Insectivores (Lipotyphla) and bats (Chiroptera) from the Late Miocene of Austria

by Reinhard ZIEGLER[1]

(With 30 text-figures and 27 tables)

Abstract

The insectivores and bats from eight samples from eight Late Miocene localities in Austria – Bullendorf, Stixneusiedl, Götzendorf, Richardhof-Golfplatz, Richardhof-Wald, Neusiedl am See, Schernham and Eichkogel – are presented. The already published insectivore fauna from Kohfidisch is considered and included in the comparisons. The faunas span the time from the Vallesian to the Early Turolian (MN 9 to MN 11). Most insectivore faunas are dominated by the erinaceid *Lantanotherium sanmigueli*, the dimylid *Plesiodimylus* aff. *chantrei,* by a desman closely related to *Archaeodesmana vinea* and by the soricid *Crusafontina* aff. *endemica*. In the Richardhof-Wald and some Richardhof-Golfplatz samples, *Desmanella* aff. *rietscheli* is the most common talpid. Five new insectivore species are described: *Plesiosorex evolutus* n. sp., *Storchia biradicata* n. sp., *Proscapanus austriacus* n. sp., *Proscapanus minor* n. sp. and *Urotrichus giganteus* n. sp. All bat faunas are dominated by or exclusively represented by vespertilionids. As the bat samples consist solely of isolated teeth and their fragments, the determinations are somewhat vague. In spite of small sample sizes the diversity in some samples is high. The insectivore samples permit a Vallesian correlation for Schernham, Richardhof-Wald, Richardhof-Golfplatz and Götzendorf, and a Turolian correlation for Kohfidisch and Eichkogel. All ecologically significant species clearly indicate humid conditions and a forested environment.

Keywords: Erinaceidae, Plesiosoricidae, Talpidae, Dimylidae, Soricidae, Megadermatidae, Rhinolophidae, Vespertilionidae, new species, faunal comparison, Late Miocene, Austria.

Zusammenfassung

Insectivoren (Lipotyphla) und Fledermäuse (Chiroptera) aus dem Obermiozän von Österreich.– Die Insectivoren und Fledermäuse von acht obermiozänen Fundstellen aus Österreich werden vorgestellt: Bullendorf, Stixneusiedl, Götzendorf, Richardhof-Golfplatz, Richardhof-Wald, Neusiedl am See, Schernham und Eichkogel. Die bereits mehrfach publizierte Insectivorenfauna von Kohfidisch wird ebenfalls berücksichtig und in die Vergleiche mit einbezogen. Die Faunen reichen stratigraphisch vom Vallesium bis zum frühen Turolium (MN 9 bis MN 11). Die meisten Insectivorenfaunen werden vom Galericinen *Lantanotherium sanmigueli*, dem Dimyliden *Plesiodimylus* aff. *chantrei*, einem *Archaeodesmana vinea* nahestehenden Desman und durch den Soriciden *Crusafontina* aff. *endemica* beherrscht. In Richardhof-Wald und einigen Faunen von Richardhof-Golfplatz ist *Desmanella* aff. *rietscheli* der häufigste Talpide. Fünf neue Insectivorenarten werden beschrieben: *Plesiosorex evolutus* n. sp., *Storchia biradicata* n. sp., *Proscapanus austriacus* n. sp., *Proscapanus minor* n. sp. und *Urotrichus giganteus* n. sp. In den Fledermausfaunen dominieren die Vespertilioniden oder sind sogar die einzigen Vertreter. Da die Fledermausfaunen fast ausschließlich aus isolierten Zähnen und Zahnbruchstücken bestehen sind ihren Bestimmungen etwas vage. Trotz der kleinen

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Probengrößen ist die Diversität in einigen Faunen beachtlich. Die Insectivorenfaunen erlauben für Schernham, Richardhof-Wald, Richardhof-Golfplatz und Götzendorf eine Korrelation mit dem Vallesium, für Eichkogel und Kohfidisch mit dem Turolium. Alle ökologisch aussagekräftigen Arten bezeugen eindeutig humide Verhältnisse und einen bewaldeten Biotop.

Schlüsselwörter: Erinaceidae, Plesiosoricidae, Talpidae, Dimylidae, Soricidae, Megadermatidae, Rhinolophidae, Vespertilionidae, neue Arten, Faunenvergleich, Obermiozän, Österreich.

Introduction

Small mammals in the Miocene of Austria – Current state of knowledge – Vertebrate faunas are generally rare in the Miocene of Austria. Late Miocene faunas with insectivores and bats are extremely rare. So far, only the Kohfidisch fauna has yielded abundant samples of small mammals including insectivores and bats. They have been published in overviews by BACHMAYER & WILSON (1970, 1978, 1980). The excavations in the Kohfidisch caves and fissures started in 1955 and continued in the following years. In the 1960s the vertebrate fauna from Eichkogel near Mödling also yielded insectivores and bats. Some insectivores (erinaceids) from this site have been presented by RABEDER (1973). The rodents from Eichkogel have been published by DAXNER-HÖCK in several papers. For a long time these two sites were the only ones in Austria yielding Late Miocene insectivores and bats.

In 1984 BACHMAYER & WILSON and in 1993 RÖGL et al. reported on some small mammals from Götzendorf, a fauna which is correlated with MN 9. Their reports are based on material from the collection of PETER ULRICH, which is housed in the Natural History Museum Vienna, and on fossils excavated by the Natural History Museum of Vienna from 1988 to 1992.

In the 1990s and early 2000s, G. DAXNER-HÖCK from the Natural History Museum in Vienna initiated a number of projects to shed light on the changes in the Eastern Alpine Miocene ecosystems based on vertebrate faunas. The excavations took place in Obergänserndorf and Teiritzberg (Korneuburg Basin), in Oberdorf in the north-western part of the Styrian Basin, in Mühlbach am Manhartshartsberg and in Grund near Hollabrunn (Molasse Basin, Lower Austria), in Apfelberg (Fohnsdorf Basin, Styria), in Richardhof-Golfplatz, Richardhof-Wald, Stixneusiedl, Neusiedl am See and Götzendorf (Vienna Basin), and in Schernham (Molasse Basin, Upper Austria). The fieldwork was carried out by G. DAXNER-HÖCK, her students, and colleagues from the museum staff. This research was funded by the Austrian Science Fund projects P- 8089-GEO, P-10338-GEO and P-15724-N06. These sites also yielded insectivores and bats. The insectivores and bats from the Korneuburg Basin localities, from Oberdorf, from Mühlbach and from Grund were presented by RABEDER (1998a) and ZIEGLER (1998a, 2003a).

Insectivores in the Late Miocene of Europe – Compared to the wealth of Early and Middle Miocene insectivore faunas, the Late Miocene record is rather scarce. A concise review of the Vallesian and Turolian insectivore faunas underlines the necessity to study insectivores from this time span. I confine myself to more fully published evidence: records known only from faunal lists are omitted.

In Austria the only Late Miocene localities with sufficiently described insectivores are the Kohfidisch cave and fissures and the Eichkogel near Mödling. Both sites yielded Early Turolian faunas. BACHMAYER & WILSON (1970, 1978, 1980) described the small mammals from Kohfidisch, RABEDER (1973) the erinaceids from the Eichkogel. The latter author also described a galericine from the Early Vallesian fauna of Vösendorf. In a contribution on soricids, RABEDER (1998b) described *Dinosorex engesseri* from Götzendorf, which correlates with MN 9.

In Hungary, certain sites have yielded Late Miocene insectivores, which have been published. The most famous site is Rudabánya, whose insectivores are reported by ZIEGLER (2005a). Meszáros (1996,1997, 1998a, b, 1999a, b) described the soricids from Sümeg, Csákvár, Széchenyi Hill, some Polgárdi localities, from Tardosbánya and from Alsótelekes. These sites span the entire Vallesian and Turolian (MN 9 – MN 13).

In Poland the late Early to Middle Miocene and the Pliocene yielded abundant small mammal faunas, mainly published in many contributions by RZEBIK-KOWALKSA (e.g. 1998, see further references therein). Bełchatów A is the only site that yielded some Late Miocene insectivore remains (see KOWALSKI & RZEBIK-KOWALSKA 2002 for a list of all mammalian taxa).

Germany yielded three small mammal faunas, with at least part of the insectivores properly published. These are: Dorn-Dürkheim from the Early Turolian (STORCH 1978), Eppelsheim with its Late Vallesian faunule (FRANZEN et al. 2003) and the Hammerschmiede near Kaufbeuren, which correlates with the Early Vallesian (MAYR & FAHLBUSCH 1975). Additionally, there are some scattered Late Miocene insectivore remains from Großlappen and Aumeister, today northern parts of the city of Munich, published by STROMER (1928, 1940).

The Nebelbergweg near Nunningen in the canton Solothurn yielded the only Late Miocene insectivore fauna in Switzerland. The whole mammal fauna, mainly small mammals, was published by KÄLIN & ENGESSER (2001).

In France the only Late Miocene insectivore fauna published in detail is Montredon, which correlates with MN 10 (CROCHET & GREEN 1982).

The insectivores of the Late Miocene sites in Spain – Can Llobateres, Castel Barbera, Pedregueras 2 A, Carrilanga (all MN 9) and Villadecabals (MN 10) – have been published by CRUSAFONT & VILLALTA (1947), GIBERT (1975) and DE JONG (1988). RÜMKE (1974) described a talpid from the Turolian faunas of Concud and Los Mansuetos (both MN 12).

The Greek faunas from Pikermi (MN 12) and Biodrak (MN 10) yielded some insectivores, which were described by RÜMKE (1976). The vertebrate locality Maramena in Macedonia at the Turolian-Ruscinian boundary yielded some insectivores, painstakingly described and figured by DOUKAS et al. (1995).

Bats in the Late Miocene of Europe – The fossil evidence of Late Miocene bats is even poorer. The above-mentioned Kohfidisch fauna yielded abundant samples of bats. The descriptions of BACHMAYER & WILSON (1978, 1980) are based on only a minor part of the material. The Late Turolian (MN 13) fauna of Lissieu yielded a bat fauna comprising four species (MEIN 1964). TOPÁL (1989) described *Plecotus atavus* from the Late Turolian Polgárdi Loc. 4 fauna. REVILLIOD (1922) reported *Samonycteris majori* from the fauna of Samos (Greece), which is correlated with MN 12. This is the only evidence worth mentioning of Late Miocene bats. In the Vallesian, not a single chiropteran fauna has been described in any detail. In the faunal lists from Can Llobateres, the reference locality of MN 9, chiropterans are listed as gen. et sp. and 1 and 2. In Masia del Barbo, the reference locality of MN 10, no bats are mentioned at all (see DE BRUIJN et al. 1992). The local fauna of Montredon (MN 10) in France yielded only isolated tooth fragments. Though described in detail by SIGÉ (1982), the fragments did not allow more precise determinations beyond one supposed molossid and two vespertilionids. The MN 9-fauna from Nebelbergweg near Nunningen (Switzerland) yielded two isolated teeth, determined as Chiropter indet. sp. I and II by KÄLIN & ENGESSER (2001).

The record improves in the Pliocene, mainly due to some rich faunas in Germany (Gundersheim; HELLER, 1936), Hungary (Osztramos 9, 13; TOPÁL, 1985) and Poland (Podlesice and Węże; see lists in KOWALSKI, 1989).

The poor Late Miocene record justifies a detailed presentation of every fauna containing bats.

Sites – A concise review of the sites is presented in chronological order (see also Fig. 1, tab. 1).

The locality Bullendorf (Middle–LateMiocene transition, MN 7/8–9) is a sandpit north of Vienna in the Northern Vienna Basin.

The fauna from Stixneusiedl is from an artificial outcrop. The locality belongs to the township Bruck an der Leitha, Lower Austria, in the Vienna Basin.

The locality Sandberg near Götzendorf an der Leitha (township of Mannersdorf am Leithagebirge) is situated in Lower Austria in the southern part of the Vienna Basin south-east of Vienna. The fauna is well known for containing the primate *Dryopithecus* (?) *brancoi* SCHLOSSER. A comprehensive contribution of this site including faunal lists was published by RÖGL et al. (1993).

Richardhof-Golfplatz is an artificial outcrop with a sequence of clay-silt near Richardhof (township Guntramsdorf, Lower Austria); it was accessible during construction work for a golf course. The site is situated south of Vienna at the westernmost margin of the Vienna Basin. The stratigraphic correlation of the fauna was established by DAXNER-HÖCK (2004a).

The locality Neusiedl am See in the Vienna Basin is a sandpit called "Alte Lehmgrube", which means "Old Claypit", near the township. The stratigraphy is based on a faunule including some insectivore teeth (DAXNER-HÖCK 2004a, correlation chart).

Richardhof-Wald is an artificial outcrop near Richardhof, discovered by VON WESSELY and DAXNER-HÖCK in 1994. Test samples from the same year resulted in the stratigraphic correlation published by DAXNER-HÖCK (1996).

Upper Miocene Insectivore localities of Austria

1 Schernham
2 Bullendorf
3 Eichkogel
4 Richardhof-Wald
5 Richardhof-Golfplatz
6 Stixneusiedl
7 Götzendorf
8 Kohfidisch
9 Neusiedl a. See

Bohemian Massiv
Alps
Tertiary Basins

Fig. 1. Sketch map of Austria showing the Late Miocene localities.

Schernham is a sand and gravel pit in a fluvial complex of the Molasse Basin in the Hausruck area in Upper Austria. The stratigraphic correlation of the fauna is given in DAXNER-HÖCK (2004b).

The Eichkogel near Mödling, south of Vienna, Lower Austria, is an artificial outcrop with a sequence of clay-silt close to the top of Eichkogel, a hill at the western margin of the Vienna Basin. The site is long known.

Kohfidisch is listed here for the sake of completeness. Several papers on the small mammal fauna have been published (BACHMAYER & WILSON 1970, 1978, 1980). It is a cave and fissure fill site, located in the Pannonian Basin.

Aim – This contribution aims to enlarge our knowledge on Late Miocene insectivores and bats in Austria. As evident from the above review of the scarce Late Miocene record in Europe, this will serve as an important basis of comparison for future studies on insectivores in Europe.

Methods – All measurements are given in mm. In the terminology of the dental elements and in the measurements of the erinaceids, plesiosoricids and soricids, the works of ENGESSER (1980: figs. 8–10), SCHÖTZ (1989: fig. 1) and REUMER (1984: figs. 1, 2) are widely followed. Regarding the talpids, I refer to HUTCHISON (1974: figs. 1–3). In the upper molars, however, the length is not measured parallel to the baseline, but parallel to the buccal margin, and the width perpendicular to it. For the dimylids I orientate myself according to MÜLLER (1967: figs. 2–6). Differing from this author, the i3 is interpreted as canine, the lower canine as p1 and the disto-lingual cusp of the M1 as metaconule, as SCHMIDT-KITTLER (1973) discussed.

The tables list the usual biometric parameters. For small samples the measurements are documented separately. The abbreviations are: n = number of specimens, R = range of measurements, i. e. the minimum and maximum value, m = arithmetic mean ± standard error of the mean (95% probability), s = standard deviation, V = coefficient of variability.

Tab. 1: The Late Miocene sites in Austria with insectivores and bats.

Locality	location	latitude	longitude	Reference
MN 11				
Kohfidisch	Cave and fissure fill site, Pannonian Basin	47°08'52"	16°20'39"	Bachmayer & Wison (1970, 1978, 1980), Daxner-Höck (2004a)
Eichkogel	Artificial outcrop Eichkogel near Mödling, south of Vienna, Vienna Basin	48°03'55"	16°17'32"	Rabeder (1970, 1973), Bachmayer & Wison (1978), Daxner-Höck (1996)
MN 10				
Schernham	Sand and gravel pit west of Haag am Hausruck, Molasse Basin, Upper Austria	48°10'40"	13°36'38"	Daxner-Höck (2004b)
Richardhof-Wald	Artificial outcrop near Richardhof, westernmost margin of the Vienna Basin	48°03'35"	16°16'15"	Daxner-Höck (1996)
Neusiedl am See	Sandpit "Alte Lehm-grube", near Neusiedl a. See, Vienna Basin	47°57'30"	16°52'37"	Daxner-Höck (2004a)
MN 9				
Richardhof-Golfplatz	Artificial outcrop, Vienna Basin	48°03'27"	16°16'13"	Daxner-Höck (2004a)
Götzendorf	Sandpit in Sandberg near Götzendorf an der Leitha, township of Mannerdorf, southern part of the Vienna Basin	48°00'27"	16°34'59"	Bachmayer & wilson (1984), Rabeder (1998b), Rögl et al (1993)
Stixneusiedl	Sandpit near Bruck an der Leitha, Lower Austria, Vienna Basin	48°03'05"	16°40'15"	Daxner-Höck (2004a)
Bullendorf	Sandpit near Mistelbach, Northern Vienna Basin	48°36'17"	16°40'17"	Daxner-Höck (1996, 2004a)

Abbreviations for the measurements of the teeth are: L = length, W = width, a = anterior, Hcor = height of the coronoid, p = posterior, iinf. = lower incisor, Isup. = upper incisor.

When measuring the width of the lower teeth, the entoconid must be exactly vertical in occlusal view. Otherwise the tooth appears distinctly wider.

The abbreviations for the measurements of the talpid humeri are: GL = greatest length, Wp = proximal width, Wpwtt = proximal width without teres tubercle, DS = medio-lateral diameter of the shaft, Wdwe = distal width without epicondyles.

All teeth, jaws and talpid humeri are figured as left ones. The right specimens are figured inversely.

The entire material is stored in the Natural History Museum of Vienna (NHMW).

Systematic palaeontology

Lipotyphla Haeckel, 1866
Erinaceidae Fischer von Waldheim, 1817
Galericinae Pomel, 1848
Schizogalerix Engesser, 1980
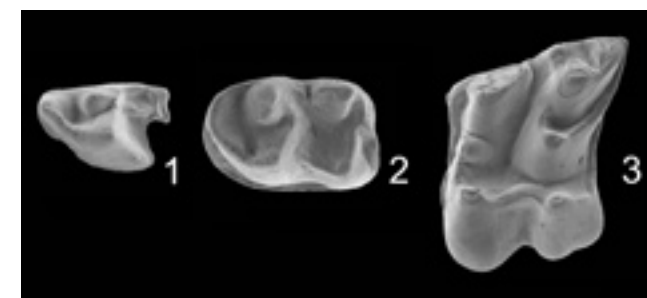Type species: *Schizogalerix anatolica* Engesser, 1980

Fig. 2: *Schizogalerix moedlingensis*, Eichkogel. – Ca. 10x.
1. Left p4, occlusal view, NHMW 2004z0170/0001
2. Right m2, occlusal view, NHMW 2004z0170/0002
3. Right M1, occlusal view, NHMW 2004z0170/0003.

Schizogalerix moedlingensis (Rabeder, 1973)
Fig. 2

1970 *Galerix* cf. *exilis* (Blainv.); Rabeder: 592
1973 *Galerix moedlingensis* n. sp.; Rabeder: 433–441, figs 11–20
1980 *Schizogalerix moedlingensis* (Rabeder); Engesser: 63, figs 3–4

M a t e r i a l (measurements see tab. 2):

Eichkogel	NHMW 2004z0170/0000–0003
1993/0008/0016	right p2/3, 2 left p4, 2 m1, left m3, right P3, right P4, 3 M1, 4 M1/2 fragments, 2 M3 (most teeth are fragments)

1974/1680 (Coll. J. Huimann) left m1 talonid, right m2, left P3 fragment

Tab. 2: *Schizogalerix moedlingensis*, Eichkogel, sample statistics of the teeth

locality	meas.	n	R	m	locality	meas.	n	R	m
Eichkogel	Lp4	1		1,75	Eichkogel	Lm3	1		2,05
	Wp4	2	1,17–1,20	1,19		Wam3	1		1,28
Eichkogel	Wam1	1		1,66		Wpm3	1		1,06
	Wpm1	2	1,92–2,09	2,01	Eichkogel	WP3	1		1,82
Eichkogel	Lm2	1		2,34	Eichkogel	LbM1	1		2,62
	Wam2	1		1,59		LliM1	3		2,09
	Wpm2	1		1,50		WaM1	1		2,90
Eichkogel	Lm3	1		2,05	Eichkogel	LM3	1		1,26
	Wam3	1		1,28		WaM3	1		2,00
	Wpm3	1		1,06					

D e s c r i p t i o n   a n d   c o m p a r i s o n s

Most teeth are only fragments, but some of them show the distinctive characters of *S. moedlingensis*: p4 with a longitudinal ridge in the talonid, m1 and m2 with a postcingulid joining the postcristid near the entoconid, M1 and M2 with long postmetaconule crests extending to the metastyle, conical and widely spaced mesostyles, M3 with a postparacrista terminating in a faint mesostyle.

Rabeder (1973) described *Galerix moedlingensis* based on 20 isolated teeth from the Eichkogel fauna stored at the palaeontological institute of the University of Vienna. The species was referred to *Schizogalerix* Engesser 1980 by the author of the genus. The above-listed additional material was sampled by G. Höck and donated to the NHMW. It

fits well the specimens described by RABEDER. Deviations of measurements are due to small sample size and do not exceed the expected normal variability. The smaller widths of the lower teeth may also be due to different orientation of the teeth. Without doubt, the teeth and tooth fragments represent *S. moedlingensis*.

Lantanotherium FILHOL, 1888

Type species: *Erinaceus sansaniensis* LARTET, 1851

Lantanotherium sanmigueli VILLALTA & CRUSAFONT, 1944
Fig. 3

1993 *Lantanotherium* cf. *sanmigueli* VILLALTA & CRUSAFONT; RABEDER in RÖGL et al.: 511

M a t e r i a l (measurements see tab. 3):

Schernham	NHMW 2004z0171/0001–0011
	5 dentary fragments with teeth, 160 isolated teeth (partly fragments)
Richardhof-Wald	NHMW 2004z0172/0000
Rh 94/1	81 isolated teeth (partly fragments)
Rh 94/3	5 tooth fragments
Rh 94/5A	17 tooth fragments
Richardhof-Golfplatz	NHMW 2004z0173/0000–0002
RH-A/2	2 edentulous dentary fragments, 52 isolated teeth (mostly fragments)
RH-A/7	18 isolated teeth (mostly fragments)
RH-A/11	2 isolated teeth
RH-B	right m1-fragment, right M2
Götzendorf	NHMW 2004z0174/0001–0003
Gö, 1988	left dentary fragment with p4
Gö 1–6	right m1, 5 M1
Gö 1, 1990/15	2 left p4, left m2, left and right m3, right M1 fragment
Gö 1, 1990/16	left edentulous dentary fragment, left and right p4, left m1, right m2, right m3,
	right M2
Gö 2, 1990/22	right dentary fragment with p4, left m1, right m3

D e s c r i p t i o n

D e n t a r y : The vast majority of the material comprises isolated teeth only. There are some dentary fragments with teeth from Schernham, two edentulous ones from Richardhof-Golfplatz-A/2, and one dentary fragment with p4 from Götzendorf. The mental foramen is situated under the posterior root of p3 in all four specimens in which this part is preserved. In the Schernham sample there is one dentary fragment with only three alveoles between the canine and the p4: two small ones for the double-rooted p3 and a large one for a single-rooted p2. This large alveole is broken out buccally. The lingual side bears a tiny bony projection, perhaps a remnant of the septum separating a large p2 alveole and a distinctly smaller one for p1. The RH-A/2 fragment shows two alveoles of similar size between the anterior alveole of p3 and the canine alveole. The Götzendorf specimen has five alveoles anterior to p4: two for the double-rooted p3, one for the vertically implanted p2, a small one for an obliquely implanted p1 and a large one for the canine. The incisor alveoles are broken off in all dentaries. One premolar is
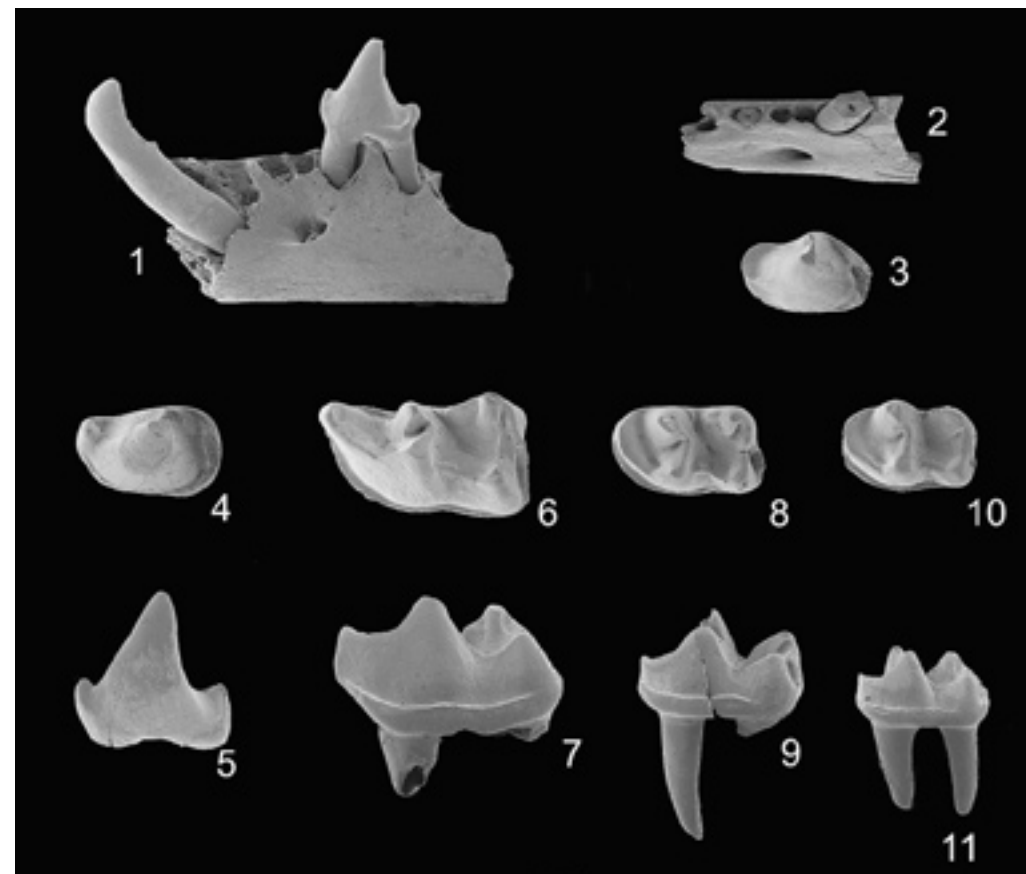
Fig. 3a: *Lantanotherium sanmigueli*
1. Left dentary fragment with c and p4, buccal view, Schernham, NHMW 2004z0171/0001. – Ca. 7,5x.
2. Right dentary fragment with anterior root of p4 and alveoles of p1-p3, occluso-buccal view, Richardhof-Golfplatz, NHMW 2004z0173/0001. – Ca. 7,5x.
3. Left d4, occlusal view, Schernham, NHMW 2004z0171/0002. – Ca. 10x.
4. Left p4, occlusal view, Schernham, NHMW 2004z0171/0003. – Ca. 10x.
5. Left p4, buccal view, Richardhof-Golfplatz, NHMW 2004z0173/0002. – Ca. 10x.
6. Left m1, occlusal view, Schernham, NHMW 2004z0171/0004. – Ca. 10x.
7. Right m1, buccal view, Götzendorf, NHMW 2004z0174/0001. – Ca. 10x.
8. Left m2, occlusal view, Schernham, NHMW 2004z0171/0005. – Ca. 10x.
9. Left m2, buccal view, Götzendorf, NHMW 2004z0174/0002. – Ca. 10x.
10. Left m3, occlusal view, Schernham, NHMW 2004z0171/0006. – Ca. 10x.
11. Left m3, buccal view, Götzendorf, NHMW 2004z0174/0003. – Ca. 10x.

clearly eliminated in the Schernham dentary.

T e e t h : In the canine the apex in bent disto-lingually. The crown base is marked by a faint posterior cuspule. There is no clear demarcation between crown and the strong root.

Tab. 3: *Lantanotherium sanmigueli*, sample statistics of the teeth

locality	meas.	n	R	m	s	V
Schernham	Lp4	10	1.75–2.00	1.87±0.07	0.095	5.10
	Wp4	13	1.14–1.31	1.25±0.03	0.049	3.96
Rh-94/1	Lp4	7	1.73–1.89	1.79±0.05	0.054	3.00
	Wp4	8	1.19–1.41	1.27±0.06	0.068	5.34
RH-A/2	Lp4	2	1.89–2.05	1.97		
	Wp4	4	1.13–1.30	1.24		
RH-A/7	Lp4	1		2.06		
	Wp4	1		1.26		
Götzendorf	Lp4	3	1.91–2.00	1.94		
	Wp4	5	1.16–1.33	1.24±0.12	0.083	6.67
Schernham	Lm1	13	2.49–2.80	2.60±0.07	0.105	4.05
	Wam1	15	1.30–1.50	1.40±0.04	0.064	4.58
	Wpm1	13	1.42–1.63	1.51±0.04	0.067	4.42
Rh-94/1	Wam1	10	1.33–1.52	1.45±0.05	0.061	4.20
	Wpm1	5	1.46–1.66	1.57±0.10	0.073	4.62
Rh-94/3	Wpm1	1		1.64		
Rh-94/5A	Wpm1	2	1.54–1.69	1.67		
RH-A/2	Wam1	1		1.58		
	Wpm1	2	1.62–1.72	1.67		
RH-A/7	Lm1	1		2.70		
	Wam1	2	1.36–1.43	1.40		
	Wpm1	3	1.50–1.57	1.53		
Götzendorf	Lm1	2	2.68–2.71	2.70		
	Wam1	3	1.36–1.44	1.40		
	Wpm1	3	1.45–1.64	1.52		
Schernham	Lm2	20	2.00–2.25	2.13±0.04	0.073	3.43
	Wam2	21	1.19–1.53	1.42±0.04	0.083	5.85
	Wpm2	19	1.21–1.50	1.41±0.04	0.072	5.13
Rh-94/1	Lm2	1		2.22		
	Wam2	13	1.32–1.55	1.46±0.05	0.073	4.99
	Wpm2	2	1.42–1.49	1.46		
Rh-94/3	Wam2	1		1.41		
Rh-94/5A	Wam2	2	1.43–1.50	1.47		
	Wpm2	2	1.46–1.49	1.48		
RH-A/2	Lm2	1		2.30		
	Wam2	4	1.37–1.47	1.42		
	Wpm2	2	1.41–1.42	1.42		
RH-A/7	Lm2	1		2.13		
	Wam2	3	1.29–1.45	1.38		
	Wpm2	2	1.38–1.48	1.43		
Götzendorf	Lm2	2	2.19–2.24	2.22		
	Wam2	2	1.57–1.59	1.58		
	Wpm2	2	1.50–1.61	1.56		
Schernham	Lm3	12	1.64–1.80	1.72±0.03	0.055	3.22
	Wam3	11	1.08–1.22	1.13±0.03	0.048	4.24
	Wpm3	11	0.96–1.09	1.03±0.03	0.043	4.14
Rh-94/1	Lm3	1		1.77		
	Wam3	8	1.14–1.31	1.21±0.06	0.064	5.29
	Wpm3	1		1.14		
Rh-94/5A	Wam3	2	1.18–1.30	1.24		
RH-A/2	Wam3	4	1.19–1.31	1.25		
	Wpm3	1		1.10		
RH-A/2	LP1/2	2	1.17–1.19	1.18		
	WP1/2	2	0.67–0.68	0.68		
Schernham	LP3	2	1.18–1.37	1.28		
	WP3	2	0.89–0.98	0.94		
Rh-94/1	LP3	6	1.12–1.35	1.22±0.12	0.105	8.55
	WP3	5	0.75–0.91	0.82±0.09	0.066	8.09
Rh-94/5A	LP3	1		1.29		
	WP3	1		0.89		
RH-A/2	LP3	2	1.36–1.40	1.38		
	WP3	1		0.88		
Schernham	LP4	7	2.26–2.44	2.33±0.06	0.057	2.46
	WP4	6	1.98–2.19	2.08±0.09	0.079	3.79
Rh-94/1	LP4	1		2.05		
RH-A/2	WP4	1		2.12		
	LP4	1		2.44		
Schernham	LbM1	19	1.96–2.32	2.13±0.05	0.102	4.79
	LliM1	25	1.84–2.21	1.97±0.03	0.080	4.08
	WaM1	14	2.02–2.35	2.20±0.06	0.105	4.76
	WpM1	31	2.27–2.57	2.42±0.05	0.084	3.47
Rh-94/1	LbM1	3	2.16–2.27	2.22		
	LliM1	5	2.00–2.31	2.13±0.17	0.125	5.85
	WaM1	4	2.27–2.43	2.32		
	WpM1	3	2.41–2.56	2.49		
Rh-94/3	WpM1	1		2.47		
Rh-94/5A	LbM1	1		2.37		
	LliM1	1		2.07		
	WaM1	2	2.24–2.37	2.31		
	WpM1	2	2.42–2.62	2.52		
RH-A/2	LbM1	4	2.13–2.35	2.26		
	LliM1	4	2.00–2.10	2.05		
	WaM1	4	2.23–2.50	2.35		
	WpM1	5	2.43–2.56	2.50		
RH-A/7	LbM1	2	2.12–2.21	2.17		
	LliM1	3	2.01–2.07	2.05		
	WaM1	2	2.22–2.33	2.28		
	WpM1	2	2.31–2.33	2.32		
Götzendorf	LbM1	2	2.33–2.36	2.35		
	LliM1	5	2.02–2.08	2.05±0.03	0.024	1.16
	WaM1	3	2.35–2.43	2.39		
	WpM1	3	2.54–2.62	2.58		
Schernham	LbM2	25	1.61–1.96	1.75±0.04	0.085	4.85
	LliM2	32	1.59–1.87	1.74±0.03	0.073	4.16
	WaM2	22	1.92–2.26	2.09±0.04	0.089	4.25
	WpM2	21	1.81–2.13	1.98±0.04	0.096	4.82
Rh-94/1	LbM2	7	1.72–1.98	1.87±0.10	0.101	5.42
	LliM2	6	1.76–2.02	1.89±0.11	0.100	5.30
	WaM2	6	2.13–2.45	2.26±0.15	0.130	5.77
	WpM2	7	2.00–2.38	2.15±0.12	0.120	5.59
Rh-94/3	WpM2	1		2.06		
Rh-94/5A	LbM2	2	1.78–1.83	1.81		
	LliM2	1		1.74		
	WaM2	2	1.88–1.94	1.91		
	WpM2	3	1.94–2.08	2.02		
RH-A/2	LbM2	2	2.27–2.31	2.29		
	LliM2	2	2.04–2.06	2.05		
	WaM2	2	1.98–1.99	1.99		
	WpM2	2	2.28–2.33	2.31		
RH-A/7	LbM2	2	2.20–2.22	2.21		
	LliM2	1		2.07		
	WaM2	1		1.90		
	WpM2	1		2.30		
RH-A/11	LbM2	1		1.86		
	LliM2	1		1.80		
	WaM2	1		2.38		
Schernham	LbM3	17	1.32–1.50	1.41±0.03	0.055	3.90
	WaM3	16	1.36–1.63	1.49±0.04	0.077	5.21
Rh-94/1	LM3	3	1.51–1.66	1.58		
	WaM3	3	1.50–1.70	1.62		
RH-A/2	LM3	4	1.47–1.53	1.50		
	WaM3	4	1.54–1.62	1.57		
RH-A/7	LM3	2	1.42–1.57	1.50		
	WaM3	1		1.52		
RH-A/11	LM3	1		1.53		
	WaM3	1		1.55		

Fig. 3b: *Lantanotherium sanmigueli*
12. Right P3, occlusal view, Schernham, NHMW 2004z0171/0007. – Ca. 10x.
13. Left P4, occlusal view, Schernham, NHMW 2004z0171/0008. – Ca. 10x.
14. Left M1, occlusal view, Schernham, NHMW 2004z0171/0009. – Ca. 10x.
15. Left M2, occlusal view, Schernham, NHMW 2004z0171/0010. – Ca. 10x.
16. Left M3, occlusal view, Schernham, NHMW 2004z0171/0011. – Ca. 10x.

The p4 is characterised by a low, more or less conical paraconid situated mesio-lingually. The metaconid is hinted by a faint swelling of the disto-lingual crest.

In the lower molars the conical metaconid stands lingually to the protoconid, the proto-cristid is bent posteriorly, and there is a marked entocristid. The strong postcingulid of the m1 is confluent with the entoconid. In the m2 the postcingulid is reduced and joins the postcristid, in the m3 it is vestigial to absent.

The upper P4–M3 are compact. The P4 has a concave anterior margin, an indistinct parastyle, and a protocone being distinctly larger than the hypocone. The most conspi-cuous character in M1 and M2 is the conical to slightly crescent-shaped metaconule. Its posterior arm is, if present at all, vestigial. The anterior crest joins a mesio-lingual crest of the metacone. There are marked anterior cingula. In the M3 the posterior crest of the protocone, if present, extends to the metacone. The size relation between the metacone and the posteriormost cusp, termed the hypocone by some authors, is quite variable. In most specimens the hypocone is bigger than the metacone, in a few smaller. In some M3, both cusps are fused to a crescent.

C o m p a r i s o n s

The finds without doubt represent *Lantanotherium*, as is indicated by the centrally placed and isolated metaconules of M1 and M2, the presence of the "hypocone" in M3, and the shape of the protocristid in the lower molars.

The genus is known from the Miocene of Europe, Asia and North America. In Euro-pe there are seven valid species. The Early Miocene species *L. piveteaui* Crusafont, Villalta & Truyols, 1955 from Can Cerda and *L. lactorensis* Baudelot & Crouzel 1976 from Navère are known based on their holotypes only. The Middle Miocene species are *L. sansaniense* (Lartet, 1851) from Sansan, the best-known species, *L. longirostre* Thenius, 1949 from Leoben in Austria and *L. robustum* Viret, 1940 from La Grive. Mein & Ginsburg (2002) described a second species from La Grive, which is somewhat smaller than *L. robustum* but bigger than all of the other species: *L. sabi-nae* Mein & Ginsburg 2002. In Late Miocene faunas, mostly the small *L. sanmigueli* Villalta & Crusafont, 1944 can be identified. In most samples this species is repre-

sented by few teeth and dentary remains. The type locality Viladecaballs yielded only the holotype, a dentary fragment with m1–m2 (Villalta & Crusafont 1944). Further localities are Can Llobateres (Engesser 1979), Montredon (Crochet & Green 1982), Dorn-Dürkheim (Storch 1978) and Eichkogel (Rabeder 1973). The Late Miocene Lu-feng hominoid locality in China yielded the only extra-European record of this species (Storch & Qiu 1991), and the so far only dentary with all alveoli preserved. Accordin-gly, in *L. sanmigueli* there are 3 incisors, the canine, the single-rooted p1 and p2, and the double-rooted p4, resulting in the tooth formula 3143. All samples are much too small to even roughly represent the full size range of *L. sanmigueli*. Consequently, the small size differences between the teeth of the different samples are meaningless. The record from Schernham represents the largest so far published and probably the most advanced sample, as one premolar (p1) is eliminated. Before postulating a trend, however, this should be verified by more dentaries from different localities spanning the whole Valle-sian. In all samples under study, *L. sanmigueli* is one of the most common insectivores, outnumbered mostly by the dimylid *Plesiodimylus*.

Galerix Pomel, 1848

Type species: *Viverra exilis* Blainville, 1840

Galerix sp. and Galericinae gen. et sp. indet.
Fig. 4

M a t e r i a l   a n d   m e a s u r e m e n t s :

Schernham	Galericinae gen. et sp. indet., NHMW 2004z0175/0000
	1. right m1 >3.4x1.9x2.1 (enamel corroded)
	2. left m1/2 talonid Wpost. 2.23
Richardhof-Golfplatz	Galericinae gen. et sp. indet., NHMW 2004z0176/0000
RH-A/2	left m1-talonid Wp 2.65
	right m3-fragment –x1.66x1.58
RH-A/7	*Galerix* sp., NHMW 2004z0179/0001
	right p4 2.85x2.09
RH-A/11	Galericinae gen. et sp. indet., NHMW 2004z0176/0000
	left M3 ca. 1.25x>1.3 (enamel corroded)
Bullendorf	Galericinae gen. et sp. indet.
1993/0026/13	left d3 1.66x0.93
1993/0026/14	left M3 1.26x1.95
1993/0026/15	right P4 lingual fragment

D e s c r i p t i o n   and comparison

Among the many galericine teeth, some do not fit *Lantanotherium* either morphologi-cally or in size.

The large and compact p4 from RH-Golfplatz has a conical paraconid somewhat more elevated than the metaconid. No cingulid is preserved. Despite its large size it is not an erinaceine p4. It clearly belongs to a galericine. As the metaconid is better developed in *Parasorex* and *Schizogalerix*, thus giving their p4 a more molariform appearance, the specimen cannot belong to any species of these genera. On the other hand the mere pre-sence of a distinct metaconid excludes an affiliation with *Lantanotherium*. Morphologi-
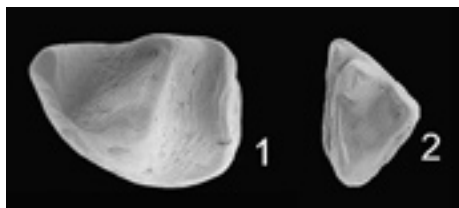
Fig. 4:
1. Right p4, *Galerix* sp., occlusal view, Richardhof-Golfplatz, NHMW 2004z0179/0001. – Ca. 15x.
2. Left M3, Galericinae gen. et sp. indet., Bullendorf, occlusal view, NHMW 1993/0026/14. – Ca. 15x.

Fig. 5:
1. Right p4, buccal view, ?cf. *Atelerix depereti*, Götzendorf 1, NHMW 2004z0181/0001. – Ca. 7.5x.
2. Left M1, occlusal view, ?cf. *Postpalerinaceus vireti*, Schernham, NHMW 2004z0180/0001. – Ca. 7.5x.

cally, the p4 best fits with *Galerix*, in which the metaconid of p4 may be quite variable in shape and volume. However, it is distinctly larger than any known European species. With some reserve the specimen is named *Galerix* sp.

The m inf. are either heavily corroded, as in the case of the m1 from Schernham, or too fragmentary to allow exact determination. They are too small to belong to any of the known European erinaceine species. In the m3 from Richardhof-Golfplatz, most of the trigonid is broken off. The well-developed talonid shows that it is not an erinaceine m3. It cannot be decided whether these m inf. represent a large species of *Galerix*, of *Schizogalerix*, or of *Parasorex*. Morphologically, even an affiliation with *Lantanotherium* cannot be excluded. These specimens are referred to a large Galericinae gen. et sp. indet. The M3 from RH-Golfplatz is heavily corroded, preserving only a part of its enamel cover. Its small size is not due to corrosion alone. The anterior cingulum is well developed. As there is only one distal cusp, the metacone, it cannot belong to *Lantanotherium*. The Bullendorf M3 shows the same morphology. Morphologically, both specimens are compatible with *Galerix*, *Parasorex* and *Schizogalerix*. Because of their small size they cannot belong to the same species as represented by the p4 or by the m inf. The determination is Galericinae gen. et sp. indet.

