

Insectivore faunas from the Lower Miocene of Anatolia — Part 7: The Kargi assemblages

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The insectivores of three assemblages from the Kargi K.Y.B. lignite mine are described. These assemblages are considered to be of Early Miocene age, intermediate between those from Inkonak and Kilçak. In Kargi 2 a shrew was found that was not yet known from Lower Miocene deposits in Anatolia. All other insectivores found were encountered in Inkonak and/or Kilçak also. Notable absentees are the talpids *Theratiskos* and *Suleimania*, a small shrew and the dimylid *Turkodimylus*. The two talpids and the shrew are probably Asian immigrants that appeared in Anatolia after the deposition of the Kargi lignite sequence. The absence of *Turkodimylus* is probably a result of the small sampling sizes.

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Introduction

In 1994 a locality for fossil mammals was discovered in the Kargi K.Y.B. lignite mine near the village of Dodurga, about 200 km northeast of Ankara (see van den Hoek Ostende, 2001a, fig. 1), by Engin Ünay of the Mineral Research and Exploration Institute of Turkey. The deposits of the mine were formed in the narrow Osmancik/Dudurga intramontane basin. The basin contains many lignite mines. The deposits of most of these mines have suffered immense tectonic disturbance due to the vicinity of the North Anatolian fault. The Kargi K.Y.B. mine is of interest because the local diatomites have suffered less disturbance than the nearby sections containing mostly clay.

Three fossiliferous layers in the Kargi K.Y.B. mine have been sampled for mammal fossils. The faunas from these levels are considered indicative of an Early Miocene age. Only four other localities with Late Oligocene to Early Miocene mammals are known in Anatolia. The fauna from Inkonak is dominated by the Muroidea *Meteamys* and *Muhsinia* (de Bruijn et al., 1992; Krijgsman et al., 1996). The other Lower Miocene

mammal localities are considered to be younger than Inkonak. Their assemblages are all characterized by the dominance of the Muroidea *Eumyarion* and *Spanocricetodon*/*Democricetodon*. The oldest of these localities is in the Kilçak lignite mine, which yielded four assemblages. Two assemblages were collected in the Harami mine and one in the mine at Keseköy. All these faunas are rich in insectivores (c. 20 % of $M^1/M_1 + M^2/M_2$) with the exception of Inkonak, which has only about 5 % Insectivora.

This paper is the seventh in a series on Early Miocene insectivore faunas from Anatolia. Earlier papers (van den Hoek Ostende, 1992, 1995a,b, 1997, 2001a,b) focussed on the taxonomy of specific insectivore groups. The insectivores from Kargi were not discussed in these papers, since the material was collected later.

Although the three assemblages found in Kargi have yielded low numbers of insectivores, the faunas are of interest since they are intermediate in age between the ones from Inkonak and Kilçak, to a certain extent filling the gap between the two. The Kargi section was sampled for palaeomagnetism, but unfortunately no sound results were obtained (Krijgsman et al., 1996). Therefore the age estimate of the section is based on biostratigraphy only. The faunas from the lower levels, Kargi 1 and 2, resemble the Inkonak fauna with a dominance of *Metamys* and *Muhsinia* and low numbers of insectivores. The assemblage from the upper level, Kargi 3, shows more affinity with the assemblages from Kilçak. It is surprisingly rich in insectivores (c. 40 %).

Material and methods

The material was obtained by wet-screening. Caustic soda was used in order to remove the coal. All elements were measured using a Reflex measuring microscope. Length and width were taken at right angles. All measurements are in mm. The width given for lower molars is always the width of the talonid. The number of studied specimens of an element is given between brackets in the description. We follow Engesser (1980) for the nomenclature for parts of molars for the Erinaceidae. The anterior arm of the protoconid is called the paralophid. The erinaceid teeth were oriented for measuring in accordance with the standards of de Jong (1988). For the measurements and terminology for parts of molars of the Heterosoricidae and Soricidae we follow Reumer (1984), except for the oblique crest and the entoconid crest which, in analogy with the terminology used for other insectivores, are called the oblique cristid and the entocristid, respectively. The terminology for parts of molars and the method of measuring for the Talpidae was described by van den Hoek Ostende (1989). We follow Hutchison (1974) for the terminology of the parts of the humerus of talpids. The material will be stored in the collections of the Mineral Research and Exploration Institute of Turkey (M.T.A.) in Ankara.

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Systematic part

Erinaceidae Bonaparte, 1838

Galericinae Pomel, 1848

Galerix Pomel, 1848

Galerix saratji van den Hoek Ostende, 1992

Pl. 1, figs. 1-10.

Material — Kargi 1 (*Galerix* cf. *saratji*): 3 M₁ fragm., 1 M₃ fragm., 1 D⁴ fragm., 2 M³; Kargi 2: 1 mandible fragment with P₄, 1 M₁, 2 M₂, 3 M₃, 1 D³, 6 P³, 1 P⁴, 2 M¹, 2 M², 2 M³, various fragments; Kargi 3: 3 D₃, 1 D₄, 1 mandible fragment with P₃ and P₄, 2 P₄, 1 M₁, 1 mandible fragment with M₂ and M₃, 3 M₂, 2 P³, 2 M¹, 2 M², 1 M³, various fragments.

