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Insectivore faunas from the Lower Miocene of Anatolia

Part 1: Erinaceidae

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SUMMARY

Two new species of *Galerix* (Erinaceidae, Insectivora) are described from Lower Miocene localities of Anatolia. These species are *G.saratji* n. sp. from Kilçak 0, Kilçak 0″, Kilçak 3A, Kilçak 3B, Harami 1 and Harami 3, and *G.uenayae* n. sp. from Keseköy. The recent literature on *Galerix* is reviewed and the phylogenetic relationships of the Early Miocene species of *Galerix* are elaborated.

The presence of the erinaceid *Neurogymnurus* in Kilçak 3A indicates that the Kilçak localities are probably older than the Harami localities.

INTRODUCTION

This is the first of a series of papers on the taxonomy and stratigraphic distribution of the Insectivore faunas from the Lower Miocene of Anatolia. The erinaceid material described in this contribution comes from seven Turkish localities: Kilçak 0, Kilçak 0″, Kilçak 3A, Kilçak 3B, Harami 1, Harami 3, and Keseköy (fig. 1). In forthcoming articles the Heterosoricidae, Soricidae, Talpidae and Dimylidae of these localities will be discussed. The rodents of the various localities will be described by Ünay, Saraç and de Bruijn. De Bruijn and Saraç (1991) discuss the different species of *Eumyarion.* The Kilçak localities in this article lie very close to the Kilçak locality described by Becker-Platen et al. (1975). Since the old Kilçak locality has been destroyed, no additional material could be collected. The fauna of a eighth locality, the Oligocene/Miocene locality Inkonak 6 has been described by de Bruijn, Ünay, Saraç and the present author (in press).

The Early Miocene smaller mammals from southeastern Europe are poorly

known. The only published insectivore fauna from the Lower Miocene of the Eastern Mediterranean is that from Aliveri, Greece (Doukas, 1986). As a consequence, the material from the Anatolian localities can only be compared in more detail with faunas described from the Lower Miocene of western Europe. The best documented insectivore faunas from the Lower Miocene of western Europe were derived from localities in southern Germany. In the sixties the Soricidae and the Dimylidae were described from the locality Wintershof-West (Doben-Florin, 1964; Müller, 1967). Recently insectivores have been described from a number of southern German localities, ranging from the uppermost Oligocene to the lowermost Middle Miocene (van den Hoek Ostende, 1989; Ziegler, 1985, 1989, 1990a, 1990b; Ziegler et al. 1986). The Daroca-Calatayud Basin (Spain) offers a very well-documented record of the insectivores from south-western Europe, covering the upper part of the Lower Miocene and all of the Middle Miocene. The Middle Miocene insectivore assemblages have been described by de Jong (1988), the Lower Miocene assemblages are being studied by the present author.

Most of the erinaceid material described in this contribution belongs to the genus *Galerix*. Before describing the material from Anatolia we will review the recent literature on *Galerix*. Finally we will reconstruct the phylogeny of the Early Miocene species of *Galerix*.

METHODS AND COLLECTIONS

The studied material was collected by Dr. E. Ünay and Mr. G. Saraç of the Mineral Research and Exploration Institute of Turkey (M.T.A.) and by Dr. H. de Bruijn of the State University of Utrecht. The Harami material was collected during field trips in 1987 and 1988; the Keseköy material in 1988 and 1989. The material from Kilçak was collected in 1990 and 1991. The fossil teeth were obtained by wet-screening. Caustic soda was used in processing the sediment from Harami 1 and 3 in order to remove the coal.

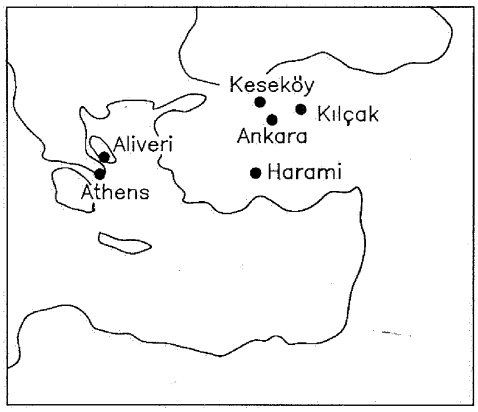

Fig. 1. The localities discussed in this paper.

The nomenclature used for parts of molars is according to Engesser (1980). The anterior arm of the protoconid is called the paralophid. Ziegler (1983) is followed in using the same terms for the premolars.

All elements were measured using a Reflex measuring microscope. The teeth were oriented according to the standards of de Jong (1988). Length and width were taken at right angles. The width given for lower molars is always the width of the talonid. All measurements are in mm. The number of available specimens of a specific tooth from a particular locality is given in brackets in the descriptions.

The material will be stored in the collections of the general directorate of the Mineral Research and Exploration Institute (M.T.A.) in Ankara.

REVIEW OF THE RECENT LITERATURE ON *GALERIX*

In the last couple of years a great number of publications appeared on the echinosoricine genus *Galerix*. In 1980 the genus was revised in two separate publications. Engesser (1980) placed the forms with a divided mesostyle on the M1 and M2 in the genus *Schizogalerix*. *Galerix exilis* and *G.socialis* were the only European species remaining in *Galerix*, because *G.stehlini* was considered synonymous to *G.exilis*.

Butler (1980) came to a similar subdivision. However, he placed the *socialis*-type in the genus *Parasorex,* together with the species Engesser assigned to *Schizogalerix*. According to Butler, *G.stehlini* is a well-defined species. His generic division was not followed by later authors. Butler (1984) maintained that the differences between *G.socialis* and the other species of *Galerix* are clear enough to warrant at least a division at subgenus level.

In 1983 Ziegler gave an extensive account of the characteristics of *G.exilis* from Steinberg and Goldberg (Southern Germany), commenting on the differences between this species and the other species of the genus. He considered, as Butler did, *G.stehlini* to be a well-defined species. It is distinctly larger than *G.exilis* and it has a p4 in which the metaconid is strongly reduced. De Jong (1986) commented only on the differences between *G.exilis* and *G.socialis*. He found different characters to distinguish the two species than Ziegler did. According to de Jong the configuration of the posterior arm of the metaconule on the M 1 and M2 would be one of the most important differences between the two species. This arm reaches up to the metastyle in *G.socialis*, whereas it stops at the posterior cingulum in *G.exilis*.

Two species of *Galerix* were described from localities outside Europe. Munthe and West (1980) described *Galerix rutlandae* from Pakistan, which description they based on a few teeth only. Butler (1984) described new material of *G.africanus* from deposits in eastern Africa. This very large species had originally been described earlier from the same localities (Butler, 1956), but at the time only limited material was available. *G. africanus* is morphologically close to *G.exilis* and *G.stehlini*.

During the last decade three new european species of *Galerix* were described. Doukas (1986) described *G.symeonidisi* from the Greek locality Aliveri. *G.sy-*

meonidisi has a well-developed hypocone on the P3, as does *G.socialis*. In other characters it is closer to *G.exilis*. *G.symeonidisi* was later also found in southern Germany (Ziegler et al., 1986). A number of the Galerix-assemblages from the latter area contain P3 both with and without a well-developed hypocone (Schötz, 1988). On basis of these intermediate assemblages Ziegler proposed that *G.exilis* is a descendant of *G.symeonidisi*.

Ziegler (1990) described a large species of *Galerix* from southern Germany. This *G.aurelianensis* is found in localities somewhat older (MN 3/4) than those with *G.symeonidisi*. According to Ziegler *G.aurelianensis* makes a good ancestor for *G. stehlini*.

G.depereti (Crochet, 1986) is a large species of *Galerix* derived from Pliocene deposits in southern France. In dental morphology it is close to *G.socialis*. *G.depereti* is, however, much larger.

The morphological characters used so far in *Galerix* taxonomy can be summarized as follows:

a. The hypocone on the P3 is either well-developed or absent.
b. The paraconid of the p4 is either connected to the protoconid by a paralophid or it is not.
c. The p2 is either smaller than the p3 or it is larger than or subequal to the p3.
d. The posterior arm of the metaconule of the M1 and M2 either reaches the postero-labial corner of the tooth or it ends at the posterior cingulum.
e. The protocone-metaconule connection is either invariably absent or may be present. Ziegler (1983) showed that there is a variability in the ridges connecting protocone, metaconule and hypocone. However, the protocone-metaconule connection is invariably absent in some species of *Galerix*.

The distribution of these characters over the different species of *Galerix* is listed in table 1.

SYSTEMATIC PART

Erinaceidae Bonaparte, 1821
Echinosoricidae Cabrera, 1838
Galerix Pomel, 1848

Galerix saratji n. sp. (Plate I, II, III)

Derivatio nominis: In honor of Mr. Gerçek Saraç, who discovered the Keseköy and Harami localities.

Diagnosis: *G.saratji* is a small species of *Galerix*. The p2 is longer than the p3. The p4 has a well-developed trigonid. Its paraconid is not connected to the protoconid. The P3 usually has one lingual cusp. The connections between the protocone and hypocone and between the protocone and the metaconule in the M1 and M2 are equally strong.

Table 1. Distribution of characters in *Galerix*

			G.saratji	*G.uenayae*	*G.symeonidisi*	*G.aurelianensis*	*G.exilis*	*G.stehlini*	*G.socialis*	*G.depereti*	*G.africanus*	*G.rutlandae*
P3	Hypocone well-developed	A	B	B	A	B	B	B	A	A	B	B
	Hypocone absent	B										
p4	Paraconid connected to the protoconid	A	B	B	A	B	B	B	A	A	B	A
	Paraconid not connected to the protoconid	B										
p2/p3	p2<p3	A	B	B	B	B	B	B	A	A	B	?
	p2>p3	B										
M1/M2	Posterior arm of the metaconule reaches postero-labial corner	A	A/B	A/B	B	B	B	A/B	A	A	B	A/B
	Posterior arm of the metaconule ends at the posterior cingulum	B										
M1/M2	Protocone meta-conule connection invariably absent	A	B	B	B	B	B	B	A	A	B	B
	Protocone-metaconule connection may be present	B										

Differential diagnosis: *G.saratji* is much smaller than *G.socialis*, *G.africanus*, *G.depereti*, *G.exilis*, *G.aurelianensis* and *G.stehlini*, and is somewhat smaller than *G.rutlandae*, *G.symeonidisi* and *G.uenayae*. It differs from *G.symeonidisi* in having usually only one lingual cusp on the P3. *G.saratji* differs from *G.rutlandae* in the absence of a paralophid on the p4. It differs from *G.uenayae* in having a well-developed metaconid on the p4.

