Quaternary International xxx (2015) 1–13

Contents lists available at ScienceDirect

Quaternary International

journal homepage: www.elsevier.com/locate/quaint

Teeth of early generations of Early Pleistocene elephants (Mammalia, Elephantidae) from Sinyaya Balka/Bogatyri site (Sea of Azov Region, Russia)

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ARTICLE INFO

Article history:
Available online xxx

Keywords:
Early Pleistocene
Taman Faunistic complex
Archidiskodon
Dental characteristics
Variability

ABSTRACT

Based on study of a series of early generations' teeth DP4/dp4 – M1/m1 of elephants from the Late Villafranchian–Early Galerian locality Sinyaya Balka/Bogatyri (Taman peninsula, Russia) the variability of their characteristics is established. There is no clear normal distribution of main diagnostic dental parameters in the sample. This confirms the assumption of the possible presence of two elephant taxa in the structure of Taman Faunistic complex from south Eastern Europe, which was made earlier on the basis of the M3 teeth. The main part of the collection is represented by remains of the late meridionaloid elephant subspecies *Archidiskodon meridionalis tamanensis*, typical for late Early Pleistocene of Eastern Europe and neighboring regions. Individual specimens of the sample may refer to other form of elephants with similar morphological teeth characteristics, probably to *Phanogoroloxodon mammonthoides*. Though the lesser diagnosticity of early generation teeth in comparison with the M3/m3, it was found that they can be used when determining the taxonomic forms of elephants, even for the meridionaloid elephant subspecies.

1. Introduction

A determination of systematic position of fossil elephants is mainly based on features of skull structure and morphometric data of molars of last generation. Craniological features they specify the taxa of relatively high rank, while evolutionary changes within the genera and species can be traced by the teeth structure. The preservation of fossil elephants' teeth and their study have established systematic and phylogenetic positions of these leading fossils of Pleistocene continental deposits.

Almost all the features of elephants' teeth structure can be evaluated in numerical values, that change consecutively both in the ontogeny and phylogeny (Garutt and Foronova, 1976). The tooth crown size, number of plates, their length, and enamel thickness increase in each successive generation in ontogenesis. The number of enamel plates and lamellar frequency increase, but the length of single plates and enamel thickness decreased from archaic to advanced forms in phylogeny. These morphometric characteristics used for taxonomic diagnosis of Proboscidea are most clearly expressed on teeth of the two last generations (M2 and M3). Based on the study of teeth M3/m3 variability and skulls of southern elephant *Archidiskodon meridionalis* s.l. in early Pleistocene of south Eastern Europe, three taxa are defined: *A. m. gromovi* (Middle Villafranchian Khapry Faunal complex); *A. m. meridionalis* (Late Villafranchian Psekups Faunal complex); and *A. m. tamanensis* (Late Villafranchian–Early Galerian Taman Faunal complex) (Gromov, 1948; Dubrovo, 1964; Garutt and Alexeeva, 1964; Alexeeva and

Abbreviations: AMZ, Azov historical, archeological and paleontological museum-reserve, Azov, Russia; GGM, State geological museum of V.I. Vernadskiy, Moscow, Russia; GIN, Geological institute of Russian Academy of Sciences, Moscow, Russia; IPG, Institute of paleobiology, Tbilisi, Georgia; KM, Krasnodar state historical and archeological museum-reserve of E.D. Felicyn, Krasnodar, Russia; NMC, Don Cossacks' history museum, Novocherkassk, Russia; PIN, Paleontological museum of Russian Academy of Sciences, Moscow, Russia; PKM, Pyatigorsk regional museum, Pyatigorsk, Russia; PRKM, Primorsk regional museum, Primorsk, Ukraine; ROMK, Rostov-on-Don Regional museum, Rostov-on-Don, Russia; SMZ, Stavropol state museum-reserve, Stavropol, Russia; SSC, Southern Scientific centre of Russian Academy of Sciences, Rostov-on-Don, Russia; TM, Taganrog regional museum, Taganrog, Russia; ZIN, Zoological Institute of Russian Academy of Sciences, St. Petersburg, Russia.

