

The skull of young *Mammuthus trogontherii* (Pohlig, 1885) from the early Middle Pleistocene of the north-eastern Sea of Azov Region

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ABSTRACT. Incomplete skull of a young elephant with dP4 and a fragmentary tusk were found in the alluvial deposits exposed in a sand pit near the settlement of Kagalnik. The age of the enclosing deposits correlates with the early Middle Pleistocene, the time range of the Tiraspol faunal complex of the Eastern Europe (= Cromerian), and the regional rodent biochron MQR 5. Two skeletons of *Mammuthus trogontherii* have been previously found in this area. The dental structure of the studied specimen evidences its attribution to *M. trogontherii* and demonstrate its difference from other taxa of mammothoid elephants. How to cite this article: Baigusheva V.S., Matishov G.G., Titov V.V. 2018. The skull of young *Mammuthus trogontherii* (Pohlig, 1885) from the early Middle Pleistocene of the north-eastern Sea of Azov Region // Russian J. Theriol. Vol.17. No.2. P.61–67. doi: 10.15298/rusjtheriol.17.2.01

KEY WORDS. *Mammuthus*, dental morphology, variability, early Middle Pleistocene, Russia.

Череп молодой особи *Mammuthus trogontherii* (Pohlig, 1885) из нижнего неоплейстоцена Северо-Восточного Приазовья

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РЕЗЮМЕ. Из аллювиальной толщи, вскрытой в нескольких карьерах около пос. Кагальник, происходит находка неполного черепа молодой особи слона с зубами dP4 и обломком бивня. Вмещающие отложения датируются ранним средним плейстоценом (= ранним неоплейстоценом), временем существования тираспольского фаунистического комплекса Восточной Европы (= Кромер) и региональной зоной по грызунам MQR 5. Из этих карьеров известны находки двух скелетов *Mammuthus trogontherii*. Характеристики зубов позволяют отнести находку к *M. trogontherii* и показать её отличия от других таксонов мамонтоидных слонов.

КЛЮЧЕВЫЕ СЛОВА. *Mammuthus*, морфология зубов, изменчивость, ранний средний плейстоцен, Россия.

Introduction

The recent literature describing finds of *Mammuthus trogontherii* (Pohlig, 1885) from the vast areas of Eurasia is quite ample (Guenther, 1969; Palombo & Ferretti, 2005; Lister & Stuart, 2010 *et al.*). But the cranial and dental features of young animals of this species are insufficiently known. Guenther (1969) presented tables and graphic data showing a number of measurements in teeth of different replacement series for the abundant material from early Middle Pleistocene Süssenborn locality (Germany), including the features of deciduous teeth. Dubrovo (2001) described a specimen of dp4 from Early Pleistocene site of Untermaassfeld (Germany) and for the purpose of comparison tabulated metrical characters of dP3/dp3–dP4/dp4 in throgontherine elephants. The remains of elephants with

dp2–dp3 referred to *M. trogontherii* were also noted from the Early Pleistocene site of Shanshenmiaozui in China (Tong, 2012; Tong & Chen, 2016). The dentition of *M. trogontherii* with incomplete dP3–4 and M2–M3 was described from late Middle Pleistocene Belchatów locality in Poland (Pawlowska *et al.*, 2014). Yatsko (1948) reviewed dental characters of different replacement series in *Elephas wüsti* M. Pawlow (= *M. trogontherii*) from Pleistocene deposits of the Khadzhibey Estuary (vicinities of Odessa, Ukraine). The tooth fragment identified by the authors as dP4–M1 of *M. trogontherii* was mentioned from the Cromerian West Runton locality (Great Britain) (Lister & Stuart, 2010). Garutt & Foronova (1976) and Garutt (1977) published variability ranges of dental characters in several replacement series of throgontherine elephants.