Erinaceinae FISCHER VON WALDHEIM 1817

**?cf. *Postpaerinaceus vireti* CRUSAFONT & VILLATA, 1947 and
?cf. *Atelerix depereti* MEIN & GINSBURG, 2002**
Fig. 5

M a t e r i a l   a n d   m e a s u r e m e n t s :

Schernham		? cf. *Postpaerinaceus vireti*,	
NHMW 2004z0180/0001	left M1	5.71x5.14x5.79x6.54 (L bxLlxWaxWp)	
Götzendorf		? cf. *Atelerix depereti*	
NHMW 2004z0181/0000	right P4	3.36xca.3.9	
Gö 1, 1990/15			
NHMW 2004z0181/0001	right p4	2.57x1.85	

D e s c r i p t i o n   a n d   c o m p a r i s o n s

The erinaceine teeth lumped together here certainly do not represent one species.

In the p4 the conical paraconid is higher than the metaconid. It lies within the size range of *Atelerix depereti* MEIN & GINSBURG 2002 from La Grive (MEIN & GINSBURG 2002)
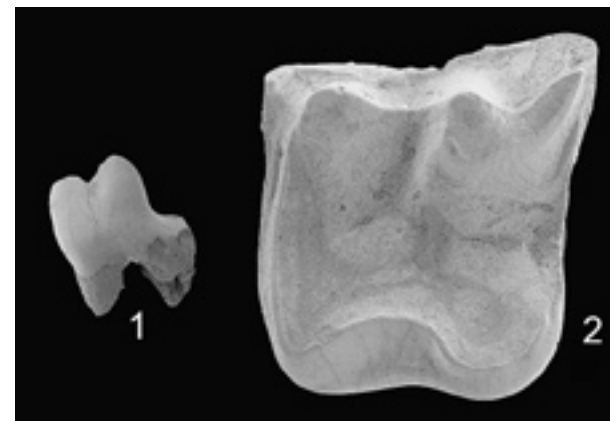
and is distinctly smaller than *Postpalerinaceus vireti* CRUSAFONT & VILLALTA, 1947 from the type locality Viladecaballs.

The M1 is heavily worn down. There is no vestige of a metaconule, which certainly was present in an earlier stage of wear. There is a modest anterior cingulum. Otherwise, the only character is the large size. Due to its large size the M1 certainly belongs to an erinaceine. In *Postpalerinaceus vireti* from Viladecaballs the M1 is somewhat larger (L 6.10; W 6.10; from CRUSAFONT & VILLALTA 1947: 329), but roughly fits in size.

The P4 roughly fits *Atelerix depereti* from La Grive. It has no projecting parastyle, and the hypocone extends more lingually than the protocone.

In the Late Miocene we expect *Postpalerinaceus vireti*, whose teeth are distinctly bigger than those under study here. Isolated erinaceine teeth are hardly determinable to species level. In most cases even the genus cannot be determined with certainty. The problem generically allocating Oligocene and Miocene erinaceines is discussed in ZIEGLER (2005b). The Götzendorf sample may represent *Atelerix depereti*. Except for matching size, however, there is no character preserved to corroborate this assumption. The Schernham specimen represents a different species, which may be close to *Postpalerinaceus vireti*.

Plesiosoricidae WINGE, 1917

Plesiosorex POMEL, 1854

Type species: *Erinaceus soricinoides* BLAINVILLE, 1838

***Plesiosorex evolutus* n. sp.**
Fig. 6

1993 *Plesiosorex* n. sp.; RABEDER in RÖGL et al.: 511

E t y m o l o g y : Latin evolutus = advanced, the species is interpreted as the most advanced so far known.

H o l o t y p e : Right M1, cat.-no. NHMW 2004z0182/0001, Fig. 6.10

Measurements of the holotype: Lbuccal 4.09; Llingual 3.57; Wmesial 5.71; Wdistal 4.80.

T y p e   l o c a l i t y : Schernham, Hausruck-Kobernaußerwald area, fluvial complex in the Molasse Basin, Upper Austria.

A g e : Early Late Miocene, Upper Vallesian, MN 10 (DAXNER-HÖCK 2004b).

P a r a t y p e s   a n d   m e a s u r e m e n t s   (see tab. 4):

R e f e r r e d   m a t e r i a l from Götzendorf, *Plesiosorex* sp. from Stixneusiedl and measurements (see tab. 4)

D i a g n o s i s – Big-sized species of *Plesiosorex*, with a metaconule in M1 and M2, without a vestige of a postmetaconule crista. The cusp situated buccally to the paracone in M1 and M2 is as high as the paracone. The hypocone is cone-shaped and stands isolated, as high as the postprotocrista. The entocristid of m1 and m2 is deeply notched, joining the posterior face of the metaconid. The trigonid of m1 is moderately long, with a trigonid:talonid length ratio of ca. 1.50.

Tab. 4: *Plesiosorex evolutus* n. sp., Schernham, Götzendorf and Stixneusiedl measurements of the teeth.

Schernham: Sch. 5, 25 isolated teeth (2004z0182/0001–0012)

p2/3	no	L	W		?A sup.	no	L	W		
	2004z0182/0002	2.15	1.67			2004z0182/0000	2.53	1.31		
p4	2004z0182/000	3.04	2.21			2004z0182/0000	2.62	1.23		
	2004z0182/0000	2.87	2.18			2004z0182/0000	2.31	1.21		
	2004z0182/0003	2.84	2.02			2004z0182/0000	2.40	x1.26		
m1	no	L	Wa	Wp	P3	2004z0182/0008	3.03	2.41		
	2004z0182/0004	5.31	3.11	3.10		2004z0182/0000	3.44	2.74		
m2	2004z0182/0005	3.28	2.62	2.69	P4	2004z0182/0000	4.32	3.75		
	2004z0182/0000	3.35				2004z0182/0000	–	4.16		
m3	2004z0182/0000	–	>1.67	>1.78		2004z0182/0009	5.14	4.32		
?A sup.	no	L	W		M1	no	Lbuc.	Lling.	Wa	Wp
	2004z0182/0006	1.93	1.32		(holotype)	2004z0182/0001	4.09	3.57	5.71	4.80
	2004z0182/0000	1.81	1.20			2004z0182/0000	–	–	–	–
	2004z0182/0000	1.78	1.31		M2	2004z0182/0010	3.04	2.80	4.02	3.55
	2004z0182/0000	1.75	1.23		M3	2004z0182/0011	2.00	1.96	2.48	2.07
	2004z0182/0007	2.71	1.14		M3 sup.			L	B	

Götzendorf: 9 isolated teeth/tooth fragments (2004z0183/0000–0001)

m1	no	L	Wa	Wp	?A	no	L	W		
Götzend. 1–6	2004z0183/0001	5.19	2.64	2.90	Götzend. 1	2004z0183/0000	1.74	1.00		4.34
Götzend. 5	2004z0183/0000	–	2.72	–	M1			L	Wa	Wp
Götzend. 2	2004z0183/0000	–	–	ca.3.3	Götzend. 1–6	2004z0183/0000	3.56	3.20	4.95	4.34
Götzend. 1	2004z0183/0000	–	–	3.18	P3.			L	B	
Götzend. 1	2004z0183/0000	–	–	3.02	Götzend. 1	2004z0183/0000	2.77	2.02		
m3					Götzend. 1	2004z0183/0000	2.97			
Götzend. 1	2004z0183/0000	2.31	1.84	1.93	M3 sup.			L	B	
					Götzend. 1	2004z0183/0000	ca. 1.7	–		

Stixneusiedl: *Plesiosorex* sp.

P4	no	L	B	
P4	1991/1517/30	–	–	
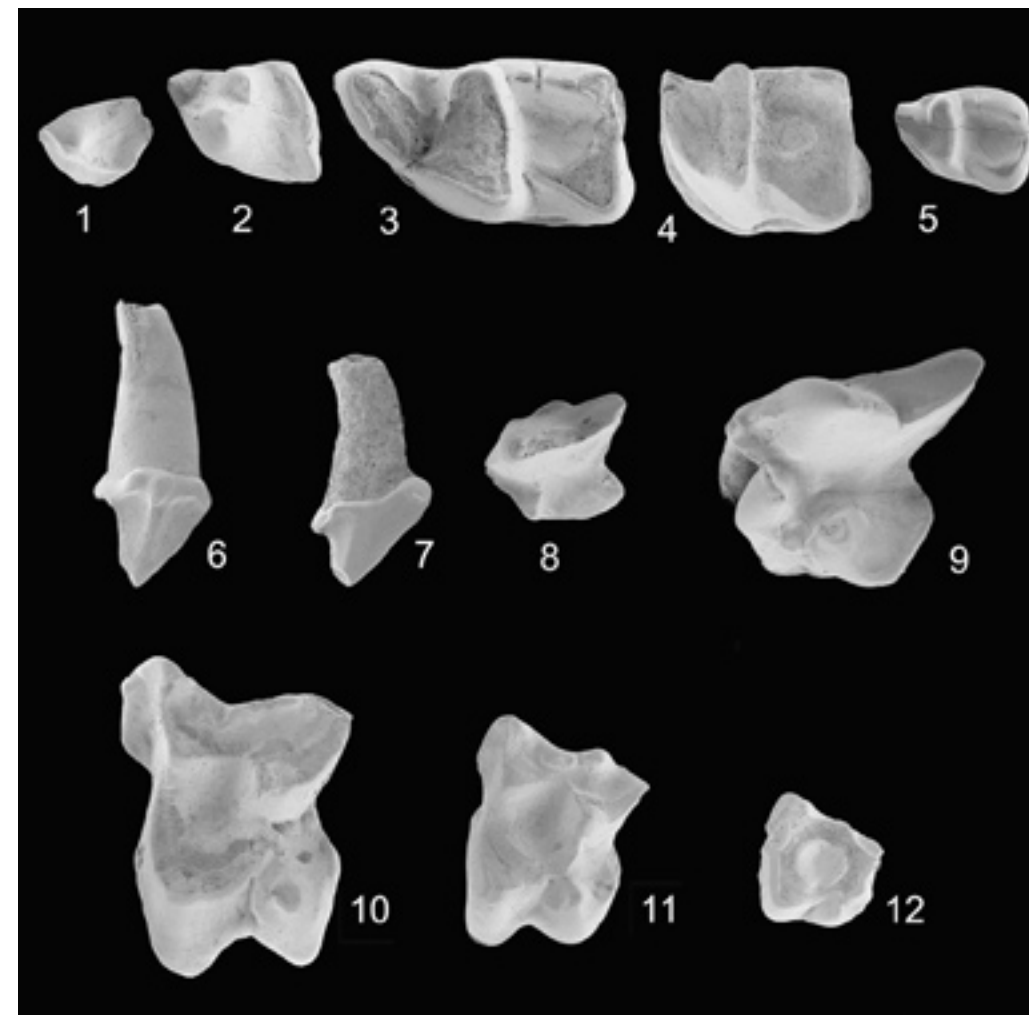
Fig. 6. *Plesiosorex evolutus* n. sp. – Ca. 7,5x
1. Right p2/3, occlusal view, Schernham, NHMW 2004z0182/0002.
2. Right p4, occlusal view, Schernham, NHMW 2004z0182/0003.
3. Right m1, occlusal view, Schernham, NHMW 2004z0182/0004.
4. Left m2, occlusal view, Schernham, NHMW 2004z0182/0005.
5. Right m3, occlusal view, Götzendorf, NHMW 2004z0183/0001.
6. Left upper antemolar, lingual view, Schernham, NHMW 2004z0182/0006.
7. Left upper antemolar, lingual view, Schernham, NHMW 2004z0182/0007.
8. Left P3, occlusal view, Schernham, NHMW 2004z0182/0008.
9. Right P4, occlusal view, Schernham, NHMW 2004z0182/0009.
10. Right M1, holotype, occlusal view, Schernham, NHMW 2004z0182/0001.
11. Left M2, occlusal view, Schernham, NHMW 2004z0182/0010.
12. Left M3, occlusal view, Schernham, NHMW 2004z0182/0011.

D e s c r i p t i o n   o f   t h e   h o l o t y p e :   The M1 is distinctly wider than long and rectangular in occlusal view. The crest of protocone, paracone and metacone each are considerably worn. The paracone and the cusp buccal to it are of the same height. Buccal to the metacone there is no conical cusp, but rather a low ridge extending mesio-distally. The apomorphic character is the complete absence of a postmetaconule crista. The hypocone is conical, without any crest, and less voluminous and lower than the protocone. A lobe-shaped prominence is located mesial to the paracone and the cusp buccal to it . There is a small node above the preprotocrista, indicating a vestige of a mesial cingulum. The other sides do not have any cingula.

D e s c r i p t i o n   o f   t h e   p a r a t y p e s   and referred material

In addition to the holotype there are 25 isolated teeth from Schernham, only one P4 and one M1 being fragments. It is not possible to definitely determine the single-rooted lower and upper teeth anterior to p4/P3. Not all teeth of *Plesiosorex* are known. The most complete dentary, with all teeth preserved except the two incisors, is that of *P. soricinoides* from St. André near Marseille. The upper antemolars in situ are not known at all. Consequently, the determinations of isolated antemolars are valid only with some reservation. The Götzendorf fauna yielded a left edentulous dentary fragment with one mental foramen below the posterior root of p4 and a further one under the second alveole (p2) anterior to p4; it also yielded 11 isolated teeth and tooth fragments. Stixneusiedl yielded a disto-buccal fragment of a left P4.

The p2/3 has one strong root directed somewhat posteriorly. It therefore slightly overlapped the tooth anterior to it. At the buccal face the crown extends more downward than lingually. A mesial and a distal crest descend from the cusp. This tooth is similar to the p2 or p3 of *Plesiosorex soricinoides* figured by VIRET (1946: fig. 1).

In the double-rooted p4, the low paraconid is blade-shaped and separated by a notch from the anterior crest of the protoconid. The well-developed metaconid is attached at the disto-lingual side of the protoconid. The lower margin of the crown is bent upwards on both sides. It extends more downwards on the buccal face. Only a postcingulid descends lingually and bucally from a central posterior cuspule.

In the m1 from Schernham the crests are considerably worn. The trigonid is distinctly longer than the talonid, the trigonid:talonid length ratio being 1.53 in Schernham and 1.51 for the Götzendorf specimen. There is a deep notch between the paralophid and the anterior crest of the protoconid. The entocristid extends to the posterior face of the metaconid and is notched anterior to the entoconid. We also can interpret this structure as an elongated cusp between entocristid and metaconid. There is a faint precingulid and a short ectocingulid below the buccal re-entrance valley.

The intact m2 is heavily worn. From the less-worn specimen, only the buccal half is preserved. The trigonid is distinctly shorter than in the m1. Thus, the talonid is as long as the trigonid. The talonid is closed lingually by the prolonged, notched entocristid. The precingulid and the ectocingulid are continuous and better developed than in m1.

The m3 resembles a diminutive m2. In the Schernham m3 the paraconid is broken off and the enamel of the buccal side is partly eroded. In the well-preserved Götzendorf m3 the talonid is inflated and the precingulid well developed.

The Schernham sample includes nine single-rooted teeth, with a strong root in prolongation of the vertical axis of the crown. These teeth were clearly implanted straight. They are identical in morphology to those figured by ENGESSER (1972: fig. 9) and SCHÖTZ (1989: fig. 4) and reservedly determined as upper antemolars. Two size categories, possibly two different A sup., are represented in the current sample.

The P3 has a projecting parastyle, a small mesio-lingual cusp and a disto-lingually descending heel or flange. The margin of the crown is bent downwards at the buccal base of the paracone.

In the P4 the disto-lingual flange has a lingual cusp, which is more voluminous than the mesio-lingual one. The flange is surrounded distally by a cingulum.

The Schernham sample includes a fragment of a further M1. Differing from the holotype, the cusp buccal to the metacone is clearly conical, as in some M1 of *P. germanicus* and in *P. schaffneri*. The Götzendorf M1 is morphologically identical to the type but slightly smaller.

The M2 differs from the M1 in its distinctly smaller size and the rather trapezoidal occlusal outline. The cusp buccal to the paracone is well developed and as high as the paracone. The cusp buccal to metacone is conical. The metaconule also lacks postmetaconulecrista. The hypocone is connected with the postprotocrista by a weak crest. There are no cingula.

The M3 is more trapezoidal than the M2. The only preserved specimen is heavily worn and shows few morphological details beyond a moderately developed hypocone.

C o m p a r i s o n s   a n d   d i s c u s s i o n

There are five species of *Plesiososrex* in the Miocene of Europe: the type species *Plesiosorex soricinodes* (BLAINVILLE, 1838) from Oligocene and Agenian sites, *P. styriacus* (HOFMANN, 1892) from the Early/Middle Miocene of Austria, *P. germanicus* (SEEMANN, 1938) from the Early/Middle Miocene of Bavaria, *P. schaffneri* ENGESSER, 1972 from the late Middle Miocene of Switzerland and the Early Vallesian (MN 9) of Hammerschmied near Kaufbeuren, and *Plesiosorex* sp. from Großlappen (today part of the city of Munich), which is correlated with MN 9. The latest occurrence of *Plesiosorex* in Europe is *P. roosi* FRANZEN, FEJFAR & STORCH 2003 from the Late Vallesian (MN 10) of Eppelsheim (FRANZEN et al. 2003). The easternmost records are *P. schaffneri* from Rudabánya (ZIEGLER 2005a) and *Plesiosorex* sp. from Alsóteleke (MÉSZÁROS 1999) in Hungary. The genus is represented by three species in North America: *P. coloradensis* WILSON, 1960 from the Early Miocene of Colorado, *P. donroosai* GREEN, 1977 from the Barstovian (Late Miocene) of South Dakota, and *P. greeni* MARTIN & LIM, 2004 from the Early Miocene of Nebraska. *P. aydarlensis* KORDIKOVA, 2000 from the Early Miocene of South Eastern Kazakhstan is the only Asian species of the genus. The Late Miocene record of Bayraktepe in Turkey is not yet described (ENGESSER & ZIEGLER 1996).

P. evolutus differs from all of them, except *P. donroosai*, in its larger size and the complete absence of a postmetaconule crista. It differs from all European species with known M1 in that the paracone and its buccal counterpart are of equal height. This buccal cusp is lower in the other European species. On the other hand, it is higher in *P. coloradensis* (see ENGESSER 1979: fig. 1 b, e, h, k; SCHÖTZ 1989: fig. 3/2c, fig. 5/3c). In this character, *P.*

evolutus is intermediate between the earlier European and the North American species. In the development of the trigonid in m1, which seems to be a carnassial adaptation, it is intermediate between *P. schaffneri* from Rudabánya (trigonid:talonid length ratio 1.37) and *P. roosi* from Eppelsheim (ratio 1.93, see FRANZEN et al. 2003: 98). According to FRANZEN et al. (2003) this ratio cannot be calculated on the crushed m1 of the type of *P. schaffneri* from Anwil. They also showed that the original measurement of the length is exaggerated and suppose a restored length of less than 4.52 mm. Hence, all molars of *P. schaffneri* from Anwil are smaller than in *P. evolutus*. The cutting edge of the m1 is best developed in *P. roosi*. *P. evolutus* shows a mosaic of characters. In the absence of a postmetaconule crista on M1 and M2, it is the most evolved species in which this tooth is known (*P. styriacus*, *P. germanicus*, *P. schaffneri*, *Plesiosorex* sp. from Großlappen, *P. coloradensis*, and *P. aydarlensis*) (see SCHÖTZ 1989: fig. 9, KORDIKOVA 2000: pl. 1, fig. 7). In the length of the cutting edge on m1, it is less advanced than the roughly contemporaneous *P. roosi* from Eppelsheim. The Schernham and Götzendorf samples correspond well in overall size, in the development of the cutting edge, and in the absence of the postmetaconule crista. They definitely represent the same species. The P4 fragment from Stixneusiedl cannot be determined to species level.

Talpidae FISCHER VON WALDHEIM, 1817

Desmaninae THOMAS, 1912

Archaeodesmana TOPACHEVSKI & PASHKOV, 1983

Type species: *Desmana pontica* SCHREUDER, 1940

Archaeodesmana aff. and cf. *vinea* (STORCH, 1978)
Figs. 7–8

1970   *Desmana* cf. *kormosi* SCHREUDER, 1940; Rabeder: 594
1993   *Dibolia* sp.; RABEDER in RÖGL et al.: 511

M a t e r i a l (measurements see tab. 5):

Eichkogel	*A. vinea*, NHMW 2004z0184/0000
1993/0008/0016	11 isolated teeth
1974/1680 (Coll. HUIMANN)	right dentary fragment with m2, 5 isolated teeth
Schernham	*A.* aff. *vinea*, NHMW 2004z0185/0000–0007
	11 dentary fragment with teeth, 2 maxillary fragment with P3–P4,
	71 isolated teeth
Neusiedl a. See	*A.* cf. *vinea*
1990/1519/21	right m1
Richardhof-Wald	*A.* cf. *vinea*, NHMW 2004z0186/0000
Rh-94/1	9 isolated teeth
Rh 94/5A	5 isolated teeth
Richardhof-Golfplatz	*A.* cf. *vinea*, NHMW 2004z0187/0000
RH-A/2	30 isolated teeth (partly fragments)
RH-A/7	15 isolated teeth (partly fragments)
RH-B.2	right m1-trigonid
Götzendorf	*A.* cf. *vinea*, NHMW 2004z0188/0000
Gö1, 1990/14	6 dentary fragments with teeth, 6 isolated teeth
Gö 1	right dentary fragment with m2–m3, 13 isolated teeth
Gö, (Coll. ULRICH)	2 left humerus fragments
Gö 1, 1990/15	13 isolated teeth (partly fragments),
	right humerus fragment (NHMW 2004z0188/0001)
Gö 1, 1990/16	5 dentary fragments with teeth, 9 teeth, right humerus fragment
Gö 2, 1990/22	right m1-trigonid

D e s c r i p t i o n

The species was described in detail by STORCH (1978) and RÜMKE (1985). Hence, for the material under study, only the significant characters will be mentioned in order to justify the determination. Except for some dentary and maxillary fragments and some humeri fragments from Schernham and Götzendorf, all samples are represented by isolated teeth only. In the Schernham sample the mandibular symphysis extends posteriorly to p2. In one dentary fragment, the alveoles for three increasingly procumbent incisors, for a single-rooted canine and the double-rooted p1 are preserved. Accordingly, the mandibular tooth formula is 3143. The p1 consistently has two separated roots, which is a diagnostic character of *A. vinea*. There are two mental foramina: the anterior one under the p1 (in 3 specimens) or below p1/p2 (in one specimen), the posterior one under the trigonid of m1 (5x) or below the posterior root of p4. In the Götzendorf sample the anterior mental foramen is preserved in one dentary under the anterior alveole of p2, the posterior one consistently below the anterior root of m1 (4x).

Th p1 is implanted obliquely with respect to the length axis of the dentary, its anterior roots being buccally dispaced. The size relation of the premolars is p4>p2>p1>p3. The ratio p2/p3 varies between 1.07 and 1.24, as can be calculated from 3 dentaries from Schernham. In two dentaries from Kohfidisch the corresponding values are 1.24 and 1.33, i.e. the p3 is smaller with respect to the p2 in the Kohfidisch sample. The teeth are low-crowned, compact and amblyodont, i.e. they have inflated cusps, especially the premolars. The premolars lack sharp crests but have horizontal wear facets, as known from dimylids. The i3 and lower canines as well as p1 and p3 cannot be distinguished with certainty among isolated teeth. p1 and p2 are without a vestige of a cingulid, but each bears a tiny mesial and distal cuspule. In p3 and p4 the cingulid is confined to the distal part. It forms a small talonid in p4. In the Schernham sample, eight p4 have a disto-lingual accessory cuspule. Three other p4 are too worn to to enable further details to be discerned. In the Rh-94/5A-sample, two out of three p4 lack a minute accessory cuspule. Both the p4 of the RH-A/2-sample also have a disto-lingual cuspule. In Götzendorf, this cuspule is vestigially preserved in one p4 but not in the other. Due to its disto-lingual position, this cuspule is probably not homologous with the metaconid, as for example in the p4 of erinaceids. No upper teeth anterior to P2 have been identified. In the Vallesian samples the P2 and P3 have the posterior and the postero-lingual root fused to one broad root with a hint of a median sulcus. This is visible on isolated P3 and on a maxillary fragment with the two alveoli of P2 from Schernham and on two isolated P3 from Götzendorf. In the three P3 from the RH-A/2 sample, the roots are broken, and it cannot be decided whether there was a tiny lingual root or not. In the Turolian samples from Kohfidisch and Eichkogel the P3 is clearly triple-rooted; the P2 is also triple-rooted in Kohfidisch, and was not recorded in Eichkogel.

Tab. 5: *Archaeodesmana* aff. *vinea*, sample statistics of the teeth (p1/p3 means p1 or p3).

locality	meas.	n	R	m	s	V
Kohfidisch	Lp1-m3	1		11.1		
	Lp1-p4	1		4.89		
	Lm1-m3	3	6.08–6.17	6.12		
	Lp2/Lp3	2	1.24–1.33	1.29		
Schernham	Lp1-p4	2	5.10–5.11	5.11		
	Lm1-m3	1		6.40		
	Lp2/Lp3	3	1.07–1.24	1.15		
Schernham	Li3	4	1.29–1.46	1.39		
	Wi3	4	0.95–1.02	0.96		
RH-A/2	Li3/cinf.	1		1.18		
	Wi3/cinf.	1		0.88		
Schernham	Lcinf.	10	1.12–1.28	1.18±0.03	0.049	4.17
	Wcinf.	10	0.76–0.95	0.83±0.05	0.063	7.58
RH-A/7	Lcinf.	2	1.07–1.27	1.17		
	Wcinf.	2	0.73–0.85	0.79		
Kohfidisch	Lp1	4	1.04–1.11	1.07		
	Wp1	4	0.74–0.88	0.82		
Schernham	Lp1	4	1.26–1.37	1.32		
	Wp1	4	0.86–0.97	0.93		
Schernham	Lp1/p3	4	1.21–1.38	1.23		
	Wp1/p3	4	0.87–0.96	0.93		
RH-A/2	Lp1/p3	4	1.20–1.35	1.27		
	Wp1/p3	4	0.78–0.87	0.84		
Götzendorf	Lp1/p3	1		1.05		
	Wp1/p3	1		0.75		
Kohfidisch	Lp2	5	1.43–1.58	1.50±0.08	0.061	4.06
	Wp2	5	0.96–1.02	1.00±0.03	0.023	2.31
Schernham	Lp2	6	1.40–1.49	1.45±0.04	0.032	2.20
	Wp2	6	0.92–0.97	0.95±0.02	0.020	2.11
Kohfidisch	Lp3	3	1.12–1.25	1.18		
	Wp3	3	0.93–0.97	0.96		
Schernham	Lp3	4	1.17–1.34	1.23		
	Wp3	4	0.81–0.95	0.90		
RH-94/1	Lp3	3	1.22–1.28	1.24		
	Wp3	3	0.73–0.80	0.77		
Kohfidisch	Lp4	5	1.54–1.77	1.65±0.11	0.082	4.98
	Wp4	5	1.09–1.16	1.12±0.04	0.028	2.47

locality	meas.	n	R	m	s	V
Eichkogel	Lp4	1		ca.1.75		
	Wp4	1		1.10		
Schernham	Lp4	11	1.46–1.66	1.56±0.05	0.072	4.62
	Wp4	11	1.06–1.18	1.12±0.03	0.040	3.53
Rh-94/5A	Lp4	3	1.53–1.60	1.57		
	Wp4	3	0.98–1.05	1.01		
RH-A/2	Lp4	2	1.55–1.55	1.55		
	Wp4	2	0.95–0.96	0.96		
Götzendorf	Lp4	2	1.53–1.56	1.55		
	Wp4	2	0.95–0.98	0.97		
Kohfidisch	Lm1	8	2.23–2.38	2.32±0.04	0.048	2.06
	Wam1	8	1.40–1.56	1.46±0.05	0.055	3.77
	Wpm1	8	1.59–1.76	1.69±0.05	0.055	3.24
Eichkogel	Lm1	1		2.09		
	Wam1	1		1.45		
Neusiedl	Lm1	1		>2.25		
	Wam1	1		1.44		
	Wpm1	1		1.64		
Schernham	Lm1	13	2.25–2.39	2.32±0.03	0.050	2.14
	Wam1	14	1.36–1.62	1.45±0.05	0.081	5.56
	Wpm1	14	1.55–1.88	1.72±0.05	0.088	5.12
RH-A/2	Lm1	1		2.35		
	Wam1	2	1.32–1.35	1.34		
	Wpm1	2	1.64–1.64	1.64		
Götzendorf	Lm1	9	2.19–2.32	2.25±0.04	0.054	2.39
	Wam1	11	1.21–1.48	1.38±0.06	0.084	6.03
	Wpm1	12	1.52–1.71	1.62±0.04	0.067	4.11
Kohfidisch	Lm2	8	2.18–2.31	2.23±0.05	0.054	2.42
	Wam2	8	1.39–1.56	1.48±0.05	0.055	3.75
	Wpm2	8	1.52–1.71	1.59±0.05	0.060	3.77
Schernham	Lm2	3	2.20–2.36	2.27		
	Wam2	3	1.43–1.54	1.50		
	Wpm2	3	1.59–1.71	1.65		
RH-A/2	Lm2	3	2.24–2.35	2.29		
	Wam2	7	1.35–1.54	1.47±0.06	0.061	4.12
	Wpm2	4	1.52–1.65	1.59		
RH-A/7	Lm2	1		2.17		

locality	meas.	n	R	m	s	V
	Wam2	2	1.35–1.47	1.41		
	Wpm2	1		1.53		
RH-B	Wam2	1		1.48		
Götzendorf	Lm2	7	2.21–2.36	2.28±0.05	0.046	2.02
	Wam2	8	1.34–1.59	1.46±0.07	0.079	5.42
	Wpm2	6	1.48–1.59	1.54±0.05	0.040	2.56
Kohfidisch	Lm3	6	1.76–1.89	1.81±0.06	0.049	2.70
	Wam3	6	1.13–1.32	1.22±0.08	0.066	5.36
	Wpm3	6	1.09–1.28	1.18±0.08	0.072	6.06
Eichkogel	Lm3	1		1.79		
	Wam3	1		1.24		
	Wpm3	1		1.24		
Schernham	Lm3	15	1.74–1.92	1.85±0.03	0.047	2.51
	Wam3	15	1.12–1.30	1.22±0.03	0.048	3.97
	Wpm3	15	1.11–1.26	1.19±0.03	0.046	3.87
Rh-94/1	Lm3	3	1.66–1.86	1.75		
	Wam3	3	1.11–1.21	1.17		
	Wpm3	3	1.08–1.21	1.16		
Rh-94/5A	Lm3	1		1.79		
	Wam3	1		1.27		
	Wpm3	1		1.17		
RH-A/2	Lm3	3	1.81–1.88	1.84		
	Wam3	3	1.15–1.25	1.19		
	Wpm3	3	1.15–1.18	1.17		
RH-A/7	Wam3	1		1.14		
	Wpm3	1		1.08		
Götzendorf	Lm3	7	1.74–1.98	1.88±0.07	0.071	3.77
	Wam3	6	1.12–1.28	1.19±0.07	0.063	5.27
	Wpm3	7	1.08–1.28	1.18±0.08	0.078	6.62
Kohfidisch	LCsup.	1		1.31		
	Wcsup.	1		0.90		
RH-A/2	LCsup.	1		1.60		
	Wcsup.	1		1.00		
Kohfidisch	LP1	1		1.07		
	WP1	1		0.89		
RH-A/2	LP1	1		1.09		
	WP1	1		0.79		
Kohfidisch	LP2	7	1.44–1.64	1.53±0.07	0.066	4.29
	W2	7	1.12–1.20	1.15±0.03	0.032	2.82

locality	meas.	n	R	m	s	V
Schernham	LP2	1		1.74		
	WP2	1		1.29		
RH-A/2	LP2	1		1.55		
	WP2	1		0.99		
Kohfidisch	LP3	3	1.19–1.30	1.26		
	WP3	3	1.03–1.12	1.08		
Eichkogel	LP3	2	1.34–1.36	1.35		
	WP3	2	1.18–1.19	1.19		
Schernham	LP3	7	1.17–1.45	1.32±0.09	0.093	7.05
	WP3	7	1.10–1.33	1.21±0.08	0.077	6.34
RH-A/2	LP3	3	1.24–1.31	1.28		
	WP3	3	0.96–1.01	0.98		
Götzendorf	LP3	2	1.23–1.26	1.25		
	WP3	2	1.02–1.06	1.04		
Kohfidisch	LP4	3	1.89–2.00	1.94		
	WP4	3	0.69–1.75	1.73		
Schernham	LP4	6	1.87–2.12	1.99±0.10	0.091	4.58
	WP4	5	1.67–1.83	1.76±0.10	0.073	4.13
Götzendorf	LP4	2	1.92–2.02	1.97		
	WP4	2	1.64–1.67	1.66		
Kohfidisch	LbM1	7	2.80–2.93	2.89±0.05	0.048	1.66
	WM1	7	2.07–2.20	2.16±0.05	0.049	2.28
Eichkogel	LbM1	2	2.96–3.04	3.00		
	WM1	2	2.03–2.07	2.05		
Schernham	LbM1	9	2.59–2.99	2.81±0.10	0.119	4.24
	WM1	8	2.06–2.26	2.15±0.08	0.087	4.05
RH-A/2	LbM1	1		2.90		
	WM1	2	2.14–2.28	2.21		
Götzendorf	LbM1	7	2.59–2.96	2.75±0.14	0.135	4.90
	WM1	9	1.93–2.27	2.08±0.08	0.100	4.78
Kohfidisch	LbM2	6	2.47–2.70	2.64±0.10	0.088	4.13
	WaM2	6	1.90–2.07	2.02±0.10	0.085	3.21
Schernham	LbM2	5	2.46–2.60	2.51±0.05	0.070	3.45
	WaM2	7	2.05–2.20	2.13	0.047	1.88
RH-A/2	LbM2	2		2.51		
	WaM2	1		2.00		
Götzendorf	LbM2	1		2.50		
	WaM2	2	2.48–2.51	1.46		
Kohfidisch	LM3	3	1.45–1.46			

Fig. 7: *Archaeodesmana* aff. *vinea*, Schernham
1. Right dentary fragment with c-p4, occlusal view, NHMW 2004z0185/0001. – Ca. 7,5x.
2. Right dentary fragment with i3-p4, buccal view, NHMW 2004z0185/0002. – Ca. 7,5x.
3. Right dentary fragment with m1-m3, occlusal view, NHMW 2004z0185/0003. – Ca. 7,5x.
4. Right maxillary fragment with P3-P4 and the alveoli of a double-rooted P2, occlusal view, NHMW 2004z0185/0004. – Ca. 10x.
5. Left M1, occlusal view, NHMW 2004z0185/0005. – Ca. 10x.
6. Left M2, occlusal view, NHMW 2004z0185/0006. – Ca. 10x.
7. Left M3, occlusal view, NHMW 2004z0185/0007. – Ca. 10x.

There are four humerus fragments from Götzendorf (SD: R=1.70–1.83; n = 4; m = 1.76) with typical desmanine morphology, and 11 have been identified from the Kohfidisch sample (SD: R=1.59–1.81; n=11; m=1.72). At the type locality Dorn-Dürckheim, the shaft width lies between 1.4 and 1.6 mm in four fragments (STORCH 1978: 431). Based on overall size, the specimens under study may belong either to *Archaeodesmana* or to the second desman, *Storchia*, which is of roughly the same size. All humeri from Götzendorf are arbitrarily listed among *Archaeodesmana*. Some may belong to *Storchia*, which is sufficiently represented by dentition. As only one fragment of an upper jaw of *Storchia* was found in the Kohfidisch talpid fauna, the vast majority of the desmanine humeri is expected to belong to *Archaeodesmana*.

D i s c u s s i o n

Archaeodesmana vinea is currently known from the type locality Dorn-Dürkheim, SW-Germany, and from Kohfidisch in Austria. MEIN (1999) referred specimens from several
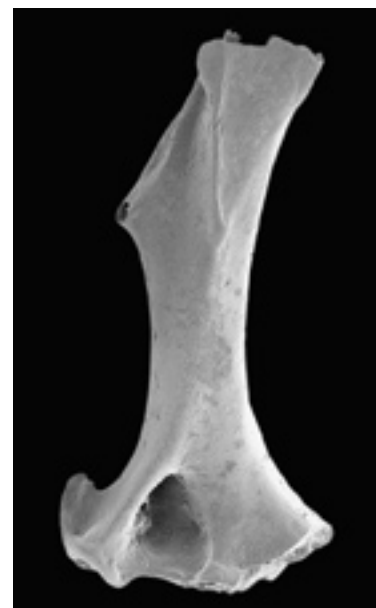

Fig. 8: *Archaeodesmana* aff. *vinea* or *Storchia biradicata* n. sp., left humerus, cranial view, Götzendorf, NHMW 2004z0188/0001.–Ca. 7,5x.

French sites to this species. Comparative measurements are available only from the sample from the type locality (STORCH 1978: tab. 1) and from the Kohfidisch sample (BACHMAYER & WILSON 1978: 555, RÜMKE 1985: tab. 9, and own measurements). The present samples show certain differences.

In the Schernham sample the p1 is slightly bigger than the p3, whereas in the Kohfidisch sample this size relation is reversed. In Dorn-Dürckheim and in Kohfidisch the p1 is distinctly smaller, i. e. more reduced. The p4 is more slender in the sample under study than in Dorn-Dürkheim and differs in the presence of the disto-lingual cuspule from the p4 from Dorn-Dürckheim and Kohfidisch. The size of the lower molars from Schernheim fits well to *A. vinea* from the type locality. In the Richardhof and Götzendorf samples the lower molars are somewhat more slender. The only P2 in situ, preserved in the Schernham sample, is distinctly bigger than in *A. vinea* from Dorn-Dürckheim, Eichkogel, and Kohfidisch. P3 and P4 from the samples are also slightly larger, whereas the upper molars are rather similar in size. P2 and P3 are triple-rooted in the Turolian samples, but only double-rooted in the Vallesian ones. Triple-rooted P2 and P3 represent the advanced character state in desmans. In this respect, the Vallesian samples from Schernham and Götzendorf, which include the P3, are more primitive.

In the Eichkogel sample the M1 are slightly narrower and their lingual cuspules are better differentiated, especially the accessory cuspule. Nonetheless, the sample is roughly compatible with *A. vinea* in size and morphology.

There are some minor differences in the dental proportions, the anterior premolars p1 and P2 row being bigger, and in the number of premolar roots. In spite of such differences I consider these samples to be closely related to *A. vinea*. Hence, at least the denomination *A.* aff. *vinea* is warranted for the Schernham sample. Based on the lack of distinctive characters, the smaller samples from the other Vallesian localities can only be denominated *A.* cf. *vinea*. As the Eichkogel sample has a small P2, it probably belongs to *A. vinea*.

This and other species of the genus have made a real odyssey through systematics. STORCH (1978) described the subspecies "*Desmana*" *pontica vinea* from Dorn-Dürckheim. RÜMKE (1985) elevated the subspecies to species rank and referred it to the genus *Dibolia* RÜMKE, 1985. She also referred the *Desmana pontica*? from Kohfidisch to *Dibolia vinea*. As the genus name *Dibolia* was preoccupied, RZEBIK-KOWALSKA (1994) created *Ruemkelia* for this desman. HUTTERER (1995) recognised that the name *Archaeodesmana* TOPACHEVSKI & PASHKOV, 1983 is available for this desman, hence a replacement name was not necessary.

A. aff./cf. *vinea* is by far the most common talpid in the Schernham sample and in Richardhof-Golfplatz-A/7 as well as in Götzendorf. In the other samples it is outranged by *Desmanella*.

Storchia DAHLMANN, 2001

Type species: *Storchia woelfersheimensis* DAHLMANN, 2001

Storchia biradicata n. sp.
Figs. 8–9

E t y m o l o g y :   Latin biradicatus, -a = double-rooted; the P2 is consistently double-rooted.

H o l o t y p e :   left dentary fragment with p1–m2, cat.-no. NHMW 2004z0190/0001, fig. 9/1

M e a s u r e m e n t s   o f   t h e   h o l o t y p e :   Lp1-p4 5.85; p1 1.30x0.71; p2 1.46x0.78; p3 1.59x0.92; p4 1.81x1.06; m1 2.28x1.06x1.25; m2 2.32x1.21x1.28.

T y p e   l o c a l i t y :   Schernham, Hausruck-Kobernaußerwald area, fluvial complex in the Molasse Basin, Upper Austria.

