Research Article

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Some small mammal fossils of Üçağızlı Cave (Hatay, Turkey)

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Abstract: Small mammal assemblages of Üçağızlı Cave, 2 from the early Upper Paleolithic and 1 from the Epipaleolithic, spanning a period from 41 to 17 kya, are described. The remains are referred to as *Chionomys nivalis*, *Microtus guentheri*, *Apodemus mystacinus*, *Apodemus flavicollis*, *Apodemus witherbyi*, *Mus macedonicus*, *Mesocricetus brandti*, *Glirulus* sp., *Crocidura* sp., *Pipistrellus* cf. *kuhlii*, and *Myotis* sp. The rodent fauna of Üçağızlı suggests the dominance of open country and rocky ground with a woodland component. There does not seem to have been any essential environmental changes during the deposition of these layers. However, the poor sample of the Epipaleolithic hampers environmental conclusions. The rodent assemblages of Üçağızlı contain European, local, and Asiatic elements. All of the rodent taxa from Üçağızlı, except for *Glirulus*, are also known from the contemporaneous levels of Karain B and the extant fauna of the Hatay region. This shows that the rodent fauna of the eastern Mediterranean has not changed much since the Late Pleistocene.

Key words: Small mammals, Upper Paleolithic/Epipaleolithic, environment, Üçağızlı (Hatay, Turkey)

Üçağızlı Mağarasının bazı küçük memeli fosilleri

Özet: Üçağızlı Mağarasının 41 ile 17 kya aralığından Epipaleolitik'den bir ve Erken Üst Paleolitik'den iki küçük memeli topluluğu tanımlanmıştır. Diğerleri *Chionomys nivalis*, *Microtus guentheri*, *Apodemus mystacinus*, *Apodemus flavicollis*, *Apodemus witherbyi*, *Mus macedonicus*, *Mesocricetus brandti*, *Glirulus* sp., *Crocidura* sp., *Pipistrellus* cf. *kuhlii*, ve *Myotis* sp. olarak adlandırılır. Üçağızlı kemirici faunası daha çok kayalık zeminli açık kırlık bir alanı ve ağaçlıklı ortamı gösterir. Bu tabakaların çökelmesi sırasında önemli çevresel değişiklikler olmadığı gözlemlenmiştir. Buna rağmen Epipaleolitiğin fakir örnekleri ortamsal sonuçların alınmasını güçleştirir. Üçağızlı kemirici topluluğu Avrupa, Asya ve yerel elementleri içerir. *Glirulus* dışındaki bütün Üçağızlı kemirici taksonları Hatay bögesinin mevcut faunasından ve Karain B' nin şimdiki seviyelerinden de bilinir. Bu da Doğu Akdeniz kemirici faunasının Geç Pleyistosenden bu yana değişmediğini gösterir.

Anahtar sözcükler: Küçük memeliler, Üst Paleolitik/Epipaleolitik, ortam, Üçağızlı (Hatay, Türkiye)

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Introduction

Üçağızlı Cave is located on the Mediterranean coast of the Hatay region (Figure 1).

The principal goal of the joint research by the University of Arizona and Ankara University since 1997 in Üçağızlı Cave is to investigate the cultural adaptations of the earliest Upper Paleolithic rodents to changes in the environment (Güleç et al., 2002; Kuhn et al., 2009). The main sediment type of the early Upper Paleolithic stratigraphic sequence in the northern part of Üçağızlı Cave (Figure 2) consists of reddish silty clays, the *terra rossa* typical of the karstic terrain in the Mediterranean basin. The main stratigraphic distinctions are based on the relative abundance of anthropogenic sediment. Although there are no major changes in the lithology of the Üçağızlı Cave section, the stratigraphic sequence may not be continuous. At least 2 bedding planes (between layers I and H3 and C and B1-B4) are flat and sharp and may indicate erosional surfaces. Most of the layers rich in ash were further subdivided into finer stratigraphic units, such as B1, B2, H3, etc. These finer stratigraphic distinctions are based on differences in the anthropogenic components of the sediments (Kuhn, 2004; Kuhn et al., 2009).

A series of AMS radiocarbon dates indicate that the stratigraphic sequence in the cave spanned a period of at least 12,000-13,000 years, from 29,000 BP to 41,000 radiocarbon years before present (Kuhn et al., 2001; Güleç et al., 2002; Kuhn, 2004), covering the earliest Upper Paleolithic (41 kya) and the Ahmarian. There is an Epipaleolithic locality with small mammals, Loc. 1 (calculated radiocarbon age of 17,530 ± 140 with the lab number AA38199, Steven Kuhn, personal communication), at the south end of Üçağızlı Cave that is not directly connected to the rest of the stratigraphic sequence.

