

New data on Soricomorpha (Lipotyphla, Mammalia) from the Pliocene and Pleistocene of Transbaikalia and Irkutsk Region (Russia)

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Abstract. Remains of five genera and 14 species (Talpidae and Soricidae) have been found in the Pliocene and Pleistocene sediments of ten localities in Western Transbaikalia and Irkutsk Region. Besides fossil (*Petenya* sp., *Sorex palaeosibiriensis*) and Recent taxa (*Asioscalops altaica*, *Crocidura* sp., *Neomys fodiens*, *Sorex minutissimus*, *S. minutus*, *S. roboratus*, *S. cf. isodon* and *S. cf. daphaenodon*) known today from the Asiatic continent, two new fossil *Sorex* species (*S. erbajevae* and *S. baikalensis*) have been described. Thus, the number of fossil *Sorex* species cited so far from Asia (16) increased to 21.

Key words: Fossil mammals, Soricomorpha, Plio/Pleistocene, Siberia.

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I. INTRODUCTION

Central and East Asia are considered to be of fundamental importance for the evolution of the insectivores. However our current knowledge of fossil representatives of this group is limited. Most fossils are only tentatively identified to family, subfamily or genus levels. As a result all new information concerning the fossil insectivore fauna of Asia is of great value and importance.

The material comes from 10 localities located in Transbaikalia [Zasukhino (section II, layer 5), Tologoi I, Tologoi II, Tologoi (upper layer)] and the Irkutsk Region [Rykovo, Razdolinskaya 7 Cave, Kozlovka Cave, Bolshaya Baidinskaya Cave, Kurten I Cave and Malta]. Tologoi I is dated to the early Late Pliocene (MN16), Zasukhino (section II, layer 5) to the Late Pliocene and Tologoi II to the late Early Pleistocene. The remaining localities represent the Late Pleistocene.

Measurements were taken according to the pattern used for Talpidae by HUTCHISON (1974), and Soricidae by REUMER (1984). The highest number of individual elements (e.g. right first lower molar M_1) was used to denote the minimum number of individuals.

The I^1 , I_1 and A_1 teeth were measured along their buccal side, all other teeth on their occlusal side. Abbreviations include: L = maximal length, W = maximal width, W (med.) = median width and H = maximal height.

The specimens described are housed in the collection of the Institute of Systematics and Evolution of Animals, Polish Academy of Sciences, Kraków.

II. SYSTEMATIC PART

Superorder **Insectivora** (sensu NOVACEK, 1986)

Order **Lipotyphla** HAECKEL, 1866

Suborder **Soricomorpha** SABAN, 1954

Family **Talpidae** FISCHER VON WALDHEIM, 1817

Subfamily **Talpinae** FISCHER VON WALDHEIM, 1817

Genus *Asioscalops* STROGANOV, 1941

Asioscalops altaica NIKOLSKY, 1883

M a t e r i a l. One mandible fragment with M_2 - M_3 and alveoli including the posterior alveolus of P_1 to the second alveolus of the first molar, M_1 , without processes. Minimal number of individuals = 1. Razdolinskaya 7 Cave, Late Pleistocene. No. MF/5120.

D e s c r i p t i o n o f m a t e r i a l. The horizontal ramus of the mandible is narrow. In occlusal view the posterior alveolus of P_1 , and alveoli of P_2 - M_1 are visible. The alveolus of P_1 is the largest and that of P_2 the smallest. Those of P_2 and P_3 lie obliquely to the long axis of the mandible. The anterior parts of their crowns were situated lingually and the posterior ones buccally. Two mental foramina are placed below P_2/P_3 and M_1 .

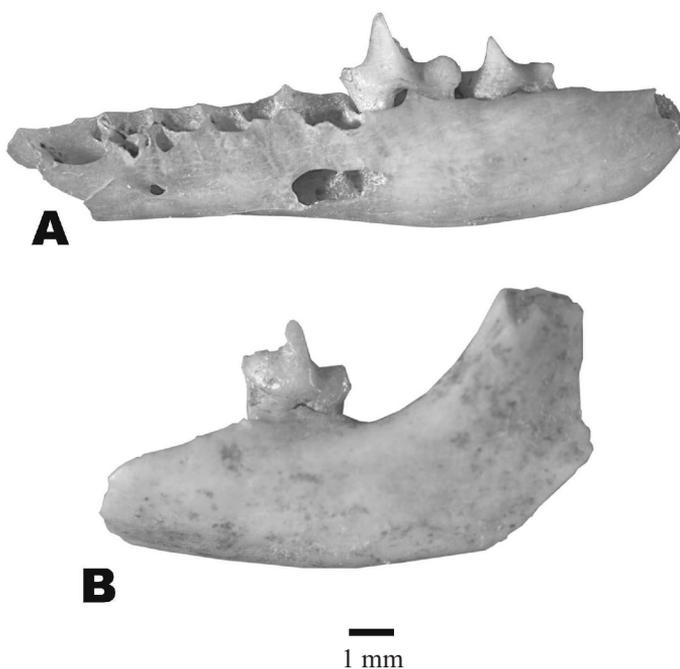


Fig. 1. A – left mandible fragment of *A. altaica*, No. MF/5120, B – left mandible fragment of *Talpidae* gen. et sp. indet., No. MF/5121 (Razdolinskaya 7 Cave).

The molars, M_2 and M_3 , are narrow and the talonid of M_3 extremely narrow. The highest cusp is the protocone. The enamel of teeth is heavily damaged so their structures are not visible.

M e a s u r e m e n t s. H of mandible below $P_2 = 1.70^*$ mm, H of mandible below $M_1 = 1.98$ mm, L of $M_2 = 1.87^*$ mm, W of $M_2 = 0.87^*$ mm, L of $M_3 = 1.55^*$ mm, W of $M_3 = 0.70^*$ mm (* = a little damaged).

S y s t e m a t i c p o s i t i o n a n d d i s t r i b u t i o n. The size of the mandible lies in the range of variation of *Talpa europaea* LINNAEUS, 1758 but its teeth are much smaller than in the latter species. According to YUDIN (1989) this characteristic represents the Siberian mole *Asioscalops altaica* NIKOLSKY, 1883, today the only living mole in Central Siberia. *Talpa europaea*, with much larger teeth, does not reach the Baikal territory. Its eastern boundary is situated in the vicinity of the Irtysh River. Two other Siberian moles of the genus *Mogera* POMEL, 1848 live today more eastwards, on the Japanese Islands, Korea, East China, Primorie etc. Although the material is limited and very badly preserved, the mandible described above undoubtedly belongs to *A. altaica*.

Talpidae gen. et sp. indet.

M a t e r i a l. One short fragment of mandible without teeth (except M_3) and processes. Minimal number of individuals = 1. Razdolinskaya 7 Cave, Late Pleistocene. No. MF/5121.

D e s c r i p t i o n o f m a t e r i a l. The mandible below the M_3 is high and wide.

The M_3 talonid is also wide, but the entoconid is not very large on its lingual side. The enamel on the paraconid is damaged so the presence or absence of the parastyloid can not be confirmed.

M e a s u r e m e n t s. L of $M_3 = 1.70$ mm, W of $M_3 = 0.87$ mm.

S y s t e m a t i c p o s i t i o n. The mandible below the M_3 is much heavier than that described above for *A. altaica* and even heavier than that of *T. europaea*. The M_3 is also larger than its counterpart in the Siberian mole and its talonid is much larger. On the other hand its size is smaller than the size of the M_3 in *T. europaea*. This indicates that during the Pleistocene other species of moles, not present today, probably lived in the Baikal territory. However, the badly preserved and very scant material does not allow for precise identification.

Family **Soricidae** FISCHER VON WALDHEIM, 1817

Subfamily **Crocidurinae** MILNE-EDWARDS, 1874

Genus **Crocidura** WAGLER, 1832

Crocidura sp.

M a t e r i a l. One fragment of mandible with the talonid of the M_1 , M_2 and the talonid of the M_3 without processes (except for a lingual fragment of the lower facet of the condyloid process). Minimal number of individuals = 1. Tologoi II, late Early Pleistocene. No. MF/5122.

D e s c r i p t i o n o f m a t e r i a l. The horizontal ramus is slightly concave below the M_2 . One mandibular foramen is situated below the middle of the internal temporal fossa. This fossa is wide in its lower part.

All teeth are worn and damaged. The talonid of the M_2 is wider than the trigonid.

The talonid of M_3 is reduced to one cusp. Tooth pigmentation is absent.

M e a s u r e m e n t s. See Table I.

S y s t e m a t i c p o s i t i o n a n d d i s t r i b u t i o n. Although the mandible is much damaged some preserved characters indicate that it represents the genus *Crocidura* WAGLER, 1832. In contrast to Soricinae shrews, its teeth are white. They are heavily worn but the pigmentation, if present, should be visible on the buccal side of the paraconids. In this area it descends very low, lower than in the other parts of the molars. The talonid of the M_2 is wide, wider than the trigonid, while e. g. in *Sorex* species the difference in width between the talonids and trigonids is not so

Table I

Dimensions of mandible and lower dentition (in mm) of *Crocidura* sp., *C. suaveolens* and *C. leucodon*

	<i>Crocidura</i> sp. Tologoi II Russia Asia late Early Pleistocene	<i>C. suaveolens</i> Poland Europe Recent	<i>C. leucodon</i> Poland Europe Recent
M ₂ L	1.23	1.20-1.34 (n=11)	1.41-1.53 (n=12)
M ₂ w	0.83	0.83-0.90 (n=11)	0.95-1.04 (n=12)
H of mandible below M ₂	1.34	1.20-1.36 (n=11)	1.44-1.72 (n=12)

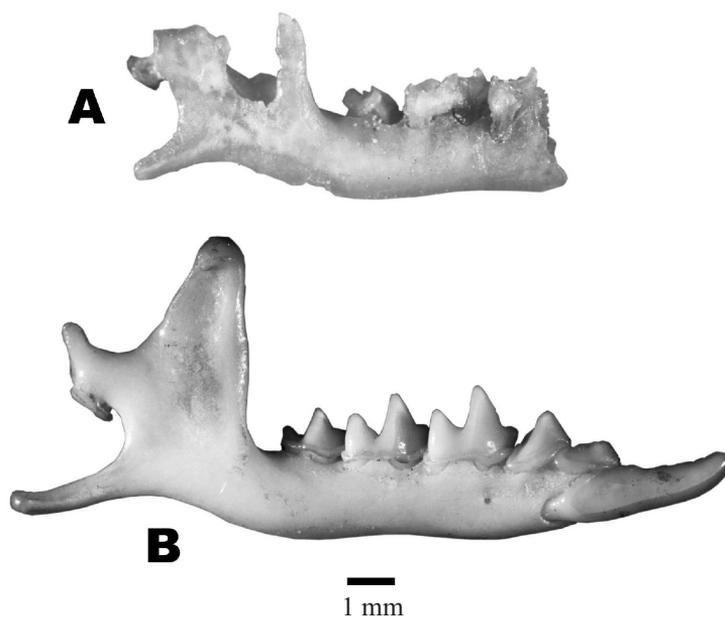


Fig. 2. A – right mandible fragment of *Crocidura* sp., No. MF/5122 (Tologoi II), B – right mandible of *Crocidura suaveolens*, No. M/668 (Recent, Poland, coll. ISEZ PAN).

great. The M₃ in the Tologoi II mandible is reduced, and the lower margin of the internal temporal fossa is long. This indicates that the fossa was large, as usual in *Crocidura* species.

Data on fossil *Crocidura* in Asia is very limited. So far, only three specifically named forms: *C. wongi* (PEI, 1936) from the Early Pleistocene and *C. horsfieldi* (THOMAS, 1856) from the Late Pleistocene of China as well as the Middle/Late Pleistocene *C. dzimezumi* (TEMMINCK, 1843) from Japan are known. Besides these specimens, only Crocidurinae gen. et sp. indet., as well as specifically

unnamed *Crocidura* sp. were mentioned. These fossils were found in localities dated to the Middle and Late Miocene and the Pleistocene, in such areas as Asia Minor, Tadzhikistan, China and Japan (STORCH et al. 1998).

The small size of the specimen described above approaches the size of the Recent *C. suaveolens* (PALLAS, 1811). Today *C. suaveolens* lives in a temperate zone of forests and steppes of the Palearctic, from Spain to Korea in Eurasia and in North Africa. According to YUDIN (1989) it is absent in Siberia between the Ob river and lake Baikal, but it is known from the area of Zabaikalia. GUREEV (1979) mentioned it also from South Buryatia.

Two species, *C. lasiura* DOBSON, 1980 and *C. sibirica* DUKELSKY, 1930 which are listed by YUDIN (1989) from Siberia are much larger than *C. suaveolens* and their Recent ranges do not overlap the Baikal area (although WOLSAN and HUTTERER 1998 write that *C. sibirica* lives near Lake Baikal).

In Europe, *C. suaveolens* is known since the Early Pleistocene. It is also possible that it appeared this early in eastern Asia. It may well be, however, that during the Pleistocene other species of the genus *Crocidura* inhabited this part of Siberia. As the material is very limited and badly preserved and as we still know little of the fossil *Crocidura* species in Asia, the mandible from Tologoi II was tentatively identified as *Crocidura* sp.

Subfamily **Soricinae** FISCHER VON WALDHEIM, 1817

Tribe **Blarinellini** REUMER, 1998

Genus **Petenya** KORMOS, 1934

Petenya sp.

M a t e r i a l. Four mandible fragments with teeth and processes, except A₁-P₄ and the coronoid process. The minimal number of individuals = 3. Tologoi I, early Late Pliocene (MN16). No. MF/2217.

