
Insectivore faunas from the Lower Miocene of Anatolia

Part 3: Dimylidae

by Lars W. van den Hoek Ostende

Instituut voor Aardwetenschappen, Postbus 80 021, 3508 TA Utrecht, the Netherlands
Nationaal Natuurhistorisch Museum, Postbus 9517, 2300 RA Leiden, the Netherlands

Communicated by Prof. C.W. Drooger at the meeting of October 31, 1994

SUMMARY

A new genus of Dimylidae (Insectivora, Mammalia) is described from the Lower Miocene of Anatolia. This genus, *Turkodimylus* n.g. contains two species, *Turkodimylus hartogi* n.g. n.sp. from Kilçak 3A and Harami 1 and *Turkodimylus sondaari* n.g. n.sp. from Keseköy. The literature on the Dimylidae is reviewed and a new classification is suggested.

INTRODUCTION

Insectivores are often neglected in descriptions of fossil mammal faunas. Usually they are determined at family or genus level only. As a rule the taxonomy of this group is discussed in monographs on (sub-)families. This certainly holds true for the Dimylidae. Two major revisions of this family were published (Hürzeler, 1944; Müller, 1967), both dealing with the Dimylidae of Central Europe. Ziegler (1990) also discussed the Dimylidae in his work on the Insectivores of the Lower Miocene of S. Germany.

In this paper we discuss the Dimylidae of the Lower Miocene of Anatolia (Turkey). It is the third paper in a series on the Insectivores of the Lower Miocene this area. In these papers we concentrate on the taxonomy and stratigraphic distribution of the various species. Our aim is to come to a paleo-ecological reconstruction. However, since all of the species and some of the genera are new, the taxonomy has to be elaborated before we can arrive at any paleo-ecological conclusion. The first paper of this series dealt with the Erinaceidae (van den Hoek Ostende, 1992), in the second paper the Heterosoricidae were described (van den Hoek Ostende, 1995). The Soricidae and Talpidae will be

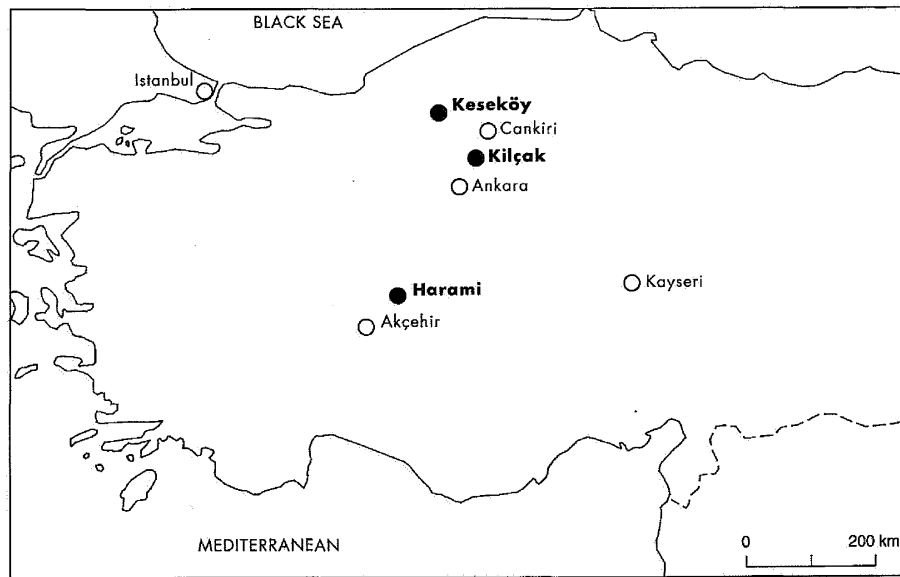


Fig. 1. The various Lower Miocene mammal localities of Anatolia.

treated in forthcoming articles. The material described in these papers was derived from eight Turkish localities: Kilçak 0, Kilçak 0'', Kilçak 3A, Kilçak 3B, Harami 1, Harami 2, Harami 3 and Keseköy (fig. 1). The Kilçak assemblages are allocated to MN 1, the Harami assemblages to MN 2 and the Keseköy assemblage to MN 3 (van den Hoek Ostende, in press). Dimylidae have only been found in Kilçak 3A, Harami 1 and Keseköy.

The rodents of the localities listed above are discussed in the series 'Early Miocene rodent faunas from the eastern Mediterranean area'. This series is also published in the Proceedings of the Royal Netherlands Academy of Science. So far papers on the muroid genera *Eumyarion*, *Mirabella*, *Deperetomys*, *Cricetodon* and *Enginia* (de Bruijn and Saraç, 1991, 1992; de Bruijn et al., 1993; de Bruijn and von Koenigswald, 1994) and on the Gliridae (Ünay, 1994) have appeared.

METHODS AND COLLECTIONS

The material studied was collected by Dr. E. Ünay and Mr. G. Saraç of the Mineral Research and Exploration General Directorate of Turkey (M.T.A.) and by Dr. H. de Bruijn of Utrecht University in 1987–1992. The fossil teeth were obtained by wet-screening.

We follow the terminology proposed by Müller (1964) for the nomenclature of the different cusps of the molars. The same terminology is used for the premolars. Schmidt-Kittler (1973) suggested that in view of the close relationship between talpids and dimylids the posterolingual cusp of the upper molars should be called the metaconule. This suggestion was followed by Ziegler (1990). We agree that this cusp should be indicated in talpids and dimylids by the same term. However, there is no reason to indicate this cusp in Talpidae by a different term than is used in Erinaceidae and Soricidae. We therefore pro-

posed to use the term hypocone for this cusp in all insectivore families (van den Hoek Ostende, 1989).

All elements were measured using a Reflex measuring microscope. Length and width were taken at right angles. The width given for lower molars is, except for the m2 in fig. 2, always the width of the talonid. In fig. 2 the greatest width is used to allow comparison with data from the literature. All measurements are in mm. The magnification for the plates is 12.5. In the descriptions the numbers of available specimens of a specific tooth from a particular locality are given in brackets. The length-ratios between different elements are considered to have taxonomic value. In this paper we use the mean length P4/mean length M1 and mean length m1/mean length m2. We refer to these ratios as the P4/M1 and m1/m2 ratio respectively.

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

This is publication NSG 950104 of the Netherlands Researchschool for Sedimentary Geology.

REVIEW OF THE LITERATURE ON DIMYLIDAE

Von Meyer (1846) described an insectivore from Lower Miocene strata in the Mainz Basin (Germany). This species was unlike anything known at the time. Von Meyer erected a new genus for this species, which he named *Dimylus paradoxus*. In 1859, he described an insectivore from the locality Haslach in southern Germany. Again he created a genus for this new species, *Cordylodon haslachensis*. Both *Dimylus* and *Cordylodon* did not fit in any of the Recent insectivore families. Therefore Schlosser (1887) included these genera in the new family Dimylidae. Unfortunately Schlosser did not see the holotype of *Cordylodon haslachensis* and figured a different species under this name (see below).

