Rodents from the Upper Miocene Hominoid Locality Çorakyerler (Anatolia)

by

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Abstract

The rodents of the Çorakyerler fauna are described. Twelve species, two of which are new, are recognized: *Hansdebruijnia erksinae* n.sp., *Hansdebruijnia* cf. *neutrum*, *Byzantinia pikermiensis*, *Byzantinia* aff. *hellenicus*, aff. *Rhinocerodon* sp., *Allocricetus aylasevimae* n.sp., Cricetidae gen. et sp. indet., *Pseudomeriones latidens*, cf. *Pliospalax* sp., *Protalactaga* aff. *major*, *Myomimus* sp., and *Keramidomys* sp. This rodent assemblage suggests a savannah-like environment and an MN 11 age.

Keywords: Small Mammals, Neogene, Biostratigraphy

Zusammenfassung

Es werden die Rodentia aus der Fauna der Fundstelle Çorakyerler beschrieben. Zwölf Arten, von denen zwei neu beschrieben werden, sind von dort bekannt: *Hansdebruijnia erksinae* n.sp., *Hansdebruijnia* cf. *neutrum*, *Byzantinia pikermiensis*, *Byzantinia* aff. *hellenicus*, aff. *Rhinocerodon* sp., *Allocricetus aylasevimae* n.sp., Cricetidae gen. et sp. indet., *Pseudomeriones latidens*, cf. *Pliospalax* sp., *Protalactaga* aff. *major*, *Myomimus* sp., und *Keramidomys* sp. Diese Nagetiergesellschaft läßt auf savannenähnliche Umgebung und ein Alter von MN 11 schließen.

1. Introduction

The Çorakyerler locality has been known for its large mammal fauna since SICKENBERG et al. (1975). In 1997, a team led by Dr. Ayla Sevim restarted excavations at this locality aiming to find fossil primates (SEVÍM et al., 2001). This paper deals with the small mammals that were obtained by washing the sediments (± 10 tons) from which the large mammals were collected during the field seasons of 2001-2002. The small mammals of Çorakyerler are almost exclusively rodents. Lagomorpha are absent and the Insectivora are represented by one soricid m1 only.

2. Material and methods

Measurements were taken using an ocular micrometer and are given in 0.1 mm units. The rodent specimens are all figured x 20 and as if they are from the right side. In case the original is from the left side the number on the plate is underlined.

Relative abundance of rodents has been calculated as the number of first and second molars. Taxa represented by tooth fragments only have been calculated as one.

The small mammals described below are kept in the collections of Paleoanthropology Department of the Faculty of Letters of the Ankara University.

3. Systematic Palaeontology

Ordo Rodentia BOWDICH, 1821
Familia Muridae ILLIGER, 1811
Subfamilia Murinae ILLIGER, 1811

Hansdebruijnia STORCH & DAHLMANN, 1995

Hansdebruijnia erksinae n.sp.
(Plate 1, figs. 1-15)

Derivatio nominis: After Dr. Erksin Güleç who took the initative to restart the Çorakyerler excavation.
Type locality: Çorakyerler
Holotype: M1 dext. no. 14 (Pl. 1, fig. 4)
Type level: MN 10-11
Diagnosis: Molars low crowned with slender cusps. M1 wide with t6-t9 connection, ridge-like t12 and without t1

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bis. M2 with or without t6-t9 connection and with a ridge-like t12. m1 with or without antero-central cusp
Differential diagnosis: *Hansdebruijnia* n.sp. is different from the other *Hansdebruijnia* species by the occurence of the morphotypes without tma in the m1. Besides some other minor differences *Hansdebruijnia erkinsae* differs from *H. neutrum, H. pusillus,* and *H. perpusilla* by its larger size and from *H. amasyaensis* by its smaller size (Fig. 1).

Measurements:

	Length			Width	
	range	mean	N	mean	range
M1	17.6-20.8	19.6	12	12.7	11.4-14.5
M2	12.4-13.6	13.0	8	12.9	12.2-14.0
M3	9.0-9.6	9.3	8	9.7	9.0-10.5
m1	16.0-20.0	18.2	15	11.0	10.0-12.5
m2	12.2-13.9	13.2	14/15	11.9	10.5-12.7
m3	9.8-11.0	10.5	7	9.5	9.0-10.2

Description:
M1. The M1 is low crowned and rather wide. The cusps are slender. t1 is elliptical and situated posteriorly relative to t2 and connected with this cusp, but not with t5. t3 rarely bears a short and low posterior spur which in one specimen connects to t5. t4 is either isolated from t8 or connected with this cusp by a low ridge. The t6 and t9 are connected by a low ridge. The t12 may be absent, but generally is a distinct ridge.
M2. t1 is large, t3 is small. t4 is connected to t8. t6 is inclined to t9, but is separated from this tubercle in four out of seven specimens. t12 is distinct.
M3. t1 is large and isolated in rather fresh specimens. t3 is developed as a crest or is absent. t4, t5, t6 are connected and t8+t9 are fused enclosing a basin.
m1. The antero-central cusp is absent in four and minute in ten specimens. If present, the tma does not determine the anterior outline of the tooth. In the remaining three specimens a low ridge replaces the antero-central cusp connecting the two anteroconid cusps. A low, short longitudinal ridge may exist. The labial cingulum, which has an accessory cusp next to the protoconid in five specimens, develops from the labial cusp of the anteroconid as a high to low crest in seven or as a relatively well delimited cusp of variable size in the remaining eight m1. The morphology of c1 varies: it may be big, small or a ridge. A low posterior cingulum is developed as just a crest in four specimens. It is an antero-posteriorly compressed low cusp in eleven and more rounded in the remaining two specimens. The m1 has two roots.
m2. With the exception of the one in front of the protoconid, the accessory cusps of the labial cingulum are weak, though the one next to the protoconid in eleven and the one next to the hypoconid in eight out of fifteen specimens is a distinct minute cusp. The posterior cingulum is low and developed as an antero-posteriorly compressed cusp