Measurements — The measurements are listed in Table 1.

Description

Lower dentition. The D₃ consists mainly of a large, pyramidal protoconid, with a low conical paraconid in front and a posterior shelf. The paraconid is isolated. One of the D₃ has a very small cuspule on the posterolingual flank of the protoconid, at the position of the metaconid. Such a cuspule has also been found on some D₃ of *Galerix saratji* from Kilçak 0", but not in specimens from other localities. The only D₄ found is damaged, missing a part of the posterior shelf. The milk molar consists mainly of a well-developed trigonid. The paraconid is connected to the protoconid by a sharp ridge. The D₄ has a well-developed labial cingulum.

In Kargi 3 a mandible fragment has been found, carrying the P₃ and P₄ and showing the alveoles of the P₂. The fragment shows a large foramen mentale below the posterior root of the P₃. The P₃ consists mainly of its main cusp. There is a small cuspule at the anterior end of the premolar. A posterior shelf borders the P₃ at the back. The occlusal surface of the P₄ is subrectangular. The P₄ consists of a large trigonid bordered posteriorly by a short shelf. The protoconid is the highest cusp. The metaconid lies against the postero-lingual flank of the protoconid. The paraconid is a low, conical cusp. The posterior shelf is bordered at its back by a low ridge.

The occlusal surface of the M₁ is subrectangular. The length and width of the trigonid and the talonid are the same. There is a strong posterior cingulum, which is not connected to the entoconid. The M₂ differs mainly from the M₁ in the morphology of the paraconid. The paraconid of the M₂ is blade-like and incorporated in the paralophid. As in the M₁, the trigonid and talonid are of similar length and width. The posterior arm of the entoconid connects to both the posterior cingulum and the posterior arm of the hypoconid in one of the two M₂ from Kargi 2 and in three of the four M₂ from Kargi 3. The trigonid of the M₃ resembles that of the M₂, but is smaller and has a shorter paralophid. The talonid of the M₃ is clearly narrower than the trigonid.

Upper dentition. The only D³ found in Kargi is unworn. It is triangular in occlusal view. The labial side is straight. The milk-molar consists mainly of the large paracone. Directly behind the tip of the paracone lies an indistinct metacone. The parastyle is a very small cusplet on the anterior cingulum. The postero-lingual cingulum is well developed.

Table 1. Measurements of *Galerix saratji* van den Hoek Ostende, 1992 from the Kargi localities

tooth	loc.	N	Length		Width	
			range	mean	range	mean
d3	Ka3	3	1.74-1.76	1.75	0.94-1.05	1.00
p3	Ka3	1		1.41		0.80
p4	Ka3	3	1.60-1.96	1.79	1.16-1.23	1.19
	Ka2	1		1.72		1.29
m1	Ka3	1		2.40		1.55
	Ka2	1		2.31		1.75
m2	Ka3	4	1.93-2.05	2.01	1.37-1.58	1.52
	Ka2	2	2.04-2.12	2.08	1.55-1.65	1.60
m3	Ka3	1		1.36		0.86
	Ka2	4	1.41-1.61	1.51	0.86-1.10	0.95
D3	Ka2	1		1.96		1.28
P3	Ka3	2	1.60-1.70	1.65	1.22-1.22	1.22
	Ka2	4	1.66-1.87	1.78	1.25-1.51	1.39
P4	Ka2	1		2.03		2.63
M1	Ka3	1		2.09		2.62
	Ka2	1		2.24		2.76
M2	Ka3	2	1.66-1.74	1.70	2.15-2.26	2.21
	Ka2	1		1.85		2.38
M3	Ka3	1		0.95		1.46
	Ka2	2	1.03-1.03	1.03	1.42-1.49	1.46
	Ka1	2	0.91-1.05	0.98	1.54-1.54	1.54

The occlusal surface of the P³ is hook-shaped, due to the lingual extension which lies antero-lingually of the large paracone. All eight P³ bear only the protocone on the lingual extension. The P⁴ has a very large paracone with a long posterocrista. A wide valley separates the lingual cusps from the paracone. The protocone and hypocone are cone-shaped. They are interconnected by an indistinct ridge.

The M¹ and M² have the same pattern. The main difference between the two elements is the posterior arm of the metacone, which is much longer in the M¹ than in the M². The hypocone of the M¹ is somewhat larger than that of the M². The protocone is the largest cusp. Its posterior arm divides into an arm connecting to the hypocone and one connecting to the crescent-shaped metaconule. These two arms are equally strong in all of the M¹ and M² (including the fragmentary specimens) from the Kargi assemblages. The posterior cingulum is either continuous, reaching from the base of the hypocone to the posterolabial corner of the molar, or bipartitioned. In the latter case the cingulum consists of a labial part, which is a continuation of the posterior arm of the metaconule, and a lingual part, which runs from the hypocone to the flank of the posterior arm of the metaconule. A continuous cingulum is found in one M¹ and one M² from Kargi 2 and in two M¹ and one M² from Kargi 3. A bipartitioned cingulum is found in one M¹ and one M² from Kargi 2 and in one M¹ and one M² from Kargi 3. The M³ has a triangular occlusal outline. The molar bears three cusps which are subequal in height.