The third species of the Dimylidae was described by Gaillard (1897) from La Grive-St.Alban (France). Again a new genus was erected, *Plesiodimylus*. The species was named *P.chantrei*. Seven years later Andreae (1904) described *Cordylodon schlosseri* from Oppeln (Germany). Schlosser (1911) placed this species in a separate genus, *Metacordylodon*. *M.schlosseri* was later also found in Anwil (Switzerland) and in La Grive-St.Alban (France).

Wegner (1913) divided the Dimylidae into two subfamilies (table 1a). *Metacordylodon* and *Cordylodon* were placed in the Cordylodontinae. This subfamily was characterized by specialized premolars and an m1 which was larger than the m2. *Dimylus* and *Plesiodimylus* were placed in the Dimylinae. The premolars of these genera are not specialized and the m1 and m2 are approximately of equal size.

Hürzeler (1944) published a revision of the family. At the time, four species were known, which were assigned to four different genera. To these Hürzeler added three more genera, each containing one species: *Exoëdaenodus schaubi* from the Middle Oligocene of the Quercy (France), *Dimyloides stehlini* from the Lower Miocene of Boudry (Switzerland) and *Pseudocordylodon vireti* from the Lower Miocene of Saulcet (France). Hürzeler used other characters than

Wegner for his subdivision of the family. On the basis of the morphology of the M1 *Plesiodimylus* was placed into a separate subfamily, the Plesiodimylineae. The other genera were all placed in the Dimylineae (table 1b).

Müller (1967) discussed the evolutionary history of the family on the basis of material from fissure-fillings in southern Germany. He described two new species, *Plesiodimylus huerzeleri* and *Cordylodon intercedens*. Müller recognized the same subfamilies as Wegner. According to Müller the Cordylodontinae are characterized by an antero-labial extension of the p4 ("Vorderflappen") and a reduced number of premolars. In addition to *Metacordylodon* and *Cordylodon* he tentatively placed *Pseudocordylodon* in the Cordylodontinae as well. This genus does have a reduced dental formula, but lacks the antero-labial extension of the p4. Müller placed all the other dimyloid genera in the Dimylineae (table 1c).

Engesser (1976) synonymized *P.huerzeleri* with *P.chantrei*. Schötz (1985), however, showed that *P.huerzeleri* and *P.chantrei* are separate species. He described a new species, *P.bavaricus*, from Middle Miocene (MN 5) localities in Germany. However, *P.bavaricus* does not seem to be a well-defined species. It shows no great differences with either *P.huerzeleri* or *P.chantrei*.

In the seventies two more species of Dimylidae were described from the Lower Miocene of Central Europe. These are *Cordylodon sulcatus* from the locality Nordbassin in Frankfurt, Germany (Stephan-Hartl, 1972) and *Pseudocordylodon rigassii* from Messen, Switzerland (Engesser, 1976). The latter species is intermediate between *Dimyloides stehlini* and *Pseudocordylodon vireti* in size and in morphology.

Recently the lost holotype of *Cordylodon haslachensis* was found and re-described by Ziegler (1990). He showed that the mandible belongs to species differing from all of the Dimylidae described later. As a consequence he concluded that the name *Cordylodon* had been used incorrectly for more than a century. Ziegler proposed the name *Chainodus* for *Cordylodon* sensu Schlosser (*C.sulcatus* and *C.intercedens*). He described two new species of this genus, *C.ulmensis* and *C.eggingensis*.

Ziegler (1990) showed that there are no sound criteria to justify a division of the Dimylidae into subfamilies. A division based on the reduction of the premolars differs from one that is based on the presence of an antero-labial extension on the p4. The morphology of the molars would give still another subdivision.

Most of the papers on Dimylidae deal with the Central European species, but the family has also been found in other regions. Gibert (1975) described *Chainodus intercedens* from the Lower Miocene locality Rubielos de Mora (Spain, MN 4). Doukas (1983) described *Plesiodimylus huerzeleri* from the Lower Miocene greek locality Aliveri (MN 4), an identification he later changed into *P.chantrei* (Doukas, 1986), since he considered *P.huerzeleri* to be a junior synonym of *P.chantrei*. We follow Schötz (1985) in considering *P.huerzeleri* and *P.chantrei* separate species, and refer to the Aliveri species as *P.huerzeleri*. Engesser (1980) described a Middle Miocene species of *Plesiodimylus* from the Anatolian locality Sariçay (MN 7/8), *P.crassidens*.

Table 1. Various classifications of the Dimyilidae.

A) Wegner, 1913	B) Hürzeler, 1944	C) Müller, 1967	D) Classification proposed in this paper
Dimyilidae	Dimyilidae	Dimyilidae	Dimyilidae
Dimylinae	Plesiodimylinae	Dimylinae	Dimylinae
<i>Dimylus</i>	<i>Plesiodimyilus</i>	<i>Dimylus</i>	<i>Dimylus</i>
<i>D. paradoxus</i>	<i>P. chantrei</i>	<i>D. paradoxus</i>	<i>D. paradoxus</i>
<i>Plesiodimyilus</i>		<i>Plesiodimyilus</i>	<i>Plesiodimyilus</i>
<i>P. chantrei</i>	Dimylinae	<i>P. chantrei</i>	<i>P. chantrei</i>
	<i>Dimylus</i>	<i>P. huerzeleri</i>	<i>P. huerzeleri</i>
	<i>D. paradoxus</i>		<i>P. crassidens</i>
	<i>Dimyloides</i>	<i>Dimyloides</i>	<i>Dimyloides</i>
	<i>D. stehlini</i>	<i>D. stehlini</i>	<i>D. stehlini</i>
			<i>D. vireti</i>
	<i>Exoedaenodus</i>	<i>Exoedaenodus</i>	<i>Exoedaenodus</i>
	<i>E. schaubi</i>	<i>E. schaubi</i>	<i>E. schaubi</i>
Cordylodontinae		Cordylodontinae	
<i>Cordylodon</i>	<i>Cordylodon</i>	<i>Cordylodon</i>	<i>Cordylodon</i>
<i>C. haslachensis</i>	<i>C. haslachensis</i>	<i>C. haslachensis</i>	<i>C. haslachensis</i>
<i>Metacordylodon</i>	<i>Metacordylodon</i>	<i>Metacordylodon</i>	<i>Metacordylodon</i>
<i>M. schlosseri</i>	<i>M. schlosseri</i>	<i>M. schlosseri</i>	<i>M. schlosseri</i>
	<i>Pseudocordylodon</i>	<i>Pseudocordylodon</i>	<i>Chainodus</i>
	<i>P. vireti</i>	<i>P. vireti</i>	<i>C. intercedens</i>
			<i>C. sulcatus</i>
			<i>C. eggingsensis</i>
			<i>C. ulmensis</i>
			<i>Turkodymylus n.g.</i>
			<i>T. hartogi n.g. n.sp.</i>
			<i>T. sondaari n.g. n.sp.</i>

CLASSIFICATION OF THE DIMYLIDAE

The Dimylidae have been considered to be related to either the Talpidae (von Meyer, 1846; Gaillard, 1899) or to the Erinaceidae (Schlosser, 1887). According to Müller (1967) the presence of deciduous molars in the family suggests a close relationship with the Erinaceidae. This argument is no longer valid. Engesser (1980) showed that the fossil talpid *Desmanella* also has deciduous molars. The same goes for two out of the four talpid species found in the Lower Miocene of Anatolia (unpublished material). Schmidt-Kittler (1973) argued that the Dimylidae are probably related to the Talpidae on the basis of skull-characteristics of *Dimyloides stehlini* from Ehrenstein 4. A close relationship between Dimylidae and Talpidae is corroborated by the finding of a dimylid-like talpid in Anatolia (unpublished material).