Type locality: Harami 3 (Code Ha 3)

Other localities with *G.saratji*: Harami 1 (Ha 1), Kilçak 3A (Ki 3A), Kilçak 3B (Ki 3B), Kilçak 0 (Ki0), Kilçak 0″ (Ki 0″).

Type level: Lower Miocene (MN 2?)

Holotype: Fragment of a mandibulum dext. with p4-m2 and the alveoli of p2-p3 (Ha 3, 556)

Description of the holotype

The mandible is rather slender. There are five alveoli in front of the p4. Presumably one of these belongs to the p1, the other four to the two-rooted p2 and p3. The mandible is broken in front of the alveole of the p1. Judging from the size of the alveoli the p2 is somewhat longer than the p3. The ramus ascendens has broken off in line with the ramus horizontalis, so the angle between these cannot be observed. The foramen mentale lies under the alveoli of the p3.

The p4, m1 and m2 all have two roots. The outline of the occlusal surface of the p4 is sub-rectangular. The larger part of the tooth consists of the trigonid. The metaconid is somewhat lower than the protoconid. The paraconid is well-developed and somewhat lower than the metaconid. There are no ridges between these three cusps. The talonid is very short.

The m1 has a rectangular outline. The protoconid and metaconid are of the same height. The paraconid is low. It lies at the end of a well-developed paralophid. The entoconid is somewhat lower than the metaconid. The hypoconid is very worn (?damaged). The posterior cingulum is short but strong; the anterior cingulum is narrow. The m2 resembles the m1. The main difference is in the paraconid, which is blade-like and incorporated in the paralophid in the m2. The hypoconid is less worn than in the m1.

Measurements: The measurements are listed in table 2.

Description

Locality: Harami 3

d3 (7). The tooth is two-rooted. The enamel-dentine boundary curves up between the roots on both sides of the tooth. The outline of the occlusal surface is sub-rectangular. The tooth is wider posteriorly than anteriorly. The anterior side is rounded; the posterior side is straight. The pyramidal protoconid is the main cusp. The paraconid is strong. It is connected to the protoconid by an indistinct ridge in one of the seven specimens. The shallow talonid is bordered by a ridge posteriorly.

d4 (4). The tooth has two roots. The outline of the occlusal surface is rectangular. The trigonid takes up the largest part of the d4. The metaconid is slightly lower than the protoconid. The paraconid is very low. It is connected to the protoconid by the indistinct paralophid. The talonid is short. It is bordered by a posterior ridge. A narrow labial cingulum is present in one of the four specimens.

c (1). The tooth has one root, which is elliptical in cross-section.

In labial view the crown is trapezoidal. The tip is rounded and inclined towards the lingual side. A blunt ridge runs from the tip backwards. The labial side of the tooth is convex, the lingual side is slightly concave.

Table 2a. Measurements of *Galerix saratji* (lower teeth)

			Length		Width	
Tooth	Loc	N	range	mean	range	mean
d3	Ha3	7	1.55–1.64	1.60	0.81–0.96	0.90
	Ha1	2	1.65–1.67	1.66	0.96–0.98	0.97
	Ki3B	–				
	Ki3A	4	1.45–1.63	1.55	0.78–0.93	0.85
	Ki0″	8	1.52–1.66	1.61	0.86–0.99	0.91
	Ki0	–				
d4	Ha3	4	1.67–1.75	1.71	1.18–1.39	1.29
	Ha1	5	1.65–1.78	1.72	1.17–1.32	1.23
	Ki3B	1		1.57		1.32
	Ki3A	2	1.76–1.76	1.76	1.25–1.40	1.33
	Ki0″	2	1.78–1.79	1.79	1.28–1.31	1.30
	Ki0	–				
p4	Ha3	8	1.67–1.91	1.75	1.08–1.29	1.16
	Ha1	22	1.65–1.92	1.77	1.06–1.32	1.23
	Ki3B	3	1.59–1.67	1.62	0.99–1.20	1.06
	Ki3A	3	1.72–1.73	1.72	1.06–1.19	1.12
	Ki0″	10	1.65–1.86	1.78	1.11–1.41	1.23
	Ki0	3	1.68–1.72	1.69	1.12–1.14	1.13
m1	Ha3	6	2.27–2.51	2.39	1.55–1.72	1.52
	Ha1	11	2.32–2.67	2.47	1.60–1.84	1.69
	Ki3B	4	2.40–2.46	2.42	1.40–1.71	1.61
	Ki3A	–				
	Ki0″	2	2.50–2.80	2.65	1.66–1.70	1.68
	Ki0	–				
m2	Ha3	8	1.96–2.14	2.08	1.39–1.63	1.52
	Ha1	17	1.97–2.22	2.09	1.33–1.64	1.50
	Ki3B	3	1.92–2.11	2.04	1.40–1.49	1.44
	Ki3A	2	2.06–2.11	2.09	1.41–1.50	1.45
	Ki0″	8	1.96–2.25	2.11	1.33–1.66	1.49
	Ki0	2	1.93–1.98	1.96	1.39–1.50	1.45
m3	Ha3	5	1.55–1.72	1.63	0.82–0.99	0.88
	Ha1	14	1.38–1.68	1.53	0.83–1.03	0.94
	Ki3B	3	1.50–1.51	1.50	0.86–0.91	0.88
	Ki3A	5	1.41–1.62	1.51	0.69–0.89	0.80
	Ki0″	5	1.50–1.63	1.55	0.84–1.02	0.94
	Ki0	2	1.42–1.52	1.47	0.81–0.91	0.86

p2, p3, P1, P2 (24). These premolars are described as a group, since they cannot be distinguished and are thought to be similar (see remarks).

These teeth are two-rooted. The outline of the occlusal surfaces is sub-elliptical. The posterior side may be straight or convex. The teeth bear one cusp. A

Table 2b. Measurements of *Galerix saratji* (upper teeth)

			Length		Width	
Tooth	Loc	N	range	mean	range	mean
D3	Ha3	3	1.59–1.85	1.73	0.95–1.20	1.09
	Ha1	11	1.64–1.78	1.69	1.00–1.09	1.04
	Ki3B	1		1.68		0.86
	Ki3A	1		1.94		1.08
	Ki0"	3	1.76–1.83	1.80	1.10–1.14	1.12
D4	Ha3	1		2.14		1.93
C	Ha3	1		1.62		0.70
	Ha1	10	1.41–1.78	1.57	0.55–0.78	0.65
	Ki3B	1		1.51		0.70
	Ki3A	1		1.54		0.67
P3	Ha3	6	1.59–1.72	1.65	1.18–1.51	1.38
	Ha1	14	1.52–1.82	1.69	1.11–1.56	1.28
	Ki3B	5	1.49–1.65	1.56	1.16–1.34	1.23
	Ki3A	9	1.46–1.74	1.61	1.10–1.33	1.22
	Ki0″	13	1.35–1.75	1.60	1.08–1.47	1.25
	Ki0	1		1.64		1.30
P4	Ha3	2	2.07–2.10	2.09	2.45–2.79	2.62
	Ha1	4	1.80–2.23	2.05	2.26–2.51	2.38
	Ki3B	2	1.88–2.01	1.95	2.42–2.53	2.48
	Ki3A	–				
	Ki0″	3	1.94–2.34	2.10	2.15–2.27	2.23
	Ki0	–				
M1	Ha3	3	1.92–2.14	2.06	2.63–2.76	2.51
	Ha1	7	2.02–2.22	2.13	2.60–2.97	2.59
	Ki3B	3	1.85–2.16	2.02	2.59–2.77	2.69
	Ki3A	11	1.87–2.19	2.04	2.33–2.73	2.56
	Ki0″	5	2.07–2.15	2.12	2.66–2.86	2.74
	Ki0	2	2.10–2.19	2.08	2.59–2.65	2.62
M2	Ha3	6	1.72–1.80	1.75	2.16–2.35	2.27
	Ha1	17	1.59–1.85	1.73	2.09–2.40	2.28
	Ki3B	4	1.69–1.72	1.70	2.20–2.31	2.26
	Ki3A	15	1.54–1.81	1.68	2.05–2.38	2.19
	Ki0″	8	1.62–1.81	1.71	2.06–2.42	2.22
	Ki0	3	1.57–1.66	1.62	2.10–2.19	2.14
M3	Ha3	5	1.06–1.16	1.11	1.47–1.69	1.54
	Ha1	25	0.96–1.14	1.05	1.42–1.71	1.58
	Ki3B	5	0.93–1.06	0.97	1.49–1.54	1.51
	Ki3A	11	0.88–1.07	0.99	1.33–1.56	1.48
	Ki0″	15	0.88–1.14	0.97	1.28–1.63	1.51
	Ki0	–				

posterior flattening is invariably present; some specimens have an indistinct anterior edge.

p4 (8). The tooth is two-rooted. The occlusal surface has a sub-rectangular outline; the antero-lingual side is rounded. The trigonid takes up most of the p4. The metaconid is small and lower than the protoconid. The paraconid is low but distinct. Both the metaconid and the paraconid are separated from the protoconid by a notch.

The talonid is short. It is bordered posteriorly by a ridge. The talonid basin is a narrow groove which slopes down labially.

m1 (6). The m1 has two roots. The outline of the occlusal surface is rectangular. The protoconid and metaconid have the same height. There is a deep notch between these two cusps. The paraconid lies directly in front of the metaconid. It is connected to the protoconid by the well-defined paralophid. The entoconid is somewhat lower than the metaconid; the hypoconid is much lower than the entoconid. The posterior arm of the entoconid connects to both the posterior cingulum and to the posterior arm of the hypoconid in one of the six specimens. In the other specimens it is only connected to the posterior arm of the hypoconid. There is a clear notch where the posterior arms of the entoconid and hypoconid meet. The talonid is bordered lingually by the entocristid and the small metacristid.

