloph is

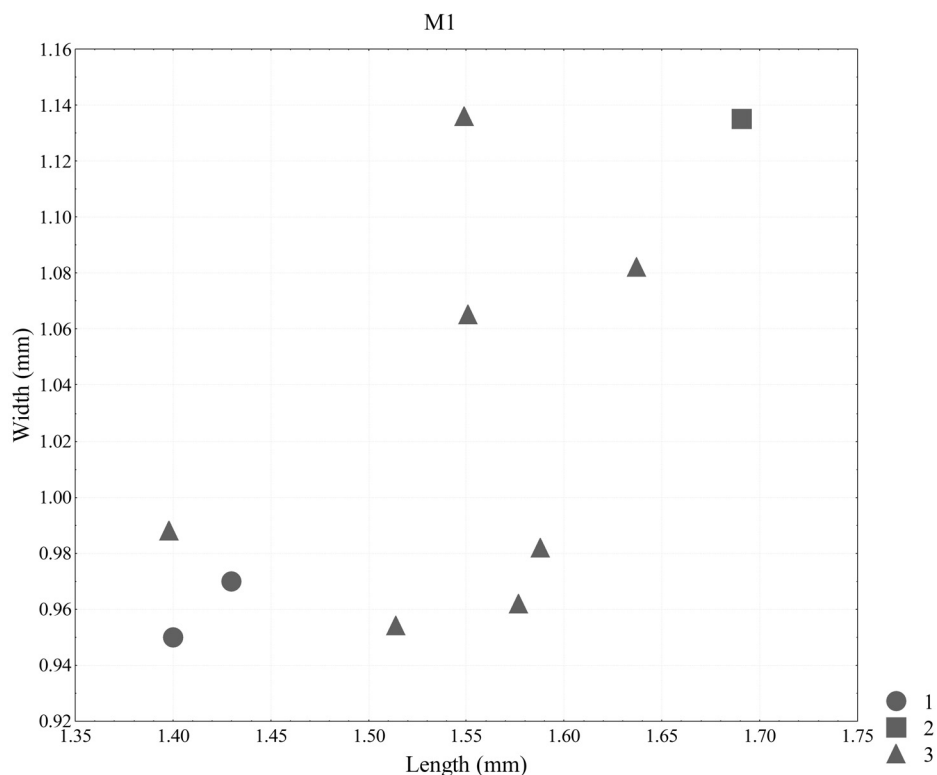


FIGURE 4. Length/Width diagrams of M1 of *L. cimishliensis*. 1. Chimishliya 2. Gura Galbene 3. Gradishte.

connected to hypocone, and in three from six determinable specimens also to metacone.

The *m1* is relatively elongated. The anterocoonid varies in its development: it is well developed as a separated cusp (nine teeth), poorly developed but also separated (three teeth), or poorly developed, joining the metaconid (two teeth). The protoconid is isolated in a single tooth (Figure 3.15), otherwise joining to the strong ectolophid that connects the protoconid, metaconid and mesoconid. In a single tooth (Figure 3.13), a rudimentary ridge between the protoconid and mesoconid can be observed. A small cusp (mesostylid?) is present in one tooth from Gura Galbene (Figure 3.12). The well-developed mesoconid is triangular in shape, fused with a long ectomesolophid, which ends with an ectostylid. The hypoconid, is connected to entoconid (Figure 3.12), mesoconid (Figure 3.13) or is isolated (Figure 3.15). Strong developed posterolophid varies in its configurations: separated in one tooth, joins only to hypoconid in seven teeth and joint to hypoconid and posterior part of entoconid in another six. The well-developed posterostylid connects to hypoconid in seven teeth, but is separated in other six and is missing in one tooth.

The *m2* shows distinct variation in outline. The labial arm of the anterolophid is long and turns pos-

terolabially. Connection between the labial arm of anterolophid and protoconid can be seen in five teeth, and is lacking in another five. In two teeth (Figure 3.18-19), a fine and low lingual arm of anterolophid is observed. The protoconid is connected to metaconid (six teeth) or to metaconid-anteroconid (four teeth) by a crest, variable in outline. The hypoconid is always connected to the entoconid by the posterior ectolophid. The posterolophid joins the hypoconid in five teeth and is connected to entoconid with closed posterior ectosinusid in another five. The anterostylid can be seen in a form of a small separated cusp in five cases. The posterostylid can be seen in three cases.

