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A second Contribution to the Small Mammal Fauna of Kohfidisch, Austria

Zweiter Beitrag zur Kleinsäugerfauna von Kohfidisch (Burgenland, Österreich)

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Mit 5 Tafeln, davon 4 Tafeln mit Stereoaufnahmen)

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Zusammenfassung

Die Bearbeitung weiteren Materials aus Kohfidisch, die seit 1968 fortgeführt wurde, hat folgende für die Fauna von Kohfidisch neue Arten ergeben: *Lanthanotherium* sp., *Rhinolophus grivensis*, *Myotis* nahestehend *M. boyeri*, cf. *Myotis* sp., *Keramidomys* sp. und *Promimomys* (*Prosomys*) sp. Außerdem hat die Verbesserung von Taxonomie und Nomenklatur noch folgende Elemente hinzugefügt: cf. *Desmanella crusafonti*, *Plecotus* (*Paraplecotus*) sp., *Pliopetaurista* cf. *P. bressana*, cf. *Myomimus dehmi*, cf. *Myomimus multicristatus* und *Epimeriones* cf. *E. austriacus*.

Der Vergleich mit der Fauna vom Eichkogel bei Mödling im Wiener Becken zeigt eine enge Faunen-Verwandtschaft, aber mit einigen Hinweisen, daß die Fauna von Kohfidisch etwas älter ist, jedoch nicht so alt wie jene von Brunn-Vösendorf bei Wien. Wenn man die Entwicklungshöhe der Murinen als verlässlichen Hinweis auf das Alter annimmt, so liegt die Fauna von Kohfidisch nahe der Grenze zwischen Vallesien und Turolien, aber schon innerhalb des frühen Turolien.

Abstract

Study of new material from Kohfidisch which has been processed since 1968, adds species new to the Kohfidisch fauna as follows: *Lanthanotherium* sp., *Rhinolophus grivensis*, *Myotis* nr. *M. boyeri*, cf. *Myotis* sp., *Keramidomys* sp., and *Promimomys* (*Prosomys*) sp. In addition, refinement in taxonomy and nomenclature add: cf. *Desmanella crusafonti*, *Plecotus* (*Paraplecotus*) sp., *Pliopetaurista* cf. *P. bressana*, cf. *Myomimus dehmi*, cf. *Myomimus multicristatus*, and *Epimeriones* cf. *E. austriacus*.

Comparison with the Eichkogel bei Mödling fauna of the Vienna Basin demonstrates a close faunal relationship, but with some indication that the Kohfidisch fauna is somewhat older, although not so old as that of Brunn-Vösendorf bei Wien.

If stage of murine evolution is a reliable guide to age, the Kohfidisch fauna lies near the boundary between Vallesian and Turolian, but within the early Turolian.

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Introduction

The fissure system at Kohfidisch, Austria, has produced much fossil material, and especially the remains of small mammals (Insectivora, Chiroptera, Lagomorpha, Rodentia). A first account based on specimens collected and processed through 1967 was issued by us in 1971 although bearing the publication date of 1970. Since that time much additional material has been obtained, mostly from Fundstellen II and III, especially III Oben (see BACHMAYER & ZAPFE, 1969). The present account is concerned with this new material, which includes species new to the Kohfidisch fauna, as well as specimens which make necessary some modification of the original work. Moreover, knowledge of related faunas in other parts of Europe has improved considerably, also making taxonomic modification necessary in some instances.

The time relation of the fauna is again briefly reviewed, partly made necessary by additions to the Kohfidisch fauna, and partly by increased knowledge of some other faunas, especially of the closely related fauna from Eichkogel bei Mödling, which is now much better known than in 1968, and is from the well-studied bedded sequence of the Pannon Series of the Vienna Basin. A comparison of Eichkogel and Kohfidisch adds another criterion for determining the age of the Kohfidisch fauna, a problem frequently difficult in dealing with fissure deposits. Additionally, important new faunas, related in time to Kohfidisch, are being discovered and described in the eastern Mediterranean; the small mammal sequence in Spain continues to be dealt with in detail by researchers from the Netherlands, France and Spain; and new data are also emerging as a result of continued work in France.

Acknowledgments

In addition to those acknowledged previously in earlier publications (see BACHMAYER & ZAPFE, 1969, and BACHMAYER & WILSON, 1970), the junior author wants to express his appreciation of the opportunity to participate in study of the Kohfidisch materials, and also of the privilege of being a house guest (1973, 1976) of the Natural History Museum of Vienna. Contributing also to his support were the National Geographic Society with a grant toward defraying expenses of the 1973 visit, and the Netherlands Organization for Scientific Research (ZWO) which financed a short visit (1976) to Utrecht for the purpose of comparative studies of materials from Spain and Greece.

Additions to the Fauna

New elements in the Kohfidisch fauna may be listed in three categories:
(a) previously not represented in the fauna by any segregated specimens;
(b) previously identified only in a general way, but now with a more specific

determination possible; and (c) new through taxonomic and nomenclatural changes.

(a) new to Kohfidisch

Lanthanotherium sp.
Rhinolophus grivensis
Myotis nr. *M. boyeri*

cf. *Myotis* sp.
Keramidomys
Promimomys (*Prosomys*)

(b) new by improved identification

Plecotus (*Paraplecotus*) sp.
cf. *Desmanella crusafonti*

Pliopetaurista cf. *P. bressana*
Epimeriones cf. *E. austriacus*

(c) new by taxonomic and nomenclatural changes

Neomyine ? sp.

cf. *Myomimus multicristatus*

cf. *Myomimus dehmi*.