Table 2a. Measurements of the lower elements of *Turkodimylus hartogi* (Ki3A and Ha1) and *T.sondaari* (Ke).

Tooth	Loc	N	Length		Width	
			range	mean	range	mean
d3	Ki3A	1		1.71		1.33
	Ha1	–				
	Ke	–				
d4	Ki3A	–				
	Ha1	–				
	Ke	3	2.28–2.55	2.39	1.63–1.79	1.69
p1	Ki3A	1		1.80		1.36
	Ha1	–				
	Ke	–				
p2	Ki3A	1		1.06		0.88
	Ha1	–				
	Ke	1		1.62		1.37
p3	Ki3A	1		1.25		1.09
	Ha1	–				
	Ke	–				
p4	Ki3A	1		2.18		1.54
	Ha1	1		2.42		1.59
	Ke	–				
m1	Ki3A	4	2.64–3.26	2.82	1.92–2.22	2.01
	Ha1	1		3.39		2.22
	Ke	1		3.16		2.51
m2	Ki3A	2	2.12–2.43	2.28	1.13–1.17	1.15
	Ha1	1		2.13		0.97
	Ke	3	2.15–2.32	2.23	0.93–1.01	0.98

Table 2b. Measurements of the upper elements of *Turkodimylus hartogi* (Ki3A and Ha1) and *T.sondaari* (Ke).

Tooth	Loc	N	Length		Width	
			range	mean	range	mean
D4	Ki3A	–				
	Ha1	–				
	Ke	1		2.57		2.07
P4	Ki3A	1		2.64		2.02
	Ha1	1		2.98		2.34
	Ke	–				
M1	Ki3A	1		3.15		2.20
	Ha1	3	3.16–3.35	3.29	2.21–2.26	2.23
	Ke	3	3.79–4.12	4.00	2.58–2.72	2.64
M2	Ki3A	3	1.34–1.50	1.42	1.99–2.31	2.13
	Ha1	1		1.59		2.29
	Ke	4	1.50–1.69	1.60	2.13–2.27	2.20

The Dimylidae have been subdivided into eight genera. Five of these are monospecific. Except for *Metacordylodon* and *Exoedaenodus*, all genera occur in the Lower Miocene of Central Europe. This classification suggests strongly diverging trends in different lineages of this highly specialized family during the Early Miocene. However, this supposed diversity might also be an artefact due to the extreme ‘splitting’ of the various authors. This seems to be the case for *Dimyloides* and *Pseudocordylodon*. The species of these genera are very close in dental morphology (Engesser, 1976; Ziegler, 1990). They differ in the dental formula: *Pseudocordylodon* shows a reduction in the number of premolars. Because a difference in the number of premolars is used in other groups of insectivores to distinguish between subspecies only (e.g. *Heterosorex neumayrianus* (Dobin-Florin, 1964) and *Paratalpa micheli* (Hugeuney, 1970)), we do not consider this a diagnostic feature on which genera can be distinguished. In view of their similarity in dental morphology, the species of *Pseudocordylodon* and *Dimyloides* should be included in one genus. Since *Dimyloides* has page-priority, we consider *Pseudocordylodon* a junior synonym of *Dimyloides*.

The two species of large dimylids found in Anatolia will be described on the following pages. These two species do not fit into any of the genera described thus far, so a new genus, *Turkodimylus*, has been erected.

The classification used in this paper is represented in table 1d.

SYSTEMATIC PART

Family Dimylidae Schlosser, 1887

Genus *Turkodimylus* n.g.

Derivatio nominis: *Turkodimylus*, 'Dimylid from Turkey', since the genus is only known from Anatolia thus far.

Type species: *Turkodimylus hartogi*

Type locality: Kilçak 3A

Diagnosis: *Turkodimylus* contains medium to large-sized dimylids with moderately inflated cusps. The m1 has a talonid which is clearly wider than the trigonid. The P4 is very long relative to the M1 (P4/M1 circa 0.85); the m1/m2 ratio is high (>1.30). The mesostyles of the M1 and M2 are clearly divided to widely spaced.

Differential diagnosis: The two species of *Turkodimylus* are larger than the ones assigned to *Dimylus* and *Cordylodon*. *Turkodimylus* also differs from these genera in the shape of the m1, which has a very wide talonid in *Turkodimylus*. The P4/M1 and m1/m2 ratios in *Turkodimylus* are larger than in any other dimylid (tab. 3). Moreover, *Turkodimylus* differs from *Exoedaenodus* in lacking the m3. It differs from *Chainodus* and *Metacordylodon* in lacking an antero-labial extension ('Vorderflappen') on the p4. It also differs from *Chainodus* in the development of the parastyle of the M1, which is weak or absent in *Turkodimylus* and very large in *Chainodus*. It differs from *Plesiodimylus* in having a clearly divided mesostyle on the upper molars.

Other species belonging to *Turkodimylus*: *T.sondaari* n.sp.

Stratigraphic and geographic distribution: *Turkodimylus* has been found in the three Lower Miocene localities Kilçak 3A, Harami 1 and Keseköy (MN 1–MN 3) and seems to be restricted to Anatolia.

Turkodimylus hartogi n.g. n.sp. (Pl. I fig. 1–11, Pl. II fig. 1–3)

Derivatio nominis: The species is named after Mr. Wil den Hartog, the expert photographer of the department of stratigraphy and paleontology, Institute of Earth Sciences, Utrecht.

Diagnosis: A medium-sized *Turkodimylus* with relatively poorly inflated cusps. The mesostyles on the M1 and M2 are clearly divided. A parastyle on the M1 is present. The hypocone of the M2 forms a distinct cusp.

Type locality: Kilçak 3A

Type level: Lower Miocene (MN 1)

Other localities with *Turkodimylus hartogi*: Harami 1 (MN 2)

Table 3. The P4/M1 and m1/m2 ratios of the various species of Dimylidae.