DISCUSSION

Biometry. In terms of molar length and width, *Lophocricetus cimishliensis* is generally smaller than most known representatives to species of *Lophocricetus* (Figures 4, 5, 6, 7, 8 and 9). *Lophocricetus cimishliensis* is close to *L. minusculus* from Cherevichnoe (Ukraine) and Petropavlovsk 1A (Kazakhstan) (Topachevsky et al., 1984; Zazhigin et al., 2002) in morphology. However, the number of specimens of *L. minusculus* available for

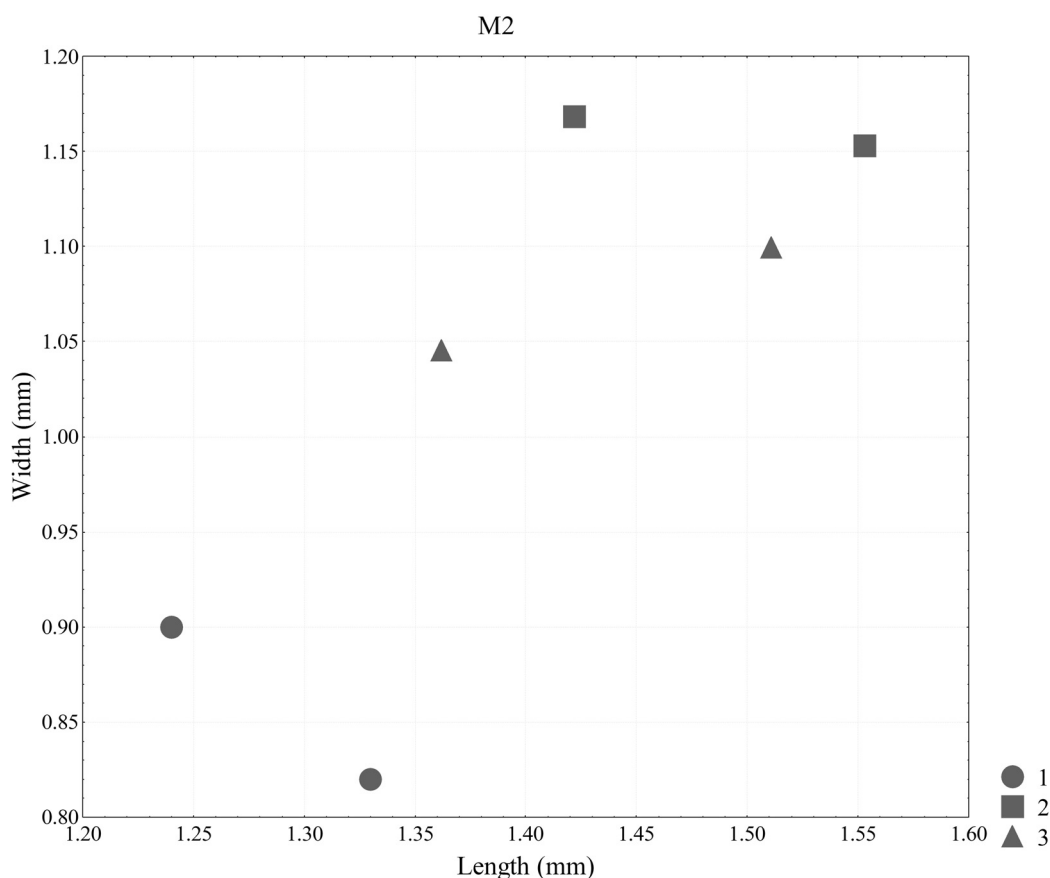


FIGURE 5. Length/Width diagrams of M2 of *L. cimishliensis*. 1. Chimishliya 2. Gura Galbene 3. Gradishte.

study is very small, with the four M1 – m1 from Petropavlovsk 1A, and a single m1 from Cherevichnoe. Therefore, it is difficult to conclude about the relationships of these two species. *Lophocricetus cimishliensis* is slightly smaller than *L. xianensis* (Figure 8-9) from Loc.19, Lantian County, China (Qiu, 2008).

The sample of *Lophocricetus reliquus* from Hirghis-Nur, Mongolia (Zazhigin et al., 2002) is very scanty, making any comparison difficult. Nevertheless, M1 of *L. reliquus* is slightly larger than that of M1 of *L. cimishliensis*, moreover, size of M2 of *L. reliquus* is within the limits of M2 of *L. cimishliensis*.