Small mammals were found in all of the major units and in the Epipaleolithic of Loc. 1. Those from layers H through C, however, were represented by skeletal elements only. Since postcranial elements of most small mammals cannot be identified to the genus or species level, work was confined to the teeth collected from layer I, layers B-B3 (Figure 2), and from the Epipaleolithic of Loc. 1. The faunas from layers C6d, E5-6, E5/6, and E6d, the depth of which was measured in meters, appeared to correspond with level I and they were considered together. The faunas from Loc. 3 and D6d corresponded with levels B-B3 and were considered together (Table 1). The

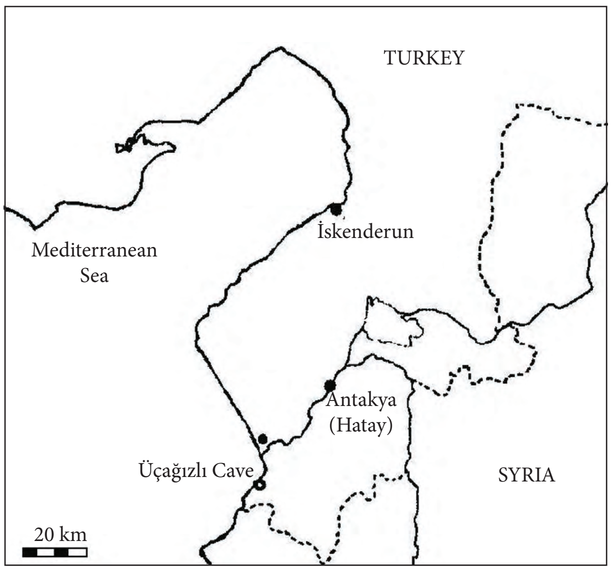

Figure 1. Sketch map of Üçağızlı Cave of the Hatay region.

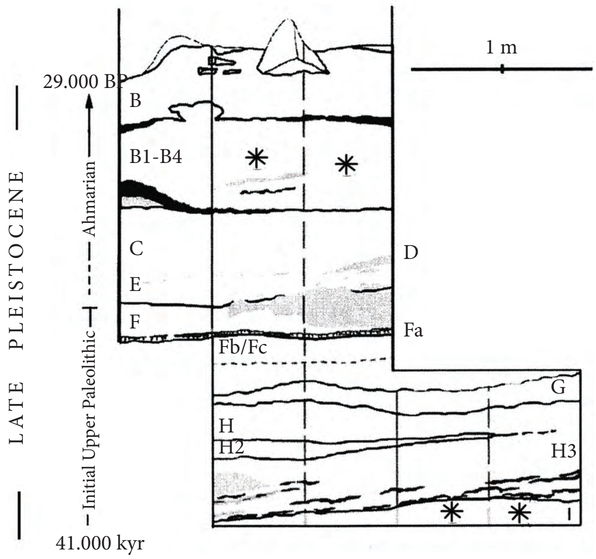

Figure 2. Üçağızlı Cave stratigraphy showing approximate depth ranges of major chronostratigraphic units (modified after Kuhn, 2004). Localities with small mammals from layers B, C, D, E, and I (asterisk indicates the layers from which small mammals are described). Localities with skeletal elements from layers C, F, G, and H.

Table 1. The small mammal taxa recognized in the samples from Üçağızlı. Layers I, B-B3, and the Epipaleolithic of Loc. 1 of Üçağızlı (N refers to the total number of M1, M2, m1, and m2 of the Rodentia, Soricomorpha, and Chiroptera).

	Loc. I	Loc. 3	C6d	D6d	E5-6	E5/E6	E6d	EP	B-B3	I	N
Chionomys nivalis	-	9	-	-	3	1	2	-	9	6	15
Microtus guentheri	4	34	-	3	2	-	-	4	37	2	43
Apodemus mystacinus	1	60	-	-	13	5	4	1	60	22	83
Apodemus flavicollis	-	55	-	2	12	1	-	-	57	13	70
Apodemus witherbyi	-	3	-	-	-	-	-	-	3	-	3
Mus macedonicus	-	6	-	2	-	-	-	-	8	-	8
Mesocricetus brandti	-	5	-	-	-	-	-	-	5	-	5
Glirulus sp.	-	1	-	-	-	-	-	-	1	-	1
Crocidura sp.	-	2	-	-	2	-	-	-	2	2	4
Myotis sp.	-	4	-	-	-	-	-	-	4	-	4
Pipistrellus cf. *kuhlii*	-	2	-	-	-	-	-	-	2	-	2

small mammals were obtained from a 1.3-m^3 area of sediment from layer I, a 4.5-m^3 area from layers B-B3, and from a 0.35-m^3 area from the Epipaleolithic site, Loc. 1. *Lepus* was excluded from the study, as it is considered to be among the animals that were hunted by Paleolithic man.