in most and as a crest in few specimens. The m2 has two roots.
m3. The anterior cingulum is developed as a crest in three and as a cusp in one specimen.
Remarks: The Çorakyerler *Hansdebruijnia* shows similarity to the genus *Karnimata* in having poorly developed stephanodonty, the cusps weakly connected in chevrons, no t1 bis and a distinct ridge-like t12 in M1 and the tma in m1 absent or weakly developed. Our specimens have these characters in common with *Karnimata*, but do not belong to that genus because of relatively lower crowned molars with more slender and lower cusps and the relatively larger M1 with connected t6-t9. We agree with Mein et al. (1993) that *Progonomys woelferi* and *Karnimata darwini* are synonymous, but *Progonomys cathalai*, which is the type species of the genus *Progonomys*, is different, particularly in the narrower outline of the M1. Since *P. cathalai* is the type species of *Progonomys*, the genus name *Karnimata* should be maintained for the species *K. woelferi* (= *K. darwini*). We follow Hordijk & De Bruijn (in press) in considering *Senia* Sarica-Filorea, 2002 a junior synonym of *Hansdebruijnia* Storch & Dahlmann, 1995 because the type species of these genera differ in size and relative width of their cheek teeth only.
The Çorakyerler assemblage is assigned to the genus *Hansdebruijnia* because it has wide and low crowned molars with slender cusps and no t1-t5 and t3-t5 connections (except in one tooth), no t1 bis, and a ridge-like t12 in the M1. Storch & Ni (2002) considered *Hansdebruijnia perpusilla* from Baogedawula Sumu (Abaga Qi County, Inner Mongolia) morphologically the most primitive and the earliest known species of the genus suggesting eastern Palearctic origin for *Hansdebruijnia*. This fauna is considered to be of Middle Baodean age which is roughly comparable to the European MN11-12 zones (Qiu & Wang, 1999, Qiu & Li, 2003). The Çorakyerler species is more advanced than *H. perpusilla* because of the connected t6-t9 and the much larger size (Fig. 1). When the characteristics of other species of the genus are taken into account, it seems that the Çorakyerler species displays mozaic evolution in having combination of plesiomorphic (tma weak or absent and t3-t5 connections absent or very rare) and apomorphic (rather large size) characters. *Hansdebruijnia pusillus* from Ertemte 2 (Schaub, 1938, Storch, 1987) which is correlated to MN13 (Storch, 1987) is more advanced in having a much better developed longitudinal ridge in the lower molars and a better developed stephanodonty than in the Çorakyerler species, but it has a smaller size (Fig. 1). The Çorakyerler species is larger in size (Fig. 1) than the type material of *H. neutrum* from Pikermi 4 and the assemblage of this species from Maramena, but more primitive in having less frequent connections between t3 and t5 and tma in the m1 absent or weaker. The Maramena assemblage is even more progressive in the occurence of t1 bis in most M1, and the strong antero-central cusp in m1. *H. amasyaensis* (Sarica-Filorea, 2002) is more advanced than the Çorakyerler species having stronger connection between t6-t9, stronger tma and a larger size (Fig. 1).
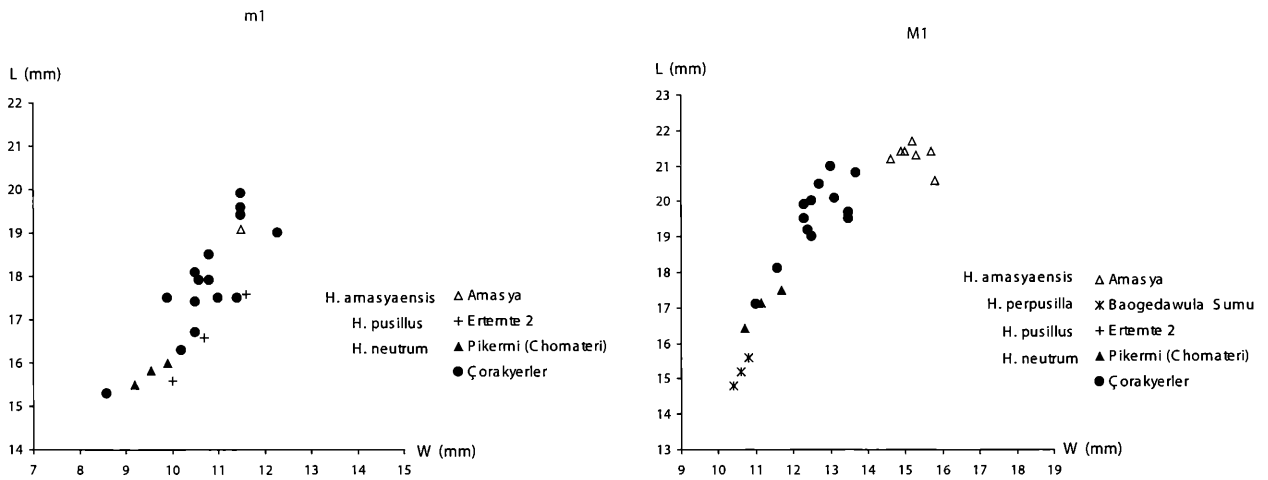
Figure 1: Length-width scatter diagrams of m1 and M1 of different *Hansdebruijnia* species.

Hansdebruijnia cf. *neutrum* (DE BRUIJN, 1976)
(Plate I, figs 16, 17)

Material and measurements: 1 M1 (17.1 x 11.0), 1 m1 (15.3 x 8.6).

Description:
M1. The M1 is low crowned and rather wide. The t1 is situated posteriorly relative to t3, which has a low, weak spur reaching the posterior slope of t6. The t4 is contiguous with t8. The t6 and t9 are connected. The t12 is rather strong.
m1. A hardly distinct low crest replaces the antero-central cusp. There is no longitudinal ridge. The labial cingulum is rather weak: the c1 and one cuspid next to the protoconid are developed. The posterior cingulum is rather rounded.

Remarks: Two specimens from Çorakyerler, one M1 and one m1, are distinctly smaller than those of *Hansdebruijnia erksinae* and fit very much *H. neutrum* from Pikermi, Chomatri (DE BRUIJN, 1976) in size (Fig. 1) and morphology. It is therefore conceivable that the Çorakyeryer *Hansdebruijnia* association contains two species. SARICA-FILOREA (2002) also assigned an assemblage to *Hansdebruijnia* cf. *neutrum* from Sirma. *Hansdebruijnia neutrum* is known from Düzyayla 1 as well (DE BRUIJN et al., 1999).

Subfamilia Cricetodontinae STEHLIN & SCHAUB, 1951

Byzantinia DE BRUIJN, 1976

Byzantinia pikermiensis DE BRUIJN, 1976
(Plate 2 , figs. 27-31)
Measurements:

	Length			Width	
	range	mean	N	mean	range
M1		32.6	1	20.7	
M2		24.5	1	18.6	
M3	19.1-21.1	20.1	2	17.5	17.0-17.1
m1		25.0	1	16.5	
m2	23.7-26.4	25.0	2	17.3	17.0-17.7
m3		20.2	1	15.2	