The length values of *Lophocricetus complicidens* from its type locality Novoelizavetovka, Ukraine (Topachevski et al., 1984) as well as the width measurements of M1 – 2 and m1–2 clearly show larger sizes of *L. complicidens* (Figure 8-9).

Size differences of *Lophocricetus grabaui* from Ertemte and Harr Obo, China (Qiu, 1985), "*L. gansus*" from Builstyn Khudag, Mongolia (Daxner-Hock, 2001), *L. vinogradovi* from Gusinyi Perelet,

Kazakhstan and "*L. saraicus*" (Figure 8, 9) from the Olkohon Island, Irkutsk, Russia (Zazhigin et al., 2002) is present in Figure 8-9.

Biostratigraphic Assignations of Species of *Lophocricetus*

Lophocricetus is a typical representative to genera of the Upper Miocene faunas from Asia and Eastern Europe. The oldest records of *Lophocricetus* are considered *L. xianensis* from Loc. 19, Lantian County, China (MN10, Qiu, 2008), and *L. minusculus* from Petropavlovsk 1A, Kazakhstan, (MN10, Savinov, 1977; Zazhigin et al., 2002).

Description of *L. minusculus* from Cherevichnoe (Ukraine, MN12) is based on only a single m1, therefore it is difficult to make an advanced comparison regarding its relationships with other taxa. Zazhigin et al. (2002) considered this species typical for the Late Vallesian of Kazakhstan, but according to Nesin and Nadachovski (2001) and Nesin and Storch (2004) Cherevichnoe is considered as a Middle Turolian locality. Thereby, it is necessary to revise of Cherevichnoe specimen, or

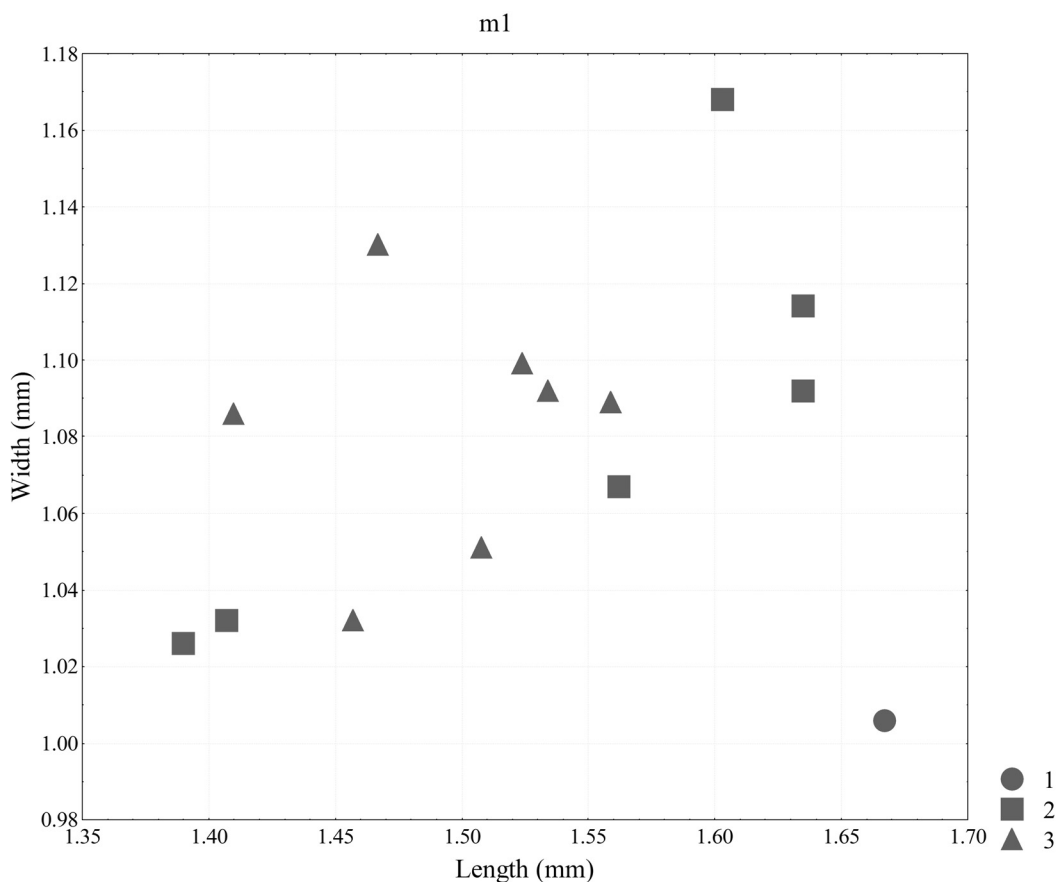


FIGURE 6. Length/Width diagrams of m1 of *L. cimishliensis*. 1. Chimishliya 2. Gura Galbene 3. Gradishte.