Materials and methods

The small mammal teeth described below were collected by underwater screening. The mesh of the finest sieve used was 0.5 mm. The approximate weight of the matrix washed from the locality was 3000 kg. The residues obtained after washing were sorted under a microscope. The measurements of the cheek teeth are maximum lengths measured in the direction of the tooth row and maximum widths at right angles to the length. The teeth were drawn under a binocular microscope and measured with a Nikon measuroscope. Measurements (length × width) in the Tables are given in millimeters. The Üçağızlı material was stored in the collections of Cumhuriyet University, Faculty of Science and Literature, Department of Anthropology.

Results

A morphological description of 2 small mammal assemblages from Üçağızlı Cave is given with systematic, stratigraphic, and paleoecologic relationships.

Systematics

Chiroptera Blumenbach, 1779

Vespertilionidae Gray, 1821

Myotis Kaup, 1829

Myotis sp. Kaup, 1829

Layers: B-B3 (Sites: C6d, D6d)

Material and measurements: Table 2

Table 2. Measurements of the occlusal surface of *Myotis* sp. (N, number of specimens).

	Length			Width	
	Range	Mean	N	Range	Mean
m1	-	1.57	1	-	1.02
m2	1.50-1.65	1.56	3	1.05-1.26	1.12
m3	1.45-1.50	1.47	3	0.90-1.15	1.00

Remarks

The material was scanty and diagnostic elements were lacking (Table 2). However, the morphology of the available teeth and the position of the mental foramen with respect to the teeth match well with those of the extant *Myotis* species in the collection at the Department of Biology, Niğde University, whereas the size of the Üçağızlı material was slightly smaller than those of the extant ones.

Pipistrellus Kaup, 1829

Pipistrellus cf. *kuhlii* Natterer, 1819

Layers: B-B3 (Site: D6d)

Material and measurements: 1 from m1 (1.20 × 0.95); 1 from m2 (1.10 × 0.95); 1 from m3 (1.05 × 0.90)

Remarks

Although the diagnostic elements were lacking in size, the morphology of the teeth and the position of the mental foramen, which was below p3/c, were the same as those of the extant *Pipistrellus kuhlii* in the collection at the Department of Biology, Niğde University.

Soricomorpha Gregory, 1910

Soricidae G. Fischer, 1814

Crocidura Wagler, 1832

Crocidura sp. Wagler, 1832

Layers: B-B3 (Site: Loc. 3), I (Site: E5-6)

Material and measurements: Table 3

Remarks

The morphology and the size of the teeth match well with those of extant *Crocidura* in the collection at the Department of Biology, Niğde University (Table 3). Since the diagnostic elements were lacking, we refrained from giving specific identification of this material.

Table 3. Measurements of the occlusal surface of *Crocidura* sp.

	Length			Width	
	Range	Mean	N	Range	Mean
m1	1.45-1.50	1.47	2	1.01-1.02	1.01
m2	1.40-1.45	1.42	2	0.90-0.95	0.92
m3	-	1.10	1	-	0.75

Rodentia Bowdich, 1821

Arvicolidae Gray, 1821

Chionomys Miller, 1908

Chionomys nivalis Martins, 1842

(Figure 3A and 3B)

Layers: I (Sites: E5-6, E5/E6), B-B3 (Site: Loc. 3)

Material and measurements: Table 4

Table 4. Measurements of the first lower molar of *Chionomys nivalis*.

m1	Length	Width	N
Range	2.40-2.95	0.86-1.12	9

Remarks

Among the arvicolid material, 9 of the m1 showed the nivalid type of AC2 (anterior/frontal cap) (Meulen, 1973) with a BSA4 (buccal/labial salient angle) and the absent (4 specimens) or incipient BRA4 (buccal reentrant angle; 5 specimens) (Table 4). The tip of the LRA4 (lingual reentrant angle) lies in front of that of the BRA3. The size and the morphology of the m1 fit with those of the fossil associations of *Chionomys nivalis* described (as *Microtus nivalis* and *Microtus nivalis* synonym *C. nivalis*, (Wrobel, 2007)) from Arnissa (Mayhew, 1978), Karain B (Storch, 1988), Latomi-I, Chios (Storch, 1975) and the recent populations of this species from Anatolia (Yardımcı, 1997).