Description:
M1. The anterocone is divided into two cusps, the labial one being the larger and higher of the two. The narrow valley between them is as deep as two-thirds of the height of the anterocone in the sole complete specimen available. This valley is rather wide reaching the crown-root border in a fragment. In this specimen the labial cusp of the anterocone is directed strongly postero-labially unlike in the complete one. A lingual spur of anterolophule is present. The ectolophs are complete, but lower than the labial cusps. The metaloph is connected to the posterior arm of the hypocone and is fused with the posteroloph. The sinus is inclined forwards.
M2. The labial branch of the anteroloph is strong and connected to the paracone forming the anterior ectoloph. The lingual branch is very weak. The ectolophs are lower than the labial cusps. The lingual connections of the parallel and posteriorly inclined protoloph and the metaloph are as in the M1. The lingual sinus is directed backwards as in the M1.
M3. The posterior part of the M3 is reduced. The labial branch of the anteroloph is strong connecting to the paracone. The lingual one is weak. The paracone and the protocone dominate the occlusal surface. The hypocone is small, but well individualized. There is a distinct groove between the hypocone and the posterior part of the tooth. The metacone is incorporated in the posteroloph. The narrow lingual sinus is directed posteriorly.
m1. The small anteroconid is rounded, connecting to the metaconid-protoconid complex or to the metaconid itself. The metalophulid and the hypolophulid are directed anteriorly. The mesolophid is short and free lingually. The posterolophid ending as hypoconulid is separated from the entoconid. The anteriorly directed sinusid is closed by a low cingulum.
m2. The low labial branch of the anterolophid continues till the protoconid enclosing a protosinusid. The metalophulid and the hypolophulid are directed forwards and connected to the ectolophid in front of the protoconid and hypoconid, respectively. The mesolophid is distinct and free from the metaconid but with wear it connects to this tubercle. The posterolophid ending in a hypoconulid is free from the
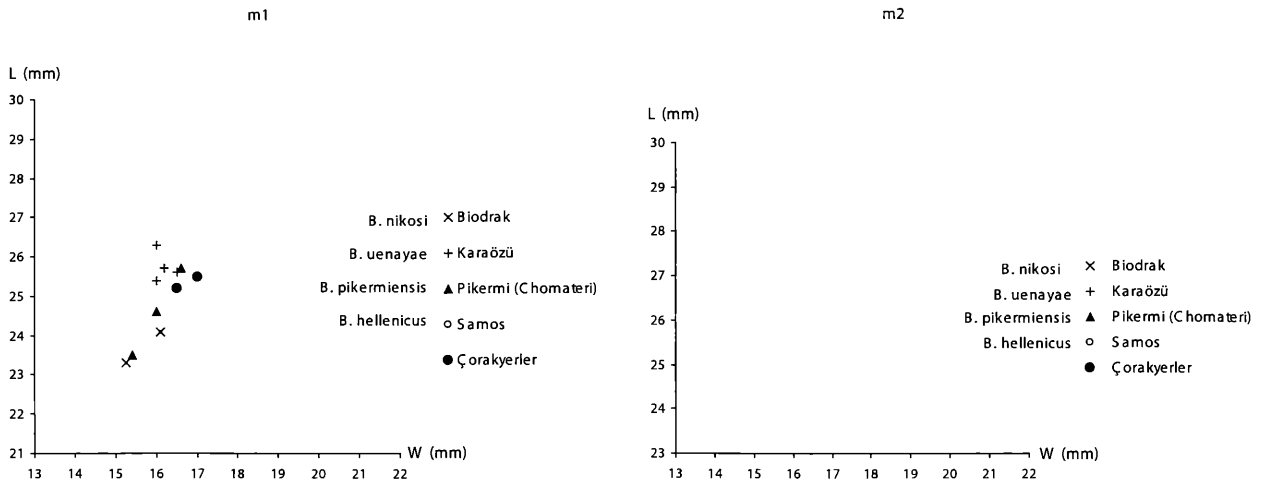
m1

L (mm)

B. nikosi   × Biodrak
B. uenayae   + Karaözü
B. pikermiensis   ▲ Pikermi (Chomateri)
B. hellenicus   o Samos
● Çorakyerler

W (mm)

m2

L (mm)

B. nikosi   × Biodrak
B. uenayae   + Karaözü
B. pikermiensis   ▲ Pikermi (Chomateri)
B. hellenicus   o Samos
● Çorakyerler

W (mm)

Figure 2: Length-width scatter diagrams of m1 and m2 of different *Byzantinia* species.

entoconid. The anteriorly directed sinusid is closed by a low cingulum.

m3. The posterior part of the m3 is reduced. The low labial branch of the anterolophid is distinct. The metalophulid and the hypolophulid are directed forwards. The mesolophid is short. The posterolophid is free from the entoconid. The anteriorly directed sinusid is narrow.

Remarks: One complete M1 and one fragment of an M1 from Çorakyerler show a lingual spur of anterolophule, but not a funnel. Among the *Byzantinia* species, *B. pikermiensis*, *B. hellenicus*, *B. nikosi,* and *B. unayae* show this character. The Çorakyerler material (the M1 and the M2, the two M3, two m1, two m2, and one m3) resembles *B. pikermiensis* very much in morphology and in size (Fig. 2). *Byzantinia nikosi* is smaller and *B. hellenicus* is much larger (Fig. 2) than the Çorakyerler material. Additionally, the M3 of the former species has a well-delimited metacone, unlike that of *B. pikermiensis* and the Çorakyerler material. *Byzantinia unayae* has linguo-buccally compressed upper and lower third molars and an anterocone with a valley reaching the crown-root border. One anterocone fragment in the collection has a rather wide valley reaching the crown-root border and resembles this species. There is a size difference among the lower teeth in the Çorakyerler *Byzantinia* material (Fig. 2). The smaller ones mentioned above fall into the size variation of *B. pikermiensis* and are assigned to this species.

Byzantinia aff. *hellenicus* (FREUDENTHAL, 1970)
(Plate 2, figs. 32-34)

Material and measurements: 3 m1 (27.0 -27.2 x 15.8 -17.5), 2 m2 (27.0 - 29.5 x 19.5), 1 m3 (25.5 x 17.0)
Description:
m1. The anteroconid is small and rounded, connecting to the metaconid-protoconid complex. Both the anterior and the posterior metalophulids exist, but the latter is weak (Pl. II, fig. 32). The anterior metalophulid is connected to the anterolophulid or to the anteroconid. The mesolophid is short or absent. The hypolophulid is directed forwards and connected to the ectolophid in front of the hypoconid. The

posterolophid terminating in a hypoconulid is free from the entoconid. The anteriorly directed sinusid is closed by a low cingulum.

m2. The labial branch of the anterolophid is low, but it runs as far as the hypoconid enclosing a protosinusid. The metalophulid is directed forwards and the hypolophulid is rather transverse. They connect to the ectolophid in front of the protoconid and hypoconid, respectively. The mesolophid is distinct and free from the metaconid. The posterolophid ending in hypoconulid is free from the entoconid.

m3. The m3 is elongate with a reduced posterior part. The labial branch of the anterolophid is low, but it continues till the protoconid enclosing a protosinusid. The metalophulid and the hypolophulid are directed forwards. The mesolophid is rather long and free lingually. The posterolophid ending in a hypoconulid is free from the entoconid. The anteriorly directed sinusid is closed by a low cingulum.

Remarks: The teeth described above are the larger lower teeth of the Çorakyerler *Byzantinia* material and they, with the exception of one m1 which is outside the variations of both *B. pikermiensis* and *B. hellenicus,* fall within the size variation of *B. hellenicus* (Fig. 2). All three m1, however, have a double metalophulid, which is not the case in *B. hellenicus*. Therefore, we identify this material as *B.* aff. *hellenicus*.

Rhinocerodon ZAZHIGIN, 2003

cf. *Rhinocerodon* sp.
(Fig. 3a)

Material: Fragments of cheek teeth only.
Description:
m1. The antero-labial portion of the m1 is broken off. The metalophid and the hypolophid are thick and short and widely separated from each other labially as well as lingually so the median lingual valley is wide. The posterolophid is also thick and short and separated from the entoconid. The protoconid and the hypoconid are very close to each other so the sinusid is narrow.

Remarks: Some hypsodont/lophodont tooth fragments

from Çorakyerler show affinities to the genus *Rhinocero-don* known from three Late Miocene localities in Kazakhstan that are correlated to MN12 and MN13 (ZAZHIGIN, 2003). The size and the morphology of the m1 fragment from Çorakyerler is very similar to some undescribed material from Düzyayla (DE BRUIJN et al., 1999) and Hayranlı assigned to '*Blancomys*' The m1 from these localities are different from those from Kazakhstan in the configuration of the anteroconid part which is cricetid-like. The Anatolian material seems to represent a new genus related to *Rhinocerodon*.

