Fossil Elephants of Turkey

Türkiye'nin Fosil Filleri

Research Article

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ABSTRACT

Fossil elephants are a favourite subject of study on patterns and process of evolution. They also have importance as a guide fossil in Quaternary studies. After their emergence in Africa at the Miocene-Pliocene boundry, *Elephas* and *Mammuthus* migrated into Eurasia. And as Turkey is at the crossroads of Africa, Asia and Europe, it occupies an important position for the migration of elephantids. Until now *Mammuthus meridionalis*, *M. trogontherii* and *Elephas maximus* were identified from Turkey. Some *M. meridionalis* remains have some primitive features compared to typical *meridionalis* which might be important in the evolution of the species. *M. trogontherii* remains from Dursunlu have strange features that some have features of typical *trogontherii*, but some have primitive features evoking *meridionalis*. *E. maximus* was identified from Gavur Lake Swamp. New radiocarbon dates indicate that at approximately 3500 BP, the range of the Asian elephant extended as far west as south-east of Turkey.

Key Words
Turkey, Elephantidae, *Mammuthus meridionalis*, *Mammuthus trogontherii*, *Elephas maximus*

ÖZET

Fosil filler evrim mekanizmaları ve işleyişi konularında önemli bir araçtır. Filler ayrıca Kuvaterner çalışmalarında kılavuz fosil olarak da öneme sahiptir. Miyosen-Pliyosen sınırında Afrika'da ortaya çıkmalarından sonra *Elephas* ve *Mammuthus* cinsleri Avrasya'ya göç etti. Afrika, Asya ve Avrupa'nın ortasında yer alan Türkiye, filgiller ailesinin göç yolları açısından büyük öneme sahiptir. Bugüne kadar ülkemizden *Mammuthus meridionalis*, *M. trogontherii* ve *Elephas maximus* teşhis edildi. *M. meridionalis*'e ait buluntulardan bir kısmının *meridionalis* tip örneğine göre ilkel özelliklere sahip olması türün evrimi açısından önemli olabilir. Dursunlu'dan teşhis edilen *M. trogontherii* fosillerinin bir kısmı tipik *trogontherii* özellikleri gösterirken bir kısmı *meridionalis*'e benzerlik gösteren ilkel özelliklere sahiptir. *E. maximus* ise Gavur Gölü Bataklığı'ndan teşhis edildi. Buradan alınan örneklerden yapılan radyokarbon analizleri sonucuna göre günümüzden yaklaşık 3500 yıl önce Asya fili Türkiye'nin güneydoğusuna kadar yayılım göstermiştir.

Anahtar Kelimeler
Türkiye, Elephantidae, *Mammuthus meridionalis*, *Mammuthus trogontherii*, *Elephas maximus*

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INTRODUCTION

The Elephantidae is highly successful Proboscidean family that originated in Africa and radiated into Europe, Asia and North America during the Pliocene and Pleistocene. Although today represented by three species (*Loxodonta africana*, *Loxodonta cyclotis* and *Elephas maximus*), the family comprised more that 30 species until the end of the Pleistocene [1, 2]. The family Elephantidae showed a high rate of evolution, early stages of which were confined to Africa, while later stages occured in Eurasia. The earliest members of the family were recorded in eastern Africa at the Miocene-Pliocene boundry and with the further divergence of these elephants three lineages (*Loxodonta*, *Elephas* and *Mammuthus*) were emerged [1, 3].

After their first appearances in Eurasia in the late Pliocene, about 2.5 Ma, mammoths (genus *Mammuthus*) survived here until the end of the Pleistocene, around 10 000 years BP. Samples of mammoth fossils through the Eurasian Plio-Pleistocene show a series of anatomical trends, including changes in body size, heightening of the cranium and molar teeth, shortening of the cranium and mandible, thinning of molar enamel and increase in the number of plate. Based on these changes European mammoths have conventionally been divided into three chronospecies: Early Pleistocene *Mammuthus meridionalis*, Middle Pleistocene *M. trogontherii* and Late Pleistocene *M. primigenius* [4, 5].