Microtus guentheri Danford & Alston, 1880

(Figures 3C-3E)

Layers: Loc. 1, B-B3 (Sites: Loc. 3, D6d), I (Site: E5-6)

Material and measurements: Table 5

Remarks

There were 20 m1 of a relatively large size showing the arvalid type of anterior cap in clear differentiation from the AC2 into T6 (triangle), T7, and AC3 (Meulen, 1973), (Table 5). The BRA4 and LRA5 were well developed. The anterior cap (AC) of the m1 was relatively large. The sole M3 (L: 17.00) was complex, having an incipient BSA4 and a shallow BRA3 and BRA4. The dental characteristics of the Üçağızlı association agree with those of the fossil associations of this species described from Arnissa (Mayhew, 1978), Karain B (Storch, 1988), and Latomi-I, Chios (Storch, 1975). The size of the specimens was similar to the recent *M. guentheri* associations from Anatolia (Beseneckher et al., 1972; Yardımcı, 1997), but they were somewhat smaller than the fossil assemblages.

Muridae Gray, 1821

Apodemus Kaup, 1826

Apodemus mystacinus Danford & Alston, 1887

(Figures 4A-4C)

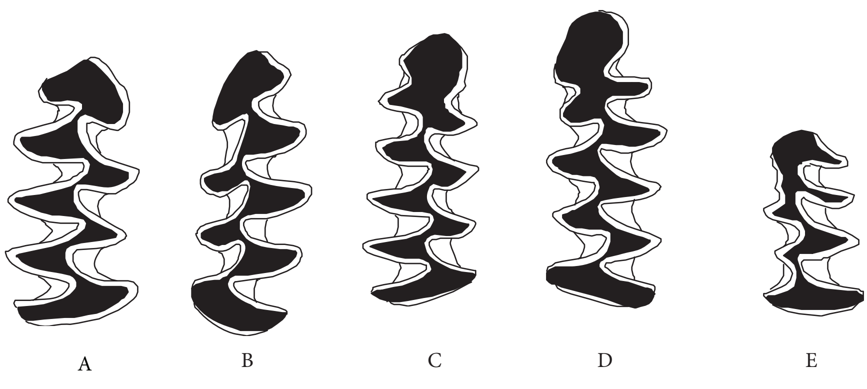

Figure 3. *C. nivalis*: A) right m1 and B) left m2; and *M. guentheri*: C) right m1, D) left m1, and E) left M3 from Üçağızlı. Occlusal views (scale: 1 mm).

Table 5. Measurements of the first lower molar of *Microtus guentheri*.

m1	Length	Width	N
Range	2.48-3.10	0.80-0.10	20

Layers: Loc. I, B-B3 (Site: Loc. 3), I (Sites: E5-6, E5/6, E6d)

Material and measurements: Table 6

Remarks

The large size of the teeth (Figure 5 and Table 6) and the morphology of the M1 with a well developed t12 (tubercule) were in harmony with those of *Apodemus mystacinus*.

Apodemus flavicollis Melchior, 1834

(Figures 6A and 6B)

Layers: B-B3 (Sites: Loc. 3, D6d), I (Sites: E5-6, E5/6)

Material and measurements: Table 7

Figure 4. *A. mystacinus* from Üçağızlı: A) left M1-M3, B) left M1, C) right m1-m3. Occlusal views (scale: 1 mm).

Table 6. Measurements of the occlusal surface of *Apodemus mystacinus*.

	Length			Width	
	Range	Mean	N	Range	Mean
m1	2.10-2.36	2.21	41	1.20-1.40	1.30
m2	1.40-1.58	1.45	31	1.15-1.45	1.29
m3	1.18-1.35	1.22	12	1.00-1.25	1.11
M1	2.30-2.40	2.33	6	1.30-1.55	1.44
M2	1.48-1.65	1.59	5	1.33-1.50	1.42
M3	1.04-1.15	1.10	3	1.04-1.10	1.07