In 2016, a fragmental skull of a young elephant was found in a sand pit on the north-eastern outskirts of the Kagalnik settlement near the Zeleniy village (Azov

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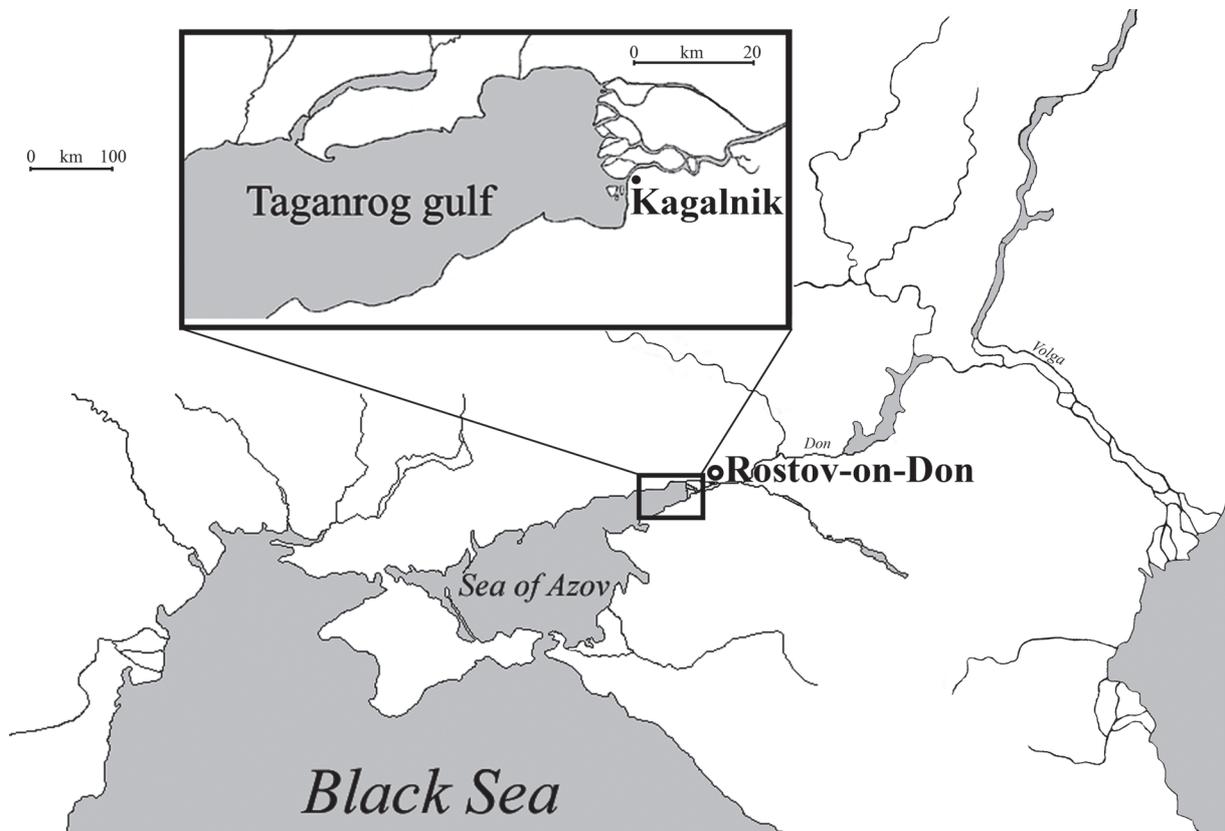


Fig. 1. The location of Kagalnik settlement (Azov district, Rostov Region, Russia).