extend the stratigraphic distribution of *L. minusculus* till Middle Turolian. Most of the other members of the genus have been recorded from Turolian deposits, including *L. complicidens* (MN11, Topachevsky et al. 1984), "*L.*" *gansus* (MN11, Daxner-Hock, 2001), *L. vinogradovi* (MN12, Savinov 1970), "*L.*" *saraicus* (MN12, Zazhigin et al. 2002), *L. reliquus* (MN12, Zazhigin et al., 2002), *L. cimishliensis* sp. nov. (MN12). The latest, geologically youngest species of *Lophocricetus* is considered *L. grabaui* from Ertemte and Harr Obo, Inner Mongolia China (MN13-14, Qiu, 1985).

Phylogenetic Relationships of *Lophocricetus cimishliensis* with Other Species of *Lophocricetus*

Based on the presence or absence of posterostyle on M1-2 the genus *Lophocricetus* can be divided into *Lophocricetus* sensu stricto and *Paralophocricetus* (Zazhigin et al., 2002). The specimen from the Chimishliya District has an indistinct posterostyle, which allows it to be attributed to *Lophocricetus* sensu stricto.

The developed protostyle located more posteriorly to the center of the protocone on M1 of *Lophocricetus cimishliensis* (a diagnostic feature of *Lophocricetus* (Schlosser, 1924)) brings the species close to *L. minusculus* from Petropavlovsk 1A (Kazakhstan) and *L. complicidens* from Cherevichnoe, beside this *L. cimishliensis* can be excluded from *L. vinogradovi*, *L. grabaui* and *L. xianensis*.

Anteroloph on M2 (another important feature of *Lophocricetus*), on *L. cimishliensis*, is single in all teeth, this is common for *L. complicidens*, "*L.*" *saraicus*, *L. grabaui*, "*L.*" *gansus*, and differs in *L. vinogradovi* and *L. xianensis*. M2 of *L. minusculus* and *L. reliquus* is unknown.

Lophocricetus cimishliensis has relatively strong and short mesoloph (also an important taxonomic character among *Lophocricetus* species.) on M1 and M2. This character also makes the new species similar to *L. minusculus* and *L. complicidens*, excluding any similarity with *L. grabaui*, *L. reliquus*, *L. vinogradovi*, and *L. xianensis*.

A connection between posterolophid and the main cusps of m1 on *Lophocricetus*, shows distinct variation. Thus, posterolophid can connect just