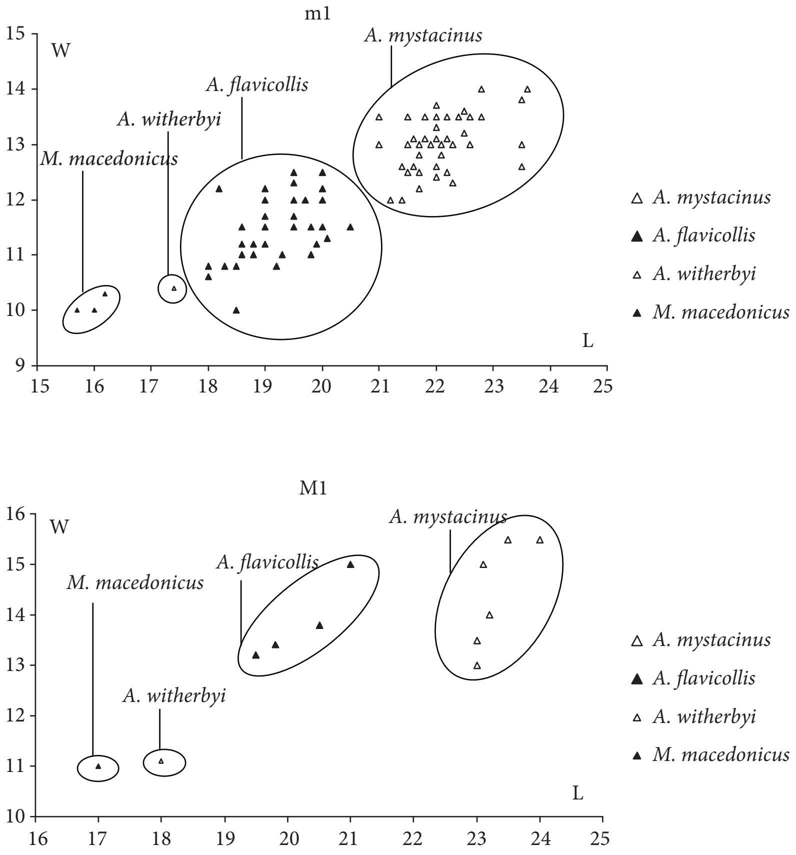

Figure 5. Length-width scatter diagrams of m1 and M1 of the *Apodemus* species and *Mus macedonicus* described from Üçağızlı Cave.

Table 7. Measurements of the occlusal surface of *Apodemus flavicollis*.

	Length			Width	
	Range	Mean	N	Range	Mean
m1	1.80-2.05	1.92	33	1.00-1.28	1.14
m2	1.20-1.37	1.29	30	1.00-1.28	1.14
m3	1.00-1.13	1.11	15	0.90-1.05	1.03
M1	1.95-2.10	2.02	4	1.32-1.50	1.41
M2	1.25-1.45	1.35	3	1.20-1.25	1.22
M3	-	1.00	1	-	0.95

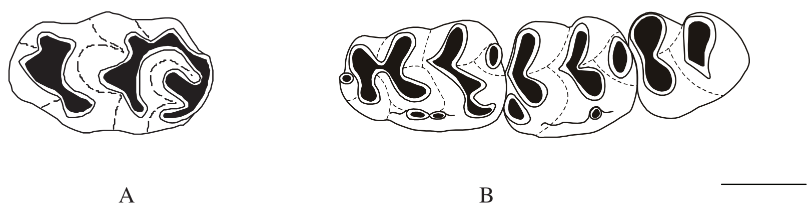

Figure 6. *A. flavicollis* from Üçağızlı: A) left M1, B) left m1-m3. Occlusal views (scale: 1 mm).

Remarks

The size of the molars (Figure 5 and Table 7) and the morphology of the M1 specimen, with weakly developed t12, resemble those of *Apodemus flavicollis*.

Apodemus witherbyi Thomas, 1902

(Figures 7A and 7B)

Layers: B-B3 (Site: Loc. 3)

Material and measurements: Table 8

Remarks

The small size of the teeth (Figure 5 and Table 8) and the morphology of the M1 specimen without t12 agree with those of *Apodemus witherbyi*.

Mus Linnaeus, 1758

Mus macedonicus Petrov & Ruzic, 1983

(Figures 8A and 8B)

Layers: B-B3 (Sites: Loc. 3, D6d)

Table 8. Measurements of the occlusal surface of *Apodemus witherbyi*.

	Length	N	Width
m1	1.74	1	1.04
M1	1.80	1	1.11
M2	1.12	1	1.05
M3	0.80	1	0.78

Material and measurements: Table 9

Remarks

A few murid teeth with simple morphology and small size (Figure 5 and Table 9) show the presence of the genus *Mus* in Üçağızlı Cave. A short, wide, closed valley between the t1-t4 in the M1 and the 4-cusped clover-shaped anterior part, and the protoconid/

Figure 7. *A. witherbyi* from Üçağızlı: A) left M1-M3, B) left M1. Occlusal views (scale: 1 mm).

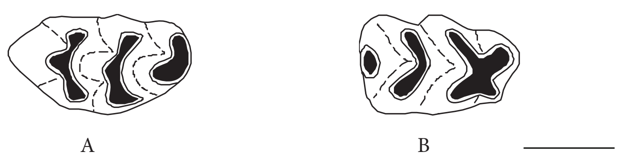

Figure 8. *M. macedonicus* from Üçağızlı: A) right M1, B) right m1. Occlusal views (scale: 1 mm).

Table 9. Measurements of the occlusal surface of *Mus macedonicus*.

	Length			Width	
	Range	Mean	N	Range	Mean
m1	1.57-1.62	1.59	3	1.00-1.03	1.01
m2	1.05-1.15	1.10	3	0.98-1.00	0.99
m3	-	0.78	1	-	0.75
M1	-	1.70	1	-	1.10
M2	-	1.09	1	-	1.04
M3	-	0.72	1	-	0.80

metaconid in the m1, are of a *Mus* species, and it can be concluded that the *macedonicus* type is excluded.