D e s c r i p t i o n o f m a t e r i a l. The horizontal ramus of the mandible is short and relatively high, and its lower margin convex. The coronoid process is broken. The lower part of the external temporal fossa does not reach much below the level of the upper sigmoid notch. The internal temporal fossa is triangular and not very high. The upper facet of the condyle is cylindrical, the lower one is higher anteriorly than posteriorly. The interarticular area is broad and low. There are two mandibular foramina. The mental foramen is situated between the protoconid and hypoconid of the M₁.

The I₁ is bicuspluate. The apex is pointed and cuspules are not very prominent when compared to other Soricini species. The buccal cingulum is weakly developed along the dorsal edge.

The M₁ is relatively wide. Its entoconid is separated from the hypolophid by a wide valley. The entoconid crest is very high. The buccal re-entrant valley opens low, directly above the buccal cingulum. It is broad and well-pronounced. The lingual cingulum is less developed than the buccal one.

The M₂ is similar but smaller. The M₃ is characterized by a reduced talonid. It bears only a comma-shaped hypoconid. The entoconid and talonid basin are lacking.

M e a s u r e m e n t s. See Table II.

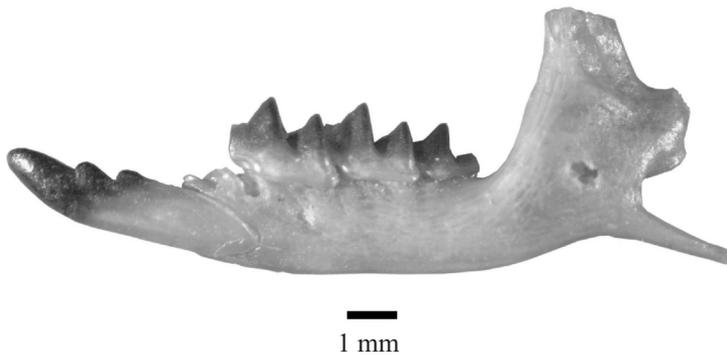
S y s t e m a t i c p o s i t i o n a n d d i s t r i b u t i o n. Characters such as a short and massive mandible, the mental foramen situated below the re-entrant valley of the M₁, the broad lower condylar facet and interarticular area, lower molars with high entoconid crests, the M₃ with a single cusped talonid and dark red (almost black) pigmentation of teeth, identify these remains as belonging to the genus *Petenya* KORMOS, 1934.

The comparisons of the *Petenya* remains from Tologoi I are here restricted to mandibles of the Blarinellini genera described from Eurasia which are characterized by a reduced talonid of the M₃, and a broad interarticular area of the condyle.

Table II

Dimensions of mandible and lower dentition (in mm) of *Petenya* species

		<i>Petenya</i> sp. Tologoi I Russia Asia Late Pliocene (MN16)	<i>P. katrinae</i> Bilike China Asia Early Pliocene (MN14) QIU and STORCH 2000	<i>P. dubia</i> Podlesice Poland Europe Early Pliocene (MN14) RZEBIK-KOWALSKA 1989	<i>P. hungarica</i> R. Królewskie 1A Poland Europe Late Pliocene (MN16) RZEBIK-KOWALSKA 1989
I ₁	L	3.66-3.74 (n=2)	3.56-3.92 (n=10)	3.41-3.77 (n=17)	3.50-3.94 (n=7)
	H	0.90-0.94 (n=2)	–	0.91-1.02 (n=18)	0.95-1.04 (n=10)
M ₁	L	1.37	1.48-1.56 (n=10)	1.30-1.38 (n=21)	1.30-1.42 (n=14)
	w	0.87	0.88-1.00 (n=10)	0.89-0.94 (n=20)	0.91-0.95 (n=13)
M ₂	L	1.24-1.38 (n=3)	1.40-1.44 (n=10)	1.18-1.29 (n=21)	1.18-1.32 (n=21)
	w	0.82-0.88 (n=3)	0.84-1.04 (n=10)	0.79-0.88 (n=21)	0.80-0.90 (n=21)
M ₃	L	1.08-1.14 (n=2)	1.08-1.22 (n=10)	1.08-1.16 (n=14)	1.03-1.17 (n=12)
	w	0.66 (n=2)	0.70-0.88 (n=10)	0.60-0.67 (n=14)	0.60-0.70 (n=12)
M ₁ -M ₃ L		3.65	3.80-4.04 (n=8)	3.48-3.69 (n=12)	3.45-3.68 (n=4)
H of mandible below M ₂		1.43-1.66 (n=3)	–	1.35-1.56 (n=20)	1.49-1.66 (n=22)
H of condyloid process		2.03	–	–	–
W of interarticular area		0.82	–	–	–

Fig. 3. Left mandible of *Petenya* sp., No. MF/2217 (Tologoi I).

Paenpetenyia STORCH, 1995 was described from Ertemte 2 in China (MN13). Apart from some morphological characters (less massive I_1 , less square lower molars M_1 - M_2 , less posteriorly situated lower articular facet and slightly more reduced M_3) differs from *Petenya* by its much larger size (e. g. L of I_1 = 4.64-4.68 mm, (n=4); L of M_1 = 1.64-1.84 mm, (n = 10); H of mandible below M_2 = 1.84-2.00 mm, (n = 10) (STORCH 1995).

Cokia STORCH, 1995 also described from Ertemte 2, was very peculiar and can be easily distinguished from *Petenya* by an extremely heavy horizontal ramus with a strongly convex lower margin, a very robust I_1 , and different lower molars (M_1 - M_2). They have a more quadrate occlusal outline, lower and not very sharp tooth cusps, narrower and much shallower postentoconid notches and inflated labial cingulum.

Alloblarinella STORCH, 1995, the third genus described from Ertemte 2 differs from *Petenya* by more rectangular and relatively narrower M_1 - M_2 , with higher and longer entoconid crests and narrower postentoconid notches, as well as a relatively larger M_3 . Its M_2/M_3 ratio = 0.98-1.06 (STORCH 1995) while in *Petenya* the same ratio = 1.07-1.21 (RZEBIK-KOWALSKA 1989).

Fossil European *Hemisorax* BAUDELLOT, 1967 described from Sansan in France (MN6) differ from *Petenya* by a more primitive structure of the condyloid process, lower entoconid crests of lower molars and a lesser reduction of the talonid in M_3 (BAUDELLOT 1967).

Deinsdorfia HELLER, 1963, belonging to the tribe Soricini and more or less similar in size, also has a reduced M_3 , differs from *Petenya* by lower entoconid crests in M_1 - M_2 and a lower coronoid process (RZEBIK-KOWALSKA 1989, 1990).

The size of *Petenya* specimens from Tologoi I lies in the range of variation of other species of this genus described from Eurasia. So far three species of *Petenya*, *P. hungarica* KORMOS, 1934, *P. dubia* BACHMAYER and WILSON, 1970 and *P. katrinae* QIU and STORCH, 2000 are currently recognized. The first two were described from Europe and the third from Asia. *P. dubia* was described from Kohfidisch in Austria, dated to the Late Miocene (MN11). It was later found in other localities of Europe dated from the early Late Miocene (MN9) to the Miocene/Pliocene boundary (MN13/MN14) (RZEBIK-KOWALSKA 1998). In 1984 this species was relegated by REUMER to the genus *Blarinella* THOMAS, 1911, but STORCH and QIU (1991) and STORCH (1995) demonstrated that it is distinct from the extant genus, and restored it to *Petenya*.

P. hungarica was described from Villány-Kalkberg (now Villány 3) in Hungary, dated to the Late Pliocene (MN17). It shows a remarkably long stratigraphic range, from the Miocene/Pliocene boundary (Maramena in Greece, MN13/MN14, DOUKAS et al. 1995) to the end of the Early Pleistocene (Urşilor Cave in Romania, TERZEA 1983). Thus, in Europe two species of the genus *Petenya* were found in many countries, in localities dated from the early Late Miocene (MN9) to the Early Pleistocene (RZEBIK-KOWALSKA 1998).

The Asiatic *P. katrinae* QIU and STORCH, 2000 was described from Bilike in China. This locality is dated to the Early Yushean, the equivalent of the Early Ruscinian (MN14). *P. katrinae* can be distinguished from European species by the morphology of the upper teeth. Unfortunately in the material from Tologoi I the upper jaw is lacking. Without more material the specific position of *Petenya* from Tologoi I cannot be ascertained.

In Asia, aside from *P. katrinae*, this genus, cited as *Petenya* sp., is known from several localities of West Siberia dated from the Late Miocene to the Late Pliocene (MN12-MN17). It was also listed as *Petenya* sp. from several Mongolian localities and one locality from Transbaikalia. In Transbaikalia it was found in the late Pliocene Beregovaya (south of Ulan Ude, near the Mongolian border, (STORCH et al. 1998).

Genus *Neomys* KAUP, 1829*Neomys fodiens* (PENNANT, 1771)

M a t e r i a l. Two mandible fragments, one with I₁ and P₄-M₁, and the second with M₂-M₃, both without processes. The minimal number of individuals = 1, Kozlovka Cave, Late Pleistocene. No. MF/5123.

D e s c r i p t i o n o f m a t e r i a l. The mental foramen is situated below the re-entrant valley of the M₁.

The cutting edge of the I₁ is damaged, but it is clearly monocuspulate. The buccal cingulum of this tooth is wide but only slightly protruding.

The P₄ has two cusps. It is short and high. Clear cingula occur on both sides of the tooth.

The lower molars M₁-M₃ are of a typical *Neomys* shape. In the M₁ and M₂ the protoconids and the metaconids are close together, causing a narrowing of the trigonids. On both teeth the buccal re-entrant valley opens low, directly above the broad, well-pronounced, undulate buccal cingulum. The lingual cingulum is also well developed. The entoconid crests are not very high.

The M₃ has a well developed talonid and strong cingula on both sides.

M e a s u r e m e n t s. See Table III.

Table III

Dimensions of mandible and lower dentition (in mm) of *Neomys fodiens*

		Kozlovka Cave Russia Asia Late Pleistocene	Poland Europe Recent
I ₁	L	4.58	4.44-4.84 (n=8)
	H	0.92	0.94-1.10 (n=9)
P ₄	L	1.34	1.35-1.47 (n=9)
	W	0.87	0.72-0.94 (n=15)
M ₁	L	1.79	1.67-1.89 (n=9)
	W	1.04	1.06-1.15 (n=9)
M ₂	L	1.54	1.54-1.63 (n=9)
	W	0.99	0.98-1.05 (n=9)
M ₃	L	1.25	1.26-1.34 (n=9)
	W	0.75	0.74-0.82 (n=9)

S y s t e m a t i c p o s i t i o n a n d d i s t r i b u t i o n. A composition of characters such as the monocuspulate I₁, the morphology of lower molars (with undulate buccal cingulum, low entoconid crests and deep re-entrant valley) as well as the posterior position of the mental fora-

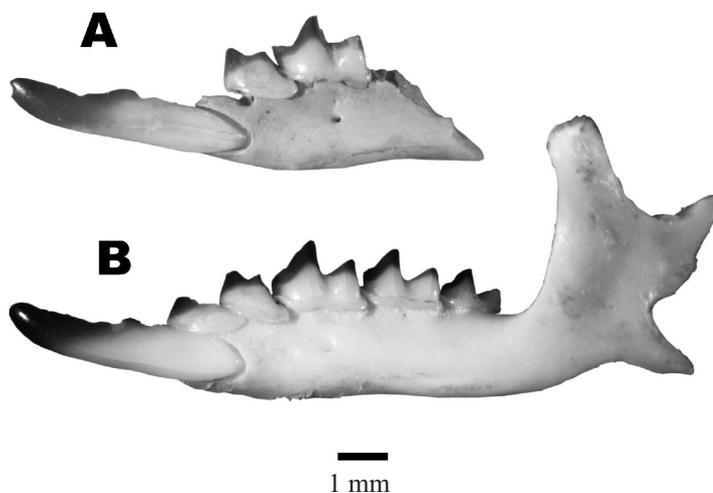


Fig. 4. A – left mandible fragment of *N. fodiens*, No. MF/5123 (Kozlovka Cave), B – left mandible of *N. fodiens*, No. M/2766 (Recent, Poland, coll. ISEZ, PAN).

men allow the identification of these remains as *Neomys* KAUP, 1829, and the large size as *N. fodiens* (PENNANT, 1771). The remaining three to four fossil species of *Neomys*: *N. newtoni* HINTON, 1911, *N. browni* HINTON, 1911, *N. hintoni* ZAITSEV and BARYSHNIKOV, 2002, and *N. intermedius* BRUNNER, 1952, and two Recent *N. anomalus* CABRERA, 1907 and *N. teres* MILLER, 1908 (= *N. schelkovnikovii* SATUNIN, 1913) are much smaller. Besides, they are not present today in the vicinity of Baikal (RZEBIK-KOWALSKA 1998, ZAITSEV and BARYSHNIKOV 2002). The only species of this genus living recently in this area is *N. fodiens*. It has a large range in the entire northern and central Palaearctic. In Europe *N. fodiens* is known from the Middle Pleistocene onwards but this is the first record of fossil *N. fodiens* from Asia.

Genus *Sorex* LINNAEUS, 1758

Sorex minutissimus ZIMMERMANN, 1780

M a t e r i a l. One mandible with teeth and processes, with the exception of an A_1 and the angular process. The minimal number of individuals = 1, Bolshaya Baidinskaya Cave, Late Pleistocene. No. MF/5124.