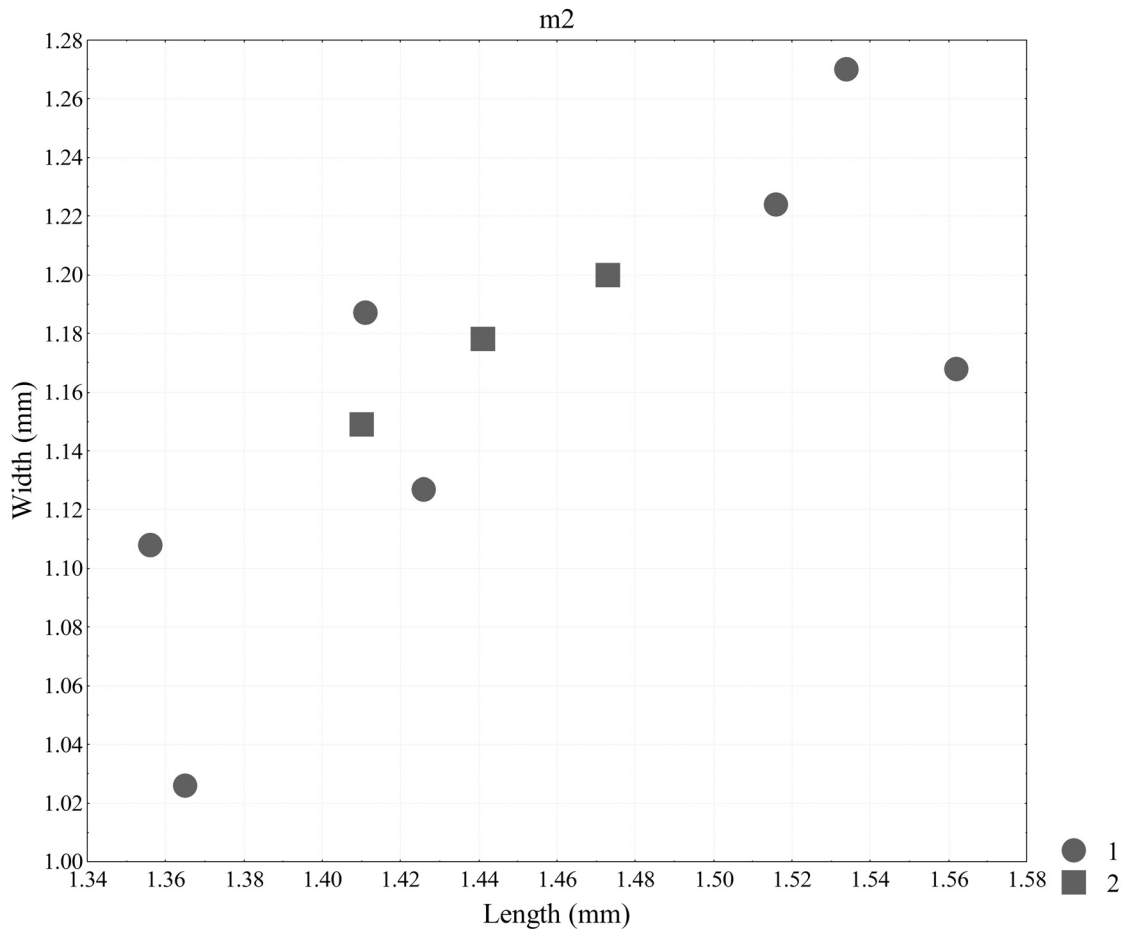


FIGURE 7. Length/Width diagrams of m1 of *L. cimishliensis*. 1. Chimishliya 2. Gura Galbene.

hypoconid like in *L. grabaui*, *L. complicidens*, *L. minuscilus*, *L. vinogradovi*, "*L. saraicus*, or connected with hypoconid and posterior part of entoconid or isolated like in *L. cimishliensis*, "*L. gansus*, and *L. xianensis*.

The development of stylids on m1-2 (a diagnostic feature of *Lophocricetus*) can occur either in form of separated cusps or can be joined to the main cusps as in *L. cimishliensis*, *L. complicidens*, *L. vinogradovi*, "*L. gansus* (few cases), *L. grabaui*, or can be indistinct in *L. xianensis*, *L. minuscilus*?

The presence of *Lophocricetus cimishliensis* in the Turolian fauna of the Republic of Moldova, indicate two possible scenarios regarding their ancestry: 1. *Lophocricetus* is considered to have descended from *Heterosminthus* (Zazhigin et al., 2002; Qiu, 2008), so *L. cimishliensis* may have descended from an East European ancestor and can form a phylogenetic line like: *Heterosminthus gabuniai* Lungu, 1981(= *Sarmatosminthus gabuniai* in Lungu and Rzebik-Kowalska, 2011), (Buzhor, MN9) – *Lophocricetus* sp. (= *Heteros-*

minthus sp. in Lungu and Rzebik-Kowalska, 2011), (Keinar, MN10) – *Lophocricetus cimishliensis* (Chimishliya, Gura Galbene, Gradishte, MN12); 2. It may have descended from an Asian population, which later migrated into Eastern Europe: *L. minuscilus* (Kazakhstan, MN10) – *L. minuscilus* (Ukraine, MN12) – *L. cimishliensis* (Republic of Moldova, MN12).

The tectonic events and geographical changes during the Neogene of Europe likely provided geographical barriers to dispersal, as well as concurrent land bridges allowing faunal interchange. As an example, similarity between *Lophocricetus cimishliensis* and *L. minuscilus* from the Vallesian of Kazakhstan can be considered (Savinov, 1977, Zazhigin et al., 2002).