Cricetidae Rochebrune, 1883

Mesocricetus Nehring, 1898

Mesocricetus brandti Nehring, 1898

(Figure 9)

Layers: B-B3 (Site: Loc. 3)

Material and measurements: Table 10

Remarks

The dentition of *M. brandti*, though generally similar to that of *M. auratus*, differs by its relatively short m2 and m3 and the isolated position of the mesolophid in m2 and m3. The Üçağızlı cricetid association, represented by lower teeth only, differs from *Cricetus* in the smaller size of the teeth and in the presence of a well-developed mesolophid in the m2 and the m3 (Figure 9 and Table 10). They are larger than those of *M. primitivus* and smaller than the ones of *M. newtoni*, but they resemble *M. brandti* in size and morphology.

Gliridae Thomas, 1897

Glirulus Thomas, 1906

Glirulus sp.

(Figure 10)

Layers: B-B3 (Site: Loc. 3)

Material and measurements: 1 from m1 (1.10 × 1.11)

Description

m1: The occlusal surface is moderately concave and has a subrectangular outline. There are 9 ridges are present: the 4 main ridges, centrolophid, anterolophid, posterolophid (bottom), 1 extra ridge between the centrolophid and the metalophid, and 1 extra ridge between the centrolophid and the mesolophid. The anterolophid is connected to the metalophid labially. The anterolophid and

Figure 9. *M. brandti* (right m3-m1) from Üçağızlı. Occlusal views (scale: 1 mm).

Table 10. Measurements of the occlusal surface of *Mesocricetus brandti*.

	Length			Width	
	Range	Mean	N	Range	Mean
m1	2.10-2.25	2.18	3	1.15-1.20	1.17
m2	1.85-1.95	1.90	2	1.34-1.35	1.34
m3	1.85-2.20	2.06	5	1.25-1.50	1.39

the posterolophid are long and as high as the main ridges. The extra ridges are weak. The endolophid is complete (Figure 10).

Remarks

Figure 10. *Glirulus* sp. (left m1) from Üçağızlı. Occlusal views (scale: 1 mm).

The Üçağızlı *Glirulus* has one extra ridge between the anterolophid and metalophid of the m1. According to de Bruijn (1998), 2 groups of *Glirulus* species can be recognized: those with m1 and m2 that usually have 2 extra ridges between the anterolophid and metalophid (*japonicus*, *pusillus*, *lissiensis*, *conjunctus*, and *ekremi*), and those with usually only 1 extra ridge between the anterolophid and metalophid of the m1 and m2 (*minor* and *diremptus*). The sole extant species *G. japonicus* shows 2 extra ridges; hence, it is different from the Üçağızlı species. The Üçağızlı m1 probably represents a new species, but one m1 was considered insufficient to define a new species. *Glirulus* used to have a wide geographic distribution in the past and is a relict on the Japanese islands today. *Glirulus* was recorded in Anatolia from MN3 (Ünay, 1994) to MN15 (Ünay and de Bruijn, 1998). Therefore, the presence of *Glirulus* in Üçağızlı is surprising. It seems that it survived in this refuge area until very recently.

Paleoenvironmental implications

It is known that rodents live in caves only exceptionally (Kowalski, 1990). The remains of the small mammals of Üçağızlı, bats excepted, are therefore most probably derived from owl pellets. Such accumulations are expected to show a sampling bias because the owls may have been selective in feeding on certain animals. Additionally, the recovery of the Epipaleolithic fauna of Üçağızlı from a much smaller sample than the ones from the other 2 units increases the sampling bias. Any conclusion about the paleoenvironment on the basis of such fossil assemblages should be considered with care. Nevertheless, these fossil assemblages reflect the fauna in the vicinity of Üçağızlı Cave during the time of deposition and bear significant data for paleoecological analysis. Figure 11 shows the relative frequencies of all taxa represented in the 3 units of Üçağızlı.

The rodent fauna contains species characteristic of different subenvironments, such as open country, rocky ground, and woodland. *A. mystacinus*, *A. flavicollis*, and *A. witherbyi* are species of primarily deciduous forests and Mediterranean woods. *A. mystacinus* prefers drier habitats than the others (Tchernov, 1986) and has been reported from barren, rocky areas of dry, open environments (Mayhew, 1978; Storch, 1988; Montuire et al., 1994). *A. flavicollis* is much less tolerant of dry environments (Tchernov, 1986) and is most often recorded in more moist-wooded habitats (Storch, 1975; Nadachowski, 1982; Montuire et al., 1994). *A. witherbyi* (= *hermonensis*) requires woodlands (Filippucci et al., 1996; Siahsarvie and Darvish, 2008). *M. macedonicus* prefers crop areas and open, dry environments (Çolak et al., 2006).