A g e :   Early Late Miocene, Upper Vallesian, MN 10 (DAXNER-HÖCK 2004b)

P a r a t y p e s   (measurements see tab. 6):

Schernham	NHMW 2004z0190/0000–0013
	4 dentary fragments with teeth, 5 maxillary fragments with teeth,
	88 isolated teeth

R e f e r r e d   m a t e r i a l   (measurements see tab. 6):

Eichkogel	*S. biradicata*, NHMW 2004z0189/0000
1993/0008/0016	9 isolated teeth
1974/1680	12 isolated teeth
Richardshof-Wald	*S.* cf. *biradicata*, NHMW 2004z0191/000
Rh-94/1	left m1, right P4, right M3
Rh 94/5A	left P4, right M2
Richardshof- Golfplatz	*S.* cf. *biradicata* NHMW 2004z0192/0000
RH-A/2	right dentary fragment with m2, 13 isolated teeth
RH-A/7	2 left m1-fragments
Stixneusiedl	*S.* cf. *biradicata* NHMW 2004z0193/0000
1990/1517/21–22	left M2 and left M3
Götzendorf	*S. biradicata*, NHMW 2004z0194/0000
Gö 1, 1990/14	right m1
Gö 1,1990/15	4 isolated teeth
Gö 1, 1990/16	5 isolated teeth
Gö 2, 1990/22	left maxillary with P4 –M1, left M2-fragment
Gö 4, 1990/1508	right M2, right M3

D i a g n o s i s :   *Storchia* species with the following characters: dentary with mental foramen between the roots of m1 and below the anterior root of p2; p1 single-rooted, p2–p4 double-rooted, p2<p3, weak metacristid on the m2 and m3; P2 double-rooted and
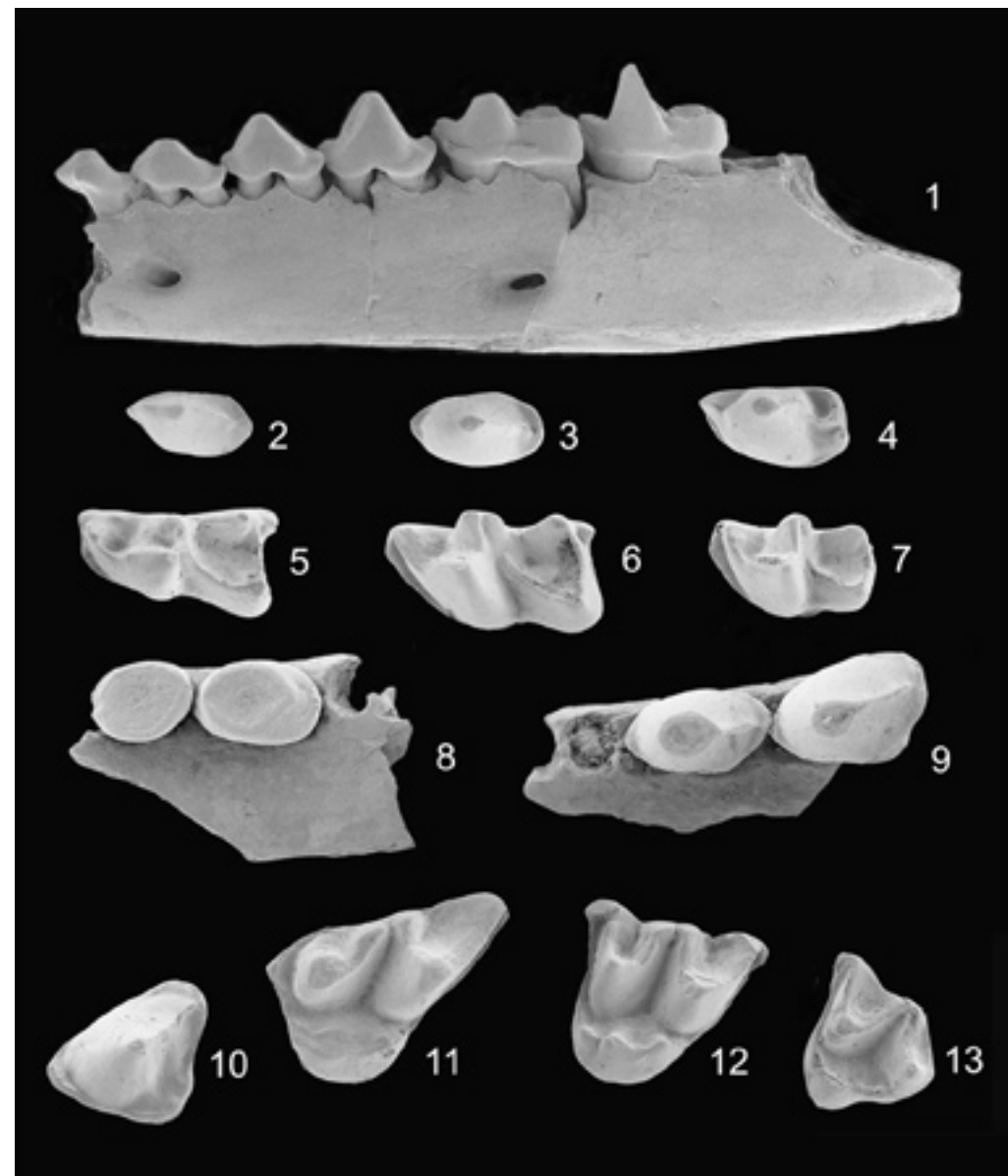
Fig. 9: *Storchia biradicata* n. sp., Schernham. 1. buccal view, – Ca. 7,5x. 2.–13. occlusal view, – Ca. 10x.
1. Left dentary fragment with p1-m2, holotype, NHMW 2004z0190/0001.
2. Left p2, NHMW 2004z0190/0002.
3. Left p3, NHMW 2004z0190/0003.
4. Left p4, NHMW 2004z0190/0004.
5. Right m1, NHMW 2004z0190/0005.
6. Left m2, NHMW 2004z0190/0006.
7. Left m3, NHMW 2004z0190/0007.
8. Right maxillary fragment with P1-P2, NHMW 2004z0190/0008.
9. Right maxillary fragment with P2-P3, NHMW 2004z0190/0009.
10. Left P4, NHMW 2004z0190/0010.
11. Left M1, NHMW 2004z0190/0011.
12. Left M2, NHMW 2004z0190/0012.
13. Left M3, NHMW 2004z0190/0013.

Tab. 6: *Storchia biradicata*, sample statistics of the teeth.

locality	meas.	n	R	m	s	V
Schernham	Lp1-p4	1		5.85		
Schernham	Lp1	1		1.30		
	Wp1	1		0.71		
Schernham	Lp2	4	1.43–1.51	1.46		
	Wp2	4	0.71–0.81	0.77		
Schernham	Lp3	6	1.54–1.62	1.58±0.03	0.027	1.74
	Wp3	6	0.85–0.95	0.91±0.04	0.039	4.24
Schernham	Lp4	7	1.69–1.88	1.78±0.06	0.059	3.30
	Wp4	6	1.00–1.06	1.04±0.03	0.025	2.43
Eichkogel	Wpm1	3	1.23–1.26	1.25		
Schernham	Lm1	8	2.21–2.35	2.29±0.05	0.054	2.35
	Wam1	8	1.00–1.21	1.07±0.06	0.069	6.44
	Wpm1	8	1.18–1.35	1.26±0.06	0.065	5.18
	Wp/L%	8	50.9–60.2	55.0±2.8	3.116	5.66
Rh-94/1	Lm1	1		2.31		
	Wam1	1		1.02		
	Wpm1	1		1.18		
	Wp/L%	1		51.1		
RH-A/2	Wam1	1		0.97		
	Wpm1	1		1.14		
Götzendorf	Lm1	1		2.27		
	Wam1	4	0.99–1.15	1.05		
	Wpm1	3	1.19–1.20	1.19		
	Wp/L%	1		52.9		
Eichkogel	Wpm2	1		1.25		
Schernham	Lm2	12	2.26–2.42	2.32±0.03	0.048	2.05
	Wam2	12	1.15–1.28	1.21±0.03	0.041	3.36
	Wpm2	12	1.17–1.31	1.23±0.03	0.045	3.63
	Wp/L%	12	51.1–55.9	53.1±1.17	1.757	3.31
RH-A/2	Lm2	2	2.32–2.36	2.34		
	Wam2	2	1.16–1.18	1.17		
	Wpm2	2	1.22–1.25	1.24		
	Wp/L%	2	51.1–53.9	52.8		
RH-A/7	Wam2	2	1.12–1.13	1.13		
	Wpm2	1		1.23		
Götzendorf	Lm2	4	2.25–2.33	2.29		
	Wam2	4	1.11–1.24	1.18		
	Wpm2	4	1.16–1.26	1.20		
	Wp/L%	4	50.2–54.5	52.3		
Eichkogel	Lm3	3	1.81–1.89	1.86		
	Wam3	3	1.01–1.08	1.04		
	Wpm3	3	0.84–0.94	0.89		
	Wa/L%	3	46.9–49.7	48.0		
Schernham	Lm3	11	1.83–1.96	1.88±0.03	0.039	2.09
	Wam3	12	0.97–1.10	1.05±0.03	0.044	4.17
	Wpm3	11	0.85–0.96	0.91±0.03	0.037	4.04
	Wa/L%	12	53.0–58.8	56.3±1.3	1.921	3.41
RH-A/2	Lm3	2	1.76–1.79	1.78		
	Wam3	3	1.01–1.10	1.04		
	Wpm3	2	0.84–0.91	0.88		
	Wa/L%	2	56.4–57.4	56.9		
RH-A/2	Ll1	1		1.49		
	Wl1	1		0.79		
Schernham	LP1	1		1.19		
	WP1	1		0.92		
Eichkogel	LP2	1		1.75		
	WP2	1		1.06		
	WP2/LP2	1		60.6		
Schernham	LP2	10	1.45–1.70	1.55±0.05	0.071	4.62
	WP2	10	0.93–1.10	1.02±0.03	0.045	4.35
	WP2/LP2	10	60.0–71.9	66.3±2.9	3.849	5.80
Eichkogel	LP3	2	1.76–1.81	1.79		
	WP3	2	1.11–1.33	1.22		
Schernham	LP3	4	1.69–1.90	1.80		
	WP3	5	1.15–1.31	1.22±0.09	0.068	5.53
Schernham	LP4	15	1.82–2.13	2.00±0.05	0.089	4.44
	WP4	12	1.35–1.58	1.49±0.04	0.064	4.31
Rh-94/1	LP4	1		1.27		
Rh-94/5A	LP4	1		1.86		
	WP4	1		1.29		
RH-A/2	WP4	1		1.20		
Eichkogel	LbM1	2	2.86–2.86	2.86		
	WM1	2	1.86–1.90	1.88		
Schernham	LbM1	11	2.69–2.90	2.80±0.05	0.068	2.42
	WM1	11	1.74–1.96	1.83±0.03	0.068	3.74
RH-A/2	LbM1	1		2.69		
	WM1	1		1.86		
Götzendorf	LbM1	1		2.78		
	WM1	1		1.87		
Eichkogel	LbM2	1		2.14		
	WaM2	1		2.34		
Schernham	LbM2	4	1.98–2.32	2.17		
	WaM2	3	2.16–2.25	2.21		
Rh-94/5A	LbM2	1		2.28		
	WaM2	1		2.36		
Stixneus.	WaM2	1		2.10		
RH-A/2	WaM2	1		2.15		
Götzendorf	LbM2	1		2.16		
	WaM2	1		2.24		
Eichkogel	LM3	2	1.32–1.46	1.39		
	WaM3	2	1.71–2.08	1.90		
Schernham	LM3	7	1.34–1.45	1.41±0.04	0.038	2.67
	WaM3	7	1.69–1.83	1.76±0.06	0.056	3.16
Rh-94/1	LM3	1		1.39		
	WaM3	1		1.73		
Stixneus.	LM3	1		1.35		
	WaM3	1		1.85		
RH-A/2	LM3	4	1.36–1.48	1.40		
	WaM3	4	1.58–1.79	1.71		
Götzendorf	LM3	1		1.35		
	WaM3	1		2.02		

bigger than P3; P3 and P4 triple-rooted; P4 with small lingual flange without protocone, with hardly projecting parastyle; upper molars with divided mesostyle, well-developed metaconule and a hardly to undeveloped paraconule.

Description of the holotype: The dentary is broken in front of p1 and behind the anterior alveole of m3. It preserves the anterior mental foramen below the anterior root of p2 and the posterior one between the roots of m1. Compared to other desmans, the teeth are rather slender, the anterior premolars even slightly incisive. The single-rooted p1 and the double-rooted p2 have a mesial and a distal crest each but, if at all, only poorly developed cuspules. In p3 the crests are suppressed and the mesial and distal cuspule are well developed. These cuspules are even more marked in the p4. This premolar has an emargination on its disto-lingual face. The molars show the apomorphic character of the genus, the low paraconid, which is the lowest of all cusps. In the m1 the metaconid is situated disto-lingually from the protoconid. The oblique cristid extends far lingually in both molars. In the m2 it joins a moderately developed metacristid. In the m2, the precingulid is more marked under the paraconid, whereas it is better developed below the paralophid in the m1.

Description of paratypes and referred material

Except for the m3, all mandibular teeth are included in the holotype. The m3 is the smallest molar and, moreover, differs from the m2 in its reduced talonid. The number of upper premolars is unknown. The worn specimens show the horizontal wear facet, which is typical for desmans among the talpids. The P1 can correctly be identified because it is in a maxillary fragment with P2, which itself is preserved in another maxillary fragment with P3. The double-rooted P1 is heavily worn down and oval in occlusal outline. The P2 differs from P1 in its bigger size and in the

presence of a postcingulum. All ten P2 are double-rooted. The P3 is bigger than the P2, triple-rooted, and has an incipient disto-lingual heel. In morphology it is intermediate between P2 and P4. The P4 has a well-developed mesial cuspule and a disto-lingual heel without protocone. The distal crest becomes increasingly cutting from P2, where it is only incipient, to P4. In the upper molars the mesostyle is clearly divided by a narrow gap. The M1 bears a marked metaconule but no or at best a vestigial protoconule. The preprotoconule crest is continuous with the paracingulum, which joins the parastyle. The postmetaconule crest is continuous with the metacingulum. The M2 has a small protoconule. The paracingulum is less developed than in the M1. In the M3 the metaconule stands close to the metacone.

No humeri can be definitively associated with the teeth. The Schernham fauna does not include any desmanine humeri. In Götzendorf, 58 dental remains of *Archaeodesmana* co-occur with only 12 teeth of *Storchia*. Most of the four desmanine humerus fragments from this fauna probably belong to *Archaeodesmana*.

C o m p a r i s o n   a n d   d i s c u s s i o n

Thus far, *Storchia* is a monospecific genus, *S. wedrevis* from Wölfersheim being the only record. D AHLMANN (2001) referred three teeth from Dorn-Dürckheim to *Storchia* sp. Despite the scarce record, the genus is sufficiently characterised by the low paraconid of the lower molars, a character not known from any other talpid species, with one exception: "*Desmanella*" *quinquecuspidata* M AYR & F AHLBUSCH, 1975 from the Hammerschmiede fauna near Kaufbeuren in Bavaria. Because of the desmanine affinities of this species, E NGESSER (1980) and R ÜMKE (1985) rejected its affiliation with the genus *Desmanella*. M AYR & F AHLBUSCH (1975) mention that the paraconid is higher than the entoconid and hypoconid in the lower molars. However, pl. 6, fig 1a clearly shows that the paraconid is the lowest cusp. The low paraconid is unique to *Storchia*. Therefore, I suggest assigning *quinquecuspidata* to the genus *Storchia*. This was already proposed with some hesitation by D AHLMANN (2001). He studied the Hammerschmiede sample and mentioned the differences and similarities with *Storchia wedrevis*. In my opinion, *quinquecuspidata* can be unequivocally referred to *Storchia*. The differences between the samples from the Hammerschmiede, from Wölfersheim and from Schernham are mere species differences. The present samples must be delimited against these species.

S. biradicata differs from *S. wedrevis* in the:
– double-rooted P2, which, moreover, is shorter and more compact;
– presence of a moderately developed metacristid in m2 and m3.

S. biradicata differs from *Storchia* sp. from Dorn-Dürkheim in the:
– more posterior position of the posterior mental foramen;
– bigger P4 with its less projecting parastyle and its less extended lingual heel.

S. biradicata differs from *S. quinquecuspidata* in the:
– more posterior position of the posterior mental foramen;
– more lingual extension the oblique cristid of the lower molars;
– absence of a protoconule in M1 and M3;
– absence of a cusp on the lingual heel (protocone) of the P4.

The Schernham sample represents the largest and most informative sample of the genus. There is no alternative to the combination of lower and upper dentition. The Schernham sample is clearly homogeneous. Triple-rooted P2 and P3 are an advanced character in

desmans (H UTCHISON 1974). Regarding its only double-rooted P2 but already triple-rooted P3, *S. biradicata* is primitive. Furthermore, in most desmans, p2 and P2 are longer than or least as long as p3 and P3, i.e. the latter are reduced. In *S. biradicata*, p3 and P3 are bigger than in their predecessors, i.e. not reduced in size. The Richardshof-Golfplatz samples are of Early Vallesian correlation (MN 9), as is the Hammerschmiede fauna. The lower molars are more compact in *S. quinquecuspidata*. Hence, *Storchia* teeth from all Austrian samples under study are at least closely related to the new species. The M2 from the Rh-94/5A sample lacks the para- and metacingulum and is distinctly wider than in Schernham. It possibly represents a fourth talpid in the Rh-94/5A talpid sample. The small samples from Stixneusiedl, Richardhof-Golfplatz, and Richardhof-Wald can only be determined as *Storchia* cf. *biradicata*.

A trend to more slender molars over time, as suggested by D AHLMANN (2001), is elusive. For example the ratio Wp*100/L of the m1 from Schernham covers a wide range from 50.9% to 60.2%. This range includes the correspondent ratios from the Hammerschmiede and from Dorn-Dürckheim. The m2 from Schernham are more slender than in the Hammerschmiede sample, and some are more robust than the Wölfersheim specimen. The m3 from Schernham are also intermediate in robustness between Hammerschmiede and Wölfersheim. Concerning slenderness, the m2 and m3 from RH-A/2 correspond well to the Schernham sample. Concerning the slenderness of the m3, *Storchia* from Eichkogel represents the most advanced sample. These are the first records of the genus *Storchia* in Austria and even the first out of Germany[2].

Talpinae F ISCHER VON W ALDHEIM, 1817

Scalopini T ROUESSART, 1879

Proscapanus G AILLARD, 1899

Type species: *Talpa sansaniensis* L ARTET, 1851

***Proscapanus austriacus* n. sp.**
Fig. 10

E t y m o l o g y : The type locality is located in Austria.

H o l o t y p e : Left M1, cat.-no. NHMW 2004z0196/0001, fig. 10/5

M e a s u r e m e n t s   o f   t h e   h o l o t y p e : 2.55x1.86.

T y p e   l o c a l i t y : Schernham, Hausruck-Kobernaußerwald area, fluvial complex in the Molasse Basin, Upper Austria.

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[2] Note added in proof: By the end of 2005 the publication of S ABOL (2005) on the insectivores from the Bonanza site near Devínska Nová Ves (Slovakia) appeared. He described the new desman species *Storchia meszaroshi* on the basis of a right dentary fragment with m2-m3. This new species represents the earliest record of the genus, extending its range into the Middle Miocene (MN 6). It could not have been taken into account in the present study. The teeth of this species are the smallest known from all species of *Storchia* and cannot be confused with *S. biriadicata*.
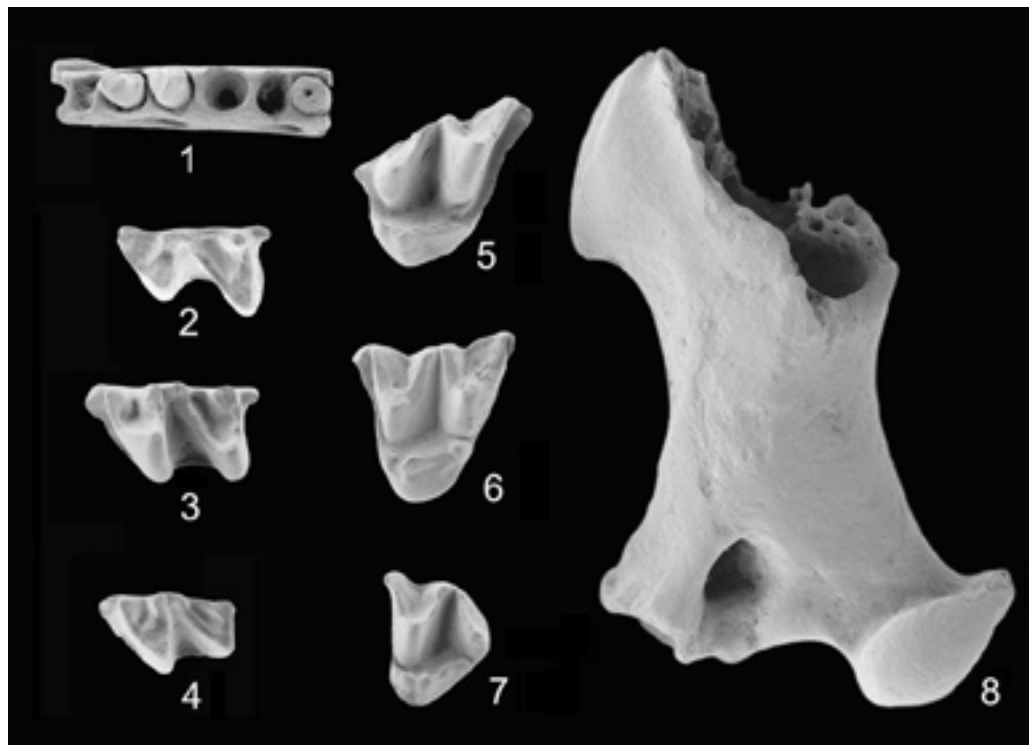
Fig. 10: *Proscapanus austriacus* n. sp., Schernham. – Ca. 10x
1. Left dentary fragment with p1-p2, occlusal view, NHMW 2004z0196/0002.
2. Right m1, occlusal view, NHMW 2004z0196/0003.
3. Left m2, occlusal view, NHMW 2004z0196/0004.
4. Right m3, occlusal view, NHMW 2004z0196/0005.
5. Left M1, holotype, occlusal view, NHMW 2004z0196/0001.
6. Left M2, occlusal view, NHMW 2004z0196/0006.
7. Left M3, occlusal view, NHMW 2004z0196/0007.
8. Right humerus, cranial view, NHMW 2004z0196/0008.

A g e : Early Late Miocene, Upper Vallesian, MN 10 (DAXNER-HÖCK 2004b)

P a r a t y p e s (measurements see tab. 7):

NHMW 2004z0196/0000–0008   left dentary fragment with p1-p2, left dentary fragment with m3, 29 isolated teeth, 2 humerus fragments

D i f f e r e n t i a l   d i a g n o s i s : Medium-sized species of *Proscapanus*, differing from *P. sansaniensis* (LARTET, 1851) mainly in the smaller size of the teeth and in the better developed metastylids of the lower molars. It differs from the roughly commensurate *P. intercedens* ZIEGLER, 1985 in the single-rooted p1–p3, in the absence of a precingulid in m1, and in the more deeply divided and more spaced mesostyles in M1–3. It is differentiated from *P. lehmanni* (GIBERT, 1975) in its distinctly smaller size (except m1), in the absence of cingulids in m1, and in the more anterior position of the mental foramina.

Tab. 7: *Proscapanus austriacus* n. sp., Schernham, sample statistics of the teeth

locality	meas.	n	R	m	s	V
Schernham	Lp1	1		0,61		
	Wp1	1		0,42		
Schernham	Lm1	3	2,02–2,10	2,05		
	Wam1	3	1,03–1,07	1,05		
	Wpm1	3	1,22–1,30	1,27		
Schernham	Lm2	5	2,22–2,39	2,29±0,10	0,071	3,11
	Wam2	5	1,35–1,50	1,41±0,09	0,065	4,59
	Wpm2	5	1,23–1,38	1,31±0,08	0,054	4,12
Schernham	Lm3	3	1,86–2,09	1,96		
	Wam3	4	1,11–1,25	1,16		
	Wpm3	4	0,78–1,00	0,86		
Schernham	LbM1	2	2,55–2,61	2,58		
	WM1	2	1,86–1,87	1,87		
Schernham	LbM2	5	2,11–2,24	2,16±0,08	0,056	2,58
	WaM2	8	2,09–2,21	2,18±0,04	0,042	1,95
Schernham	LM3	7	1,39–1,55	1,49±0,06	0,058	3,92
	WaM3	7	1,79–1,92	1,86±0,06	0,057	3,09

D e s c r i p t i o n   o f   t h e   h o l o t y p e : In the M1 the paracone lacks a mesial crest. The mesostyle is deeply divided and spaced. The parastyle is hardly projecting. The paraconule is well differentiated but small. Its mesial crest is continuous with the broad, ledge-shaped paracingulum, which itself joins the parastyle. There is no metaconule. The postprotocrista is continuous with the broad metacingulum, which extends to the disto-labial corner above the metastyle.

D e s c r i p t i o n   o f   p a r a t y p e s

D e n t a r y : There are only two fragments, one with m3, which preserves the alveoles of p3–m3. There is no posterior mental foramen, which is expected below p4. The other dentary fragment preserves the single-rooted p1 and p2 in situ, the p3 alveole, the two p4 alveoles, and three alveoles anterior to p1, one for the slightly inclined canine and two for procumbent incisors. The fracture prevents a decision on whether one incisor alveole is eliminated or only broken. The anterior mental foramen is situated under p2, the posterior one below the front-root of p4.

L o w e r   t e e t h : p1 and p2 are of roughly the same size, single-rooted, ovoid in occlusal outline, each with a mesial crest and a distal cuspule. Both are only slightly inclined anteriorly. The molars are graded in size, m2>m1≈m3. The most conspicuous character in the lower molars is the oblique cristid joining a marked metacristid. Both crests fuse in a marked metastylid, which is lower than the metaconid. Due to the small trigonid angle, the trigonid is extremely short in the m2 and m3. In the m1 the talonid is distinctly wider than the trigonid, in the m3 it is narrower, and in the m2 both are similar in width. The m1 lacks cingulids; rudiments, however, are present below the buccal re-entrant valley and near the hypoconulid. The m2 and m3 have a marked precingulid.

U p p e r   m o l a r s : The second M1 is quite similar to the holotype. In the M2 the mesostyle is deeply divided and spaced. In unworn specimens, the paraconule and metaconule are moderately differentiated. In two M2 the preparaconule crista tapers, in six specimens it is continuous with a weak paracingulum. A thin metacingulum is developed

only in one M2. In the M3 the mesostyle also is divided and spaced, the paraconule is only moderately differentiated. The postprotoconule crista terminates in a more or less developed swelling. The preparaconule crista tapers. There is no indication of a paracingulum.

H u m e r i : Two humerus fragments, broken above the pectoral tubercle, are present. In the right specimen the whole edge-shaped teres tubercle is preserved. Distally, there are two scalopine characters: the comparatively small supratrochlear fossa and the only shallow notch between trochlea and the fossa for the m. flexor digitorum ligament. Hence, both specimens belong to *Proscapanus*, the only Scalopini represented by teeth. The measurements (left: DS 2.90, Wdwe 5.70; right DS 3.25, Wdwe 6.60) principally do not exceed the size variability of a homogeneous sample. With certainty, both belong to the larger *P. austriacus*. The smaller humerus does not match in size to the small teeth of *P. minor*. Even smaller humeri can be associated with these teeth.

D i s c u s s i o n

Proscapanus is a temporo-spatially widely distributed genus in the Miocene of Europe. The Agenian *P. primitivus* HUTCHISON, 1974 was referred to *Hugueneya* VAN DEN HOEK OSTENDE, 1989 by the author of this genus. The earliest record of true *Proscapanus* is *P. intercedens* from Petersbuch 2 (MN 4), which is structurally ancestral to the late Early to Middle Miocene *P. sansaniensis* (ZIEGLER 1985). The only described Vallesian record of the genus is *P. lehmanni* (GIBERT, 1975) from Castell de Barbera in Spain, which is correlated with MN 9. Based on the number of premolar roots and the spacing of the mesostyle in the upper molars, *P. austriacus* is at the same evolutionary level as *P. sansaniensis*. GIBERT (1975) described *Domninoides santafei* on the basis of one m2 and one m3 from Castell de Barbera. In overall morphology these teeth better fit *Proscapanus*, but they are somewhat smaller than in *P. austriacus*. The new species from Schernham represents the latest record of the genus in Europe.

Proscapanus minor n. sp.
Fig. 11

E t y m o l o g y : Latin minor = smaller. *P. minor* is smaller than any other species of the genus.

H o l o t y p e : right M1, cat.-no. NHMW 2004z0197/0001, fig. 11/4

M e a s u r e m e n t s   o f   t h e   h o l o t y p e : 2.02x1.72

T y p e   l o c a l i t y : Schernham, Hausruck-Kobernaußerwald area, fluvial complex in the Molasse Basin, Upper Austria.

A g e : Early Late Miocene, Upper Vallesian, MN 10 (DAXNER-HÖCK 2004b)

P a r a t y p e s   a n d   m e a s u r e m e n t s :

Schernham	NHMW 2004z0197/0000–0006	
A1	left m1	1.88x0.91x1.03
B1	left m2	1.90x1.20x1.19
B2	left m2	1.81x1.17x1.09
C1	left m3	1.62x1.00x0.83
C2	left m3	l 1.56x0.99x0.78
D1	right m3	no measurements
F1	left M2	1.62x1.88
F2	left M2	1.59x1.68
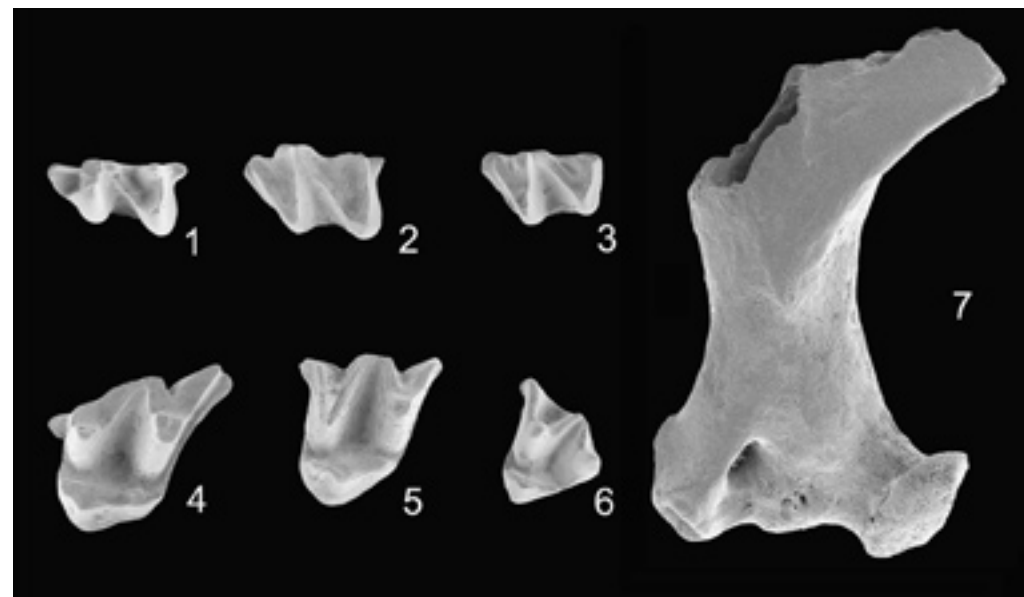
Fig. 11: *Proscapanus minor* n. sp. – Ca. 10x
1. Left m1, occlusal view, Schernham, NHMW 2004z0197/0002.
2. Left m2, occlusal view, Schernham, NHMW 2004z0197/0003.
3. Left m3, occlusal view, Schernham, NHMW 2004z0197/0004.
4. Right M1, holotype, occlusal view, Schernham, NHMW 2004z0197/0001.
5. Left M2, occlusal view, Schernham, NHMW 2004z0197/0005.
6. Left M3, occlusal view, Schernham, NHMW 2004z0197/0006.
7. Right humerus, cranial view, Richardhof-Wald, NHMW 2004z0198/0001.

G1	right M2	1.58x1.83
H1	left M3	1.19x1.55
J1	right M3	1.15x –

R e f e r r e d   m a t e r i a l   a n d   m e a s u r e m e n t s :

Rh-94/1	Richardhof-Wald	NHMW 2004z0198/000–0001
A1	left p4	1.25x0.67
A2	left p4	1.28x0.71
A3	right p4	1.25x0.74
B1	right P4	1.50x1.23
B2	right P4	1.43x1.25
B3	right P4	1.53x–
C1	right M2	1.65x1.85
C2	left humerus	DS 2.48
D2	right humerus	DS 1.96; WdwEpi 4.38
RH-A/2	Richardhof-Golfplatz	NHMW 2004z0199/000
1	left m1	1.89x1.05x1.33
2	right m2	2.00x1.21x–
3	right m3	1.77x1.03x0.76
4	right M1	2.34x1.77
5	right M2	>1.7x2.07
6	right M2	–x2.04
7	left M3	1.04x1.42

D i f f e r e n t i a l   d i a g n o s i s : Differs from all *Proscapanus* species in its distinctly smaller size. Differs from *P. intercedens*, which is nearest in size, in the deeper-notched and more widely spaced mesostyle of the upper molars and in the less-developed para-cingulum of M1.

D e s c r i p t i o n   o f   t h e   h o l o t y p e : The M1 is rather worn. The mesostyle is deeply notched and spaced. Para- and metaconule are well differentiated. The pre-protoconule crista is continuous with a faint paracingulum; the postmetaconule crista joins the well-developed metacingulum, which extends to the metastyle. The parastyle is projecting.

D e s c r i p t i o n   o f   p a r a t y p e s   and referred material

There are hardly any morphological differences between the teeth of *P. austriacus* and *P. minor*. Therefore, only the differences are listed here. The m1 has a faint precingulid and the cingulid below the buccal re-entrant valley is stronger. In the M1 and M2 the lingual conules are better differentiated. The paracingulum of the M1 is weaker, hence the parastyle is more projecting. M2 and M3 have neither a para- nor metacingulum. The m3 of the RH-A2 sample is intermediate in size between *P. minor* and *P. austriacus*. I cannot exclude that it belongs to the latter species.

D i s c u s s i o n

P. minor is the smallest species of the genus thus far known. The most urgent question is: Do both Schernham *Proscapanus* species really represent two different biological entities, or is the bimodal size distribution sufficiently explainable by sample bias? If we lump both species together and express the length of the smallest tooth of one tooth position as a percentage of the largest, we obtain percentages between 70.5% (M2) and 77.4% (LM1). In the *P. sansaniensis* samples of Sansan (type locality) and Sandelzhausen, the corresponding values range between 84% and 90%. Only the m1 from Schernham (89.5%) match the percentages of Sansan (89.8%) and Sandelzhausen (89.4%). However, the m1 of both Schernham species differ morphologically in the presence/absence of a precingulid. This means that in the homogeneous samples from Sansan and Sandelzhausen, the size variability is smaller than in the obviously mixed sample of Schernham. Therefore, I consider the distinction of two *Proscapanus* species in Schernham to be justified for morphological and metrical reasons. The small sample (7 isolated teeth) from Richardhof-Golfplatz (RH-A/2) clearly belong to *Proscapanus*. As the m1 has a moderately developed precingulid and ectocingulid below the buccal re-entrant valley, and because of its small size, it is only referable to *P. minor*. The m2 fits well in size. The m3 is somewhat large but compatible with an allocation to the small *Proscapanus*. In the sample from Richardhof-Wald (Rh-94/1) the small teeth show the morphology of *Proscapanus*. The two small humerus fragments definitely represent scalopine humeri: The scalopine characters are the small supratrochlear fossa and the shallow notch between trochlea and the fossa for the m. flexor digitorum ligament.

The presence of two species of the same genus in one fauna raises the question of competition. In the Sandelzhausen and Petersbuch 31 samples, there also two species of *Proscapanus*: *P. sansaniensis* and a smaller *Proscapanus* sp. (ZIEGLER 2000, 2003). This smaller *Proscapanus* is not identical with *P. minor*. In the small *Proscapanus* from Sandelzhausen, the M2 is distinctly wider; in Petersbuch 31, the m2 and the M1 are bigger.

The co-occurrence of two species of one genus in the same fauna is quite common for other insectivore genera and for rodents. For example, the erinaceid *Galerix* is often represented by two species in one fauna, as is also the case for the rodent *Democricetodon*. Two *Talpa* species have been reported from Dorn-Dürkheim (STORCH 1978): *T. vallesensis* VILLALTA & CRUSAFONT, 1944, and *T. gilothi* STORCH, 1978. DAHLMANN (2001) even provided evidence for three *Talpa* species in the early Pliocene Wölfersheim fauna: *Talpa gilothi*, *Talpa minor* FREUDENBERG, 1941, and *Talpa fossilis* PETÉNYI, 1864.

In the extant fauna, two *Talpa* species coexist in several regions. In the Balkans, for example, the Blind mole, *Talpa caeca,* is sympatric with the common mole, *Talpa europaea*. To avoid competition, the latter species populates wetter places with deep soil, while the smaller *T. caeca* is displaced onto dryer, rockier ground (MITCHEL-JONES et al. 1999).

Interspecific competition can also be avoided be different feeding habits, which are not discernible in scarce dental remains, or by different circadian rhythms.

Talpini FISCHER VON WALDHEIM, 1817

Talpa LINNAEUS, 1758

Type species: *Talpa europaea* LINNAEUS, 1758

Talpa aff. *minuta* BLAINVILLE, 1838
Fig. 12

M a t e r i a l (measurements see tab. 8, 9)

Eichkogel 1993/0008/0016	NHMW 2004z0200/0000 right p4, left m2-trigonid, left P4-fragment, right M1-fragment
Schernham	NHMW 2004z0201/0000–0008 17 isolated teeth, 4 humerus fragments

D e s c r i p t i o n

Only isolated teeth and additionally four humerus fragments from Schernham are preserved.

L o w e r   d e n t i t i o n : The teeth show the general morphology of *Talpa minuta*. The p4 from the Eichkogel sample has a short talonid, as all *Talpa* species. The lower molars are graded in size, with m3≤m1<m2. In all lower molars the talonid is lingually open. In the m1 the oblique cristid extends to the middle of the trigonid rear face. There is only a rudimentary ectocingulid below the buccal re-entrant valley and a faint swelling below the paraconid. In the m2 the oblique cristid extends horizontally to the base of the metaconid. The precingulid is reduced to a protrusion below the paraconid. The m3 has a reduced talonid without hypoconulid. A metacristid is developed in two specimens. The trigonid is as in m2.

Tab. 8: *Talpa* aff. *minuta*, Schernham, sample statistics of the teeth.

locality	meas.	n	R	m		locality	meas.	n	R	m
Eichkogel	Lp4	1		1.25		Schernham	LP4	2	1.44–1.52	1.48
	WSp4	1		0.66			WP4	2	0.62–0.73	0.68
Schernham	Lm1	2	1.47–1.52	1.50		Eichkogel	LbM1	1		2.08
	Wam1	2	0.75–0.77	0.76		Schernham	LbM1	4	2.11–2.31	2.19
	Wpm1	2	0.92–0.97	0.95			WM1	3	1.33–1.50	1.42
Eichkogel	Wam2	1		1.03		Schernham	LbM2	2	1.88–1.91	1.90
Schernham	Lm2	1		1.86			WaM2	2	1.68–1.77	1.73
	Wam2	1		1.04		Schernham	LM3	1		1.03
	Wpm2	1		0.97			WaM3	1		1.44
Schernham	Lm3	4	1.38–1.51	1.45						
	Wam3	4	0.76–0.80	0.78						
	Wpm3	4	0.57–0.63	0.59						

Tab. 9: *Talpa* aff. *minuta*, Schernham, measurements of the humerus fragments.

|	Schernham (NHMW 2004z0201/0000, 0008)				Sansan*
No	2004z0201/0000			2004z0201/0008	type locality
DS	2.26	2.44	2.20	2.15	2.26–2.60
Wdwe	ca. 4.2				4.78–5.50

* own measurements

U p p e r   d e n t i t i o n : The P4 morphologically resembles that of the extant *T. europaea*. Though the lingual cusp is nearly fully eliminated, and though the lingual talon is reduced to a small convexity, the P4 still has three roots. In the upper molars the lingual cusps are hardly differentiated and the mesostyle is confluent. The M1 has a marked paracingulum joining the projecting parastyle. M2 and M3 have no cingula.

H u m e r u s : There are four fragments without the proximal epiphysis. The teres tubercle is long and angled. The pectoral tubercle is shifted slightly laterally from the axis. The supratrochlear fossa is small, and the notch between trochlea and the fossa for the ligament of the m. flexor digitorum is deeper and more concave than in the Scalopini. The epicondylar wings are broken off. The preserved characters are fully compatible with an allocation of the humeri to *Talpa*.

C o m p a r i s o n   a n d   d i s c u s s i o n

The p4 is somewhat longer than in *T. minuta* from type locality Sansan. The other measurements of the fragments from Eichkogel roughly fit with *T. minuta* from Sansan.

On average, the teeth and humeri from Schernham are somewhat smaller than in *Talpa minuta* from Sansan. The only morphological difference is the absence of a protocone in P4. With respect to this character the Schernham sample is closer to the extant *T. europaea*. The Pliocene to Biharian *T. minor* FREUDENBERG, 1914 is somewhat bigger (see humerus measurements in DAHLMANN 2001: tab. 8). Moreover, we do not expect such a young species in our faunas. The humeri under study are considerably smaller than in *Talpa gilothi* STORCH, 1978, a species from the Early Turolian fauna from Dorn-Dürckheim. The sample from the type locality only comprises some humeri and one dentary fragment with p2–p4 (STORCH 1978). DAHLMANN (2001) reported, along with the hume-
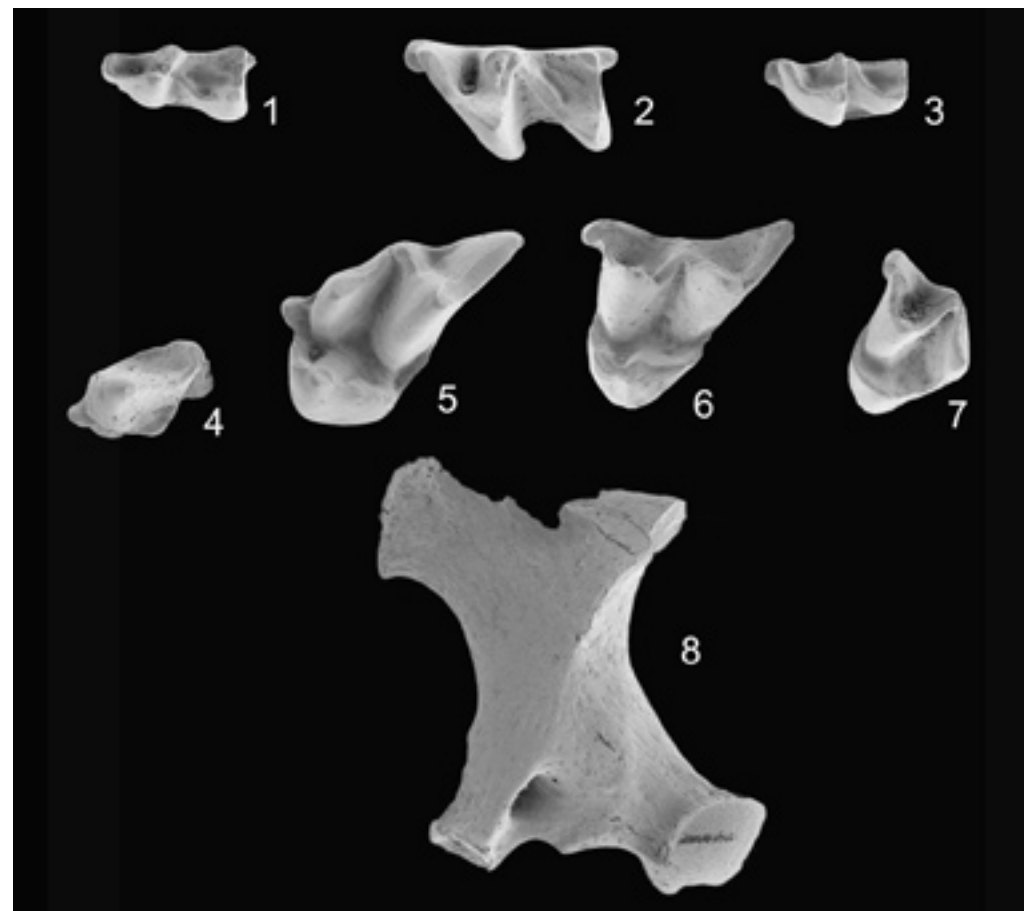
Fig. 12: *Talpa* aff. *minuta*, Schernham. – Ca. 15x
1. Left m1, occlusal view, NHMW 2004z0201/0001.
2. Right m2, occlusal view, NHMW 2004z0201/0002.
3. Left m3, occlusal view, NHMW 2004z0201/0003.
4. Right P4, occlusal view, NHMW 2004z0201/0004.
5. Right M1, occlusal view, NHMW 2004z0201/0005.
6. Left M2, occlusal view, NHMW 2004z0201/0006.
7. Right M3, occlusal view, NHMW 2004z0201/0007.
8. Right humerus, cranial view, NHMW 2004z0201/0008.

ri, some teeth of *T. gilothi* from the Early Pliocene fauna of Wölfersheim. Those teeth are only slightly bigger than the present ones, but their size does not exceed the assumed variability of a bigger Schernham sample. However, the humerus shaft is also distinctly wider. In my opinion, the association of humeri and teeth in the Schernham sample is correct. A constitutive character of *T. gilothi* is the lateral position of the pectoral tubercle. This character and the bigger size prevent an assignation of the Schernham specimens to *T. gilothi*. They show the closest affinities to *T. minuta*. The minor differences are sufficiently taken into account by naming the Schernham sample *Talpa* aff. *minuta*.