The posterior cingulum is short but strong. The labial cingulum is narrow. It may continue into the anterior cingulum. This cingulum is frequently interrupted at the base of the protoconid.

m2 (8). The m2 resembles the m1. The clearest difference is in the shape of the paraconid. In the m2 it is blade-like and totally incorporated in the paralophid. The posterior cingulum is not connected to the posterior arm of the entoconid.

m3 (5). The m3 is two-rooted and the occlusal surface has a sub-rectangular outline. The trigonid of the m3 resembles that of the m2, but the paralophid is shorter. The anterior side of the tooth is convex. The talonid is slightly narrower than the trigonid. The entoconid is small; the hypoconid is very poorly developed. The anterior cingulum is narrow.

D3 (11). The tooth is three-rooted. The outline of the occlusal surface is triangular. The lingual side is straight to slightly concave.

The paracone is the largest cusp. It lies in front of the middle of the tooth. The posterocrista is curved. It runs from the top of the paracone to the posterolabial corner of the tooth. The low metacone lies directly behind the paracone in five of the eleven specimens. In the other specimens it is absent. The parastyle is indistinct. It lies on a small shelf in front of the paracone.

There is a small lingual extension. A very low ridge runs along the lingual side

of this extension. A narrow antero-lingual cingulum connects the lingual extension to the anterior shelf. The postero-labial cingulum is narrow.

D4 (2). The outline of the occlusal surface is irregularly quadrangular. The high paracone is very large. The posterocrista runs from its tip to the postero-labial corner of the tooth. The parastyle is very strong. It lies in front of the paracone.

The two lingual cusps are cone-shaped. An indistinct ridge runs over the labial and posterior face of the protocone. This cusp is somewhat higher and larger than the hypocone. The latter lies postero-lingually of the protocone. One of the two specimens was lost while photographing it.

C (1). The tooth is two-rooted. The outline is elliptical. The tooth is symmetrical. The labial side may be slightly more convex than the lingual side.

The top of the main cusp is pointed. It lies just in front of the middle of the tooth, and is directed slightly backwards. A small cusplet is present at the back of the tooth.

P3 (6). The tooth is three-rooted and the occlusal surface has a hook-shaped outline. The postero-lingual side is strongly concave; the anterior side is somewhat curved. The lingual side is slightly convex.

The paracone is the largest cusp. The posterocrista connects to a low posterior ridge. The parastyle lies directly in front of the paracone. It is connected to the protocone by an indistinct ridge.

The cone-shaped protocone is the only cusp on the lingual extension. It lies anterolingually of the paracone. The postero-lingual cingulum is strongly developed. It connects the protocone to the posterior ridge.

P4 (1). The tooth is three-rooted. The outline of the occlusal surface is subrectangular.

The very high paracone is the largest cusp. The sharp posterocrista runs from its top backwards. The posterocrista bends halfway sharply to the posterolabial corner of the tooth. The parastyle is small. It lies directly in front of the paracone. The parastyle is connected to the protocone by a low ridge.

The lingual cusps are clearly lower than the paracone. The valley separating the paracone from the lingual cusps is wide. The protocone is higher than the hypocone. Both cusps are cone-shaped. They are connected by a indistinct ridge. The strongly developed posterior cingulum runs from the hypocone backwards. This cingulum borders the valley between the paracone and the lingual cusps.

M1 (4). The M1 has three roots. The outline of its occlusal surface is subrectangular. The posterior side is curved. The lingual side is slightly emarginated between the protocone and the hypocone.

There are six cusps. The protocone is the largest of these. The anterior arm of this cusp runs parallel to the anterior side of the tooth and connects to the

parastyle in two of the four specimens. In the two others it ends freely in front of the paracone. The protoconule is incorporated in the anterior arm of the protocone. The posterior arm of the protocone runs in the direction of the metaconule. Before reaching this cusp it bifurcates into a ridge connecting to the metaconule and a ridge connecting to the hypocone. The strong hypocone is cone-shaped. The metaconule is crescent-shaped. Its anterior arm ends against the base of the metacone; its posterior arm ends against the posterior cingulum. The labial cusps are about the same height as the protocone, but the paracone is somewhat lower than the metacone. A faint centerocrista runs over the paracone. This ridge connects to the metacone. The posterior arm of the metacone is long and extends postero-labially.

The parastyle is low. It lies in front of the paracone, to which it is connected. A well-developed cingulum is present on the anterior, labial and posterior side of the tooth. The posterior cingulum is continuous.

M2 (7). The pattern of the M2 resembles that of the M1. The clearest difference is in the shorter posterior arm of the metacone. The tooth is somewhat narrower posteriorly than anteriorly. The posterior arm of the metaconule does not reach the posterior cingulum.

M3 (7). The M3 has three roots. The outline of its occlusal surface is triangular. The tooth bears three cusps. The ridges connecting these cusps border the rather deep trigon basin. The anterior arm of the protocone connects to the paracone in four specimens. In one specimen it ends freely, and in two specimens it connects to the parastyle. The parastyle lies in front of the paracone and is connected to this cusp by a faint ridge. The anterior cingulum is well developed. Five specimens have a weak labial cingulum. Two of these have a weak posterior cingulum as well.

Localities: Harami 1, Kilçak 3A, Kilçak 3B, Kilçak 0, Kilçak 0″

The material of Harami 1, Kilçak 3A, Kilçak 3B, Kilçak 0 and Kilçak 0″ is not described in detail. Only the differences with material from the type locality and the distribution of certain characters will be given. The i1 and p1, not represented in the Harami 3 collection, will be described below. Since more specimens of the various elements have been found in Harami 1 than in Harami 3, this locality gives a better impression of the variation. In spite of this Harami 3 is chosen as type locality since this collection contains the only mandible of *G.saratji*, which has been designated as the holotype.

Harami 1

i1 (1). The tooth has one long root, which is elliptical in cross-section. The enamel-dentine boundary curves up below the middle of the tooth. This boundary lies anteriorly somewhat lower than posteriorly.

The large crown is chisel-shaped. The cutting edge is sharp. The posterior edge is rounded. The labial face is convex; the lingual face is slightly concave. The latter bears a rib which forms a small bulge at the base of the tooth. The crown narrows at the base.

c (8). See description Harami 3

d3 (2). The paraconid is connected to the protoconid by an indistinct ridge in one of the two specimens.

d4 (7). The paraconid is connected to the protoconid in four of the seven specimens. Two specimens have a distinct labial cingulum; in two others this cingulum is absent. The remaining three are too damaged to see whether or not such a cingulum was present. A short lingual cingulum is present in two specimens.

p1 (12). The p1 has two roots which are sometimes fused. The outline of the occlusal surface is elliptical. The anterior and posterior side may be either straight or convex. In the first case the occlusal surface has a rather trapezoidal outline, the lingual side being longer than the labial side.

The protoconid is the main cusp. Its top lies somewhat to the lingual side of the tooth. A small talonid is present. In some specimens there is a very small cusplet on the posterolingual corner of the talonid. There is a short cingulum in the antero-labial corner of some specimens.

p2, p3, P1, P2 (58). See description Harami 3 and discussion below.

p4 (25). See description Harami 3.

m1 (12). In ten of the twelve specimens the posterior arm of the entoconid is connected to both the posterior arm of the hypoconid and the short but strong posterior cingulum. This ratio is remarkably different from that in Harami 3 (one of the six).

m2 (21). The posterior cingulum is connected to the posterior arm of the entoconid in only one of the twenty-one specimens.

m3 (15). See description Harami 3.

C (?dC) (14). See description Harami 3. The variation in size of these elements is so large, that probably both C and dC are represented. Unfortunately the two cannot be clearly distinguished.

D3 (8). A metacone can be recognized in five of the eight specimens.

P3 (14). In one of the fourteen specimens a very clear second lingual cusp is present, which is much lower than the protocone and lies posteriorly to this cusp.

P4 (6). See description Harami 3.

M1 (15). In all of the M1 the posterior cingulum consists of two parts: a cingulum which is confluent with the posterior arm of the metaconule and another which runs from the hypocone to this cingulum. This is clearly a different configuration than in Harami 3, where the posterior cingulum is one continuous ridge.

M2 (23). The posterior cingulum of the M2 shows the same configuration as that of the M1 from this locality.

M3 (27). The anterior arm of the protocone ends freely in only two of the 27

specimens. This arm connects to the parastyle in one specimen. In the other specimens it is connected to the paracone.

Kilçak 3B

p1 (1). The p1 has two roots which are fused.

d4 (1). The paraconid is connected to the protoconid by a faint ridge. Both a lingual and a labial cingulum are present.

p4 (3). See description Harami 3.

m1 (4). In one of the four specimens the posterior cingulum is connected to the entoconid.

m2 (4). In three of the four specimens the posterior cingulum is clearly not connected to the entoconid. The fourth specimen is too worn to observe this character.

C (1). See description Harami 3.

D3 (1). A metacone is recognizable in the only specimen available.

P3 (5). One of the five specimens bears a weak hypocone.

M1 (3). The posterior arm of the metaconule reaches the postero-labial corner of the tooth in all of the three M1, thus giving the posterior cingulum a bipartitioned appearance.

M2 (5). The configuration of the posterior cingulum is the same as in the M1 of this locality.

M3 (5). The anterior arm of the protocone reaches the paracone in all five specimens.

Kilçak 3A

d3 (4). The paraconid is connected to the protoconid in one of the four specimens.

d4 (2). A faint paralophid is present in both specimens.

p4 (10). See description Harami 3.

m1 (2). The posterior cingulum is not connected to the entoconid.

m2 (8). The posterior cingulum is not connected to the entoconid.

m3 (5). See description Harami 3.

P3 (13). All P3 have only one lingual cusp.

P4 (1). See description Harami 3.

M1 (6). The posterior arm of the metaconule reaches the postero-labial corner of the tooth in five of the six M1, thus giving the posterior cingulum a bipartitioned appearance. The posterior cingulum of the sixth specimen is continuous.

M2 (18). The posterior arm of the metaconule reaches the postero-labial corner of the tooth in fifteen of the eighteen specimens.

M3 (11). The anterior arm of the protocone is connected to the paracone in six of the eleven specimens. In four other it ends freely. The eleventh specimen is too worn to judge this character.