		P4/M1	m1/m2
<i>Dimyloides</i>			
<i>D.stehlini</i>	Ehrenstein 4	0.62	1.22
<i>D.rigassii</i>	Messen	0.68	1.30
	Weissenburg	0.58	1.15
<i>D.vireti</i>	Saulcet	0.70	1.19
<i>Cordylodon</i>			
<i>C.haslachensis</i>	Haslach	–	1.18
<i>Metacordylodon</i>			
<i>M.schlosseri</i>	La Grive	0.59	1.00
<i>Dimylus</i>			
<i>D.paradoxus</i>	Ulm-Westtangente	0.59	1.04
	Eggingen	0.56	1.13
	Budenheim	0.64	1.09
<i>Turkodimylus</i>			
<i>T.hartogi</i>	Kilçak 3A	0.83	1.38
<i>T.hartogi</i>	Harami 1	0.91	–
<i>T.sondaari</i>	Keseköy	–	1.42
<i>Chainodus</i>			
<i>C.intercedens</i>	Wintershof-West	0.79	1.04
<i>C.sulcatus</i>	Nordbasin	–	1.17
<i>C.ulmensis</i>	Ulm-Westtangente	1.00	1.41
<i>C.eggingensis</i>	Eggingen	–	1.22
<i>Plesiodimylus</i>			
<i>P.chantrei</i>	La Grive	0.57	0.92
<i>P.huerzeleri</i>	Wintershof-West	0.65	0.99
<i>P.crassidens</i>	Sarıçay	–	1.00
<i>Exoedaenodus</i>			
<i>E.schaubi</i>	Gaimersheim	–	1.18

Holotype: Fragment of left mandible with m1 and m2 (Ki3A 2165)

Description of the holotype

The stout mandible is broken off in front of the m1 and directly behind the m2. Two alveoles, which belong to the p4, can be observed in front of the m1. A foramen mentale cannot be seen, which suggest that this foramen is probably situated in front of the p4.

The outline of the occlusal surface of the m1 is irregularly quadrangular. The talonid is much wider than the trigonid. The cusps of the trigonid are relatively sharp. The inflated hypoconid is the largest cusp. The entoconid is somewhat lower than this cusp. The hypoconid and the entoconid are connected by a

sharp edge. The oblique cristid runs in the direction of the protoconid, but ends before reaching it. The cusps of the trigonid are lower than the entoconid. The protoconid is larger than the metaconid and paraconid. The protoconid and the metaconid are separated by a notch. The low paraconid is not connected to the protoconid. The anterior cingulum is strong and continuous with the well-developed labial cingulum. The posterior cingulum is strong. There is a small entostylid.

The m2 has a trigonid which is somewhat wider than the talonid. The protoconid is the highest cusp. It is connected to the paraconid and metaconid by relatively sharp ridges. The paraconid and the metaconid are of the same height. The hypoconid is somewhat lower than the metaconid; the entoconid is lower than the hypoconid. The hypoconid and the entoconid are connected by a relatively sharp ridge. The entocristid is well developed. The oblique cristid connects to the middle of the protoconid–metaconid crest.

The anterior cingulum is strong. A well-developed labial cingulum runs between the protoconid and hypoconid. A short lingual cingulum runs along the base of the paraconid.

Measurements: The measurements are listed in table 2.

Description

d3 (1). The outline of the occlusal surface is sub-rectangular. The tooth is labially longer than lingually. It bears one pyramidal cusp. This cusp is completely surrounded by a strongly developed cingulum.

p1 (1). The outline of the occlusal surface is sub-rectangular. The enamel-dentine boundary slopes labially further down than lingually. The paraconid is the main cusp. Its tip lies in the antero-lingual part of the tooth. The curved posterior side of the paraconid reaches the postero-labial corner of the tooth. Lingually the paraconid only reaches up to the middle of the tooth. A small cusp lies in the postero-lingual corner of the tooth.

p2 (1). The p2 has two roots, which are directed backwards. The front root is very small. The back of the tooth is wider than the front, so the outline of the occlusal surface is sub-triangular. There is one cusp, which has its tip in the front part of the tooth. A wide posterior cingulum is present. This cingulum bears a small cusplet in the postero-lingual corner of the tooth.

p3 (3). The outline of the occlusal surface is subrectangular. The cingulum is strongly developed on all sides of the tooth. Two of the three p3 have a small second cusplet on the antero-lingual flank of the paraconid.

p4 (1). The outline of the occlusal surface is sub-rectangular. The protoconid is the main cusp. The tip lies in the antero-lingual part of the tooth. The posterior side of the cusp is curved. This side is steep at the lingual side where it ends in the middle of the tooth. Labially the protoconid reaches the postero-

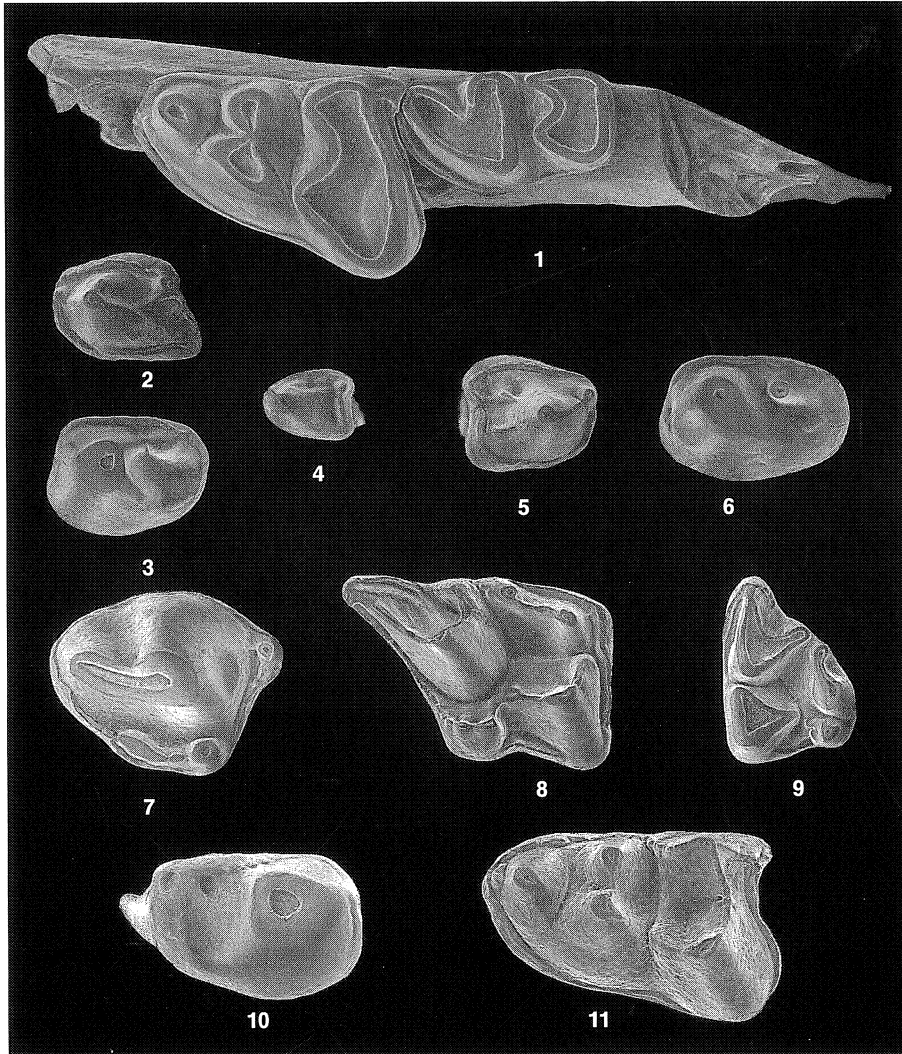


Plate I. *Turkodimylus hartogi* 1. Mandibulum with m1 and m2 (Holotype; Ki 3A, 2165); 2. d3 (Ki 3A, 2157); 3. p1 (Ki 3A, 2169); 4. p2 (Ki 3A, 2151); 5. p3 (Ki 3A, 2153); 6. p4 (Ki 3A, 2171); 7. P4 (Ki 3A, 2173); 8. M1 (Ki 3A, 2175); 9. M2 (Ki 3A, 2179); 10. p4 (Ha 1, 3577); 11. m1 (Ha 1, 3582).

labial corner of the tooth. There is a flattening of the postero-lingual side of the p4. A very low cusplet lies in the middle of the flattening.

m1 (3); m2 (2). The m1 and m2 are described above in the description of the holotype.