Cricetinae FISCHER VON WALDHEIM, 1817

Allocricetus SCHAUB, 1930

Allocricetus aylasevimae n.sp.
(Plate 1, figs. 18-22)

Derivatio nominis: After Dr. Ayla Sevim, who was in charge of the Çorakyerler excavation.
Type locality: Çorakyerler
Holotype: M2 sin., no.54 (Pl. I. fig.19)
Type level: MN10-11
Diagnosis: Medium sized, molars with wide crowns, anteriorly smooth wide anterocone with two cusps that are posteriorly connected, M2 with double protolophule, M1 with or without metalophule, funnels between the labial and lingual cusps in the upper molars, anteroconid of m1 wide.
Differential diagnosis: *Allocricetus* n.sp. differs from all other *Allocricetus* species by a weak metalophule of the M1.
Measurements: 3 M1 (19.0-19.9 x 13.0-13.3), 2 M2 (16.2-16.3 x 13.4-14.2), 2 m1 (19.5-19.7 x 11.6-12.2), 1 m3 (15.5 x 13.1).
Description:
M1. The wide, anteriorly smooth and rounded anterocone bears two cusps that are posteriorly connected. The forked anterolophule connects to both anterocone cusps. A weak mesoloph connects to the metacone. The posteriorly directed protolophule is single. A weak and short metalophule is present in two and absent in two other specimens. The posteroloph is strong, running as far as the postero-labial side of the metacone.
M2. The labial and lingual branches of the anteroloph are equally strong reaching the paracone and protocone and enclosing the anterosinus and protosinus, respectively, in one of the two specimens (Pl. I, fig. 19). In the other tooth the lingual branch is weaker (Pl. I, fig. 20). The protolophule is double. The mesoloph is of medium length and connected to the metacone at its base. The metalophule is weak. The posteroloph connects to the metacone posteriorly.
m1. The anteriorly rounded anteroconid is divided posteriorly into two cusps by a notch. The low and single anterolophulid connects to the slope of the anteroconid in one specimen (Pl. I, fig. 22) and is absent in the other (Pl. I, fig. 21).The protosinusid is closed by a crest descending

from the labial cusp of the anteroconid. The forwards directed metalophulid and the hypolophulid are parallel and connected to the anterior arms of the labial cusps. The mesolophid is absent. The posterolophid descending from the hypoconid connects to the base of the metaconid.
m2. The postero-labial part of the sole m2 is broken off. The lingual branch of the anterolophulid is weak and the labial one is well developed, enclosing an antero-labial sinusid. The forwards directed metalophulid and hypolophulid are parallel. There is no mesolophid. The posterolophid is strong.
m3. The lingual branch of the anterolophulid is weak and the labial one is strong, reaching the protoconid. The metalophid and the hypolophid are anteriorly directed. A small mesostylid blocks the median labial sinusid. The well-developed mesolophid is free from the metaconid. The posterolophid is strong reaching the entoconid. The deep main lingual sinusid is rather transverse. The m3 has one anterior and one posterior root.
Remarks: The wide crowns of the molars, the anteriorly smooth wide anterocone with two cusps that are posteriorly connected, the wide anteroconid, double protolophule of the M2, no metalophule of the M2 and the occurrence of the morphotypes without metalophule in the M1, funnels between the labial and lingual cusps in the upper molars, oblique metalophulid and the hypolophulid of the Çorakyerler assemblage recall the genus *Allocricetus*. Except for two M1 with a weak and short metalophule, the dental morphology and the size of the material match those of the *A. bursae* specimens from Villany in the comparative collection of the Utrecht Faculty well. The presence of a weak and short metalophule - a plesiomorphic character - in two M1 is in fact in harmony with the antiquity of the Çorakyerler assemblage. *Allocricetus aylasevimae* is in the size variations of those of *A. ehiki, A. bursae, A. magnus, A. jesreelicus,* and *A. croaticus,* but smaller than *A. teilhardi.* The genus *Allocricetus,* which is regarded to be a paraphyletic taxon by CUENCA BESCOS (2003), is a common element in the Villanyian-Pleistocene faunas of Europe and the Near East. Recently, some assemblages from older localities in the Eastern Mediterranean have been assigned to this genus, e.g. *Allocricetus* cf. *ehiki* from Maramena (MN13) (DAXNER-HÖCK, 1995), Amasya (MN13), and Karaözü (MN9-11), and *Allocricetus* sp. from Kavurca (MN13) (RUMMEL, 1998). In *Allocricetus* cf. *ehiki* from Karaözü and *Allocricetus* sp. from Kavurca, the presence or absence of the metaloph in the M1 and M2 is within the variation. The Karaözü material is almost the same as those from Çorakyerler, in particular in the M1 with metaloph. Although the material from Amasya is very fragmentary, it seems to be quite similar also. Most likely these three associations represent the same species. However, the specimens from Kavurca are much bigger. Additionally, some undescribed material in our collection from Düzyayla and the cricetine material from Pikermi (Chomatri), assigned to *Kowalskia* aff. *K. lavocati* (DE BRUIJN, 1976) are very similar in size and morphology to the Çorakyerler material as well and so they all may belong to *A. aylasevimae*.

Muridae gen. et sp. indet.
(Plate 1, fig. 23)

Material and measurements: 1 M3 (15.0 x 15.2)
Description:
M3. The outline of the M3 is a rounded triangle. The paracone, metacone, and the protocone dominate the occlusal surface. The forwards directed protoloph and the backwards directed metaloph converge labially enclosing a triangular sinus. The strong labial branch of the anteroloph encloses an antero-labial sinus.

Remarks: This enigmatic M3 is the only tooth that documents the presence of a rather large low-crowned cricetid in the Çorakyerler assemblage. Its dental pattern is primitive in having a forwards directed protoloph, a large metacone and lacking the lingual sinus. Given the Late Miocene age of the assemblage it seems probable that this basic tri-tubercular pattern was secondarily acquired via a more derived stage. Having only a single rather worn M3 of this taxon, we are at a loss what it represents even at the (sub) familial level. Could it be a rhizomyid?