Kilçak 0

d3 (8). The paraconid is connected to the protoconid in five of the eight specimens. Two of these also bear a very weak metaconid.

d4 (2). The paraconid is connected to the protoconid in one of the two specimens.

p4 (10). See description Harami 3.

m1 (2). The posterior cingulum is not connected to the entoconid.

m2 (8). The posterior cingulum is not connected to the entoconid.

m3 (5). See description Harami 3.

D3 (4). A metaconid is present in two of the four specimens.

P3 (13). All specimens have only one lingual cusp.

P4 (3). See description Harami 3.

M1 (8). In five of the eight specimens the posterior cingulum is bipartitioned. It is continuous in the other three.

M2 (16). In thirteen of the sixteen specimens the posterior cingulum is bipartitioned. It is continuous in the other three.

M3 (17). The anterior arm of the protoconid is connected to the paracone in fourteen of the seventeen specimens. It ends freely in the other three.

Kilçak 0

p1 (1). See description Harami 3.

d4 (1). The paraconid is not connected to the protoconid.

p4 (3). See description Harami 3.

m2 (2). The posterior cingulum is not connected to the entoconid.

m3 (2). See description Harami 3.

P3 (2). Both P3 have only one lingual cusp.

P4 (1). See description Harami 3.

M1 (2). One of the two specimens has a bipartitioned posterior cingulum. The posterior cingulum of the other M1 is continuous.

M2 (3). All three M2 have a bipartitioned cingulum.

Remarks on *G.saratji.*

The p1, p4, P3 and P4 of *Galerix saratji* are readily recognizable. Both the c and the C are also easy to identify as such (C and dC can not be differentiated). The remaining premolars that seem to belong to this species are very similar. This group consists for Harami 1 of 56 specimens and for Harami 3 of 24 specimens. Comparing these numbers with the number of P3 (14 and 6 resp.) shows that the group contains four times this number. We therefore assume that p2, p3, P1 and P2 are represented, and that *G.saratji* had four premolars, as all other species of *Galerix.*

An attempt has been made to distinguish the various premolars within the group of two-rooted elements with a subelliptical outline of the occlusal surface.

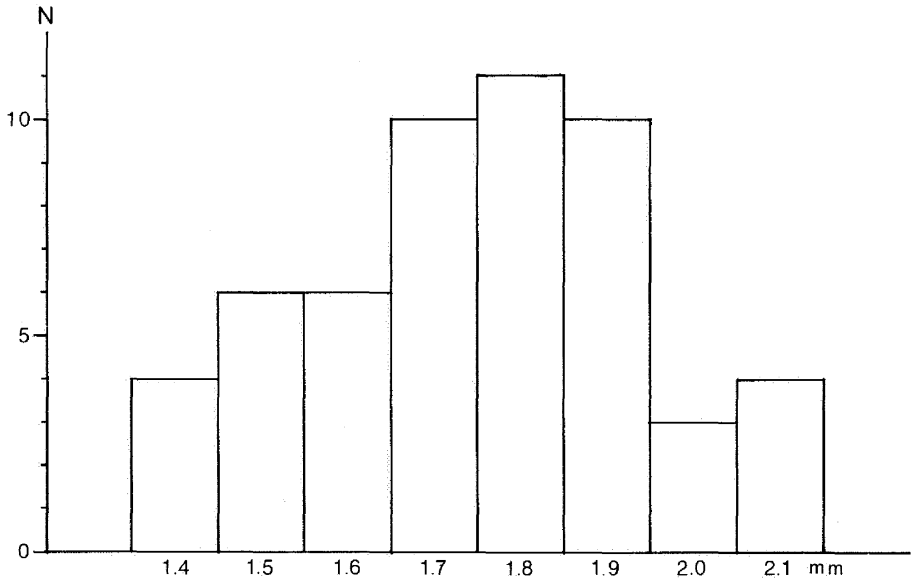

Fig. 2. Length distribution diagram of the unidentifiable premolars of *G.saratji* (p2, p3, P1, P2) for Harami 1.

The results of the biometrical analysis for the specimens from Harami 1 are given in fig. 2. Since this group shows a unimodal distribution, no division can be made on the basis of size. A division on the basis of the morphology also seems impossible. A fragment of a maxilla from Harami 1 (no. 3031, Pl. I fig. 17) carries a P1 with a talon reminiscent of the talonid of the p4. This element would therefore not have been identifiable as an upper premolar if found isolated. Ziegler (1986, 1990) already noted the difficulties in separating p2 from p3 in isolated teeth of *G.exilis* and *G.symeonidisi* from southern Germany. In the Harami assemblages of *G.saratji* it is not possible to distinguish these elements from the upper premolars.

The relative size of the p2 and p3 is considered to be of taxonomical value (Doukas, 1986; Ziegler et al., 1986). As shown above, we cannot separate these two elements. However, the relative size of p2 and p3 can be inferred from the holotype of *G.saratji*.

Another important character in distinguishing the species of *Galerix* is the number of lingual cusps on the P3. This character seems to be variable in *G.saratji*. One of the fourteen P3 from Harami 1 and one of the five from Kilçak 3B have two lingual cusps, the other P3 of these localities have only one, as do all of the P3 from the other localities with *G.saratji*. The two-cusped specimens from Harami 1 and Kilçak 3B are considered to be within the variation of the species. Specimens with a weak hypocone have also been found in *G.exilis* from Steinberg and Goldberg (Ziegler, 1983).

The *Galerix*-assemblages from Harami 1 and Harami 3 differ in two respects. The first concerns the connection of the posterior cingulum to the posterior arm

of the entoconid in the m1. In Harami 1 this connection is present in ten of the twelve m1, whereas in Harami 3 only one of the six m1 shows this character. The connection is also rare in the Kilçak localities. For the m2, however, the distribution of this character is similar in the various assemblages (one of the twenty-two for Harami 1 versus none in Harami 3 or the Kilçak localities). Ziegler et al. (1986) noted the variability of this character in *G.symeonidisi*-assemblages from southern Germany.

The other, more remarkable, difference concerns the configuration of the posterior cingulum of the M1 and M2. In Harami 1 and Kilçak 3B this cingulum consists of two parts: one of these is connected to the posterior arm of the metaconule, the other to the hypocone. In Harami 3, however, the posterior cingulum is one continuous ridge. The specimens from the other Kilçak localities usually have the same configuration as found in Harami 1, although specimens with a continuous posterior cingulum are present. De Jong (1988) used this character for distinguishing *G.exilis* and *G.socialis* in his Spanish assemblages. A posterior cingulum consisting of two parts is invariably present in *G.socialis, G.depereti* and all species of *Schizogalerix*. Because of the otherwise great similarity of the *Galerix*-assemblages of Harami 1 and Harami 3 this difference seems insufficient a reason to place the assemblages in different species. It seems that in the Lower Miocene this character was part of the intraspecific variation.

Engesser (1980) described an M2 of *Galerix* from the old Kilçak-locality. Doukas (1986) tentatively placed this specimen in *G.symeonidisi.* Since *G.saratji* is found in the new Kilçak localities, and the M2 described by Engesser falls completely within the variation of this species, it is clear that this M2 belongs to *G.saratji.*

Galerix uenayae n.sp. (Pl. IV, V)

Derivatio nominis: The species is named in honor of Dr. Engin Ünay, in recognition of her work on the fossil mammals of Turkey.

Diagnosis: *G.uenayae* is a small species of *Galerix*. The p2 is longer than the p3. The P4 is larger than the M1. The length of the p4 is sub-equal to the length of the m2. The p4 has a paraconid which is not connected to the protoconid; the metaconid is weak or absent. The P3 usually has one lingual cusp.

Differential diagnosis: *Galerix uenayae* is smaller than *G.africanus, G.depereti, G.socialis, G.exilis, G.aurelianensis* and *G.stehlini.* It is somewhat larger than *G.saratji* and *G.symeonidisi. G.uenayae* differs from *G.symeonidisi* and *G.socialis* in having only one lingual cusp on the P3. It differs from *G.rutlandae* and *G.saratji* in having a strongly reduced metaconid on the p4.

Type locality: Keseköy (code Ke)

Type level: Lower Miocene (MN 3?)

Holotype: M2 dext. in part of the maxillary (Ke 6333)

Description of the holotype

The M2 has a subrectangular outline; the lingual and the posterior sides are slightly curved. The protocone is the largest cusp and equal in height to the paracone and metacone. The anterior arm of the protocone runs parallel to the anterior side of the tooth. It ends freely before reaching the paracone. The protoconule is a mere widening in this arm. The parastyle is very low. It lies directly in front of the paracone. A faint rib runs over the posterior face of the paracone and connects to the base of the metacone. The posterior arm of the metacone is relatively short. It is strongly curved to the labial side.

The posterior arm of the protocone divides into two equally strong ridges. One of these connects to the crescent-shaped metaconule, the other to the cone-shaped hypocone. The posterior arm of the metaconule does not connect to the posterior cingulum.

The anterior cingulum is strong. It connects to the parastyle. A well-developed labial cingulum runs along the base of the paracone. The posterior cingulum is well developed.