P4 (1). The outline of the occlusal surface is almost circular. The paracone is a large bulbous cusp which makes up the larger part of the tooth. The postero-crista runs from its tip backwards. It curves slightly to the labial side of the

tooth. The protocone is a small but distinct cusp which lies lingually of the tip of the paracone. The parastyle, which is as large as the protocone, lies in front of the tip of the paracone. Protocone and parastyle are connected by a well-developed anterior cingulum. The strong lingual cingulum runs from the protocone backwards. The cingulum bears a small ridge. A short antero-labial cingulum is present.

M1 (3). The outline of the occlusal surface is irregularly quadrangular. The protocone is a large, crescent-shaped cusp. Its anterior arm runs parallel to the anterior side of the tooth and ends before reaching the paracone. The posterior arm of the protocone runs parallel to the lingual side of the tooth. It curves and connects to the hypocone, which is small and crescent-shaped. Protocone and paracone are separated by a valley. The paracone is lower than the protocone but higher than the hypocone. A well-developed posterocrista runs from the top of the paracone to the mesostyle, which is clearly divided.

The metacone is the highest cusp. Its tip is pointed. The short anterior arm of the metacone connects to the mesostyle; its posterior arm extends to the postero-labial corner of the tooth.

A well-developed anterior cingulum is present. This cingulum starts at the base of the protocone. It bends along the antero-labial corner of the tooth and continues as a labial cingulum. The blade-like parastyle is incorporated in this cingulum, which ends against the mesostyle. A short, strong lingual cingulum is present between the protocone and the hypocone. A well-developed posterior cingulum extends from the posterior arm of the hypocone to the postero-labial corner of the tooth.

M2 (3). The outline of the occlusal surface is sub-triangular. The posterior side is rounded. The protocone is triangular in occlusal view. It is separated by a valley from both the paracone and the metacone. The paracone is the largest cusp. The anterior arm is longer than the posterior arm. The mesostyle is clearly divided. The metacone has no posterior arm. The curved anterior arm connects to the mesostyle. The hypocone is a distinct cusplet directly lingual of the metacone.

The anterior cingulum runs from the base of the protocone to the antero-labial corner of the tooth. A short but strong lingual cingulum runs from the base of the protocone to the hypocone.

Locality: Harami 1

Description

p4 (1). The outline of the occlusal surface is sub-rectangular. The protoconid is the main cusp. The tip lies in the antero-lingual part of the tooth. The posterior side of the cusp is curved. This side is steepest at the lingual side where it ends in the middle of the tooth. Labially the protoconid reaches further backwards. There is a flattening of the postero-lingual side of the p4.

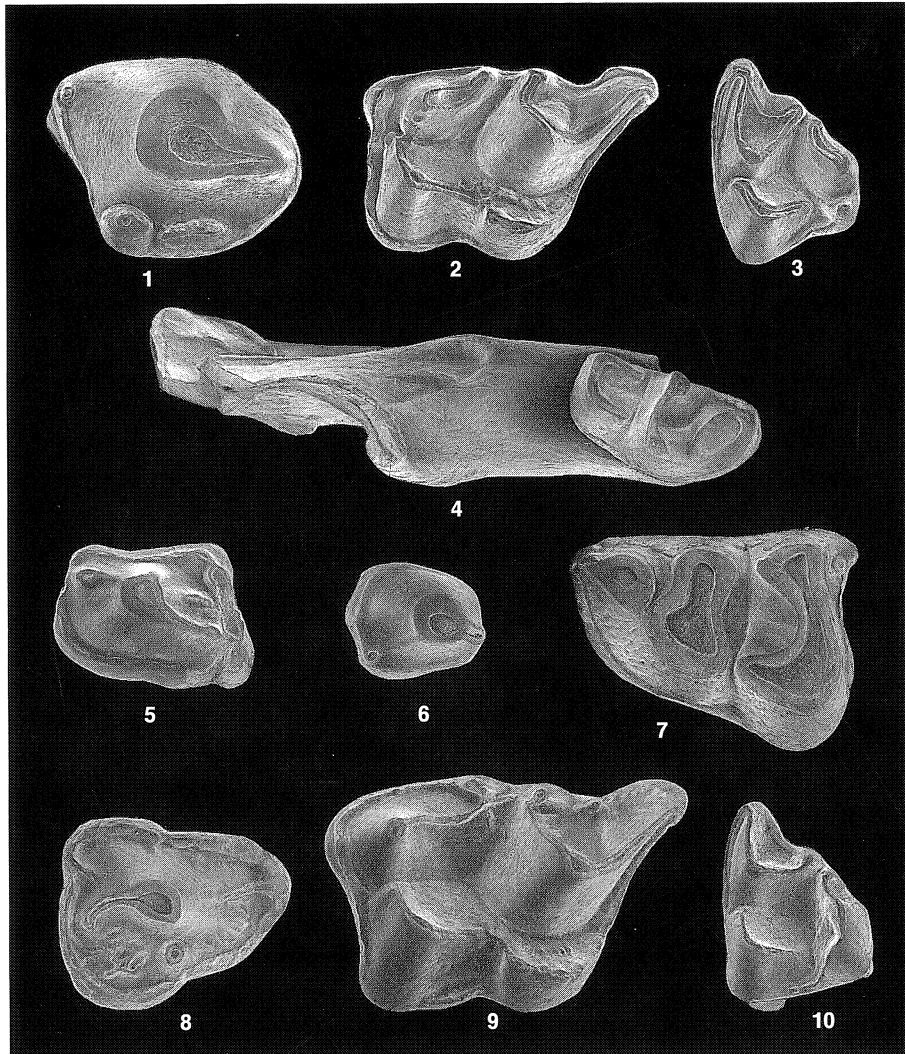


Plate II. *Turkodimylus hartogi* 1. P4 (Ha 1, 3584); 2. M1 (Ha 1, 3595); 3. M2 (Ha 1, 3598). *T. sondaari* 4. m3 (Ke, 6678); 5. d4 (Ke, 6683); 6. p2 or p3 (Ke, 6685); 7. m1 (Ke, 6672); 8. D4 (Ke, 6686); 9. M1 (Holotype; Ke, 6691); 10. M2 (Ke, 6696).