Gerbillinae GRAY, 1825

Pseudomeriones SCHAUB, 1934

Pseudomeriones latidens ŞEN, **2001**
(Plate 2, figs. 35-40)

Measurements:

	Length		N	Width	
	range	mean		mean	range
M1		25.4	1	17.7	
M2	14.0-15.3	14.6	4	16.0	15.6-16.5
M3		9.1	1	8.9	
m1	22.4-25.5	24.2	6	15.6	14.2-16.6
m2	15.2-15.3	15.2	2	15.0	14.6-15.5
m3		10.5	1	10.7	

Description:
M1. The anterocone is wide, but narrower than the two posterior lophes. The labial cusps are situated distally with respect to the lingual ones. The antero-labial and the main lingual sinuses are the deepest and the postero-labial one is the widest.
M2. The labial branch of the anteroloph is weak, but distinct. The main cusps oppose. The lingual sinus is very deep, curving posteriorly at its tip. The labial sinus is shallow. The posteroloph is also distinct. The anterior one of the two roots is divided into two.
M3. The posterior part of the M3 is reduced. The occlusal surface shows one transverse lingual sinus.
m1. The wide anteroconid is rounded anteriorly. Its labial crest reaches the base of the protoconid, enclosing a protosinusid. In one of the six specimens a small but distinct accessory cusp is formed on this ridge. The main cusps

alternate. The labial and lingual sinusids are equally deep. In a rather fresh specimen (Pl. 2, fig. 37) the connecting ridges between the anteroconid and the metaconid-protoconid complex as well as between the metaconid-protoconid complex and the entoconid-hypoconid complex are much lower than the cusps. The posterolophid is strong. The m1 has one anterior and one posterior root.
m2. The labial branch of the anterolophulid is strong, connecting to the base of the protoconid, thus enclosing a protosinusid. The lingual branch is absent. The main cusps alternate with one another. The main lingual and labial sinusids are equally very deep. The posterolophid is strong.
m3. A V-shaped lophid dominates the occlusal surface. The labial branch of the anterolophid is distinct, enclosing a small protosinusid. There are two roots.

Remarks: The Çorakyerler *Pseudomeriones* assemblage is morphologically very similar to the type material of *Pseudomeriones latidens* from Molayan (ŞEN, 2001) in having M2 with a deep lingual backward curving sinus, three roots and weak anteroloph, m1 with a strong labial anterolophid and reaching the base of the protoconid, m2 and m3 with strong labial anterolophulid, m1 and m2 with a strong posterolophid. Apart from m1, which is somewhat larger than the corresponding tooth of the type material of *P. latidens*, the two assemblages are also similar in size. *Pseudomeriones latidens* has been reported from Karaözü, Kaleköy, and Dendil in Anatolia (WESSELS, 1998; SUATA-ALPASLAN, 2003). *Pseudomeriones pythagorasi* from Samos (BLACK et al., 1980) and *P. abbreviatus* from Pul-e Charkhii (ŞEN, 1983) are close to the Çorakyerler assemblage in size, but morphologically different: *P. pythagoresi* has a triangular anteroconid and a shorter labial anterolophid, and *P. abbreviatus* has no labial anterolophid in the m1 and has a relatively shallow labial sinus and no anteroloph in the M2. According to DE BRUIJN et al. (1999), *P. pythagoresi* occurs in the Düzyayla fauna. Our *Pseudomeriones* collection from this locality has the same morphology as the Çorakyerler specimens in having an M2 with a deep lingual sinus and a weak anteroloph and m1, m2, and m3 with a strong labial anterolophid reaching the base of the protoconid enclosing a protosinusid, and m1 with a strong posterolophid. The only available m2 in our collection from Düzyayla, however, has no posterolophid. In spite of that the Düzyayla assemblage represents, in our opinion, *Pseudomeriones latidens* and not *P. pythagoresi*.

Spalacinae GRAY, 1821

Pliospalax KORMOS, 1932

cf. *Pliospalax* sp. indet.

Material: 1 M3 fragment – x 22.8?
Description:
M3. The anterior part of the M3 is broken off. One forked re-entrant fold which is open labially is preserved.
Remarks: A hypsodont rather large spalacid M3 fragment

is assigned to ?*Pliospalax*. This very limited material hampers a more detailed identification.

Allactaginae VINOGRADOV, 1925

Allactaginae gen. et sp. indet.

Protalactaga YOUNG, 1927

Protalactaga aff. *major* QIU, 1996
(Fig. 3b-d)

Material: One and half m1 and two posterior parts of two m3.
Measurements: m1 (26.5 x 19.0)
Description:
m1. The lingual border of the single complete m1 is slightly damaged by stomac acid. The m1 is narrower anteriorly than posteriorly. The metaconid and the protoconid are laterally compressed elongated cups that are separated by a narrow deep median valley that shows an indistinct crest in the place of anteroconid. The anteroconid is low, but more distinct in an m1 fragment in which the metaconid is an isolated cusp. The mesolophid is lingually damaged, but seems to have ended in a strong mesostylid. The entoconid is separated by a deep valley from the mesolophid and connected to the well-developed ectomesolophid by an almost transverse hypolophid. The posterolophid expands in the place of hypoconulid and ends before reaching the entoconid.
m3. The posterior part is reduced. The protoconid seems to have been a big cusp. There is a wide labial sinusid. The entoconid and the hypoconid are fused. A crest originating from the hypoconid closes the sinusid.
Remarks: The few bunolophodont, low-crowned dipodid molars from Çorakyerler display the diagnostic characters of *Protalactaga*. The size of the m1 with the narrow anterior part, reduced or absent anteroconid are very similar to *P. major* described from the Early Miocene of Ulan-Tologoi, Mongolia (ZAZHIGIN & LOPATIN, 2000). The only difference seems to be in the greater depth of the valley separating the metaconid and

protoconid. In our specimen it penetrates deeper posteriorly than in the Ulan-Tologoi specimens (ZAZHIGIN & LOPATIN, 2000: fig. 3h, i). A fragment of an m1 from Çorakyerler and the one with the metaconid isolated from Ulan-Tologoi (ZAZHIGIN & LOPATIN, 2000: fig. 3g), however, are the same. The type material of this species is from the late Middle Miocene (Tunggurian) of Moergen, Inner Mongolia (QIU, 1996). The other species assigned to this genus by ZAZHIGIN & LOPATIN (2000), *P. grabaui* and *P. shevyrevae*, are smaller in size than the Çorakyerler material (Fig. 4).

Familia Gliridae MUIRHEAD, 1819

Myomimus OGNEV, 1924

Myomimus sp.
(Plate 1, figs. 24, 25)

Material and measurements:
1 fragment of M1-2: (– x 25.0), 1 M3 (19.2 x 22.0).
Description:
M1-2. The posterior part of the sole specimen is broken off. The anteroloph is free lingually and connected to the slope of the paracone labially. The long anterior centroloph and the protoloph are connected labialy. There is a tiny extra ridge between the anteroloph and the protoloph.
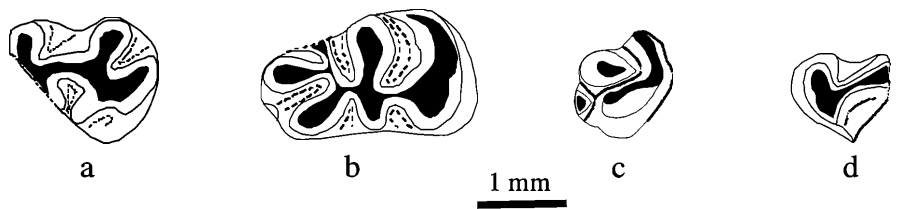