Measurements: The measurements are listed in table 2

Description

Table 3a. Measurements of *Galerix uenayae* (lower teeth)

			Length		Width	
Tooth	Loc	N	range	mean	range	mean
d3	Ke	13	1.50–1.85	1.68	0.84–1.05	0.94
d4	Ke	13	1.84–2.06	1.94	1.21–1.50	1.35
p1	Ke	10	1.12–1.32	1.22	0.61–0.73	0.67
p2	Ke	8	1.68–1.89	1.78	0.86–1.04	0.93
p3	Ke	11	1.34–1.50	1.42	0.69–0.96	0.86
p4	Ke	16	1.83–2.55	2.23	1.23–1.57	1.44
m1	Ke	18	2.49–2.99	2.81	1.66–2.09	1.82
m2	Ke	27	2.06–2.50	2.28	1.41–1.76	1.60
m3	Ke	10	1.60–1.94	1.78	0.92–1.56	1.10

Table 3b. Measurements of *Galerix uenayae* (upper teeth)

			Length		Width	
Tooth	Loc	N	range	mean	range	mean
D3	Ke	20	1.68–2.12	1.87	0.99–1.67	1.19
D4	Ke	1		2.42		2.22
C	Ke	6	1.53–2.34	1.93	0.97–1.06	0.89
P1	Ke	4	1.66–1.76	1.72	0.94–1.01	0.98
P2	Ke	8	1.77–2.02	1.92	0.89–1.14	1.02
P3	Ke	15	1.70–2.03	1.85	1.43–1.63	1.52
P4	Ke	14	2.44–2.95	2.61	2.46–2.93	2.68
M1	Ke	18	2.13–2.49	2.33	2.77–3.21	3.03
M2	Ke	22	1.79–2.10	1.98	2.40–2.68	2.55
M3	Ke	19	1.06–1.38	1.20	1.55–1.96	1.76

Mandible. Only fragments of the mandible of *G.uenayae* are available. All these are fragments of the ramus horizontalis. The lower jaw appears to have been relatively slender. The foramen mentale lies directly under the p3, or between the p3 and p4. The p3 is set obliquely in the jaw.

d3 (13). The tooth has two roots. The enamel-dentine boundary curves up between the roots on both sides of the tooth.

The outline of the occlusal surface is sub-rectangular. The tooth is posteriorly wider than anteriorly. The anterior side is convex, the posterior side is straight.

The pyramidal protoconid is the main cusp. The paraconid is distinct. It lies in front of the protoconid. It may or may not be connected to the protoconid by a blunt ridge. The talonid is rather short. It bears a cusplet on the postero-lingual corner.

d4 (14). The tooth has two roots. The outline of the occlusal surface is parallelogram-shaped.

The trigonid is very long. It makes up the largest part of the tooth. The metaconid is only slightly lower than the protoconid. The paraconid is low but distinct. It is connected to the protoconid by a long paralophid.

The talonid is short. It is bordered by a posterior ridge. The labial cingulum is very weak. There is a short cingulum lingually of the paraconid in ten of the fourteen specimens. This cingulum is absent the four others.

p1 (11). The p1 is either one-rooted or two-rooted. Four of the nine specimens of which the roots are preserved have one root. In three specimens the two roots are fused, two specimens have separate roots. The crown is symmetrical; the outline of the occlusal surface is elliptical. The top of the main cusp, the protoconid, lies in front of the middle of the tooth. The small talonid bears a cusplet.

p2 (9). The p2 is two-rooted. The outline of the occlusal surface is elliptical. The tooth is very symmetrical. The top of the protoconid lies in the middle of the occlusal surface. A small flattening is invariably present on the posterior side. It may or may not bear a small cusplet. An anterior flattening is present in five of the nine specimens.

p3 (13). The p3 has two roots. The outline of the occlusal surface is sub-rectangular. The posterior side is straight; the anterior side is rather rounded. The top of the protoconid lies somewhat to the lingual side in front of the middle of the tooth. A small talonid is present on the postero-lingual corner. A small anterior flattening may be present.

p4 (21). The p4 has two roots. The outline of the occlusal surface is rectangular. The high trigonid makes up the largest part of the tooth. The metaconid is absent in eleven of eighteen specimens. In seven others it is a mere bulge on the flank of the protoconid. Three specimens are too worn to check this character. There is no paralophid. The shallow talonid is bordered posteriorly by a indistinct ridge.

m1 (19). The tooth has two roots. The outline of the occlusal surface is rectangular.

The protoconid and metaconid are the same height. There is a deep notch halfway between these cusps. The paraconid is lower than the protoconid. It lies directly in front of the metaconid, at the end of a rather long paralophid.

The entoconid is somewhat lower than the metaconid; the hypoconid is lower than the entoconid. The ridge connecting the hypoconid and entoconid is notched. The talonid is bordered lingually by the entocristid and the very short metacristid.

The posterior cingulum is short but strong. It is not connected to the posterior arm of the entoconid. The labial cingulum is narrow. It continues into the well-developed anterior cingulum.

m2 (28). The m2 resembles the m1. The clearest difference between these elements is the paraconid, which is blade-like and totally incorporated in the paralophid in the m2. The strong posterior cingulum is not connected to the entoconid.

m3 (12). The m3 is two-rooted. The occlusal surface has a sub-rectangular outline. The trigonid of the m3 resembles that of the m2, but the paralophid is

shorter. The anterior side of the tooth is rather rounded. The talonid is slightly narrower than the trigonid. Talonid and trigonid are equally long. The entoconid is small; the hypoconid is very poorly developed. The anterior cingulum is narrow.

C (?dC) (8). The tooth is two-rooted. The outline is elliptical. The tooth is symmetrical. The labial side may be a bit more convex than the lingual side.

The top of the main cusp is pointed. It lies just in front of the middle of the tooth, and is directed slightly backwards. A small cusplet is present at the back of the tooth.

The variation in size is so large, that probably both C and dC are represented.

D3 (23). The D3 is three-rooted. The outline of the occlusal surface is triangular.

The paracone is the largest cusp. It lies just in front of the middle of the tooth. The posterocrista is straight. It runs from the top of the paracone backwards. The metacone lies directly behind the paracone; it is clearly lower than this cusp. The metacone is completely incorporated in the posterocrista in three of the twenty-three specimens. The parastyle is a cusplet which lies on a small shelf in front of the paracone.

The lingual extension is very small. It extends from the middle of the paracone to the middle of the metacone and bears a very small protocone in three specimens. The posterolabial cingulum is narrow and may even be absent. If present it connects to a posterior ridge, bordering the back of the tooth. A narrow antero-lingual cingulum as well as a weak (postero-)labial cingulum may be present.

D4 (1). The outline of the occlusal surface is irregularly quadrangular. The paracone is high and very large. The posterocrista runs from its tip to the posterolabial corner of the tooth. The parastyle is very strong. It lies in front of the paracone.

The two lingual cusps are cone-shaped. The protocone is clearly higher and larger than the hypocone. The latter lies directly posterior to the protocone. The posterior cingulum is well developed. There is a narrow postero-lingual cingulum.

P1 (9). The tooth is two-rooted. The outline of the occlusal surface is elliptical; the P1 is very symmetrical. The tooth is only somewhat longer than wide. The main cusp is the bulbous paracone. The small posterior flattening may bear a cusplet. Three of the nine specimens also have a weak anterior flattening. One of these bears a small cusplet on this flattening.

P2 (9). The tooth has two roots. The outline of the occlusal surface is elliptical. The labial side is somewhat more convex than the lingual side. The P2 is clearly longer than the P1.

The bulbous paracone is the main cusp. There is a posterior flattening. An anterior flattening is present in eight of the nine specimens.

P3 (15). The P3 has three roots. The outline of the occlusal surface is hook-shaped.

The postero-lingual side is strongly concave. The anterior side is straight or slightly emarginated. The lingual side is rather straight and runs parallel to the labial side.

The paracone is the largest cusp. The posterocrista lies far to the lingual side and connects to a posterior ridge. The parastyle is a small cusplet, which lies on a flattening in front of the paracone. It is connected to the protocone by a very low ridge. The protocone is rather large. It lies antero-lingually of the paracone. One of the fifteen specimens bears a very weak second cusplet directly behind the protocone. This cusplet lies inside the postero-lingual cingulum. The extension remains the same width up to the middle of the tooth. The lingual and postero-lingual cingulum are very well developed. The latter connects to the posterior ridge.

P4 (21). The tooth is three-rooted. The outline of the occlusal surface is sub-square. The cusps are bulky.

The paracone is very large. The posterocrista runs from the top of this cusp backwards. Halfway it bends towards the postero-labial corner of the tooth. The parastyle is very small. It lies directly in front of the paracone. The parastyle may be connected to the protocone.

The lingual cusps are lower than the paracone. The valley separating the paracone from the protocone is relatively narrow. The protocone is large. It is clearly higher than the hypocone. Both cusps are cone-shaped. They are not interconnected. The posterior cingulum is well developed.

M1 (25). The M1 is three-rooted. The outline of the occlusal surface is sub-rectangular. The posterior side is slightly curved; the lingual side is emarginated between the protocone and the hypocone.

The tooth has six cusps. The protocone is the largest of these. The anterior arm of this cusp runs parallel to the anterior side of the tooth and ends freely before reaching the paracone. The protoconule is a mere widening at the end of this arm. The posterior arm of the protocone connects only to the hypocone in six of the twenty-five specimens. In the other specimens the posterior arm of the protocone divides into two ridges. One of these connects to the hypocone, the other connects to the metaconule. The ridge connecting to the hypocone is usually stronger, but may be as strong as the protocone-metaconule connection. The latter is stronger in one of the twenty-five specimens. The hypocone is cone-shaped. A faint rib may be present on the posterolabial side of the cusp. The metaconule is crescent-shaped. Its anterior arm ends against the base of the metacone; its posterior arm ends against the posterior cingulum. In three of the twenty-five specimens the posterior arm of the metaconule continues as the post-

ero-labial cingulum, so that the posterior cingulum consists of two parts. The labial cusps are the same height as the protocone. A faint rib runs over the posterior side of the paracone. It connects to the base of the metacone. The posterior arm of the metacone is long and extends postero-labially.

The parastyle is low. It lies antero-labially of the paracone. It is connected to this cusp by a short ridge. There is a well-developed cingulum on the anterior, labial and posterior side of the tooth. The posterior cingulum is continuous in twenty-two of the twenty-five specimens; in the other specimens it is bipartitioned (see above). There is a short lingual cingulum in the emargination between the protocone and the hypocone. The posterior cingulum bears a small cusplet at the base of the hypocone in two of the twenty-five specimens.

M2 (26). The pattern of the M2 resembles that of the M1. The most apparent difference is in the shorter posterior arm of the metacone. The posterior arm of the protocone is connected both to the hypocone and the metaconule in twenty-two of the twenty-six specimens. The protocone-metaconule connection is usually slightly stronger than the protocone-hypocone connection. In two of the twenty-six specimens the protocone is not connected to the hypocone, in two others the protocone-metaconule connection is absent. A clearly bipartitioned posterior cingulum is found in four specimens. There may be a short lingual cingulum.