Remarks — The material described above falls within the morphological and size variation of *Galerix saratji*. This *Galerix* species was found in the various assemblages from Kilçak and Harami (van den Hoek Ostende, 1992). The galericine from Inkonak was identified as *Galerix* cf. *saratji*, since this assemblage does not contain elements allowing an unambiguous species identification, such as the P_4 or P^3 (de Bruijn et al., 1992). The sparse material from Kargi 1 is classified as *G.* cf. *saratji* for the same reason.

The taxonomically important P_2/P_3 ratio was inferred from the size of the alveoles of the holotype of *G. saratji*, which shows that the P_2 was larger than the P_3 . So far, no mandibles were found with the P_2 and/ or P_3 in place. A mandible fragment from Kargi 3 bears the P_3 and P_4 and shows the alveoles of the P_2 . This fossil confirms that in *Galerix saratji* the P_2 is larger than the P_3 .

Neurogymnurus Filhol, 1877
cf. *Neurogymnurus* sp.
Pl. 2, fig. 1.

Material— Kargi 2: 1 P_4 sin. (2.07 × 1.41).

Description — The outline of the occlusal surface is rectangular. The trigonid is well developed. It consists of a high protoconid with a low, conical paraconid and a well-developed metaconid. The paraconid is connected to the protoconid by a long paralophid. The protoconid-metaconid crest lies in the middle of the premolar. Behind the trigonid lies a large posterior shelf, which is bordered posteriorly by a low ridge. This ridge is highest near its centre. There are no cingulums.

Remarks — This P_4 resembles that of *Galerix saratji*, but its size is larger and it has a larger posterior shelf. The low paraconid identifies the specimen as a Galericine, since Erinaceinae have a high paraconid of the P_4 (Butler, 1948). The presence of a large Galericinae was already noted in Inkonak 6 (de Bruijn et al., 1992) and in Kilçak 3A (van den Hoek Ostende, 1992). In Inkonak this galericine was represented by a P^3 and a M^3 and classified as cf. *Neurogymnurus*. An M^2 of the species from Kilçak 3A was identified as *Neurogymnurus* sp. The P_4 from Kargi 2 probably belongs to the same species. It represents a species that is clearly smaller than *cayluxi*. The elements from Inkonak and Kilçak are morphologically close to the corresponding elements of *N. cayluxi*, but the P_4 is not. It shows a well-developed metaconid, resulting in a trigonid which is comparable to that of the molars. The metaconid of *Neurogymnurus* is absent or poorly developed (Viret, 1947). A well-developed metaconid of the P_4 is rare in erinaceids. It is present in some species of *Galerix* and in *Schizogalerix* as well as in the Oligocene genera *Ictopidium* and *Tupaiodon*. According to Ziegler (1983) a metaconid is also found in the extant genus *Podogymnura*, but according to Butler (1948) 'it is missing in the figured specimen'. The morphology of the P_4 may indicate that the large galericine from Inkonak, Kargi and Kilçak does not belong to *Neurogymnurus*. However, the material is too limited to be certain. Therefore is this species best classified as cf. *Neurogymnurus* sp.

Heterosoricidae Viret & Zapfe, 1951

Dinosorex Engesser, 1972

Dinosorex cf. *anatolicus* van den Hoek Ostende, 1995

Pl. 2, figs. 2-3.

Material and measurements — Kargi 2: 1 M_3 dext. (1.65×0.96); Kargi 3: 1 M^1 dext. (1.85×2.21).

Description — The occlusal surface of the M_3 is subrectangular. The talonid is narrower, but longer, than the trigonid. The protoconid is the highest cusp. The paraconid and metaconid stand closely together, making the trigonid basin very narrow. The entoconid and hypoconid form part of a ridge bordering the talonid basin. This ridge consists of the oblique cristid, the posterior arm of the hypoconid and the well-developed entocristid. The anterior cingulum is wide. It continues along the base of the protoconid as a narrow labial cingulum and ends against the base of the hypoconid. A short and narrow posterior cingulum is present.

The M^1 is subsquare, but somewhat wider than long. The metacone is the largest and highest cusp. The paracone is somewhat smaller and lower than the metacone. The mesostyle is undivided. The protocone is crescent-shaped. The anterior arm ends against the base of the paracone, the posterior arm ends freely near the base of the metacone. The hypocone lies lingually of the tip of the metacone. It is a well-defined, cone-shaped cusp, which is separated from the posterior arm of the protocone by a shallow valley. The hypocone is the starting point of a very strong posterior ridge, which connects to the posterior arm of the metacone in the posterolabial corner of the molar. The trigon valley and the valley between the metacone and the posterior ridge are deep.