a   b   1 mm   c   d

Figure 3: a. cf. *Rhinocerodon*, m1 sin.; b-d. *Protalactaga* aff. *major*, b-c. m1 sin; d. m3 dext.
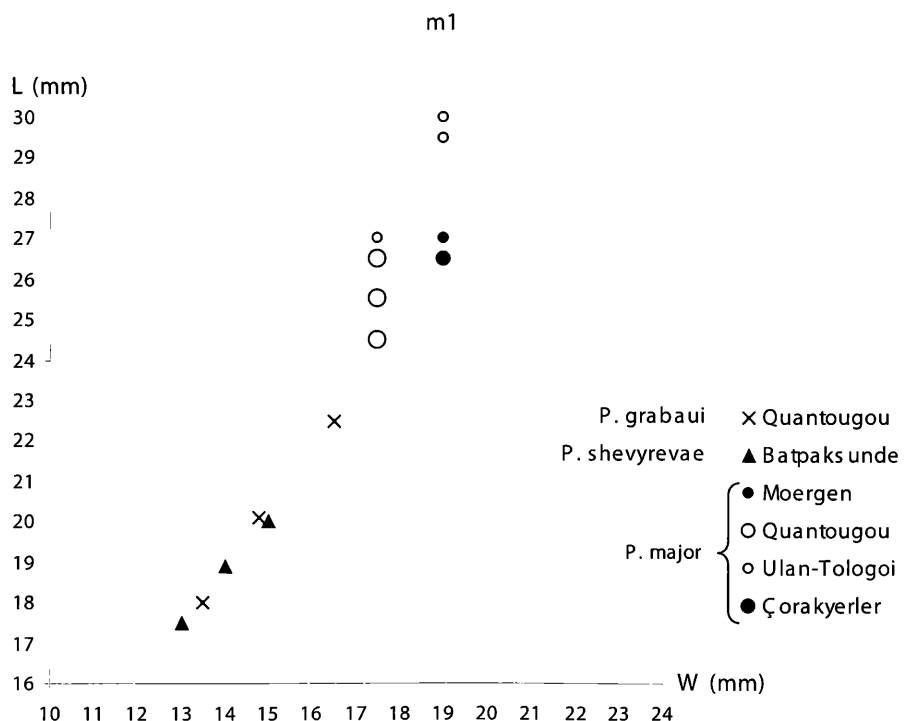

Figure 4: Length-width scatter diagram of m1 of different *Protalactaga* species.

The posterior centroloph is indicated as a low tiny cusp.
M3. The occlusal pattern is composed of the four main
lophs, two centrolophs and an extra ridge between the
posterior centroloph and the metaloph. The anterior cen-
troloph is free labially.

Remarks: The one and half teeth of Gliridae from Çoraky-
erler with their rather simple morphology are assigned
to *Myomimus*. The fragment of the M1-2 represents the
morphotype D of M2 of Daams (1981). The Çorakyerler
M3 has seven ridges as in the morphotype S of the M3
of Daams (1981), but the extra ridge is the anterior one
in his morphotype whereas it is the posterior one in the
Çorakyerler specimen.

Eomyidae Winge, 1887

Keramidomys Hartenberger, 1966

Keramidomys sp.
(Plate 1, fig. 26)

Material and measurements: 1 m1 (8.8 x 8.6).
Description:
m1. The occlusal surface shows pentalophodont pattern so
the mesolophid is long and connected with the protoloph at
the lingual border. The first synclinid is deep penetrating,
more than two thirds of the occlusal surface. The hypoco-
nid is elongated. The ectolophid is complete.
Remarks: The highly lophodont m1 with elongated
hypoconid and slightly forward directed hypolophid con-
necting to the ectolophid is assigned to the genus *Kera-
midomys*. Its size fits in the upper limit of the variation of
the m1 of *Keramidomys karpathicus* from Neudorf and
its morphology with a long mesolophid connecting to the
metalophid at the lingual border is in line with the mor-
phology of *Keramidomys thaleri* from Obergänserndorf
(Daxner-Höck, 1998). We refrain from identifying the
single m1 at species level.

4. Discussion and Conclusions

4.1. The age of the Çorakyerler fauna

The age assignment of Çorakyerler is of special inter-
est because of the hominoid remains found there. The
constraints provided by the regional geology (Kaymakçı,
2000:91) are between MN10 and MN13. The locality is
situated in the folded Tuğlu Formation, which is uncon-
formably overlain by the Süleymanlı Formation. A diverse
assemblage of small mammals collected from the type
section of that formation at some ten metres above its base
contains among many other rodents *Calomyscus delicatus*
Aguilar et al., 1986, an element characteristic for MN13.
The small mammal content of the locality Çorakyerler
was expected to contribute considerably to accuracy of
its correlation to the preliminary rodent-based zonation of
the Neogene of Anatolia (Ünay et al., 2003). Since rodent

remains are relatively rare in Çorakyerler and occur scat-
tered throughout the deposit, the amount of work done in
order to obtain an adequate sample of about one hundred
M1+M2+m1+m2 has been excessive. Although we lost
count of the number of sacks of the fossiliferous nodular
marl that were wet-screened and consequently sorted, the
sample size is estimated to be around the ten tons. This
action would have been physically impossible without the
enthusiastic help and the perseverance of a team of students
from the University of Ankara.

Reasons that a precise biostratigraphic correlation is still
not possible are: 1) the composition of the assemblage of
small mammals is unusual in the absence of lagomorphs,
near-absence of insectivores and in the domination of one
murine species that is not known from any other locality.
2) The succession of rodent faunas from the Late Mi-
ocene of Anatolia (zones I and J of Ünay et al., 2003) is
inadequately known. This lack of a dependable calibrated
biostratigraphic reference succession is largely due to the
absence of long continuous sections of continental deposits
in most Central Anatolian basins as a result of tectonics.
3) The assemblage of large mammals from Çorakyerler
has not been studied in detail yet.

The type levels of the species recognised range from
MN7/8 (Tungurian, Moergen 2) for *Protalactaga major*
to MN 13 (Molayan) for *Pseudomeriones latidens*. Two
Anatolian assemblages that share a number of species with
Çorakyerler are the ones from Düzyayla and Karaözü.
However, the composition of these assemblages in terms of
dominating genera is in each case quite different: *Hansde-
bruijnia* in Çorakyerler. *Keramidomys, Spermophilinus,*
and *Apodemus* in Düzyayla and "*Progonomys*", *Byzan-
tinia,* and *Allocricetus* in Karaözü. The uncertainty about
the age of the latter two localities is clear from the literature
also. Sümengen et al. (1990), while expressing their doubts,
consider Karaözü to correlate best with MN10-11, and De
Bruijn et al. (1999) correlate Düzyayla with MN12. On the
species level the three assemblages discussed above share
Allocricetus aylasevimae and *Pseudomeriones latidens*
only. In the absence from Çorakyerler of dependable bio-
stratigraphic markers with a large, geographic range, such
as *Eozapus intermedius* and a *Parapodemus/Apodemus*
transitional population, accurate biostratigraphic correla-
tion to the MN scale is impossible. Taking all geological,
as well as biological evidence into account we tentatively
suggest a correlation with MN11, realising that a detailed
study of the associated large mammals may change this
conclusion.