D e s c r i p t i o n o f m a t e r i a l. The horizontal ramus of the mandible is comparatively massive, its lower margin is only slightly concave. The coronoid process is very narrow, rounded at the tip and bends slightly anteriorly. The coronoid spicule is clear. The external temporal fossa is very distinct. It is deepest below the coronoid spicule. It reaches the upper sigmoid notch. The internal temporal fossa is narrow and high. Two mandibular foramina are present. The mental foramen lies behind the protoconid of the M_1 (the morphotype 2). The condyloid process is rather short and its interarticular area comparatively short and wide (the morphotype 2) (ZAITSEV and RZEBIK-KOWALSKA 2003). The sigmoid spicule is very weak.

The I_1 is comparatively massive, tricuspluate with distinct cusps. Its buccal cingulum is narrow and not very pronounced.

The P_4 is large with a wide cingulum on both sides. Its postero-lingual basin is well developed.

The *Sorex*-like molars are characterized by a high endoconid crest. The lower lingual margins of their crowns are navicular. The buccal cingulum is not very wide but protruding, the lingual one is

wide. The M_2 is smaller than M_1 . The M_3 is not reduced. Its talonid is basined and encompasses an entoconid and hypoconid.

M e a s u r e m e n t s. See Table IV.

Table IV

Dimensions of mandible and lower dentition (in mm) of *Sorex minutissimus*

	B. Baidinskaya Cave Russia Asia Late Pleistocene	Kozi Grzbiet Poland Europe early Middle Pleistocene RZEBIK-KOWAL- SKA 1991	Mamutowa Cave Cave Poland Europe Late Pleistocene RZEBIK-KOWAL- SKA 1991	Finland Europe Recent SULKAVA 1990	Russia Asia Recent YUDIN 1989	Russia Asia Recent*
I_1						
L	2.35	–	2.44	–	–	2.46-2.53 (n=2)
H	0.59	–	0.62-0.68 (n=2)	–	–	0.66-0.68 (n=2)
P_4						
L	0.71	0.85 (n=2)	0.87	–	–	0.69-0.88 (n=2)
W	0.48	0.51-0.56 (n=2)	0.53	–	–	0.53-0.58 (n=2)
M_1						
L	0.98	1.02-1.12 (n=10)	1.06-1.13 (n=3)	–	–	1.15-1.18 (n=2)
W	0.62	0.62-0.74 (n=10)	0.70-0.72 (n=3)	–	–	0.68 (n=2)
M_2						
L	0.87	0.88-1.00 (=8)	1.00 (n=2)	–	–	1.05-1.07 (n=2)
W	0.59	0.58-0.63 (n=8)	0.63-0.67 (n=2)	–	–	0.64-0.66 (n=2)
M_3						
L	0.76	0.81-0.89 (n=6)	0.88	–	–	0.87-0.88 (n=2)
W	0.47	0.45-0.55 (n=6)	0.56	–	–	0.52-0.55 (n=2)
M_1 - M_2 L	2.60	2.75-2.91 (n=6)	2.89	–	–	2.98-3.03 (n=2)
H of mandible below M_2	0.75	0.85-0.90 (n=10)	0.82-0.85 (n=2)	–	–	0.92-0.93 (n=2)
H of ascending Ramus	2.57	2.73-2.81 (n=2)	2.84	2.80-3.20 (n=15)	2.40-3.40 (n=179)	2.99-3.15 (n=2)
W of coronoid process	0.44	0.57-0.61 (n=3)	0.49-0.54 (n=2)	–	–	0.60-0.62 (n=2)
H of condyloid process	1.13	1.25 (n=2)	1.16-1.21 (=2)	–	–	1.27-1.30 (n=2)
W of interar- ticular area	0.45	–	0.30	–	–	0.43-0.55 (n=2)

*two specimens from ISEZ PAN collection

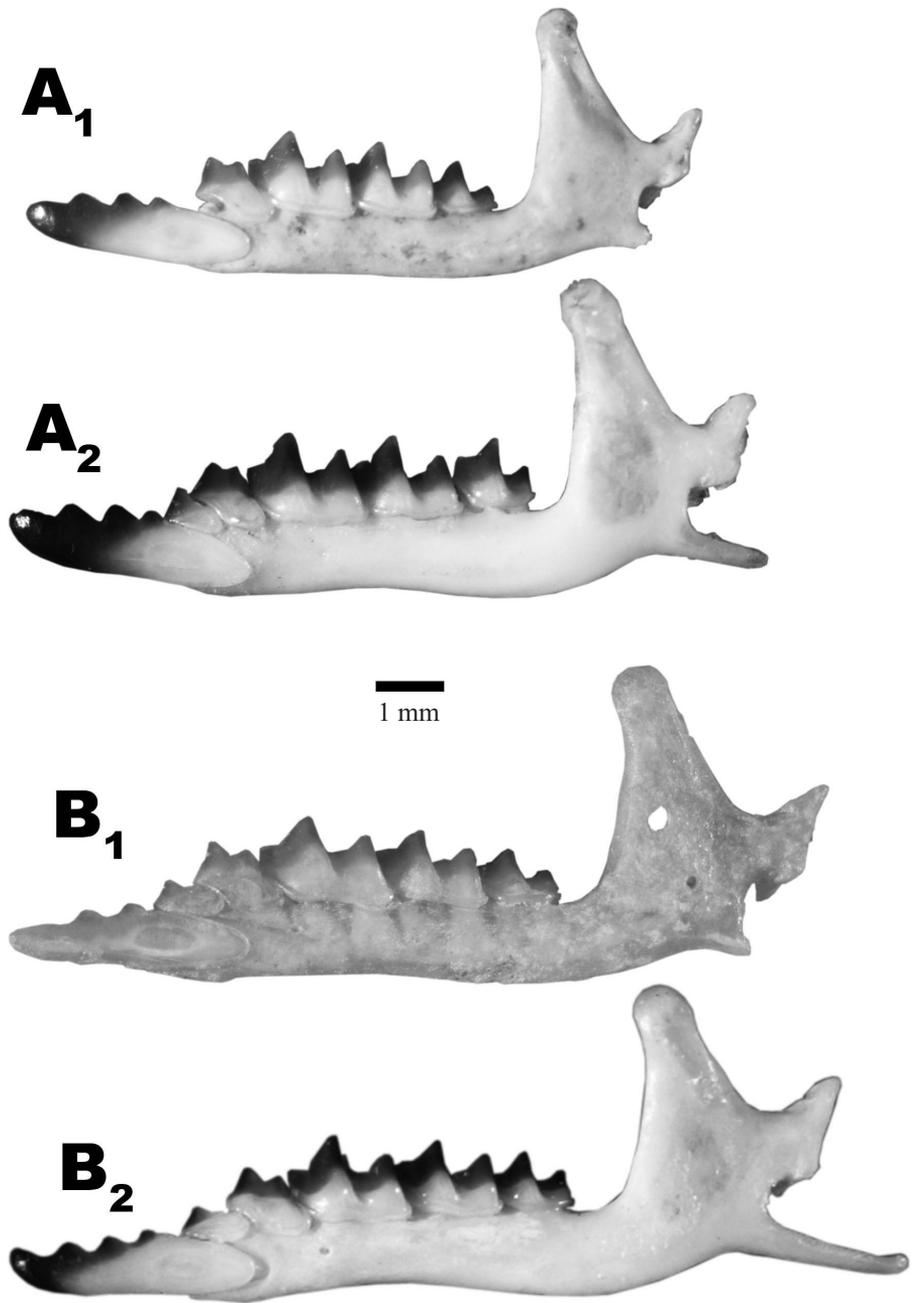


Fig. 5. A₁ – left mandible of *S. minutissimus*, No. MF/5124 (Bolshaya Baidinskaya Cave), A₂ – left mandible of *S. minutissimus*, No. M/11361 (Recent, East Siberia, coll. ISEZ PAN), B₁ – left mandible of *S. minutus*, No. MF/5126/1 (Razdolinskaya 7 Cave), B₂ – left mandible of *S. minutus*, No. M/11858 (Recent, Poland, coll. ISEZ PAN).

S y s t e m a t i c p o s i t i o n a n d d i s t r i b u t i o n. The very small size as well as the morphology described above (massive I_1 with distinct cusps, comparatively low condyloid process, and the posterior position of mental foramen) indicate that the specimen from Bolshaya Baidinskaya Cave belongs to *S. minutissimus* ZIMMERMANN, 1780.

A comparison of the small Recent *Sorex gracillimus* THOMAS, 1907 and *S. minutissimus* (which can occur together in Siberia) indicates that the first one is larger, has a wide coronoid process, especially at the level of the upper sigmoid notch, its condyloideus process is comparatively high and the mental foramen is situated more anteriorly, underneath the P_4/M_1 transition.

On the other hand, a comparison of the Bolshaya Baidinskaya specimen with the Recent *S. minutissimus* shows that the fossil specimens and especially the individual from Bolshaya Baidinskaya Cave are a little smaller and more delicate. This indicates that the size of this species increased over geological time. This change occurs in many evolutionary lineages of shrews.

Today *S. minutissimus* inhabits regions from Finland to East Siberia and Japan. It is associated with the taiga zone and is a particularly good indicator of cold, boreal conditions. In the Pleistocene of Europe its range spread more west- and southwards. So far, the oldest, Early Pleistocene remains of this smallest Eurasian *Sorex* shrew are known from Bulgaria (Cave 15-I of Temnata-Prochodna Cave System). In the Middle Pleistocene it was found in Poland, Bulgaria, France and Germany, in the Late Pleistocene in Austria, France, Germany, Poland and Slovakia, and as *S. cf. minutissimus*, it was also cited from the Late Pleistocene of Germany and England (RZEBIK-KOWALSKA 1998). It withdrew to its present European range at the end of the last glaciation. So far, in Asia it was listed once, from the Middle Pleistocene of Honshu Island (Japan) (STORCH et al. 1998).

Karyologically, *S. minutissimus* belongs to the 42 group ($2N = 42$) but the homogeneity of this group is not recognized (ZIMA et al. 1998). Some authors (TADA and OBARA 1988) consider *S. minutissimus* as an ancestor of at least part of this group, but paleontological data are not sufficient to resolve this problem.

Sorex minutus LINNAEUS, 1766

M a t e r i a l. One right mandible with all teeth, coronoid and condyloid processes. Minimal number of individuals = 1. Kozlovka Cave, Late Pleistocene. No. MF/5125. Two mandibles and seven fragments of mandibles with all teeth and processes except for the angular process. Minimal number of individuals = 6. Razdolinskaya 7 Cave, Late Pleistocene. No. MF/5126.

D e s c r i p t i o n o f m a t e r i a l. The apex of the coronoid process is narrow and rounded. It bends towards the anterior. The coronoid spicule is hardly visible. The external temporal fossa is not very deep and reaches the level of the upper sigmoid notch. The internal temporal fossa is triangular and high. It continues almost to the tip of the coronoid process. The condyloid process represents morphotype 1 characterized by a narrow (in its lower part) interarticular area. Its lower edge meets approximately the middle of the upper edge of the lower facet and its internal edge is more or less straight. The mental foramen is situated in the anterior position, underneath the P_4/M_1 transition (the morphotype 1). Mandibular and postmandibular foramina are present (ZAITSEV and RZEBIK-KOWALSKA 2003).

The I_1 is narrow and tricuspluate. A weak cingulum is situated along its buccal posterior margin.

The A_1 is long on the buccal side, one with a trace of the second cusp, the other is worn so it is difficult to say if a second cusp was present. Its buccal cingulum is wide and flat, and the lingual one wider and more protruding.

The P_4 is also long and two-cusped. Its postero-lingual basin is well developed and the cingulum similar to that in A_1 .

The M_1 and M_2 are similar in morphology, but M_1 is larger. Their buccal re-entrant valleys open at some distance above the buccal cingulum. The entoconid crests are rather high, and the entostylids and mesocodids are present. The buccal cingula are well-developed, narrow and protruding, the lingual ones are larger but flat.

The M₃ is unreduced, but its talonid is narrower than the trigonid.

M e a s u r e m e n t s. See Table V.

Table V

Dimensions of mandible and lower dentition (in mm) of *Sorex minutus*

	Kozlovka Cave Russia Asia Late Pleistocene	Razdolinskaya 7 Cave Russia Asia Late Pleistocene	Poland Europe Recent	Russia Asia Recent YUDIN 1989
I ₁				
L	–	2.61-2.67 (n=2)	2.52-2.85 (n=34)	–
H	0.62	0.59-0.67 (n=3)	0.60-0.70 (n=40)	–
A ₁				
L	0.70	0.77	0.62-0.83 (n=38)	–
P ₄				
L	0.78	0.72-0.86 (n=4)	0.77-0.99 (n=40)	–
W	0.48	0.46-0.56 (n=4)	0.48-0.57 (n=40)	–
M ₁				
L	1.17	1.13-1.28 (n=8)	1.11-1.25 (n=40)	–
W	0.65	0.64-0.67 (n=8)	0.66-0.75 (n=40)	–
M ₂				
L	1.01	0.97-1.07 (n=9)	0.99-1.10 (n=40)	–
W	0.59	0.58-0.63 (n=9)	0.58-0.72 (n=40)	–
M ₃				
L	0.82	0.85-0.97 (n=6)	0.91-1.04 (n=40)	–
W	0.47	0.48-0.51 (n=6)	0.48-0.57 (n=40)	–
M ₁ -M ₃ L	3.02	3.02-3.26 (n=5)	3.00-3.28 (n=40)	–
H of mandible below M ₂	0.78	0.76-0.92 (n=9)	0.86-1.08 (n=40)	–
H of ascending ramus	2.98	3.00-3.12 (n=2)	2.90-3.25 (n=40)	2.70-3.20 (n=188)
W of coronoid process	0.57	0.48-0.63 (n=3)	0.48-0.69 (n=40)	–
H of condyloid process	1.44	1.36-1.41 (n=3)	1.37-1.62 (n=39)	–
W of interarticular area	0.49	0.42-0.50 (n=3)	0.41-0.56 (n=40)	–

S y s t e m a t i c p o s i t i o n a n d d i s t r i b u t i o n. The very small size as well as the morphology described above attribute the specimen from Kozlovka Cave and Razdolinskaya 7 Cave to the Recent species – *S. minutus* LINNAEUS, 1766. It does not differ in any way from the

comparative material of living Polish *S. minutus* used. It is also similar to other small Asiatic shrew of the genus *Sorex*, *S. gracillimus* THOMAS, 1907, which was originally described as *S. minutus gracillimus*. In 1965, YUDIN elevated it to specific status. Differences between *S. minutus* and *S. gracillimus* are best visible on the upper jaws which are missing in the Kozlovka and Razdolinskaya 7 material. However the presence of *S. gracillimus* on the western Baikal territory is less probable because its Recent range is shifted much more eastwards. This species lives today on the southern shore of the Sea of Okhotsk (Russia) to North Korea, Sakhalin Island, south Kuril Islands, and Hokkaido in Japan.