region, Rostov district, Zeleniy locality; Fig. 1). Several working and abandoned sand pits aimed at the thick sequence of fluvial sands dated to early Middle Pleistocene are available for the study near the settlement of Kagalnik. The generalised geological section includes basal sandy and loamy sequence of deltaic-lagoon origin overlain by subaerial deposits. Sandy deposits (15–20 m thick) are represented by light quartz sands with numerous shells of *Viviparus*, *Dreissena*, and other freshwater mollusks. They form the base of the so-called Vth Semibalki terrace of the left bank of the Don River valley spreading to the northeast from the mouth of the Kagalnik River (Lebedeva, 1972). The entire section of sandy sequence contains uniform assemblage of land of vertebrates and molluscs indicating a relatively short period of its sedimentation (Tesakov *et al.*, 2007; Quaternary ..., 2010). Molluscan and fish fauna from the sequence evidence a large fluvial freshwater basin with backwaters and abandoned channels, and abundant riparian and water vegetation (Frolov & Kurshakov, 2015). The mammalian assemblage includes *Trogontherium cf. cuvieri*, *Microtus (Stenocranius) gregaloides*, *Microtus nivaloides*, and *Eolagurus argyropuloi*, as well as *Equus sp.*, *Praemegaceros sp.*, *Bison sp.* This association, typical for the Tiraspol Faunal Complex (late Early Biharian, Galerian, Cromerian), is widely known from a number of localities dated at the beginning of the Middle Pleistocene and

correlates with the regional micromammalian biochron MQR 5 (Tesakov *et al.*, 2007; Quaternary ..., 2010). Old sand pits near Kagalnik (the Kagalnik locality) yielded two famous nearly complete skeletons of *Mammuthus trogontherii* in 1964 and 1998 (Baygusheva & Garutt, 1987; Baygusheva & Timonina 2001, Baygusheva *et al.*, 2012) coming from loam bed in the upper part of the fluvial sequence. The new specimen comes from a layer of inequigranular sands in the middle part of the same thickness.

Material and methods

An incomplete facial cranium of a young elephant with both preserved dP4 and partially erupted left M1 is catalogued in the collection of the Southern Scientific Center RAS, No. SSC K-1. The braincase is missing (Fig. 2). The distal parts of the tusk alveoli are not preserved. The left alveolus preserves the base of the tusk.

Dental measurements and indexes follow standard systems (Dubrovo, 1960; Maglio, 1973; Garutt & Foronova, 1976). Measurements of the skull conforms to the methodology of Dubrovo (1960). The individual age was estimated based on the comparison of the averaged data on teeth replacement series in the extant elephant *Loxodonta africana* (Blumenbach, 1797) (Laws, 1966; Jachmann, 1988; Lee *et al.*, 2012).