Remarks — Two elements of Heterosoricidae have been found, an M_3 from Kargi 2 and an M^1 from Kargi 3. The M^1 has clearly defined lingual cusps, one of the characteristics given by Engesser (1975) to distinguish *Dinosorex* from *Heterosorex*. Unfortunately, neither the M^1 nor the M_3 have any species diagnostic characteristics. *Dinosorex* is represented in the Lower Miocene of Anatolia by one species only, *Dinosorex anatolicus* (van den Hoek Ostende, 1995a). The size of the M_3 falls within the variation found for *D. anatolicus*, the M^1 is slightly smaller. Since the material is so limited, the Kargi finds are best classified as *D. cf. anatolicus*.

Talpidae Fischer von Waldheim, 1817

Talpinae Fischer von Waldheim, 1817

Desmanodon Engesser, 1980

cf. *Desmandon zieglerei* van den Hoek Ostende, 1997

Pl. 2, figs. 7-10.

Material — Kargi 1: M^2 fragment; Kargi 2: 1 M_1 , 1 P^4 , 4 M^2 , 3 M^3 ; Kargi 3: 1 P^4 fragm., 1 M^1 , 1 M^2 , 1 M^3 .

Measurements — The measurements are listed in Table 2.

Description — The trigonid of the M_1 is narrower than the talonid. The trigonid and the talonid are of the same length. The protoconid is high. The paraconid and metaconid stand close together, making the trigonid basin narrow. The hypoconid is

Table 2. Measurements of *Desmanodon* cf. *ziegleri* from the Kargi localities.

tooth	loc.	N	Length		Width	
			range	mean	range	mean
m1	Ka2	1		1.83		1.29
M1	Ka3	1		2.63		1.75
M2	Ka2	3	1.87-1.99	1.92	2.06-2.28	2.18
M3	Ka3	1		1.11		1.77
	Ka2	2	1.16-1.25	1.21	1.78-1.81	1.80

large. The oblique cristid ends against at about two-third of the protoconid-metaconid crest, closer to the metaconid than to the protoconid. The talonid basin is bordered lingually by a well-developed entocristid. The re-entrant valley is wide. It is bordered by a labial cingulum. The posterior cingulum is narrow, the anterior cingulum is damaged.

The only preserved P^4 is damaged; the area around the protocone is broken off. The premolar is subtriangular in occlusal view and consists mainly of the large and very high paracone. The posterocrista is sharp and slightly curved. In front of the tip of the paracone lies the low parastylid on a sharply protruding shelf. The protoconal flange is large. The P^4 was probably of morphotype A (van den Hoek Ostende, 1989). Unfortunately, this cannot be determined with certainty since the protocone is lacking.

The occlusal surface of the M^1 is subtriangular. The protocone is flanked by the protoconule and the hypocone. The latter two cusps are about the same size. The metacone, the largest cusp of the M^1 , is damaged in the only specimen. The mesostyle is divided. In front of the paracone lies a large parastyle. The only cingulum is the well-developed posterior cingulum, which runs from the hypocone along the base of the posterior arm of the metacone to the postero-labial corner of the molar.

The M^2 is slightly asymmetrical due to the position of the protocone, which lies anteriorly of the middle of the molar. In front of the protocone lies the protoconule, which is poorly developed in the specimen from Kargi 3, distinct in the specimens from the other levels. The hypocone, which lies posterolabially of the protocone, is somewhat better developed than the protoconule. The division of the mesostyle is incomplete. Two of the specimens from Kargi 2 have small cingulums anteriorly and posteriorly of the base of the protocone.

The paracone is the largest cusp of the M^3 . Its anterior arm is somewhat longer than the posterior arm. The mesostyle is well divided in one of the specimens from Kargi 2. The division of the mesostyle is incomplete in all the other specimens. The protocone occupies the entire lingual part of the molar. A distinct hypocone is present in all four M^3 . It lies near the base of the metacone. There are no cingulums.

Remarks — The presence of *Desmanodon* in Kargi was already noted earlier (van den Hoek Ostende, 1997). Unfortunately, this species is represented by molars only. For the identification of *Desmanodon*, the humerus is very important, since the dentitions of the Early Miocene representatives of the genus closely resemble those of *Paratalpa* (van den Hoek Ostende, 1989, 1997; Ziegler, 1990a). The material from Kargi

resembles that from Kilçak and Harami in having a distinct protoconule on the M^1 and M^2 . Therefore it has been classified as cf. *D. ziegleri*.

Geotrypus Pomel, 1848
Geotrypus haramiensis van den Hoek Ostende, 2001
Pl. 2, figs. 4-6.

Material and measurements — Kargi 2: 1 M_3 sin. (2.13×1.27), 1 M^2 sin. (2.24×2.92), 2 humeri.