The Recent *S. minutus* inhabits a large area from northern Spain in Europe to Lake Baikal in Asia. It is the oldest specifically identified *Sorex* in Europe. It was found in Early Pliocene (MN14) localities, dating back about five million years (RZEBIK-KOWALSKA 1998). Therefore, it was the first of the living *Sorex* species that appeared on this continent and persisted until the Recent. Later (during the Late Pliocene and the Pleistocene), *S. minutus* was already very common in the European fauna.

As concerns Asia, *S. minutus* was found only once, in the Early Pleistocene deposits of China (STORCH et al. 1998). Besides, ZAITSEV and BARYSHNIKOV (2002) described *S. cf. minutus* from the Middle Pleistocene deposits of the Caucasus Mountains.

The origin and the phylogenetic relationship of *S. minutus* with other fossil and Recent *Sorex* species is not clear. According to STORCH et al. (1998) the supposed ancestor of *S. minutus* could be *S. minutoides*. It was described by STORCH in 1995 from Ertemte 2 in China, a locality dated to the end of the Late Miocene. This very small species was more primitive than its supposed descendant *S. minutus* and various common characters suggest a close relationship of *S. minutoides* with *S. minutus*. The divergence of this lineage (*S. minutoides* – *S. minutus*) from other *Sorex* took place probably in the Late Miocene.

Sorex roboratus HOLLISTER, 1913

M a t e r i a l. One mandible with I₁, M₁-M₃ and the coronoid and condyloid processes. Minimal number of individuals = 1, Bolshaya Baidinskaya, Late Pleistocene. No. MF/5127.

D e s c r i p t i o n o f m a t e r i a l. The coronoid process is wide and low, and its narrow apex only slightly bends towards the anterior. The coronoid spicule is situated high and is well developed. The external temporal fossa is large and deep. It reaches a little lower than the level of the upper sigmoid notch. The internal temporal fossa is also large, but not very high. It reaches half of the height of the coronoid process. It has the shape of an equilateral triangle with rounded angles. The external pterygoid fossa is shallow and the pterygoid spicule is hardly visible. The condyloid process represents an intermediate type between the morphotype 1 and 2 (ZAITSEV and RZEBIK-KOWALSKA 2003). It is high and its interarticular area is not very wide. The upper facet is long, narrow, cylindrical in shape, the lower one short, very wide and concave in its lingual side. Mandibular and postmandibular foramina are present. The mental foramen is situated in the posterior position. It lies under the M₁, between its protocone and re-entrant valley (morphotype 2) (ZAITSEV and RZEBIK-KOWALSKA 2003).

The I₁ is long, massive, and its cusps are very well developed. They diminish posteriorly. Its buccal cingulum is hardly visible.

The molar crowns are narrow, and their entoconid crests well developed. In the M₁ the buccal re-entrant valley opens at some distance above the buccal cingulum, in the M₂ directly above it. The buccal cingulum is narrow and slightly undulated; the lingual one is wide and straight.

The M₃ is not reduced.

M e a s u r e m e n t s. See Table VI.

S y s t e m a t i c p o s i t i o n a n d d i s t r i b u t i o n. The large maxillae present in the material of Bolshaya Baidinskaya cannot be ascribed to this species because their upper molars are characterized by high metalophs, while the teeth of *S. roboratus* are devoid of this feature. On the other hand the morphology of this characteristic mandible from Bolshaya Baidinskaya

Table VI

Dimensions of mandible and lower dentition (in mm) of *Sorex roboratus*

	B. Baidinskaya Cave Russia Asia Late Pleistocene	Amurskaya Province Russia Asia Recent*	Russia Asia Recent YUDIN 1989
I ₁	L 4.18	3.96-4.40 (n=5)	–
	H 0.94	0.85-0.93 (n=5)	–
M ₁	L 1.48	1.42-1.53 (n=5)	–
	W 0.77	0.74-0.81 (n=5)	–
M ₂	L 1.26	1.17-1.27 (n=5)	–
	W 0.78	0.72-0.75 (n=5)	–
M ₃	L 0.99	1.00-1.06 (n=5)	–
	W 0.59	0.58-0.62 (n=5)	–
M ₁ -M ₃	L 3.73	3.61-3.82 (n=5)	–
	H of mandible below M ₂ 1.38	1.24-1.36 (n=5)	–
	H of ascending ramus 4.20	4.10-4.38 (n=5)	3.90-5.10 (n=425)
	W of coronoid process 0.89	0.67-0.87 (n=5)	–
	H of condyloid process 2.51	2.10-2.43 (n=4)	–
	W of interarticular area 0.65	0.58-0.70 (n=5)	–

*specimens from the Zoological Institute, Russian Academy of Sciences (St. Petersburg)

Cave does not differ from the morphology of the Recent *S. roboratus* HOLLISTER, 1913 and its measurements also lie in the range of variation of this east Palaearctic species. Described by HOLLISTER in 1913, in 1914 it was named as *Sorex vir* by ALLEN, and later it was considered a subspecies of *S. araneus* (STROGANOV 1957). However, in 1989 YUDIN proved that it was a distinct species. The karyological study of ORLOV and KOZLOVSKII (1971) supported this distinction. Taking into account the priority of name it is identified now as *S. roboratus*. Today, according to YUDIN (1989), *S. roboratus* inhabits a large area of Siberia, from the eastern bank of the Ob river to Czuzkotka and Primorie. The fossil locality (Bolshaya Baidinskaya Cave), where this specimen was found lies in the Recent range of *S. roboratus*. This is the first fossil record of this shrew.

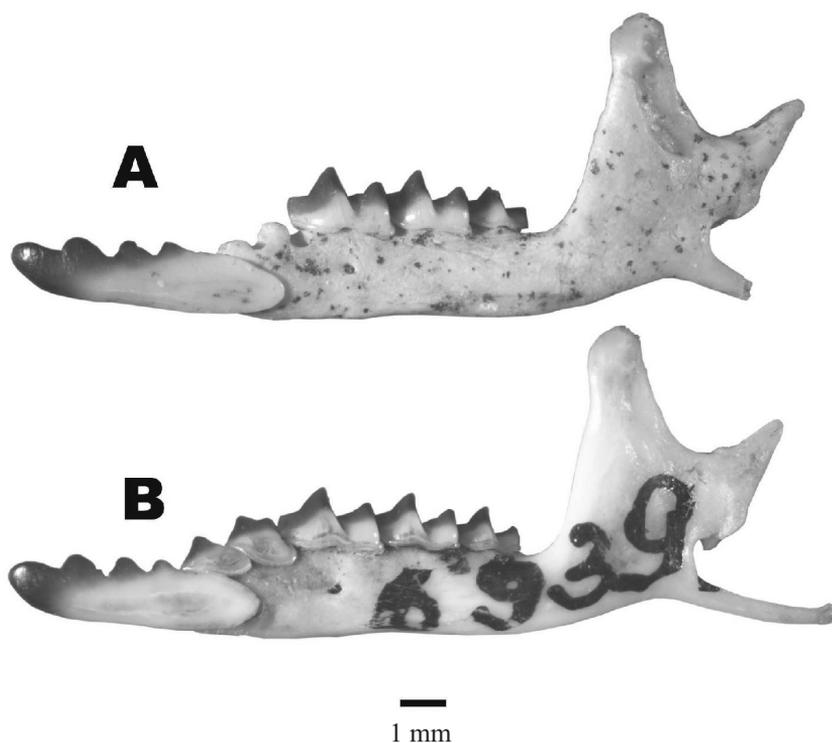


Fig. 6. A – left mandible of *S. roboratus*, No. MF/5127 (Bolshaya Baidinskaya), B – left mandible of *S. roboratus*, No. 6939 (Recent, Amurskaya Province, Russia, coll. ZI, St. Petersburg).

Sorex cf. *isodon* TUROV, 1924

M a t e r i a l. Five fragments of maxilla with teeth (A^1 , A^5 and P^4 - M^2) and two mandible fragments with teeth and processes, except I_1 and A_1 and the angular process. The minimal number of individuals = 3, Bolshaya Baidinskaya Cave, Late Pleistocene. No. MF/5128.

D e s c r i p t i o n o f m a t e r i a l. Only two antemolars, A^1 and A^5 , are present. They are unicuspid.

The A^1 is large and triangular in shape. Its cusp is situated more or less in the middle of the crown. The buccal side of the tooth is slightly convex, the lingual one concave. Three crests run from the tip of the cusp: the first crest to the anterior corner of the crown, the second to the postero-buccal, and the third to the antero-lingual cingulum. The last crest divides the lingual depression into two parts: a smaller antero-lingual, and much larger postero-lingual.

The A^5 is much smaller than A^1 , and its morphology is similar to the morphology of the first antemolar. It is, however more quadrate in shape, and its anterior depression is much smaller. Both teeth have well-developed cingula all around.

The P^4 has a large parastyle and a long parastylar crest. The protocone is situated relatively far buccally. It is L-shaped and separated from the middle-sized hypocone by a large valley. The lingual, posterior and postero-buccal cingula are present.

The M^1 and M^2 are similar, but the M^2 is smaller. Their highest cusp is the metacone, the largest one the protocone. The hypocone is well developed, the metaloph is high and the protocone/hypocone valley is not very deep. The well developed cingulum is present below the protocone/hypocone valley, and on the posterior side of the crown. The buccal one is rather weak. The posterior emargination of the P^4 and M^1 - M^2 is deep.

The coronoid process of the mandible is not very high, its tip is rather wide and the coronoid spicule is well-developed. It is situated close to the tip of the process. The external temporal fossa is large and pretty deep. It extends downwards to a level half-way along the condyloid process. The internal temporal fossa extends to the tip of the coronoid process, but possesses a horizontal bar separating the shallow upper part from the deep lower part of the fossa. The condyloid process is rather high. Its interarticular area is of the middle size and the lower facet short and not very wide. It represents morphotype 1 (ZAITSEV and RZEBIK-KOWALSKA 2003). Two mandibular foramina are large and they lie in one groove. The mental foramen is situated in front of the protoconid of M₁ (morphotype 2) (ZAITSEV and RZEBIK-KOWALSKA 2003).

The P₄ is bicuspid and relatively narrow. Its postero-lingual basin is well developed. Its cingulum is strong on both sides, but the lingual one is very flat.

The M₁ and M₂ are similar in morphology, but the M₁ is larger. Their talonids are a little wider than trigonids, their re-entrant valley opens near the buccal cingulum, the protoconids and metaconids lie close together and their tips slightly bend in the posterior direction. The entostylids are present. The cingula are narrow in their buccal sides and wide in its lingual sides but more pronounced buccally than lingually. The most characteristic feature of these molars, however, is the structure of the entoconid crest. It forms a cusp (not a crest) between the metaconid and entoconid and is separated from the entoconid by a shallow, narrow groove.

The M₃ is not reduced, basined and provided with both hypoconid and entoconid.

M e a s u r e m e n t s. See Tables VII and VIII.