M3 (19). The tooth has three roots. The outline of the occlusal surface is triangular. The three cusps are the same height. The ridges connecting the cusps border the trigon basin. The ridge connecting paracone and metacone is notched. The parastyle is low. It lies directly in front of the paracone. The anterior cingulum is usually very well developed. A short and narrow posterior cingulum is present in sixteen of the nineteen specimens. One of these also has a weak labial cingulum.

Remarks on *G.uenayae*.

Ziegler (1990) already noted that the choice of a holotype in species of *Galerix* is always somewhat problematical, because isolated teeth show insufficient characters to be characteristic for a species. If present, a mandible or maxillary carrying several elements should be designated as a holotype. However, the mandible of *G.uenayae* is only represented by relatively small fragments and no part of the maxillary with more than one element has been found. Therefore, as in *G.symeonidisi*, a well-preserved M2 has been designated as the holotype.

The various premolars of *Galerix* from Keseköy can all be recognized. The lower molars have a clear posterior flattening. The p3 differs from the p2 by having a straight posterior side. Two fragments of mandibles carrying p2 and p3 are preserved, so it is certain that the p2 is clearly larger than the p3. The C and dC cannot be separated.

The configuration of the posterior cingulum of the M1 and M2 is as variable in *G.uenayae* as it is in *G.saratji*. In Keseköy however both specimens with a continuous posterior cingulum as well as those with a bipartitioned posterior cingulum are present. This shows once more that, although the configuration of the posterior cingulum can be used to distinguish geologically younger species of *Galerix* from one another, it was part of the intraspecific variation in the Lower Miocene species.

Neurogymnurus Filhol, 1877

Neurogymnurus sp. from Kilçak 3A

Material: 1 M2 (2.79 × 3.60) (Fig. 3)

Description.

M2 (1). The outline of the occlusal surface is irregularly quadrangular. The anterior side is clearly wider than the posterior side. Both the lingual side and the posterior side are curved.

The protocone is a high cusp. Two ridges run from its tip. One ridge runs along the anterior side and ends lingually of the paracone. The second ridge runs backwards. It forks in two ridges which connect to the metaconule and hypocone.

The paracone is equally high as the protocone. The parastylid is small. It lies in front of the paracone. The metacone is somewhat lower than the paracone. The hypocone is cone-shaped. The metaconule is very indistinct.

The anterior cingulum is well developed. It widens near the parastyle. A weak posterior cingulum is present.

Remarks on *Neurogymnurus* sp.

Neurogymnurus is known from the in the locality Inkonak 6 (de Bruijn et al. in press). In Inkonak the species is represented by a P3 and M3 only. The M2 described above probably belongs to the same species. As the elements of In-

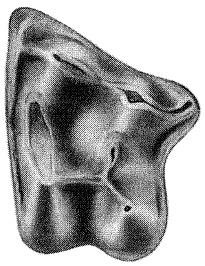

Fig. 3. *Neurogymnurus* sp. M2 sin. (Ki 3A, 2001)

konak 6 it is morphologically close to *Neurogymnurus cayluxi* but clearly smaller than this species.

The presence of *Neurogymnurus* in Kilçak and Inkonak, and the absence of the genus in the Harami localities, indicates that the latter are probably somewhat older than Kilçak. The relative age of the localities is confirmed by the rodents of the various localities (de Bruijn, pers. comm.). Harami 1 and 3 are therefore tentatively placed in MN 2.

PHYLOGENY OF THE LOWER MIOCENE SPECIES OF *GALERIX*

G.aurelianensis from Stubersheim 3 (MN 3) is the oldest species of *Galerix* described in literature (Ziegler, 1990). *G.saratji* from Kilçak and Harami (MN 1–2) is distinctly older. Moreover, *Galerix* was already present in Anatolia in the Oligo-/Miocene locality Inkonak M.R. 6 (de Bruijn et al. in press).

If we assume that *G.uenayae* descended from *G.saratji*, this lineage is characterized by an increase in size and a reduction of the metaconid and paraconid of the p4. The size of the p4 relative to the lower molars is much larger in *G.uenayae* than in *G.saratji*. There is a gradual reduction of the protocone-metaconule connection in the M1 and M2.

G.saratji also makes a good structural ancestor for *G.aurelianensis*. The species are morphologically very close. The only evolutionary development in this lineage is an increase in size of about 30%.

Reduction of the metaconid of the p4 is apparent in both *G.uenayae* and *G.symeonidisi* from the type locality Aliveri. In contrast, *G.symeonidisi*-assemblages from S.Germany have a well-developed metaconid on the p4. *G.uenayae* and *G.symeonidisi* also share the reduction of the protocone-metaconule connection on the M1 and M2. It is, however, unlikely that *G.uenayae* is a direct ancestor of *G.symeonidisi*, because the p4 of the Anatolian species is very large relative to the lower molars. The same applies for the P4 relative to the upper molars. This character is not found in *G.symeonidisi* or any other species of *Galerix*. Furthermore, *G.uenayae* is overall clearly larger than *G.symeonidisi*. Considering the characters shared by the two species, it seems plausible that *G.symeonidisi* is a branch of the *G.saratji-G.uenayae*-lineage.

The evolutionary model proposed here (fig. 4) agrees very well with Zieglers assumption (1990) that *Galerix* entered Western Europe in two migration waves. In our model both migrating species come from Anatolia. Unfortunately, our material does not allow an estimate of the timing of these migrations. It is clear that *G.aurelianensis* reached S. Germany in MN 3, while *G.symeonidisi* entered the record in the upper part of MN 4.

The evolutionary development of *Galerix* in Anatolia before MN 1 and after MN 3 remains unclear. The oldest findings of *Schizogalerix* are from Anatolia (MN 6). The reduction in the p4 and the different p2/p3-ratio, however, make *G.uenayae* not a likely ancestor to *Schizogalerix*. The latter genus possibly evolved from an unknown stock of the echinosoricinae to which also *G.socialis* and *G.depereti* may belong.

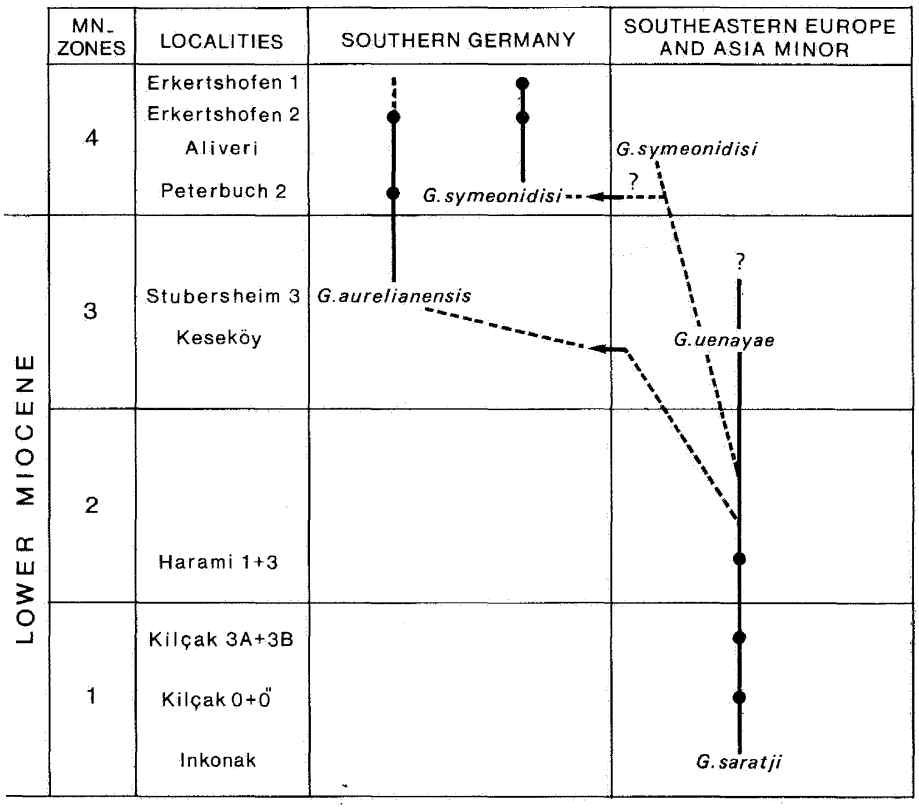

Fig. 4. Proposed phylogeny of the Early Miocene species of *Galerix*

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The photographs were taken by Wil den Hartog and retouched by Jaap Luteijn who also made the illustrations. Ton van Hinten made figure 1. Dr David Mayhew suggested some linguistic improvements.