Faunal Comparisons with Eichkogel

Although work on both the Kohfidisch and Eichkogel faunas continues, a much more detailed listing of the latter can now be made than was possible at the time of our original work on Kohfidisch. A comparative list follows.

Kohfidisch

Eichkogel bei Mödling *)

Insectivora

Family Erinaceidae

Galerix cf. *G. socialis*
Galerix zapfei
Lanthanotherium sp.
Erinaceus ? sp.

Galerix moedlingensis

Lanthanotherium cf. *sanmigueli*

Family Soricidae

Petényia dubia
Petényiella ? *repenningi*
Anourosorex kormosi
Neomyine ? sp.

Petényia hungarica

Petényiella cf. *pannonica*

Anourosorex sp.

Sorex spp.

Limnoecus ? sp.

Family Talpidae

Desmana pontica ?
cf. *Desmanella crusafonti*
Talpa ? sp.

Desmana cf. *kormosi*

desmanine spp.

various remains of talpids

*) From DAXNER-HÖCK (1970, 1972a, 1972b, 1975); RABEDER (1970, 1973); and DAXNER-HÖCK & RABEDER (1970).

Chiroptera

Family Megadermidae

Megaderma vireti

undet. fragments of Chiroptera

Family Rhinolophidae

*Rhinolophus delphinensis**Rhinolophus grivensis*

Family Vespertilionidae

Myotis nr. *M. boyeri**Plecotus (Paraplecotus)* sp.cf. *Myotis* sp.

Lagomorpha

Family Ochotonidae

Prolagus cf. *P. oeningensis*

no lagomorphs

Rodentia

Family Sciuridae

Spermophilinus cf. *S. bredai**Spermophilinus bredai-turolensis*
complex*Pliopetaurista* cf. *P. bressana**Pliopetaurista bressana**Pliopetes* cf. *hungarica**Blackia miocoenica*

Family Castoridae

cf. *Chalicomys jaegeri*

none

Family Gliridae

Muscardinus pliocaenicus
*austriacus**Muscardinus pliocaenicus*cf. *Myomimus dehmi**Peridomys* sp.cf. *Myomimus multicristatus**Glirudinus* sp.*Glirulus* sp.

Family Zapodidae

Protozapus intermedius

zapodid indet.

Family Eomyidae

Keramidomys sp.

none

Family Cricetidae

*Kowalskia fahlbuschi**Kowalskia* cf. *fahlbuschi**Collimys primus*

Subfamily Gerbillinae

Epimeriones cf. *E. austriacus**Epimeriones austriacus*

Subfamily Arvicolinae

Promimomys (Prosomys) sp.

none

?Family Cricetidae

*Prospalax petteri**Prospalax priscus*

Spalacid indet.

Family Muridae

*Progonomys woelferi**Parapodemus lugdunensis**Parapodemus lugdunensis*

Family Hystricidae

Hystrix cf. *H. suevica*

none

The resemblance between these two faunas is remarkable, considering that one is a cave and fissure accumulation of specimens and the other comes from bedded sediments. Because of open determinations in these two faunas, calculation of faunal resemblance by SIMPSON's method is difficult. Approximately, however, the coefficient of resemblance is 66. Species resemblance is probably also high if due allowance is made for different authors selecting some specific names from a choice of several poorly known nominal species. There thus can be little doubt that the two faunas are closely related in time, and seemingly ecologically as well, reducing the environmental factor in correlation as one of much importance. Geologically, the Kohfidisch fissures offer evidence that the filling occurred in Pannon F time (see BACHMAYER & ZAPFE, 1969). The Eichkogel fauna represents Zone H. Both are late Pannonian, although from an age standpoint they have been called Pontian (see, for example, DAXNER—HÖCK, 1975, p. 69). Faunally there is some evidence as well, as outlined below, that Kohfidisch is slightly older.

The chief distinctions between these two faunas are:

- (1) absence of lagomorphs, beavers, eomyids, microtines, and porcupines at Eichkogel
- (2) greater diversity of species in some groups of small mammals at Eichkogel, as, for example, in the sciurids, glirids, and shrews
- (3) some specific differences when genera are in common, for example, in species of *Prospalax*, *Desmana*, and *Petényia*
- (4) absence of *Progonomys* in the Eichkogel fauna.

In regard to (1) a beaver has been reported from Eichkogel by PAPP & THENIUS (1954). In any case, lagomorphs, beavers, porcupines, and eomyids appear earlier and survive later than temporal equivalents of either fauna. The Kohfidisch microtine is represented only by a single specimen, and, if rare, could be missing for that reason from Eichkogel. Further, in faunal sequences from other European regions, the microtines are distinctly later in their first appearance than the Austrian faunas appear to be, and for that reason, the occurrence may be suspect. In either case, it does not in itself indicate an age difference.

The second difference may be due to a wider source area at Eichkogel, differences in screen size used in washing, or a more refined taxonomy. Again, it does not point to an age difference.