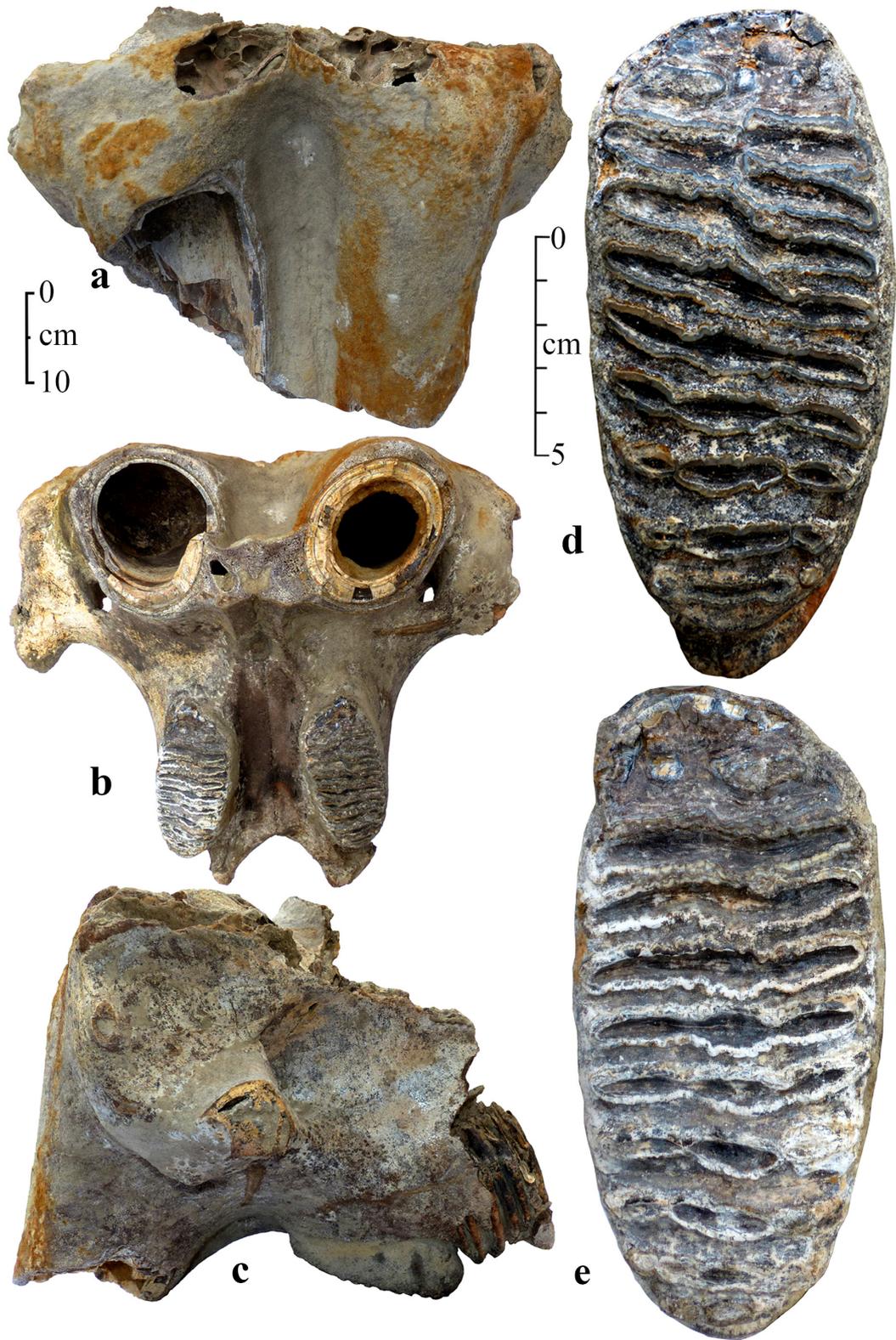


Fig. 2. Incomplete skull of *Mammuthus trogontherii* from Kagalnik (Zeleniy locality; North-Eastern Sea of Azov area, Russia). a — anterior view, b — ventral view, c — lateral view, d — upper left DP4, occlusal view, e — upper right DP4, occlusal view.

Table 1. Measurements of the skull of *Mammuthus trogontherii* from Kagalnik village (collection No SSC RAS K-1; Zeleniy locality; North-Eastern Sea of Azov area, Russia).

Parameters	Measurements, mm
Width between supraorbital processes	465.0
The upper width of the intermaxillary bones at the level of the lower edge of the infraorbital foramens	312.0
Width of interalveolar hollow at the upper level of tusks alveoli	76.0
Width between preorbital foramens	254.6
Width of upper jaw at level of dP4 posterior edges	205.4
Maximal width between dP4 outer edge	194.4
Internal width between anterior edges of dP4 (anterior width of bony palate)	53.8
The height of the right zygomatic arch in its anterior third	67.7
Width of the hoanal notch	83.8
Antero-posterior diameter of left tusk at the alveolus base	109.0
Lateral-medial diameter of left tusk at the alveolus base	93.5
Antero-posterior diameter of right alveolus base	112.0
Lateral-medial diameter of right alveolus base	103.9

The attribution of the studied teeth to the replacement series was based on comparison with rich odontological collection of the related group of Early Pleistocene southern elephants *Archidiskodon meridionalis gromovi* Garutt et Alexeeva, 1965 from Liventsovka and Khapry localities, and *A. m. tamanensis* Dubrovo, 1964 from the Sinyaya Balka locality (Baigusheva *et al.*, 2016a, b). The data on deciduous teeth of *Mammuthus primigenius* (Blumenbach, 1799) from Kostenki (Maschenko, 2002) were also used.