Description — The trigonid of the M_3 is much wider than the talonid. Trigonid and talonid are of about the same length. The protoconid is the highest cusp. The paraconid and metaconid stand close together, making the trigonid basin very narrow. The oblique cristid ends near the base of the metaconid. The hypoconid and entoconid are discernible as elevations in a ridge circling the talonid basin and consisting of the oblique cristid, the posterior arm of the hypoconid and the entocristid. The re-entrant valley is very wide. The anterior cingulum is very wide near the paraconid, but becomes quickly much narrower and ends halfway the anterior arm of the protoconid.

The M^2 is slightly askew due to the anterior position of the protocone. The two lingual cusps are high and pointed. The anterior arm of the paracone bends at its end to form a small parastyle. The mesostyle is undivided, though the two individual cusp-lets are recognizable in the unworn specimen. The protocone is relatively small. Its short anterior arm ends against the base of the paracone, the posterior arm ends near the base of the metacone. There is neither a protoconule nor a hypocone.

One of the two humeri from Kargi 2 is relatively complete. It lacks the area around the caput, including the greater tuberosity, the lesser tuberosity and the pectoral crest. The other humerus lacks most of the proximal part. The humeri are very robust. The teres tubercle is strong. The pectoral process is pronounced. The pectoral ridge is well defined. The supratrochlear fossa and olecranon fossa are large and deep.

Remarks — The M^2 is somewhat narrower and wider than the specimens from Harami 1 and 3. Morphologically it agrees well with the M^2 from the younger localities. The M_3 of *Geotrypus haramiensis* was so far only known by the damaged M_3 of the type mandible.

Soricidae Gray, 1821
Crocidosoricinae Reumer, 1987
Oligosorex Kretzoi, 1959
Oligosorex aff. *reumeri* van den Hoek Ostende, 2001
Pl. 2, figs. 14-16.

Material and measurements — Kargi 1 (cf. *Oligosorex* sp.) 1 M^1 fragm., 1 M^2 fragm.

Kargi 2: 1 P_4 (0.83×0.52); mandible with M_1 , M_2 and M_3 ($M_1 = 1.22 \times 0.80$; $M_2 = 1.15 \times 0.80$; $M_3 = 0.97 \times 0.50$); mandible with alveoles of the anterior dentition and M_1 (1.20×0.79); 1 M_1 (1.19×0.76); 1 M_2 (1.15×0.81); 1 M_3 (1.02×0.44); 1 P^4 ($P = 0.83$; $BL = 1.31$; $LL = ?$; $W = 1.05$); 1 M^1 ($LL = 1.13$; $BL = 1.16$; $AW = 1.19$; $PW = 1.53$; PE -ratio = 0.28).

Kargi 3:1 M¹ (LL = 1.19; BL = 1.29; AW = 1.29; PW = 1.50; PE-ratio = 0.23); 1 M² (LL = 1.19; BL = 1.19; AW = 1.46; PW = 1.49; PE-ratio = 0.21).

Description — A fragment of a mandible from Kargi 2 shows that there are at least five alveoles in front of the M₁. Two of these belong to the two-rooted P₄. There is a foramen mentale under the anterior alveole of the P₄.

The P₄ consists mainly of the paraconid. Two ridges run from the tip of this cusp backwards, giving it the Y-shape typical for Crocidosoricinae. The two arms border a sulcus. Directly behind this sulcus lies a small cusplet. It is incorporated in the posterior ridge bordering the very short talonid. This ridge continues labially and lingually as a well-developed cingulum.

The talonid of the M₁ is only somewhat wider than its trigonid. Talonid and trigonid are of the same length. The paraconid is the highest cusp. The paraconid stands far to the front of the molar, making the trigonid basin relatively wide. The trigonid basin is very deep. The oblique cristid ends labially of the middle of the protoconid-metaconid crest. The hypolophid runs behind the entoconid and is separated from that cusp by a narrow valley. A well-developed entocristid borders the talonid basin lingually. The anterior and posterior cingulum are well developed. The labial cingulum is interrupted at the base of the protoconid in one of the three M₁. It is continuous in another specimen. The third specimen is damaged labially, so that the character cannot be observed.

The M₂ closely resembles the M₁. The trigonid basin is somewhat narrower and the difference in width between trigonid and talonid is smaller. The labial cingulum is continuous in both specimens available. The trigonid of the M₃ resembles that of the M₂, but is clearly smaller. The talonid of the M₃ is clearly narrower than the trigonid. There is a well-developed anterior cingulum, which continues along the labial side of the molar.

The P⁴ from Kargi 2 is slightly damaged, missing the posterior part of the hypoconal flange. The paracone is high and has a sharp posterocrista. The parastyle is low and lies directly in front of the paracone. The parastylar crest is absent. The protocone lies antero-lingually of the tip of the paracone. Its anterior arm connects to the parastyle. Postero-lingually of the protocone there is a small elevation, which might either be the beginning of the posterior ridge or a small hypocone. Due to the damage to the hypoconal flange, this cannot be decided. There is a well-developed cingulum along the lingual flange of the posterocrista of the paracone.