M. meridionalis has primitive features compared to other mammoth species: low plate number (11-14 in M3), low plate frequency (1.25-1.75 in M3), thick enamel (2.0-2.4 mm in M3), broad and low-crowned molars, long skull, relatively short tusks [4, 6-8]. *M. trogontherii* as an intermediate link between *M. meridionalis* and *M. primigenius* is more advanced than *M. meridionalis* and more primitive than *M. primigenius*.

Elephas maximus is one of the three living representative of family Elephantidae. Although the present-day distribution of this species is limited around Indian subcontinent, six thousand years ago its range extended from the Tigris-Euphrates Basin in Western Asia, eastward up to the Yangtze-Kiang, perhaps in northern China [9, 10]. This species, potentially best known species of *Elephas*, is distinct in both cranial and dental morphology from every extinct form, especially with advanced features; M3 with 22 to 27 plates, crown height 50 to 150 per cent greater than width, lamellar frequency 5.0 to 9.0, coarsely folded enamel with small, open loops [6]. The Asian elephant of Mesopotamia and Syria which is known from fragmentary remains and several Bronze age illustrations, was named as a new subspecies, *Elephas maximus asurus*, by Deraniyagala [11].

As located between Africa, Asia and Europe, Turkey occupies an important position for the migration of Elephantidae between these continents. However there has been no detailed study of its fossil elephants until now. In previous years the studies on Proboscidean of Turkey focused mostly on Neogene species [12-17]. The elephant remains of Turkey were far from the focus of the studies. The oldest study on fossil elephants of Turkey was made by Falconer [18]. In this study he decribed a new species, *Elephas armeniacus*, on the basis of molar teeth from Erzurum. Maglio [6] considered these molars to be synonyms to the European taxon *Mammuthus trogontherii*. However, because *M. armeniacus* was based on limited material from a deposit of uncertain age, Lister [4] retained *M. trogontherii* for European Middle Pleistocene mammoths. Moreover there is still some discussion about the validity of *armeniacus*. Adam [19] considered that there are insufficient morphological evidences for synonymizing *armeniacus* with *M. trogontherii* and suggests that Erzurum material might represent a westerly population of Asian elephant, *Elephas maximus* [4]. Later in 1986, molar teeth and skelatal parts were found in Erzurum, close to the *armeniacus* locality, and were identified as *M. trogontherii* [19, 20].

Another studies made by Şenyürek [21, 22] and he described a molar tooth from Akdoğan (Ankara) as *Archidiskodon planifrons*, molar teeth from Sivrihisar (Eskişehir), Sarayköy (Denizli) and Alpu (Eskişehir) as *Archidiskodon* (*Mammuthus*) *meridionalis* and a single molar tooth from Ankara Gazi Orman Çiftliği as *Elephas trogontherii*. But all these specimens are in need of revision as they were

identified without any detailed study or comparision.

Becker-Platen and Sickenberg [23] and Sickenberg et al. [24] described *Mammuthus (Archidiskodon) meridionalis*, *Palaeoloxodon* sp. ex gr. *Palaeoloxodon antiquus* and *A. planifrons* from the Villafranchian locality of Yukarısöğütönü.

Mayda [25] described molar teeth from Early to Middle Pleistocene (MNQ 19-20) age locality Manisa-Turgutlu-Aşağıçobanisa as *M. meridionalis*.

Albayrak [26] and Albayrak and Lister [27] made detailed study on dental remains of elephants from five different localities: Eskişehir-Yukarısöğütönü, Konya-Zengen, Amasya-Suluova, Konya-Dursunlu and Kahramanmaraş-Gavur Lake Swamp. And four different species were identified: *Mammuthus meridionalis*, *M. trogontherii*, *Elephas maximus* and probably *Palaeoloxodon antiquus*.