Abbreviations:

AzMZ — Azov museum-reserve, Azov, Russia;
 AstrMZ — Astrakhan state museum-reserve, Astrakhan', Russia;
 GIN — Geological institute RAS, Moscow, Russia;
 PIN — Paleontological institute RAS, Moscow, Russia;
 ROMK — Rostov local museum, Rostov-on-Don, Russia;
 SSC — Southern Scientific Centre RAS, Rostov-on-Don, Russia.

Description and comparison

The interalveolar hollow in front is well defined, appears relatively narrow and deep, distally not widened, unlike those on the skulls of adult and juvenile individuals of the genus *Elephas (Palaeoloxodon)* (Dubrovo, 1960; Palombo & Ferretti, 2005). It has approximately equal width throughout the observed length. Premaxillary bones in their preserved upper half do not expand rostrally, which also distinguishes the described specimen from skulls of straight-tusked or forest elephants. The bony palate is relatively narrow. It is comparable to the width of the tooth crown. The posterior edge of the palate is situated behind the posterior edge of dP4 and forms a wide U-shaped notch. Fragments of the tusk in the aboral part of the alveoli make it possible

to estimate its diameter (Tab. 1). The tusk is slightly flattened from the sides. The coefficient of its flatness is 0.86.

The upper teeth dP4 are relatively wide. The ratio of the width of the crown to its length is about 49.1% (left), 46.7% (right). The enamel is slightly folded. The incipient wear figures on the occlusal surface of trinomial plate is of antiquoid type (• – •). Median sinuses are not expressed. The teeth consists of 11 enamel plates in the right one, and 10.5 plates in the left (including additional plate), plus anterior and posterior talons (= platelets) (Tab. 2). The estimated full number of plates in these teeth is based on the preservation of the anterior main root, which is displaced laterally. Its front edge, which is the base for the first plate, has been preserved. There are two plates in addition to a talon at the main root. The additional enamel plate is present on the buccal surface of the right tooth between the third and fourth plates, reaching the mid-width of the crown. The dP4 belong to the wear stage 4–5 (according to Garutt & Foronova, 1976). Traces of the alveoli of the tooth previous replacement are absent. Posterior talons are not affected by wear.

The incomplete unerupted tooth M1 is located in the upper jaw. A height of the 4th dental plate is 116.1 mm, the length of single plate, about 12.7 mm. The lamellar frequency at 5 cm is 4.1. The enamel thickness is 2.2 mm.

The degree of teeth wear corresponds to the XI age stage of African elephants. The estimated age of the studied individual corresponds to 15 years (according to Laws, 1966), or 13–14 (by Lee *et al.*, 2012).

In the length of the crown and the number of plates, the dP4 teeth from Kagalnik are similar to those of the early Middle Pleistocene *M. trogontherii* of Süssenborn (Guenther, 1969). Teeth of the described specimen have somewhat higher lamellar frequency in comparison to the sample from Süssenborn (Figs 3, 4).

Table 2. Measurements of dP4 of *Mammuthus trogontherii* from Kagalnik settlement (collection No SSC RAS K-1; Zeleniy locality; North-Eastern Sea of Azov area, Russia) with comparison to dP4 of *M. trogontherii* from Süssenborn (Germany; by Guenter, 1969, Tab. 6, Abb. 1, 3, 4, 6).