Table VII

Dimensions of upper teeth (in mm) of *Sorex cf. isodon* and *S. isodon*

		<i>S. cf. isodon</i> Bolshaya Baidinskaya Cave Russia Asia Late Pleistocene	<i>S. isodon</i> Amurskaya Province* Russia Asia Recent
A ¹	L	0.96-1.00 (n=2)	0.86-0.94 (n=5)
	W	0.90 (n=2)	0.79-0.85 (n=5)
A ⁵	L	0.62	0.59-0.68 (n=5)
	W	0.68	0.59-0.66 (n=5)
P ⁴	L	1.48-1.58 (n=5)	1.44-1.52 (n=5)
M ¹	L	1.40-1.49 (n=2)	1.40-1.48 (n=5)
	L (med.)	1.11-1.20 (n=2)	1.14-1.21 (n=5)
	W	1.51-1.60 (n=2)	1.49-1.61 (n=5)
M ²	L	1.17-1.28 (n=2)	1.22-1.26 (n=5)
	L (med.)	1.00-1.12 (n=2)	1.05-1.15 (n=5)
	W	1.43-1.51 (n=2)	1.40-1.53 (n=5)

* specimens from the Zoological Institute, Russian Academy of Sciences (St. Petersburg)

Table VIII

Dimensions of mandible and lower dentition (in mm) of *Sorex cf. isodon* and *S. isodon*

		<i>S. cf. isodon</i> B. Baidinskaya Cave Russia Asia Late Pleistocene	<i>S. isodon</i> Amurskaya Province* Russia Asia Recent	<i>S. isodon</i> Russia Asia Recent YUDIN 1989
P ₄	L	1.21-1.22 (n=2)	1.06-1.18 (n=5)	–
	W	0.80-0.82 (n=2)	0.70-0.80 (n=5)	–
M ₁	L	1.55-1.66 (n=2)	1.50-1.55 (n=5)	–
	W	0.88-0.93 (n=2)	0.83-0.91 (n=5)	–
M ₂	L	1.33-1.37 (n=2)	1.23-1.32 (n=5)	–
	W	0.84-0.87 (n=2)	0.77-0.83 (n=5)	–
M ₃	L	1,07-1.10 (n=2)	0.99-1.08 (n=5)	–
	W	0.62-0.66 (n=2)	0.61-0.65 (n=5)	–
M ₁ -M ₃	L	3.90-4.10 (n=2)	3.71-3.90 (n=5)	–
H of mandible below M ₂		1.40-1.48 (n=2)	1.41-1.49 (n=5)	–
H of ascending ramus		4.73-4.96 (n=2)	4.36-4.65 (n=5)	4.30-5.70 (n=371)
W of coronoid process		1.20-1.29 (n=2)	1.04-1.17 (n=5)	–
H of condyloid process		2.06-2.34 (n=2)	2.11-2.31 (n=5)	–
W of interarticular area		0.72-0.83 (n=2)	0.63-0.77 (n=5)	–

* specimens from the Zoological Institute, Russian Academy of Sciences (St. Petersburg)

S y s t e m a t i c p o s i t i o n a n d d i s t r i b u t i o n. The morphological features and size of specimens described above approach the Recent species *Sorex isodon* TUROV, 1924. In specimens from Bolshaya Baidinskaya Cave a particularly characteristic seems to be the large A⁵ and the morphology of their lower molars in which the entoconid crest has the shape of a cusp instead of a typical crest. This structure, unknown in other species, is also present in molars of five Recent *S. isodon* accessible for comparison.

As some small differences are visible between the fossil and Recent specimens discussed above, the mandibles from Bolshaya Baidinskaya Cave are tentatively identified as *S. cf. isodon*. These differences especially concern measurements. The fossil specimens are slightly more massive whereas

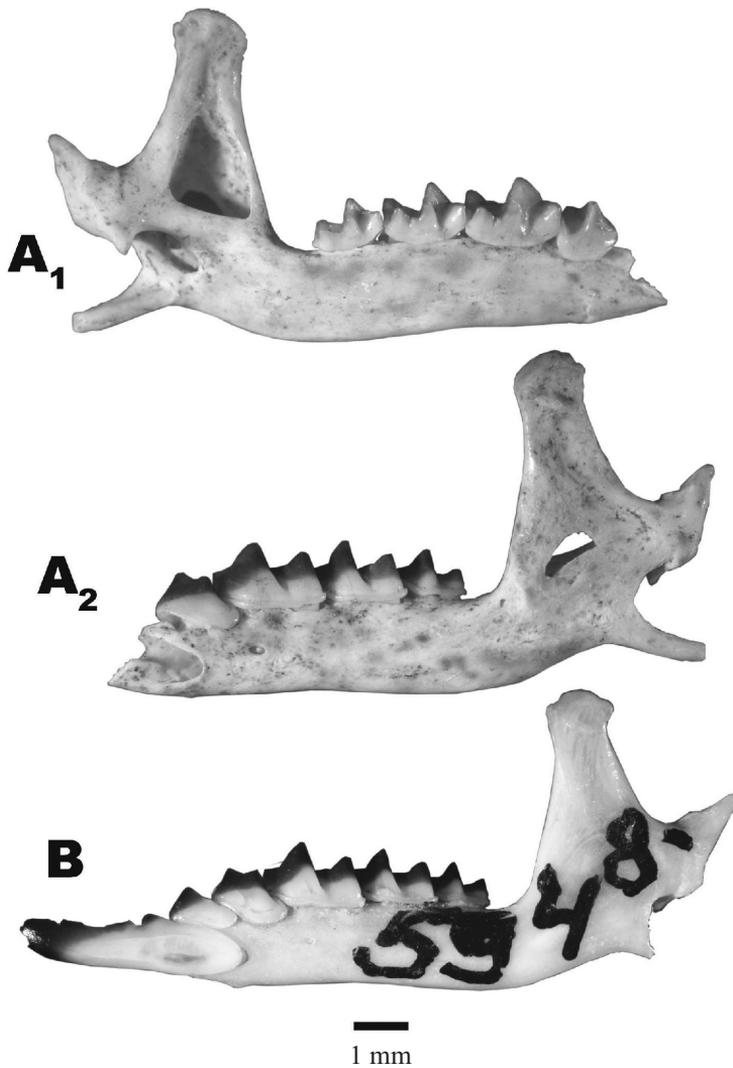


Fig. 7. Left mandible (A₁ – lingual side, A₂ – buccal side) of *S. cf. isodon*, No. MF/5128 (Bolshaya Baidinskaya Cave), B – left mandible of *S. isodon*, No. 5948 (Recent, Amurskaya Province, Russia, coll. ZI, St. Petersburg).

older shrews are usually smaller and more delicate. Also, according to YUDIN (1989) the hypocones of the upper molars are devoid of pigmentation. In the material from Bolshaya Baidinskaya Cave among five specimens there is one which has its hypocones pigmented. This specimen cannot belong to the second large form of *Sorex* (*S. roboratus*) present in this cave, because the upper molars of the last species are almost devoid of metalophs.

Today, *S. isodon* lives in a large area of north-eastern Eurasia from Scandinavia in Europe to the Chukcha and Kamchatka Peninsulas, Kuril and Sakhalin Islands, and Primorie in Asia. It inhabits the Urals, in the taiga and zones south of the taiga in western Siberia, all of central and eastern Siberia, and south of the Siberian mountains (Altai and Sajan). The southern limit of its range is not clear. STROGANOV (1957) also mentioned *S. isodon* from the Zabaikale region.

Sorex cf. daphaenodon THOMAS, 1907

M a t e r i a l. One mandible fragment with teeth and the coronoid process. Minimal number of individuals = 1. Kozlovka Cave, Late Pleistocene. No. MF/5129.

D e s c r i p t i o n o f m a t e r i a l. The horizontal ramus of the mandible is high and only slightly concave below the M_1/M_2 . The coronoid process is also high. Its apex is blunt and bends towards the posterior and interior. The external temporal fossa is rather deep. It extends to below the upper sigmoid notch. The coronoid spicule is not very well developed. The internal temporal fossa is high. It extends to close to the tip of the coronoid process. It possesses a horizontal bar separating the shallow upper part from the deep lower part of the fossa. The mental foramen is situated below the protoconid of the M_1 . One mandibular foramen is situated in the middle of the lower border of the internal temporal fossa.

The I_1 is used. It was most probably short and tricuspluate. Its buccal cingulum is not protruded.

The A_1 and P_4 are massive and their posterolingual basins shallow. The teeth have a wide cingulum on both sides.

The molars, especially M_3 , are wide and massive. They have high entoconid crests and well developed cingula on all sides.

M_3 is not reduced.

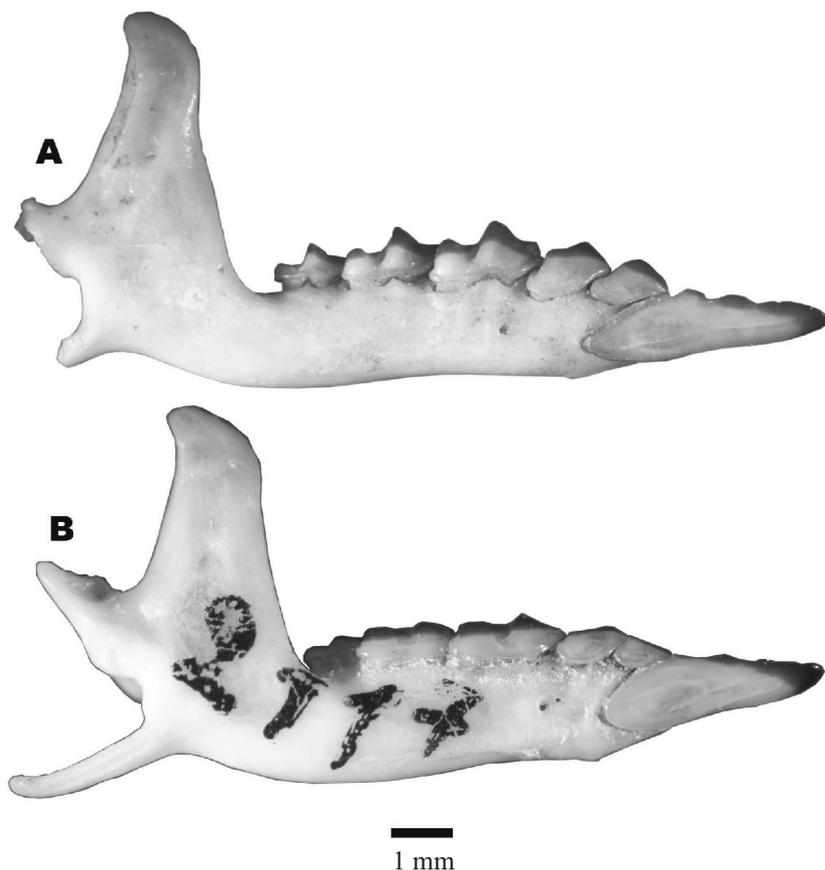


Fig. 8. A – right mandible of *S. cf. daphaenodon*, No. MF/5129 (Kozlovka Cave), B – right mandible of *S. daphaenodon*, No. 2117 (Recent, Chukotka, Russia, coll. ZI, St. Petersburg).

M e a s u r e m e n t s. See Table IX.

Table IX

Dimensions of mandible and lower dentition of *Sorex cf. daphaenodon* and *S. daphaenodon*

		<i>S. cf. daphaenodon</i> Kozlovka Cave Russia Asia Late Pleistocene	<i>S. daphaenodon</i> Chukotka* Russia Asia Recent	<i>S. daphaenodon</i> Russia Asia Recent YUDIN 1989
I ₁	L	–	–	–
	H	0.98	0.95-0.96 (n=4)	–
A ₁	L	1.19	–	–
P ₄	L	1.28	1.06-1.10 (n=4)	–
	W	0.85	0.79-0.84 (n=4)	–
M ₁	L	1.58	1.51-1.63 (n=5)	–
	W	0.90	0.89-0.94 (n=5)	–
M ₂	L	1.31	1.36-1.41 (n=5)	–
	W	0.80	0.85-0.90 (n=5)	–
M ₃	L	1.08	0.97-1.04 (n=5)	–
	W	0.68	0.66-0.73 (n=5)	–
M ₁ -M ₃	L	3.97	3.77-4.02 (n=5)	–
H of mandible below M ₂		1.47	1.57-1.69 (n=5)	–
H of ascending ramus		5.04	5.10-5.30 (n=5)	3.50-5.40 (n=215)
W of coronoid process		1.10	1.01-1.30 (n=5)	–

* specimens from the Zoological Institute, Russian Academy of Sciences (St. Petersburg)

S y s t e m a t i c p o s i t i o n a n d d i s t r i b u t i o n. A comparison of the size of this large mandible from Kozlovka Cave with mandibles of the *Sorex* species living today more or less in the vicinity of lake Baikal indicates that it is smaller than e. g. the mandible of *S. mirabilis* OGNEV, 1937 but larger than mandibles of *S. araneus* LINNAEUS, 1758, *S. isodon*, or *S. roboratus*. Its size approaches the size of the Recent *S. unguiculatus* DOBSON, 1890 and is congruent with the size of *S. daphaenodon* THOMAS, 1907. This species has a different type the coronoid process than *S. unguiculatus* which is higher, wider on the top and declines posteriorly and interiorly (not to-

wards the anterior as in *S. unguiculatus*). The morphology of its ascending ramus and the coronoid process resemble the same characters in *S. daphaenodon*. However, the lack of the condyloid process in the described mandible, very characteristic in *S. daphaenodon* (low, but wide and massive), and the presence of only one mandibular foramen (in *S. daphaenodon* there are two, mandibular and postmandibular foramina) tentatively ascribes the specimen from Kozlovka Cave as *S. cf. daphaenodon*.

Today *S. daphaenodon* inhabits a large area of the eastern Palaeartic, including Buryatia and Pribaikale.

Sorex palaeosibiriensis* MEZHHERIN, 1972

*In his work of 1972, MEZHHERIN described *Sorex palaeosibiriensis* and *S. praecaecutiens*. Apart from a good description he also published photographs and measurements. According to him the authors of these two species names are MEZHHERIN and POKATILOV, 1969. However, a search for the paper of MEZHHERIN and POKATILOV (1969) has shown that it was never published. In this situation, according to ICZN, the exact date of the species description is the year 1972, and the name of the author – MEZHHERIN.

M a t e r i a l. Four maxillar fragments with A^2 - A^3 and P^4 - M^3 , two mandibles and 17 mandible fragments with all types of teeth and processes except the angular process. The minimum number of individuals = 9, Razdolinskaya 7 Cave, Late Pleistocene. No. MF/5130.