m1 (1). The outline of the occlusal surface is sub-rectangular. The cusps are rather inflated. The talonid is wider than the trigonid. The hypoconid is the largest cusp. The entoconid is lower than the hypoconid; the two cusps are connected by a relatively sharp ridge. The oblique cristid runs in the direction of the protoconid, but ends before reaching this cusp. The cusps of the trigonid are lower than the entoconid. The protoconid is connected to the metaconid by a ridge which has a clear notch halfway the two cusps. The well-developed paraconid is free-standing. There are well-developed cingula on the anterior,

labial and posterior side. The cingulum is only interrupted at the base of the hypoconid. A small entostylid is present.

m2 (1). The trigonid of the m2 is somewhat wider than the talonid. The protoconid is connected to the paraconid and metaconid by sharp ridges. The paraconid, metaconid hypoconid and entoconid are of the same height. The hypoconid and the entoconid are interconnected by a well-defined ridge. The oblique cristid ends just before reaching the middle of the protoconid and metaconid crest. A well-developed entocristid borders the talonid basin. The anterior cingulum is strong. The labial cingulum runs between the protoconid and hypoconid. This cingulum is well developed. A short lingual cingulum runs along the base of the paraconid. A very weak posterior cingulum is present.

P4 (2). The outline of the occlusal surface is sub-rectangular. The paracone is a large bulbous cusp which makes up the largest part of the premolar. The postero-crista runs from its tip backwards. It curves slightly to the labial side of the tooth. The protocone is a small but distinct cusp which lies lingually of the tip of the paracone. The parastyle is a very small cusplet directly in front of the paracone. The only cingulum is the very strong lingual cingulum which runs from the protocone backwards.

M1 (3). The outline of the occlusal surface is irregularly quadrangular. The protocone is a large, crescent-shaped cusp. Its anterior arm runs parallel to the anterior side of the tooth and ends against the base of the paracone. The posterior arm of the protocone runs parallel to the lingual side of the tooth. It bends sharply and connects to the hypocone, which is a low but well-developed cusp. Hypocone and paracone are equally high. The posterior arm of the paracone is short and curved, it connects to the mesostyle. The parastyle is a low cusplet in front of the paracone. The mesostyle is clearly divided to widely spaced. The metacone is the highest cusp. Its tip is pointed. The anterior arm of the metacone connects to the mesostyle. The posterior arm is longer than the anterior arm. It extends to the postero-labial corner of the tooth.

A well-developed anterior cingulum runs from the base of the protocone to the parastyle. A weak labial cingulum runs from the parastyle to the mesostyle. A short, well-developed lingual cingulum is present between the protocone and hypocone. A well-developed posterior cingulum extends from the posterior arm of hypocone to the postero-labial corner of the tooth.

M2 (2). The outline of the occlusal surface is sub-triangular. The protocone is a crescent-shaped cusp. It is separated from both the paracone and metacone by a narrow valley. The paracone is somewhat larger than the protocone. Its anterior arm is somewhat longer than the posterior arm. The mesostyle is clearly divided. The metacone is lower than the paracone and protocone. This cusp has no posterior arm; the curved anterior arm connects to the mesostyle. The hypocone is a well-developed cusplet directly lingual of the metacone.

A weak anterior cingulum runs along the base of the anterior arm of the

paracone. In one of the two specimens a short but strong lingual cingulum runs from the base of the protocone to the hypocone.

Turkodimylus sondaari n.g. n. sp. (Pl. II, figs. 4–10)

Derivatio nominis: This species is named after Dr. Paul Sondaar, in recognition of his work on fossil mammals.

Diagnosis: *T.sondaari* is a large species of *Turkodimylus*. The mesostyle on both the M1 and M2 is clearly divided to widely spaced. The M1 lacks the parastyle. The hypocone of the M2 is almost fused with the metacone.

Differential diagnosis: *Turkodimylus sondaari* has an M1 which is distinctly larger than that of *T.hartogi*. Contrary to the latter species, the M1 lacks the parastyle. The hypocone of the M2 is partly fused with the metacone. The cusps are more inflated than in *T.hartogi*.

Type locality: Keseköy

Type level: Lower Miocene (MN 3)

Holotype: Left M1 (Ke 6691)

Description of the holotype

The outline of the occlusal surface is irregularly quadrangular. The anterior side is curved. The protocone is a large, bulbous cusp. Its anterior arm runs parallel to the anterior side of the tooth and ends before reaching the paracone. The posterior arm of the protocone runs parallel to the lingual side of the tooth. It bends before connecting to the hypocone. The hypocone is a strong, crescent-shaped cusp, which is lower than the protocone. The paracone and the protocone are separated by a narrow valley. There is no parastyle. A curved posterocrista runs from the tip of the paracone to the mesostyle. The mesostyle is clearly divided. The bulbous metacone is the highest cusp. Its anterior arm connects to the posterior part of the mesostyle. The posterior arm of the metacone is longer than the anterior arm and extends to the postero-labial corner of the tooth.

A well-developed cingulum runs from the middle of the anterior side to the mesostyle. A short, well-developed cingulum is present between the protocone and the hypocone. The posterior cingulum extends from the posterior side of the hypocone to the postero-labial corner of the tooth.

Measurements : The measurements are listed in table 2.

Description

d4 (4). The outline of the occlusal surface is sub-rectangular. The tooth is labially longer than lingually. Most of the tooth consists of one large cusp. This cusp is pyramid-shaped. A second cusplet is present in front of the main cusp.

The cusplet is well developed in one of the four elements, but is very weak in the other three. The tooth is surrounded by a well-developed ridge in two of the four specimens. In the other two specimens the ridge is present but weak; they have a low cusp postero-lingually of the main cusp.

p2 or p3 (1). The outline of the occlusal surface is sub-rectangular. The tooth is somewhat longer than wide. There is one large cusp which makes up the larger part of the tooth. A second cusplet is a mere bulge on the anterior side of this cusp.

m1 (1). The only available specimen is worn. The outline of the occlusal surface is sub-rectangular. The talonid is wider than the trigonid. The cusps are all strongly inflated. The paraconid is a free-standing cusp, even though the cusps are so worn that protoconid and metaconid as well as the entoconid and hypoconid are fused. The hypoconid is the largest cusp. A very weak cingulum is present along the base of the protoconid. There is a weak entostylid. The posterior cingulum runs from the entostylid up to halfway the posterior side of the tooth.

m2 (3). The outline of the occlusal surface is sub-rectangular. The trigonid is longer and wider than the talonid. The protoconid is the largest cusp. The metaconid is lower than the protoconid; the paraconid is lower than the metaconid. The ridges connecting the paraconid and metaconid to the protoconid are relatively sharp. The entoconid and hypoconid are small. A low entocristid borders the talonid basin lingually. The low oblique cristid runs straight forward and connects to the base of the protoconid. The anterior cingulum is well developed. A weak antero-lingual cingulum is present. There is a weak labial cingulum between the protoconid and hypoconid.

D4 (1). The outline of the occlusal surface is sub-triangular. The tooth consists mainly of one large cusp which is surrounded by a broad ridge. A weak postero-crista runs from the top of the main cusp backwards. Lingually of the tip of the main cusp a small cusplet is present.