ABBREVIATIONS

M3 – upper third molar tooth
m3 – lower third molar tooth
dP2 – second deciduous premolar
dp4 – lower fourth deciduous premolar

Mammuthus meridionalis

M. meridionalis was described from Yukarısöğütönü, Zengen and Aşağıçobanisa localities [25-27].

The specimens from Yukarısöğütönü are the least derived elephantid remains identified among Turkish material which is consistent with the age of the locality (Villanyian, MN17, ca. 2.2-1.8 Ma) [28]. An upper and lower third molar teeth from Yukarısöğütönü (Figure 1a, b) have pritimive features: low plate number, low hypsodony index and primitive enamel figure. Especially the m3 (Figure 1b) with 11 plates is very interesting. Because the plate number is at the lower end of the range of variation of *M. meridionalis* and possibly within the upper end of *M. rumanus*.

The fossils from Zengen were found from a sand mine during excavations, this is why there is no information about exact locality or stratigraphic level [27]. The molar teeth from Zengen mostly have typical characteristics of *M. meridionalis*, but two lower third molars (Figure 1c, d) have plate count rather at the low end of the species' range of variation [27].

Another locality with *M. meridionalis* remains is Aşağıçobanisa (MNQ–1.7 Ma). The remains of *meridionalis* from this locality are close to the typical form of *meridionalis* [25].

Mammuthus trogontherii

M. trogontherii was described from Pasinler, Dursunlu and Suluova [19, 20, 26, 27]. The remains of *M. trogontherii* from Pasinler is the first evidence of this species' occurrance in Turkey. The molar teeth are similar to type specimens from Süssenborn [19, 20].

Dursunlu (0.9 Ma) *trogontherii* remains shows interesting features. Two molar teeth with similar enamel pattern (Figure 2a, b) are definable as *M. trogontherii*. A dP2 (Figure 2c), a very rare finding, is intermediate in metrics between known *meridionalis* and *primigenius*. And also a dp4 (Figure 2d) has some intermediate features between *meridionalis* and *trogontherii*.

With high crown and high plate number, a molar tooth from Suluova is within the range of typical *M. trogontherii* (Figure 2e).

Elephas maximus

Elephas maximus was described from Gavur Lake Swamp in Kahramanmaraş. This locality, once a big lake and now one of the biggest peatland in Turkey, yields large number of elephant remains. These remains include skeletal parts, isolated teeth, mandibles, maxillae and skulls including teeth. Most of the isolated teeth have typical features of *Elephas maximus* (Figure 3a, b, c): high plate number (21-29 in M3), hypsodonty, high lamellar frequency (5.0-9.0 in M3), wrinkled and thin enamal (2.5-3.0 mm in M3). With the comparison of these remains with actual Asian elephant teeth, it is seen that Gavur Lake Swamp elephants are similar to today's Asian elephant [26, 27]. Radiocarbon analysis was made on fragments of roots from two *E. maximus* specimens (2047-Figure 3b, 1639-Figure 3c) from this locality. The uncalibtared date is 3297 +/- 29 BP (OxA-20592) and calibrated median is 3521 +/-