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http://dx.doi.org/10.1016/j.quaint.2015.08.007
1040-6182/

Garutt, 1965; Alexeeva, 1977; Garutt, 1977, 1986; Garutt et al., 1977; Baigusheva, 2000; Baigusheva and Titov, 2001, 2010, 2012; Kahlke et al., 2011).

There are disagreements regarding the genus affiliation and the species of "meridionaloid" elephants. Some researchers do not recognize the validity of the genus *Archidiskodon* and include "southern elephants" in the genus *Mammuthus* (Maglio, 1973; Aguirre and Morales, 1990; Lister, 1993, 1996; Lister and Sher, 2001; Lister et al., 2005; Palombo and Ferretti, 2005; Essen van, 2009, and others). According to another point of view, the genus *Archidiskodon* is autonomous and is regarded as a primitive stage of elephants of tribe Mammuthini Brookes (Osborn, 1942; Dubrovo, 1960, 1964, 2001; Baigusheva, 1971; Alexeeva, 1977; Azzaroli, 1977; Garutt, 1986, 1998; Foronova and Zudin, 1999; Baigusheva and Titov, 2012, and others). Some of these paleontologists rate them as "mammuthoid" elephants. The present authors hold the opinion that Late Pliocene – Early Pleistocene mammuthoid elephants should be attributed to the separate genus *Archidiskodon*, being a paraphyletic group, according to a non-cladistic attitude (c.f. Lister, 1996). This point of view is based on distinct differences between Late Pliocene–Early Pleistocene and Middle–Late Pleistocene representatives of this elephants' tribe.

Diagnosis of early generation teeth of elephants is complex due to the fact that the characteristics are not expressed clearly, and are less stable because of the transgression of parameters, as well as due to insufficient study. In this context, the teeth DP2/dp2 – M1/m1, especially single finds, practically are not used for taxonomic definitions. However, the information about the structure and variability of early generation teeth belonging to different members of the mammoth lineage is of scientific interest. Some information about them can be found in the literature.

Among the works dedicated to analysis of dental system of mammoth lineage's elephants and morphometric characteristics of teeth of all generations, including premolars, are publications of Garutt and co-authors (Garutt and Foronova, 1976; Garutt, 1977; Garutt and Bajguševa, 1981). In these papers, dental morphometric characteristics are presented in tables and graphs, and show the variability of characteristics, including teeth of early generations of different taxa. On the basis of large serial material, including the localities discussed in this article, Garutt and Foronova (1976) proposed a method that uses not extreme values of transgressing digital characteristics, but optimal (=mode) ones, which are the most frequent for this form. However, in that publication the numerical characteristics of *A. meridionalis*' teeth were given as a whole, without subdivision into chronological subspecies: *A. m. meridionalis* (Nesti, 1825) and *A. m. tamanensis* Dubrovo, 1964. This makes it difficult to use it in this study.

In papers which study elephants' teeth from Pleistocene of the North Sea area (Essen van and Mol, 1996; Essen van, 2009), there is a comparison of characteristics of several teeth generations of "*Mammuthus*" *meridionalis*, *Mammuthus trogontherii*, and *M. primigenius* from some localities. However, these authors give the parameters of teeth DP3/dp3 – M1/m1 only in graphs, which mainly explain the changing of general size and hypsodonty index of teeth. When analyzing *M. trogontherii* teeth from Süssenborn (Germany), Guenther (1969) compared parameters of teeth of trogontherii mammoth with those of meridionaloid elephants and woolly mammoths. He also showed the variability of teeth, including mm2 (= DP3/dp3), mm3 (= DP4/dp4) and M1/m1 in the graphs. Maglio (1973) gives a summary table with teeth measurements (including DP2/dp2-M1/m1) of meridionaloid elephants from multiple Italian Villafranchian sites.