D e s c r i p t i o n o f m a t e r i a l. The dental elements are stained dark red. Among upper antemolars only the A^2 and A^3 are present in the material. Their morphology is similar, but A^2 is larger than A^3 . They are unicuspid. Their cusps are situated in the antero-buccal side of the crown. Two ridges run from the cusp to the antero-lingual and postero-buccal corners of the teeth. The anterior side of the crown is convex, the buccal side straight and the lingual and posterior sides are concave. The cingulum is well-developed all around.

The P^4 and upper molars are massive. In the P^4 the parastyle, parastylar crest, protocone and hypocone are very well-developed.

The M^1 and M^2 are also characterized by strong cusps, especially the hypocones, but their metaleses are not very high. Their cingula, especially the lingual and posterior ones, are well-developed.

The M^3 is also massive and has well developed cusps.

The anterior edge of the coronoid process is slightly concave, the posterior edge is straight. The coronoid spicule is well developed, situated closely to the tip of the coronoid process. The external temporal fossa is deep, reaching the level of the upper sigmoid notch. The internal temporal fossa is high and triangular, in two specimens a weak bar is visible. The condyloid process represents morphotype 1 (ZAITSEV and RZEBIK-KOWALSKA 2003), of average height. The interarticular area is rather narrow; its lower edge meets approximately the middle of the upper edge of the lower facet. Two mandibular foramina are present. The mental foramen is in a posterior position. It lies behind the protoconid of the M_1 , or more posteriorly, below or behind the re-entrant valley of this tooth.

The I_1 is short and thick, tricuspidate. Its first cusp (behind the apex) is not very well developed. The buccal cingulum is flat, poorly visible or lacking.

The A_1 is rather long at the buccal side, single-cusped.

The P_4 is short and high. Their buccal and lingual cingula are wide and protruding.

The lower molars, M_1 - M_3 are of a typical *Sorex* shape. In both M_1 and M_2 the talonid is wider than the trigonid. The buccal re-entrant valley opens at some distance above the buccal cingulum. The entoconid crest is rather high, and entostylid is present. Cingula are well developed on both sides. The buccal cingulum is slightly undulate, particularly in the M_1 .

The talonid in the M_3 is well developed, basined and has a clearly distinguishable hypoconid and entoconid.

Measurements. See Tables X and XI.

Table X

Dimensions of upper teeth (in mm) of *Sorex palaeosibiriensis*

		Razdolinskaya 7 Cave Russia (Asia) Late Pleistocene
A ²	L	0.80
	W	0.82
A ³	L	0.70
	W	0.72
P ⁴	L	1.58-1.63 (n=4)
M ¹	L	1.39-1.45 (n=3)
	L(med.)	1.08-1.15 (n=3)
	W	1.50-1.62 (n=3)
M ²	L	1.21-1.35 (n=3)
	L(med.)	0.96-1.03 (n=3)
	W	1.38-1.55 (n=3)
M ³	L	0.69
	W	1.12-1.23 (n=2)

S y s t e m a t i c p o s i t i o n a n d d i s t r i b u t i o n . An intermediate size between *S. minutus* and *S. araneus* ascribes the specimens from Razdolinskaya 7 Cave to the Recent species *S. tundrensis* MERRIAM, 1900 or to the fossil *S. palaeosibiriensis* MEZHHERIN, 1972.

Originally, *S. tundrensis* was considered to be a subspecies of *S. arcticus* (KERR, 1792) but its specific status has been lately confirmed by the chromosomal studies of IVANITZKAYA and KOZLOVSKI (1983) and OKHOTINA (1983). *S. tundrensis* lives today in the eastern Palaearctic and according to OSIPOVA et al. (2006) may be conspecific with European fossil *S. runtonensis* HINTON, 1911.

S. palaeosibiriensis was described by MEZHHERIN in 1972 from the Early Pleistocene of West Zabaikale, a locality situated 15 km south-east of Ulan Ude. According to this author it is similar to *S. runtonensis* and a second European fossil species *S. praealpinus* HELLER, 1930, however, these species are larger. He also suggested that *S. palaeosibiriensis* could have lived in Europe. He found that *S. runtonensis* described by KORMOS (1937) from the Middle Pleistocene locality Hundsheim in Austria is probably *S. palaeosibiriensis*. As there is a considerable gap between the known ranges of these three species (*S. runtonensis* and *S. praealpinus* lived in western and *S. palaeosibiriensis* in the eastern Palaearctic) the presence of the latter on European territory seems improbable.

As concerns morphology, specimens from Razdolinskaya 7 Cave are more similar to *S. palaeosibiriensis* than to *S. tundrensis*. The description of *S. palaeosibiriensis* given by MEZHHERIN

Table XI

Dimensions of mandible and lower dentition (in mm) of *Sorex palaeosibiriensis*

		Razdolinskaya 7 Cave Russia Asia Late Pleistocene	15 km southeast of Ulan Ude Russia Asia Early Pleistocene MEZH ZHERIN 1972
I ₁	L	3.20-3.70 (n=4)	–
	H	0.82-0.90 (n=4)	–
A ₁	L	0.87-0.96 (n=4)	–
P ₄	L	0.94-1.24 (n=10)	–
	W	0.68-0.77 (n=8)	–
M ₁	L	1.35-1.54 (n=12)	1.60-1.60 (n=4)
	W	0.65-0.87 (n=12)	–
M ₂	L	1.17-1.34 (n=14)	–
	W	0.60-0.82 (n=14)	–
M ₃	L	0.97-1.05 (n=10)	–
	W	0.50-0.59 (n=10)	–
M ₁ -M ₃	L	3.53-3.81 (n=8)	3.60
H of mandible below M ₂		1.14-1.40 (n=16)	1.10-1.40 (n=4)
H of ascending ramus		3.95-4.25 (n=4)	3.80-4.20 (n=4)
W of coronoid process		0.80-1.02 (n=4)	0.80-0.90 (n=4)
H of condyloid process		1.78-1.84 (n=3)	–
W of interarticular area		0.54-0.67 (n=5)	–

(1972) is very limited but according to illustrations in the paper one can see that *S. tundrensis* has a more slender first lower incisor, I₁, and a higher and narrower condyloid process (especially the interarticular area) than specimens from Razdolinskaya 7 Cave and *S. palaeosibiriensis*. On the other hand, the morphology of the internal temporal fossa, the coronoid and condyloid processes as well as the position of the mental foramen are identical with specimens of *S. palaeosibiriensis*. It seems very probable that in the Early to Late Pleistocene *S. palaeosibiriensis* lived in the vicinity of Baikal, on both banks. The upper teeth of *S. palaeosibiriensis* were not present in the MEZH ZHERIN (1972) material. They were tentatively included as corresponding in size to the mandibles described above. Besides *S. palaeosibiriensis*, only smaller *S. minutus* and larger *Sorex baikalensis* n. sp. are present in Razdolinskaya 7 Cave material.

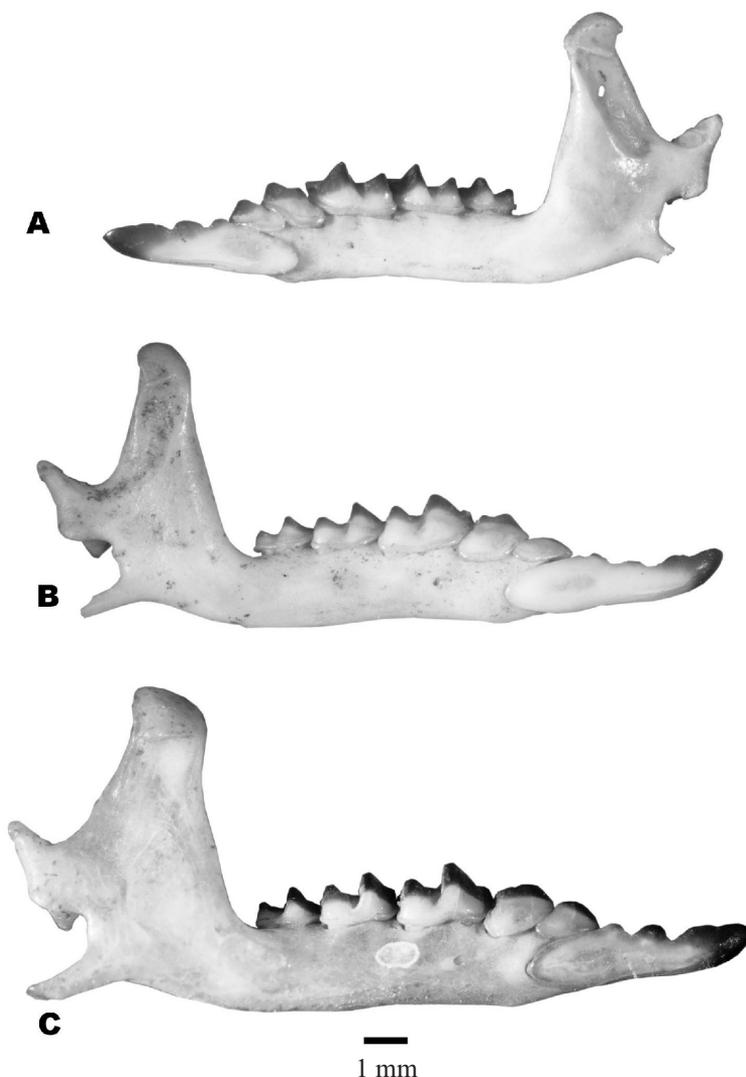


Fig. 9. A – left mandible of *S. palaeosibiriensis*, No. MF/5130 (Razdolinskaya 7 Cave), B – right mandible of *S. erbajevae* n. sp., holotype No. MF/5131/1 (Bolshaya Baidinskaya Cave), C – right mandible of *S. baikalensis* n. sp., holotype No. MF/5137/1 (Razdolinskaya 7 Cave).

Sorex erbajevae n. sp.

H o l o t y p e. The right mandible with complete dentition and processes except the angular process. No. MF/5131/1.

E t y m o l o g y. The species is named in honour of Dr Margarita Erbajeva, an excellent palaeontologist from Ulan Ude (Buryat Republic, Russia) who collected the material.

T y p e l o c a l i t y. Bolshaya Baidinskaya Cave (Buryat Republic, Russia).

S t r a t i g r a p h i c r a n g e. Late Pleistocene.

M a t e r i a l. Two mandible fragments with teeth (I_1 broken at its anterior end) and one coronoid and one condyloid process. The upper facet of the condylus is broken. The minimal number of

individuals = 1. Rykovo II. No. MF/5132. 14 jaw fragments with upper teeth except I^1 and A^1 and 14 mandible fragments with all teeth and processes except the angular process. The minimal number of individuals = 9. Bolshaya Baidinskaya Cave. No. MF/5131. Five mandible fragments with all teeth and processes with the exception of the angular process. The minimal number of individuals = 3, Kozlovka Cave. No. MF/5133. Three mandible fragments with all teeth except M_3 and all processes except the angular process. The minimal number of individuals = 2. Kurten I. No. MF/5134. One mandible fragment with M_2 and M_3 and the coronoid process. Minimal number of individuals = 1. Tologoi (upper layer). No. MF/5135. Three mandible fragments with teeth (I_1 almost completely worn) and processes except the angular process. The minimal number of individuals = 2. Malta. No. MF/5136. All localities are dated to the Late Pleistocene.

D i a g n o s i s. A medium-sized *Sorex* shrew with a narrow rostral part of the skull, a well-developed parastyle, protocone and hypocone in P^4 , a large hypocones in M^1 - M^2 , a high and distinctly narrow (in its entire height) coronoid process and internal temporal fossa, low condyloid process, comparatively long and slender I_1 , a two-cusped A_1 , and a wide (almost square) buccal overhanging the root in the P_4 .

D e s c r i p t i o n o f t h e h o l o t y p e. The horizontal ramus of the mandible is narrow, and its lower margin concave below the M_1/M_2 transition. The coronoid process is high and narrow, also at the level of the upper sigmoid notch. Its tip bends backwards. The coronoid spicule and the external temporal fossa are well developed. This fossa reaches to 1/3 of the length down the condyle. The external pterygoid fossa is deep and the pterygoid spicule visible. The internal temporal fossa is high and narrow. It has the shape of an equilateral triangle and a poorly discernible bar. The condyloid process is low. Its upper facet is small and cylindrical, the lower one is long and concave lingually. The interarticular area is narrow in its lower part, representing morphotype 1. Two mandibular foramina are situated in the groove, below the posterior angle (corner) of the internal temporal fossa (morphotype 2). The mental foramen lies underneath the trigonid of the M_1 (morphotype 2) (ZAITSEV RZEBIK-KOWALSKA 2003).

The I_1 is long, narrow, tricuspluate. It is deprived of the buccal cingulum. The A_1 is also long (especially on the buccal side) and it has two cusps. The second cusp is small.

The P_4 is large. Its postero-lingual basin does not reach the postero-lingual cingulum. The buccal overhang over the root is wide, almost quadrate in shape. On both sides of the A_1 and P_4 , the cingula are present. They are flat and narrow on the buccal and wide on the lingual side.

The M_1 is long. The re-entrant valley does not reach the buccal cingulum. The entoconid crest and entostylid are well developed. The buccal cingulum is narrow and slightly undulate, the lingual cingulum is wide. They do not protrude.

The M_2 is similar but much shorter.

The M_3 is not reduced.

M e a s u r e m e n t s o f t h e h o l o t y p e. I_1 – L 3.68 mm, H 0.91 mm; A_1 – L 1.00 mm; P_4 – L 1.12 mm, W 0.74 mm; M_1 – L 1.43 mm, W 0.80 mm; M_2 – L 1.22 mm, W 0.73 mm; M_3 – L 1.04 mm, W 0.63 mm; M_1 - M_3 – L 3.63 mm; H of mandible below M_2 – 1.20 mm; H of ascending ramus – 4.29 mm; W of coronoid process – 0.87 mm; H of condyloid process – 1.81 mm; W of interarticular area – 0.61 mm.