CONCLUSIONS

The assemblage with *Lophocricetus* from the Chimishliya District (Chimishliya, Gura Galbene, Gradishte) is the first record of this genus from the

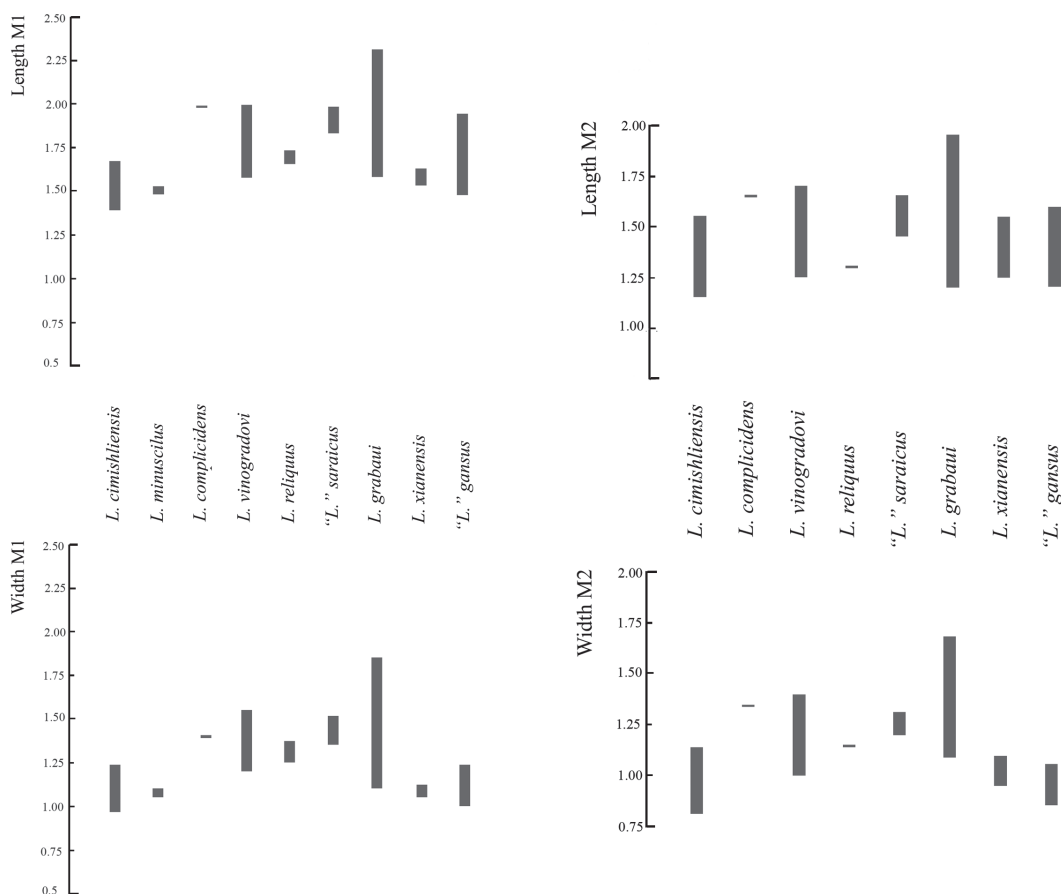


FIGURE 8. Ranges of size variation (in millimetres) in the upper dentition of genera *Lophocricetus*.

Turolian deposits of the Republic of Moldova. *Lophocricetus cimishliensis* from the Chimishliya District is smaller than the majority of the *Lophocricetus* species, shearing comparable sizes with *L. minusculus*. The molars of this new species distinctly differ from those of all other *Lophocricetus* species, in the constant presence of a well-developed mesocone and short mesoloph on M1, and strong stylids on m1-2.

The study of *Lophocricetus cimishliensis* promises interesting results on evolution and distribution of *Lophocricetus*, as well as on biostratigraphy and faunal evolution in Eastern Europe. This genus is of peculiar interest, since it did not penetrate into Western Europe, due to orographic, climatic, biological or other barriers.

Among the other Upper Miocene representatives of zapodids in the Republic of Moldova *Heterosminthus gabuniai* occurs abundantly (= *Sarmatosminthus gabuniai* in Lungu and Rzebik-Kowalska, 2011) in Buzhor (MN9), whereas

Lophocricetus sp. (= *Heterosminthus* sp. in Lungu and Rzebik-Kowalska, 2011) is present with two teeth in Keinar (MN10).