The third difference is much more critical, and difficult to evaluate. It mostly concerns species from Eichkogel that have not been studied in detail,

are fragmentary compared to Kohfidisch, and were determined before the Kohfidisch work was available to DAXNER—HÖCK & RABEDER. As already stated, there may be a choice of names with little basis for that choice, giving rise to different names whether the species are taxonomically the same or not. In the instance of *Prospalax priscus* versus *P. petteri*, the former species is generally a geologically later one, and if both determinations are valid and *Prospalax* rapidly evolving, the distinction could have temporal significance.

The final difference, absence of *Progonomys* at Eichkogel, seems to be the most valid evidence for an age difference. Murines are common at both localities, but *Parapodemus* is relatively rare at Kohfidisch. Generally, the two genera do not occur together (one other such case?), and *Parapodemus* is known to survive after *Progonomys* becomes extinct. The Eichkogel fauna has been called Turolian in age by its describers, and Kohfidisch, in our earlier report, has been termed early Turolian, which suggests once again a certain difference in age.

Temporal Position of Kohfidisch

In the Spanish sequence, *Parapodemus* and *Protozapus* occupy a rather narrow zone, and the combination of *Progonomys* and *Parapodemus* is rare or unknown. This may be taken as indicating that Kohfidisch belongs to the earliest part of this zone, and can be regarded as latest Vallesian or earliest Turolian. This position is supported by other elements of the fauna such as cf. *Chalicomys jaegeri*, no advanced dormice, *Kowalskia fahlbuschi* rather than *Cricetus kormosi*, absence of *Dipoides*, presence of mostly warmth-loving bats, species allied to Vallesian forms such as *Lanthanotherium sanmigueli*, *Miope-taurista bressana*, and *Epimeriones* but no true gerbils. On the other hand, there are a number of "first appearances" such as *Anourosorex*, *Petényia*, ?*Prospalax*, and *Promimomys* which suggest a post-Vallesian age. We were at first rather sceptical of putting much reliance on the murines for correlation of faunas over wide areas, but after examination of samples of small mammals at the Geological Institute, Utrecht, and speaking at length with workers there, we now feel that minimally the murines offer a basic framework against which to test evidence obtained from other elements of the fauna. For the most part the murines survive this test in excellent fashion. The chief negative aspects are: (1) presence of *Promimomys*, if it is a genuine member of the fauna, and (2) presence of genera not known in Vallesian faunas, and indicating a typical rather than a marginal Turolian (perhaps early) fauna.

Environment at Kohfidisch

Not much can be added to the statement in the first report concerning the Kohfidisch small mammals in relation to environment. *Epimeriones* would seem to indicate a steppe or an arid-steppe environment. DAXNER-HÖCK (1972a) indicates an eastern Asiatic source for this animal, but an African to Near East source is equally plausible. It is tempting to correlate its presence with

a desiccating Mediterranean, and generally arid conditions (compare KOWALSKI, 1974, p. 594), but the fauna in general, with evidence of woodland and watered areas, makes this a highly uncertain relationship, substantiated principally by *Prospalax*, and temperature-wise by *Megaderma*. The presence of *Promimomys* (*Prosomys*) suggests another arrival from the eastern Holarctic, and the presence of harsher grasslands. Both these new elements are so rare that the environmental implications are limited. Moreover, DE BRUIJN (oral communication) does not think that *Epimeriones* is a true gerbil.

Our knowledge of Kohfidisch talpids has expanded very little except that most representatives of the family seem aquatic and surface-dwelling types, although typical moles (represented by humeri) are present. Whether the paucity of typical fossorial types has any climatic or environmental significance can not be ascertained at present.

Shrews, murines, and to a lesser extent cricetids, continue to be the common non-volant small mammals at Kohfidisch. On the other hand, dormice, and especially squirrels, remain sparse elements of the fauna.

All in all, the new collections simply reinforce the original impression of a largely grasslands fauna, dominated by elements derived from, or coming through, eastern Asia. Woodland of Miocene type was of course still present, but we think it was of open type, and less important than in the typical, earlier Miocene.

Systematic Description

Order Insectivora

In the new material, insectivores continue to be abundantly represented. Shrews are the most common, followed by the genus *Galerix*. Some insectivores, such as *Erinaceus*? and *Lanthanotherium* (new record) are rare. Talpids are somewhat between these extremes with *Desmana* the most common mole.

Family Erinaceidae

Lanthanotherium sp.

Taf. 1, Fig. 1

A single specimen, right M $\bar{2}$ or M $\bar{3}$, seems to represent the genus *Lanthanotherium*. The morphology of the tooth differs from that of *Galerix* in less alternating cusps, more cusped metaconid, more reduced paraconid, and more open trigonid. In size (L = 1.8; W = 1.25 mm), it would probably be comparable to *L. cf. sanmigueli* of the Eichkogel fauna (RABEDER, 1973a, p. 441), if M $\bar{3}$ of that species were known, rather than to an M $\bar{2}$. However, the root beneath the talonid is vertical, suggesting an M $\bar{2}$.

Galerix cf. G. socialis (v. MEYER 1865)

Galerix exilis, BACHMAYER & WILSON 1970.