Talpa vallesensis VILLALTA & CRUSAFONT, 1944
Fig. 13

M a t e r i a l   (measurements see tabs. 10, 11):

Schernham   NHMW 2004z0203/0000–0004
                             left dentary fragment with m3, left dentary fragment with m2-talonid,
                             8 isolated teeth, 1 nearly complete humerus, 4 fragments

Tab. 10: *Talpa vallesensis*, Schernham, sample statistics of the teeth

locality	meas.	n	R	m		locality	meas.	n	R	m
Schernham	Lm1	3	1.62–1.92	1.79		Kohfidisch	LM1	2	2.87–3.03	2.95
	Wam1	3	0.73–0.87	0.80			WM1	2	1.88–1.98	1.93
	Wpm1	3	0.92–0.95	0.93		Schernham	LM3	1		1.18
Schernham	Lm2	2	2.21–2.32	2.27			WaM3	1		1.63
	Wam2	2	1.00–1.14	1.07						
	Wpm2	3	0.97–1.07	1.01						
Schernham	Lm3	2	1.80–1.81	1.81						
	Wam3	3	0.78–0.83	0.80						
	Wpm3	2	0.55–0.58	0.57						

Tab. 11: *Talpa vallesensis*, measurements of the humeri

Site/no	GL	Wp	Wpwtt	DS	Wdwe	Wd*100/GL	Wp*100/GL
Kohfidisch							
I/11-1	–	–	–	4.03	8.51	–	–
I/11-2	13.5	11.0	9.7	3.97	8.60	63.7	84.5
I/11-3	13.5	10.1	9.3	3.75	8.0	59.3	74.8
I/11-4	–	10.4	–	3.82	8.10	–	–
I/11-5	–	–	–	3.84	8.10	–	–
I/13-1	13.8	–	–	3.71	7.90	57.2	–
II/12-1	–	–	9.1	3.95	–	–	–
II/12-2	–	–	–	3.92	8.40	–	–
Schernham							
2004z0203/0004	14.0	10.6	9.1	3.90	8.30	59.3	66.7
2004z0203/0000	–	–	–	4.10	–	–	–
2004z0203/0000	–	–	–	>3.6	–	–	–
2004z0203/0000	–	–	–	4.00	–	–	–
Viladecaballs*	12.0	9.0	–	–	8.0	66.7	75.0

* Measurements of the holotype from VILLALTA & CRUSAFONT (1944:18)

D e s c r i p t i o n

There is one dentary fragment with m3 and the basis of the ascending ramus, and another fragment with the mental foramen below the posterior alveole of m1. Otherwise, only isolated teeth are available.

T e e t h :   In the m1 the oblique cristid extends horizontally to the middle of the protocristid or slightly buccally to it. There is no vestige of a cingulid. The talonid is lingually
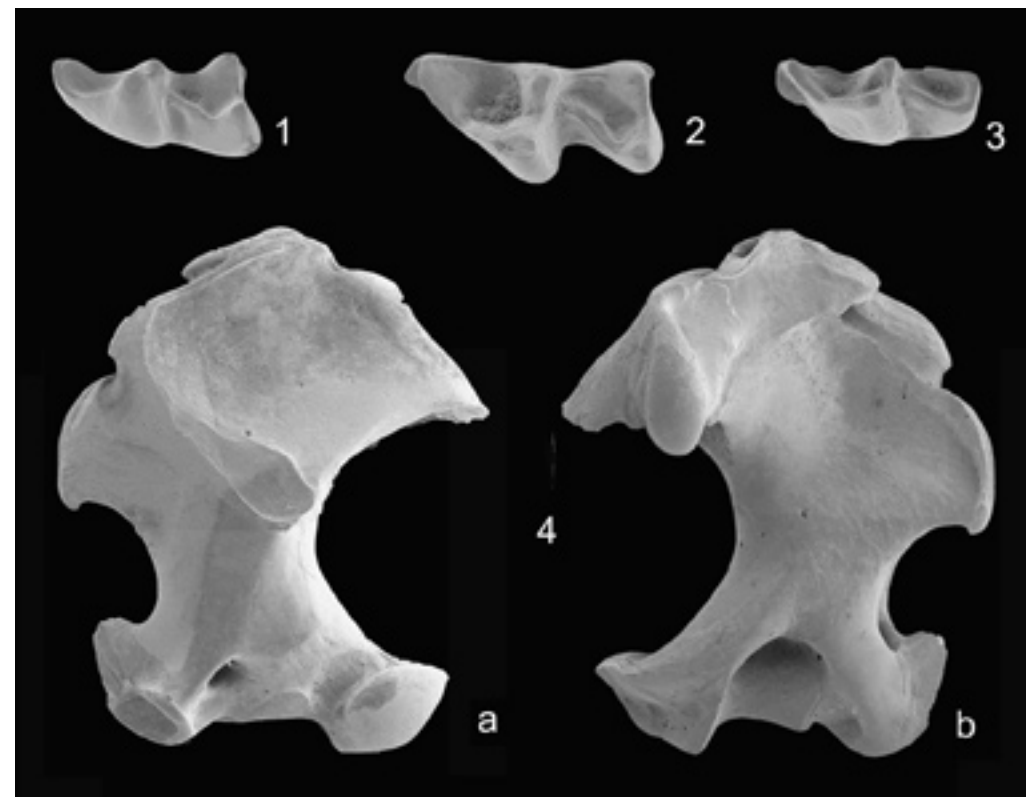
Fig. 13: *Talpa vallesensis*, Schernham
1. Left m1, occlusal view, NHMW 2004z0203/0001. – Ca. 15x.
2. Right m2, occlusal view, NHMW 2004z0203/0002. – Ca. 15x.
3. Left m3, occlusal view, NHMW 2004z0203/0003. – Ca. 15x.
4. Right Humerus, a. cranial, b. caudal view, NHMW 2004z0203/0004. – Ca. 5x.

open. In the m2 and m3 the precingulid is reduced to a short protrusion below the paraconid. The talonid is lingually closed by a low and weak entocristid. The M3 is heavily worn. In occlusal outline and in the absence of the paracingulum it resembles *Talpa*.

H u m e r i :   The associated humeri show the diagnostic characters of the Talpini. The overall robustness is indicative of the true moles, the Scalopini and Talpini. The extremely deep and pocketed brachialis fossa is an exclusive character of the Talpini. Though the ridge between the medial side of the scapular facet and the distal end of the lesser tubercle is complete, there is an abrupt change of plane between the two areas divided by this ridge. Typically, in Talpini this ridge is developed only in its medial half. At the distal epiphysis the notch between the trochlea and the fossa for the ligament of the m. flexor digitorum is somewhat deeper than in a scalopine humerus, e.g. *Proscapanus*. The pectoral tubercle is situated roughly in the midline of the shaft and not displaced laterally as it should be in *T. gilothi*. In the complete specimen (fig. 13/4) the pectoral tubercle is tongue-shaped and looks slightly displaced laterally. Morphologically it would better agree with *T. gilothi*, but in size it compares better with *T. vallesensis*.

Discussion

The humeri under study clearly belong to the genus *Talpa*. Here , they are associated with the large teeth with *Talpa* morphology. In the Schernham sample, there is no alternative to this association. Several *Talpa* species are based on humeri. In *T. gilothi* from the type locality Dorn-Dürkheim, the pectoral tubercle is shifted laterally and the humeri are somewhat smaller (cf. measurements in STORCH 1978: tab. 3; DAHLMANN 2001: tab. 8). In *T. csarnotana* from the Late Ruscinian (MN 15) site Csarnóta in Hungary, the humerus is of similar size and proportion. Its pectoral tubercle, however, extends further distally than in *T. vallesensis* and in the humeri under study. Among the known Late Miocene and younger *Talpa* species of Europe, the Schernham humeri tolerably agree with *Talpa vallesensis*, a species described based on one humerus from Viladecaballs. According to the measurements given in VILLALTA & CRUSAFONT (1944: 56), the complete Schernham specimen is somewhat bigger than the holotype humerus, but both correspond well in the proximal gracility index (sensu VILLALTA & CRUSAFONT 1944: 56 means Wp 100/L = 75 %). Distally, the type specimen is somewhat more robust (Wd*100/GL = 59.3 % for Schernham, 66.7 % for Viladecaballs). The Schernham humeri are slightly smaller than in *T. vallesensis* from Can Llobateres (cf. STORCH 1978: Tab. 2) and thus are intermediate. However, they compare well in size with *T. vallesensis* from Dorn-Dürkheim (cf. STORCH 1978: Tab. 2) and from Eppelsheim (FRANZEN et al. 2003: 97). In any case, they are bigger than the humeri of *Talpa gilothi* from Dorn-Dürkheim (cf. STORCH 1978: Tab. 3), without any overlap in the shaft width.

To date, there is no record of *Talpa vallesensis* with referred dentition. As the proposed association of humeri and dentition is without alternative, the Schernham sample can be definitively designated as *Talpa vallesensis*.

This species is also recorded in the Kohfidisch fauna. Its humeri are also intermediate in size between the smaller holotype humerus from Viladecaballs and the bigger specimens from Can Llobateres. Based on its pectoral tubercle, which is positioned in the midline of the shaft and does not extend far distally, it is less advanced than *T. csarnotana* from Csarnóta 2.

Talpa cf. and aff. *gilothi* STORCH, 1978
Fig. 14

1978   *Talpa gilothi* n. sp.; STORCH: 436, tab. 3. (Kohfidisch material)
1980   *Talpa gilothi* STORCH, 1978; Bachmayer & Wilson, 1980: 362. (Kohfidisch material)
1993   *Talpa* cf. *gilothi* STORCH; RABEDER in RÖGL et al.: 511. (Götzendorf material)

Material (measurements see tabs. 12, 13)

Richardhof-Wald Rh-94/1	*T.* cf. *gilothi*, NHMW 2004z0204/0000 5 tooth fragments
Neusiedl am See 1990/1519.22	*T.* cf. *gilothi,* NHMW 2004z0205/0000 left m2
Richardhof-Golfplatz RH-A/2 RH-A/11	*T.* cf. *gilothi*, NHMW 2004z0206/0000 13 isolated lower teeth, partly fragments left humerus fragment
Götzendorf Gö 1988	*T.* aff. *gilothi*, NHMW 2004z0207/000–0001 right dentary fragment with m2

Gö 1, 1990/14	left dentary fragment with m2, 3 isolated teeth
Gö 1, 1990/15	6 tooth fragments
Gö 1, 1990/16	2 dentary fragments with teeth, 16 isolated teeth, 5 humeri
Gö 2, 1990/22	left dentary fragment with m1, 2 left m1/2-talonids, right humerus fragment
Gö 4, 1990/1508	left M2
Gö 5	left m3
Gö (Coll. ULRICH)	3 humerus fragments

Tab. 12: *Talpa* aff. *gilothi*, sample statistics of the teeth

locality	meas.	n	R	m		locality	meas.	n	R	m
RH-A/2	Lp4	3	1.06–1.43	1.27		Rh-94/1	Wam3	1		1.11
	Wp4	3	0.64–0.80	0.74			Wpm3	1		1.10
RH-A/2	Lm1	2	2.35–2.44	2.40		RH-A/2	Lm3	1		2.10
	Wam1	5	1.19–1.39	1.27			Wam3	2	1.20–1.27	1.24
	Wpm1	3	1.41–1.50	1.44			Wpm3	1		0.97
Götzendorf	Wam1	3	1.21–1.31	1.28		Götzendorf	Lm3	3	2.05–2.11	2.07
	Wpm1	3	1.33–1.40	1.36			Wam3	4	1.14–1.21	1.18
Rh-94/1	Wam2	2	1.37–1.46	1.42			Wpm3	2	0.81–0.88	0.85
	Wpm2	1		1.34		Götzendorf	LP4	1		1.76
Neusiedl	Lm2	1		2.41		Eichkogel	LaM1	2	2.87–3.03	2.95
	Wam2	1		1.44			WM1	2	1.88–1.98	1.93
	Wpm2	1		1.21		Götzendorf	WM1	2	1.93–2.16	2.00
RH-A/2	Lm2	3	2.50–2.55	2.53		Götzendorf	LM2	1		2.24
	Wam2	3	1.48–1.61	1.55			WaM2	3	2.33–2.50	2.43
	Wpm2	3	1.33–1.46	1.41		Rh-94/1	LM3	1		1.32
Götzendorf	Lm2	5	2.43–2.62	2.53			WaM3	1		1.86
	Wam2	12	1.13–1.57	1.43		Götzendorf	LM3	2	1.21–1.34	1.28
	Wpm2	9	1.09–1.48	1.32			WaM3	2	1.83–2.08	1.96

Tab. 13: *Talpa* aff. *gilothi*, measurements of the humerus fragments

locality	meas.	n	R	m	s	V
Kohfidisch	GL	4	12.1–12.9	12.5		
	Wp	4	9.0–9.5	9.4		
	WpwT	4	8.2–8.6	8.5		
	DS	11	2.81–3.47	3.15±0.15	0.216	6.87
	Wdwe	7	6.1–6.9	6.55±0.25	0.245	3.75
	Wd/GL	3	51.2–57.0	54.1		
Götzendorf	DS	9	2.95–3.60	3.31±0.19	0.234	7.07
	Wdwe	6	7.05–7.85	7.42±0.39	0.324	4.61
RH-A11	DS	1		3.40		

Description

Except for some dentary fragments from Götzendorf – one with the posterior mental foramen below the protoconid of m1, another with the mental foramina under the anterior roots of p4 and m1 – only isolated teeth and humerus fragments are preserved.
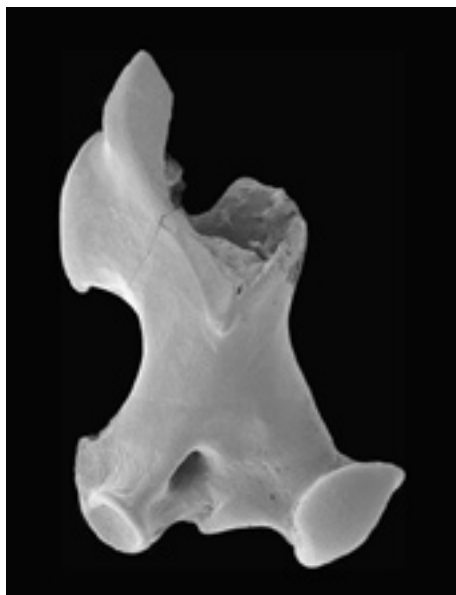
Fig. 14: *Talpa* aff. *gilothi*, right humerus, cranial view, Götzendorf 1, NHMW 2004z0207/0001. – Ca. 5x.

The teeth show the morphology typical for *Talpa*. The p4 is slender and has a small talonid. The lower molars lack an entocristid or metacristid. In the m1 the oblique cristid terminates buccally, in the m2 in the median line, and in the m3 slightly lingually to it. In the m1 the precingulid is indicated by a faint vertical crest joining the paraconid. The precingulid is reduced to a short protrusion below the paraconid in the m2 and m3. In the P4 the lingual part is broken, and the parastyle is vestigial. The upper molars have a confluent mesostyle and hardly differentiated lingual conules.

The distal third of the humerus from Richardhof-Golfplatz (RH-A11/4) and the specimens from Götzendorf show the compact shaft and the shallow notch between trochlea and the fossa for the m. flexor digitorum ligament. The preserved morphology indicates well-developed fossorial adaptation. No specimen has a proximal epiphysis. The pectoral tubercle is situated in the midline of the shaft or slightly lateral to it.

D i s c u s s i o n

The above-listed specimens are lumped together because they are the only ones with Talpini morphology in the samples. It is assumed that the dentition and humeri of the Götzendorf sample belong to one *Talpa* species. The humeri are distinctly smaller than in *T. vallesensis,* but only slightly smaller than in *Talpa gilothi* STORCH, 1978 from the type locality Dorn-Dürkheim (DS 3.30–3.70; STORCH 1978: Tab. 3) and from Wölfersheim (DS 3.40; DAHLMANN 2001: tab. 8). In the Götzendorf fragments, however, the pectoral tubercle is not tongue-shaped and not or only slightly displaced laterally. According to STORCH (1978: 434) this is a diagnostic character of *T. gilothi*. Among the paratypes, there are nine humerus fragments and one dentary fragment with p2-p4. Hence, most of the dentition of *T. gilothi* is unknown. DAHLMANN (2001) referred some molars from Wölfersheim to *T. gilothi*; they are smaller than those under study here and smaller than in *T. vallesensis* from Schernham. The pectoral tubercle in the Wölfersheim humeri is tongue-shaped, but not shifted laterally (see DAHLMANN 2001: fig. 7.1). In spite of these differences the Austrian samples more closely resemble *Talpa gilothi* than *T. vallesensis*. More astonishing is the size relation between humeri and dentition when comparing *T. gilothi* with *T. vallesensis* from Schernham. The latter species has bigger humeri and a smaller dentition than *T. gilothi*. Nonetheless, this reverse size relation is more parsimonious explanation than the separation of the Götzendorf sample into two species: a smaller one, represented by humeri, and a bigger one, represented only by teeth. Because of their morphological deviation, the Götzendorf specimens are denominated *T.* aff. *gilothi*. The other samples lack sufficient defining characters and

cannot be determined to species level. As they agree in size better with *T.* aff. *gilothi* from Götzendorf than with *T. vallesensis* from Schernham, I expect them to be closer to *T. gilothi*. They must be referred to *T.* cf. *gilothi*.

STORCH (1978: 436, tab. 3) referred the two Kohfidisch humeri, labelled *Talpa* ? sp. by BACHMAYER & WILSON (1970: 557), to *Talpa gilothi* and presented the measurements. However, in all the Kohfidisch humeri I investigated, the pectoral tubercle is not displaced laterally. I therefore prefer the determination *T.* aff. *gilothi*. Morphologically and in the mediolateral diameter of the shaft, the humeri compare well with others referred to this species. In the distal width, they are somewhat smaller than the Götzendorf humeri (see tab. 13).

Urotrichini DOBSON, 1883

Urotrichus TEMMINCK, 1841

Type species: *Urotrichus talpoides* TEMMINCK, 1841

***Urotrichus giganteus* n. sp.**
Fig. 15

E t y m o l o g y : Latin giganteus, -a = gigantic, the new species has by far the biggest humerus of all urotrichine species.

H o l o t y p e :   Left humerus, cat.-no. NHMW 2004z0208/0001, measurements see tab. 14, fig. 15/1

T y p e   l o c a l i t y :   Schernham, Hausruck-Kobernaußerwald area, fluvial complex in the Molasse Basin, Upper Austria.

A g e :   Early Late Miocene, Upper Vallesian, MN 10 (DAXNER-HÖCK 2004b)

P a r a t y p e s   (measurements see tab. 14):

| Schernham | NHMW 2004z0208/0000–1 |
| | 6 humerus fragments |

R e f e r r e d   m a t e r i a l   (measurements see tab. 14):

Eichkogel	NHMW 2004z0209/0000
	right humerus fragment
Götzendorf	NHMW 2004z0210/0000–0001
Gö 1, 1990/16	right humerus fragment
Gö 1, 1990/16	3 left, 3 right humeri (partly fragments)
Gö 2, 1990/22	right humerus fragment
Gö, 2004z0210/0009 (Coll. ULRICH)	right humerus

D i a g n o s i s : Based on its humerus, this is the largest shrew-mole known thus far, characterised by the co-occurrence of the following traits: very large size, shallow brachialis fossa, pectoral tubercle situated on the axis of the shaft, narrow notch between teres tubercle and pectoral ridge, supratrochlear fossa large and deep. No epicondylar wings, no deltoid process.

Tab. 14: *Urotrichus giganteus*, Schernham, measurements of the humeri

Site/no	side	Gl	Wp	WpwTter	DS	WdwEpi
Eichkogel						
1974/1680/E5	right	–	–	–	2.89	–
Schernham						
2004z0208/0001*	left	14.9	7.3	6.05	2.74	6.80
2004z0208/0000	left	–	–	–	2.70	6.65
2004z0208/0000	left	–	–	–	2.78	6.70
2004z0208/0000	left	–	–	–	2.90	6.70
2004z0208/0000	left	–	–	–	–	6.65
2004z0208/0000	right	–	–	–	2.80	–
2004z0208/0000	right	–	–	–	2.67	–
Götzendorf						
Gö/L: 2004z0210/0000	left	13.7	7.16	5.42	2.77	6.22
Gö1: 2004z0210/0000	right	–	–	–	2.50	5.73
Gö2: 2004z0210/0000	right	–	–	–	2.68	–
Gö1: 2004z0210/0001	right	13.3	7.14	5.81	2.74	6.41
Gö1: 2004z0210/0000	right	13.7	7.03	5.82	2.80	–
Gö1: 2004z0210/0000	right	–	–	–	2.91	–
Gö1: 2004z0210/0000	left	13.5	6.97	5.66	2.82	6.40
Gö1: 2004z0210/0000	left	–	–	–	–	–
Gö1: 2004z0210/0000	left	–	–	–	2.84	–

* holotype

Fig. 15: *Urotrichus giganteus*
1. Left humerus, holotype, cranial view, Schernham, NHMW 2004z0208/0001. – Ca. 5x.
2. Right humerus, caudal view, Götzendorf 1, NHMW 2004z0210/0001. – Ca. 5x.

Description of the holotype, the paratypes and the referred specimens from Götzendorf

The type specimen is the only nearly complete one from the Schernham sample. Only the head is broken. In its overall morphology and adaptively, it is similar to the humerus of recent Urotrichini. The shaft is slender and straight. The lesser tubercle extends further proximally than the pectoral crest. Both frame a well-defined open bicipital groove. The brachialis fossa is shallow. There is no deltoid process. The pectoral tubercle is situated in the mid-line about halfway down the shaft. The proximal border of the teres tubercle passes gradually into the shaft. The teres tubercle is separated from the pectoral ridge by a narrow notch. A marked scalopine ridge extends horizontally from the lesser tubercle to the head, and there is a notch between head and the greater tubercle. There are no epicondylar wings. The supratrochlear fossa is large and deeply pocketed. A deep and arcuated notch is present between the trochlea and the fossa of the m. flexor digitorum ligament.

The paratype and referred specimens do not differ morphologically from the type except that they are less complete. The four complete Götzendorf humeri are smaller than the holotype, but the size differences lie well within the variability of a population.

Comparisons

Only the humeri of extant and fossil shrew moles need to be in included in the comparisons. The humeri of all urotrichines resemble one another in their modest fossorial spe-

cialisation, which is expressed in their slenderness and in the shallow brachialis fossa. *U. giganteus* differs from all other urotrichines in its considerably larger size (see tab. 15). Therefore, only morphological differences are listed in the detailed comparisons. *U. giganteus* differs from all other urotrichines in the mid-line position of the pectoral tubercle, which is situated more laterally in the others.

Additionally, in the extant species of *Urotrichus* – *U. talpoides* TEMMINCK, 1841 and *U. pilirostris* (TRUE, 1886) – the teres tubercle is shorter, more angled proximally, and leaves a wider notch between it and the pectoral crest (see STORCH & QIU 1985: figs. 20–21). The scalopine ridge is curved proximally convex. The same is true for *U. dolichochir* from La Grive (see HUTCHISON 1974: fig. 17), whereas the teres tubercle is proximally less angled in ?*U. dolichochir* from Petersbuch 6 (see ZIEGLER 2003b: fig. 8). The shape of the teres tubercle and its proximal transition into the shaft is somewhat variable in the extant species too.

In *Neurotrichus*, represented by the recent *N. gibbsi* (BAIRD, 1858) and the Pliocene *N. polonicus* SKÓCZEN, 1980, and in *Quyania chowi* STORCH & QIU, 1985 from the late Turolian or Ruscinian from China, the trochlea of the humerus is narrow in anterior view and connected to the capitulum by a thin bridge of the articular facets. In *Urotrichus* the trochlea widens towards the capitulum.

In *Tenuibrachiatum storchi* ZIEGLER, 2003 from the late Middle Miocene of Petersbuch 31 in South Germany, the teres tubercle is proximally less angled and the scalopine ridge is arcuated proximally.

In *Myxomygale gracilis* ZIEGLER, 2003 from the late Middle Miocene of Petersbuch 10, the teres tubercle is also proximally less angled and the scalopine ridge is arcuated proximally.

In *Paratalpa micheli* Lavocat, 1951 from the Late Oligocene site Coderet, the teres tubercle is a knob rather than a ridge, like in the other species.

Recapitulating, the most conspicuous differences are the large size and the mid-line position of the teres tubercle.

Tab. 15: Greatest length of humeri and Lm1 of various urotrichine species

Species	Site	humerus GL	Lm1	Reference
Urotrichus pilirostris	Recent	6.9		Storch & Qiu 1983: tab. 5
Urotrichus talpoides	Recent	9.4–9.6		Storch & Qiu 1983: tab. 5
Urotrichus talpoides	Recent	8.4–9.4		Skóczen 1980: tab. 7
Urotrichus dolichochir*	La Grive	7.0–7.3	1.67	Hutchison 1974: tab. 3, 2
Urotrichus dolichochir	Petersbuch 6	7.60	–	Ziegler 2003: 634
Neurotrichus polonicus**	Rebielice Królewskie, Kadzielnia	7.8–9.1	1.70–1.95	Skóczen 1980: tab. 5, 7
Neurotrichus gibbsi	Recent	7.6		Storch & Qiu 1983: tab 5
Quyania chowi	Ertemte	6.6–7.4	1.36–1.56	Storch & Qiu 1983: tab. 5, 2
Tenuibrachiatum storchi	Petersbuch 31	7.6–7.75	1.40	Ziegler 2003: 637
Myxomygale gracilis	Petersbuch 10	8.05	1.47	Ziegler 2003: 635
Myxomygale hutchisoni	Petersbuch 2	9.2–9.4	1.44–1.70	Ziegler 1985, tab. 3
Paratalpa micheli	Coderet	9.2	1.60–1.89	Engesser 1980: 127; Hugueney 1972: 29
Urotrichus giganteus	Schernham	14.9	–	present paper

* According to Hutchison (1974: 226) the lectotype dentary of "*Scaptonyx*" *edwardsi* may be associated with the humerus of ?*Urotrichus dolichochir*, both from La Grive.
** Pooled dates from *N. polonicus* from Rebielice Królewskie and Kadzielnia.

D i s c u s s i o n

It is difficult to imagine that no humeri can be assigned to the moles best represented by dental remains and that no teeth match in size with the most abundant humeri. In most samples the talpids best represented by dental remains are the two desmans *Archaeo-desmana* and *Storchia*. The rich Schernham sample yielded no humerus fragment of a desman. Desman humeri are very characteristic and cannot be confused with urotrichine humeri. In desman humeri the proximal epiphysis is narrower with a small greater tubercle and brachialis fossa. The epicondyles have extended wings. The above-described humeri are without doubt urotrichine and cannot be assigned to the dental remains of *Archaeodesmana* or *Storchia*, which represent unquestioned desmans. The only dental remains from Schernham with urotrichine affinities are definitively too small (Lm1 1.42–1.58 mm) for the big humeri. The teeth represent a second urotrichine species. *U. giganteus* represents the biggest urotrichine moles thus far known. In table 15 the greatest lengths of humeri of known urotrichine species are opposed to the length of their m1. This compilation reveals that for *Urotrichus giganteus*, with its large humerus, we expect an m1 distinctly longer than 2 mm. There are no such teeth in the Schernham talpid sample. It is worth considering whether the new species is really compatible with *Urotrichus* or whether it would better be referred to a new genus. Big size alone is no constitutive character for a genus. Based on the mid-line position of the pectoral tubercle, *U. giganteus* differs from all known *Urotrichus* species, where it is shifted laterally.

There may be more differences in the unknown dentition of *U. giganteus*. As there is no referable dentition, I hesitate to describe a new genus and with some reserve leave *giganteus* in the genus *Urotrichus*.

Urotrichini gen. et sp. indet.
Fig. 16

M a t e r i a l   a n d   m e a s u r e m e n t s :

Schernham7		Size
NHMW 2004z0211/0001	left m1	1.58x0.78x0.97
NHMW 2004z0211/0000	left m1	1.49x0.76x0.90
NHMW 2004z0211/0000	right m1	1.42x0.76x0.95
NHMW 2004z0211/0002	left m2	1.60x0.89x0.87
NHMW 2004z0211/0003	left m3	1.38x0.73x0.58
NHMW 2004z0211/0004	right P4	1.62x1.14
NHMW 2004z0211/0005	left M1	1.72x1.20
NHMW 2004z0211/0006	left M2	1.49x1.48
NHMW 2004z0211/0000	right M2	1.50x1.57
NHMW 2004z0211/0000	right M2	–x1.60
NHMW 2004z0211/0007	right humerus	WdwEpi ca. 4.5

D e s c r i p t i o n

Only isolated teeth and one distal humerus fragment are available.

In the m1 the oblique cristid extends to the distal face of the protoconid, slightly buccally from the mid-line. No metacristid is present. A faint cingulid extends from below the paraconid to the hypoconid. In the m2 the trigonid is somewhat shorter than in the m1. The oblique cristid joins a marked metacristid. The cingulid is as in the m1, with a mesial protrusion beneath the paraconid. In the m3 the oblique cristid extends to the middle of distal side of the trigonid. The precingulid is better developed than in m1 and m2. The ectocingulid is restricted to the buccal re-entrant valley. The P4 is surrounded by a weak cingulum with a parastylar projection. The lingual flange bears a small protocone. On the M1, the paraconule and metaconule are only slightly differentiated. Para- and metacingulum are interrupted. The parastyle is projecting. In the slightly worn tooth the mesostyle is confluent. In the M2 the lingual conules are somewhat better developed than in the M1. Preparaconule-crista and postmetaconule-crista taper bucally. The mesostyle is confluent even in unworn specimens.

The distal end of the humerus is superficially corroded, but shows the urotrichine characters: deep and pocketed supratrochlear fossa, marked notch between trochlea and the fossa for the m. flexor digitorum ligament. The epicondylar wings are not extended and lack spines.

D i s c u s s i o n

The teeth have been lumped together because of compatible overall morphology and size. However, the m3 should have a metacristid joined by the oblique cristid as the m2. This m3 cannot be assigned to any other species. It shows acceptable fit with the other teeth as proposed. The teeth cannot be referred to any known urotrichine species.
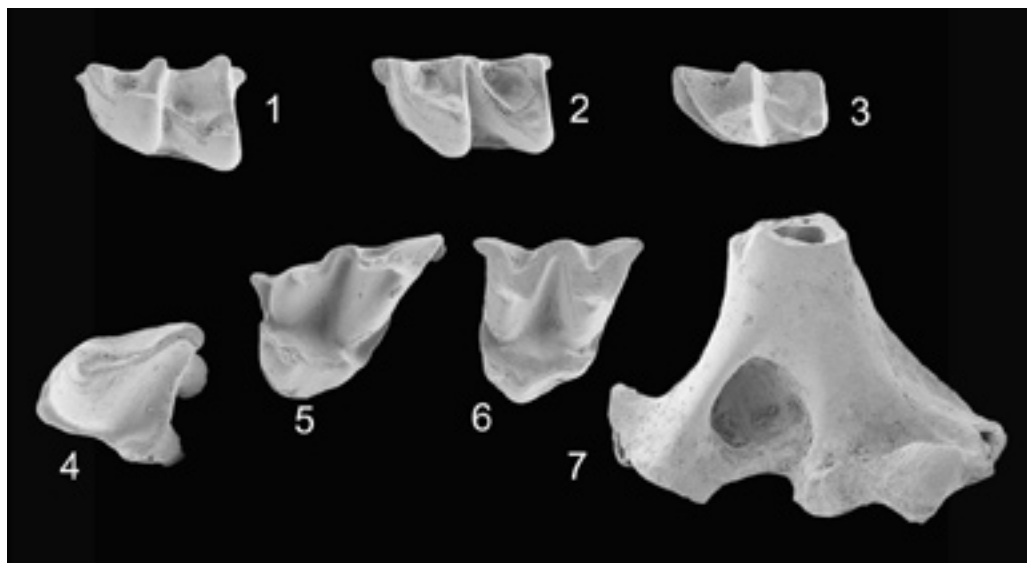
Fig. 16: Urotrichini gen. et sp. indet., Schernham
1. Left m1, occlusal view, NHMW 2004z0211/0001. – Ca. 15x.
2. Left m2, occlusal view, NHMW 2004z0211/0002. – Ca. 15x.
3. Left m3, occlusal view, NHMW 2004z0211/0003. – Ca. 15x.
4. Right P4, occlusal view, NHMW 2004z0211/0004. – Ca. 15x.
5. Left M1, occlusal view, NHMW 2004z0211/0005. – Ca. 15x.
6. Left M2, occlusal view, NHMW 2004z0211/0006. – Ca. 15x.
7. Distal fragment of right humerus, NHMW 2004z0211/0007. – Ca. 10x.

The distal humerus fragment is morphologically identical with the humeri of *Urotrichus giganteus*, but distinctly smaller. The small size is only partly due to superficial corrosion. This specimen cannot be assigned to *U. giganteus*, though it seems to be somewhat too big for the teeth. The suggested association is based on the expectation that there are not two further urotrichines, one represented by the teeth, the other by a humerus. Because of the uncertainty in the association, I refrain from a more precise determination. The other samples do not include similar, small-sized urotrichine humeri and teeth.

Talpidae incertae sedis

Desmanella ENGESSER, 1972

Type species: *Desmanella stehlini* ENGESSER, 1972

Desmanella aff. *rietscheli* STORCH & DAHLMANN, 2000
Fig. 17

1993   *Desmanella* n. sp.?; RABEDER in RÖGL et al.: 511. (Eichkogel material)

M a t e r i a l (measurements see tab. 16):

Eichkogel	NHMW 2004z0212/0000–0003
1993/0008/0016	30 isolated teeth
1974/1680 (Coll. HUIMANN)	right dentary with m1-m2, right M1, right M2
Schernham	NHMW 2004z0213/0000–0003
	3 left dentary fragments with teeth, right maxillary fragment with P4-M1,
	14 isolated teeth
Richardhof-Wald	NHMW 2004z0214/0000
Rh 94/1	44 isolated teeth (partly fragments)
Rh 94/5A	14 isolated teeth
Richardhof-Golfplatz	NHMW 2004z0215/0000–0008
RH-A/2	left dentary fragment with p4, 68 isolated teeth (partly fragments)
RH-A/7	*D.* cf. *rietscheli*, NHMW 2004z0216/0001–6
	6 isolated teeth (partly fragments)
Stixneusiedl	*D.* cf. *rietscheli*, NHMW 1990/1517/23–24
	left P4, 1 single-rooted antemolar
Götzendorf	NHMW 2004z0217/0000
Gö 1, 1990/14	right m1, right dentary fragment with m2
Gö1	2 left M1
Gö 1, 1990/15	6 isolated teeth
Gö 1, 1990/16, leg. RÖGL	2 m1, left M2

D e s c r i p t i o n

Except for some short dentary fragments and one maxillary fragment with P4-M1 from Schernham, the whole material consists of isolated teeth. Only the left dentary fragment with p4 from RH-A/2 yields some additional information. It preserves six crowded alveoles anterior to p4 and a mental foramen under the second alveole in front of p4. Granted that all antemolars are single-rooted, as is known from *D. sickenbergi* ENGESSER, 1980 and from *D. crusafonti* RÜMKE, 1974, the dental formula is 2143 and the mental foramen is situated below p2. This antemolar part is quite similar to that of *D. sickenbergi*, figured in ENGESSER (1980: 44 b).

L o w e r t e e t h : Among the antemolars, only the i2 have been identified with some certainty. They are the smallest i2 and resemble those attributed by DAHLMANN (2001: pl. 6, fig. 17) to *D. woelfersheimensis* DAHLMANN, 2001. The p4 has a weak disto-buccal and a marked disto-lingual border. In one of four specimens from RH-A/2, a cuspule is situated on the basis of the disto-lingual border. The p4 is surrounded by a marked cingulid, which extends distally to a small talonid. In the m1 the metaconid is situated disto-lingually from the metaconid. The talonid is distinctly wider than the trigonid. The oblique cristid extends to the middle of the rear side of the trigonid or slightly lingually to it. It does not join the metacristid. The ectocingulid is interrupted below the protoconid and hypoconid. In all samples where both molars are preserved, the m2 is bigger than the m1 and more hypsodont. The metaconid is situated lingually from the protoconid. Trigonid and talonid are of similar width. The metacristid is better developed than in the m1. The oblique cristid extends more lingually but does not join the metacristid in most specimens. The ectocingulid is stronger than in the m1 and not interrupted under the protoconid. In the m3 the talonid is reduced and lacks the entostylid. The oblique cristid joins the metacristid.

Tab. 16. *Desmanella* aff. *rietscheli*, sample statistics of the teeth

locality	meas.	n	R	m	s	V
Rh-94/1	Li2	6	0.91–1.02	0.96±0.05	0.044	4.62
	Wi2	6	0.47–0.53	0.50±0.03	0.023	4.62
RH-A/2	Li2	6	0.95–1.09	1.02±0.05	0.047	4.61
	Wi2	6	0.47–0.57	0.52±0.04	0.038	7.34
Eichkogel	Lp4	2	0.97–1.02	1.00		
	Wp4	2	0.69–0.73	0.71		
Rh-94/1	Lp4	2	0.88–0.90	0.89		
	Wp4	2	0.61–0.68	0.65		
Rh-94/5A	Lp4	1		0.86		
	Wp4	1		0.67		
RH-A/2	Lp4	4	0.96–1.02	0.98		
	Wp4	4	0.67–0.78	0.74		
Eichkogel	Lm1	3	1.42–1.57	1.50		
	Wam1	5	0.84–1.17	1.02±0.13	0.090	8.82
	Wpm1	5	1.11–1.21	1.16±0.06	0.041	3.53
Schernham	Lm1	3	1.34–1.37	1.35		
	Wam1	2	0.81–0.92	0.86		
	Wpm1	2	0.95–1.07	1.01		
Rh-94/1	Lm1	5	1.42–1.55	1.49±0.08	0.060	3.74
	Wam1	5	0.90–1.05	0.98±0.10	0.073	7.48
	Wpm1	5	1.02–1.20	1.11±0.10	0.073	6.55
RH-A/2	Lm1	10	1.48–1.59	1.51±0.02	0.032	1.65
	Wpm1	11	0.85–1.10	0.97±0.06	0.080	7.05
	Wpm1	12	0.98–1.23	1.13±0.04	0.062	5.06
Götzendorf	Lm1	1		1.42		
	Wpm1	3	0.93–1.08	1.00		
	Wpm1	3	1.07–1.18	1.12		
Eichkogel	Lm2	2	1.61–1.64	1.63		
	Wam2	2	1.05–1.18	1.12		

locality	meas.	n	R	m	s	V
Schernham	Wpm2	2	1.05–1.13	1.09		
	Lm2	6	1.58–1.71	1.62±0.06	0.051	3.12
	Wam2	5	0.89–1.09	1.00±0.11	0.076	7.62
	Wpm2	5	0.87–1.12	1.03±0.14	0.102	9.62
Rh-94/1	Lm2	1		1.77		
	Wam2	1		1.06		
	Wpm2	1		1.07		
Rh-94/5A	Lm2	2	1.67–1.70	1.69		
	Wam2	2	1.08–1.14	1.11		
	Wpm2	2	1.08–1.14	1.11		
RH-A/2	Lm2	6	1.58–1.78	1.69±0.09	0.075	4.45
	Wam2	6	0.95–1.13	1.06±0.07	0.065	6.09
	Wpm2	5	1.01–1.16	1.10±0.09	0.065	5.86
Götzendorf	Lm2	2	1.54–1.73	1.64		
	Wam2	2	1.06–1.11	1.09		
	Wpm2	2	1.08–1.10	1.09		
Eichkogel	Lm3	2	1.34–1.35	1.35		
	Wam3	2	0.83–0.89	0.86		
Schernham	Lm3	3	1.31–1.33	1.32		
	Wam3	2	0.81–0.85	0.86		
Rh-94/1	Lm3	5	1.21–1.36	1.30±0.07	0.054	4.18
	Wam3	6	0.76–0.88	0.83±0.05	0.042	5.07
Rh-94/5A	Lm3	1		1.28		
	Wam3	1		0.86		
RH-A/2	Lm3	5	1.21–1.33	1.29±0.07	0.049	3.81
	Wam3	5	0.74–0.85	0.79±0.06	0.041	5.16
RH-A/7	Lm3	1		1.22		
	Wam3	2	0.74–0.75	0.75		
Eichkogel	Li1	2	0.90–0.94	0.92		

locality	meas.	n	R	m	s	V
Rh-94/1	WI1	2	0.54–0.55	0.55		
	LI1	6	0.76–0.91	0.87±0.06	0.056	6.45
	WI1	6	0.50–0.55	0.52±0.02	0.019	3.65
Rh-94/5A	LI1	1		0.84		
	WI1	1		0.42		
RH-A/2	LI1	7	0.85–0.97	0.91±0.04	0.036	4.01
	WI1	7	0.45–0.57	0.50±0.04	0.038	7.63
Eichkogel	LP4	4	1.35–1.44	1.39		
	WP4	3	1.26–1.33	1.30		
Schernham	LP4	2	1.34–1.42	1.38		
	WP4	2	1.20–1.26	1.26		
Rh-94/1	LP4	1		1.35		
	WP4	1		1.16		
RH-A/2	LP4	4	1.21–1.35	1.26		
	WP4	4	1.16–1.23	1.20		
Stixneus.	LP4	1		1.19		
	WP4	1		1.15		
Götzendorf	LP4	1		1.30		
	WP4	1		1.27		
Eichkogel	LiM1	4	1.28–1.34	1.32		
	W	1		1.67		
Schernham	LbM1	2	1.89–1.96	1.93		
	LiM1	5	1.23–1.31	1.26		
	W	2	1.73–1.78	1.76		
Rh-94/1	LbM1	2	1.94–1.95	1.95		
	LiM1	2	1.35–1.39	1.37		
	WM1	2	1.73–1.81	1.77		
RH-A/2	LbM1	3	1.90–2.04	1.98		
	LiM1	7	1.22–1.42	1.31±0.07	0.073	5.57
	WM1	3	1.58–1.74	1.67		

| locality	meas.	n	R	m	s	V
Götzendorf	LbM1	1		2.02		
	LiM1	2	1.27–1.27	1.27		
	WM1	2	1.70–1.72	1.71		
Eichkogel	LbM2	2	1.49–1.67	1.58		
	LiM2	3	1.25–1.38	1.33		
	WaM2	3	1.87–1.90	1.89		
	WpM2	3	1.43–1.57	1.51		
Schernham	LiiM2	1		1.33		
	WM2	1		1.71		
Rh-94/1	LbM2	1		1.59		
	LiM2	3	1.27–1.28	1.28		
	WaM2	1		1.81		
	WpM2	3	1.72–1.72	1.72		
RH-A/2	LbM2	2	1.54–1.57	1.56		
	WaM2	2	1.75–1.92	1.84		
RH-A/7	LiM2	1		1.20		
	WaM2	1		1.92		
Eichkogel	LM3	4	0.90–0.99	0.96		
	WM3	3	1.33–1.47	1.39		
Rh-94/1	LM3	6	0.93–1.05	0.98±0.07	0.051	5.17
	WM3	4	1.27–1.53	1.41		
Rh-94/5A	LM3	3	0.99–1.03	1.01		
	WM3	1		1.50		
RH-A/2	LM3	9	0.87–0.97	0.93±0.03	0.035	3.75
	WM3	6	1.36–1.54	1.44±0.10	0.089	6.01
RH-A/7	WM3	1		0.96		
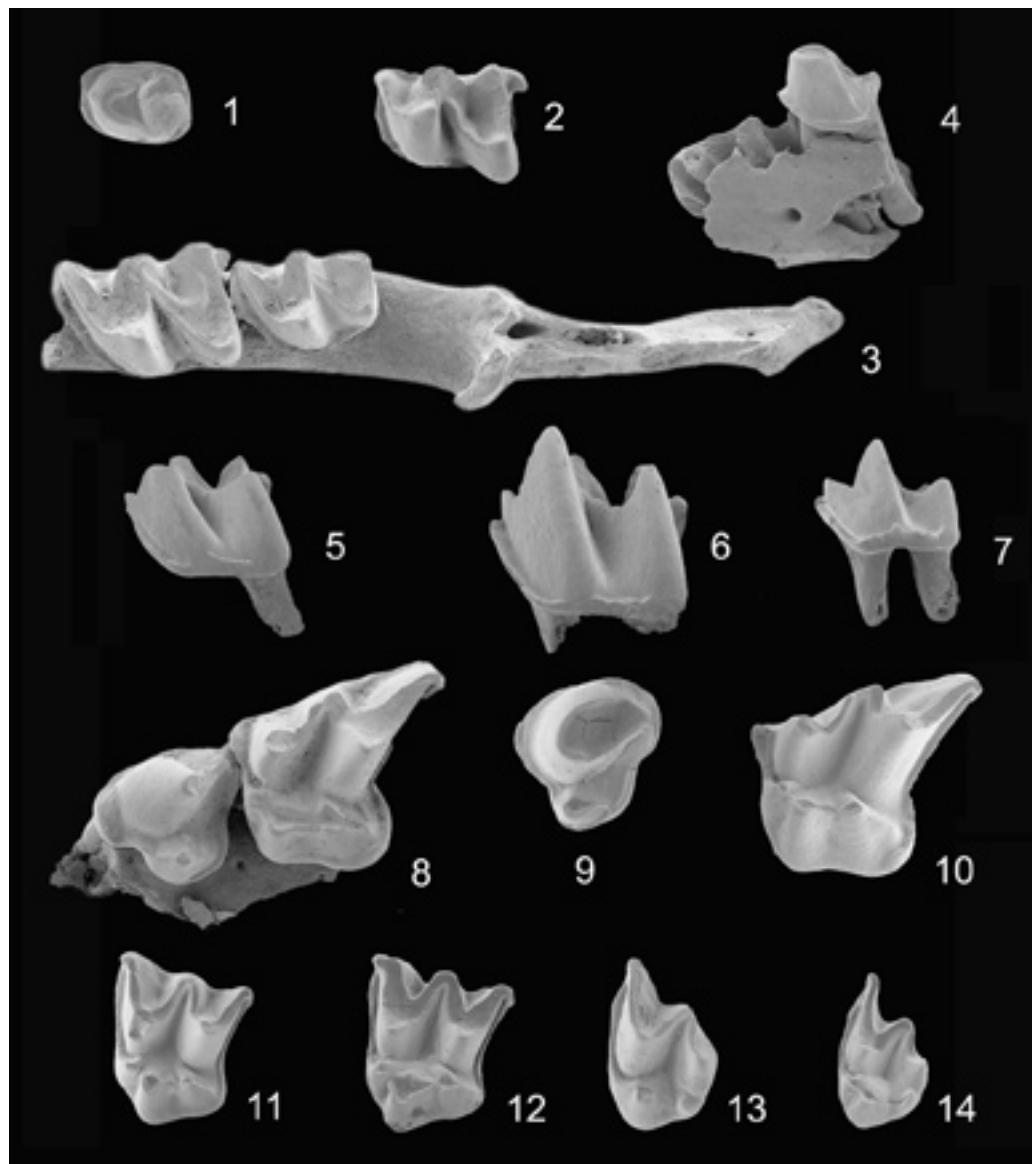
Fig. 17: *Desmanella* aff. *rietscheli*. 1., 12., and 14. Eichkogel; 2., 3., and 8. Schernham; 4.–7., 9.–11., and 13. Richardhof-Golfplatz. 1.–3., 8.–14. occlusal view; 4.–7. buccal view. – Ca. 15x.
1. Right p4, NHMW 2004z0212/0001.
2. Left m1, NHMW 2004z0213/0001.
3. Left dentary fragment with m2-m3, NHMW 2004z0213/0002.
4. Left dentary fragment with p4, NHMW 2004z0215/0001.
5. Left m1, NHMW 2004z0215/0002.
6. Right m2, NHMW 2004z0215/0003.
7. Left m3, NHMW 2004z0215/0004.
8. Right maxillary fragment with P4-M1, NHMW 2004z0213/0003.
9. Left P4, NHMW 2004z0215/0005.
10. Right M1, NHMW 2004z0215/0006.
11. Left M2, NHMW 2004z0215/0007.
12. Left M2, NHMW 2004z0212/0002.
13. Left M3, NHMW 2004z0215/0008.
14. Left M3, NHMW 2004z0212/0003.