There is also a number of publications describing single finds of *Archidiskodon* and *Mammuthus* teeth of early generations from Italy (Falconer and Cautley, 1846; Friant, 1959), Germany (Untermaβfeld; Dubrovo, 2001), France (Saint-Vallier; Guérin, 2004); Georgia (Akhalkalaki; Vekua, 1962), as well from Russia: Azov Sea, Lower Don and the Taman Peninsula (Gromov, 1977; Maschenko, 2002; Baigusheva and Titov, 2012), Stavropol Region (Gabunia, 1961), Trans-Baikal (Udunga; Kalmykov and Maschenko, 2006), and Yakutia (Vilyuisk; Dubrovo, 1953). Dubrovo (2001) gives characteristics of individual teeth DP4/dp4 of elephants and mammoths from some localities from Ukraine and Russia, including the Taman Peninsula. The early generation teeth of *M. primigenius* are studied and described in more detail (e.g. Maschenko, 2002).

There has been no detailed description of representative series of southern elephant teeth of early generations until today. Therefore, the teeth collection of the later form of southern

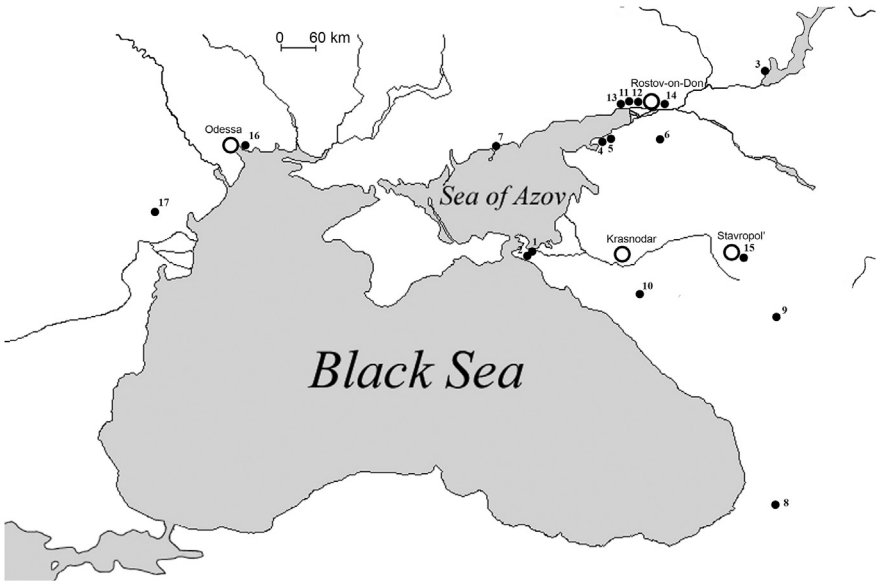

Fig. 1. Some Eastern European Middle and Late Villafranchian localities with *Archidiskodon meridionalis* remains: 1 – Sinyaya Balka/Bogatyri, 2 – Tsimbal, 3 – Sarkel, 4 – Port-Katon, 5 – Semibalki, 6 – Samarskoe, 7 – Nogaisk, 8 – Akhalkalaki, 9 – Old Georgievsk sand pit, 10 – Saratovskaya/Psekups, 11 – Linentsovka, 12 – Khapry, 13 – Mokriy Chaltir', 14 – Kobiakova Balka, 15 – Kosiakino, 16 – Kryzhanovka, 17 – Kotlovina.

Please cite this article in press as: Baigusheva, V.S., et al., Teeth of early generations of Early Pleistocene elephants (Mammalia, Elephantidae) from Sinyaya Balka/Bogatyri site (Sea of Azov Region, Russia), Quaternary International (2015), http://dx.doi.org/10.1016/j.quaint.2015.08.007