Since our original work, the taxonomy and nomenclature of the genus *Galerix* has been reviewed by several workers. It has been concluded by

ENGESSER (1972) and RABEDER (1973a) that the proper name for much material previously assigned to *G. exilis* is *G. socialis*. Moreover, RABEDER in his review of species from the Vienna Basin concludes that the Kohfidisch specimens assigned to *G. exilis* pertain to the *G. socialis* group, but not, perhaps, to *G. socialis* itself. We agree with RABEDER that the answer to the exact affinities requires careful study of the large Kohfidisch series, a task beyond the scope of this report. It seems likely to us also that the Kohfidisch species will prove not to be *G. socialis*, but a species more in line with the stratigraphic level represented by the Kohfidisch fauna.

Galerix zapfei BACHMAYER & WILSON 1970

The first lower premolar in this species is now represented by something other than an alveolus. It is a forwardly slanting tooth in which the anterior edge of the crown is well in front of the supporting root. There is a minute heel area, but no paraconid. P $\bar{1}$ is contained in a jaw with P $\bar{3}$ and a single-rooted alveolus for P $\bar{2}$. Hence, this specimen probably represents *G. zapfei* rather than cf. *G. socialis*.

Erinaceus ? sp.

An additional upper molar (M $\bar{2}$) has been recovered, but does not add anything to our original comments.

Family Talpidae

A number of additional specimens are now available, especially of the talpid, desmanine talpid ?, genus indet., but the systematics of the Kohfidisch moles are not greatly improved.

Desmana pontica ? SCHREUDER 1940

RABEDER (1970, p. 594) has referred specimens from Eichkogel to *Desmana* cf. *kormosi* SCHREUDER 1940, rather than to *Desmana pontica*. He states that in spite of the somewhat smaller dimensions, a closer approach to *D. kormosi* is made in: (1) strong cingulum on lower molars, and (2) parastyle on M $\bar{1}$ and M $\bar{2}$ divided. A distinction from *D. kormosi* is that in the Eichkogel P $\bar{4}$, the hypocone is clearly developed.

In reference to these characters, our material shows: (1) relatively weak cingula in lower molars, and (2) parastyle seemingly single in M $\bar{1}$, double in M $\bar{2}$, no hypocone in P $\bar{4}$ (our figured specimen — 1970, pl. 8, 36a). Additional specimens show in M $\bar{1}$ a very slight double parastyle quickly obliterated by wear, and in M $\bar{2}$ faint or no twinning of the parastyle.

It does not seem that *Desmana pontica* and *D. kormosi* can be successfully distinguished, or at least not the Eichkogel and Kohfidisch species.

cf. *Desmanella crusafonti* RÜMKE 1974

Taf. 1, Fig. 2 u. 2a

desmanine talpid?, BACHMAYER & WILSON 1970.

Various jaw fragments with molars seem to match well the description of *Desmanella crusafonti* given by RÜMKE (1974). In size there is more or less agreement although our material may be somewhat intermediate in this character between *D. crusafonti* and *D. stehlini*. $M\bar{1}$ might be slightly shorter, relative to $M\bar{2}$, than in *D. crusafonti*. Several of these jaw fragments show alveoli for the teeth anterior to $P\bar{4}$, and these alveoli, although not easily interpreted, seem, with one exception, to likewise agree with RÜMKE's description. However, the five specimens in which $P\bar{4}$ is available show a considerably shorter $P\bar{4}$. (One of these was described in BACHMAYER & WILSON, 1970, p. 557, figs. 35, 35a.) Another specimen with alveolus for $P\bar{4}$ agrees more closely with *D. crusafonti* in presumed size of $P\bar{4}$ ($M\bar{1}$, L: 2.0; W: 1.2). Perhaps these several departures from *D. crusafonti* as described suggests that our collection is a composite of two or more genera, but if so, this might raise the question as to whether the type species, *D. stehlini* ENGESSER is determinant. ENGESSER (1972) referred *D. stehlini* to the Desmaninae, but RÜMKE thought the allocation in error, and referred both species to the Uropsalinae. It is interesting to note that in reference to the two specimens previously placed on record from Kohfidisch by us, our assignment was to desmanine talpid?, but in the text, it was suggested that there was resemblance to the American species, *Mydecodon martini*, a possible uropsiline.

Measurements (in millimeters)

cf. *Desmanella crusafonti*

	R	M
$M\bar{1}-M\bar{3}$, alveolar length:	4.0—4.4	4.1
$P\bar{4}$, L:	0.8—0.9	0.85
W:	0.6—0.75	0.7
$M\bar{1}$, L:	1.3—1.7	1.5
W:	1.1—1.25	1.2
$M\bar{2}$, L:	1.6—1.8	1.7
W:	1.1—1.25	1.2
$M\bar{3}$, L:	1.1—1.4	1.3
W:	0.8—1.0	0.85

Talpa? sp.

A few additional specimens reveal nothing new over our original statement.

Family Soricidae

In spite of a considerable addition of material, not much can be added to our previous report. The presence of *Petényia* and *Anourosorex* seems amply

confirmed. *Petényiella? repenningi* still seems not assignable to the Neomyini, whatever the status of the type species of the genus may be. These three soricids are common elements of the fauna. A fourth element, previously listed as *Paracryptotis? sp.*, is now known by more material, including specimens with articular parts of lower jaws preserved. Allocation to a definite tribe within the Soricinae has not thereby been made possible, although the genus is clearly not *Paracryptotis*. So far as soricids are concerned, the fauna is dominated by eastern elements.