D e s c r i p t i o n o f t h e r e m a i n i n g m a t e r i a l. The rostral part of the skull is narrow. I^1 and A^1 are not preserved. The remaining antemolars (A^2 - A^5) decrease regularly in size posteriorly and the A^5 is partly hidden behind the P^4 . They are unicuspid. Their cusps are situated on the antero-buccal side of the teeth. The anterior side of the antemolars is convex, the buccal side straight and the postero-lingual side concave. Two crests run from the tip of the cusp: the main crest to the postero-buccal and a shorter crest to the antero-lingual cingulum. The short crest divides the lingual depression into two parts: a shallow antero-lingual and a deeper postero-lingual. In A^5 the antero-lingual depression is not visible. The teeth are surrounded by well-developed cingula all around.

The P⁴ has a large parastyle, protocone and hypocone. A deep valley separates the paracone and protocone and a long valley separates the protocone and hypocone. The posterior cingulum is well developed, the lingual and anterior cingula are poorly developed and the buccal cingulum is absent.

The M¹ is characterized by a well-developed hypocone, medium sized metaloph and the lack of a parastyle. A rather wide valley is present between the protocone and hypocone. There is a cingulum on the lingual side of this valley. The posterior cingulum, as well as the posterior emargination, are well-developed. The anterior and buccal cingula are absent.

The M² is similar to the M¹ but smaller.

The M³ is wide on its lingual side. The paracone and protocone are very well developed, the third cusp, the metacone, is lower.

As concerns mandibles and lower dentition, most specimens do not differ from the holotype although in some the horizontal bar of the internal temporal fossa is poorly visible and their mental foramen is situated more anteriorly (between the P₄/M₁ transition) or more posteriorly (below the re-entrant valley of the M₁). In unworn teeth the mesoconids are present.

M e a s u r e m e n t s. See Tables XII and XIII).

Table XII

Dimensions of upper teeth (in mm) of *Sorex erbajevae* from the Late Pleistocene Bolshaya Baidinskaya Cave (Russia, Asia)

A ²	L	0.71-0.73 (N=2)
	W	0.68-0.68 (n=2)
A ³	L	0.62
	W	0.61
A ⁴	L	0.52-0.55 (n=2)
	W	0.59-0.62 (n=2)
A ⁵	L	0.47-0.47 (n=2)
	W	0.54-0.55 (n=2)
P ⁴	L	1.28-1.44 (n=12)
M ¹	L	1.27-1.41 (n=11)
	L (med.)	1.00-1.16 (n=11)
	W	1.36-1.45 (n=11)
M ²	L	1.11-1.25 (n=12)
	L (med.)	0.94-1.03 (n=12)
	W	1.24-1.45 (n=12)
M ³	L	0.67-0.74 (n=5)
	W	1.09-1.18 (n=5)

Table XIII

Dimensions of mandible and lower dentition (in mm) of *Sorex erbajevae* n. sp.
(Late Pleistocene, Russia, Asia)

	Rykovo II	B. Baidinskaya Cave	Kozlovka Cave	Kurten I	Tologoi (upper l.)	Malta	
I ₁	L	–	3.48-3.68 (n=3)	3.42	3.41	–	
	H	0.81-0.82 (n=2)	0.80-0.91 (n=4)	0.81-0.86 (n=2)	0.79	–	0.82
A ₁	L	0.97-0.98 (n=2)	1.00-1.07 (n=2)	0.98-1.02 (n=2)	0.97	–	0.93
P ₄	L	0.92-0.95 (n=2)	0.93-1.12 (n=8)	0.90-0.98 (n=4)	1.04-1.14 (n=3)	–	1.04
	W	0.64-0.69 (n=2)	0.64-0.78 (n=8)	0.63-0.73 (n=4)	0.65-0.74 (n=3)	–	0.63
M ₁	L	1.34-1.37 (n=2)	1.37-1.50 (n=12)	1.38-1.47 (n=4)	1.43-1.49 (n=3)	–	1.36-1.38 (n=2)
	W	0.75-0.77 (n=2)	0.70-0.88 (n=12)	0.74-0.80 (n=4)	0.72-0.80 (n=3)	–	0.73-0.74 (n=3)
M ₂	L	1.13-1.17 (n=2)	1.13-1.22 (n=13)	1.10-1.19 (n=4)	1.19	1.28	1.16-1.20 (n=3)
	W	0.71-0.71 (n=2)	0.67-0.77 (n=13)	0.60-0.75 (n=4)	0.79	0.78	0.65-0.67 (n=3)
M ₃	L	0.91-0.95 (n=2)	0.90-1.04 (n=6)	0.89-1.08 (n=4)	–	1.05	0.95-1.01 (n=3)
	W	0.52-0.54 (n=2)	0.53-0.63 (n=6)	0.59-0.60 (n=3)	–	0.61	0.51-0.55 (n=3)
M ₁ -M ₃	L	3.43-3.46 (n=2)	3.47-3.66 (n=5)	3.45-3.50 (n=2)	–	–	3.47-3.57 (n=3)
H of mandible below M ₂		1.08-1.08 (n=2)	1.11-1.24 (n=13)	1.13-1.31 (n=4)	1.25	1.26	1.17-1.34 (n=3)
H of ascending ramus		–	4.11-4.47 (n=9)	4.02-4.33 (n=3)	4.24	4.46	3.80-4.10 (n=2)
W of coronoid process		0.83	0.79-0.90 (n=9)	0.87-0.99 (n=3)	0.89	0.79	0.71-0.75 (n=2)
H of condylid process		–	1.70-1.87 (n=8)	1.57-1.80 (n=3)	1.68	–	1.63-1.65 (n=2)
W of interarticular area		–	0.48-0.61 (n=9)	0.46-0.63 (n=4)	0.63	–	0.51-0.55 (n=2)

S y s t e m a t i c p o s i t i o n a n d d i s t r i b u t i o n. The medium size of the specimens described above suggests that they could be identified as *Sorex caecutiens* LAXMANN, 1788 or *S. tundrensis* because other Siberian *Sorex* shrews are either smaller or larger. These two Recent shrews have at present a very large range. The range of the first species extends from eastern Poland to the Siberian Mountains (including Altai) and the range of the second species extends from the Pechora River and Kazakhstan in the west to Chukotka in the east. They could both therefore be present in the vicinity of lake Baikal. Additionally, the size of the remains described above also agrees with the size of fossil *S. palaeosibiriensis* described by MEZHHERIN (1972) and with material attributed to *S. palaeosibiriensis* in this paper. However, on average these three species are

smaller and more slender and they differ in morphology, above all in the morphology of the coronoid and condyloid processes. On the other hand, the morphology of the coronoid process in *S. erbajevae* n. sp. considerably resembles that of *S. praecaecutiens* described in the same paper of MEZHHERIN (1972) as *S. palaeosibiriensis* (Western Zabaikale, the Early Pleistocene). However, a comparison of their measurements indicates that *S. praecaecutiens* is much larger than the specimens described above, e.g. its L of $M_1 = 1.60-1.90$ mm, L of $M_1-M_3 = 3.7-4.00$ mm, H of mandible below $M_2 = 1.20-1.40$ mm, H of ascending ramus = $4.40-4.60$ mm, and W of coronoid process = $1.00-1.20$ mm ($n = 10$) (MEZHHERIN 1972). An enlargement of size in geological time is common among shrews, but in this case the older (Early Pleistocene) remains of *S. praecaecutiens* described by MEZHHERIN (1972) are larger than the younger Late Pleistocene described above as *S. erbajevae* n. sp. Apart from this, if the upper teeth tentatively included in this species really belong to it, they differ from those described by MEZHHERIN (1972). In the material examined, A^2-A^5 diminish their size regularly in a posterior direction. Premolars described by MEZHHERIN form three size groups: A^1-A^2 are the largest and are equal in size, the smaller A^3-A^4 are also equal, and A^5 is the smallest.

These numerous remains from six localities described above seem to differ from the fossil and Recent species of medium-sized *Sorex* known from Siberia. Therefore, the description of a new species seems justified.

***Sorex baikalensis* n. sp.**

H o l o t y p e. The right mandible with complete dentition and processes except for the angular process. No. MF/5137/1.

E t y m o l o g y. The species is named after Lake Baikal.

T y p e l o c a l i t y. Razdolinskaya 7 Cave, Buryat Republic (Russia).

S t r a t i g r a p h i c r a n g e. Late Pleistocene.

M a t e r i a l. Five mandible fragments with teeth and processes. The minimal number of individuals = 3, Razdolinskaya 7 Cave. No. MF/5137.

D i a g n o s i s. A large *Sorex* species characterized by a high and wide (on the tip as well as on the level of the upper sigmoid notch) coronoid process, a relatively low condyloid process, slightly bulbous teeth and one or two mandibular foramina, but the posterior one, if present, is extremely small.

D e s c r i p t i o n o f t h e h o l o t y p e. The coronoid process is high and wide, and its tip is also wide. The coronoid spicule is rather well-developed. The external temporal fossa is large and shallow. It extends downwards to a level half-way along the condyloid process. The internal temporal fossa is not very high, it reaches $3/4$ of the coronoid process. The condyloid process is comparatively low and its interarticular area is not very wide. Its lingual edge extends to approximately the middle of the upper edge of the lower facet. It represents morphotype 1. The mental foramen also represents morphotype 1. It is situated in an anterior position, below the protoconid of M_1 . There are two mandibular foramina, but the second one is extremely small. They represent morphotype 1 (ZAITSEV and RZEBIK-KOWALSKA 2003). The teeth are stained a dark red. With the exception of I_1 they are slightly bulbous, especially P_4 and M_1 .

The I_1 is tricuspluate, long and narrow. The first cusp behind the apex is very low and the valley between them shallow. The next valley, between first and second cusps is very deep. The buccal cingulum is very narrow and flat.

The A_1 is large. A shallow postero-lingual basin is present. It does not reach the lingual cingulum. The cingulum is broad on both sides.

The P_4 is slightly bulbous. Its postero-lingual basin is deeper but it also does not reach the lingual cingulum. The flat but wide cingulum is present on both sides of the tooth.

Most characteristic of the large lower molars, M_1 - M_2 , is the slight convexity of trigonids and their buccal re-entrant valleys which open at some distance above the buccal cingulum. The entocoid crests are not very high. The cingula are flat and narrower than in A_1 and P_4 .

The M_3 is large, not reduced, with a well developed hypoconid and entoconid.

M e a s u r e m e n t s o f t h e h o l o t y p e. I_1 – L 3.87 mm, H 0.99 mm; A_1 – L 1.15 mm; P_4 – L 1.25 mm, W 0.80 mm; M_1 – L 1.61 mm, W 0.92 mm; M_2 – L 1.33 mm, W 0.90 mm; M_3 – L 1.07 mm, W 0.63 mm; M_1 - M_3 – L 3.98 mm; H of mandible below M_2 – 1.46 mm; H of ascending ramus – 5.03 mm; W of coronoid process – 1.32 mm; H of condyloid process – 1.94 mm; W of interarticular area – 0.73 mm.

D e s c r i p t i o n o f t h e r e m a i n i n g m a t e r i a l. The remaining specimens do not differ from the holotype with the exception of the position of the mental foramen which may be situated between the P_4 / M_1 transition and the mandibular foramina because in one specimen there is only one foramen.

M e a s u r e m e n t s. See Table XIV.

Table XIV

Dimensions of mandible and lower dentition (in mm) of *Sorex baikalensis* n. sp. from the Late Pleistocene Razdolinskaya 7 Cave (Russia, Asia)

I_1	L	3.87
	H	0.85-1.01 (n=3)
A_1	L	1.15-1.25 (n=3)
P_4	L	1.23-1.25 (n=3)
	W	0.80-0.90 (n=3)
M_1	L	1.59-1.68 (n=5)
	W	0.91-0.99 (n=5)
M_2	L	1.31-1.40 (n=5)
	W	0.82-0.91 (n=5)
M_3	L	1.02-1.10 (n=4)
	W	0.57-0.65 (n=4)
M_1 - M_3	L	3.89-4.19 (n=4)
H of mandible below M_2		1.46-1.62 (n=5)
H of ascending ramus		5.03
W of coronoid process		1.32
H of condyloid process		1.94-1.99 (n=2)
W of interarticular area		0.73-0.77 (n=2)

Systematic position and distribution. The size as well as bulbous teeth of mandibles from Razdolinskaya 7 Cave suggest their inclusion in the European subgenus *Sorex* (*Drepanosorex* KRETZOI, 1941). The species of the subgenus *Sorex* (*Drepanosorex*) differ, however, by the color of tooth pigmentation (yellow), by the shape of the coronoid (high and narrow in its entire length) and condyloid processes (very high), and more anterior position (below P₄) of the mental foramen. The size of the Razdolinskaya 7 shrew is also more or less similar to the size of several *Sorex* species living today in Siberia. These include *S. unguiculatus*, *S. araneus*, *S. isodon*, *S. daphaenodon*, and *S. roboratus*. However, mandibles of all of these species are less massive, especially their coronoid processes, all having two large mandibular foramina and none have bulbous teeth. Additionally, *S. daphaenodon* has a different, much heavier condyloid process (with very large interarticular area) and *S. roboratus* has a more posterior position of its mental foramen. The most similar species to the Razdolinskaya 7 shrew is *S. araneus*. According to YUDIN (1989), the H of the ascending ramus of Siberian *S. araneus* = 4.0-6.1 mm (n=341), so the dimension 5.03 mm of the Razdolinskaya 7 Cave mandible lies in the range of variation of that species. However, the teeth of *S. araneus* are not bulbous and it has two large mandibular foramina in the mandible.