The posterior side of the M¹ is clearly wider than the anterior side. The posterior side is moderately emarginated. The metacone is the highest and largest cusp. Its posterior arm is much longer than the anterior arm. The same holds true for the paracone, though in lesser degree. The mesostyle is undivided. The anterior arm of the protocone ends against the base of the paracone. The posterior arm ends freely between the base of the metacone and the hypocone. The posterior arm of the protocone is connected by an indistinct ridge to the base of the metacone in the specimen from Kargi 3. This ridge is absent in the M¹ from Kargi 2. The hypocone is small but distinct. The hypoconal flange is bordered by a low ridge that continues to the posterolabial corner of the molar over the posterior cingulum. There is a short cingulum against the anterior flank of the protocone.

The occlusal surface of the M² is subsquare. The metacone is the largest cusp. Its

posterior arm is somewhat longer than the anterior arm. The paracone resembles the metacone, but is somewhat smaller. The mesostyle is undivided. The anterior arm of the protocone ends against the base of the paracone. The posterior arm of the protocone ends freely between the base of the metacone and the hypocone. The hypocone is small but distinct. It is the starting point for a low ridge that borders the hypoconal flange. This ridge nearly disappears near the base of the metacone, where the cingulum is very narrow, but continues at the posterior cingulum, which becomes wider towards the posterolabial corner of the molar.

Remarks — The Kargi material agrees well with *Oligosorex* aff. *reumeri* from Kilçak and Harami in size and morphology and is considered to belong to the same species. The jawfragment from Kargi 2 shows that this species had at least five alveoles in front of the M₁.

Soricid I

Pl. 2, figs. 11-12.

Material and measurements — Kargi 3: 1 P₄ (0.96 × 0.62); 1 M₁ (1.35 × 0.85); 2 M¹ (LL = 1.27/1.11; BL = 1.27/-; AW = 1.39/1.32; PW = 1.71/-; PE-ratio = 0.24/-); 1 M³ (0.68 × ?); 1 M² fragm.

Description — The wear surface of the protoconid of the P₄ has the Y shape typical for Crocidosoricinae. The two arms of the P₄ are the same length and border a distinct sulcus. The talonid is very short end is bordered by a high ridge. A small cusplet is incorporated in the posterior ridge, directly behind the tip of the protoconid. The posterior ridge continues lingually and labially as a well-developed cingulum, which ends just before reaching the front of the premolar.

The talonid of the M₁ is wider than the trigonid. The talonid and trigonid are of about the same length. The protoconid is the highest cusp. The paraconid lies at the end of a long paralophid. The metaconid lies close to the protoconid. The trigonid basin is open. The oblique cristid ends against the protoconid-metaconid crest labially of its centre. The hypolophid runs behind the entoconid and is separated from that cusp by a narrow valley. The entocristid is well developed. The anterior and posterior cingulums are well developed. The labial cingulum is narrow. There is a very narrow lingual cingulum between the base of the paraconid and the base of the metaconid.

The outline of the occlusal surface of the M¹ is subsquare, the posterior side being wider than the anterior side. The posterior side is moderately emarginated. The metacone is the largest cusp. The posterior arm of this cusp is much longer than the anterior arm. The posterior arm of the paracone is longer than the anterior arm. The mesostyle is undivided. The anterior arm of the protocone ends against the base of the paracone. The posterior arm of the protocone ends freely between the base of the metacone and the hypocone. The latter is a distinct, cone-shaped cusplet. The hypoconal flange is bordered by an indistinct ridge, which starts at the hypocone and continues over the posterior cingulum to the postero-lingual corner of the molar. There is a short cingulum between the base of the protocone and the hypocone. One of the two specimens has a short cingulum against the anterior flank of the protocone also.

One M² has been found, in which the hypoconal flange is missing. This is unfor-

tunate, since in the Anatolian localities the degree of development of the hypocone is a key character for distinguishing the M^1 and M^2 of Soricid I from those of *Oligosorex*. The M^2 is attributed to Soricid I on the basis of its more elongated outline. The metacone is the largest cusp. The paracone is only slightly smaller. The mesostyle is undivided. The anterior arm of the protocone ends against the anterior flank of the paracone. The posterior arm of the protocone ends freely, lingually off the base of the metacone. There is a very narrow and short cingulum against the anterior flank of the protocone.

The only M^3 found is damaged, lacking the end of the anterior arm of the paracone. The paracone is the largest cusp. Its anterior arm is much longer than the posterior arm. The protocone is low. Its anterior arm continues along the anterior flank of the paracone as the well-developed anterior cingulum. The posterior arm of the protocone end freely in the trigon basin. The metacone is small. Lingually of the metacone and partly incorporated with that cusp lies the small hypocone.

Remarks — No lower molars of Soricid I are known from Kilçak 0'', Kilçak 3A and Harami 3. It is suspected that the lower molars are indistinguishable from those of *Oligosorex* aff. *reumeri*, a somewhat smaller soricid also found in these assemblages (van den Hoek Ostende, 2001b). The M_1 from Kargi 3 is tentatively assigned here to Soricid I on the basis of its size. It is somewhat larger than the lower molars of *Oligosorex* from Kilçak and Harami. The P_4 is also attributed to Soricid I on the basis of its size, which agrees very well with that of the two P_4 of the species found in Kilçak 3A.