Petényia dubia BACHMAYER & WILSON 1970

Taf. 5, Fig. 18

Not only a number of additional specimens have been obtained since the original account was written, but through the courtesy of Dr. Denis JÁNOSSY, one of us (WILSON) has had the opportunity to examine the type specimen of *P. hungarica* in Budapest. Originally, our comparisons had been based on specimens of *P. hungarica* from Schernfeld. There seems little reason now to doubt the assignment of *P. dubia* to *Petényia*, and indeed the Kohfidisch material is close to that of *P. hungarica*. Comparison of the two types involved suggests that the Kohfidisch species differs in: (1) much less intense pigmentation (a condition of preservation?), and (2) internal temporal vacuity higher and separated by a limula into two parts. Additionally, some specimens of *P. dubia* suggest that the lower incisor is less strongly serrated, and possibly that the coronoid spicule averages less development.

Nevertheless, other specimens from Kohfidisch have a less triangular internal temporal vacuity, more intense pigmentation, and sometimes a coronoid spicule that is nearly if not quite as prominent as in *P. hungarica*. Perhaps also if more lower incisors were present, and in an unworn state, the sharply serrate condition in *P. hungarica* would also be duplicated. The question arises as to whether two species are represented at Kohfidisch, or whether only one of considerable individual variation. If the latter view is correct, is *P. dubia* valid, or should the specimens be assigned to *P. hungarica*? As a matter of fact, we have not been able to divide the collection into two specific groups on any consistent criteria. In view of the differences cited — especially of the types — we retain the species, *Petényia dubia*.

In most specimens of *Petényia dubia* in which unworn third lower molars are present, the heel appears to be truly crested and centrally located. In a few specimens, however, the hypoconid is more as in REPENNING's figure of *P. hungarica* (1967a, p. 34, fig. 23) with a still somewhat crescentic hypoconid. In specimens with worn dentition, the talonid seems to possess a small basin, or sometimes the hypoconid seems to be simply a cusp, neither crested nor crescentic. We ascribe these latter variations to tooth wear, not only because of the evident dental wear, but also because no other characters of jaw or dentition can be consistently associated with them.

Petényiella? repenningi BACHMAYER & WILSON 1970

Taf. 1, Fig. 3

The assignment of this species, now augmented by considerably more material, remains very uncertain. *P. ? repenningi* can hardly be a neomyine shrew, whatever the type species or *P. pannonica* may be. It has some blarinine features (*Cryptotis*-like), notably in the lack of entoconid crests in the lower molars. On the whole, it seems to us better to regard it as a soricine, generally primitive, but with some advanced features. We continue to place the species tentatively in *Petényiella* for want of a better assignment. Some fragments of upper dentition are now known.

The principal osteological features of *Petényiella? repenningi* are: (1) condyles of lower jaw of primitive soricine construction, but with some tilt to coronoid and articular processes; (2) dental formula $\frac{1, 6, 3,}{1, 2, 3}$ next to last upper antemolar tiny and beneath P₄; (3) probably with non-pigmented teeth, or if pigmentation present, only slightly tinted; (4) mental foramen under middle of M₁; (5) upper molars emarginate posteriorly; (6) lower incisor large, with two serrations; (7) no entoconid crests on M₁—M₂, and entoconids small; (8) heel of M₃ reduced to a single cusp; (9) size small (M₁—M₃ = 3.0±) but larger than *P. pannonica*.

Neomyine? sp.

Taf. 1, Fig. 4, 4a u. 4b

?Paracryptotis sp. BACHMAYER & WILSON 1970.

Some additional material has been obtained since 1970; the most important additions are jaws in which parts posterior to M₃ are preserved. Even with these additional specimens, a certain assignment taxonomically is not possible. That, however, the genus is not *Paracryptotis* is demonstrated through the much less advanced character of the lower articular surface, lack of pigmentation, the fact that entoconid cresting, although weak, seems to be present except possibly in M₁ of one specimen. There now seems little reason to regard this species as a blarinine shrew. Perhaps it is at the beginning of specialization of the group of genera designated as Neomyini by REPENNING, 1967a.

The species may be described as follows: (1) size of *Neomys newtoni*; (2) upper molars with posterior emargination; (3) lower incisor with relatively obscure serrations, tip upturned; (4) entoconids of molars prominent, but cresting relatively weak; (5) M₃ reduced as a whole, and retaining a basined heel with tiny entoconid in some specimens; (6) mental foramen beneath posterior part of hypoconid of M₁; (7) mandibular (dental) foramen and post-mandibular confluent; (8) articular processes well-separated, relatively narrow interarticular area, upper process oval, lower process elongate and partly concealed in external view, but as a whole the articulation is not much advanced; (9) coronoid process high, tilted somewhat to outside, usually without coronoid

spicule; (10) internal temporal opening generally rounded triangular, but with some variation in shape; (11) pigmentation seems to be either weak or absent.

Ratios determined from measurements of $M\bar{1}$ and $M\bar{3}$ (length of $M\bar{1}$ is very constant) indicate an $M\bar{3}$ which is some, but not significantly, longer than $M\bar{3}$ of *Petényia dubia*, but indicate a significantly narrower trigonid, as would be expected in view of the kind of reduction in $M\bar{3}$ of these two species.