U p p e r   t e e t h :   Several small I1 have been attributed to *Desmanella*. They are the smallest, single-rooted and morphologically quite similar to those referred by DAHLMANN (2001: pl 6, figs. 7–8) to *D. woelfersheimensis*. The P4 has a slightly projecting cingular parastyle, a marked protocone, and is surrounded by a well-developed cingulum. Each M1 has a well-differentiated para- and metaconule. Unworn specimens preserve the buccal crests originating from these conules. The mesostyle is confluent in slightly worn M1. The parastyle is only slightly projecting. The preparaconule crista joins the paracingulum, which itself extends to the buccal margin. The postmetaconule crista tapers distally and does not join the postcingulum, which itself joins the metacingulum. The metacone base extends further lingually than the base of the protocone. The M2 exhibits the same development of lingual conules and their crests. In the M1 and M2 the distal concavity is marked. In the M3 the metaconule is attached to the metacone basis. Postmetacrista, postcingulum and metacingulum are eliminated.

C o m p a r i s o n s   a n d   d i s c u s s i o n s

Desmanella is a temporo-spatially widespread genus. The earliest records are known from the Late Oligocene of South Germany (ZIEGLER 1998b), the latest from the Late Pliocene of South France (CROCHET 1986). Most of the so far described 12 species are from Europe, some from Turkey and one from Inner Mongolia. The type species, *D. stehlini* ENGESSER, 1972 from Anwil, was described based on six isolated teeth. The material under study differs morpho-metrically from that species in the m1 being smaller than the m2 and in the distally tapering postmetaconule-crista of the M1.

It compares well with *Desmanella crusafonti* RÜMKE, 1976 from Concud (Spain, MN 12) in the number of alveoles anterior to p4 and in the position of the anterior mental foramen. In the Spanish species, however, the teeth are distinctly bigger and the M1 has a notched mesostyle.

The present samples are closest to *Desmanella rietscheli* STORCH & DAHLMANN, 2000 from the early Turolian (MN 11) fauna of Dorn-Dürkheim. They share with this species the marked distal concavity of the M1 and M2, the distally tapering postmetaconule crista of the M1 and M2, and the m1 being smaller than the m2. However, there are some consistent differences in size. All lower molars in the present study are narrower than in *D. rietscheli* from Dorn-Dürkheim. These differences are sufficiently taken into account by designating the samples *D.* aff. *rietscheli*. For lack of proper material the small samples from RH-A/7 and from Stixneusiedl only can be designated *D.* cf. *rietscheli*.

Desmanella represents the most common talpid in the samples from Eichkogel, Richardhof-Wald (Rh-94/1, Rh-94/5 A) and from Richardhof-Golfplatz (RH-A/2).

Desmanella from the Kohfidisch fissures compares well with the other Austrian samples and clearly represents the same species. It differs from *D. crusafonti*, a determination proposed by BACHMAYER & WILSON (1978, 1980, cf. *Desmanella crusafonti*), in the smaller size, especially of the p4, and in the undivided mesostyle of the M1. It is probably more closely related to *D. rietscheli* and I also list it as *D.* aff. *rietscheli*.

Talpidae gen. et sp. indet. I
Fig. 18

M a t e r i a l   a n d   m e a s u r e m e n t s :

Schernham   NHMW 2004z0218/0001
             right m1 1.48x0.73x0.92

The tooth shows a peculiar morphology and without doubt represents the tenth talpid species in the Schernham insectivore fauna. The trigonid is very short and small. Paraconid and metaconid are situated very low. The oblique cristid joins a marked metacristid, which does not extend to the top of the metaconid. There is a deep buccal re-entrant valley. Cingulids are not developed. This specimen is definitely a talpid m1, but does not fit any known talpid species. A new talpid taxon should not be based on one tooth, and the determination is therefore Talpidae gen. et sp. indet.

All the other sites yielded indeterminable tooth fragments and antemolars, some of which certainly belong to talpids. They are not listed in table 25.
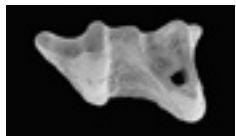

Fig. 18: Talpidae gen. et sp. indet., right m1, occlusal view, Schernham, NHMW 2004z0218/0001. – Ca. 15x.

Dimylidae SCHLOSSER, 1887

Plesiodimylus GAILLARD, 1897

Type species: *Plesiodimylus chantrei* GAILLARD, 1897

Plesiodimylus aff. *chantrei* GAILLARD, 1897
Fig. 19

1993   *Plesiodimylus chantrei* GAILLARD; RABEDER in RÖGL et al.: 511. (Götzendorf material)

M a t e r i a l (measurements see tab. 17):

Eichkogel	*P.* cf. *chantrei* NHMW 2004z0219/0000
	right p4
Schernham	*P.* aff. *chantrei* NHMW 2004z0220/0000–0007
	29 dentary fragments with teeth, 265 isolated teeth
Richardhof-Wald	*P.* aff. *chantrei* NHMW 2004z0221/0000
Rh-94/1	3 dentary fragments with teeth, 111 isolated teeth
Rh-94/3	7 isolated teeth
Rh-94/5A	3 dentary fragments without teeth, 34 isolated teeth
Richardhof-Golfplatz	*P.* aff. *chantrei* NHMW 2004z0222/0000
RH-A/2	2 dentary fragments with teeth, 93 isolated teeth
RH-A/7	10 isolated teeth
RH-A/11	left P4
RH-B	right M2
Götzendorf	*P.* aff. *chantrei* NHMW 2004z0223/0000
Gö 1–6	11 isolated teeth
Gö 1, 1990/15	14 isolated teeth
Gö 1, 1990/16	right edentulous dentary fragment, 15 isolated teeth
Gö 2, 1990/22	5 isolated teeth
Gö 4, 1990/1508	right m1

D e s c r i p t i o n

As *Plesiodimylus* is very common in the Miocene of Europe, enough painstaking descriptions and informative figures are available (e.g. MÜLLER 1967, SCHÖTZ 1985, KÄLIN & ENGESSER 2001). I confine myself to listing the defining characters of the samples under study.

Most teeth from Schernham, Richardhof-Wald and from Richardhof-Golfplatz are very large. On average they are bigger than in *P. chantrei* from its type locality La Grive and from Anwil. Some markedly exceed the size range of the teeth of those samples. In the m1 the paraconid is crested, i.e. it is mostly integrated into the lingually curved paralophid. The oblique cristid consistently joins the protoconid instead of ending abruptly at its posterior wall. The entoconid slightly projects disto-lingually. The P4 has no distinct cuspulate parastyle. It is fully fused with the mesial cingulum. In a few specimens a slight swelling hints at a parastyle. In the M1 the consistently projecting parastyle and the absence of a cusp-shaped mesostyle are characteristic. The postparacrista joins the metacone, except in a few specimens where it terminates abruptly before the metacone. The junction between postproto-crista and premetaconule-crista is somewhat variable. In most specimens there is a short labial continuation, which may be a small cusp, but both crests also may join without leaving a cusp or a labial crest.

C o m p a r i s o n

The above-listed criteria are compatible with *P. chantrei*. However, some of the teeth from Schernham, Richardhof-Wald, Richardhof-Golfpaltz and from Götzendorf are markedly bigger than in *P. chantrei*. In size they would rather fit with *Plesiodimylus johanni* KÄLIN & ENGESSER, 2001. This species was described by KÄLIN & ENGESSER (2001) based on 13 isolated teeth of the fauna from Nebelbergweg near Nunningen in Switzerland, which is correlated with MN 9. Beyond its large size, it is characterised by a suite of characters: the absence of a mesostyle in M1 and M2, an m1 with a shallow trigonid valley and a less developed posterior cingulid, a paraconid edge in line with the anterior crest of the protoconid, the protoconid linked with the metaconid by a transverse crest, and the protoconid being only little differentiated from the oblique cristid. Not all these characters are real autapomorphies. The absence of the mesostyle in M1 and M2 is not diagnostic because this is also the case in *P. chantrei*.

All m1 under study have no conspicuously shallow trigonid valley, and the paraconid edge and anterior arm of the protoconid are either curved or angulated. Morphologically, the Austrian samples are fully compatible with *P. chantrei*.

The p4 from Eichkogel agrees in size and morphology with *P. chantrei*. Due to lack of sufficient diagnostic characters it is referred to *P.* cf. *chantrei*.

The samples from Schernham, Richardhof-Wald, Richardhof-Golfplatz and from Götzendorf are referred to *P.* aff. *chantrei* because of their large size.

Tab. 17: *Plesiodimylus* aff. *chantrei*; sample statistics of the teeth

locality	meas.	n	R	m	s	V
Schernham	Lcinf.	1		1.32		
	Wcinf.	1		1.01		
Rh-94/5A	Lcinf.	1		1.48		
	Wcinf.	1		1.00		
RH-A/2	Lcinf.	5	1.09–1.26	1.19±0.12	0.087	7.33
	Wcinf.	5	0.70–0.81	0.76±0.06	0.044	5.86
Götzendorf	Lcinf.	1		1.49		
	Wcinf.	1		0.97		
Schernham	Lp1	5	1.64–1.78	1.70±0.08	0.054	3.18
	Wp1	5	0.96–0.99	0.97±0.02	0.011	1.13
Rh-94/1	Lp1	6	1.63–1.81	1.70±0.09	0.080	4.70
	Wp1	6	0.97–1.11	1.04±0.06	0.049	4.73
Rh-94/5A	Lp1	3	1.73–1.87	1.79		
	Wp1	4	1.02–1.19	1.12		
RH-A/2	Lp1	13	1.55–1.73	1.63±0.03	0.048	2.97
	Wp1	15	0.93–1.09	1.00±0.03	0.052	5.24
RH-A/7	Lp1	1		1.60		
	Wp1	1		1.00		
RH-A/2	Lp2/3	4	0.78–0.97	0.88		
	Wp2/3	4	0.72–0.75	0.74		
Schernham	Ld4	1		1.64		
	Wd4	1		1.07		
Rh-94/1	Ld4	2	1.61–1.68	1.65		
	Wd4	2	1.08–1.10	1.09		
Rh-94/5A	Ld4	2	1.60–1.67	1.64		
	Wd4	1		1.03		
RH-A/2	Wd4	2		0.96		
Eichkogel	Lp4	1		1.62		
Götzendorf	Wp4	1		1.02		

locality	meas.	n	R	m	s	V
Schernham	Lp4	10	1.61–1.66	1.64±0.01	0.017	1.04
	Wp4	11	0.88–1.02	0.97±0.03	0.040	4.11
Rh-94/1	Lp4	3	1.63–1.80	1.71		
	Wp4	3	0.97–1.07	1.02		
Rh-94/3	Lp4	2	1.59–1.66	1.63		
	Wp4	2	0.97–1.10	1.04		
RH-A/2	Lp4	1		1.50		
	Wp4	3	0.90–0.97	0.94		
RH-A/7	Wp4	1		0.90		
Götzendorf	Lp4	1		1.67		
	Wp4	2	0.95–1.02	0.99		
Schernham	Lm1	34	2.24–2.71	2.47±0.04	0.109	4.42
	Wpm1	31	1.27–1.53	1.39±0.02	0.062	4.42
Rh-94/1	Lm1	7	2.47–2.79	2.61±0.10	0.098	3.73
	Wpm1	10	1.40–1.59	1.47±0.05	0.067	4.56
Rh-94/3	Lm1	1		2.70		
	Wpm1	1		1.46		
Rh-94/5A	Lm1	1		2.87		
	Wpm1	1		1.61		
RH-A/2	Lm1	5	2.49–2.87	2.63±0.21	0.148	5.65
	Wpm1	5	1.29–1.54	1.40±0.13	0.097	6.92
RH-A/7	Lm1	1		2.65		
	Wpm1	1		1.27		
Götzendorf	Lm1	6	2.55–2.70	2.61±0.08	0.066	6
	Wpm1	8	1.33–1.49	1.42±0.05	0.051	8
Schernham	Lm2	63	2.53–2.91	2.70±0.02	0.095	3.51
	Wam2	64	1.22–1.50	1.34±0.02	0.065	4.84
Rh-94/1	Lm2	12	2.59–2.98	2.79±0.07	0.105	3.78
	Wam2	12	1.36–1.63	1.44±0.05	0.074	5.12

locality	meas.	n	R	m	s	V
Rh-94/5A	Lm2	1		2.78		
	Wam2	2	1.40–1.47	1.44		
RH-A/2	Lm2	9	2.60–2.84	2.70±0.05	0.067	2.48
	Wam2	14	1.31–1.48	1.39±0.03	0.056	4.02
RH-A/7	Lm2	2	2.68–2.72	2.70		
	Wam2	2	1.26–1.31	1.29		
Götzendorf	Lm2	11	2.59–2.91	2.75±0.08	0.108	3.92
	Wam2	14	1.28–1.48	1.36±0.04	0.061	4.48
Schernham	LCsup.	10	1.27–1.42	1.36±0.04	0.059	4.38
	WCsup.	10	0.71–0.83	0.78±0.03	0.042	5.34
Rh-94/5A	LCsup.	1		1.40		
	WCsup.	1		0.79		
RH-A/2	LCsup.	4	1.26–1.33	1.30±0.05	0.030	2.30
	WCsup.	5	0.71–0.75	0.72±0.02	0.017	2.31
RH-A/7	LCsup.	1		1.31		
	WCsup.	1		0.76		
Schernham	LP4	19	1.76–2.12	1.95±0.05	0.097	5.06
	WP4	20	1.46–1.74	1.60±0.04	0.078	4.89
Rh-94/1	LP4	9	1.84–2.24	2.06±0.12	0.141	6.87
	WP4	6	1.55–1.85	1.66±0.13	0.112	6.76
Rh-94/3	LP4	1		2.03		
	WP4	1		1.75		
Rh-94/5A	LP4	2	2.09–2.10	2.10		
	WP4	1		1.74		
RH-A/2	LP4	7	1.86–2.00	1.95±0.05	0.052	2.69
	WP4	9	1.45–1.63	1.56±0.05	0.057	3.66
RH-A/7	LP4	1		1.81		
	WP4	1		1.48		
RH-A/11	WP4	1		1.64		
Götzendorf	LP4	2	2.09–2.18	2.14		

| locality	meas.	n	R	m	s	V
Schernham	WP4	3	1.50–1.69	1.62		
	LbM1	21	3.12–3.55	3.25±0.05	0.117	3.59
	WaM1	12	1.98–2.20	2.09±0.04	0.066	3.15
	WpM1	12	2.24–2.47	2.37±0.04	0.068	2.85
Rh-94/1	LbM1	5	3.36–3.62	3.50±0.13	0.093	2.65
	WaM1	5	1.94–2.28	2.12±0.19	0.136	6.44
	WpM1	5	2.16–2.56	2.42±0.23	0.167	6.91
Rh-94/5A	LbM1	2	3.41–3.42	3.42		
	WaM1	2	2.09–2.18	2.14		
	WpM1	2	2.41–2.51	2.46		
RH-A/2	LbM1	2	3.34–3.57	3.46		
	WaM1	3	2.09–2.12	2.11		
	WpM1	4	2.31–2.38	2.34		
Götzendorf	LbM1	3	3.35–3.52	3.43		
	WaM1	4	2.07–2.20	2.14		
	WpM1	4	2.41–2.47	2.45		
Schernham	LM2	30	1.83–2.09	1.95±0.03	0.074	3.77
	WaM2	16	2.45–2.74	2.59±0.05	0.088	3.41
Rh-94/1	LM2	10	1.84–2.10	2.00±0.06	0.079	3.96
	WaM2	7	2.43–2.78	2.61±0.11	0.106	4.06
Rh-94/5A	LM2	1		1.95		
	WaM2	1		2.72		
RH-A/2	LM2	9	1.81–2.02	1.93±0.05	0.064	3.30
	WaM2	6	2.50–2.68	2.62±0.08	0.067	2.57
RH-A/7	LM2	2	1.91–2.04	1.98		
	WaM2	2	2.61–2.72	2.67		
RH-B	LM2	1		2.00		
	WaM2	1		2.72		
Götzendorf	LM2	3	1.92–2.00	1.95		
	WaM2	3	2.56–2.77	2.67		
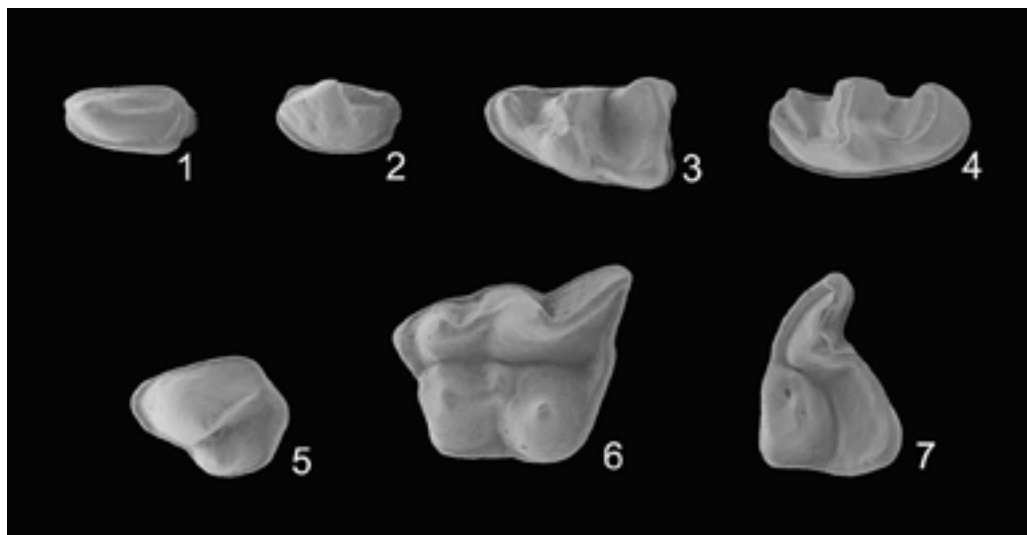
Fig. 19: *Plesiodimylus* aff. *chantrei*, Schernham. occlusal views. – Ca. 10x
1. Left p1, NHMW 2004z0220/0001.
2. Left p4, NHMW 2004z0220/0002.
3. Left m1, NHMW 2004z0220/0003.
4. Left m2, NHMW 2004z0220/0004.
5. Left P4, NHMW 2004z0220/0005.
6. Left M1, NHMW 2004z0220/0006.
7. Left M2, NHMW 2004z0220/0007.

In the Late Miocene there were clearly two or more species of *Plesiodimylus* in Europe. The second species is *P. johanni*, a form close to *P. chantrei*, from Can Llobateres (EN-GESSER 1972) and from Montredon (CROCHET & GREEN 1982). The latest occurrences of *P. chantrei* and of the genus itself correlate with MN 11: Ambérieu 3 in France (MEIN 1999) and Dorn-Dürkheim in Germany (STORCH 1978). The single p4 from Eichkogel points to an equally late occurrence in Austria. The early Late Miocene (MN 9) site Bełchatów A in Poland yielded two large m2, referred to *Plesiodimylus* sp. by RZEBIK-KOWALSKA (1996). They are more massive than in *P. johanni*. *P. chantrei* has also been recorded from this site and layer.

P. aff. *chantrei* is the most common insectivore species in the Schernham, Richardhof-Wald and RH-A/2 samples. The predominance of *Lantanotherium* in RH-A/7, RH-A/11 and RH-B may be incidental due to small samples sizes. In the Götzendorf fauna, *Plesiodimylus* is outnumbered by *Archaeodesmana* and has roughly the same share as *Talpa*.

Metacordylodon SCHLOSSER, 1911

Type species: *Cordylodon schlosseri* ANDREAE, 1904

***Metacordylodon schlosseri* (ANDREAE, 1904)**
Fig. 20

M a t e r i a l (measurements tab. 18):

Schernham	NHMW 2004z0225/0000–0005
	left and right maxillary fragment with teeth, 16 isolated teeth
Richardhof-Golfplatz RH-A/2	NHMW 2004z0226/0000 3 isolated teeth

Tab. 18: *Metacordylodon schlosseri*, sample statistics of the teeth

locality	meas.	n	R	m	locality	meas.	n	R	m
Schernham	Lp1	2	2.95–3.29	3.12	Schernham	L?P2	1		2.02
	Wp1	3	1.71–1.94	1.81		W?P2	1		1.20
RH-A/2	Wp1	1		1.71	Schernham	LP4	3	2.27–2.31	2.31
Schernham	Lp4	1		2.20		WP4	4	2.16–2.42	2.27
	Wp4	1		2.19	RH-A/2	LP4	1		2.19
Schernham	Lm1	2	2.23–2.29	2.26		WP4	1		1.94
	Wpm1	2	2.01–2.07	2.04	Schernham	LbM1	3	3.78–3.91	2.83
Schernham	Lm2	2	2.28–2.31	2.30		WaM1	2	2.56–2.65	2.61
	Wam2	2	1.24–1.32	1.28		WpM1	2	2.76–2.76	2.76
RH-A/2	LP1-P3	1		1.63					
	WP1-P3	1		1.02					

D e s c r i p t i o n

The most conspicuous character of all teeth is their high degree of amblyodonty, i.e. the teeth are inflated. Hence, they were exoedaenodontous, which means that they overlapped the jawbones. The p1 (canine in the older literature) is almond-shaped in occlusal view, with the apex of the crown bent lingually and with two distally directed roots. There is no cingulid. The p4 has a disto-lingual cingulid and a lobe directed mesio-bucally, whereas its cusp is directed disto-lingually. The shape of the p4 is highly variable. In the p4 from Petersbuch 35, this lobe is directed disto-buccally (see ZIEGLER 2005b, fig. 6 B). In the m1, the protoconid and hypoconid are no longer distinct cusps but fully fused in a continuous crest. The metaconid is positioned close to this crest. The paraconid is either tiny, fully eliminated or fused in the crest. A faint precingulid and a weak postcingulid are present. In the m2 the talonid is reduced to one fourth of the total length of the tooth. The precingulid is better developed than in the m1. The maxillary fragments show the infraorbital foramen between the root of P4, the posterior opening of the infraorbital canal in the anteriormost corner of the orbita, and a zygomatic process of the maxilla originating above the M2. The P4 has a marked protocone and a projecting parastyle. There is a cingulum at the mesio- and disto-lingual crown-base. In the M1 the parastyle is small and not projecting; the postparacrista joins the metacone.

C o m p a r i s o n

The high degree of amblyodonty confirms the affiliation of the samples to *Metacordylodon*, the only dimylid in the Middle and Late Miocene with such inflated teeth. *M. schlosseri*, the only species of the genus, was first described from Opole in Poland (ANDREAE 1904), which according to KOWALSKI (1989: tab. 1) correlates with MN 6. The type is best figured and measured in FAHLBUSCH (1989). According to the measurements
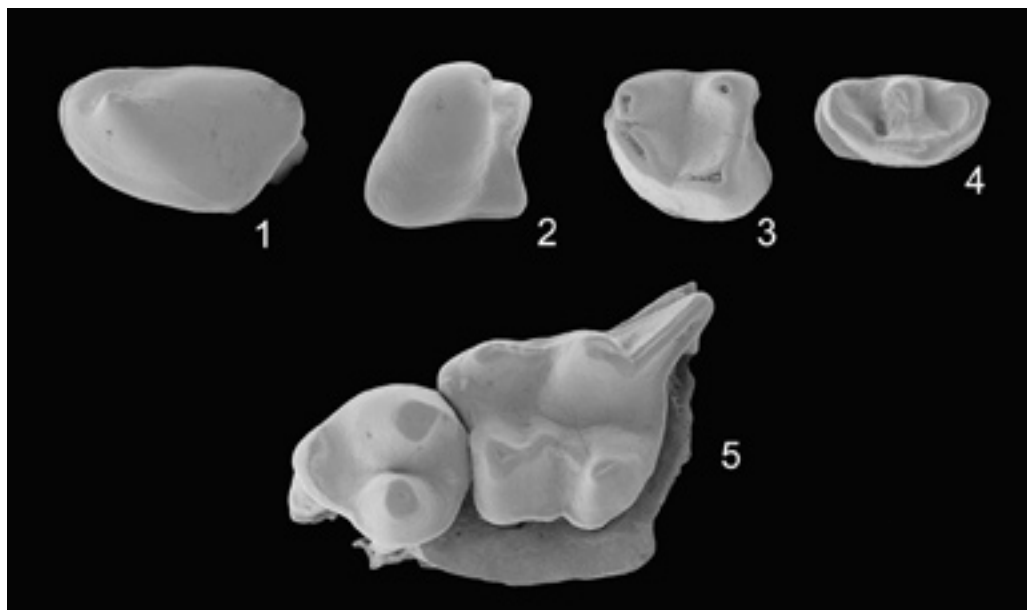
Fig. 20: *Metacordylodon schlosseri*, Schernham, occlusal views. – Ca. 10x
1. Left p1, NHMW 2004z0225/0001.   4. Right m2, NHMW 2004z0225/0004.
2. Right p4, NHMW 2004z0225/0002.   5. Left maxillary fragment with P4-M1,
3. Left m1, NHMW 2004z0225/0003.   NHMW 2004z0225/0005.

given there, the type is somewhat bigger than the specimens under study; especially the m1 is wider than long. *M. schlosseri* from Anwil and La Grive also differs slightly in size, the p4 being somewhat bigger and the m2 from La Grive wider. I consider these differences to be within the normal size variation of a population. The earliest records of this species to date are *M.* aff. *schlosseri* from Sandelzhausen and Franzensbad (ZIEGLER 2000, FEJFAR 1974), both correlative with MN 5; the latest record came from the Early Vallesian (MN 9) fauna of Castel del Barbera (AGUSTI et al. 1984). The Austrian records from Schernham and Richardhof-Wald extend the range of *Metacordylodon* to the Late Vallesian (MN 10).

<div align="center">

Soricidae G. FISCHER, 1814

Heterosoricinae VIRET & ZAPFE, 1952

Dinosorex ENGESSER, 1972

</div>

Type species: *Sorex sansaniensis* LARTET, 1851

<div align="center">

Dinosorex engesseri RABEDER, 1998
Fig. 21

</div>

1993   *Dinosorex* n. sp.; RABEDER in RÖGL et al.: 511. (Götzendorf material)
1998   *Dinosorex engesseri* n. sp.; RABEDER (1998 b): 122–125, figs. 3–6. (Götzendorf material)

M a t e r i a l (measurements see tab. 19):

Schernham	NHMW 2004z0227/0000–0004
	2 dentary fragments with teeth, 24 isolated teeth
Richardhof-Wald	NHMW 2004z0228/0000–0007
Rh-94/1	23 isolated teeth
Rh-94/3	3 isolated teeth
Rh-94/5A	*D.* cf. *engesseri* NHMW 2004z0229/0000
	7 isolated teeth
Neusiedl am See	NHMW 1990/1519/23
	right M1
Richardhof-Golfplatz	NHMW 2004z0230/0000–0001
RH-A/2:	30 isolated teeth
RH-A/7: 2004z0231/0001–11	*D.* cf. *engesseri*, NHMW 2004z0231/0000
	11 isolated teeth
Götzendorf	NHMW 2004z0232/0000–0004
Gö 1998/0046/1–56, 58–60	4 dentary fragments with teeth, 55 isolated teeth
Gö 1, 1990/14	left m1, left I sup.
Gö 1, 1990/15	5 isolated teeth
Gö 1, 1990/16	left edentulous dentary fragment, right dentary fragment
	with m1-m2, 14 isolated teeth
Gö 5, 1990/1512/34	right I sup. fragment

D e s c r i p t i o n

Except for one dentary fragment from Schernham and four from Götzendorf, all samples consist of isolated teeth. Some specimens show the mental foramen below the protoconid of m2; one fragment from Götzendorf shows the symphyseal foramen under the anterior root of m3 near the ventral margin. The dentary fragment from Schernham is broken under the trigonid of m1. One dentary from Götzendorf preserves three antemolar alveoles for two antemolars.

L o w e r   t e e t h : There are three incisors in the Rh-94/1 sample and 11 from Götzendorf. All are acuspulate, which is an apomorphic character for the genus *Dinosorex*, and have slightly wrinkled enamel on their labial side. The apex of the black teeth is somewhat brighter than the remainder of the crown. This may indicate lost pigmentation.

The exact determination of all lower antemolars is not possible unless their number is known. With certainty the large ones are the a1. Based on the posteriorly directed root, this antemolar imbricated the incisor, and it was imbricated by the following tooth. It has a marked distal concavity, a mesial crest, and a faint cingulid on both sides.

The antemolars lumped together as p4 in table 19 are antemolars posterior to a1. These smaller antemolars resemble mesio-distally-compressed a1. They are distinctly smaller, but relatively wider than the a1.

The size relation of the lower molars is m1>m2>m3. There is no marked entocristid, i.e. the mesial crest of the entoconid is weak and descends steeply. The postcristid joins the disto-lingual face of the entoconid without leaving any postentoconid gap. The m1 and m2 bear a marked ectocingulid which joins the ledge-shaped postcingulid and a fading precingulid. In the m3 the ectocingulid and most of the precingulid are ledge-shaped, whereas the postcingulid is less well developed.

Tab. 19. *Dinosorex engesseri*, sample statistics of the teeth

locality	meas.	n	R	m	s	V
Götzendorf	Hcor.	1		8.45		
Schernham	Lm1-m3	1		5.85		
Rh-94/1	Liinf.	1		7.48		
	Hiinf.	3	2.07–2.10	2.08		
Götzendorf	Liinf.	5	6.70–7.53	6.99±0.47	0.341	4.88
	Hiinf.	6	1.90–2.15	2.00±0.11	0.097	4.84
Schernham	La1	1		1.54		
	Wa1	1		1.28		
RH-A/2	La1	4	1.43–1.56	1.49		
	Wa1	4	1.05–1.15	1.07		
RH-A/7	La1	2	1.47–1.52	1.50		
	Wa1	2	1.09–1.17	1.13		
Götzendorf	La1	1		1.63		
	Wa1	1		1.13		
Rh-94/1	Lp4	2	0.57–0.73	0.65		
	Wp4	1		0.82		
Rh-94/3	Lp4	1		0.73		
	Wp4	1		0.92		
Rh-94/5A	Lp4	1		0.77		
	Wp4	1		0.90		
RH-A/2	Lp4	1		0.69		
	Wp4	1		0.95		
Schernham	Lm1	2	2.55–2.78	2.67		
	Wam1	1		1.55		
	Wpm1	1		1.61		
Rh-94/1	Lm1	2	2.81–2.87	2.84		
	Wam1	2	1.49–1.50	1.50		
	Wpm1	2	1.61–1.68	1.65		
Rh-94/5A	Lm1	1		2.82		

locality	meas.	n	R	m	s	V
	Wam1	1		1.56		
	Wpm1	1		1.76		
RH-A/2	Lm1	4	2.69–2.78	2.73		
	Wpm1	4	1.51–1.62	1.55		
	Wpm1	4	1.65–1.73	1.69		
RH-A/7	Lm1	3	2.69–2.78	2.73		
	Wam1	3	1.51–1.57	1.54		
	Wpm1	3	1.62–1.71	1.65		
Götzendorf	Lm1	13	2.57–2.89	2.74±0.06	0.088	3.22
	Wam1	13	1.42–1.73	1.58±0.05	0.080	5.08
	Wpm1	13	1.49–1.84	1.73±0.06	0.095	5.47
Schernham	Lm2	10	2.16–2.38	2.26±0.06	0.083	3.66
	Wam2	5	1.41–1.59	1.49±0.09	0.067	4.46
	Wpm2	5	1.35–1.56	1.44±0.11	0.080	5.55
Rh-94/1	Lm2	2	2.26–2.30	2.28		
	Wam2	2	1.36–1.40	1.38		
	Wpm2	2	1.33–1.39	1.36		
Rh-94/5A	Lm2	1		2.21		
	1Wam2	1		1.40		
	Wpm2	1		1.47		
RH-A/2	Lm2	1		2.51		
	Wam2	1		1.60		
	Wpm2	1		1.63		
RH-A/7	Wpm2	1		1.50		
Götzendorf	Lm2	11	2.24–2.62	2.41±0.09	0.133	5.55
	Wam2	12	1.40–1.68	1.57±0.06	0.096	6.09
	Wpm2	12	1.39–1.70	1.59±0.06	0.087	5.46
Schernham	Lm3	1		1.78		
	Wam3	1		1.12		

locality	meas.	n	R	m	s	V
Rh-94/1	Lm3	2	1.72–1.80	1.76		
	Wam3	2	1.12–1.28	1.20		
Rh-94/5A	Lm3	2	1.74–1.74	1.74		
	Wam3	2	1.10–1.14	1.12		
RH-A/2	Lm3	3	1.71–1.85	1.77		
	Wam3	3	1.19–1.32	1.25		
Götzendorf	Lm3	4	1.65–1.90	1.76		
	Wam3	4	1.16–1.33	1.25		
Schernham	L1sup.	1		4.43		
	L2sup.	1		2.43		
Rh-94/1	L1sup.	1		4.40		
	L2sup.	1		2.44		
Rh-94/5A	L1sup.	1		4.36		
	L2sup.	1		2.40		
RH-A/7	L1sup.	1		4.14		
	L2sup.	1		2.03		
Götzendorf	L1sup.	5	3.90–4.56	4.23±0.04	0.300	7.11
Schernham	LA1	2	2.28–2.43	2.36		
	WA1	2	1.57–1.70	1.64		
Rh-94/1	LA1	3	2.36–2.56	2.48		
	WA1	3	1.64–1.66	1.65		
RH-A/2	LA1	5	2.18–2.33	2.26		
	WA1	3	1.72–1.78	1.78		
Götzendorf	LA1	5	2.20–2.36	2.27±0.05	0.063	2.77
	WA1.	5	1.57–1.65	1.61±0.06	0.040	2.51
Rh-94/5A	LAx	1		0.86		
	WAx	1		0.94		
RH-A/2	LAx	3	0.73–0.92	0.81		
	WAx	3	0.83–0.98	0.92		
RH-A/7	LAx	1		0.88		

locality	meas.	n	R	m	s	V
Schernham	WAx	1		0.92		
	LP4	1		2.29		
	WP4	1		2.32		
Rh-94/1	LP4	2	2.26–2.26	2.26		
	WP4	2	2.19–2.23	2.21		
Götzendorf	LP4	3	2.38–2.45	2.41		
	WP4	2	2.21–2.42	2.32		
Rh-94/1	LM1	2	2.05–2.19	2.12		
Neusiedl	LM1	1		2.28		
	WM1	1		2.76		
Götzendorf	LM1	5	2.38–2.47	2.41±0.05	0.034	1.42
	WM1	4	2.69–2.82	2.76±0.12	0.065	2.35
Schernham	LM2	3	1.91–2.11	1.99		
Rh-94/1	LM2	2	1.92–1.93	1.93		
	WM2	2	2.42–2.45	2.44		
Rh-94/3	LM2	1		2.05		
	WM2	1		2.31		
RH-A/2	LM2	2	2.06–2.20	2.13		
	WM2	1		2.47		
Götzendorf	LM2	3	2.07–2.24	2.13		
	WM2	3	2.48–2.49	2.49		
Schernham	LM3	2	1.13–1.15	1.14		
	WM3	2	1.52–1.52	1.52		
Rh-94/1	LM3	2	1.09–1.09	1.09		
	WM3	2	1.50–1.62	1.56		
RH-A/2	LM3	2	1.16–1.20	1.18		
	WM3	1		1.61		
RH-A/7	LM3	2	1.14–1.18	1.16		
	WM3	2	1.55–1.57	1.56		
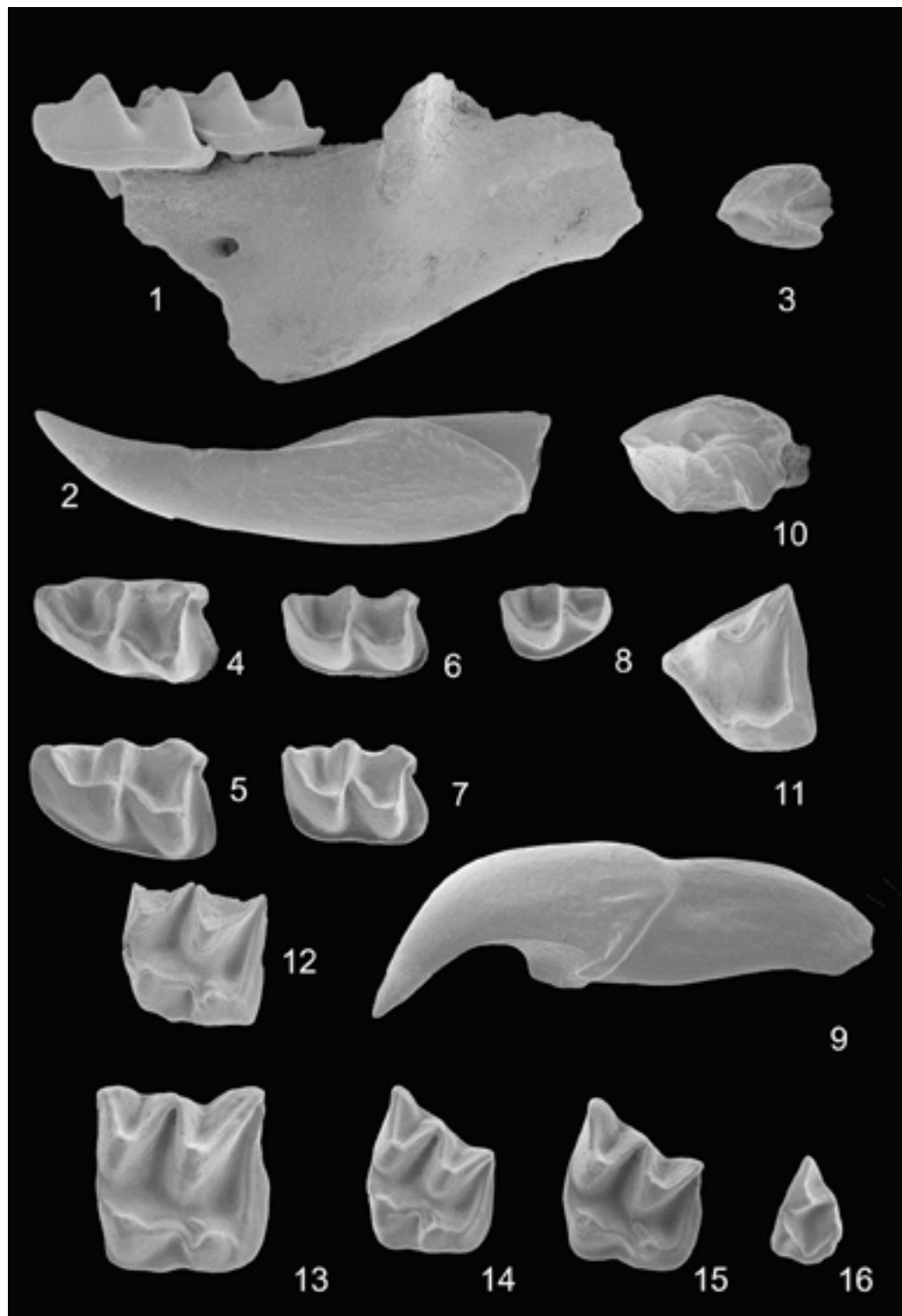
U p p e r   t e e t h : The upper incisor has a bifid apex, a straight upper margin, and slightly wrinkled enamel on the labial crown-base. The apex differs in colour from the remainder of the crown, which indicates a vanished pigmentation.