4.2. Palaeoecology

The large mammals of the Çorakyerler fauna will surely
tell more about the palaeoecology of the site. We may
however, reconstruct the following picture about the pal-
aeoecology of the site on the basis of the rodents.
Hansdebruijnia, representing approximately 56% of the
specimens, dominates the assemblage from Çorakyerler.
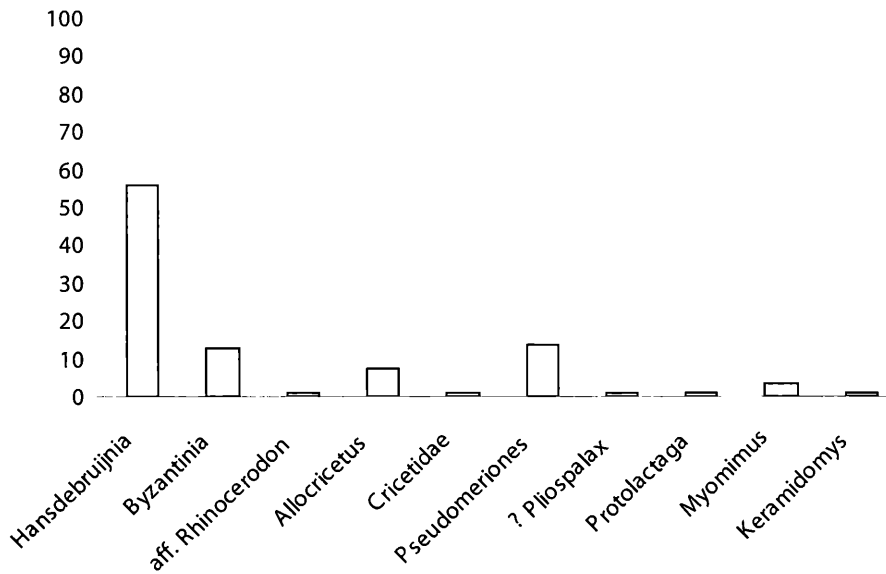Further there is *Byzantinia* with about 13%, *Pseudomeri-*

Figure 5: Relative frequencies of rodent genera in Çorakyerler.

ones with 14 %, *Allocricetus* with 8 %, *Myomimus* with 3 %, and each of the remaining five taxa is around 1 % (Fig. 5). We assume a similar habitat for *Hansdebruijnia erksinae* as that of *Hansdebruijnia neutrum* because of the similar morphology of the dentition. The latter species occurs associated with representatives of wet/wooded biotopes such as eomyids and flying squirrels in Maramena (DE BRUIJN, 1995) and Düzyayla (DE BRUIJN et al., 1999) and therefore suggests a rather moist and vegetated environment. The environment suggested for Pikermi, the type locality of this species (BLACK et al., 1980) is in accordance with this assumption. *Byzantinia* is known from associations with rather different compositions and seems to have lived in a rather wide range of habitats, but open, more arid environments are assumed for this genus (DE BRUIJN et al., 1993; VAN DAM, 1997). Extant *Cricetulus, Meriones,* and spalacids are grassland animals indicating steppes. Allactagines are the animals of semiarid to arid steppes. Also *Myomimus* is thought to have inhabited open biotopes. *Keramidomys* and soricids are the animals of wet/wooded environments. The absence/rareness of arboreal species and the presence of representatives of rather open biotopes in the Çorakyerler fauna suggest that there were no extensive forests, but rather savannah-like biotopes in the region.

5. Acknowledgements

6. References

BLACK, C.C., KRISHTALKA, L. & SOLOUNIAS, N., 1980. Mammalian fossils of Samos and Pikermi, Part I. The Turolian rodents and insectivores of Samos. — Annals of the Carnegie Museum, **49**:359–378, Pittsburg, PA.

BRUIJN, H. de, 1976. Vallesian and Turolian Rodents from Biotia, Attica and Rhodes (Greece). — Proceedings of the Koninklijke Nederlandse Akademie van Weten-schapen, Serie B, **79** (**5**): 361–389, Amsterdam.

BRUIJN, H. de, 1995. The Vertebrate Locality Maramena (Macedonia, Greece) at the Turolian-Ruscinian Boundary (Neogene). 8. Sciuridae, Petauristidae and Eomyidae (Rodentia, Mammalia). — Münchner Geowissenschaftliche Abhandlungen, A, **28**:87–102, München.

BRUIJN, H. de, FAHLBUSCH, V., SARAÇ, G. & ÜNAY, E., 1993. Early Miocene rodent faunas from the eastern Mediterranean area. Part III. The genera *Deperetomys* and *Cricetodon* with a discussion of the evolutionary history of the Cricetodontini. — Proceedings of the Koninklijke Nederlandse Akademie van Wetenschap-en, Serie B, **96** (**2**):151–216, Amsterdam.

BRUIJN, H. de, SARAÇ, G., HOEK OSTENDE, L. W. van den & ROUSSIAKIS, S., 1999. The status of the genus name *Parapodemus* SCHAUB, 1938; new data bear-ing on an old controversy — [in:] REUMER, J.W.F. & VOS, J. de (eds). Elephants have a Snorkel. Papers in Honour of Paul Y. Sondaar. — Deinsea, 7:95–112, Rotterdam.

CUENCA-BESCOS, G., 2003. *Allocricetus* (Cricetidae, Rodentia, Mammalia) from the Pleistocene. A phy-logenetical approach. — Coloq. Paleont., Vol. Ext. **1**: 95–113, Madrid.

DAAMS, R., 1981. The dental pattern of the dormice *Dryo-mys, Myomimus, Microdyromys* and *Peridyromys.* — Utrecht Micropaleontological Bulletin, Special Publications, **3**:1–115, Utrecht.

DAM, J.A. van, 1997. The Small Mammals From The Up-

per Miocene Of The Teruel-Alfambra Region (Spain): Paleobiology And Paleoclimatic Reconstructions. — Geologia Ultraiectima, **156**:1–204, Utrecht.

DAXNER-HÖCK, G., 1995. The Vertebrate Locality Maramena (Macedonia, Greece) at the Turolian-Ruscinian Boundary (Neogene), 9. Some Glirids and Cricetids from Maramena and other late Miocene localities in Northern Greece. — Münchner Geowissenschaftliche Abhandlungen, A, **28**:103–120, München.

DAXNER-HÖCK, G., 1998. Säugetiere (Mammalia) aus dem Karpat des Korneuburger Beckens 3. Rodentia und Carnivora. — Beiträge zur Paläontologie, **23**:367–407, Wien.

HORDIJK, K. & BRUIJN, H. de, 2007 (in press). The succession of rodent faunas from the Mio/ Pliocene lacustrine deposits of the Florina-Ptolemais-Servia Basin (Greece). — Hellenic Journal of Geosciences, University of Athens.

KAYMAKÇI, N., 2000. Tectono-stratigraphical evolution of the Çankırı Basin (Central Anatolia, Turkey). — Geologia Ultraiectina, Mededeledingen Fac. Aardwetenschapen, Universiteit Utrecht, **190**:1–247, Utrecht.

MEIN, P., MARTIN-SUÁREZ, E. & AGUSTI, J., 1993. *Progonomys* SCHAUB, 1938 and *Huerzelerimys* gen. nov. (Rodentia); their evolution in Western Europe. — Scripta Geologica, **103**:41–64, Leiden.

QIU, Z.D., 1996. Middle Miocene Micromammalian Fauna from Tunggur, Nei Mongol. Beijing (Science Press), 1-216.

QIU, Z.D. & WANG, X.M., 1999. Small mammal faunas and their ages in Miocene of central Nei Mongol (Inner Mongolia). — Vertebrata PalAsiatica, **37** (2):120–139, Bejing.