Soricid gen. et sp. indet.

Pl. 2, fig. 13.

Material and measurements — Kargi 2: 1 M^2 sin. (LL = 1.44; BL = 1.40; AW = 1.86; PW = 1.83; PE-ratio = 0.19).

Description — The M^2 is rather worn. The occlusal surface is subsquare. The posterior side is moderately emarginated. The anterior arm of the protocone ends against the base of the paracone. The posterior arm ends near the base of the metacone. There is a short transverse connection between the base of the metacone and the posterior arm of the protocone. The hypocone is very small. It forms the beginning of an indistinct ridge that runs along the hypoconal flange and continues along the base of the posterior arm of the metacone as a very narrow posterior cingulum. The paracone and metacone are subequal in size. The division of the mesostyle cannot be ascertained due to wear.

Remarks — One M^2 from Kargi 2 is considerably larger than that of any soricid found in the Lower Miocene of Anatolia. The largest species found thus far is 'Soricid I' from Kilçak 0'', Kilçak 3A, Harami 3 (van den Hoek Ostende, 2001b) and Kargi 3. The M^2 of this species is unknown. It is unlikely that the M^2 from Kargi 2 would belong to Soricid I, because the M^1 of this species is characterized by a well-developed, cone-shaped hypocone, while the hypocone of the M^2 described above is tiny. Furthermore, the molar is too large to belong to Soricid I. Since soricid taxonomy is largely based on characters of the mandible, it is impossible to identify the species or even genus on the basis of a single M^2 .

Table 3. The composition of the Kargi insectivore assemblages.

Kargi 1		Kargi 2		Kargi 3	
<i>Galerix cf. saratji</i>	50 %	<i>cf. Neurogymnurus</i>	5 %	<i>Galerix saratji</i>	56 %
<i>cf. Desmanodon zieglerei</i>	17 %	<i>Galerix saratji</i>	32 %	<i>cf. Desmanodon zieglerei</i>	11 %
<i>Oligosorex aff. reumeri</i>	33 %	<i>cf. Desmanodon zieglerei</i>	23 %	<i>Oligosorex aff. reumeri</i>	11 %
		<i>Geotrypus haramiensis</i>	5 %	Soricid I	22 %
		<i>Dinosorex anatolicus</i>	5 %		
		<i>Oligosorex aff. reumeri</i>	27 %		
		Large soricid	5%		

It is remarkable that this large soricid appears in an assemblage, in which the uropiline mole *Theratiskos* and Soricid I are missing. Possibly this large soricid played the ecological role of middle-sized hunter, and a niche occupied later by the somewhat larger *Theratiskos* and the somewhat smaller Soricid I.

Discussion

Kargi 1 and 2 resemble the Inkonak fauna in their relatively low abundances of insectivores (less than 10 %). On the other hand, insectivores make up about 40 % in the Kargi 3 assemblage, a percentage even higher than in the Kilçak and Harami assemblages. This rise in the abundance of insectivores coincides with the change of *Metamys* and *Muhsinia* dominated faunas to *Eumyarion* and *Spanocricetodon*/*Democricetodon* dominated faunas. This change in faunal composition and abundance of insectivores is believed to portray an environmental change.

The composition of the various Kargi assemblages is listed in Table 3. All the species found are also known from the Kilçak assemblages, with the exception of the large soricid from Kargi 2. Remarkable absentees in the Kargi assemblages are the talpids *Suleimania* and *Theratiskos*, the dimylid *Turkodimylus* and the small soricid III. Their absence can partly be explained by the small sample sizes. This holds in particular true for the dimylid, which is a rare element in all Lower Miocene Anatolian faunas. The absence of the talpids and the soricid is probably real. These are presumably immigrants that arrived after deposition of the Kargi sequence. Since none of the genera that make their first appearance in Kilçak are known from European faunas, we assume that these immigrants originated from Asia.

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References

For References see Part 8 in this volume.

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Plate 1

Figs. 1-10. *Galerix saratji* van den Hoek Ostende, 1992 from Kargi.

1: Mandible with P₃-P₄ dext.; a: occlusal view; b: labial view (Ka3 7).

2: D₃ sin. (Ka3 1).

3: M₁ sin. (Ka3 11).

4: M₃ sin. (Ka2 10).

5: D³ sin. (Ka2 11).

6: P³ sin. (Ka2 65).

7: P⁴ sin. (Ka2 12).

8: M¹ dext. (Ka2 61).

9: M² sin. (Ka3 31).

10: M³ sin. (Ka2 9).

All figs. × 15.