Measurements dP4, mm	left	right	Süssenborn
Tooth formula	$t1 \frac{1}{2} 7t$	$t1 10t$	
Number of plates (without talons)	10.5	11	8-(9.4)-11
Crown length, mm	142.4	140.8	110-(143.2)-165
Crown width, mm	69.9	65.7	50-(57)-70
Lamellar frequency at 5/10 cm	4.4/8.8	4.25/8.5	7-8*
Length of single plate, mm	11.4	12.2	10.25-(11.9)-14.5
Enamel thickness, mm	1.6-(1.8)-2.1	1.5-(1.6)-1.9	1.0-(1.7)-3.0

* — by Dubrovo, 2001, tab. 1a. ~ — wearing part of the crown.

From dP4 of *M. cf. intermedius* from the lower Volga region near Astrakhan (terminal Middle Pleistocene – early Late Pleistocene; Russia; coll. AstrMZ No. PL-129), which has a similar lamellar frequency, the specimen from Kagalnik differs in larger crown size and enamel thickness (Figs 3, 4).

Showing similar values of enamel thickness, the studied specimen has a higher lamellar frequency and larger crown size of dP4 and M1 than Early Pleistocene forms of *Archidiskodon* (Figs 2, 3; Baigusheva *et al.*, 2016a, b). The crown of dP4 in the described specimen is somewhat narrower than in southern elephants from the collections of AzMZ, GIN, PIN, ROMK. The crown W/L ratio ranges as 52.8–53.2 (n=2) in *A. meridionalis gromovi*, and as 45.3-(50.5)-5.4 (n=6) in *A. m. tamanensis*.

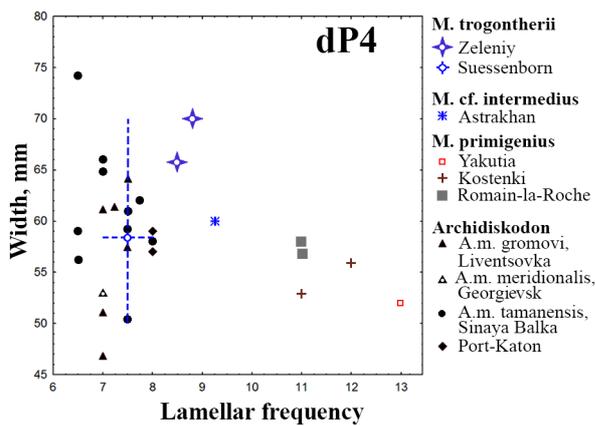


Fig. 3. Scatter diagram of crown width against lamellar frequency of dP4 of *Mammuthus trogontherii* from Kagalnik (Zeleniy locality) in comparison with some findings of the same teeth of *M. trogontherii*, *M. cf. intermedius*, *M. primigenius* and *Archidiskodon* from different European localities. Data from Guenter, 1969, Dubrovo, 2001 (Süssenborn), Dubrovo, 2001 (Yakutia and Romain-la-Roche), Maschenko, 2002 (Kostenki), and own measurements of the specimens from Zeleniy, Astrakhan, Liventsovka, Georgievsk, Sinaya Balka and Port-Katon. For the sample from Süssenborn the variability ranges of dental characters are indicate by dashed line.

Variables of dP4 No. SSC K-1 exceed the variability observed for this tooth type in the Late Pleistocene *M. primigenius* from Eastern Siberia and Eastern Europe, from sites Kostyonki, Eliseevici, Sevsk, Bolshoy Lyakhovsky Island (Dubrovo, 2001; Maschenko, 2002; Maschenko *et al.*, 2005, 2006). The teeth of woolly mammoths are smaller, have a noticeably higher lamellar frequency, a longer length of a single plate, and a smaller enamel thickness (Figs 3, 4).