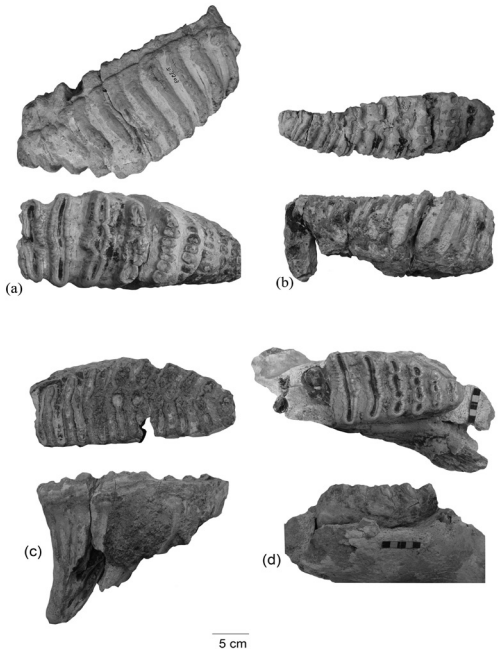

Figure 1. *Mammuthus meridionalis* remains from Yukarısöğütönü (a, b) and Zengen (c, d). All teeth shown in medial or lateral and occlusal views. (a) M.T.A. Natural History Museum, Ankara no. 2306, M3 left; (b) M.T.A. Natural History Museum, Ankara no. 1853, m3, right; (c) Museum of Ereğli, Konya no. 2222, m3, left; (d) Museum of Ereğli, Konya no. 2221A, m3, left.

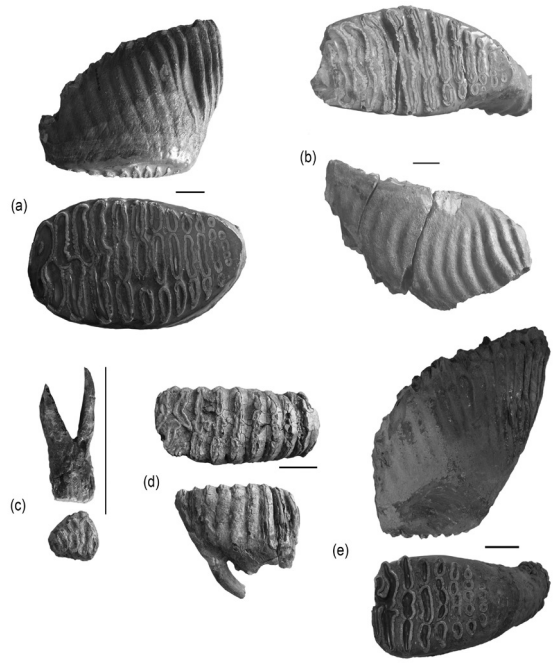

Figure 2. *M. trogontherii* remians from Dursunlu (a-d) and Suluova (e). (a) M.T.A. Natural History Museum, Ankara no. 42-DUR-1-41, M3, right; (b) M.T.A. Natural History Museum, Ankara no. 42-DUR-1-40, m3, left; (c) M.T.A. Natural History Museum, Ankara no. 42-DUR-1-39, dP2; (e) M.T.A. Natural History Museum, Ankara no. 42-DUR-1-29, dp4, right. Scale is 5 cm.

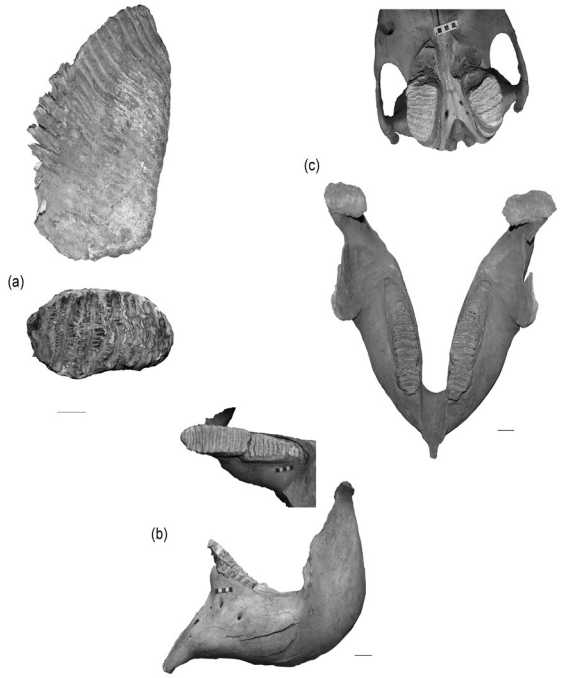

Figure 3. *Elephas maximus* remains from Gavur Lake Swamp. (a) Museum of Kahramanmaraş, no. 46GGB04, M3, left; (b) M.T.A. Natural History Museum, Ankara no. 2047, left mandible with m2 and m3, left and occlusal view; (c) M.T.A. Natural History Museum, Ankara no.1639, mandible with m1 and m2s and skull with M2s, both occlusal view. Scale is 5 cm.