Two assignments seem possible. One is to the genus *Sorex* in the broadest sense. The other is to a primitive neomyine. REPENNING (1967a, p. 46) comments that in the dentition, *Sorex* and *Neomys* can only be separated by dental formula, P_4 , and the incisors. The lower incisor seems more of the neomyine type than soricine, but P_4 resembles more that in *Sorex* and some other neomyines than it does *Neomys* in the distance between parastyle and protocone. Absence of pronounced pigmentation suggests neomyine affinities, but not especially a relation to *Neomys*. Any close relationship to *Petényia* seems doubtful. Although the articular area is not much different (only slightly less advanced in *Petényia*) a number of differences are present including: (1) $M\bar{3}$ reduced as a whole, not merely in the heel area; (2) mandibular (dental) foramen and post-mandibular not separated; (3) less pronounced serrations on lower incisor; (4) narrower interarticular area; and (5) probably less pigmentation, at least in comparison with *P. hungarica*.

A new genus may well be represented, but better material seems needed.

Measurements (in millimeters)

Neomyine ? sp.

	R	M
\bar{I} , W (at base):	0.6—0.7	0.6
$M\bar{1}$ — $M\bar{3}$, L:	3.5—3.8	3.6
$P\bar{4}$, L:	0.8—1.2	1.0
W:	0.6—0.8	0.7
$M\bar{1}$, L:	1.5	1.5
W:	0.8—1.0	0.9
$M\bar{2}$, L:	1.25—1.5	1.4
W:	0.8—0.9	0.8
$M\bar{3}$, L:	1.0—1.25	1.1
W:	0.6—0.7	0.6

Comparison: Neomyine ? sp. vs. *Petényia dubia*

	Neomyine ? sp.	<i>Petényia dubia</i>
Ratio $M\bar{3}L / M\bar{1}L$:	0.73	0.69
Ratio $M\bar{3}W / M\bar{1}W$:	0.69	0.80

Anourosorex kormosi BACHMAYER & WILSON 1970

Taf. 2, Fig. 5, 5a

Additional specimens of *Anourosorex kormosi* permit some supplementary description. Several specimens are now known that have the upper incisor in place. These specimens show that the isolated teeth assigned to *A. kormosi* were correctly placed. The tip of the incisor is unfissured. There is a basal shearing cusp, and internally a strong wide ledge that runs anteroposteriorly, the two becoming more distinctly divided as shearing wear continues. The third antemolar is now known from several specimens in place. It is a tiny tooth, with flattened crown and transversely oval outline. M₃ is also now known. It is, of course, a very small tooth, rounded triangular in outline, but with a relatively pronounced and obliquely projecting parastyle. Otherwise, the crown is flattened with a small oval basin around which are almost indiscernable paracone, protocone, and a „metacone“: area. In the original description, M₃ was described as a much reduced tooth, with a slightly basined heel in most specimens. This tooth is perhaps more variable than this brief description indicates. Those with basined heel have two rather well-defined roots. In other specimens these roots may nearly coalesce as the heel region is further reduced to no more than a basal ledge. In one specimen, M₃ is single-rooted, and even the trigonid is becoming bicuspid. These latter specimens are nearly identical with REPENNING's illustration (1967 a, p. 54, fig. 39) of the Recent *Anourosorex squamipes*.

JÁNOSSY (1972 a, p. 41) is sceptical of assigning *A. kormosi* to the living genus. Of course, it shows features that differ in being more primitive than those of *A. squamipes*. It may be a matter of personal judgement when a new genus is established in such cases, but the close relationship to *Anourosorex* is undoubted, and use of the generic name is identifying. RABEDER (1970) in a simultaneously published work in respect to our first statement has identified as *Anourosorex* species specimens from the Eichkogel fauna which are only slightly younger than those of the Kohfidisch fauna (see previous discussion).

Order Chiroptera

Bats, of course, are numerous in the cave and fissure system at Kohfidisch. By far the most common genera are *Megaderma* and *Rhinolophus*. *Megaderma* is tropical, and the latter genus warmth-loving. According to RABEDER (1972), *Rhinolophus* so far as modern European occurrences are concerned, is a cave dweller, and it takes mild winters for it to winter in these caves. The much rarer vespertilionid bats are not so cold sensitive, but do not contradict the impression from the bat fauna as a whole of a mild year-round climate at Kohfidisch.

RABEDER (1973 b) has assigned the fragment previously identified by us as chiropterid, genus indet. to *Plecotus* (*Paraplecotus*), the earliest Austrian occurrence of *Plecotus* (*Paraplecotus*). In addition, the new material has per-

mitted the identification of a second species of *Rhinolophus*, and one, possibly two, species of *Myotis*.

The bat fauna of Kohfidisch, as now known, has a striking resemblance to that from Lissieu (Rhône) in western France (see MEIN, 1964). The Lissieu fauna is regarded by French workers as considerably later than either Kohfidisch or Eichkogel. These bats suggest a climatic similarity rather than any close relationship in time, as is obvious in comparing the murine rodents from the several localities.

Family Megadermidae

Megaderma vireti MEIN 1964

A number of upper jaw pieces of *Megaderma* are now available, and permit some comments on the upper jaw.

The maxillary bone is heavily punctate. This same characteristic is present in *Rhinolophus delphinensis*, but perhaps because of the large size of *Megaderma vireti*, it is more striking to the eye.

Compared with *Rhinolophus delphinensis* (the bat from Kohfidisch most nearly comparable in size to *M. vireti*), the dentition shows: (1) a considerably larger size; (2) P₄ with distinct parastyle and with paracone-metacone blade more extended anteroposteriorly; (3) M₁—M₂ with metacone-metastyle and heel area more extended posteriorly, and consequently with more emarginate posterior outline; and (4) protocone crescent much more contracted anteroposteriorly.