Discussion

Teeth of early generations in elephants are traditionally considered to be poorly diagnosed. The accumulation of representative dental collections, however,

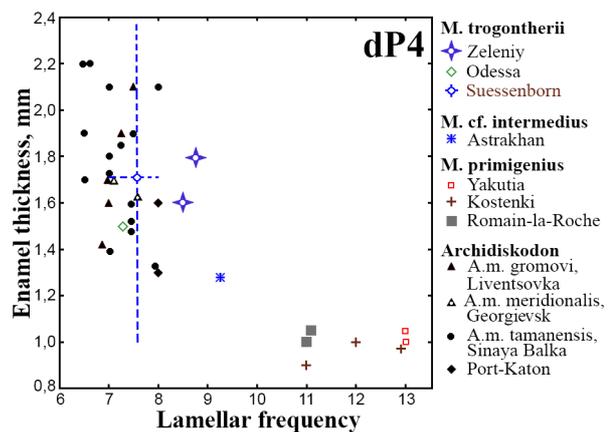


Fig. 4. Scatter diagram of enamel thickness against lamellar frequency of dP4 of *Mammuthus trogontherii* from Kagalnik (Zeleniy locality) in comparison with specimens of the same teeth in *M. trogontherii*, *M. cf. intermedius*, *M. primigenius*, and *Archidiskodon* from different European localities. Data from Guenter, 1969, Dubrovo, 2001 (Süssenborn), Yatsko, 1948 (Odessa), Dubrovo, 2001 (Yakutia and Romain-la-Roche), Maschenko, 2002 (Kostenki), and original measurements of the specimens from Zeleniy, Astrakhan, Liventsovka, Georgievsk, Sinaya Balka and Port-Katon. For the sample from Süssenborn the variability ranges of dental characters are indicate by dashed line.

makes it possible to use the teeth of early ontogenetic types for their taxonomic attribution in cases when other diagnostic characters are missing. Based on the material from a number of Early Pleistocene localities from the south of Eastern Europe (variables of the dP4/dp4, M1/m1 and, partly, dP3/dp3), it is demonstrated a possibility to differentiate between forms of mammothoid elephants, even at the level of chrono-subspecies of *Archidiskodon meridionalis* (Nesti, 1825) (Baigusheva *et al.*, 2016a, b).

Unfortunately, there are very few published accounts of juvenile teeth of *M. trogontherii* and *M. primigenius* with given measurements (for example, Guenther, 1969; Dubrovo, 2001; Maschenko, 2002; Maschenko *et al.*, 2006). Though the studied samples of woolly mammoths are relatively numerous, the published samples of juvenile teeth are not representative. This hampers a detailed comparison of the described form with latest mammoths. Nevertheless, the available data permits to differentiate dP4 of *M. trogontherii* from both Early Pleistocene southern elephants, and from other species of the genus *Mammuthus* too.

Results

The described record of the fragmentary skull of a young elephant from the site of Kagalnik in the Lower Don River area adds to the knowledge of large size trogontherine elephants, previously known in this region by two nearly complete adult skeletons. *M. trogontherii* is the characteristic element in the Eurasian mammal fauna of early Middle Pleistocene.

The variables of dP4 in this specimen make it possible to distinguish it from the juvenile teeth of the Early Pleistocene *Archidiskodon* by averagely larger crown size and higher lamellar frequency. From late Middle and Late Pleistocene forms of the genus *Mammuthus* it differs by larger crown dimensions, lower lamellar frequency, and by thicker enamel. Dental characters of early Middle Pleistocene elephants from the northeast of the Sea of Azov are similar to variables published for *M. trogontherii* from Süssenborn. Its parameters fall within the uppermost limits of the variability range of the sample from Germany. The Kagalnik specimen is different from the early Middle Pleistocene trogontherine elephants of Western Europe in larger size and slightly higher values of lamellar frequency.

The structure of the premaxillary bones, as well as the crown variables in addition to the absence of median sinuses in the wear pattern on the occlusal surface, distinguish a fragmentary skull from Kagalnik from the straight-tusked elephants *Elephas (Palaeoloxodon)* co-occurring with mammothoid elephants in the Middle Pleistocene of Eurasia.

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