ACKNOWLEDGEMENTS

I would like to thank M. Sinita (Kiev) and V.S. Zazhigin (Moscow) for their criticism and continuous encouragement. Also, many thanks to colleagues from the Paleontological collection, University of Tübingen, Germany: M. Böhme, J. Prieto and D. Vasilyan for their help, as well as valuable comments and critical remarks. Thanks are also due to V. Codrea (Cluj-Napoca) and A. Ciornei for the improvement of English grammar and I. Rosca for cartographic assistance. Many thanks are also given to N. Volontir, Head of Department of General Geography, Tiraspol State University Moldova, for making possible work on the collection of Prof. Lungu.

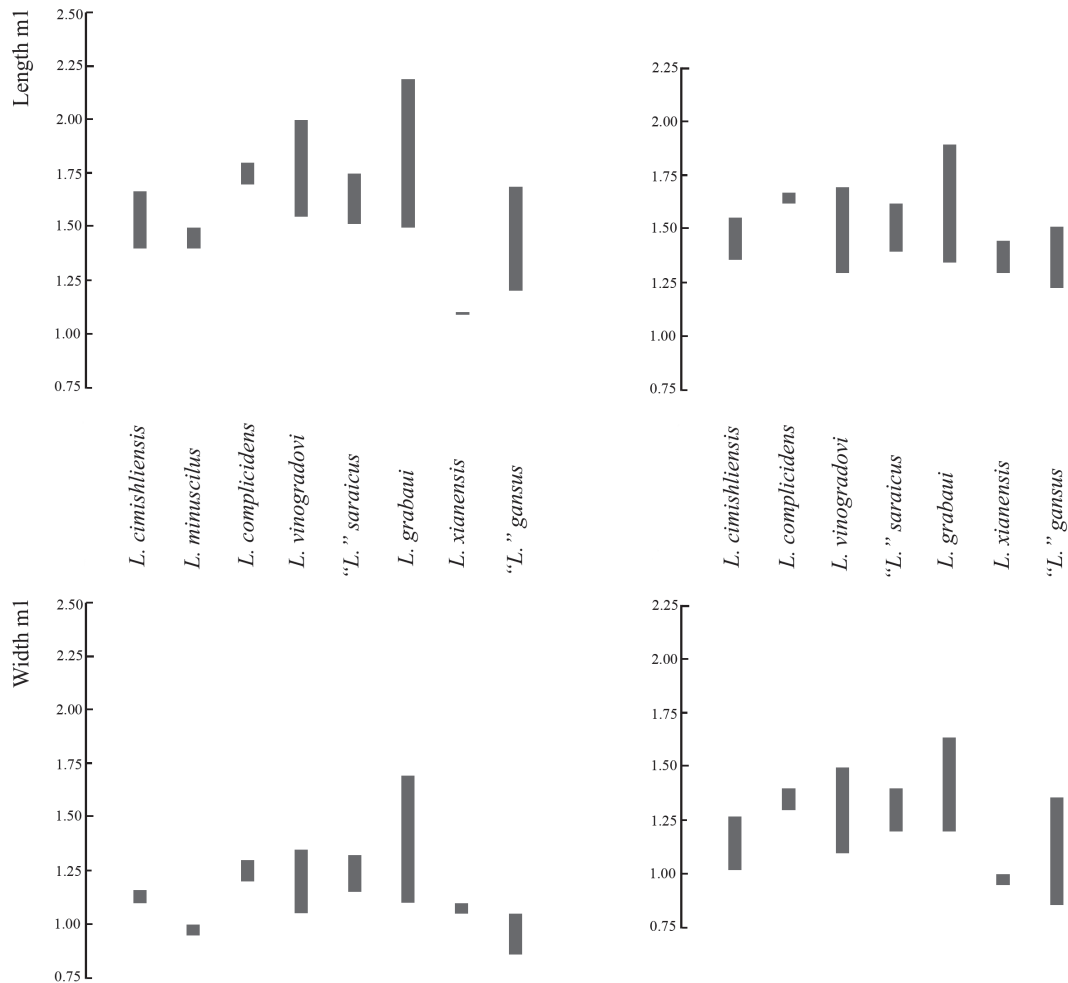


FIGURE 9. Ranges of size variation (in millimetres) in the lower dentition of genera *Lophocricetus*.

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