Family Rhinolophidae

Rhinolophus delphinensis GAILLARD 1899

Additional specimens have been obtained, but do not call for further comment.

Rhinolophus grivensis (DEPERET 1892)

Taf. 2, Fig. 6, 6a

This species is much rarer than *R. delphinensis* in the Kohfidisch collections, and was not recognized in the first report. At present, it is known by an upper jaw fragment, and about a half dozen lower jaws of which the best is a lower jaw with alveolus for the first incisor and the remaining teeth present (see Taf. 2, Fig. 6, 6a).

Our specimens are relatively robust, ranging in size between measurements given by MEIN (1964, p. 248) for *Rhinolophus grivensis lissiensis* and *R. euryale*. They are distinctly larger and more robust than specimens of *R. grivensis* from Podlesice. Size of the talonid relative to trigonid in M₃ is not altogether consistent, but seems to be larger than in *R. g. lissiensis*, more as in *R. g. grivensis*. The position of P₃ in the tooth row is also variable. In one jaw it is in line

with the other teeth, and in one it is considerably displaced externally as in *R. delphinensis* and *R. g. lissiensis* (MEIN, fig. 15c).

In spite of some differences from other populations of *Rhinolophus grivensis*, there seems no reason to think the Kohfidisch specimens are not of this species.

Measurements (in millimeters)

Rhinolophus grivensis

P ₄ —M ₃ , L:	4.25
M ₁ —M ₃ , L:	3.75
P ₄ , L:	0.7
W:	0.8
M ₁ , L:	1.4
W:	1.6
M ₂ , L:	1.3
W:	1.5
M ₃ , L:	0.9
W:	1.5
Alveolar length of lower tooth row:	7.5
P ₄ —M ₃ , L:	5.2
M ₁ —M ₃ , L:	4.3—4.5
P ₄ , L:	1.0
W:	0.8
M ₁ , L:	1.5—1.7
W:	0.9—1.0
M ₂ , L:	1.4—1.5
W:	0.9—1.0
M ₃ , L:	1.3—1.5
W:	0.8—1.0

Family Vespertilionidae

Myotis nr. *M. boyeri* MEIN 1964

Taf. 2, Fig. 7, 7a

A species of *Myotis* is represented by a right lower jaw with M₁—M₂ and alveoli for other teeth, with a dental formula of $\bar{3}, \bar{1}, \bar{3}, \bar{3}$. The alveoli of P₁ and P₃ are in line, and of subequal size. In M₁ and M₂, the hypoconid joins the entoconid directly. A distinct hypoconulid is present in both teeth as an extension of the posterior cingulum, and it lies at a distinctly lower level than the heel cusps otherwise. The mental foramen is under the posterior part of the canine, and hence has a position slightly anterior to that in *Myotis boyeri*. It differs from *M. boyeri* also in having M₁ slightly larger than M₂, rather than more or less equal, and probably in slightly smaller size. The Kohfidisch

specimen is larger than *M. murinoides*, and still larger than *M. elegans*, two species from the Sansan (BAUDELLOT, 1972).

Measurements (in millimeters)

\bar{C} — $M\bar{3}$, L (approximate):	6.5
$M\bar{1}$ — $M\bar{2}$, L:	2.8
$M\bar{1}$, L:	1.5
W:	0.9
$M\bar{2}$, L:	1.3
W:	0.9

A second fragment of jaw consists of $P\bar{3}$ — $P\bar{4}$, destroyed $M\bar{1}$, and alveoli for $P\bar{1}$ and \bar{C} . $P\bar{3}$ is two-rooted. The two-rooted $P\bar{3}$ suggests something like *Miniopterus*, and size seems to be only slightly larger than in *M. fossilis* ZAPFE (1950). Size is also probably about as in *Myotis* nr. *M. boyeri*. BAUDELLOT (1972, p. 29) shows that in *M. murinoides*, the $P\bar{3}$ can be two-rooted, and further suggests that *M. fossilis* ZAPFE may be a *Myotis* with a two-rooted $P\bar{3}$. This Kohfidisch specimen then could pertain to *M.* nr. *M. boyeri*. The other possibility may be that it belongs to the species listed as Chiropterid, genus indet., in the original Kohfidisch work. RABEDER, however, has identified this species as *Plecotus* (*Paraplecotus*), which see.

cf. *Myotis* sp. (small)

Taf. 2, Fig. 8

A left ramus with $M\bar{2}$ — $M\bar{3}$ seems to be the smallest bat in the Kohfidisch fauna. Tentatively, this specimen may be assigned to *Myotis*, and compared with such a small bat as *Myotis murinoides* of the Sansan, in which it would be at the lower limit in size.

Measurements (in millimeters)

$M\bar{2}$ — $M\bar{3}$, L:	2.0
$M\bar{2}$, L:	1.0
W:	0.75
$M\bar{3}$, L:	1.0
W:	0.7

Plecotus (*Paraplecotus*) sp.

Chiropterid, genus indet. BACHMAYER & WILSON 1970.