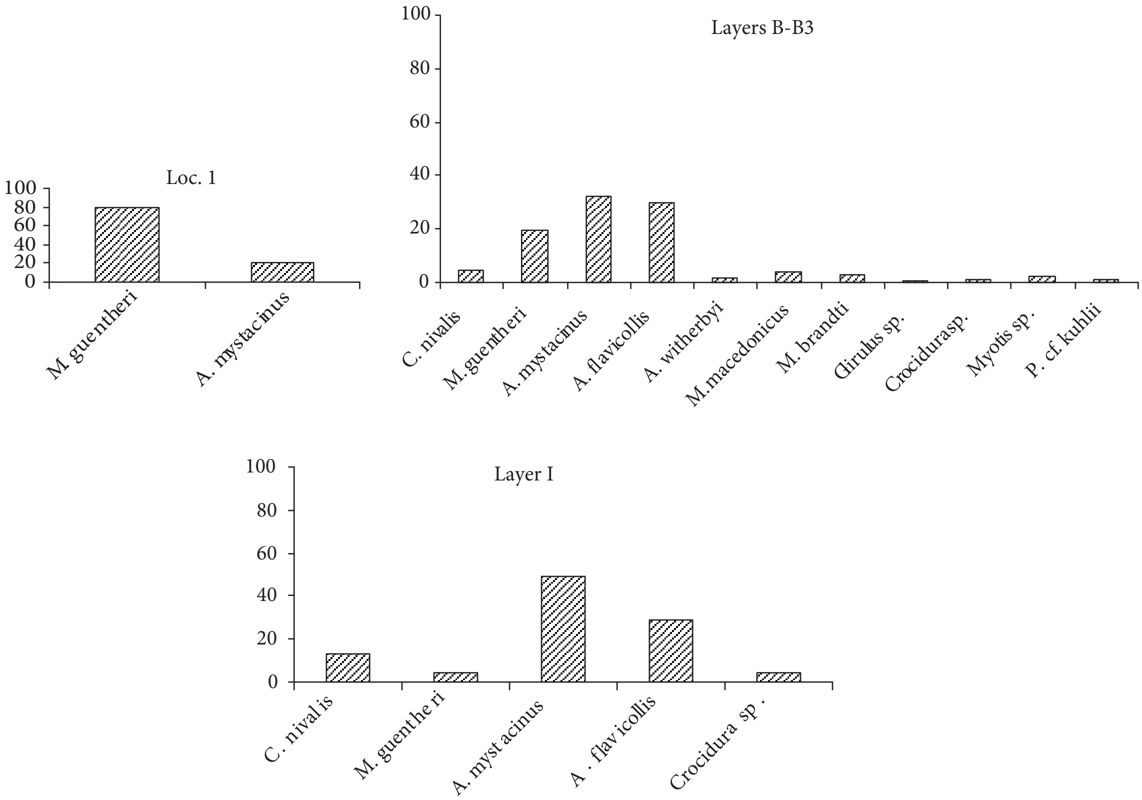

Figure 11. Relative frequencies of the taxa represented in layers I, B-B3, and the Epipaleolithic of Loc. 1 of Üçağızlı based on the total number of M1, M2, m1, and m2 of Rodentia, Chiroptera, and Soricomorpha.

C. nivalis is known to represent rocky environments (Storch, 1975; Mayhew, 1978; Chaline et al, 1995). *M. guentheri* is a steppe element (Storch, 1975; Mayhew, 1978) and so is *M. brandti* (Tchernov**,** 1968). The species of *Glirulus*, however, are assumed to prefer wooded environments (Meulen and de Bruijn, 1982; Daams and Meulen, 1984; Van Dam, 1997). The only living species of the genus, *Glirulus japonicus*, inhabits mountain forests on some Japanese islands (Nowak, 1991).

In order to see the distribution of the environmental indicators and to check whether or not environmental changes existed between the levels, the rodents were grouped according to their environments of preference: *M. guentheri*, *C. nivalis*, *M. brandti*, *A. mystacinus*, and *M. macedonicus* representing open country environments with rocky ground and *A. flavicollis*, *A. witherbyi*, and *Glirulus* representing woodlands. Figure 12 shows the relative frequencies of these ecological groups.

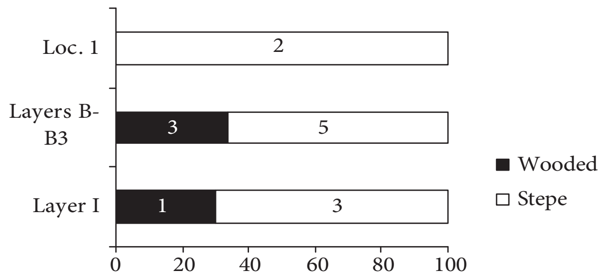

Figure 12. Relative frequencies of the ecological groups of rodents represented in the various levels of Üçağızlı Cave. Numbers refer to the number of rodent species.

