

Paleoenvironment and age of the Middle Pleistocene site of Gölbaşı (near Adıyaman, southeastern Turkey): a reconstruction based on rodents

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Abstract

Small mammals from Gölbaşı (near Adıyaman, southeastern Turkey) have been analyzed in order to reconstruct paleoenvironment and age of the fossil site. The species recorded at Gölbaşı indicate an age around the Biharian/Toringian transition ('Miomys-Arvicola boundary', early Middle Pleistocene). The composition of the micromammal fauna suggests an open, humid and warm environment with wooded areas in the vicinity and confirms the trend towards open landscapes in the region during the Middle Pleistocene.

Keywords: *Turkey, early Middle Pleistocene, small mammals, paleoenvironment*

Introduction

The Pleistocene small mammals of Turkey are still poorly known. Despite the existence of a considerable number of fossil sites, in most of these localities the total number of specimens available is limited and therefore the palaeofaunistic picture is rather incomplete (Unay and Bruijn, 1998). Thus, in particular cases the absence of taxa in a fauna may be caused rather by a small sample size than by biochronological or ecological reasons. Nevertheless, in many Pleistocene faunas from Turkey still indicative arvicolid taxa were recorded and allow biochronological correlations with widely accepted subdivisions, e.g. with that for the Neogene of Europe (Fejfar and Heinrich, 1980; Fejfar et al., 1998).

The locality Gölbaşı, which is on focus of this paper, is situated in the south-east of Turkey, about 70 km west of the town Adıyaman (Fig. 1). Small mammals from this site have been collected in the frame of the MTA (Mineral Research and Exploration General Directorate of Turkey) project between 2004 and 2005. The faunal remains of Gölbaşı originate from green lacustrine marls interbedded with lignite deposits. The lignitic clay in the lacustro-fluvial siltstone dominated sequence which is transitionally underlain by grey, light reddish sequence of sandstones with conglomerate intercalations. In this paper we attempt biostratigraphical and paleoenvironmental implica-

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tions for the micromammal fauna of this site.



Figure 1: Location map of the locality Gölbaşı

Material and method

Small mammal remains were collected by screen washing with mesh sizes down to 0.5 mm. The approximate weight of the sediment washed was 1000 kg. The residues obtained after processing were sorted under a microscope. The cheek teeth were drawn under a stereo microscope and measured with a Nikon measuroscope.

The Gölbaşı material is stored in the collections of the Department of Anthropology, Cumhuriyet University, Sivas, Turkey.”

Systematic paleontology

After the systematic study (see Suata-Alpaslan and Dinçarslan, 2011) a list of identified taxa from Gölbaşı is given in Table 1 and the relative frequencies of all rodent taxa represented in Figure 2.

Table 1: List of species identified in the fauna of Gölbaşı

Mammalia/ Rodentia Family	Species	NISP (Number of Identified Specimens)
Cricetidae	<i>Mesocricetus auratus</i>	7
	<i>Cricetulus</i> sp.	5
Muridae	<i>Apodemus mystacinus</i>	13
	<i>Apodemus flavicollis</i>	11
Arvicolidae	<i>Microtus guentheri</i>	9
	<i>Microtus</i> sp.	4
	<i>Mimomys</i> sp.	5
	<i>Arvicola</i> sp. (or juv. individuals of <i>Mimomys</i>)	4
	<i>Lağurini</i> gen. et. sp. indet.	1