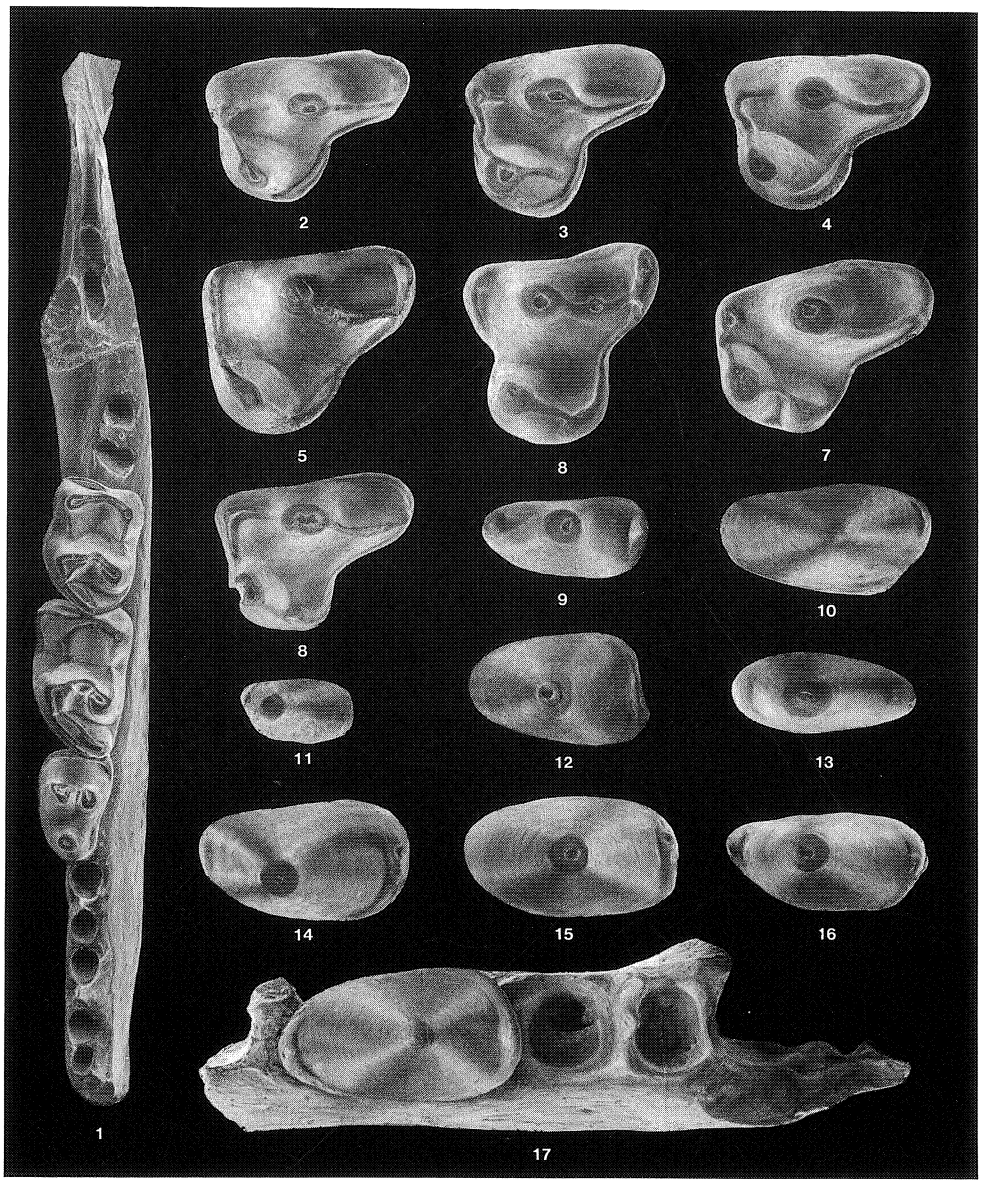

Plate I. *G.saratji* 1. Left mandible with p4-m2 (× 7,5)(Ha 3, 556, Holctype); 2. P3 (Ha 3, 616); 3. P3 (Ha 3, 615); 4. P3 (Ha 3, 617) 5. P3 (Ha 1, 3339); 6. P3 (Ha 1, 3336) 7. P3 (Ha 1, 3344) 8. P3 (Ki 3A, 2071); 9. P/p (Ha 1, 3045); 10. P/p (Ha 1, 3036); 11. p1 (Ha 3, 3107); 12. P/p (Ha 3, 521); 13. C (dC) (Ha 1, 3251); 14. P/p (Ha 3, 522); 15. P/p (Ha 3, 523): 16. P/p (Ha 1, 3037): 17. P1 (Ha 1, 3031).

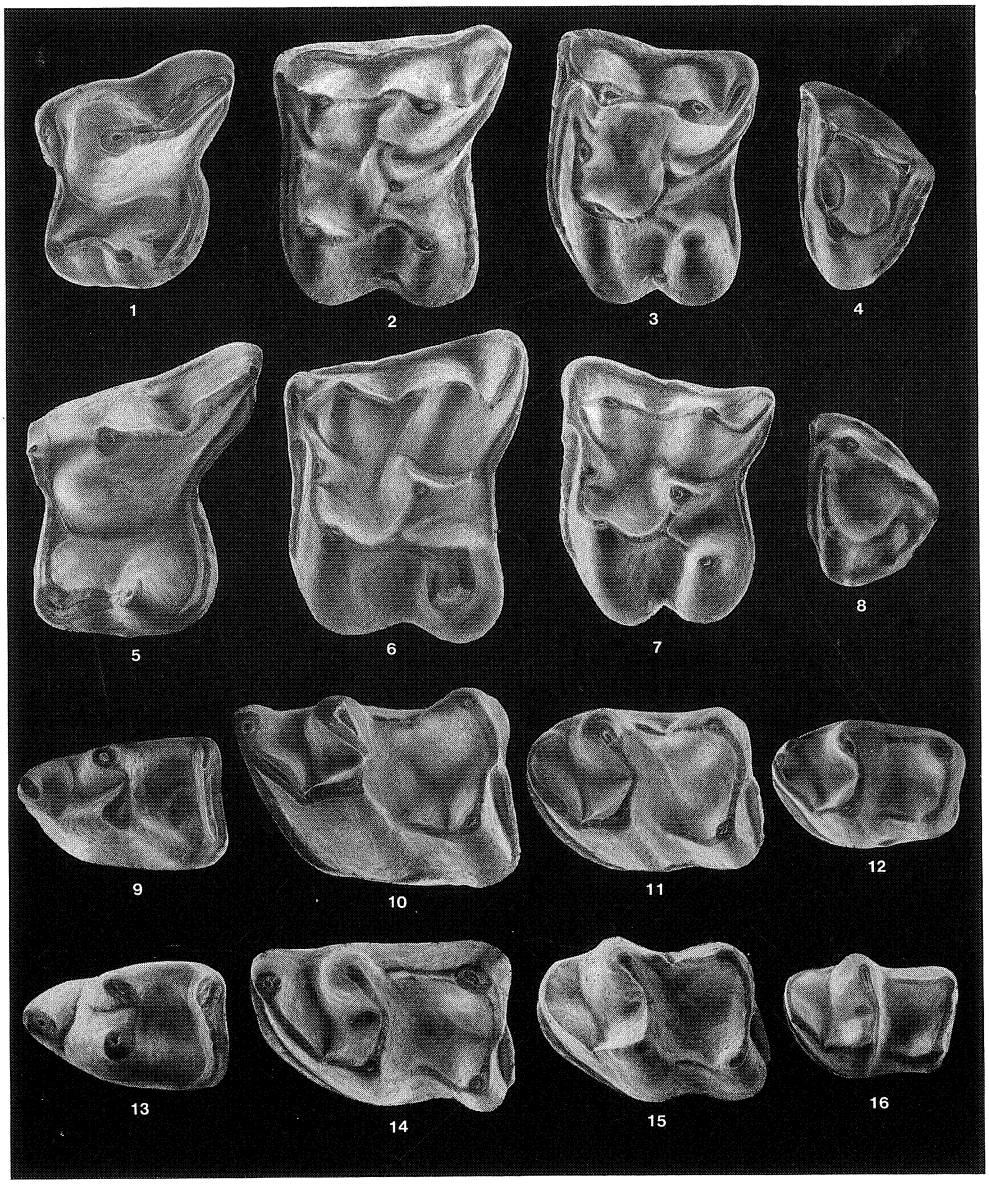

Plate II. *G.saratji* 1. P4 (Ha 1, 3351) 2. M1 (Ha 1, 3363); 3. M2 (Ha 1, 3391); 4. M3 (Ha 1, 3414); 5. P4 (Ha 3, 621); 6. M1 (Ha 3, 625); 7. M2 (Ha 3, 631); 8. M3 (Ha 3, 640); 9. p4 (Ha 1, 3136); 10. m1 (Ha 1, 3157); 11. m2 (Ha 1, 3178); 12. m3 (Ha 1, 3201); 13. p4 (Ha 3, 552): 14. m1 (Ha 3, 562) 15. m2 (Ha 3, 571); 16. m3 (Ha 3, 581).