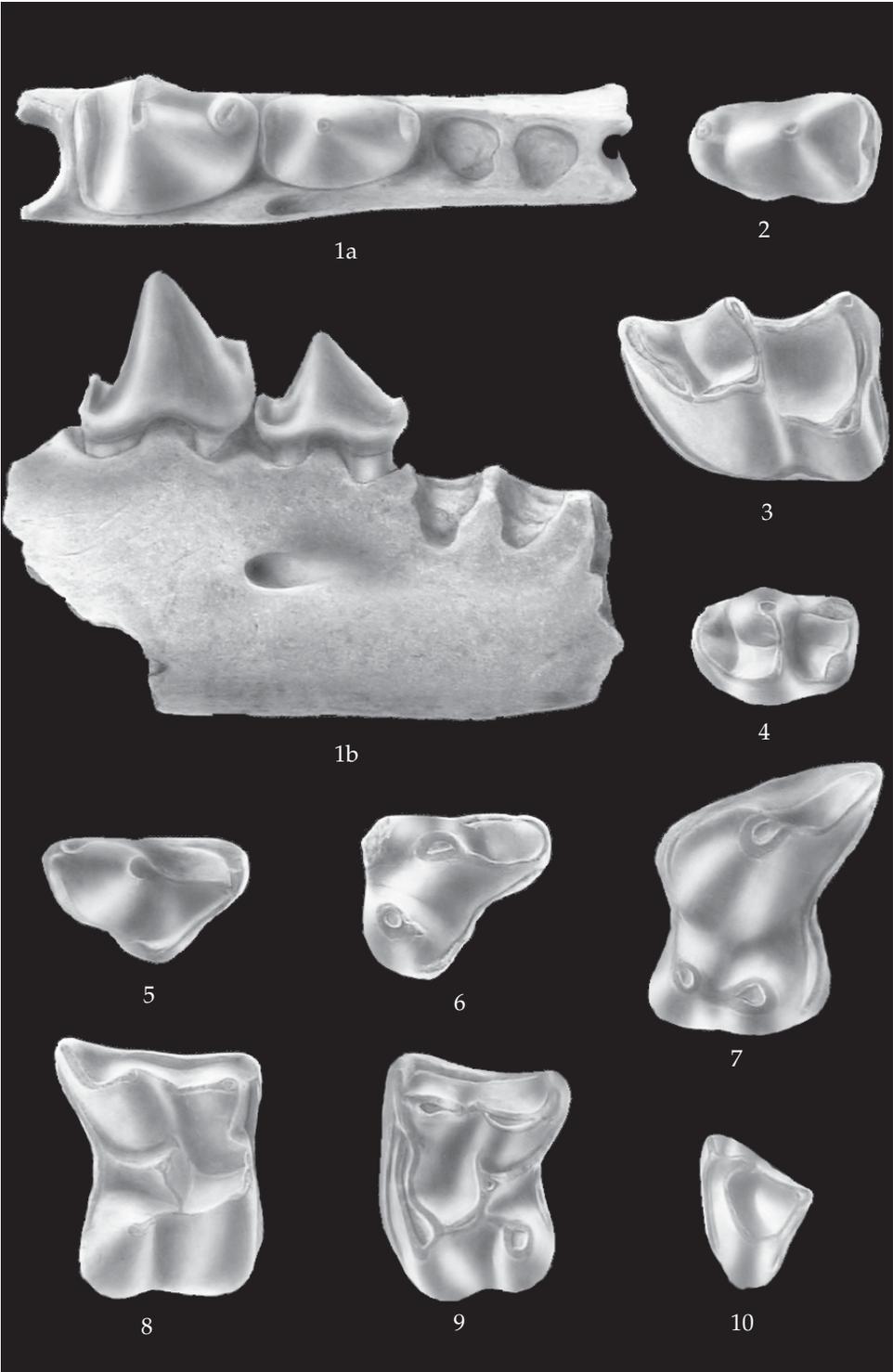


Plate 2

Fig. 1. cf. *Neurogymnurus* sp.
P₄ sin. (Ka2 1).

Figs. 2-3. *Dinosorex anaticus* van den Hoek Ostende, 1995
2: M₃ dext. (Ka2 22).
3: M¹ dext. (Ka3 38).

Figs. 4-6. *Geotrypus haramiensis* van den Hoek Ostende, 2001
4: Humerus anterior view (Ka2 33).
5: M² sin. (Ka2 31).
6: M₃ (Ka2 24).

Figs. 7-10. cf. *Desmanodon zieglerei* van den Hoek Ostende, 1997
7: M₁ dext. (Ka2 21).
8: M¹ sin. (Ka3 43).
9: M² dext. (Ka2 26).
10: M³ (Ka2 28).

Figs. 11-12. Soricid I
11: P₄ sin. (Ka3 47).
12: M₁ dext. (Ka3 49).

Fig. 13. Soricid gen et sp. indet.
M² sin. (Ka2 80).

Figs. 14-16. *Oligosorex* aff. *reumeri* van den Hoek Ostende, 2001
14: Mandible with M₁ - M₃ dext. (Ka2 44).
15: P⁴ sin. (Ka3 53).
16: M¹ dext. (Ka2 77).

All figs. × 15.