QIU, Z.D. & LI, C.K., 2003. Rodents from the Chinese Neogene: Biogeographic relationships with Europe and North America. — Bulletins of the American Museum of Natural History, **279**:586–602, New York, NY.

RUMMEL, M., 1998. Die Cricetiden aus dem Mittel- und Obermiozän der Türkei. — Documenta Naturae, **123**:1–300.

SARICA-FILOREAU, N., 2002. Faunes de Rongeurs Néogènes et Quaternaires des Grabens d'Anatolie Occidentale. Systematique, Biochronologie et Implications Tectoniques. — Musée Nationale d'Histoire Naturelle, Paris. Ph.D. These. (unpublished).

SCHAUB, S., 1938. Tertiäre und quärtare Murinae. — Abhandlungen der Schweizerischen Paläontologischen Gesellschaft, **51**:1–38, Basel.

SICKENBERG, O., BECKER-PLATEN, J.J., BENDA, D., ENGESSER, B., GAZIRY, W., HEISSIG, K., HÜNERMANN, K.A.,

SONDAAR, P.Y., SCHMIDT-KITTLER, N., STAESCHE, U., STEFFENS, P. & TOBIEN, H., 1975. Die Gliederung des höheren Jungtertiärs und Altquartärs in der Türkei nach Vertebraten und ihre Bedeutung für die internationale Neogen-Stratigraphie. — Geologisches Jahrbuch, B, **15**:1–167, Stuttgart.

SEVIM, A., BEGUN, D.R., GÜLEÇ, E., GERAADS, D. & PEHLEVAN, Ç., 2001. A new late Miocene hominid from Turkey. — American Journal of Physical Anthropology, **32**:134–135.

STORCH, G., 1987. The Neogene mammalian faunas of Ertemte and Harr Obo in İnner Mongolia (Nei Mongol), China. Muridae (Rodentia). — Senckenbergiana lethaea, **67**:401–431, Frankfurt a.M.

STORCH, G. & NI, X., 2002. New Late Miocene murids from China (Mammalia, Rodentia). — Geobios, **35**: 515–521, Villeurbanne.

SUATA ALPASLAN, F., 2003. Karaözü, Kaleköy ve Dendil (Sivas, Türkiye) Lokalitelerinden Bulunan Pseudomeriones latidens Sen, 2001 (Rodentia, Mammalia). — A. Ü. Dil ve Tarih-Coğrafya Fakültesi dergisi, **16**:17–32.

SÜMEGEN, M., ÜNAY, E., SARAÇ, G., BRUIJN DE, H., TERLEMEZ, İ. & GÜRBÜZ, M., 1990. New Neogene Rodent Assemblages from Anatolia (Turkey). European Neogene Mammal Chronology. — Nato ASI Series, A: Life Sciences, **180**:61–72.

ŞEN, Ş., 1983. Rongeurs et Lagomorphes du gisement Pliocène de Pul-e Charkhi, bassin de Kabul, Afganistan. — Bulletins du Musée Nationale d'Histoire Naturelle, Paris, **5**, C (1): 33–74, Paris.

ŞEN, Ş., 2001. Rodents and Insectivores from the Upper Miocene of Molayan, Afghanistan. — Palaeontology, **44** (5):913–932, London.

ÜNAY, E., BRUIJN, H. DE & SARAÇ, G., 2003. A preliminary zonation of the continental Neogene of Anatolia based on rodents. - Distribution and Migration of Tertiary Mammals in Eurasia. A Volume in Honour of Hans de Bruijn. — Deinsea, **10**:539–547, Rotterdam.

Wessels., W., 1998. Gerbillidae from the Miocene and Pliocene of Europe. — Mitteilungen der Bayerischen Staatssammlung für Paläontologie und historische Geologie, **38**:195–198, München.

ZAZHIGIN, V.S., 2003. New genus of Cricetodontinae (Rodentia: Cricetidae) from the Late Miocene of Kazakhstan. — Russian Journal of Theriology, **2** (2):65–69.

ZAZHIGIN, V.S. & LOPATIN, A.V., 2000. The History of the Dipodoidea (Rodentia, Mammalia) in the Miocene of Asia: 3. Allactaginae. — Paleontological Journal, **34** (5):553–565, Moscow.

PLATE 1

Hansdebruijnia erksinae n. sp. from Çorakyerler

Fig. 1-5 M1 dext.

Fig. 6-8 M2 dext.

Fig. 9   M3 dext.

Fig. 10-13 m1 dext.

Fig. 14   m2 dext.

Fig. 15   m3 dext.

Hansdebruijnia cf. *neutrum* (DE BRUIJN, 1976) from Çorakyerler

Fig. 16   M1 dext.

Fig. 17   m1 dext.

Allocricetus aylasevimae n. sp. from Çorakyerler

Fig. 1.   M1 dext

Fig. 19, 20 M2 dext.

Fig. 21, 22 m1 dext.

Muridae gen. et sp. indet. from Çorakyerler

Fig. 23   M3. dext.

Myomimus sp. from Çorakyerler

Fig. 24   M1-2 dext.

Fig. 25   M3 dext.

Keramidomys sp. from Çorakyerler

Fig. 26   m1 dext.

PLATE 1

<u>1</u>   2   3   4

<u>5</u>   6   <u>7</u>   <u>8</u>

<u>9</u>   <u>10</u>   11   12

<u>13</u>   <u>14</u>   15   16   17

<u>18</u>   <u>19</u>   20   <u>21</u>

22   23   24   <u>25</u>   26

PLATE 2

Byzantinia pikermiensis DE BRUIJN, 1976 from Çorakyerler

Fig. 27   M1 dext.

Fig. 28   M3 dext.

Fig. 29   m1 dext.

Fig. 30   m2 dext.

Fig. 31   m3 dext.

Byzantinia aff. *hellenicus* (FREUDENTHAL, 1970) from Çorakyerler

Fig. 32   m1 dext.

Fig. 33   m2 dext.

Fig. 34   m3 dext.

Pseudomeriones latidens ŞEN, 2001 from Çorakyerler

Fig. 35   M2 sin.

Fig. 36   M3 dext

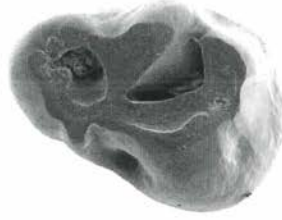Fig. 37, 37A m1 dext., same specimen, 37A labial view

Fig. 38, 38A m1 sin.,same specimen, 38A labial view

Fig. 39   m2 sin.

Fig. 40   m3 dext.

PLATE 2

27

28
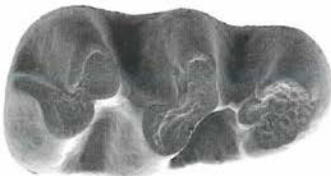
29

<u>30</u>

31

<u>32</u>

<u>33</u>

34

<u>35</u>

1 mm

<u>36</u>

37

<u>38</u>

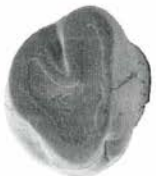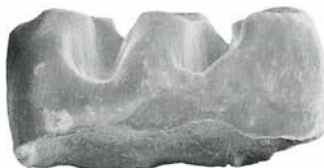<u>39</u>

7A

<u>38A</u>

<u>40</u>