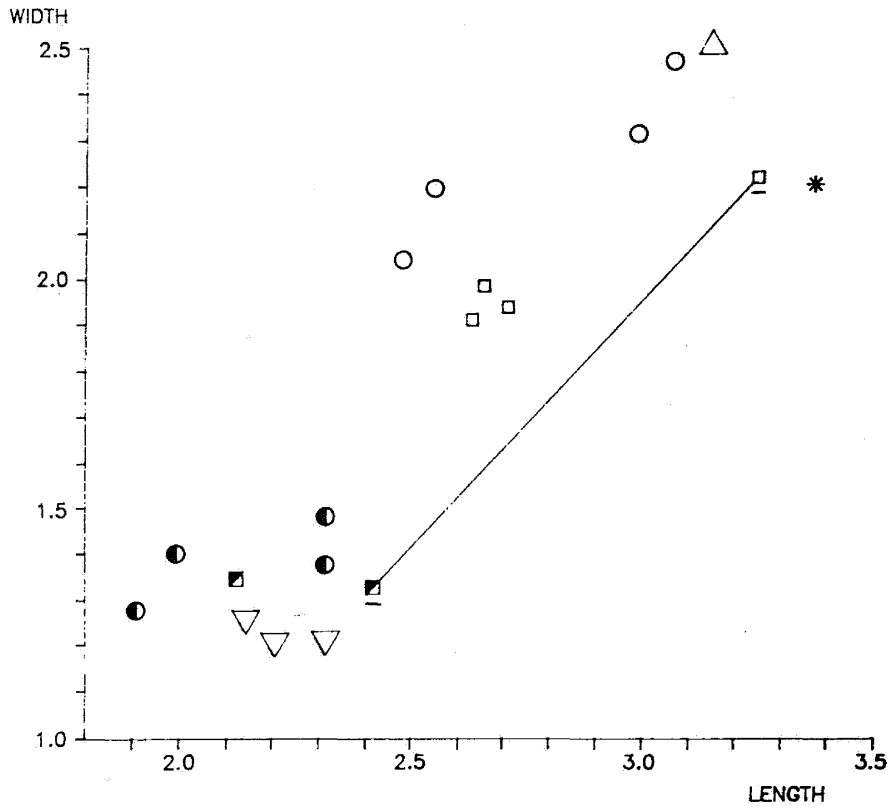
M1 (3). Apart from the holotype two more M1 were found. They do not differ in morphology from the type.

M2 (4). The outline of the occlusal surface is sub-triangular. The posterior side is rounded. The protocone is a triangular cusp. Its anterior arm ends against the base of the paracone. The posterior arm is separated from the metacone by a valley. The paracone is smaller than the protocone. The anterior and posterior arm are equally long. The metacone is a small cusp with a short, curved, anterior arm which connects to the mesostyle. The hypocone is a small cusplet which is fused with the metacone.

The anterior cingulum is well developed. It runs along the anterior arm of the paracone. A short, distinct lingual cingulum runs between the protocone and hypocone.

DISCUSSION

The collections from Kilçak, Harami and Keseköy contain many insectivores. However, only a few Dimylidae were found, which all belong to



- = m1 *Dimyloides rigassii* Messen
- = m2 *Dimyloides rigassii* Messen
- = m1 *Turkodimylus hartogi* Kilçak 3A
- = m2 *Turkodimylus hartogi* Kilçak 3A
- * = m1 *Turkodimylus hartogi* Harami 1
- △ = m1 *Turkodimylus sondaari* Keseköy
- ▽ = m2 *Turkodimylus sondaari* Keseköy

Fig. 2. Scatterdiagram of the length and width of lower molars of *Turkodimylus*. The data for *Dimyloides rigassii* have been added for comparison. The underlined data represent the holotype. Elements in the same jaw are connected.

Turkodimylus. The most remarkable and diagnostic feature of this genus is the very large P4. Unfortunately, the P4 is missing in the Keseköy assemblage, so that the P4/M1 ratio cannot be calculated. However, the dimylid from Keseköy shares the high m1/m2 ratio with *T.hartogi*. This ratio is larger than in any other representative of the family. This seems to be the result of an enlargement of the m1 rather than of the reduction of the m2. Table 3 compares the P4/M1 and m1/m2 ratios of *Turkodimylus* with those of other Dimylidae. In most genera the various species have similar ratios. *Chainodus* is an exception, because the ratios of the various species of this genus differ considerably. Only one species of *Chainodus*, *C.ulmensis*, has P4/M1 and m1/m2 ratios fairly similar to those in *Turkodimylus*.

Turkodimylus is in morphology and in size closest to *Dimyloides*. *Dimyloides*, which is known from the Upper Oligocene and Lower Miocene of Europe, makes a plausible ancestor for *Turkodimylus*. The large variation in size found in *Dimyloides stehlini* (Hürzeler, 1944; Engesser, 1976) is also found in the species of *Turkodimylus*. Hürzeler (1944) suggested that this variation may be due to sexual dimorphism. This seems to be true for the Turkish dimylid. Three of the four m1 of *Turkodimylus hartogi* (visualized in L/W diagram 2, open squares) are of similar size. The fourth specimen is considerably larger. A similar pattern was found by Engesser in *Dimyloides rigassii* from Messen. Two of the m1 of this species (the open circles in diagram 2) have a length of ca. 2.5 mm, the other two of about 3.0 mm. The samples we have are small. Nonetheless they seem to indicate that there are two distinct size categories, which could very well reflect sexual dimorphism.

ACKNOWLEDGEMENTS

I am indebted to the General Directorate of the M.T.A. for allowing me to study the material. Hans Brinkerink helped with the sieving and the sorting of the material in the laboratory. Johan Meulenkamp, Hans de Bruijn and John de Vos critically read the manuscript. Their comments were of great help.

Tallie Uittenbroek typed part of the manuscript. The SEM photographs were taken by Wil den Hartog and retouched by Jaap Luteijn. Mary Boquet suggested some linguistic improvements.

REFERENCES

- Andreae, A. – Dritter Beitrag zur Kenntnis des Miocäns von Oppeln i. Schlesien. Mitt. Roemer-Mus., p. 1–22, Hildesheim (1904).
- Bruijn, H. de and G. Saraç – Early Miocene rodent faunas from the eastern Mediterranean area. Part I. The genus *Eumyarion*. Kon. Ned. Akad. Wetensch., Proc. **94** (1), 1–36, 4 fig., 18 pl., Amsterdam (1991).
- Bruijn, H. de and G. Saraç – Early Miocene rodent faunas from the eastern Mediterranean area. Part II. *Mirabella*. Kon. Ned. Akad. Wetensch., Proc. **95** (1), 25–40, 1 fig., 13 pl., Amsterdam (1992).
- Bruijn, H. de, V. Fahlbusch, G. Saraç and E. Ünay – Early Miocene rodent faunas from the eastern Mediterranean area. Part III. The genera *Deperetomys* and *Cricetodon* with a discussion of the evolutionary history of the Cricetodontini. Kon. Ned. Akad. Wetensch., Proc. **96** (2), 151–216, 2 fig., 19 pl., Amsterdam (1993).