Among the upper antemolars, only the A1 can be identified reliably. They have one root, which is extremely directed posteriorly. Thus, most of the A1 imbricated the incisor. There is a lingual flange with a mesial and a distal accessory cuspule. The main cusp – the paracone, with its mesial and distal crest – therefore seems to be shifted labially. The enamel is wrinkled in the lingual half. The other antemolars are lumped together. They are distinctly smaller, differ in shape from round to heart-shaped, and are surrounded by a cingulum.

The P4 from all samples show the trapezoidal outline, which is an apomorphic character of the genus *Dinosorex*. The lingual flange is surrounded by a broad cingulum, thus leaving a deep lingual basin. There is a lingual cusp on the cingulum, which is somewhat better developed in the two P4 of the RH.94/1 sample. The buccal cingulum, on the other hand, is slightly better developed in the Schernham specimen.

In the M1 and M2 the mesostyle is superficially divided in unworn, intact specimens. This observation is based on only few M1/2 because most are damaged on their buccal side. All have a well-developed hypocone with a more or less well-developed, buccally directed crest, the hypoloph. The M3 is preserved only in the Schernham sample. Both specimens show the characteristic short, free-ending postprotocrista.

C o m p a r i s o n s   a n d   d i s c u s s i o n s

Miocene faunas probably contain two genera of heterosoricines: *Dinosorex* E<small>NGESSER</small>, 1972 and *Heterosorex* V<small>IRET</small> & Z<small>APFE</small>, 1952. The first is characterised by a subdivided masseteric fossa, an acuspate lower incisor, a postcristid joining the entoconid in most species, a trapezoidal P4, and an M3 with a short, tapering postprotocrista. The apomorphic characters of *Heterosorex* are: an undivided masseteric fossa, a bicuspulate lower incisor, a more or less wide postentoconid gap between postcristid and entoconid, a P4 triangular in occlusal outline and an M3 with a continuous postprotocrista. Except for

Fig. 21 (previous page): *Dinosorex engesseri*. – Ca. 10x
1. Left dentary fragment with m1-m2, buccal view, Schernham, NHMW 2004z0227/0001.
2. Right i inf., buccal view, Richardhof-Wald, NHMW 2004z0228/0001.
3. Right a1, occlusal view, Schernham, NHMW 2004z0227/0002.
4. Left m1, occlusal view, Richardhof-Wald, NHMW 2004z0228/0002.
5. Left m1, occlusal view, Götzendorf, NHMW 2004z0232/0001.
6. Left m2, occlusal view, Richardhof-Wald, NHMW 2004z0228/0003.
7. Left m2, occlusal view, Götzendorf, NHMW 2004z0232/0002.
8. Left m3, occlusal view, Richardhof-Wald, NHMW 2004z0228/0004.
9. Left I sup., buccal view, Richardhof-Golfplatz, RH-A, NHMW 2004z0230/0001.
10. Right A1, occlusal view, Schernham, NHMW 2004z0227/0003.
11. Left P4, occlusal view, Schernham, NHMW 2004z0227/0004.
12. Right M1, occlusal view, Richardhof-Wald, NHMW 2004z0228/0005.
13. Left M1, occlusal view, Götzendorf, NHMW 2004z0232/0003.
14. Left M2, occlusal view, Richardhof-Wald, NHMW 2004z0228/0006.
15. Right M2, occlusal view, Götzendorf, NHMW 2004z0232/0004.
16. Right M3, occlusal view, Richardhof-Wald, NHMW 2004z0228/0007.

the RH-A/7 sample, all samples preserve one or more diagnostic elements. Given that the samples are homogeneous, these can be referred to the genus *Dinosorex*. All samples except Richardhof-Wald-94/5A and Richardhof-Golfplatz-A/7 include M1 and/or M2 with a hypoloph, the most diagnostic character of *D. engesseri*. Götzendorf is the type locality and we can expect this species in all Late Miocene faunas of Austria. RABEDER (1998: fig. 6/6, 7) figured the m1 and m2 of *D. engesseri* with a marked postentoconid valley. This is quite exaggerated. Actually, the hypolophid joins the entoconid at its posterior face as in *Dinosorex zapfei* ENGESSER, 1975. Thus, all samples from Schernham, Richardhof-Wald and Richardhof-Golfplatz morphologically best fit the Götzendorf sample. The variability in tooth size between the samples is quite normal and a further argument that all samples with preserved M1/2 belong to *D. engesseri*. Rh-94/5A and RH-A/7 yielded no upper molars. Hence, the presence of the apomorphic character cannot be verified. Both samples are named *D.* cf. *engesseri*.

In addition to the above-listed Austrian faunas, *D. engesseri* also has been recorded at the hominoid locality Rudabánya in Hungary (ZIEGLER 2005a). There, the incisors are somewhat longer.

Soricinae Fischer von Waldheim, 1817

Anourosoricini ANDERSON, 1879

Crusafontina GIBERT, 1975

Type species: *Crusafontina endemica* GIBERT, 1975

Crusafontina aff. *endemica* GIBERT, 1975
and
Crusafontina kormosi (BACHMAYER & WILSON, 1970)
Fig. 22

1970 *Anourosorex kormosi* nov. spec.; BACHMAYER & WILSON: 551–553, figs. 3, 4, 4a, 29, 20a, 21, 22, 23, 23a, 24, 25. (Kohfidisch material)
1970 *Anourosorex* sp.; RABEDER: 593. (Eichkogel material)
1978 *Anourosorex kormosi* BACHMAYER & WILSON 1970; BACHMAYER & WILSON: 141, pl. 2, figs. 5, 5a. (Kohfidisch material)
1980 *Anourosorex kormosi* BACHMAYER & WILSON, 1970; BACHMAYER & WILSON: 361–362. (Kohfidisch material)
1991 *Crusafontina kormosi*; STORCH & QIU: 611.

M a t e r i a l (measurements see tab. 20):

	C. kormosi
Eichkogel	NHMW 2004z0233/0000–0002
1974/1680 (Coll. HUIMANN)	11 isolated teeth
1993/0008/0016	57 isolated teeth
	C. aff. endemica
Schernham	NHMW 2004z0234/0000–0010
	15 dentary fragments with teeth, 2 maxillary fragments with teeth, 83 isolated teeth
Richardhof-Wald	NHMW 2004z0235/0000–0001
Rh-94/1	66 isolated teeth

Rh-94/3	4 isolated teeth
Rh-94/5A	2 dentary fragments with teeth, 19 isolated teeth
Neusiedl am See	NHMW 1990/1519/24–25
	left m1, left M2
Richardhof- Golfplatz	NHMW 2004z0236/0000–0001
RH-A/2	62 isolated teeth
RH-A/7	22 isolated teeth
RH-A/11	left I sup., right m2
RH-B	left I sup.
Götzendorf	NHMW 2004z0237/0000
Gö1–6, 1998/0046/0057	left dentary fragment with m1
Gö 1–6	right edentulous dentary
Gö 1, 1990/16	2 edentulous dentary fragments, 2 dentary fragments with m1, 12 isolated teeth
Gö 1, 1990/15	left dentary fragment with m1-m2, 9 isolated teeth
Gö2, 1990/22, leg. Höck	right dentary fragment with m1-m3, 3 isolated teeth
Gö 4, 1990/1508	left dentary fragment with i
Gö 5, 1990/1512	right i inf. fragment
Gö (Coll. ULRICH)	right edentulous dentary
Bullendorf	cf. *Crusafontina* sp., NHMW 1993/0026/16–18
	right i inf, 2 I sup.

D e s c r i p t i o n

D e n t a r y : The bulk of the material consists of isolated teeth. Some dentary fragments with teeth are available from the Schernham, from the Richardhof-Wald 94/5A and from the Götzendorf samples. All fragments show the mental foramen between the roots of m1. One specimen from Schernham in which the lower part of the ascending ramus is preserved has a rounded-subtriangular, deeply pocketed pterygoid fossa and an extremely shallow masseteric fossa. The upper articular facet, preserved in one specimen, is cylindrical rather than triangular. One dentary fragment from Schernham has two alveoles for the antemolars, one for the strong posterior root of p4 and an equally sized one for the a1. The small alveole for the tiny anterior root of the p4 is broken out. In another specimen from Götzendorf it is preserved.

M a x i l l a r y : There are only two fragments in the Schernham sample, one with the two anterior antemolars and one with M1 and M2. The latter shows the root of the zygomatic arch and the anterior margin of the orbita above M1/M2 and the lacrimal foramen above the middle of M1.

Dentition – There is no unambiguous indication for coloration of the teeth. The tips of some teeth of the Schernham sample are somewhat darker, perhaps a trace of pigmentation.

L o w e r i n c i s o r s : They are bicuspulate in unworn condition, with an upturned apex.

L o w e r a n t e m o l a r s : There are two, the latter being the p4. Based on the number of alveoles in two dentaries, the a1 is single-rooted. The a1 have one strong posterior root inclined backwards and a vestigial anterior root, which obviously had no corresponding alveole. The crown is sub-triangular in occlusal view, with a marked mesial crest and a broad lingual cingulid. The second antemolar, the p4, also has a strong posterior root and a somewhat better developed, though tiny anterior root. It is more triangular in occlusal outline, with a well-developed mesial and a crescent-shaped distal crest. The p4 is surrounded by a broad cingulid.

Tab. 20: *Crusafontina* aff. *endemica* and *C. kormosi* (Kohfidisch and Eichkogel), sample statistics of the teeth

locality	meas.	n	R	m	s	V
Kohfidisch	Wpm1	5	1.12–1.19	1.16±0.04	0.026	2.20
RH-A/2	Lm1	6	2.05–2.22	2.15±0.07	0.058	2.70
	Wpm1	10	1.06–1.21	1.12±0.04	0.055	4.88
	Wpm1	9	1.10–1.24	1.16±0.04	0.051	4.37
RH-A/7	Lm1	3	2.08–2.16	2.12		
	Wam1	4	1.04–1.09	1.06		
	Wpm1	4	1.12–1.14	1.14		
Götzendorf	Lm1	4	2.15–2.35	2.25		
	Wam1	7	1.07–1.16	1.12±0.03	0.031	2.75
	Wpm1	9	1.10–1.23	1.15±0.03	0.042	3.61
Kohfidisch	Lm2	10	1.70–1.93	1.84±0.05	0.070	3.83
	Wam2	10	1.06–1.21	1.13±0.04	0.074	4.18
	Wpm2	10	0.96–1.19	1.06±0.05	0.064	6.02
Eichkogel	Lm2	4	1.70–1.84	1.76±0.11	0.058	3.31
	Wam2	6	0.97–1.04	1.02±0.03	0.026	2.59
	Wpm2	5	0.91–1.02	0.95±0.06	0.045	4.77
Schemham	Lm2	8	1.70–1.83	1.77±0.04	0.049	2.78
	Wam2	8	0.93–1.03	0.98±0.03	0.033	3.42
	Wpm2	8	0.90–0.97	0.93±0.02	0.026	2.83
Rh-94/1	Lm2	3	1.70–1.77	1.72		
	Wam2	3	0.95–0.98	0.97		
	Wpm2	3	0.91–0.94	0.92		
Rh-94/5A	Lm2	1		1.75		
	1Wam2	2	0.91–0.98	0.95		
	Wpm2	2	0.88–0.91	0.90		
RH-A/2	Lm2	4	1.64–1.86	1.77		
	Wam2	7	0.90–1.05	0.99±0.05	0.052	5.27
	Wpm2	6	0.90–1.05	0.99±0.06	0.050	5.07
RH-A/7	Lm2	1		1.77		

locality	meas.	n	R	m	s	V
Kohfidisch	Hcor.	10	5.71–6.58	6.09±0.18	0.235	3.87
Götzendorf	Hcor.	3	5.00–5.53	5.34		
Kohfidisch	Lm1–m3	10	4.91–5.41	5.14±0.13	0.175	3.41
Schemham	Lm1–m3	1		4.84		
Götzendorf	Lm1–m3	1		5.13		
Kohfidisch	Liinf.	10	4.61–5.09	4.87±0.11	0.153	3.13
	Hlinf.	10	1.20–1.37	1.27±0.04	0.050	3.92
Schemham	Liinf.	4	4.91–5.43	4.99		
	Hlinf.	6	1.14–1.25	1.20±0.05	0.040	3.33
RH-A/2	Liinf.	1		4.83		
	Hlinf.	6	1.11–1.17	1.14±0.03	0.030	2.57
Götzendorf	Liinf.	2	4.17–4.34	4.26		
	Hlinf.	5	1.04–1.28	1.14±0.13	0.092	8.04
Kohfidisch	La1	4	1.16–1.32	1.26		
	Wa1	4	0.98–1.08	1.04		
Eichkogel	La1	5	1.10–1.26	1.20±0.09	0.062	5.17
	Wa1	4	0.83–0.97	0.92		
Rh-94/1	La1	3	1.05–1.11	1.09		
	Wa1	3	0.81–0.91	0.85		
Rh-94/5A	La1	1		1.05		
	Wa1	1		0.80		
RH-A/2	La1	2	1.05–1.06	1.06		
	Wa1	2	0.77–0.86	0.82		
RH-A/7	La1	1		1.24		
	Wa1	1		0.85		
Götzendorf	La1	1		1.13		
	Wa1	1		0.73		
Kohfidisch	Lp4	10	1.35–1.61	1.46±0.06	0.085	5.80
	Wp4	10	1.12–1.25	1.18±0.03	0.047	3.96

locality	meas.	n	R	m	s	V
Schemham	LA1	5	1.62–1.83	1.74±0.14	0.099	5.69
	WA	4	1.07–1.21	1.12		
Rh-94/1	LA1	3	1.45–1.71	1.59		
	WA1	3	1.06–1.20	1.14		
Rh-94/5A	LA1	2	1.72–1.72	1.72		
	WA1	2	1.07–1.10	1.09		
RH-A/2	LA1	3	1.58–1.66	1.63		
	WA1	3	1.08–1.17	1.13		
Kohfidisch	LA2	7	1.08–1.18	1.13±0.04	0.036	3.20
	WA2	7	0.95–1.13	0.99±0.06	0.064	6.49
Eichkogel	LA2	5	0.94–1.22	1.10±0.19	0.136	12.4
	WA2	4	0.90–0.98	0.94±0.07	0.039	4.10
Schemham	LA2	3	1.18–1.28	1.23		
	WA2	3	0.96–0.99	0.97		
Rh-94/1	LA2	7	0.96–1.08	1.01±0.04	0.042	5.07
	WA2	7	0.82–0.93	0.87±0.04	0.044	
RH-A/2	LA2	9	0.93–1.02	0.98±0.03	0.031	3.13
	WA2	9	0.84–0.95	0.88±0.03	0.037	4.19
Götzendorf	LA2	1		0.95		
	WA2	1		0.88		
Kohfidisch	LP4	10	2.57–2.74	2.67±0.04	0.053	2.00
	WP4	10	1.85–2.24	2.04±0.10	0.130	6.38
Eichkogel	LP4	2	2.57–2.67	2.62		
Schemham	LP4	3	2.38–2.52	2.47		
	WP4	2	1.83–1.93	1.88		
Rh-94/1	LP4	4	2.25–2.38	2.33		
	WP4	1		1.94		
Rh-94/3	LP4	1		2.32		
RH-A/2	LP4	5	2.14–2.38	2.27±0.13	0.092	4.03
	WP4	1		1.84		
Kohfidisch	LM1	10	2.00–2.32	2.16±0.08	0.102	4.65
	WaM1	10	2.15–2.43	2.35±0.07	0.091	3.85

locality	meas.	n	R	m	s	V
RH-A/11	Wam2	2	1.02–1.04	1.03		
	Wpm2	2	0.97–1.04	1.01		
	Lm2	1		1.76		
	Wam2	1		0.92		
	Wpm2	1		0.92		
Götzendorf	Lm2	3	1.76–1.83	1.84		
	Wam2	4	0.91–1.04	0.96		
	Wpm2	3	0.87–0.90	0.88		
Kohfidisch	Lm3	10	0.90–1.10	1.03±0.05	0.063	6.11
	Wam3	10	0.61–0.80	0.66±0.05	0.061	9.23
Eichkogel	Lm3	5	0.94–1.08	1.04±0.08	0.056	5.40
	Wam3	5	0.59–0.68	0.62±0.05	0.038	6.06
Schemham	Lm3	4	1.02–1.16	1.08		
	Wam3	3	0.60–0.94	0.76		
Rh-94/1	Lm3	1		1.02		
	Wam3	3	0.66–0.70	0.68		
Kohfidisch	L1sup.	10	2.43–2.67	2.54±0.07	0.090	3.55
	L2sup.	10	1.08–1.28	1.18±0.06	0.079	6.66
Eichkogel	L1sup.	1		2.57		
	L2sup.	4	0.99–1.19	1.08		
Schemham	L1sup.	7	2.34–2.58	2.49±0.08	0.080	3.22
	L2sup.	8	1.04–1.28	1.15±0.06	0.070	6.13
RH-A/2	L2sup.	4	1.13–1.29	1.18		
RH-A/11	L2sup.	2	1.07–1.11	1.09		
Götzendorf	L1sup.	3	2.28–2.43	2.36		
	L2sup.	3	1.07–1.21	1.16		
Bullendorf	L1sup.	1		2.26		
Rh-94/3	L2sup.	2	0.97–1.08	1.06		
Kohfidisch	LA1	5	1.57–1.85	1.76±0.16	0.113	6.40
	WA	5	1.10–1.20	1.14±0.05	0.036	3.13
Eichkogel	LA1	7	1.81–1.90	1.85±0.03	0.030	1.64
	WA	5	1.08–1.19	1.15±0.06	0.041	3.56

locality	meas.	n	R	m	s	V
Eichkogel	LM2	2	1.42–1.42	1.42		
	WaM2	1		2.09		
	WpM2	2	1.26–1.33	1.30		
Neusiedl	LM2	1		1.24		
	WaM2	1		2.01		
Schernham	LM2	6	1.19–1.32	1.27±0.05	0.046	3.64
	WaM2	3	1.89–2.00	1.97		
	WpM2	3	1.26–1.30	1.28		
Rh-94/1	LM2	6	1.28–1.45	1.37±0.07	0.057	4.13
	WaM2	2	1.88–1.98	1.93		
	WpM2	7	1.23–1.51	1.40±0.10	0.099	7.05
Rh-94/5A	LM2	1		1.43		
	WaM2	1		2.03		
	WpM2	1		1.38		
RH-A/2	LM2	4	1.37–1.45	1.40		
	WaM2	2	2.02–2.05	2.04		
	WpM2	4	1.39–1.44	1.42		

locality	meas.	n	R	m	s	V
Eichkogel	WpM1	10	1.95–2.23	2.11±0.07	0.093	4.43
	LM1	1		2.09		
Schernham	WaM1	5	2.12–2.37	2.25±0.15	0.110	4.90
	LM1	9	1.81–2.07	1.94±0.06	0.073	3.77
	WaM1	8	1.99–2.12	2.07±0.04	0.042	2.05
	WpM1	3	2.11–2.20	2.15		
Rh-94/5A	LM1	2	1.75–1.93	1.84		
	WaM1	2	1.95–2.00	1.98		
	WpM1	2	1.98–2.11	2.00		
RH-A/2	LM1	4	1.80–2.05	1.95		
	WaM1	2	2.02–2.05	2.04		
	WpM1	1		2.19		
Götzendorf	LM1	1		2.01		
	WaM1	1		2.09		
	WpM1	1		2.22		
Kohfidisch	LM2	10	1.15–1.46	1.36±0.07	0.094	6.90
	WaM2	10	1.80–2.17	2.06±0.08	0.111	5.40
	WpM2	10	1.04–1.31	1.24±0.06	0.077	6.22

L o w e r   m o l a r s : They are distinctly graded in size. The most conspicuous feature is the long and widely opened trigonid, which is longer than the talonid in all molars. The lingually opened trigonid is due to the mesially directed paralophid. The metaconid is situated lingually to the protoconid. The oblique cristid joins the posterior face of the protoconid rather buccally, thus leaving a shallow buccal re-entrant valley. The entoconid is slightly crested. The hypolophid does not join the entoconid, but leaves a narrow but well-delimited post-entoconid gap. There is a distinct precingulid but, if present at all, only a faint ectocingulid. The crown-base is slightly bent upwards under the protoconid of the m1, but straight in the m2. The precingulid is better developed in the m2 and especially in the m3. In the m2 protoconid and metaconid are more widely spaced. In the m3 the talonid is much smaller, but in unworn specimens still preserves the entocristid, oblique cristid and hypolophid.

U p p e r   i n c i s o r s : The upper incisor is not bifid and has a hooked apex. The labial basal cusp is blade-like, the lingual reduced to a strong shearing edge. The labial cingulum is restricted to the lower half of the crown-base.

U p p e r   a n t e m o l a r s : The present material gives no indication of the number of upper antemolars. The A1 and A2 are preserved in situ and as isolated teeth. None of the samples contain single-rooted, similar-shaped, but smaller teeth that can be identified as A3. The A1 is rectangular in occlusal view, with flanks slightly converging mesially.
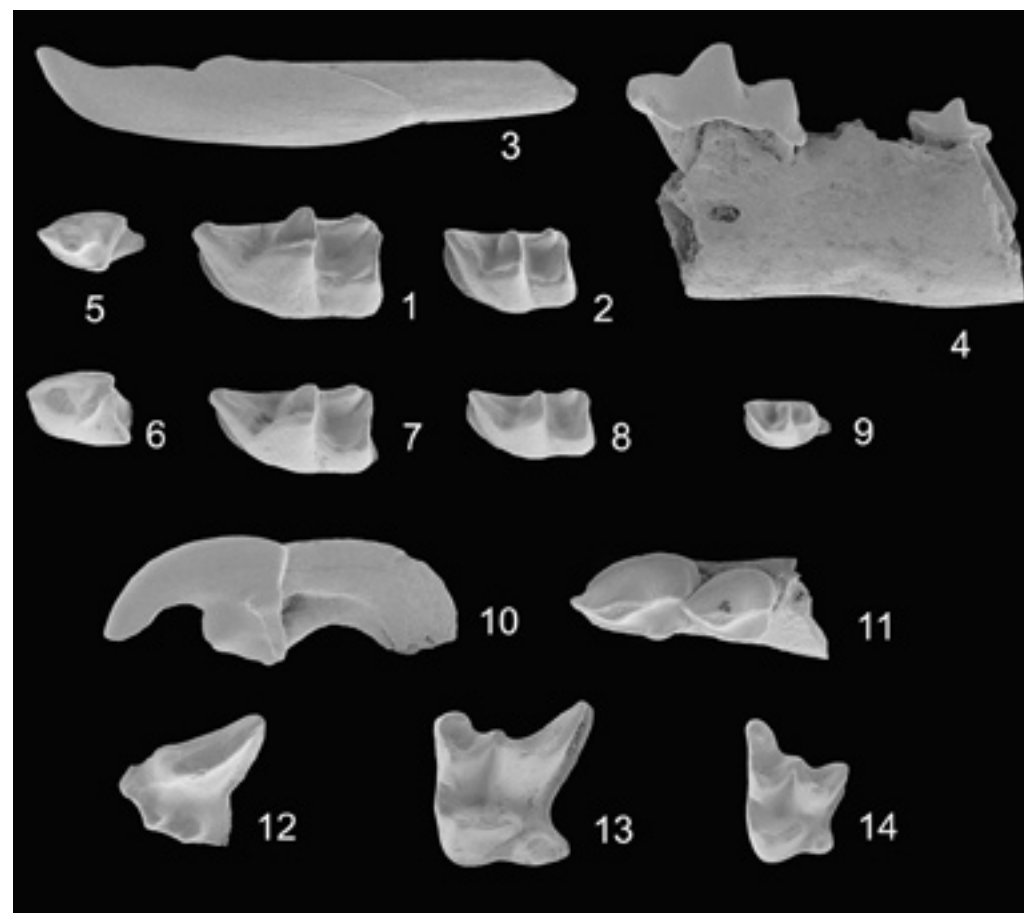

Fig. 22: 1., 2. *Crusafontina kormosi*, Eichkogel; 3.–14. *Crusafontina* aff. *endemica*. – Ca. 10x
1. Right m1, occlusal view, NHMW 2004z0233/0001.
2. Left m2, occlusal view, NHMW 2004z0233/0002.
3. Left i inf., buccal view, Schernham, NHMW 2004z0234/0001.
4. Left dentary fragment with m1+m3, buccal view, Schernham, NHMW 2004z0234/0002.
5. Left a1, occlusal view, Richardhof-Golfplatz, NHMW 2004z0236/0001.
6. Left p4, occlusal view, Schernham, NHMW 2004z0234/0003.
7. Left m1, occlusal view, Schernham, NHMW 2004z0234/0004.
8. Left m2, occlusal view, Schernham, NHMW 2004z0234/0005.
9. Left m3, occlusal view, Schernham, NHMW 2004z0234/0006.
10. Left I sup., buccal view, Schernham, NHMW 2004z0234/0007.
11. Left maxillary fragment with A1-A2, occlusal view, Schernham, NHMW 2004z0234/0008.
12. Left P4, occlusal view, Richardhof-Wald, NHMW 2004z0235/0001.
13. Left M1, occlusal view, Schernham, NHMW 2004z0234/0009.
14. Left M2, occlusal view, Schernham, NHMW 2004z0234/0010.

It is surrounded by a well-developed cingulum tapering anteriorly and by a disto-lingual cingular cuspule. Marked mesial and distal crests originate from the apex. The A3 is smaller and sub-triangular in occlusal view and has no cingular cusp. In the P4 the

projecting parastyle, protocone, and hypocone are equal-sized, similar in shape, and arranged in an open arch running from mesio-buccal to disto-lingual. The postparacrista is conspicuously long and slightly bent lingually. The distal emargination is narrow and accentuated by the extended heel.

U p p e r   m o l a r s : Only the first two upper molars are preserved. They are characterised by their extremely expanded parastyle and the long disto-buccally directed postmetacrista in M1, which leaves a strongly concave ectoflexus. The mesostyle is reduced. In the M1 the metacone is by far the largest cusp, followed by paracone and protocone, which are subequal in size, and by the small conical hypocone. The distal face is moderately emarginated.

D i s c u s s i o n

The genus *Crusafontina* GIBERT, 1975 currently comprises seven valid species: the type species *C. endemica* GIBERT, 1975 (type locality Can Llobateres, Spain, Early Vallesian, MN 9), *C. fastigata* VAN DAM, 2004 (type locality Los Aguanaces 5A, Spain, local biozone J3, corresponds to MN 10), *C. vandeweerdi* VAN DAM, 2004 (type locality Tortajada C, Spain, local biozone L, corresponds to MN 12), *C. kormosi* (BACHMAYER & WILSON, 1970) (type locality Kohfidisch, Austria, Early Turolian, MN 11), and *C. exculta* (MAYR & FAHLBUSCH, 1975) (type locality Hammerschmiede, Germany, Early Vallesian, MN 9). I agree with STORCH & QIU (1991) in including the New World genus *Anouroneomys* HUTCHISON & BOWN, 1980 into *Crusafontina*. Hence, the species *C. magna* (HUTCHISON & BOWN, 1980) (Nebraska, USA, Hemphilian) and *C. minima* (HUTCHISON & BOWN, 1980) (Oregon, USA, Clarendonian) add to *Crusafontina*. *C. kormosi* was originally described by its authors as a species of *Anourosorex* MILNE-EDWARDS, 1870. *C. inexpectata* (SCHLOSSER, 1924) from Ertemte (Inner Mongolia, China; Late Turolian, MN 11) was also temporarily housed within this genus. It was named *Neomys (Crossopus) inexpectatus* by its author and was referred to *Anourosorex* by MILLER 1927. STORCH & QIU (1991) emphasised the differences between the two species and the extant *A. squamipes* MILNE-EWARDS, 1872 and considered them to be better placed in the genus *Crusafontina*. STORCH (1995) referred *inexpectata* to the genus *Paranourosorex* RZEBIK-KOWALSKA 1975. *C. exculta* was described by its authors as a species of *Angustidens* REPENNING 1967 and referred to *Crusafontina* by RZEBIK-KOWALSKA (1998).

The material under study shows the diagnostic features of *Crusafontina* (with respect to *Anourosorex*): the projecting parastyle of P4, the wide M1 and M2, the smaller though still large parastyle on M1, the entocristids on m1 and m2, and the cylindrical to oval rather than triangular upper articular facet. Consequently, it can without any doubt be referred to this genus. The present samples agree morphologically well with *C. kormosi* from Kohfidisch. All the insectivores from this site were available for comparison. *C. endemica* from the Vallesian of Spain is morphologically very similar. The only marked difference is the slightly more anterior position of the mental foramen under the trigonid of m1, whereas in all Austrian specimens it is between the roots of m1. The ectoflexus of M1 is somewhat deeper in *C. kormosi* and the present material than in *C. endemica* from Can Llobateres. The description and figures of *C. endemica* in GIBERT (1975) are insufficient, but VAN DAM (2004) adds new evidence of this species from several Vallesian sites in Spain and provides informative figures. He also figures specimens from the type locality Can Llobateres 1 (VAN DAM 2004: figs. 2.16–2.22, 3.1–3.4, 4.17).

Tab. 21: Length relations between the m1 and m2 of various *Crusafontina* samples, calculated from the arithmetic means of Lm1 and Lm2, from own measurements and STORCH (1978, Dorn-Dürkheim), CROCHET & GREEN (1982, Montredon), GIBERT (1975, Can Llobateres), MAYR & FAHLBUSCH (1975, Hammerschmiede), MÉSZÁROS (1998a, Sümeg), ZIEGLER (2005a, Rudabánya)

Species/sample	For. ment. below	Lm1	Lm2	Lm3	Lm2/Lm1 (%)	Lm3/Lm1 (%)
C. kormosi						
Dorn-Dürkheim	–	2.27	1.66	0,92	73	41
Sümeg	middle m1	2.56	1.77	1,15	69	45
Eichkogel	–	2.47	1.76	1,04	71	42
Kohfidisch	middle m1	2.61	1.84	1,03	70	39
C. (aff.) endemica						
Montredon	–	2.15	1.73	1,07	80	50
Schernham	middle m1	2.25	1.77	1,08	79	48
Rh-94/5A	middle m1	2.18	1.75	–	80	–
RH-A/2	–	2.15	1.77	–	82	–
RH-A/7	–	2.12	1.77	–	83	–
Götzendorf	middle m1	2.25	1.84	–	82	–
Rudabánya	middle m1	2,09	1,80	1,33	87	64
Can Llobateres	anterior m1	2.07	1.66	0,98	80	47
Hammerschmiede	–	1.93	1.58		82	59

Table 21 points to a marked difference in overall size and in the size relation of m2 and m1 between *C. endemica* and *C. kormosi*. In *C. endemica* the length of m2 is about 80 % of the length of m1, as calculated from the means of the tooth-lengths, whereas this value is ca. 70 % in *C. kormosi* from Kohfidisch (72 %), Eichkogel (71 %), Sümeg (69 %) and Dorn-Dürkheim (73 %). This means that the m2 in *C. endemica* is less reduced in length than in *C. kormosi*. VAN DAM (2004) proposes the length ratio Lm1/Lm3 to separate the two species, with 40% being the demarcation. This value also shows that the Kohfidisch sample represents the most advanced *C. kormosi* and that *Crusafontina* from Rudabánya is the most primitive *C. endemica*. However, the separation is less clear than in the m1/m2-length ratio.

In this respect and in their smaller overall size, the present samples fit *C. endemica* better than *C. kormosi*, which we would expect based on geographical considerations. They represent the less advanced evolutionary stage of the lineage *C. endemica* – *C. kormosi*. The small sample from Montredon (France, Late Vallesian, MN 10), which was determined as *Anourosorex kormosi* (now *Crusafontina*) by CROCHET & GREEN (1982), corresponds in overall size and the relative lengths of the lower molars better with *C. endemica* and should be referred to this species. Because of the more posterior position of the mental foramen and the deeper ectoflexus of the M1, the present samples are better determined as *C.* aff. *endemica*. The three incisors from Bullendorf are morphologically quite similar to *Crusafontina*. They do not yield enough diagnostic characters and are therefore referred to *Crusafontina* with some reserve. A species determination is not possible.

MÉSZÁROS (1998) reported on *C. endemica* from Sümeg, a Hungarian fauna correlated with MN 10. Overall size and the size relation between m1 and m2 clearly show that it

belongs to *C. kormosi*. A small sample from Alsótelekes (Early Vallesian, MN 9) was referred to *C. endemica* by Mészáros (1999). However, as the sample comprises only seven teeth and due to the lack of distinctive characters, this expected determination cannot be corroborated. The sample from the hominoid locality Rudabánya in Hungary represents the most primitive *Crusafontina*. It was determined as *C.* aff. *endemica* by Ziegler (2005a).

C. exculta Mayr & Fahlbusch, 1975 from the Hammerschmiede fauna near Kaufbeuren in Bavaria, which correlates with MN 9, seems to be better placed in the genus *Crusafontina*. The available dental features are all compatible with this allocation. The diagnostic character of the species *exculta*, the fourth lingual cusp in P4, is rather a cingular swelling. It corresponds well with *C. endemica* in the degree of reduction of the m2 and m3 length with respect to the length of m1, but it is somewhat smaller in overall size. Van Dam (2004) lists this species in the synonymy of *C. endemica*. In my opinion it is at least closely related to this species and should be named *C.* aff. *endemica*, thus taking into account its small size.

The transition between the two species evidently took place within the Late Vallesian (MN 10). Mein (1999) lists *C. kormosi* in several French localities correlated with MN 10. Franzen et al. (2003) report on *C. kormosi* from the Late Vallesian site Eppelsheim in Germany.

From the description of new species – *C. fastigata* van Dam, 2004 and *C. vandeweerdi* van Dam, 2004 – van Dam concluded that the simple concept of one Old Word *Crusafontina* lineage (*C. endemica* – *C. kormosi*) is no longer valid. He recognised at least two additional lineages, but the old lineage still exists. The Central European samples fit well with the lineage *C. endemica* – *C. kormosi*.

Blarinellini Reumer, 1998

Petenyia Kormos, 1934

Type species: *Petenyia hungarica* Kormos, 1934

Petenyia aff. *dubia* Bachmayer & Wilson, 1970
Fig. 23

1970　　*Petenyia hungarica* Kormos, 1934; Rabeder: 593. (Eichkogel material)

M a t e r i a l (measurements see tab. 22):

Eichkogel 1993/0008/0016	NHMW 2004z0238/0000 8 isolated teeth
Schernham	NHMW 2004z0239/0000–0005 4 dentary fragments with teeth, left maxillary fragment with M1-M2, 10 isolated teeth
Richardhof-Wald Rh-94/1	NHMW 2004z0240/0000 2 edentulous dentary fragments, 3 isolated teeth
Richardhof- Golfplatz RH-A/2	NHMW 2004z0241/0000 3 isolated teeth

Tab. 22: *Petenyia* aff. *dubia*, sample statistics of the teeth

locality	meas.	n	R	m	s	V
Kohfidisch	Lm1-m3	9	3.59–4.00	3.86±0.11	0.134	3.47
	Hcor	7	4.00–4.45	4.21±0.17	0.171	4.07
Kohfidisch	La1	1		0.81		
	Wa1	1		0.54		
Kohfidisch	Lp4	5	0.90–1.03	0.96±0.07	0.052	5.46
	Wp4	5	0.65–0.82	0.73±0.08	0.061	8.41
Rh-94/1	Lp4	1		0.92		
	Wp4	1		0.76		
Kohfidisch	Lm1	10	1.45–1.61	1.53±0.04	0.051	
	Wam1	10	0.78–0.96	0.86±0.05	0.062	
	Wpm1	10	0.82–0.98	0.91±0.04	0.052	
Eichkogel	Lm1	3	1.43–1.52	1.48		
	Wam1	4	0.73–0.80	0.83		
	Wpm1	4	0.83–0.90	0.90		
Schernham	Lm1	2	1.56–1.59	1.58		
	Wam1	2	0.73–0.78	0.76		
	Wpm1	2	0.85–0.86	0.86		
Rh-94/1	Lm1	1		1.43		
	Wam1	1		0.81		
	Wpm1	1		0.87		
RH-A/2	Lm1	1		1.46		
	Wpm1	1		0.83		
	Wpm1	1		0.87		
Kohfidisch	Lm2	10	1.38–1.47	1.43±0.02	0.031	2.13
	Wam2	10	0.79–0.96	0.86±0.04	0.053	6.11
	Wpm2	10	0.82–01.91	0.86±0.02	0.031	3.55
Eichkogel	Lm2	1		1.35		
	Wam2	1		0.77		
	Wpm2	1		0.78		
Schernham	Lm2	5	1.40–1.46	1.44		
	Wam2	4	0.79–0.84	0.81		
	Wpm2	4	0.83–0.85	0.84		

| locality	meas.	n	R	m	s	V
Kohfidisch	Lm3	1	1.05–1.19	1.14±0.03	0.045	3.91
	Wam3	1	0.64–0.77	0.70±0.03	0.040	5.74
Eichkogel	Lm3	1		1.07		
	Wam3	1		0.69		
Schernham	Lm3	2	1.16–1.18	1.17		
	Wam3	2	0.65–0.69	0.67		
Rh-94/1	Lm3	1		1.12		
	Wam3	1		0.66		
Schernham	L1l sup.	2	2.19–2.20	2.20		
	L2l sup.	2	1.27–1.28	1.28		
	Hl sup.	3	1.16–1.17	1.16		
Kohfidisch	LP4	7	1.43–1.59	1.49±0.05	0.054	3.60
	WP4	7	1.29–1.42	1.33±0.04	0.042	3.19
Eichkogel	LP4	1		1.45		
	WP4	1		1.26		
Schernham	LP4	2	1.48–1.51	1.50		
	WP4	2	1.21–1.26	1.24		
Kohfidisch	LbM1	7	1.39–1.51	1.45±0.05	0.049	3.36
	LliM1	7	1.33–1.49	1.40±0.07	0.069	4.95
	WaM1	7	1.34–1.52	1.43±0.07	0.067	4.67
	WpM1	7	1.49–1.64	1.57±0.06	0.063	4.00
Schernham	LbM1	2	1.33–1.45	1.39		
	LliM1	2	1.36–1.37	1.37		
	WaM1	2	1.33–1.42	1.38		
	WpM1	2	1.49–1.54	1.52		
Kohfidisch	LbM2	6	1.30–1.41	1.35±0.04	0.037	2.70
	LliM2	7	1.24–1.44	1.34±0.07	0.066	4.90
	WaM2	7	1.40–1.55	1.47±0.06	0.057	3.90
	WpM2	6	1.38–1.51	1.45±0.05	0.044	3.04
Schernham	WaM2	1		1.40		
RH-A/2	LbM2	2	1.50–1.58	1.54		
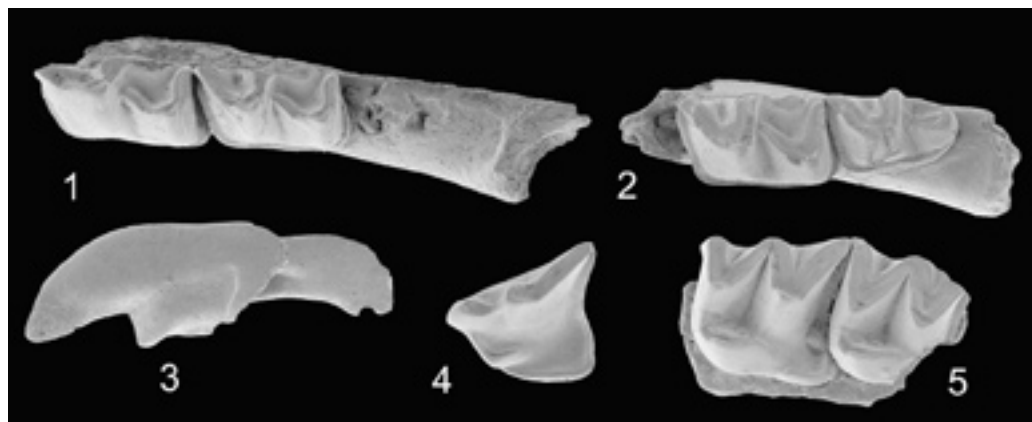
Fig. 23: *Petenyia* aff. *dubia*, Schernham. – Ca. 15x
1. Left dentary fragment with m1-m2, occlusal view, NHMW 2004z0239/0001.
2. Left dentary fragment with m2-m3, occlusal view, NHMW 2004z0239/0002.
3. Left I sup., buccal view, NHMW 2004z0239/0003.
4. Left P4, occlusal view, NHMW 2004z0239/0004.
5. Left maxillary fragment with M1-M2, occlusal view, NHMW 2004z0239/0005.

D e s c r i p t i o n

D e n t a r y : Some short fragments of the horizontal ramus show the mental foramen under the middle of m1. Two fragments of the ascending ramus have a broad interarticular area of the condylus and a deeply pocketed internal temporal fossa with a faint horizontal bar in its upper part. The external temporal fossa is clearly depressed and extends ventrally to the middle of the articular process.

L o w e r   t e e t h : All teeth have darkened cusps, indicating former coloration. The p4 is subtriangular in occlusal outline. Its worn distal crest encompasses a shallow postero-lingual basin. The tooth is surrounded by a well-developed cingulid, which tapers mesially. The molars are clearly graded in size. The mesially protruding precingulid gives them a rectangular occlusal outline. In the m1 and m2 the entocristid is short and high, the postentoconid-valley wide. The m3 has a reduced talonid with a hypoconid and a central talonid crest. In all molars, the pre-, ecto- and postcingulid are continuous and broad. The lingual cingulid is less broad.

U p p e r   t e e t h : The upper incisor is rather elongate with a straight dorsal margin, a slightly concave ventral border, and a non-fissident apex. The buccal cingulum is restricted to the ventral half. The P4 has a straight buccal margin and a well-developed parastyle, connected to the paracone by a high parastylar crest. Proto- and hypocone are hardly developed and nearly fully fused with the mesial cingulum and the distal ridge, respectively. A posterior emargination is only slightly indicated. The near-absence of a posterior emargination gives the M1 and M2 a compact and subquadrate aspect. A hypocone is, if present at all, poorly developed.