Based on the number of species, the present analyses suggest dominance of an open country environment with rocky ground as well as a woodland component for layer I and layers B-B3. The occurrence of all of the taxa of layer I in layers B-B3 and the close similarity of the distributions of the environmental preference of the taxa in layer I and in layers B-B3 show that there was no essential environmental change during the time of deposition of layer I and layers B-B3. Kuhn et al. (2003), who analyzed the large mammals from the same beds, stated that elevated frequencies of *Capreolus*, pig, and bear suggest relatively heavy vegetation in layers B-B4. Apparently, a substantial degree of forest cover prevailed in the area around the cave. The abundance of shellfish remains also suggests that the shoreline was fairly close to the cave. Combined with the radiometric dates, faunal data thus link the occupation to a relatively warm, wet interval, late within the isotope stage 3. The increase of woodlands in layers B-B3 is not significant in these diagrams. It is therefore concluded that the early Upper Paleolithic environment around Üçağızlı was probably not very different from today's seasonal Mediterranean climate of the region. Storch (1988) suggested increasing aridity and steppe conditions from the Middle Paleolithic through the Early Upper Paleolithic with a minor change in the Epipaleolithic for Karain B. Unfortunately, the sample size of the Epipaleolithic site of Üçağızlı is too small to allow conclusions for Üçağızlı. The climatic deterioration that culminated during the last glacial maximum and corresponds roughly to the Epipaleolithic in this region is known to have influenced Anatolia, as well (Nemec and Kazancı, 1999; Atalay, 2005).

Discussion

The faunas from Üçağızlı contained European, local, and Asiatic elements. The 3 species of *Apodemus* present in Üçağızlı are known from Europe from the Pliocene onwards (Pasquier, 1974). Modern *Apodemus* species also existed in the Late Pliocene of Israel (Tchernov, 1986). They are found in Anatolia since the Biharian (Storch, 1975, 1988; Montuire et al, 1994; Unay and de Bruijn, 1998). *Chionomys nivalis* is known from Middle Pleistocene localities such as Uppony (Hungary) (Janossy, 1986), Latomi-I, Chios (Greece) (Storch, 1975), Emirkaya (Anatolia) (Montuire et al., 1994), and from the Late Pleistocene of southern Europe to Hungary and Macedonia. The Late Pleistocene western range of this species is extended to England (Mayhew, 1978). *Glirulus*, a relict taxon inhabiting only some Japanese islands today, used to have a wide geographic distribution in Europe and the eastern Mediterranean from MN1 to MN15 (Unay, 1994; Unay and de Bruijn, 1998; Suata-Alpaslan, 2003). The *Glirulus* species in the Late Pleistocene of Üçağızlı seem to have survived in this refuge area until very recently. *M. guentheri* seems to be a local species. It is widely distributed in the eastern Mediterranean region since the Middle Pleistocene: Yarımburgaz (Santel and Koenigswald, 1998), Latomi-I, Chios (Storch, 1975), Arnissa (Mayhew, 1978), and Oumm-Qatafa and Kebara (Tchernov, 1968). *M. brandti* (Tchernov, 1986) is endemic in the area since the record of the genus is limited to this region. It originated from *M. primitivus* (Tchernov, 1986), a species recorded from several Pliocene localities of Anatolia (de Bruijn et al., 1970; Sen, 1977, 1998; Unay and de Bruijn, 1998). *Mus* is considered to have an Asiatic origin because the oldest record of the genus is from Pakistan (Jacobs, 1978). *M. macedonicus* now inhabits the region from central and southeastern Europe to Transcaucasian and the Near East (Mitchell-Jones et al., 1999). *M. macedonicus* now occurs in the Levantine region, has been there since at least the Late-Middle Pleistocene 160,000 years ago (Tchernov, 1992, 1996), and may have been present by the Early Pleistocene, 1.4 million years ago (Tchernov, 1996). The rodents from Üçağızlı, with the exception of *Glirulus* from layers B-B3, occur in Karain B as well as in the extant fauna of the Mediterranean region. This shows that the rodent fauna of the eastern Mediterranean has not changed much since the Late Pleistocene. The extant rodent fauna of the region contains more species, which suggests that taphonomic factors have influenced the composition of the small mammals in Üçağızlı. Close similarity between the assemblages from Üçağızlı and Karain B is expected because both sites are situated in the Mediterranean region of Anatolia and are contemporaneous.

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