- Bruijn, H. de and W. von Koenigswald – Early Miocene rodent faunas from the eastern Mediterranean area. Part V. The genus *Enginia* (Muroidea) with a discussion of the structure of the incisor enamel. Kon. Ned. Akad. Wetensch., Proc. **97** (4), 381–405, 3 fig., 6 pl., Amsterdam (1994).
- Doben-Florin, U. – Die Spitzmäuse aus dem Alt-Burdigalium von Wintershof-West bei Eichstätt in Bayern. Abh. Bayer. Akad. Wiss., Math.-naturw. Kl., N. F. **117**, p. 1–82, 11 fig., 7 pl., München (1964).
- Doukas, C.S. – Insectivores (Mammalia) from the Lower Miocene of Aliveri, Evia (in Greek). Thesis Athens, 1–87 (1983).
- Doukas, C. – The mammals from the Lower Miocene of Aliveri (Island of Evia, Greece). Part 5. The insectivores. Kon. Nederl. Akad. Wetensch., Proc. **B 89** (1), 15–38, Amsterdam (1986).
- Engesser, B. – Zum Milchgebiss der Dimyliden (Insectivora, Mammalia). *Eclogae geol. Helv.* **69** (3), 795–808, 3 pl., Basel (1976).
- Engesser, B. – Insectivora und Chiroptera (Mammalia) aus dem Neogen der Türkei. Schweiz. Paleontol. Abh. **102**, 37–363, 76 fig., 8 tab., Basel (1980).
- Gaillard, C. – Nouveau genre d’Insectivores du Miocène moyen de La Grive-Saint-Alban (Isère). C.R. hebdom. Séanc. Acad. Sc. **124** (22), p. 1248–1250, Paris (1897).
- Gaillard, C. – Mammifères Miocènes nouveaux ou peu connus de La Grive-Saint-Alban (Isère). Arch. Mus. Hist. Nat. Lyon **7**, 79 p., 32 fig., 3 pl., Lyon (1899).
- Gibert, J. – New insectivores from the Miocene of Spain. I + II. Kon. Ned. Akad. Wetensch., Proc. **B 78** (2), 108–132, 3 pl., Amsterdam (1975).
- Hoek Ostende, L.W. van den – The Talpidae (Insectivora, Mammalia) of Eggingen-Mittelhart (Baden-Württemberg, F.R.G.) with special reference to the *Paratalpa-Desmanodon* lineage. Stuttgarter Beitr. Naturk. B. **152**, p. 1–29, 4 pl., 8. fig., 4 tab., Stuttgart (1989).
- Hoek Ostende, L.W. van den – Insectivore faunas of the Lower Miocene of Anatolia. Part 1. Eriacidae. Kon. Ned. Akad. Wetensch., Proc. **94** (4), 437–467, 4 fig., 5 pl., Amsterdam (1992).
- Hoek Ostende, L.W. van den – Insectivore faunas from the Lower Miocene of Anatolia. Part 2. Heterosoricidae. Kon. Ned. Akad. Wetensch., Proc. **98** (1), 1–18, 2 fig., 3 pl., 2 tab., Amsterdam (1995).
- Hugueney, M. – Les Talpidés (Mammalia, Insectivora) de Coderet-Bransat (Allier) et l’évolution de cette famille au cours de l’Oligocène supérieur et du Miocène inférieur d’Europe. Doc. Lab. geol. Fac. Sci. Lyon, Notes Mém. **50**, 1–81, 43 fig., 10 tab., Lyon (1972).
- Hürzeler, J. – Beiträge zur Kenntnis der Dimylidae. Schweiz. Palaeont. Abh. **65**, 1–44, 45 fig., Basel (1944).
- Meyer, H. von – Mittheilungen an Professor Bronn. N. Jb. Min. Geol. Pal., 462–476, Stuttgart (1846).
- Meyer, H. von – Mittheilungen an Professor Bronn. N. Jb. Min. Geol. Pal., 172–177, Stuttgart (1859).
- Müller, A. – Die Geschichte der Familie Dimylidae (Insectivora, Mammalia) auf Grund der Funde aus der tertiären Spaltenfüllungen Süddeutschlands. Bayer. Akad. Wiss., Math.-Naturw. Kl., Abh. N. Folge. **129**, 1–93, München (1967).
- Schlosser, M. – Die Affen, Lemuren, Chiropteren, Insectivoren, Marsupialier, Creodonten und Carnivoren des Europäischen Tertiärs und deren Beziehungen zu ihren lebenden und fossilen aussereuropäischen Verwandten. I. Theil. Beitr. Paläont. Österr.-Ungarns u. d. Orients, (6, 1+2), 1–244, Taf. 1–14, Wien (1887).
- Schlosser, M. – In: K.A. von Zittel, Grundzüge der Paläontologie prt. II, 2nd ed. 598 p., 749 fig. R. Oldenbourg, München (1911).
- Schmidt-Kittler, N. – *Dimyloides*-Neufunde aus der oberoligozänen Spaltenfüllung ‘Ehrenstein 4’ (Süddeutschland) und die systematische Stellung der Dimyliden (Insectivora, Mammalia). Mitt. Bayer. Staatslg. Paläont. hist. Geol. **13**, p. 125–139, 10 fig., 1 tab., München (1973).
- Schötz, M. – Die Dimyliden (Mammalia, Insectivora) aus dem Kiesgrube Niederaichbach und Maßendorf (Obere Süßwassermolasse Niederbayerns). Mitt. Bayer. Staatslg. Paläont. hist. Geol. **25**, p. 95–130, 20 fig., München (1985).

- Stephan-Hartl, R. – Die altmiozäne Säugetierfauna des Nordbassin und der Nierräder Schleusen­kammer (Frankfurt/M., Hessen) und ihre stratigraphische Stellung. Abh. Hess. Landes­amt Bodenforsch. **64**, 97 p., 16 fig., 11 tab., 24 pl., Wiesbaden (1972).
- Ünay, E. – Early Miocene rodent faunas from the eastern Mediterranean area. Part IV. The Gli­ridae. Kon. Ned. Akad. Wetensch., Proc. **97** (4), 445–490, 7 fig., 6 pl., Amsterdam (1994).
- Wegner, R.N. – Tertiär und umgelagerte Kreide bei Oppeln (Oberschlesien). Palaeontogr. **60**, 175–274, 30 fig., 6 tab., Heidelberg (1913).
- Ziegler, R. – Didelphidae, Erinaceidae, Metacodontidae und Dimylidae (Mammalia) aus dem Oberoligozän und Untermiozän Süddeutschlands. Stuttgarter Beitr. Naturk. Ser. B. **158**, 1–99, 11 pl., 6 fig., 7 tab., Stuttgart (1990).
- Ziegler, R. and V. Fahlbusch – Kleinsäuger-Faunen aus der basalen Oberen Süßwasser-Molasse Niederbayerns. Abh. Bayer. Staatsslg. Paläont. hist. Geol. **14**, 3–80, 31 fig., 17 tab., 10 pl., München (1986).