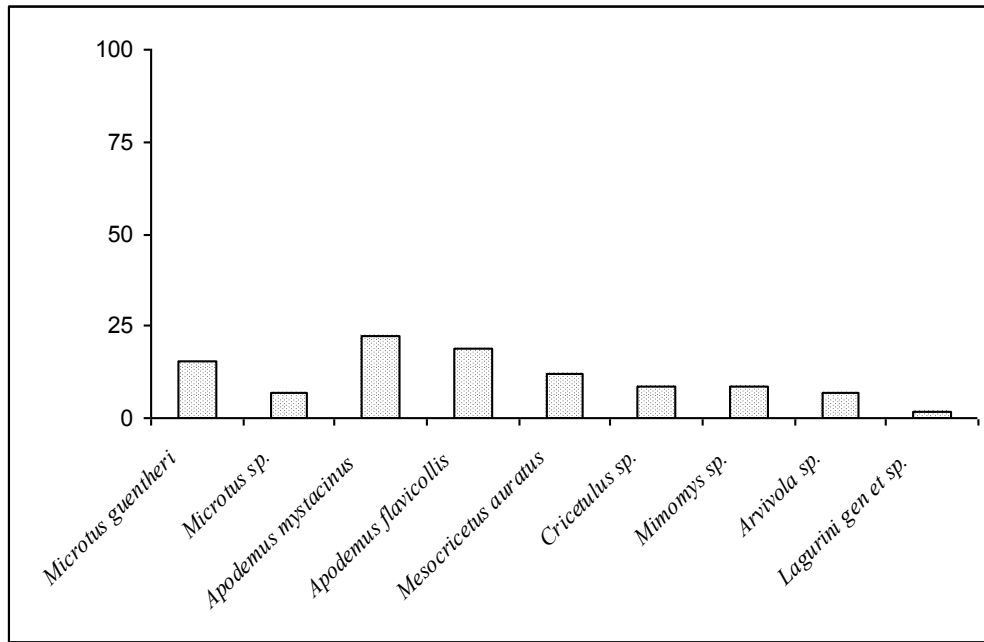


Figure 2: Relative abundance of the rodent taxa represented at Gölbaşı based on the total number of M1, M2, m1 and m2.

Paleoecological implications

According to Unay and de Bruijn (1998) the Late Pliocene and Pleistocene assemblages of Anatolia are ecologically rather monotonous. A successive decrease of taxonomic diversity by time is interpreted by these authors as a decline in temperature that may have eliminated the vegetation required by climatically demanding species, e.g. as to be seen in the disappearance of flying squirrels.

The rodent taxa recorded at Gölbaşı can be referred to different habitats: open area, rocky ground and woodlands. *Apodemus mystacinus* and *Apodemus flavicollis* primarily inhabit deciduous and Mediterranean forest. However, *Apodemus mystacinus* prefers drier habitats than the other *Apodemus* species (Tchernov, 1986) and has been reported from barren, rocky areas of dry, open environments (Storch, 1988; Mayhew, 1978; Montuire et al., 1994). *Apodemus flavicollis* is much less tolerant to dry environments (Tchernov, 1986) and is mainly recorded from more moist and wooded habitats (Storch, 1975; Montuire et al., 1994; Nadachowski, 1982). *Microtus guentheri* is a steppe element (Storch, 1975; Mayhew, 1978) and so is *Mesocricetus auratus* (Tchernov, 1968).

In order to evaluate the proportion between the environmental indicators and to conclude possible environmental changes the rodent remains are grouped according to their preferred environment: *Microtus guentheri*, *Microtus sp.*, *Mesocricetus auratus* and *Apodemus mystacinus* as representatives of open areas with rocky ground and *Apodemus flavicollis* representing woodlands. *Arvicola* prefers freshwater banks and grasslands. Figure 3 shows that the relative abundance between these ecological groups, suggests a dominance of open environment with rocky ground but indicates also a woodland component for Gölbaşı. However, this evaluation has to be considered with caution since the relative abundance may have been biased by taphonomic processes (accumulation in owl pellets, transport, etc.). To study such processes firmly more fossil remains are required.

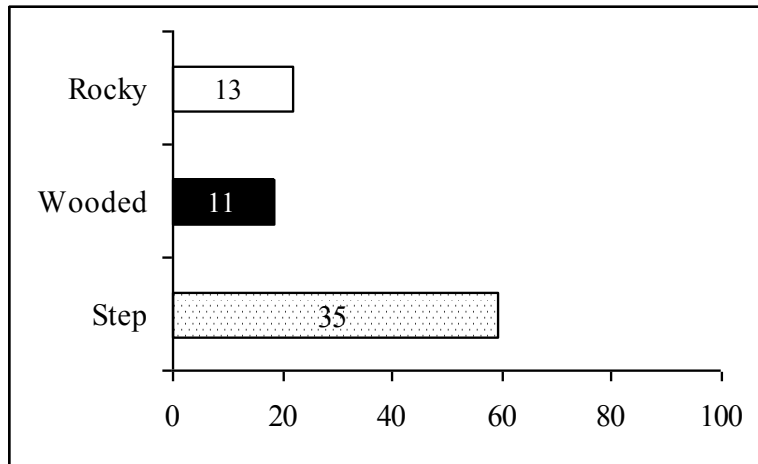


Figure 3: Relative frequencies of the ecological groups of rodents represented of Gölbaşı. Numbers refer to the number of rodent species.