D i s c u s s i o n

P. dubia was first described by Bachmayer & Wilson (1970) based on the rich sample from Kohfidisch. Reumer (1984) attributed the species *dubia* to the genus *Blarinella*

Thomas, 1911 due to the following characters: clearly spatulate upper incisor with an S-curved ventral margin, strongly quadrate lower molars, the position of the coronoid spicule, the presence of a horizontal bar in the internal temporal fossa, and the nearly certain presence of five upper antemolars. Reumer (1984) and Rzebik-Kowalska (1989) also included early Ruscinian specimens from Hungary and Poland in this species. According to Storch (1995) these specimens differ from the Vallesian *P. dubia* and also from *Blarinella*. In extant and fossil *Blarinella* specimens from China, the ventral margin of the apex of the upper incisor is straight, the limula in the internal temporal fossa is faint or lacking, and the entocristids of m1 and m2 are faint or lacking. He therefore strongly advocates the original generic assignment, viz *Petenyia dubia*. The only distinguishing character unambiguously preserved in the material under study is the strong entocristid in the m1 and m2. Hence, the suggestion of Storch (1995) is adopted here. The size of the teeth in the present samples roughly fits *P. dubia* from Kohfidisch. The lower molars and the P4 seem to be somewhat wider in the Kohfidisch sample.

Soricinae incertae sedis

Paenelimnoecus Baudelot, 1972

Type species: *Paenelimnoecus crouzeli* Baudelot, 1972

Paenelimnoecus repenningi (Bachmayer & Wilson, 1970)
Fig. 24

1970   *Petenyiella ? repenningi* nov. spec; Bachmayer & Wilson: 549–550, figs. 7, 32, 32a, 33, 50, 50a. (Kohfidisch material)
1970   *Petenyiella* cf. *pannonica* (Kormos, 1934); Rabeder: 593. (Eichkogel material)
1978   *Petenyiella ? repenningi* Bachmayer & Wilson 1970; Bachmayer & Wilson: 139, pl. 1, fig. 3. (Kohfidisch material)
1980   *Petenyiella repenningi* Bachmayer & Wilson, 1970; Bachmayer & Wilson: 352. (Kohfidisch material)

M a t e r i a l (measurements see tab. 23):

Eichkogel	NHMW 2004z0242/0000
1993/0008/0016	4 left dentary fragments with m1, left P4, left M1, right M2
	left dentary fragment with m2-m3
Schernham	NHMW 2004z0243/0000–0003
	4 dentary fragments with teeth, 2 right M2
Richardhof-Wald	NHMW 2004z0244/0000
Rh-94/1	right edentulous dentary fragment, right dentary with m2-m3, 3 isolated teeth
Rh-94/5A	*P.* cf. *repenningi*, NHMW 2004z0245/0000 right edentulous dentary fragment
Richardhof-Golfplatz	NHMW 2004z0246/0000–0002
RH-A/2	2 left dentary fragments with teeth, 8 isolated teeth
RH-A/7	right dentary fragment with m1-m2, left m1
RH-B	right dentary fragment with m2

Tab. 23: *Paenelimnoecus repenningi*; sample statistics of the teeth

locality	meas.	n	R	m	s	V
Kohfidisch	Lm1-m3	6	2.76–2.88	2.84±0.05	0.041	1.46
Schernham	Lm1-m3	1		2.82		
Kohfidisch	Humm1	11	0.98–1.12	1.04±0.04	0.050	4.76
Schernham	Humm1	2	0.92–0.95	0.94		
RH-A/2	Humm1	1		0.97		
Kohfidisch	Hcor.	3	2.93–3.02	2.97		
Kohfidisch	Li inf	2	2.38–2.39	2.39		
Kohfidisch	Hi inf.	2	0.63–0.65	0.64		
Kohfidisch	La1	1		0.53		
Kohfidisch	Wa1	1		0.45		
Kohfidisch	Lp4	1		0.80		
Kohfidisch	Wp4	2	0.61–0.62	0.62		
Kohfidisch	Lm1	11	1.12–1.27	1.19±0.03	0.042	3.53
	Wam1	11	0.60–0.72	0.64±0.03	0.037	5.72
	Wpm1	11	0.63–0.75	0.65±0.02	0.034	5.13
Eichkogel	Lm1	4	0.96–1.16	1.09		
	Wam1	4	0.48–0.63	0.56		
	Wpm1	4	0.53–0.64	0.59		
Schernham	Lm1	3	1.12–1.18	1.16		
	Wam1	3	0.56–0.63	0.59		
	Wpm1	3	0.61–0.64	0.63		
Rh-94/1	Lm1	2	1.04–1.05	1.05		
	Wam1	2	0.56–0.58	0.57		
	Wpm1	2	0.56–0.58	0.57		
RH-A/2	Lm1	1		1.22		
	Wpm1	1		0.59		
	Wpm1	2	0.61–0.61	0.61		
RH-A/7	Lm1	2	1.12–1.14	1.13		
	Wpm1	2	0.53–0.55	0.54		
Kohfidisch	Wpm1	2	0.60–0.61	0.61		
	Lm2	11	1.07–1.20	1.13±0.03	0.036	3.16
	Wam2	11	0.61–0.71	0.66±0.03	0.036	5.55
	Wpm2	11	0.61–0.69	0.64±0.02	0.025	3.87
Eichkogel	Lm2	1		1.11		
	Wam2	1		0.61		
	Wpm2	1		0.61		
Schernham	Lm2	3	1.12–1.16	1.14		
	Wam2	3	0.58–0.60	0.59		
	Wpm2	3	0.59–0.62	0.61		
Rh-94/1	Lm2	1		1.06		
	Wam2	1		0.58		
	Wpm2	1		0.54		
RH-A/2	Lm2	1		1.14		
RH-A/2	Lm2	1		1.07		
	Wam2	1		0.63		
	Wpm2	1		0.60		
RH-B	Lm2	1		1.10		
	Wam2	1		0.56		
	Wpm2	1		0.56		
Kohfidisch	Lm3	7	0.79–0.87	0.84±0.03	0.033	3.92
	Wam3	7	0.46–0.57	0.51±0.04	0.037	7.18
Eichkogel	Lm3	1		0.83		
	Wam3	1		0.54		
Rh-94/1	Lm3	2	0.81–0.95	0.88		
	Wam3	2	0.47–0.52	0.50		
Kohfidisch	L1l sup.	1		1.14		
	L2l sup.	1		0.49		
	Hl sup.	1		0.89		
RH-A/2	L1l sup.	3	1.20–1.33	1.26		
	L2l sup.	3	0.59–0.73	0.66		
	Hl sup.	3	0.73–0.80	0.76		
Kohfidisch	LP4	2	1.15–1.20	1.18		
	WP4	2	1.14–1.15	1.15		
Eichkogel	LP4	1		1.01		
	WP4	1		1.00		
Kohfidisch	LbM1	2	1.08–1.14	1.11		
	WaM1	2	1.14–1.16	1.15		
	WpM1	2	1.31–1.35	1.33		
Eichkogel	LbM1	1		1.10		
	WaM1	1		1.12		
	WpM1	1		1.27		
RH-A/2	LbM1	1		1.03		
	WaM1	1		1.02		
	WpM1	1		1.19		
Kohfidisch	LbM2	2	1.05–1.12	1.09		
	WaM2	2	1.24–1.31	1.28		
	WpM2	2	1.21–1.23	1.22		
Eichkogel	LbM2	1		1.07		
	WaM2	1		1.14		
Schernham	LbM2	2	0.93–1.00	0.97		
	WaM2	2	1.14–1.21	1.18		
	WpM2	2	1.14–1.14	1.14		
RH-A/2	LbM2	3	0.90–0.95	0.93		
	WaM2	3	1.09–1.19	1.15		
	WpM2	3	1.09–1.14	1.11		
Kohfidisch	LM3	1		0.52		
	WaM3	1		0.99		
RH-A/2	LM3	1		0.51		
	WaM3	1		1.12		

Description

D e n t a r y : All samples contain only short fragments of the horizontal ramus with the mental foramen under the middle of m1.

L o w e r t e e t h : In some teeth the tips of the cusps are slightly stained dark. The m1 is somewhat longer than the m2. Lingual and buccal margins are straight and subparallel to one another rather than convex. The most conspicuous character in both is the entoconid reduced to a tiny swelling of the faint entocristid. Already in an early stage of wear, the entoconid and entocristid have vanished. The hypoflexid is high. Pre,- ecto- and postcingulid are continuous and well developed. The lingual cingulid is weaker. In the m3 the talonid is reduced to a single cusp, the hypoconid, which is fully fused with a central crest.

U p p e r t e e t h : The upper teeth are assigned to the samples because of their small size. The upper incisor has a straight upper margin and a convex distal border with a distinct cingulum on its labial side. The apex is not fissident. The well-developed labial cusp and the weaker lingual one of the talon are separated by a groove.

The P4 is trapezoidal in occlusal outline. The protocone is placed slightly distolingually from the projecting parastyle. There is no real hypocone, only a tiny swelling of the ridge lingually bordering the hypoconal flange.

The M1 and M2 are subsquare in occlusal view and hardly distinguishable. In the M1 the postmetacrista is somewhat elongated and its buccal margin therefore slightly oblique, and the paracone is lower than the metacone. A cuspidate hypocone is present. In the M3 the paracone is the only well-developed cusp. The metacone is eliminated. Only its premetacrista still is preserved.
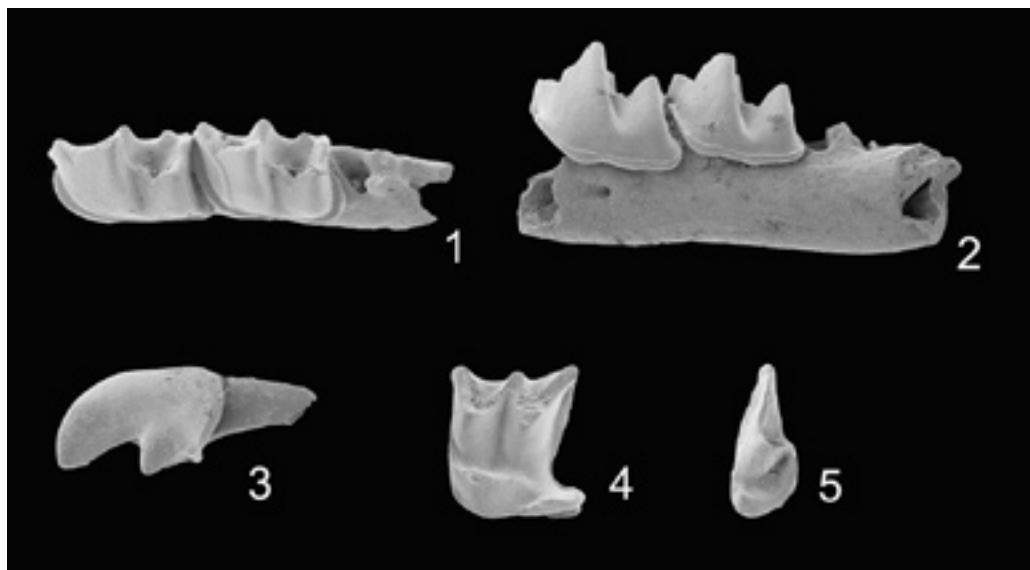
Fig. 24: *Paenelimnoecus repenningi*. – Ca. 15x
1. Left dentary fragment with m1-m2, occlusal view, Schernham, NHMW 2004z0243/0001.
2. Left dentary fragment with m1-m2, buccal view, Schernham, NHMW 2004z0243/0002.
3. Left I sup., buccal view, Richardhof-Golfplatz, NHMW 2004z0246/0001.
4. Right M2, occlusal view, Schernham, NHMW 2004z0243/0003.
5. Left M3, occlusal view, Richardhof-Golfplatz, NHMW 2004z0246/0002.

Discussion

The position of the mental foramen under the middle of m1 distinguishes our samples from the Middle Miocene *P. crouzeli* BAUDELOT, 1972 and from the Early Miocene *P. micromorphus* (DOBEN-FLORIN, 1964), where it is situated below the trigonid of m1. In the Pliocene *P. pannonicus* (KORMOS, 1934) the lower incisor extends further posteriorly, under the protoconid of m1, and the mental foramen is situated under the middle of m1 or even below its hypoconid. The occlusal outline of the m1 and m2 is more or less navicular. The current specimens are intermediate in size between *P. repenningi* from Kohfidisch and the slightly smaller *P. pannonicus* from Osztramos 9 and 7 and from Csarnóta 2 (cf. REUMER 1984: tables 51–53). As is evident from the large sample from Csarnóta, however, size varies considerably if enough material is available. The size range of this sample includes all samples from this study and most of *P. repenningi* from Kohfidisch. *P. obtusus* STORCH, 1995 from the Late Miocene of Inner Mongolia and *P. chinensis* JIN & KAWAMURA, 1997 from the Late Pliocene in China need not be taken into account because of their peculiar morphology and/or because temporo-spatial considerations exclude them.

The subfamilial allocation of *Paenelimnoecus* is a matter of continuous debate. All arguments are presented by REUMER (1992), STORCH (1995) and ZIEGLER (2003). As there are no new ones, this issue need not be taken up again. It is sufficient to note that there is no consensus concerning the subfamilial allocation of the genus. No definitive solution is in sight.

Soricinae gen. et sp. indet., various species
Fig. 25

M a t e r i a l (measurements see tab. 24):

|	
Eichkogel	NHMW 2004z0247/0000
1993/0008/0016	3 lower molars,2 left M2
1974/1689	right dentary fragment with m1-m3
Schernham	NHMW 2004z0248/0000–0002
	4 dentary fragments with teeth, 6 isolated teeth
Richardhof-Wald	NHMW 2004z0249/0000–0003
Rh-94/1	2 dentary fragments with teeth, 15 isolated teeth
Rh-94/5A	right dentary fragment with m1-m2, 11 isolated teeth
Richardshof- Golfplatz	NHMW 2004z0250/0000
RH-A/2:	6 isolated teeth, partly fragmentary
RH-A/7: 2004z0250/007–8	left dentary with m2-m3, left m1
Götzendorf	NHMW 2004z0251/0000
Gö, Coll. ULRICH	right dentary fragment without teeth
Gö 1, 1990/15	right m1, 2 I sup. fragments.
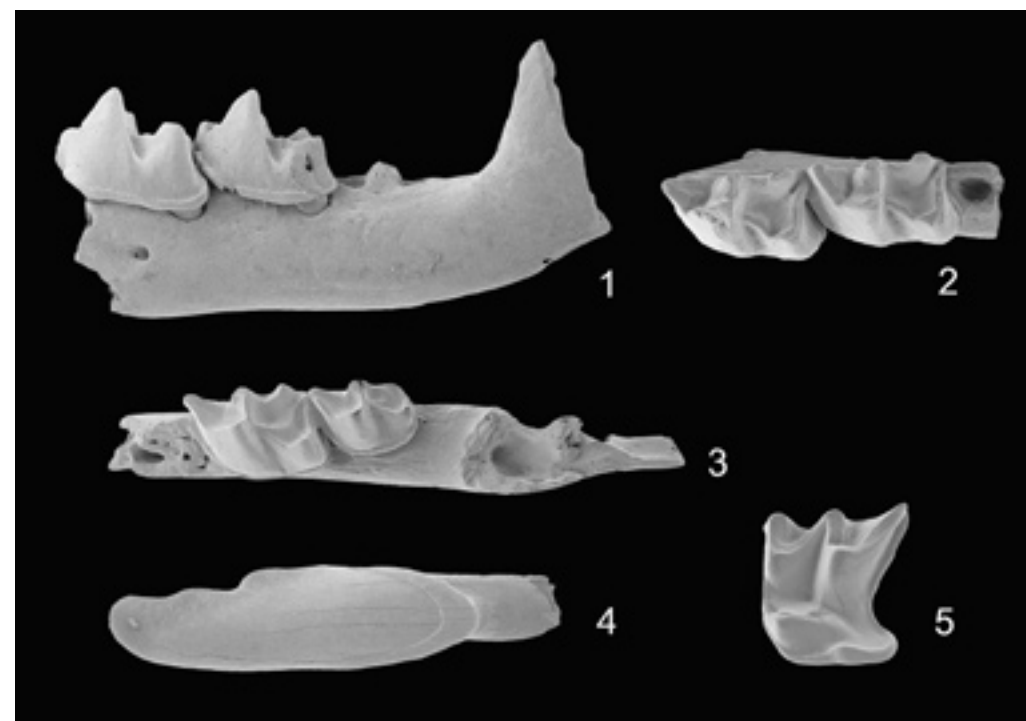
Fig. 25: Soricinae gen. et sp. indet. – Ca. 15x
1. Left dentary fragment with m1-m2, buccal view, Schernham, NHMW 2004z0248/0001.
2. Right dentary fragment with m1-m2, occlusal view, Richardhof-Wald, NHMW 2004z0249/0001.
3. Left dentary fragment with m2-m3, occlusal view, Schernham, NHMW 2004z0248/0002.
4. Left i inf., buccal view, Richardhof-Wald, NHMW 2004z0249/0002.
5. Left M1, occlusal view, Richardhof-Wald, NHMW 2004z0249/0003.

Tab. 24: Soricinae gen. et sp. indet., various species, sample statistics of the teeth

locality	meas.	n	R	m		locality	meas.	n	R	m
Götzendorf	Lm1–m3(A)	1		3.40			Wam2	1		0.75
	Hcoronoid	1		4.20			Wpm2	1		0.78
Rh-94/1	Liinf.	1		2.64		RH-A/2	Lm2	1		1.22
	Hcinf.	1		0.72			Wam2	1		0.68
Eichkogel	Lm1	1		1.18			Wpm2	1		0.68
sp. 1	Wam1	1		0.65		RH-A/7	Lm2	1		1.25
	Wpm1	1		0.68			Wam2	1		0.73
Eichkogel	Lm1	1		1.48			Wpm2	1		0.73
sp. 2	Wam1	1		0.72		Eichkogel	Lm3	1		1.11
	Wpm1	1		0.86		sp. 1	Wam3	1		0.63
Schernham	Lm1	5	1.31–1.38	1.35		Schernham	Lm3	1		0.94
	Wam1	4	0.65–0.75	0.71			Wam3	1		0.54
	Wpm1	4	0.69–0.79	0.75		Rh-94/1	L1Isup.	3	1.28–1.55	1.42
Rh-94/1	Lm1	1		1.35			L2Isup.	3	0.61–0.80	0.68
	Wam1	2	0.70–0.72	0.71		Rh-94/5A	L1Isup.	1		1.38
	Wpm1	2	0.79–0.81	0.80			L2Isup.	1		0.73
Rh-94/5A	Lm1	2	1.37–1.41	1.39		Götzendorf	L1Isup.	1		1.54
	Wam1	2	0.67–0.76	0.72			L2Isup.	1		0.78
	Wpm1	2	0.78–0.80	0.79		Rh-94/5A	LAsup.	3	0.81–0.88	0.85
RH-A/2	Lm1	2	1.24–1.26	1.25			WAsup.	2	0.70–0.71	0.71
	Wam1	2	0.60–0.70	0.65		Rh-94/5A	LP4	1		1.33
	Wpm1	2	0.73–0.74	0.74			WP4	1		1.33
RH-A/7	Lm1	1		1.31		Rh-94/1	LbM1	1		1.33
	Wam1	1		0.70			WaM1	1		1.43
	Wpm1	1		0.76			WpM1	1		1.54
Götzendorf	Wam1	1		0.99		Rh-94/5A	LbM1	2	1.28–1.39	1.34
	Wpm1	1		1.00			WaM1	1		1.38
Eichkogel	Lm2	1		1.41			WpM1	1		1.56
sp. 2	Wam2	1		0.75		Eichkogel	LM2	1		1.15
	Wpm2	1		0.81		sp. 1	WaM2	2	1.21–1.30	1.26
Schernham	Lm2	4	1.19–1.32	1.27		Schernham	LM2	3	1.14–1.27	1.21
	Wam2	4	0.66–0.70	0.69			WaM2	3	1.39–1.49	1.44
	Wpm2	3	0.64–0.70	0.67		Rh-94/1	LM3	2	0.63–0.70	0.67
Rh-94/1	Lm2	3	1.33–1.42	1.37			WaM3	2	1.15–1.17	1.16
	Wam2	3	0.73–0.81	0.78		Rh-94/5A	LM3	2	0.64–0.69	0.67
	Wpm2	3	0.73–0.82	0.76			WaM3	2	1.05–1.09	1.07
Rh-94/5A	Lm2	1		1.38						

D e s c r i p t i o n

D e n t a r y a n d l o w e r t e e t h : Only fragments of the horizontal ramus with the mental foramen between the roots of m1 are present. The Götzendorf and Eichkogel specimens yield no information about the position of the mental foramen. One fragment from Rh-94/1 preserves three alveoles between m1 and the incisor alveole. Hence, there are two lower antemolars, the double-rooted p4 and a single-rooted a1. In the Schernham sample, some teeth have residual pigmentation. The lower incisor is bicuspulate. The lower molars are graded in size. The m1 differs from the m2 only in that the protoconid and metaconid are closer together. There is a moderately developed entocristid, which descends mesially and closes the talonid lingually. The postentoconid valley is wide. In the m3 the talonid is reduced, but still has a distinct entocristid and oblique cristid. Pre-, ecto- and postcingulid are continuous and well developed. The lingual cingulid is similarly broad, but distinctly weaker.

U p p e r t e e t h : The upper incisor has a hooked apex, which is not fissident. The well-developed talon has a marked labial cusp, which is separated by a groove from a lingual ridge. The distal margin is convex with a marked cingulum. Some small rectangular teeth with one oblique root have a mesial and a distal crest each and are surrounded by a cingulum. They represent upper antemolars, probably the A1. The exact position in the tooth row depends on the number of antemolars. In the P4 the parastyle is bigger than the protocone and projects more anteriorly. The talon is surrounded by a marked cingulum. In the M1 and M2 the mesostyle is confluent. The preprotocrista tapers at the paracone basis, and the postprotocrista ends abruptly. The same configuration of the protoconus cristae is evident in the M3.

D i s c u s s i o n

Here, all small soricid teeth belonging neither to *Petenyia* nor to *Paenelimnoecus* are combined. Based on size alone, they clearly represent more than one species. Even the small sample from Eichkogel represents two species. Judging from the width of the m1, the Götzendorf species is the biggest. However, it is difficult to determine even the genus. Neither the p4 nor the articular condylus are preserved. Both these elements would allow an unambiguous subfamilial allocation. The molar morphology is compatible with *Sorex*, but all Old World species of *Sorex* have a tricuspulate lower incisor. The Early to Middle Miocene crocidosoricines (*Crocidosorex*, *Miosorex,* and *Lartetium*) differ in the more anterior position of the mental foramen and in the higher number of lower antemolars. In *Florinia* the m3 is reduced. In *Asoriculus* the upper incisor is bifid and the lower molars have high entocristids. Hence, the samples from Richardhof-Wald, Richardhof-Golfplatz and Götzendorf, which include non-bifid incisors, cannot belong to this genus. In the other samples the m1 and m2 with moderately developed entocristids rule out an affiliation with this genus. *Asoriculus gibberodon* (Petényi, 1864), the first record of the genus in Europe, is only reported from the latest Miocene to Pliocene (Rzebik-Kowalska 1998), and it is not expected to occurr in the present samples. These specimens most probably represent small soricines. The lack of diagnostic characters precludes more precise determination.

Chiroptera Blumenbach, 1779

Megadermatidae Allen, 1864

Megaderma Geoffroy, 1810

Type species: *Vespertilio spasma* Linnaeus, 1758

Megaderma cf. *vireti* MEIN, 1964
Fig. 26

M a t e r i a l   a n d   m e a s u r e m e n t s

Richardhof-Wald　　　　　　NHMW 2004z0252/0001
Rh-94/5A　　　　　　　　　left p2 ca. 1.95x1.53x1.95

D e s c r i p t i o n   a n d   d i s c u s s i o n

Morphologically, one single-rooted premolar with the distal third broken off fits best the p2 of *Megaderma vireti* from Lissieu and from Kohfidisch; it also corresponds to *Megaderma lugdunensis*. Only three comparative measurements are available. The p2 from the species of Lissieu measures 1.85x1.30x1.85 (MEIN 1964: 239), making it somewhat smaller. BACHMAYER & WILSON (1970: 558) quote for p2/p3 from Kohfidisch a range of

Fig. 26: *Megaderma* cf. *vireti*, left p2, buccal view, Richardhof-Wald, NHMW 2004z0252/0001. – Ca. 15x.

1.80–2.0 for the length and 1.50 mm for the width. A p2 of *M. lugdunensis* from Petersbuch 2 (MN 4, own measurements) is 2.09x1.38x>2.0), hence somewhat bigger. The p2 is not appropriate to distinguish species among bats. For temporal reasons I tend to refer it to the younger species and denominate it *Megaderma* cf. *vireti*.

Rhinolophidae GRAY, 1825

Rhinolophus LACÉPÈDE, 1799

Type species: *Vespertilio ferrumequinum* SCHREBER, 1774

cf. *Rhinolophus delphinensis* GAILLARD, 1899

M a t e r i a l   a n d   m e a s u r e m e n t s

Richardhof- Golfplatz　　　NHMW 2004z0253/0000
RH-A/2　　　　　　　　　　left C sup. fragment, no measurements available

D e s c r i p t i o n   a n d   d i s c u s s i o n

The mesio-lingual fragment of the upper canine shows the flat lingual face of the crown and the broad lingual cingulum. It definitely belongs to *Rhinolophus*. Based on size it best fits *Rhinolophus delphinensis*, a widespread species in the Middle to Late Miocene of Europe. From its present temporo-spatial distribution, this species can be expected, but poor preservation prohibits a definite determination.

Rhinolophus cf. *grivensis* (DEPERET, 1892)
Fig. 27

M a t e r i a l   a n d   m e a s u r e m e n t s

Richardhof-Wald　　　　　NHMW 2004z0254/0000–0004
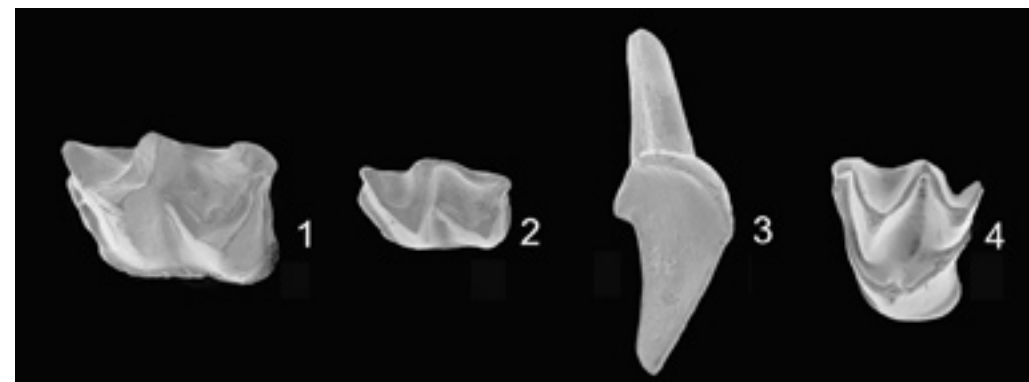Rh-94/1:　　　　　　　　　0000: left c inf. 0.80x0.80

Fig. 27: *Rhinolophus* cf. *grivensis*, Richardhof-Wald. – Ca. 15x
1. Left m1, occlusal view, NHMW 2004z0254/0001.
2. Left m3, occlusal view, NHMW 2004z0254/0002
3. Right C sup., lingual view, NHMW 2004z0254/0003.
4. Right M2, occlusal view, NHMW 2004z0254/0004.

　　　　　　　　　0001: left m1 1.43x0.87x0.91
　　　　　　　　　0000: left C sup. 1.06x0.80x–
　　　　　　　　　0004: right M2 ca. 1.30x1.47
　　　　　　　　　0003: right C sup. 1.12x0.89x>1.81
　　　　　　　　　0000: right M1/2 fragment Lb 2.16
Rh-94/5A　　　　 0000: right p2 0.73x0.73
　　　　　　　　　0002: left m3 1.35x0.84

　　　　　　　　　0000: right C sup. 1.07x0.87x–

Richardhof- Golfplatz　　　NHMW 2004z0255/0000
RH-A/2　　　　　　　　　　left c inf. 0.90x0.77x1.26 (LxWxHbuc.)
　　　　　　　　　　　　　　right c inf. –x0.75x1.26

　　　　　　　　　　　　　　left m3 1.28x0.80x0.70
RH-A/7　　　　　　　　　　right m1 1.52x0.85
　　　　　　　　　　　　　　left m2-trigonid Wa 0.81

D e s c r i p t i o n   a n d   d i s c u s s i o n

With the exception of some upper canines with broken apex, one M2 with broken metastyle, and a buccal fragment of an M1/2 from Rh-94/1 and from Rh-94/5A, only mandibular teeth are preserved. The canine has no accessory cusp and shows, like the M2, the overall morphology of *Rhinolophus*. The lower molars are nyctalodont as in all rhinolophids, i. e. there is a wide postentoconid valley. The lower canine also shows typical rhinolophid morphology. Richardhof-Golfplatz, however, yielded no dentary fragments or maxillary teeth, which would have enabled a certain discrimination of hipposiderids. To date, no hipposiderids are known from the Late Miocene of Central Europe. The latest occurrence is one upper canine of *Asellia* from the Goldberg fauna in South Germany (RACHL 1983). The Late Middle Miocene record of *Hipposideros collongensis* from the karstic fissure filling Petersbuch 6 possibly represents an earlier admixture (ZIEGLER 2003b). Late Miocene and even Pliocene hipposiderid occurrences are restricted to the Mediterranean area (LEGENDRE 1982). The present teeth with rhinolophid morphology therefore definitely represent a *Rhinolophus* species. According to

their small size, *Rh. grivensis* is the only option: it was a common and widespread bat species in the Middle to Late Miocene of Europe. Note that *Rh. lissiensis* MEIN 1964 is considered a junior synonym of *Rh. grivensis* (for arguments see ZIEGLER 2003b). As only sparse remains are available, which cannot show all diagnostic characters, the determination is *Rh*. cf. *grivensis*.

<div align="center">

Vespertilionidae GRAY, 1821

Kerivoula GRAY, 1842 and/or *Paleptesicus* ZAPFE, 1970

</div>

Type species: *Vespertilio pictus* PALLAS, 1767 for *Kerivoula*
            Eptesicus priscus ZAPFE, 1950 for *Paleptesicus*

<div align="center">

Small vespertilionid

Paleptesicus cf. noctuloides (LARTET, 1851) ?and/or
Kerivoula cf. murinoides (LARTET, 1851)
Fig. 28

</div>

M a t e r i a l   a n d   m e a s u r e m e n t s :

Locality	
Eichkogel	*P.* cf. *noctuloides*, NHMW 2004z0256/0000–0003
	A1 left. c inf. –x1.04x1.69
	A2 right c inf. 1.05x1.06x1.44
	B1 right m1/2 1.23x0.71x0.71
	B3 right m3 1.09x0.62x0.53
	C1 left C sup. 0.95x0.66x- (?)
	D1 left M1 Wa 1.24
	D2 left M1 Wa ca. 1.35
	E1 right M1 Wa 1.31
	F1 left M2 1.43x1.58
	F2 left M2 fragment, no measurements
	G1 right M2 fragment, no measurements
	H1 right M3 L ca. 0.85
Schernham	cf. *P. noctuloides* vel *K. murinoides* NHMW 2004z0257/0000
	right m2 ca. 1.20x0.73x0.78
Richardhof-Wald	*P.* cf. *noctuloides* ?and *K.* cf. *murinoides* NHMW 2004z0258/0000–0008
Rh-94/1	A1 left c inf. 0.91x0.74x1.26
	A2 right c inf. 0.89x0.76xca.1.3
	A3 left c inf. 0.76x0.68x–
	B1 right c inf. 0.78x0.66x–
	B2 right c inf. 0.74x0.64x1.01
	B3 left p2/3 0.80x0.63
	C 1 left p4 0.86x0.64x–
	C2 left p4 0.84x0.49x0.89
	C3 left p4 0.71x0.52x0.93
	C4 right p4 0.65x0.56x0.88
	D1 left m1 1.17x0.69x0.72
	D2 right m2 –x0.71x–
	E1 right m3 0.86x0.52x0.45
	F1 left M2 ca. 1.05x1.20
	17.1 left edentulous dentary fragment.
	17.4 right M1 1.08x1.34
Rh-94/3: 2004z0258/	*P.* cf. *noctuloides*
	6.1 left c inf. 0.73x0.68x–
	6.2 right p4 0.65x0.56x0.93
	7.1 right m3 1.08x0.69x0.54
	7.1 right m2/3 trigonid Wa 0.82
	7.3 left m3 trigonid Wa 0.66
Rh-94/5A	*P.* cf. *noctuloides* NHMW 2004z0258/0000
	B1. right m1 1.21x0.69x0.70
	B2. right m2-trigonid Wa0.70
	B3. right Csup. 0.82x0.63x1.33
	B4. right M1 0.99x1.06
	B5. left M3 0.76x1.35
	3. right lower canine 0.75x0.67x1.18
	4. right p4 0.73x0.66x0.92
	5. right M1 1.20x1.26
	6. left M2 1.16x1.54
Richardhof-Golfplatz	*P.* cf. *noctuloides* NHMW 2004z0259/0000
RH-A/2	D1. left p4 0.77x0.68x1.07
	D2. right p4 0.78x0.69x1.14
	D3. left m2 1.29x0.76x0.80
	A3. right I1 0.63x0.45
	D4. right M1 1.13x1.17
	D5. right M3 0.73x1.41
RH-A/7	*P.* cf. *noctuloides* ?and *K.* cf. *murinoides*
	A1. left m1 1.23x0.73x0.81
	A2. left m1 1.26x0.67x0.72
	B1. right m1 1.19x0.69x0.71
	B2. right m2 >1.18x0.68x–
	B3. left m3 0.93x0.57x0.52
	C1. left M1/2 ca. 1.15xca. 1.65
	C3. right I1 0.57x0.44
Götzendorf	*P. noctuloides* NHMW 2004z0260/0000–0001
Gö 6, 1992/1	left dentary fragment with m2-m3; Humm1 1.32; m2 1.20x0.68x0.75; m3 1.05x0.61x0.52

D e s c r i p t i o n   a n d   d i s c u s s i o n

Eichkogel – All teeth clearly show the vespertilionid morphology. In the lower molars the paralophid and protolophid are rounded, as is typical for *Paleptesicus*. The upper canine resembles a rhinolophid in the flat lingual face and in the occlusal outline. However, it is not bent distally. The upper molars, exclusively fragments, have a well-developed paracingulum and para- and metaloph. This morphology is also present in *P. noctuloides* from Sansan. The measurements are also compatible with this species (cf. BAUDELOT 1972: 53). As not all diagnostic characters are preserved in the sample, it is denominated *P*. cf. *noctuloides*.

Schernham – In the small m2 the paraconid and the mesial part of the paralophid are broken off. The trigonid angle is small and the molar is therefore probably an m2. The posterolophid shows the myotodont condition typical of most vespertilionids. The buccal cingulid is strong. In size, the m2 fits both *Paleptesicus noctuloides* and *Kerivoula murinoides* (generic assignment by HORÁČEK, 2001). The lack of preserved distinctive characters precludes a decision for one or the other species.

Richardhof-Wald, Rh-94/1 – The edentulous dentary fragment has 3 alveoles for the incisors, one canine alveole, one alveole for a single-rooted p2 and two for the p4. Hence,
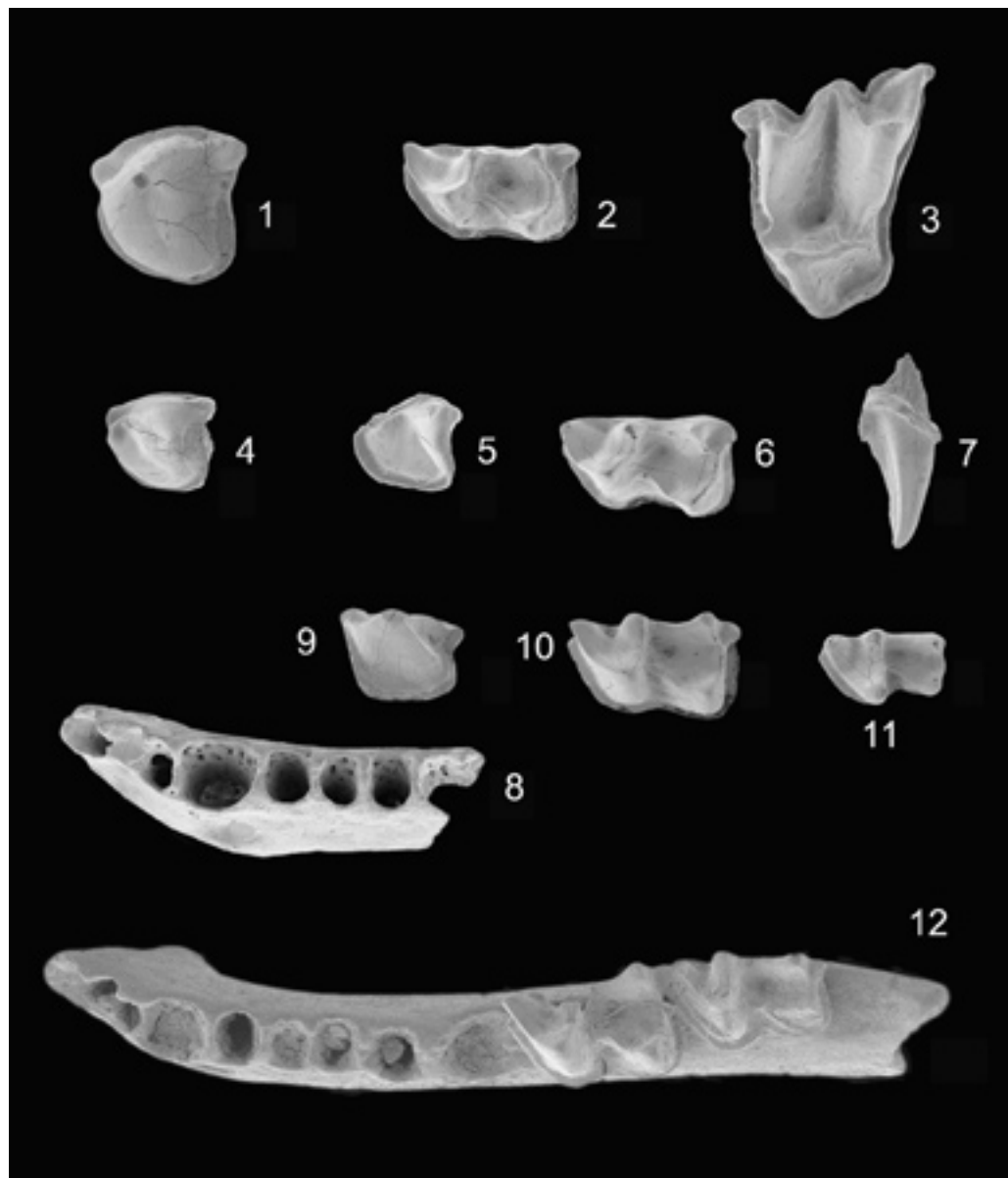
Fig. 28: *Paleptesicus* cf. *noctuloides*. 1.–3. Eichkogel; 4.–11. Richardhof-Wald; 12. Götzendorf. 1.–6., and 8.–12. occlusal views; 7. lingual view. – Ca. 20x

1. Right c inf., NHMW 2004z0256/0001.
2. Right m1/2, NHMW 2004z0256/0002.
3. Left M2, NHMW 2004z0256/0003.
4. Right c inf., NHMW 2004z0258/0001.
5. Right p4, NHMW 2004z0258/0002.
6. Right m1, NHMW 2004z0258/0003.
7. Right C sup., NHMW 2004z0258/0004.

8. Left edentulous dentary fragment, NHMW 2004z0258/0005.
9. Left p4, NHMW 2004z0258/0006.
10. Left m1, NHMW 2004z0258/0007.
11. Right m3, NHMW 2004z0258/0008.
12. Left dentary fragment with m2-m3, *Paleptesicus noctuloides*, NHMW 2004z0260/0001.

the dental formula is 3123 for the dentary, which excludes *Myotis*. The mental foramen is situated below the canine in the upper third of the dentary. In size and morphology the specimens fit best to *Paleptesicus noctuloides*. The isolated teeth show the typical vespertilionid overall morphology and represent one or two small vespertilionids. The two bigger canines are intermediate in size between *K. murinoides* and *M. bavaricus* ZIEGLER, 2003. The size and morphology of the other three lower canines and the p2/3 fit well with *K. murinoides*. The two longer p4 are longer than in *K. murinoides* from Sansan. The m1 and m3 have a rounded paralophid and fit well *P. noctuloides*. The m2-trigonid with the more angulated paralophid is better compatible with *K. murinoides*. In the upper M2 the parastyle is broken. The specimen has a faint metaloph, but no lingual conules and is smaller than in *K. murinoides*. The sample includes a species close to *P. noctuloides* and a small *Myotis* similar to *K. murinoides*.

Richardhof-Wald, Rh-94/3 – In the canine most of the crown is broken off. Only the strong cingulid, surrounding the crown-base and the root are preserved. In morphology the teeth both fit *P. noctuloides* and *K. murinoides*. However, the present p4 is somewhat shorter than in *K. murinoides* and more compact (cf. BAUDELOT 1972: 24). The canine is wide compared to its length. No corresponding measurements are available from *P. noctuloides*. But there all teeth are more compact. The m3 and both the molar trigonids show the rounded paralophid and fit best *P. noctuloides*..

Richardhof-Wald, Rh-94/5A – In the m1 and in the m2-trigonid, the paralophid and protolophid are rather rounded. The upper canine is surrounded by a strong cingulum and has a slightly concave disto-lingual face. The M1 and M2 bear neither para- nor metaconule, but a weak para- and metaloph each. The preprotocrista is continuous with the paracingulum. The postprotocrista does not join the metacingulum. The M3 has a weak metaloph but no paraconule. Except for the small M1, all teeth fit *K. murinoides* as well as *P. noctuloides* in size. The rounded para- and protolophid of the lower molars, which are angulated in *K. murinoides*, argue in favour of *P. noctuloides*.

Richardhof-Golfplatz, RH-A/2 – The six teeth from this site compare well with the preceding ones. Especially the rounded para- and protolophid of the m1 excludes them from belonging to *K. murinoides*. With some reserve, they also can be allocated to *P. noctuloides*.

Richardhof-Golfplatz, RH-A/7 – Except one left m1 (A2), which has an angulated paralophid, all lower molars show a rounded para- and protolophid. In the M1/2, the parastyle and part of the paracone are broken off, para- and metaconule are absent. This M1/2-fragment is bigger than in *K. murinoides* and *P. noctuloides*. Based on size and morphology of the lower molars, *P. noctuloides* and possibly *K. murinoides* or closely related forms are represented in the sample.

Götzendorf – The complete horizontal ramus of the dentary shows three incisor alveoles, one for the canine, one for p2, two each for p4 and m1, and m2 and m3 in situ. The mental foramen is situated between the alveoles of c and p2 in the upper third of the corpus. The reduced dental formula (3123), the rounded paralophid of the m2 and m3 and their marked cingulids, and the overall size are distinctive characters of *Paleptesicus noctuloides*. The specimen compares well with the sample from the type locality Sansan.