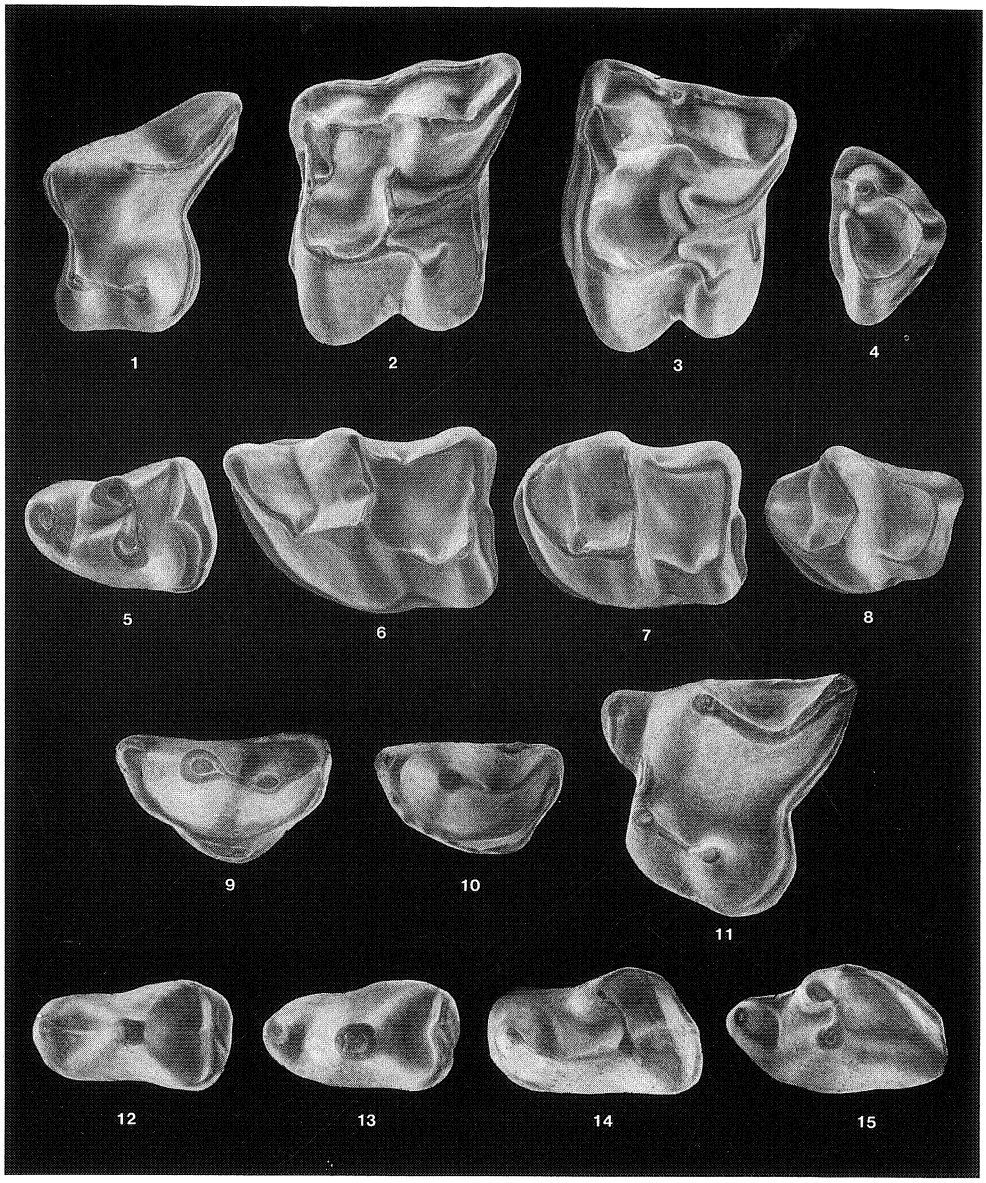

Plate III. *G.saratji* 1. P4 (Ki 3B, 2039); 2. M1 (Ki 3B,43); 3. M2 (Ki 3B, 2043); 4. M3 (Ki 3B, 2056); 5.p4 (Ki 3B, 2008); 6. m1 (Ki 3B, 2012); 7. m2 (Ki 3B, 2017); 8. m3 (Ki 3B, 2023); 9. D3 (Ha 1, 3322); 10. D3 (Ha 3, 605); 11. D4 (Ha 3, 621); 12. d3 (Ha 1, 3102); 13. d3 (Ha 3, 532): 14. d4 (Ha 1, 3114): 15. d4 (Ha 3, 621).

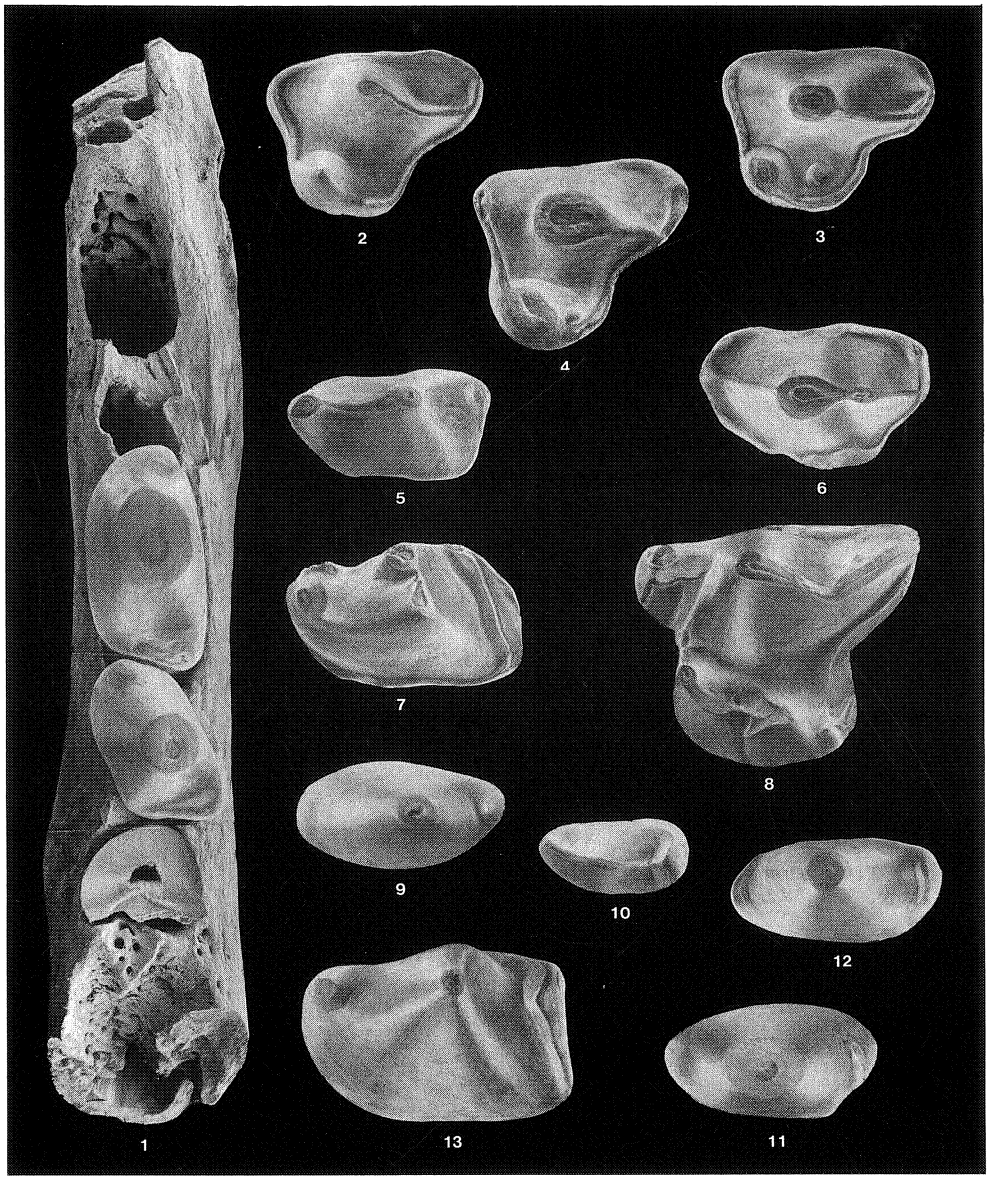

Plate IV. *G.uenayae* 1. Mandible with p2,p3 (Ke, 6038); 2. P3 (Ke, 6251); 3. P3 (Ke, 6259); 4. P3 (Ke, 6260); 5. d3 (Ke, 6063); 6. d4 (Ke, 6078); 7. D3 (Ke, 6213); 8. D4 (Ke, 6241); 9. C (dC) (Ke, 6181); 10. p1 (Ke, 6022); 11. P2 (Ke, 6205); 12. P1 (Ke, 6191); 13. p4 (Ke, 696).

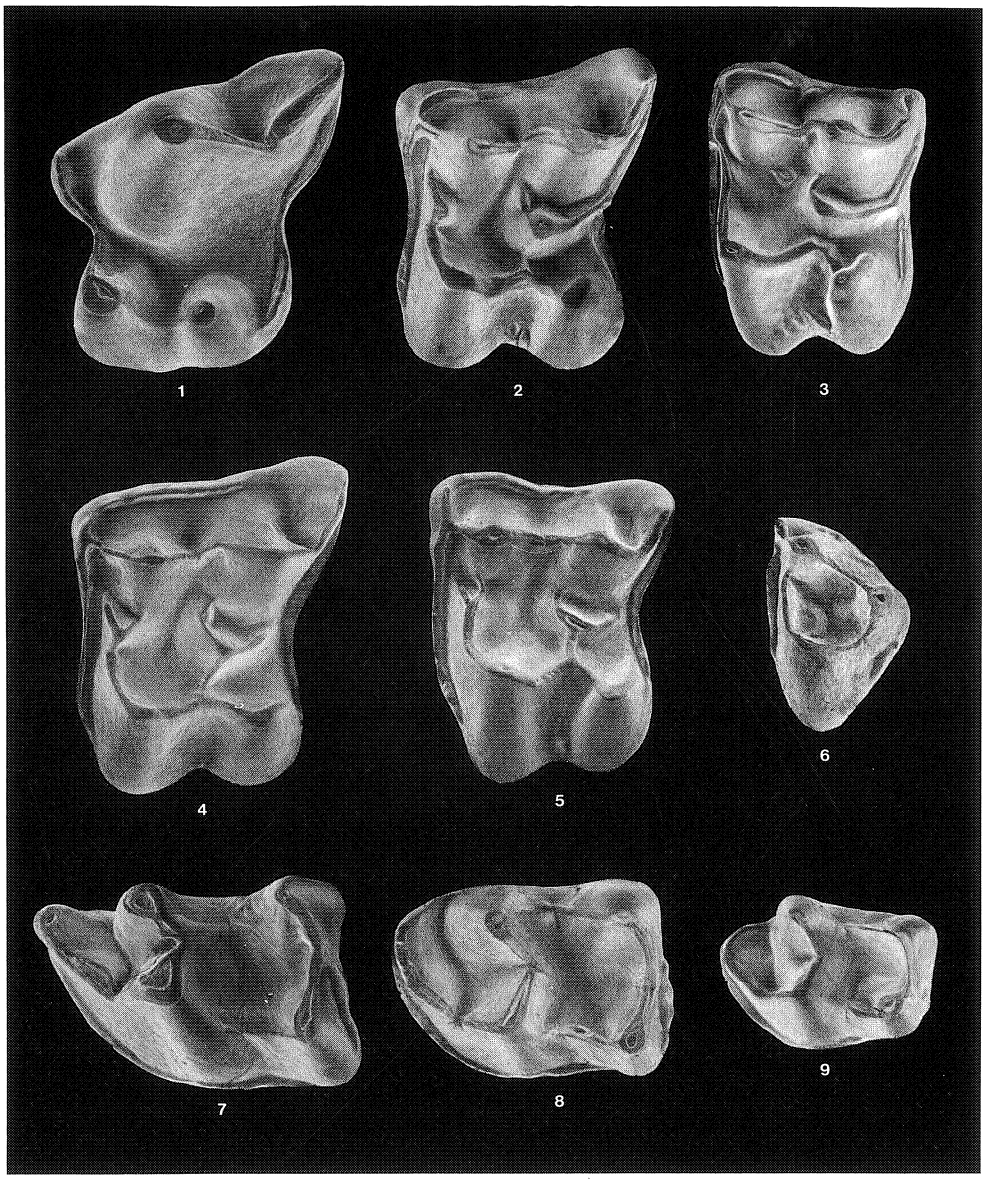

Plate V. *G.uenayae* 1. P4 (Ke, 6280); 2. M1 (Ke, 6328); 3. M2 (Ke, 6345); 4. M1 (Ke, 6314); 5. M2 (Ke, 6326)(Holotype); 6. M3 (Ke, 6373); 7. m1 (Ke, 6116); 8. m2 (Ke, 6136); 9. m3 (Ke, 6161).

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