39 cal BP, 95% confidence interval 3610-3449 for the specimen 2047. The uncalibrated date is 3267 +/- 31 BP (OxA-20593) and calibrated median is 3494 +/- 43 cal BP, 95% confidence interval 3570-3405 for the specimen 1639 [26, 27].

DISCUSSION

Although with limited number of specimens from limited localities, important discoveries were made about the fosil elephans of Turkey.

M. meridionalis specimens of Turkey have some primitive features which makes them interesting on the evolution and migration of the species. Maglio [6] suggested three chronological stages for *M. meridionalis* and put the most primitve European specimens into "Laiatico Stage". But the elephant remains from Dacic Basin (Romania) (MN16a, c. 3.5-3.0 Ma) were ascribed to *M. rumanus* [5, 29, 30]. Then the specimens which was described into "Laiatico Stage" *M. meridionalis* were referred to *M. rumanus*.

The molar teeth from Yukarısöğütönü especially the third molar (no.1853) has primitive features for *M. meridionalis*. With 11 plates, this molar tooth is at the lower limit of *meridionalis* and close to the upper limit of *rumanus* [27]. A molar tooth from Zengen has parameters typical for *M. meridionalis*, but two molar teeth have lamellar frequencies and plate number at the low end of the species' range of variation. The Zengen population might therefore be at an evolutionary level similar to that of Yukarısöğütönü, but more material is required for the corroboration [27].

M. trogontherii remains show some interesting charactestics. An M3 from Suluova and a series of specimens from Dursunlu, are metrically typical for the species. But generally Dursunlu sample is very interesting because of its morphology and its estimated age. Two molar teeth have features close to the type specimens from Süssenborn. But several localities in Europe in the time interval ca. 1.0-0.7 Ma have transitional specimens between *M. meridionalis* and *M. trogontherii* [5]. dp4 from Dursunlu with some metrical features between *meridionalis* and *trogontherii* may put this assemblage within transitional groups [27].

Although elephant remains from Gavur Lake Swamp have been know for a long time, no detailed study or radiocarbon alaysis were made [26, 27]. Santiapilli and Jackson [31] and Shoshani and Eisenberg [32] showed the past distribution of *E. maximus* extending westwards as fas as Iraq. But now the identifications and radiocarbon results [26, 27] show that in the recent past, approximately 3500 cal BP. (ca. 1500 B.C.), the distribution of this species extended more westerly, across the eastern part of Turkey.

CONCLUSION

Although small number of elephant remains were studied and identified from limited number of localities it is obvious that Turkey has important position in the history of elephantids. Early mammoths in Europe, *M. rumanus*, probably originated in Africa c. 3.5 mya and migrated into East Africa via the Levant into southern Europe [30, 33] and probably gave rise to *M. meridionalis* although there is no evidence of this transition. Primitive remains from Yukarısöğütönü may provide evidence of this transition [27]. According to recent synthesis [5, 34] *M. trogontherii* originated in Asia 2.0–1.5 mya and spread into Siberia and then Europe at around 1 mya. So Turkey might be on the route of *trogontherii* from Asia to Europe and Dursunlu population might be evidence for this migration and may represent an important addition to the group of *meridionalis*/*trogontherii* transitional assemblages in Europe. With large number of *E. maximus* remains, Gavur Lake Swamp is now has an important position on the past distribution of the recent Asian elephant.

It is expected that with future collecting from well-stratified deposits and multidisciplinary studies on these localities the importance of Turkey in the evolution and migration of elephantids will be confirmed.

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