Therefore, it is very probable that, as in Europe, in the Middle to Late Pleistocene some large and more massive shrews (larger than *S. araneus* and *S. unguiculatus*, type of *S. thaleri* JAMMOT, 1989 or *S. macrognathus* JÁNOSSY, 1965) inhabited the Siberian area. More material is needed to confirm this supposition.

Sorex sp.

M a t e r i a l. One posterior mandibular fragment with the talonid of M₁ without processes. Minimal number of individuals = 1. Zasukhino (section II, layer 5), Late Pliocene (Late Villanyian). No. MF/5138.

D e s c r i p t i o n o f m a t e r i a l. The horizontal ramus of the mandible is narrow, slightly concave below the M₂. The mental foramen is situated underneath the protoconid of the M₁ which is broken. The M₁ talonid is present but its entoconid and the buccal cingulum are damaged. The entoconid crest and entostylid are well developed. The lingual cingulum is wide but not protruding.

M e a s u r e m e n t s. Height of the mandible below M₂ = 1.14 mm.

S y s t e m a t i c p o s i t i o n. This specimen belongs to one of the medium-sized *Sorex* species but its state of preservation makes more precise identification impossible.

III. CONCLUSION

The fossils from ten localities contain 96 remains of insectivore mammals of the families Talpidae and Soricidae. They represent five genera (*Asioscalops*, *Crocidura*, *Petenya*, *Neomys*, and *Sorex*), 15 species and 49 individuals. Tables XV and XVI show the species composition in particular localities. Six species of shrews (*N. fodiens*, *S. minutissimus*, *S. minutus*, *S. roboratus*, *S. cf. isodon*, and *S. cf. daphaenodon*) and one mole (*Asioscalops altaica*) belong to the Recent fauna of Siberia, four other, the shrews (*Petenya* sp., *S. palaeosibiriensis*, *S. erbajevae* n. sp., and *S. bajkalisensis* n. sp.) are extinct. The generic and specific status of one mole (Talpidae gen. et sp. indet.) and of two shrews (*Crocidura* sp., and *Sorex* sp.) is uncertain so their placement in living or extinct taxa cannot be ascertained.

Among insectivores the most abundant were shrews of the genus *Sorex*. Moles and shrews of the genera *Crocidura*, *Petenya* and *Neomys* were very rare, and usually only one specimen was present. The medium-sized *Sorex* shrews predominated in the material. If in any locality more than one *Sorex* species was present, then the specimens belonged to different size categories. For example in Kozlovka Cave there were small *S. minutus*, medium-sized *S. erbajevae* and large *S. cf. daphaenodon*. This rule, known also in recent environments (MALMQUIST, 1985), presumably allowed for the avoidance of competition also in the past.

The insectivore remains were distributed irregularly in the localities. The most numerous (five species, two moles and three shrews) were found in Razdolinskaya 7 Cave. Bolshaya Baidinskaya and Kozlovka Caves yielded four species each (all shrews), and in the remaining localities only one species of shrew was found.

For the first time *N. fodiens*, *S. roboratus*, *S. cf. isodon* and *S. cf. daphaenodon*, were recorded from Asia as fossils and two new *Sorex* species (*S. erbajevae* and *S. baikalensis*) were described. In consequence, the number of fossil *Sorex* species known so far from Asia (16) increased to 21.

Table XV

Shrews from the early Late Pliocene – late Early Pleistocene localities

	Zasukhino (sek. I, l. 5)	Tologoi I	Tologoi II
<i>Crociodura</i> sp.	–	–	+
<i>Petenya</i> sp.	–	+	–
<i>Sorex</i> sp. (medium size)	+	–	–

Table XVI

Shrews from the Late Pleistocene localities

	Razdolinskaya 7 Cave	Kozlovka Cave	B. Baidinskaya Cave	Kurten I	Tologoi (upper l.)	Malta	Rykovo II
<i>A. altaica</i> NIKOLSKY, 1883	+	–	–	–	–	–	–
Talpidae gen. et sp. indet.	+	–	–	–	–	–	–
<i>N. fodiens</i> (PENNANT, 1771)	–	+	–	–	–	–	–
<i>S. minutissimus</i> ZIMMERMANN, 1780	–	–	+	–	–	–	–
<i>S. minutus</i> LINNAEUS, 1766	+	+	–	–	–	–	–
<i>S. roboratus</i> HOLLISTER, 1913	–	–	+	–	–	–	–
<i>S. cf. isodon</i> TUROV, 1924	–	–	+	–	–	–	–
<i>S. cf. daphaenodon</i> THOMAS, 1907	–	+	–	–	–	–	–
<i>S. palaeosibiriensis</i> MEZHHERIN, 1972	+	–	–	–	–	–	–
<i>S. erbajevae</i> n. sp.	–	+	+	+	+	+	+
<i>S. baikalensis</i> n. sp.	+	–	–	–	–	–	–

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REFERENCES

- ALLEN G. M. 1914. Notes of the birds and mammals of the Arctic coast of East Siberia. *Proceedings of the New England Zoological Club*, **5**: 49-66.
- BAUDELLOT S. 1967. Sur quelques Soricidés (Insectivores) miocènes de Sansan (Gers). *Compte Rendu Sommaire des Séances de la Société Géologique de France*, **7**: 290-292.
- DOUKAS C. S., HOEK OSTENDE L. W. VAN DEN, THEOCHAROPOULOS C. D., REUMER J. W. F. 1995. The vertebrate locality Maramena (Macedonia, Greece) at the Turolian-Ruscinian boundary (Neogene). *Münchener Geowissenschaftliche Abhandlungen, Reihe A* **28**: 43-64.
- GUREEV A. A. 1979. Nasekomoyadnye (Mammalia, Insectivora). Ezhi, krot'y i zemleroiki (Ericenidae, Talpidae, Soricidae) [Insectivores (Mammalia, Insectivora). Hedgehogs, moles and shrews (Erinaceidae, Talpidae, Soricidae)]. *Fauna SSSR. Mlekopitayushchie*, **4** (2): 1-501. [In Russian].
- HOLLISTER N. 1913. Two new mammals from the Siberian Altai. *Smithsonian Miscellaneous Collections*, Washington, **60** (24): 1-3.
- HUTCHISON J. H. 1974. Notes on type specimens of European Miocene Talpidae and a tentative classification of Old World Tertiary Talpidae (Insectivora: Mammalia). *Geobios*, **7** (3): 211-256.
- IVANITSKAYA E. Yu., KOZLOVSKIĀ A. I. 1983. Kariologicheskie dokazatelstva otsutsviya v Palearktike arkticheskoĭ burozūbki (*Sorex arcticus*) [Kariological proofs of lack of *Sorex arcticus* in Palearctic]. *Zoologicheskii Zhurnal*, **62** (3): 399-408. [In Russian].
- KORMOS T. 1937. Revision der Kleinsäuger von Hundsheim in Niederösterreich. *Földtani Közlöny*, **67**: 1-15.
- MALMQUIST M. G. 1985. Character displacement and biogeography of the pygmy shrew in Northern Europe. *Ecology*, **66**(2): 372-377.
- MEZHHERIN V. A. 1972. Shrews (*Sorex*, Insectivora, Mammalia) from the Pleistocene deposits of the USSR. Izdatelstvo "Nauka", Sibirskoe Otdelenie, Novosibirsk: 117-130. [In Russian with English summary].
- OKHOTINA M. V. 1983. The taxonomic revision of *Sorex arcticus* KERR, 1782 (Soricidae, Insectivora). *Zoologicheskii Zhurnal*, **62**: 409-417. [In Russian with English summary].
- ORLOV V. N., KOZLOVSKIĀ A. I. 1971. Obzor khromosomnykh naborov zemleroek roda *Sorex*. [Review of chromosome sets of the genus *Sorex*]. *Vestnik Moskovskogo Universiteta, Biologiya, Pochvovedenie (series VI)*, **2**: 12-16. [In Russian].
- OSIPOVA V. A., RZEBIK-KOWALSKA B., ZAITSEV M. V. 2006. Intraspecific variability and phylogenetic relationships of the Pleistocene shrew *Sorex runtonensis* (Soricidae). *Acta Theriologica*, **51** (2): 129-138.
- QIU Zh., STORCH G. 2000. The Early Pliocene micromammalian fauna of Bilike, Inner Mongolia, China (Mammalia: Lipotyphla, Chiroptera, Rodentia, Lagomorpha). *Senckenbergiana Lethaea*, **80** (1): 137-229.
- REUMER J. W. F. 1984. Ruscinian and early Pleistocene Soricidae (Insectivora, Mammalia) from Tegelen (The Netherlands) and Hungary. *Scripta Geologica*, **73**: 1-173.
- RZEBIK-KOWALSKA B. 1989. Pliocene and Pleistocene Insectivora (Mammalia) of Poland. V. Soricidae: *Pentymia* KORMOS, 1934 and *Blarinella* THOMAS, 1911. *Acta zoologica cracoviensia*, **32** (11): 521-546.
- RZEBIK-KOWALSKA B. 1990. Pliocene and Pleistocene Insectivora (Mammalia) of Poland. VI. *Deinsdorfia* HELLER, 1963 and *Zelceina* SULIMSKI, 1962. *Acta zoologica cracoviensia*, **33** (4): 45-77.
- RZEBIK-KOWALSKA B. 1991. Pliocene and Pleistocene Insectivora (Mammalia) of Poland. VIII. Soricidae: *Sorex* LINNAEUS, 1758, *Neomys* KAUP, 1829, *Macroneomys* FEJFAR, 1966, *Paenelinnoecus* BAUDELLOT, 1972 and Soricidae indeterminata. *Acta zoologica cracoviensia*, **34** (2): 323-424.
- RZEBIK-KOWALSKA B. 1998. Fossil history of shrews in Europe. [In:] J. M. WÓJCIK, M. WOLSAN (eds) – Evolution of shrews, Mammal Research Institute, Polish Academy of Sciences, Białowieża: 23-92.
- STORCH G. 1995. The Neogene mammalian faunas of Ertemte and Harr Obo in Inner Mongolia (Nei Mongol), China. 11. Soricidae (Insectivora). *Senckenbergiana Lethaea*, **75**: 221-251.
- STORCH G., QIU Zh. 1991. Insectivores (Mammalia: Erinaceidae, Soricidae, Talpidae) from the Lufteng hominoid locality, Late Miocene of China. *Geobios*, **24**: 601-621.
- STORCH G., QIU Zh., ZAZHIGIN V. S. 1998. Fossil history of shrews in Asia. [In:] J. M. WÓJCIK, M. WOLSAN (eds) – Evolution of shrews, Mammal Research Institute, Polish Academy of Sciences, Białowieża: 92-117.
- STROGANOV S. Ū. 1957. Zveri Sibiri. Nasekomoyadnye [Animals of Siberia. Insectivores]. Izdatelstvo AN SSSR, Moskva: 1-267. [In Russian].
- SULKAVA S. VON. 1990. *Sorex minutissimus* ZIMMERMANN, 1780 – Knirpsspitzmaus. [In:] J. NIETHAMMER, F. KRAPP (eds) – Handbuch der Säugetiere Europas, AULA-Verlag Wiesbaden: 207-214.

- TADA T., OBARA Y. 1988. Karyological relationships among four species and subspecies of *Sorex* revealed by differential staining techniques. *Journal of the Mammalogical Society of Japan*, **13**: 21-31.
- TERZEA E. 1983. *Pliomys „lenki”* (HELLER, 1930) (Rodentia, Mammalia) dans le Pléistocène de Roumanie. *Travaux de l'Institut de Spéologie „Émile RAKOVITZA”*, **22**: 85-101.
- WOLSAN M., HUTTERER R. 1998. A list of the living species of shrews. [In:] J. M. WÓJCIK, M. WOLSAN (eds) – Evolution of shrews, Mammal Research Institute, Polish Academy of Sciences, Białowieża: 425-458.
- YUDIN B. S. 1965. Novyi dlya faūny SSSR vid zemleroiki (Insectivora, Soricidae). Novye maloizvectnye vidy faūny Sibiri. [New species of shrew in the fauna of USSR (Insectivora, Soricidae). New poorly-known species of Siberian fauna]. Redaktsionnyi Izdatelskii Otdel, Sibirskoe Otdelenie Akademii Nauk SSSR: 44-47. [In Russian].
- YUDIN B. S. 1989. Nasekomoyadnye mlekopitayushchie Sibiri [Insectivore mammals of Siberia]. Izdatelstvo “Nauka”, Sibirskoe Otdelenie, Novosibirsk: 1- 360. [In Russian].
- ZAITSEV M. V., BARYSHNIKOV G. F. 2002. Pleistocene Soricidae (Lipotyphla, Insectivora, Mammalia) from Treugolnaya Cave, Northern Caucasus, Russia. *Acta zoologica cracoviensia*, **45** (2): 283-305.
- ZAITSEV M. V., RZEBIK-KOWALSKA B. 2003. Variation and taxonomic value of some mandibular characters in red-toothed shrews of the genus *Sorex* L. (Insectivora: Soricidae). *Russian Journal of Theriology*, **2** (2): 97-104.
- ZIMA J., LUKÁČOVA L., MACHOLÁN M. 1998. Chromosomal evolution in shrew. [In:] J. M. WÓJCIK, M. WOLSAN (eds) – Evolution of shrews, Mammal Research Institute, Polish Academy of Sciences, Białowieża: 175-218.