Biostratigraphic age

All rodent taxa from Gölbaşı but *Mimomys* and the undetermined lagurine specimens are members of the extant fauna. However, the co-occurrence molars of *Mimomys* and *Arvicola* support an early Middle Pleistocene age of the fauna. Both taxa belong to the Water Vole lineage. In accordance to many other authors (e.g., Chaline 1972; Koenigswald 1973; Heinrich, 1978; Montuire et al., 1994) *Mimomys savini* with rooted molars is considered to be the ancestor of *Arvicola mosbachensis* (= *A. cantianus* – for discussion on nomenclature see Maul et al., 2000) with rootless cheek teeth. At Gölbaşı such rooted and rootless teeth of the Water Vole lineage are recorded. There are two options: either the rootless molars are juvenile individuals of *Mimomys* or they really represent the genus *Arvicola*. More important than the taxonomic referral is the fact of the co-occurrence of rooted and rootless molars. This situation compares to several early Middle Pleistocene faunas where a transitional stage from *Mimomys savini* to *Arvicola mosbachensis* is documented, as Guru Dobrogei in Romania (Radulescu and Samson, 1993) or Mosbach-2 in Germany (Maul et al., 2000), Emirkaya-2 in Turkey (Montuire et al., 1994) and other sites (Rekovets and Nadachowski, 1995; Sen et al., 1991; Rekovets, 1990).

The boundary between faunas of the Biharian (with *Mimomys*) and the Torigian (with *Arvicola*) is defined by these two genera (e.g., Fejfar and Heinrich, 1980; Fejfar et al., 1998). It is called the '*Mimomys-Arvicola* boundary.' In Central Europe it is correlated with MIS 17-16 (= c. 700-600 ka) (Koenigswald and Kolfschoten, 1996), which was currently confirmed (Coltorti et al., 2005; Wagner et al., 2011).

Tentatively we can assume a similar age of 600-700 ka for Gölbaşı, in any case it is early Middle Pleistocene. However, this transition might have been occurred in various areas at different time. Tchernov (1986) suggested that outside Europe (probably in the Middle East) the earliest *Arvicola* and the latest *Mimomys* would have been contemporaneous. However, this assumption based on the record of '*Arvicola*' *jordanica* recorded at Ubeidiyah (Tchernov, 1986) that later has been referred to *Microtus (Tibericola)* (Koenigswald et al., 1992).

Paleobiogeography

The Pleistocene fauna of Gölbaşı contains European and Asiatic elements and such, which are typical for the Middle East: *Apodemus*, *Arvicola* and *Mimomys* occur in

Europe and Asia. The two species of *Apodemus* present in Gölbaşı are known from Europe from the Pliocene onwards (Pasquier, 1974). Modern *Apodemus* species also existed during the entire Quaternary also in Israel (Tchernov, 1986). They are found in Anatolia since the Biharian (Unay and de Bruijn, 1998; Montuire et al., 1994; Storch, 1975, 1988). *Microtus* is known from numerous Pleistocene localities from Eurasia, such as Uppony (Hungary) (Jánossy, 1986), Latomi-I, Chios (Greece) (Storch, 1975), Emir-kaya (Anatolia) (Montuire et al., 1994) and many others. *M. guentheri* is a characteristic element of faunas of SE Europe and the Middle East. It is widely distributed in the Eastern Mediterranean region since the Middle Pleistocene: e. g., in Üçağzlı (Suata-Alpaslan, 2011), Yarımburgaz (Santel and Koenigswald, 1998), Latomi-I, Chios (Storch, 1975), Arnissa (Mayhew, 1978), Oumm-Qatafa and Kebara (Tchernov, 1968). *Mesocricetus auratus* (= *Mesocricetus brandti*, Tchernov, 1986) is limited to Anatolia and the Middle East. It is originated from *M. primitivus* (Tchernov, 1986) a species also recorded from several Pliocene localities of Anatolia (de Bruijn et al., 1970; Sen, 1977, 1998; Unay and de Bruijn, 1998).

Conclusions

The presence of mammalian fossil remains at the Gölbaşı village has been known since 1978, but has not been published yet. The Middle Pleistocene fauna of Gölbaşı (Adıyaman) possesses an Eastern Mediterranean character. The rodent assemblages are composed of Asiatic and European species in combination with elements endemic to the Eastern Mediterranean.

The co-occurrence of *Mimomys* and *Arvicola* supports an early Middle Pleistocene age for the Gölbaşı fauna. During this period the environment of this part of Turkey was probably an arid, open, humid and warm environment with wooded areas in the vicinity.

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