Big vespertilionid

cf. *Myotis* sp.
Fig. 29

M a t e r i a l   a n d   m e a s u r e m e n t s :

Schernham	NHMW 2004z0261/0000
	left p4 >1.14x0.84 (enamel damaged)
	left P4 1.88xca.1.90
Richardhof-Wald	NHMW 2004z0262/0000–0002
Rh-94/1:	G1. left m1 1.39x0.76x0.82
	G2. right m1/2-talonid 0.93
	H1. I1 0.62x0.45
	H2. left C sup. 1.02x0.94x–
	I1. left M2, lingual fragment
	I2. right M1 Wa 1.88
	right p4 1.31x1.18x>1.60
	right M1 fragment Wa 2.16
Rh-94/5A	right M2-fragment Wa 1.56
Richardhof-Golfplatz	NHMW 2004z0263/0000
RH-A/2	A1. right I1 0.80x0.56
	B1. p2/P2 0.97x0.99
	B2. right p4 1.31x1.22x–
	B3. right m1/2-trigonid Wa ca. 1.28
	C3. left m3 1.43x0.89x0.71
	E1. left M2/3 Wa 1.66
	E2. left M2-fragment Wa. ca. 1.7 (enamel damaged)
	E3. right M1/2 fragment Wa >1.64
	E4. right M2/3 fragment Wa 1.74

D e s c r i p t i o n   a n d   d i s c u s s i o n

These vespertilionid teeth have been lumped together because they are bigger than in the small vespertilionid of each site. They do not necessarily represent the same species at all sites.

Schernham – In the p4 the enamel layer is damaged. Before damage it was distinctly bigger. The tooth reveals the vespertilionid overall morphology but no morphological details. In the P4 the lingual flange is broken off. It has a strong and broad cingulum around the preserved crown-base, but no parastyle and protocone. No more precise determination is possible.

Richardhof-Wald, Rh-94/1 – The m1 has a rounded paralophid. The upper canine is surrounded by a well-developed cingulum. The lingual fragment of the M2 has a marked para- and metaloph each, but neither para- nor metaconule. In the M1 the metacone is broken. Neither para- nor metaloph, nor lingual conules are developed. The cingulum extends to a disto-lingual heel. These teeth correspond in size to *Myotis bavaricus* ZIEGLER, 2003 from the Middle Miocene Petersbuch fissure fillings, but differ from it in the rounded paralophid of the m1. The teeth are bigger than in *Paleptesicus noctuloides* but distinctly smaller than in *Eptesicus campanensis* BAUDELOT, 1970. A second, bigger vespertilionid is represented by a p4 and the buccal half of an M1. The p4 is surrounded by a marked cingulid. The M1 has an oblique external margin, a well-developed para- and metacingulum each, and no paraloph. The two fragments are compatible with *Myotis* cf. *antiquus* from Wintershof-West (see ZIEGLER 1993: tab. 5).
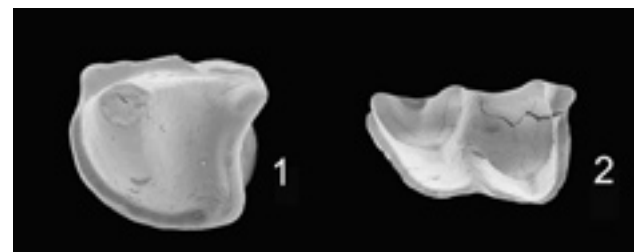

Fig. 29: cf. *Myotis* sp. from Richardhof-Wald. – Ca. x20
1. Right p4, occlusal view, NHMW 2004z0262/0001.
2. Left m1, occlusal view, NHMW 2004z0262/0002.

Richardhof-Wald, Rh-94/5A – In the large M2-fragment the metastyle is broken off. The tooth has neither para- nor metaconule. Para- and metaloph are extremely weak. The preprotocrista is continuous with the paracingulum; the postprotocrista terminates at the metacone base without any contact to the metacingulum. No more precise determination is possible.

Richardhof-Golfplatz, RH-A/2 – All specimens show the vespertilionid morphology. In the lower molars the paralophid is rounded. The upper molars show neither para- nor metaconule. Para- and metaloph are well preserved in one fragment (E3) and are weak to absent in the remaining ones. We cannot exclude that some or all teeth represent an *Eptesicus*/*Paleptesicus* species smaller than *E. campanensis* from Sansan and distinctly bigger than *Paleptesicus noctuloides*, but they may also belong to a big *Myotis* species.

Conclusions

Faunal composition (see tabs. 25, 26)

Tab. 25 lists the species for all samples with more than a few teeth. Certain other localities, not included in the table, also yielded a few insectivore remains. They are listed below (number of specimens in brackets).

Neusiedl am See: *Archaeodesmana* aff. *vinea* (1), *Talpa* cf. *gilothi* (1), *Dinosorex engesseri* (1), *Crusafontina* aff. *endemica* (2).

Stixneusiedl: *Plesiosorex* sp. (1), *Storchia* cf. *biradicata* (2), *Desmanella* cf. *rietscheli* (2).

Bullendorf: Galericinae gen. et sp. indet. (3), *Crusafontina* sp. (3)

The numbers for Kohfidisch in tab. 26 (taken from BACHMAYER & WILSON,1980) are not based upon the entire material. They do, however, provide a rough idea of the quantitative composition. The soricids are clearly the most numerous family, followed by the erinaceids and then by the talpids. Dimylids are absent, clearly vanishing by the beginning of the Turolian.

A single dimylid tooth in the Eichkogel fauna represents a holdover. At the Eichkogel, the soricids are also the most numerous insectivore family, followed by talpids. The erinaceids are comparatively rare.

The Schernham fauna is conspicuous for its highly diverse talpid association, which includes ten species. It is outnumbered only by the Pliocene fauna of Wölfersheim, which includes 11 species (DAHLMANN 2001). In the Schernham fauna the talpids are the most common

insectivore family with respect to the number of specimens (ns). Comparing the number of the most common elements (nc), however, the talpids are outranged by the dimylids. Among the dimylids of Schernham, note the occurrence of *Metacordylodon schlosseri*. *Plesiosorex*, which is generally very rare if present at all, is also recorded in Schernham.

Among the Richardhof-Wald samples, only Rh-94/1 is appropriate for faunal comparisons. The other samples are too small and their composition is more or less accidental. For the same reason, only RH-A/2 is significant among the Richardhof-Golfplatz samples. Tabs. 25 and 26 show that the erinaceids play a minor role in all samples and that the first rank goes either to the talpids (RH-A/2 and Götzendorf), to the dimylids (Schernham), or to the soricids (Rh-94/1). In RH-A/2 the occurrence of *Metacordylodon schlosseri* is notable, in Götzendorf the record of *Plesiosorex*.

The galericines among the erinaceids and *Plesiodimylus* among the dimylids are the most common insectivores in nearly all Early Miocene to Vallesian faunas. In the Early Turolian (MN 11) the dimylids disappear, with only isolated holdovers in some faunas. In the Vallesian faunas of Schernham, the dimylids make up one third of the whole insectivore fauna. The Eichkogel sample includes only one tooth of *Plesiodimylus*, and the rich Kohfidisch fauna lacks dimylids.

The dominating erinaceid in the currently studied Vallesian samples is the small lantanothere *Lantanotherium sanmigueli*. In the Voesendorf fauna, which also correlates with MN 9, the galericines are represented exclusively by *Schizogalerix voesendorfensis* (RABEDER 1973). However, *Lantanotherium* disappeared by the end of the Vallesian, leaving *Schizogalerix* as the only galericine. The Kohfidisch fauna contains only one record of *Lantanotherium* against more than 250 finds of galericines. The vast majority of the latter belong to *Schizogalerix zapfei*. Concerning the division of the mesostyle, *S. voesendorfensis* is less advanced than the two Early Turolian species, *S. moedlingensis* from the Eichkogel and *S. zapfei* from Kohfidisch. The latter two species show only minor morphological differences, but correspond in their evolutionary stage: they are clearly geographic vicariants.

The erinaceines are usually rare in post-Agenian Miocene faunas and always outnumbered by the galericines.

The plesiosoricids are a family with a rare record. If present at all, the samples are usually small compared to other insectivores. *Plesiosorex evolutus* represents an advanced species. Along with *P. roosi* from Eppelsheim, which also correlates with MN 10, the Schernham sample is the latest occurrence of this family in Europe. Furthermore, *Plesiosorex* is recorded in Austria from the Early Miocene sites Voitsberg and Schönegg, represented by *P. styriacus* (HOFMANN, 1892) (THENIUS 1949), by *P*. cf. *styriacus* from Oberdorf 3 and by *P*. aff. *germanicus* from Oberdorf 4 (ZIEGLER 1998a).

In all samples the desmans are important constituents of the talpid fauna, represented by a species closely related to *Archaeodesmana vinea* and by *Storchia biradicata*. In most talpid samples the desmans are dominant (if we compare nc); in the Richardhof-Wald and Richardhof-Golfplatz samples they are equalled or even outnumbered by *Desmanella*. Desmans are absent in pre-Vallesian faunas of Austria and generally rare in Early to Middle Miocene faunas in Europe. With the occurrence of two species each, *Proscapanus* and the Urotrichini play an important role in the Schernham sample. *Talpa* is represented by two species in Schernham and is comparatively numerous in Götzendorf.

Tab. 25: List of insectivores from Schernham, Richardshof-Wald, Richardshof-Golfplatz and Götzendorf (ns = number of specimens, nc = number of most common elements

	Taxon	Koh-fidisch	MN 11 Eichkogel ns	nc	Schernham ns	nc	MN 10 Rh-94/1 ns	nc	Rh-94/3 ns	nc	Rh-95/5A ns	nc	RH-A/2 ns	nc	RH-A/7 ns	nc	MN 9 RH-A/11 ns	nc	RH-B ns	nc	Götzendorf ns	nc
Erinaceidae	*Schizogalerix moedlingensis*		20	4																		
	Schizogalerix zapfei	*																				
	Lantanotherium sp.	*																				
	Lantanotherium sanmigueli				165	36	81	15	5	2	17	3	54	9	18	4	2	1	2	1	23	11
	Galerix sp.	*												1	1							
	Galericinae gen. et sp. indet.				2	1							2	1			1	1				
	Erinaceinae gen. et sp. indet.	*																				
	? cf. *Postpalerinaceus vireti*				1	1																
	? cf. *Atelerix depereti*																			2	2	
Plesiosoricidae	*Plesiosorex evolutus* n. sp.				25	3														12	6	
	Archaeodesmana vinea	*	14	4	117	15	9	3			5	3	30	7	15	4			1	1	58	24
	Archaeodesmana aff./cf. *vinea*				98	13	3	1			2	1	14	4	2	2					14	7
	Storchia biradicata n. sp.	*	21	6	34	9																
	Proscapanus austriacus n. sp.				12	3	9	3			7		7	2								
Talpidae	*Proscapanus minor* n. sp.				21	5																
	Talpa aff. *minuta*		4	1	15	5	5	2					13	5			1	1				
	Talpa vallesensis																					
	Talpa aff./cf. *gilothi*	*			7	7															43	18
	Urotrichus giganteus n. sp.		1	1	11	3															9	9
	Urotrichini gen. et. sp. indet.																					
	Desmanella aff./cf. *rietscheli*	*	33	6	18	6	44	6			14	3	69	12	5	2					13	7
	Talpidae gen. et sp. indet.				1	1																
Dimylidae	*Plesiodimylus* aff. *chantrei*		1	1	294	76	114	16	7	2	37	6	95	15	11	3	1	1	1	1	47	11
	Metacordylodon schlosseri				17	5							3	1								
	Dinosorex engessersi				26	11	23	3	3	1	7	2	30	5	11	3					82	18
	Crusafontina kormosi	*	68	19																		
Soricidae	*Crusafontina* aff. *endemica*	*			100	18	66	11	4	2	21	5	62	10	22	5	2	2	1	1	34	14
	Petenyia dubia	*	8	4	14	5	5	2					3	3								
	Paenelimnoecus repenningi	*	8	5	6	3	5	2	1	1			2	2	2	2						
	Soricinae, various spp.	*	6	3	10	5	17	6			12		6	3	2	1	2	2	1	1	4	3
	Sum	*	187	54	994	231	378	70	19	7	116	26	398	79	89	24	7	6	6	5	341	130

Tab. 26: Shares of the insectivore families in the Late Miocene sites of Austria (Kohfidisch numbers from BACHMAYER & WILSON 1980)

| | MN 11 | | | MN10 | | | | | | | | MN 9 | | | | | | | | | |
| | Kohfidisch | Eichkogel | | Schernham | | Rh-94/1 | | Rh-94/3 | | Rh-95/5A | | RH-A/2 | | RH-A/7 | | RH-A/11 | | RH-B | | Götzendorf | |
Taxon	ns	ns	nc	ns	nc	ns	nc	ns	nc	ns	nc	ns	nc	ns	nc	ns	nc	ns	nc	ns	nc
Erinaceidae	262	20	4	168	38	81	15	5	2	17	3	56	10	19	5	3	2	2	1	26	14
Plesiosoricidae				25	3															12	16
Dimylidae		1	1	311	81	114	16	7	2	37	6	98	16	10	3	1	1	1	1	47	11
Soricidae	330	90	31	156	42	102	24	7	3	41	10	111	23	35	11	2	2	2	2	120	45
Talpidae	51	76	18	335	67	61	12	1	1	21	8	127	29	22	8	1	1	1	1	137	65
Sum	613	187	54	995	231	358	67	18	8	116	27	392	78	86	27	7	6	6	5	342	151

The dimylid *Plesiodimylus chantrei* is widespread in Europe. In most Early to Middle Miocene faunas in South Germany they are clearly outnumbered by the galericines and make up only a few percent of the insectivore fauna. However, dimylids are well represented if not dominant in lignitic deposits such as Oberdorf (ZIEGLER 1998a), where the dimylids make 50 % of the insectivores, or Maßendorf with one third share, or Hambach 6C with ca. 17 % (ZIEGLER & MOERS 2000). The Vallesian faunas studied here include a form that is at least closely related to *P. chantrei*. *P.* aff. *chantrei* is by far the most common insectivore species in Schernham.

Metacordylodon is always less frequent than *Plesiodimylus*. *Metacordylodon schlosseri* from Schernham and from Richardhof-Golfplatz are the latest occurrences of the genus.

Crusafontina is the most common soricid in all samples, outnumbered only by *Dinosorex* in the Götzendorf fauna. *Crusafontina* appears in Europe in the Early Vallesian. The only potential pre-Vallesian record is a dentary from Anwil (MN 7/8), determined as Soricide II by ENGESSER (1972: 68) and tentatively assigned to cf. *Crusafontina* sp. by VAN DAM (2004: 744). *Dinosorex engesseri* is restricted to Vallesian sites in Austria and Hungary. *Petenyia dubia* and *Paenelimnoecus repenning*i are Late Miocene species with a fairly good record in all faunas except Götzendorf. The absence in this fauna may a sampling bias.

The chiropteran faunules of the sites are dominated by or exclusively composed of vespertilionids. Given the small sample sizes, the diversity of the Rh-94/1, Rh-95/5A and RH-A/2 samples is remarkable. The material from all sites studied here was retrieved from limno-fluviatile sediments. The scarcity or even the absence of complete jaws is quite typical for this type of sediment. Better-preserved material stems from cave and fissure fill sites. Molasse sites usually do not yield rich bat faunas. No Vallesian bat faunas have been published to date in detail.

Tab. 27: List of bats from Eichkogel, Schernham, Richardshof-Wald, Richardshof-Golfplatz and Götzendorf (ns = number of specimens, nc = number of most common elements)

| | MN 11 | | MN10 | | | | | | | | MN 9 | | | | | |
| | Eichkogel | | Schernham | | Rh-94/1 | | Rh-94/3 | | Rh-95/5A | | RH-A/2 | | RH-A/7 | | Götzendorf | |
Taxon	ns	nc	ns	nc	ns	nc	ns	nc	ns	nc	ns	nc	ns	nc	ns	nc
Megadermatidae																
Megaderma cf. *vireti*									1	1						
Rhinolophidae																
Rhinolophus cf. *delphinensis*											1	1				
Rhinolophus cf. *grivensis*					6	2			3	1	3	2	2	1		
Vespertilionidae																
Paleptesicus cf. *noctuloides*	12	3					5	2	9	2	6	2			1	1
P. cf. *noct.* / *Kerivoula* cf. *murinoides*			1	1	16	5							7	3		
Myotis sp. II			2	1	8	2			1	1	9	2				
Sum	12	3	3	2	30	9	5	2	14	5	19	7	9	4	1	1

Biostratigraphic considerations
Fig. 30

The following section outlines the thus far known stratigraphic ranges of the recorded species in order to correlate the present samples with MN-units.

The genus *Schizogalerix* appeared in Austria for the first time in the early Middle Miocene (Late MN 5) faunas of Mühlbach and Grund (ZIEGLER 2003a). It reappeared in the Early Vallesian with *S. voesendorfensis* in Voesendorf. In the Turolian, two species have been recorded: *S. zapfei* from Kohfidisch and *S. moedlingensis* from Eichkogel. The Turolian species are closely related and more advanced than *S. voesendorfensis*. They are good stratigraphic guides to distinguish the Vallesian from the Turolian.

The most common erinaceid in the Vallesian is the small *Lantanotherium sanmigueli*. Most records of this species are from Vallesian and early Turolian faunas. Its presence in a fauna argues in favour of a Vallesian correlation.

Plesiosorex evolutus shows a mosaic of advanced and less advanced characters. Not all teeth are known from all species, and comparisons are therefore restricted. Its evolutionary stage is intermediate between *P. schaffneri* from Rudabánya (MN 9) and *P. roosi* from Eppelsheim (ca. MN 10). *P. evolutus* suggests a Vallesian correlation.

Among the talpids, the desmans *Archaeodesmana* and *Storchia* are advanced elements. The Austrian records are the first in the Vallesian. The remaining talpids are less appropriate for stratigraphic correlation.

The dimylids are generally unsuited for stratigraphic correlations.

Time (Ma)	Epoch	Chron	Polarity	Standard Stages	Central Paratethys Stages	Vienna Basin Biozones (Molluscs) A-H	Mammal-Mega-Zones (STEININGER 1999)	MN-Zones Central Paratethys	Vertebrate Faunas Austria
7	LATE MIOCENE	3B		Tortonian	Pannonian		Turolian	13	
								12	
8		4				H		11	Eichkogel
									Kohfidisch
9		4A				G	Vallesian	10	Schernham
									Neusiedl a.See Richardhof-Wald Stixneusiedl Götzendorf
10		5				F			Richardhof-Golfplatz
						Mytilopsis neumayri		9	
						E			
						Congeria subglobosa			
11						C/D			
						Mytilopsis hoernesi Congeria partschi			
						B			Bullendorf
						Mytilopsis ornithopsis			
						A			
12	M.- MIOCENE			Serravallian	Sarmatian		Astaracian	7-8	
		5A							

Fig. 30: The sites and their biostratigraphic and geochronologic correlations.

The soricid *Crusafontina* indicates an at least Vallesian correlation. The lineage *C. endemica* – *C. kormosi* helps to distinguish between Vallesian and Turolian faunas. The presence of the advanced *C. kormosi* in the Eichkogel and Kohfidisch samples clearly indicates a Turolian correlation, *C. endemica* the Vallesian. The currently known range of *Petenyia dubia* is Early Vallesian (MN 9) to Late Turolian (MN 13). Its presence in a fauna indicates a Late Miocene correlation. *Paenelimnoecus repenningi* is known from MN 9 to MN 12 (RZEBIK-KOWALSKA 1998) and also suggests a Late Miocene correlation.

As the chiropteran determinations are somewhat vague, and especially as the relationships of the fossil species to extant ones are unclear, no biostratigraphic conclusions are possible.

This overview enables the rodent-based stratigraphic correlation of the faunas to be corroborated, although not as precisely. The insectivore associations point to a Turolian correlation of the Eichkogel and Kohfidisch samples and clearly indicate the Vallesian for the Schernham, Richardhof-Wald, Richardhof-Golfplatz and Götzendorf faunas.

Palaeoenvironmental aspects

The galericines, whose extant relatives all inhabit humid forests with thick undergrowth in Southeast Asia (NOWAK 1991), argue in favour of humid conditions and the presence of forests. The dimylids and *Plesiosorex* also indicate a humid environment. Among the talpids, the desmans are clear indicators of water. The semiaquatic mode of life is common to all extant desmans. Both extant *Urotrichus* species are forest dwellers that avoid the plains. Based on the ecology of the recent *Anourosorex squamipes*, the fossil anourosoricine *Crusafontina* lived under humid conditions. All ecologically significant species of the presently studied faunas indicate a humid and forested environment. Among the insectivores there are no indicators of an open habitat. A forested environment is corroborated by the presence of flying squirrels in nearly all samples (DAXNER-HÖCK 2004a).

References

AGUSTI, J., MOYÁ-SOLÁ, S. & GIBERT, J. (1984): Mammal distribution dynamics in the eastern margin of the Iberian peninsula during the Miocene. – Paléobiologie Continentale, **14**/2: 33–46. – Montpellier.

ANDREAE, A. (1904): Dritter Beitrag zur Kenntnis des Miozäns von Oppeln i. Schlesien. – Mitt. Roemer-Mus. Hildesheim, **20**: 1–22. – Hildesheim.

BACHMAYER, F. & WILSON, R. W. (1970): Small Mammals (Insectivora, Chiroptera, Lagomorpha, Rodentia) from the Kohfidisch Fissures of Burgenland, Austria. – Ann. Naturhist. Mus. Wien, **74**: 533–587. – Wien.

—— & —— (1978): A second Contribution to the Small Mammal Fauna of Kohfidisch. Austria. – Ann. Naturhist. Mus. Wien, **81**:129–161. – Wien.

—— & —— (1980): A third Contribution to the Small Mammal Fauna of Kohfidisch (Burgenland), Austria. – Ann. Naturhist. Mus. Wien, **83**: 351–386. – Wien.

—— & —— (1984): Die Kleinsäugerfauna von Götzendorf, Niederösterreich. – Sitzungsber. Österr. Akad. Wiss., math.-naturwiss. Kl., **193**/6–10: 303–319. – Wien.

BAUDELOT, S. (1972): Étude des Chiroptères, Insectivores et Rongeurs du Miocène de Sansan (Gers). – Thèse de l´Université de Toulouse, **496**: 1–364. – Toulouse.

BRUIJN, H. DE, R. DAAMS, G. & DAXNER-HÖCK, V. FAHLBUSCH, L. GINSBURG, P. MEIN, J. MORALES (1992): Report of the RCMNS working group on fossil mammals, Reisensburg 1990. – Newsl. Stratigr., **26**/2–3: 65–118. – Berlin, Stuttgart.

CROCHET, J.-Y. (1986): Insectivores pliocènes du Sud de la France (Languedoc-Roussillon) et du Nord-Est de L'Éspagne. – Palaeovertebrata, **16**/3: 145–171. – Montpellier.

—— & GREEN, M. (1982): Contributions á l'étude des micromammifères du gisement Miocène Supérieur de Montredon (Hérault). – Palaeovertebrata, **12**/3: 119–131. – Montpellier.

CRUSAFONT, M. & VILLALTA, J. F. DE (1947): Sur un nouveau Palerinaceus du Pontien d´Espagne. – Ecl. geol. Helv., **40**/2: 320–333. – Basel.

DAHLMANN , T. (2001): Die Kleinsäuger der unter-pliozänen Fundstelle Wölfersheim in der Wetterau (Mammalia: Lipotyphla, Chiroptera, Rodentia). – Cour. Forsch.-Inst. Senckenberg, **227**: 1–129. – Frankfurt a. M.

DAM, J. VAN (2004): Anourosoricini (Mammalia: Soricidae) from the Mediterranean region: a Pre-Quaternry example of recurrent climate-controlled North-South range shifting. – J. Paleont., **78**/4: 741–764. – Ithaca, NY.

DAXNER-HÖCK, G. (1996): Faunenwandel im Obermiozän und Korrelation der MN-"Zonen" mit den Biozonen des Pannons der Zentralen Paratethys. – Beitr. Paläont., **21**: 1–9.– Wien.

—— (2004a): Flying Squirrels (Pteromyinae, Mammalia) from the Upper Miocene of Austria. – Ann. Naturhist. Mus. Wien, **106A**: 387–423.– Wien.

—— (2004b): *Pseudocollimys steiningeri* nov. gen. nov. spec. (Cricetidae, Rodentia, Mammalia) aus dem Ober-Miozän der Molassezone Oberösterreichs. – Cour. Forsch.-Inst. Senckenberg, **246**: 1–13.– Frankfurt a. M.

DOUKAS, C. S., HOEK OSTENDE, L. W. VAN DEN, THEOCHAROPOULOS, C. D., REUMER, J. W. F. (1995): The Vertebrate Locality Maramena (Macedonia, Greece) at the Turolian-Ruscinian Boundary (Neogene). – Münchner Geowissenschaftliche Abhandlungen, A **28**: 43–64. – München.

ENGESSER, B. (1972): Die obermiozäne Säugetierfauna von Anwil (Baselland). – Tätigkeitsber. Naturforsch. Ges. Baselland, **28**: 35–363. – Liestal.

—— (1979): Relationships of some insectivores and rodents from the Miocene of North America and Europe. – Bull. Carnegie Mus. Nat. Hist., **14**: 68 pp.– Pittsburgh.

—— (1980): Insectivora und Chiroptera (Mammalia) aus dem Neogen der Türkei. – Schweizer. Paläont. Abh., **102**: 45–149. – Basel.

—— & ZIEGLER, R. (1996): Didelphids, insectivores, and chiropterans from the later Miocene of France, Central Europe, Greece, and Turkey. – In: BERNOR, R. L., FAHLBUSCH, V. & MITTMANN, H.-W. (eds.): The evolution of Western Eurasian Neogene mammal faunas. – 157–167.– New York (Columbia University Press).

FAHLBUSCH, V. (1989): Über den Holotypus von *Metacordylodon schlosseri* (Andreae 1904) (Insectivora, Mamm.) aus dem Miozän von Oppeln. – Mitt. Bayer. Staatsslg. Paläont. hist. Geol., **29**: 159–162. – München.

FEJFAR, O. (1974): Die Eomyiden und Cricetiden (Rodentia, Mammalia) des Miozäns der Tschechoslowakei. – Palaeontographica, (A) **146**: 100–180. – Stuttgart.

FRANZEN, J. L., FEJFAR, O. & STORCH, G. (2003): First micromammals (Mammalia, Soricomorpha) from the Vallesian (Miocene) of Eppelsheim, Rheinhessen (Germany). – Senckenbergiana lethaea, **83**/1–2: 95–102. – Frankfurt am Main.

GIBERT, J. (1975): New insectivores from the Miocene of Spain. – Proc. Koninkl. Nederl. Akad. Wetensch., (B) **78**: 108–133. – Utrecht.

HAND, S. (1985): New Miocene megadermatids (Chiroptera: Megadermatidae) from Australia with comments on megadermatid phylogeny. – Australian Mammalogy, **8**: 5–43. – Adelaide.

HELLER, F. (1936): Eine oberpliocäne Wirbeltierfauna aus Rheinhessen. – N. Jb. Min., Geol., Paläont., Beil.–Bd. **76**: 99–160. – Stuttgart.

HOEK, L. W. VAN DEN (1989): 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**: 29 p. – Stuttgart.

HORÁČEK, J. (2001): On the early history of vespertilionid bats in Europe: the Lower Miocene record from the Bohemian Massif. – Lynx, n.s., **32**: 123–154. – Praha.

HUGUENEY, M. (1972): 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**: 81 p. – Lyon.

HUTCHISON, J.-H. (1974): Notes on type specimens of European Miocene Talpidae and a tentative classification of Old World Tertiary Talpidae (Insectivora: Mammalia). – Geobios, **7**/3: 211–256. – Lyon.

HUTTERER, R. (1995): *Archaeodesmana* Topachevski & Pashkov, the correct name for *Dibolia* Rümke, a genus of fossil water moles (Mammalia: Talpidae). – Bonn. zool. Beitr., **45**/3–4: 171–172.– Bonn.

JONG, F. DE (1988): Insectivora from the Upper aragonian and the Lower Vallesian of the Daroca-Villfeliche area in the Calatayud-Teruel Basin (spain). – Scripta Geol., spec. issue, **1**: 253–285. – Leiden.

KÄLIN, D. & ENGESSER, B. (2001): Die jungmiozäne Säugetierfauna vom Nebelbergweg bei Nunningen (Kanton Solothurn, Schweiz). – Schweizer. Palaeont. Abh., **121**: 1–61. – Basel.

KORDIKOVA, H. (2000): Insectivora from the Lower Miocene of the Aktau Mountains, South-Eastern Kazakhstan. – Senckenbergiana lethaea, **80**/1: 67–79. – Frankfurt am Main.

KOWALSKI, K. (1989): Stratigraphy of Neogene mammals in Poland. – In: E. H. LINDSAY, V. FAHLBUSCH & P. MEIN (eds.): European Neogene mammal chronology. – NATO ASI series. Series A: Life sciences, **180**: 193–210. – New York, London (Plenum Press).

—— & RZEBIK-KOWALSKA, B. (2002): Paleoecology of the Miocene fossil mammal fauna from Belchatów (Poaland). – Acta Theriol., **47**, Suppl. **1**: 115–126. – Kraków.

LEGENDRE, S. (1982): Hipposideridae (Mammalia: Chiroptera) from the Mediterranean Middle and Late Neogene, and the evolution of the genera *Hipposideros* and *Asellia*. – Journal of Vertebrate Paleontology, **2**/3: 372–385. – Oklahoma.

MAYR, H. & FAHLBUSCH, V. (1975): Eine unterpliozäne Kleinsäugerfauna aus der Oberen Süßwasser-Molasse Bayerns. – Mitt. Bayer. Staatsslg. Paläont. hist. Geol., **15**: 91–111. – München.

MEIN, P. (1964): Chiroptera (Miocène) de Lissieu (Rhone). – C. R. 89e Congr. natn. Soc. Savantes, Section Sci., Lyon, 1964: 237–253. – Lyon.

—— (1999): The Late Miocene small mammal succession from France, with emphasis on the Rhône Valley localities. – In: J. AGUSTI, L. ROOK & P. ANDREWS (eds.): Hominoid evolution and climatic change in Europe. Volume I. The Evolution of Neogene terrestrial ecosystems in Europe: – 140–164. – New York (Cambridge University Press).

—— & GINSBURG, L. (2002): Sur l'âge relatif des différents dépôts karstiques Miocènes de La Grive-Saint-Alban (Isère). – Cahiers scientifiques, Mus. Hist. natur. Lyon, **2**: 7–47. – Lyon.

MÉSZÁROS, L. GY. (1996): Soricidae (Mammalia, Insectivora) remains from three Late Miocene localities in western Hungary. – Ann. Univ. Sci. Budapest., Sect. Geol., **31**: 5–25. – Budapest.

—— (1997): *Kordosia*, a new genus for some Late Miocene Amblycoptini shrews (Mammalia, Insectivora). – N. Jb. Geol. Paläont., Mh. 1977/2: 65–78. – Stuttgart.

—— (1998a): *Crusafontina* (Mammalia, Soricidae) from Late Miocene localities in Hungary. – Senckenbergiana lethaea, **77**/1–2: 145–159. – Frankfurt am Main.

—— (1998b): Late Miocene Soricidae (Mammalia) fauna from Tardosbánya (Western Hungary). – Hantkeniana, **2**: 103–125. – Budapest.

—— (1999a): Some insectivore (Mammalia) remains from the Late Miocene locality of Alsótelekes (Hungary). – Ann. Univ. Sci. Budapest, Sect. Geol., **32**: 35–47. – Budapest.

—— (1999b): An exceptionally rich Soricidae (Mmmalia) fauna from the upper Miocene localities of Polgárdi (Hungary). – Ann. Univ. Sci. Budapest., Sect. Geol, **32**: 5–34. – Budapest.

MILLER, G. S. (1927): Revised determinations of some tertiary Mammals from Mongolia. – Palaeont. sinica, (C) **5**/2: 5–20. – Beijing.

MITCHEL-JONES, A. J., AMORI, G., BOGDANOWICZ, W., KRYŠTUFEK, B, REIJNDERS, P. J. H., SPITZENBERGER, F., STUBBE, M, THISSEN, J. B. M., VOHRALÍK, V. & ZIMA, J. (1999): The Atlas of European Mammals. – 484 p. – London (Academic Press).

MÜLLER, A. (1967): Die Geschichte der Familie Dimylidae (Insectivora, Mamm.) auf Grund der Funde aus tertiären Spaltenfüllungen Süddeutschlands. – Abh. Bayer. Akad. Wiss., mathemat.-naturwiss. Kl., N. F., **129**: 1–93. – München.

NOWAK, R.M. (1991): Walker's mammals of the world. I. 5ᵗʰ edition. – LVIII + 622 + XIV pp. – Baltimore, London (John Hopkins University Press).

RABEDER, G. (1970): Die Wirbeltierfauna aus dem Alt-Pliozän (O-Pannon) vom Eichkogel bei Mödling (N. Ö.). I. Allgemeines. II. Insectivora. – Ann. Naturhist. Mus. Wien, **74**: 589–595. – Wien.

—— (1973): *Galerix* und *Lantanotherium* (Erinaceidae, Insectivora) aus dem Pannon des Wiener Beckens. – N. Jb. Geol. Paläont., Mh. 1973/7: 429–446. – Stuttgart.

—— (1998a): Säugetiere (Mammalia) aus dem Karpat des Korneubruger Beckens. 1. Insectivora, Chiroptera und Marsupialia. – Beitr. Paläont., **23**: 347–362. – Wien.

—— (1998b): *Dinosorex* (Insectivora, Mammalia) aus dem Miozän von Österreich. – Geologisch-Paläontologische Mitteilungen Innsbruck, **23**: 117–126. – Innsbruck.

RACHL, R. (1983): Die Chiroptera (Mammalia) aus den mittelmiozänen Kalken des Nördlingers Rieses (Süddeutschland). – Doctoral thesis University of München: 284 p. – München.

REUMER, J. W. F. (1984): Ruscinian to early Pleistocene Soricidae (Insectivora, Mammalia) from the Tegelen (The Netherlands) and Hungary. – Scripta Geologica, **73**: 1–173, 23 figs., 54 tabs., 37 pls. – Leiden.

—— (1992): The taxonomical position of the genus *Paenelimnoecus* BAUDELOT, 1972 (Mammalia: Soricidae): a resurrection of the subfamiliy Allosoricinae. – J. Vertebrate Paleont., **12**/1: 103–106, 3 Abb.; Lawrence/Kansas.

REVILLIOD, P. (1922): Contribution à l' étude des chiroptères des terrains tertiaires. 3ᵉᵐᵉ partie et fin. – Mémoires de la Société Paléontologique de Suisse, **45**: 133–195. – Genf.

RÖGL, R., H. ZAPFE, R. L. BERNOR, R. L. BRZOBOHATY, G. DAXNER-HÖCK, I. DRAXLER., O. FEJFAR, J. GAUDANT, P. HERRMANN, G. RABEDER, O. SCHULTZ & R. ZETTER (1993): Die Primatenfundstelle Götzendorf an der Leitha (Obermiozän des Wiener Beckens, Niederösterreich). – Jb. Geo., B.-A., **136**/2: 503–526. – Wien.

RÜMKE, C. G. (1974): A new *Desmanella* species (Talpidae, Insectivora) from the Turolian of Concud and Los Mansuetos (Prov. of Teruel, Spain). – Proc. Koninkl. Nederl. Akad. Wetensch., (B) **77**/4: 359–374. – Utrecht.

—— (1976): Insectivora from Pikermi and Biodrak (Greece). – Proc. Koninkl. Nederl. Akad. Wetensch., (B) **79**/4: 256–270. – Utrecht.

—— (1985): A review of fossil and recent Desmaninae (Talpidae, Insectivora). – Utrecht Micropaleont. Bull., Spec. Publ., **4**: 241 p. – Utrecht.

RZEBIK-KOWALSKA, B. (1996): Insectivora (Mammalia) from the Miocene of Belchatów in Poland. III. Dimylidae Schlosser, 1887. – Acta zool. cracov., **39**/1: 447–468. – Kraków.

—— (1998). Fossil History of shrews in Europe. – In: WÓJCIK, J. M. , WOLSAN, M (eds.): Evolution of Shrews. Mammal research Institute, Polish Academy of Sciences: 23–92. – Bialowieza.

SCHMIDT-KITTLER, N. (1973). *Dimyloides*-Neufunde aus der oberologozänen Spaltenfüllung "Ehrenstein 4" (Süddeutschland) und die systematische Stellung der Dimyliden (Insectivora, Mammalia). – Mitt. Bayer. Staatsslg. Paläont. hist. Geol., **13**: 115–139. – München.

SCHÖTZ, M. (1985): Die Dimyliden (Mammalia, Insectivora) aus der Kiesgrube Maßendorf (Obere Süßwassermolasse Niederbayerns). – Mitt. Bayer. Staatsslg. Paläont. hist. Geol., **25**: 95–130. – München.

—— (1989): Die *Plesiosorex*-Funde aus der Kiesgrube Maßendorf (Obere Süßwassermolasse Niederbayerns). – Mitt. Bayer. Staatsslg. Paläont. hist. Geol., **29**: 141–157. – München.

SIGÉ, B. (1968): Les chiroptères du Miocène inférieur de Bouzigues. I. Étude systématique. – Palaeovertebrata, **1**/33: 65–133. – Montpellier.

—— (1982): Contribution á l'étude du gisement Miocène supérieur de Montredon (Hérault). – Palaeovertebrata, **12**/3: 133–140. – Montpellier.

SKOZEŃ, S. (1980): *Scaptonychini* VAN VALEN, 1967, *Urotrichini* and *Scalopini* DOBSON, 1883 (*Insectivora, Mammalia*) in the Pliocene and Pleistocene of Poland. – Acta Zool. Cracov., **24**/9: 411–448. – Kraków.

STORCH, G. (1978): Die turolische Wirbeltierfauna von Dorn-Dürkheim, Rheinhessen (SW-Deutschland). 2. Mammalia: Insectivora. – Senckenbergiana lethaea, **58**/6: 421–449. – Frankfurt am Main.

—— (1995): The Neogene mammalian faunas of Ertemte and Harr Obo in Inner Mongolia (Nei Mongol), China. 11. Soricidae (Insectivora). – Senckenbergiana lethaea, **75**/1–2: 221–251. – Frankfurt am Main.

—— & Z. QIU (1991): Insectivores (Mammalia: Erinaceidae, Soricidae, Talpidae) from the Lufeng hominoid locality, Late Miocene of China. – Geobios, **24**/5: 601–621. – Lyon.

STROMER, E. (1928): Wirbeltiere im obermiocänen Flinz Münchens. – Abh. Bayer. Akad. Wiss., mathemat.-naturwiss. Kl., **23**/1: 1–71.

—— (1940): Die jungtertiäre Fauna des Flinzes und des Schweiß-Sandes von München. Nachträge und Berichtigungen. – Abh. Bayer. Akad. Wiss., mathemat.-naturwiss. Kl., N. F. **48**: 5–102. – München.

THENIUS, E. (1949): Zur Revision der Insektivoren des steirischen Tertiärs II. – Sitzungsber. Österr. Akad. Wiss., math.-naturw. Kl., Abt. I, **159**/9–10: 671–693. – Wien.

TOPÁL, G. (1985): Pliocene species of *Myotis* from Hungary. – Acta Zoologica Fennica, **170**: 153–155. – Helsinki.

—— (1989): Tertiary and Early Quaternary remains of *Corynorhinus* and *Plecotus* from Hungary (Mammalia, Chiroptera). – Vertebrata Hungarica, **23**: 33–55. – Budapest.

VILLALTA COMELLA, J. F. DE & CRUSAFONT PAIRÓ, M. (1944): Nuevos insectivoros del Mioceno Continental del Vallés-Panadés. – Not. Comm. Inst. Geol. Min. Espagna, **12**: 41–65. – Madrid.

VIRET, J. (1946): Sur un nouvel exemplaire de Plesiosorex soricinoides BLAINV. des argiles stampiennes de Marseille Saint-André. – Ecl. geol. Helv., **39**/2: 314–317. – Basel.

ZIEGLER, R. (1985): Talpiden (Mammalia, Insectivora) aus dem Orleanium und Astaracium Bayerns. – Mitt. Bayer. Staatsslg. Paläont. hist. Geol., **25**: 131–175. – München.

—— (1993): Die Chiroptera (Mammalia) aus dem Untermiozän von Wintershof-West bei Eichstätt (Bayern). – Mitt. Bayer. Staatsslg. Paläont. hist. Geol., **33**: 119–154. – München.

—— (1998a): Wirbeltiere aus dem Unter-Miozän des Lignit-Tagebaues Oberdorf (Weststeirisches Becken, Österreich): 5. Marsupialia, Insectivora und Chiroptera (Mammalia). – Ann. Naturhist. Mus. Wien, **99A**: 43–97. – Wien.

—— (1998b): Marsupialia und Insectivora (Mammalia) aus den oberoligozänen Spaltenfüllungen Herrlingen 8 und Herrlingen 9 bei Ulm (Baden-Württemberg). – Senckenbergiana lethaea, **77**/1–2: 101–143. – Frankfurt am Main.

—— (2000): The Miocene Fossil-Lagerstätte Sandelzhausen, 17. Marsupialia, Lipotyphla and Chiroptera. – Senckenbergiana lethaea, **80**/1: 81–127. – Frankfurt am Main.

—— (2003a): Insektenfresser (Lipotyphla) aus dem Mittel-Miozän vom Mühlbach am Manhartsberg und Grund, Niederösterreich. – Annalen des Naturhistorischen Museums Wien, **104A**: 251–265. – Wien.

—— (2003b): Moles (Talpidae) from the late Middle Miocene of South Germany. – Acta Palaeontol. Polonica, **48**: 617–648.

—— (2003c): Shrews (Soricidae, Mammalia) from the Middle Miocene karstic fissure fillings of Petersbuch near Eichstätt, Southern Franconian Alb (Bavaria). – Paläontologische Zeitschrift, **77**/2: 303–322, 7 figs., 5 tabs. – Stuttgart.

—— (2003d): Bats (Chiroptera, Mammalia) from Middle Miocene karstic fissure fillings of Petersbuch near Eichstätt, Southern Franconian Alb (Bavaria). – Geobios, **36**/3: 447–490. – Lyon.

—— (2005a): The insectivores (Erinaceomorpha and Soricomorpha, Mammalia) from the Late Miocene hominoid locality Rudabánya. – Palaeontographica Italica, **90**: 53–81. – Pisa.

—— (2005b): Erinaceidae and Dimylidae (Lipotyphla) from the Late Middle Miocene of South Germany. – Senckenbergiana lethaea, **85**/1: 131–152. – Frankfurt am Main.

—— & MÖRS, TH., (2000): Marsupialia, Lipotyphla und Chiroptera (Mammalia) aus dem Miozän des Braunkohletagebaus von Hambach (Niederrheinische Bucht, NW-Deutschland). – Palaeontographica, (A) **257**/1–3: 1–26. – Stuttgart.