This species, known by a left lower jaw fragment with $P\bar{4}$ — $M\bar{1}$, and aveolus for $P\bar{3}$, has been determined by G. RABEDER (1973b) as the earliest known Austrian representative of the genus *Plecotus* (*Paraplecotus*). The complete description by RABEDER makes any comment here unnecessary. We

assume that RABEDER is correct in regarding $P\bar{3}$ as single-rooted rather than two-rooted, as it is in the fragment described on page 15—17.

Order Lagomorpha

Family Ochotonidae

Prolagus cf. *P. oeningensis* (KÖNIG 1825)

Additional specimens have been added to the Kohfidisch collection since the first report, but the new material adds no new information. It may be important to emphasize that no leporid remains have yet been found.

Order Rodentia

Family Sciuridae

Spermophilinus cf. *S. bredai* (v. MEYER 1848)

A few more individual teeth of this squirrel have been recovered, including several upper cheek-teeth, namely: $LP\bar{4}$ (2); Rt. $M\bar{1}$ or $\bar{2}$ (3); Rt. maxillary with $M\bar{1}$; $LM\bar{3}$; Rt. $M\bar{1}$ or $\bar{2}$; and Rt. $M\bar{3}$. These teeth do not add anything toward solution of the problem of separation of *S. bredai* from *S. turolensis* (see BACHMAYER & WILSON, 1970, p. 562; and DAXNER-HÖCK, 1975, p. 68). The unworn $M\bar{3}$ shows more enamel rugosity, especially on the edges of the basin of the broad heel, than we have generally observed in *Spermophilinus*, but otherwise conforms to third upper molars of the genus.

Pliopetaurista cf. *P. bressana* MEIN 1970

Taf. 3, Fig. 9

Pliosciuropterus, prob. nov. sp., BACHMAYER & WILSON 1970.

Additional material obtained since 1970 includes three maxillae, and $M\bar{1}$ or $M\bar{2}$, a lower $M\bar{1}$ or $M\bar{2}$, and two third lower molars as isolated teeth. Generic transfer is in agreement with the consensus that *Pliopetaurista* KRETZOI (1962) equals *Pliosciuropterus* SULIMSKI (1964).

The upper dentitions agree well with *Pliopetaurista dehneli* (SULIMSKI, 1964) except in smaller size (approximately 25 percent), and a rather variable and weak development of mesostyles. In *P. dehneli*, the mesostyle is large on $P\bar{4}$, and absent on $M\bar{1}$ — $M\bar{3}$. Weak mesostyles may be present in the Kohfidisch specimens, but fairly distinct only on $P\bar{4}$. The presence or absence of a mesostyle on the molars is probably an individual characteristic. The protoconule on $M\bar{1}$ and $M\bar{2}$ can not be described as well-developed as is said to be the case in *P. dehneli*.

Although the lower dentition is not, of course, in direct association, occlusal relations are excellent. The most outstanding feature of the lower dentition is the absence of a hypolophid in $M\bar{3}$: the entoconid is large, but is only a swelling on the posterolophid crest. $M\bar{3}$ has four roots with the additional

root lingual in position, and midway between anterior and posterior margins. No other features of the dentition seem outstanding.

The two most closely related species to ours are: (1) *Pliopetaurista dehneli*, distinguished by larger size and a hypolophulid on M $\bar{3}$; and (2) *Pliopetaurista bressana*, and especially individuals assigned to this species by DAXNER-HÖCK (1975): the Kohfidisch specimens agree in size with the Eichkogel material, as well as in other features. Ours seem to differ from MEIN's type locality material (1970) in having the metaloph united with the protocone rather than not.

Comparative Measurements of *Pliopetaurista* (in millimeters)

	Kohfidisch	<i>P. bressana</i>	<i>P. dehneli</i> **	<i>P. bressana</i> ***
	(Eichkogel *)			(Soblay)
P $\bar{3}$ —M $\bar{3}$, L (alveolar):	7.9	—	11.1 (alveol.)	—
P $\bar{4}$ —M $\bar{3}$, L:	7.1—7.9	—	10.9 (alveol.)	—
M $\bar{1}$ —M $\bar{3}$, L:	5.4—6.0	—	8.0 (alveol.)	—
P $\bar{3}$, L:	0.8—1.0	—	1.3—1.5	—
W:	0.7	—	1.3—1.5	—
P $\bar{4}$, L:	1.7—2.0	2.06	2.6	—
W:	2.0	2.00	2.6	—
M $\bar{1}$, L:	1.7—2.0	1.69	2.5	—
W:	2.0—2.2	2.13	2.6	—
M $\bar{2}$, L:	1.8—2.1	1.88—1.93	2.6	—
W:	2.1—2.2	2.13—1.19 ?	2.6	—
M $\bar{1}$ or $\bar{2}$, L:	—	—	—	1.72—1.88
W:	—	—	—	1.98—2.16
M $\bar{3}$, L:	2.0	2.06	2.6	—
W:	2.0	—	2.4	—
M $\bar{1}$, L:	—	—	2.5	1.66—1.9
W:	—	—	2.4	1.81—1.83
M $\bar{2}$, L:	—	1.81	2.6	1.83
W:	—	1.94	2.7	1.83
M $\bar{1}$ or $\bar{2}$, L:	2.0	—	—	—
W:	2.2	—	—	—
M $\bar{3}$, L:	2.5	—	3.8	—
W:	1.8—2.0	—	2.5	—

* after DAXNER-HÖCK, 1975

** after SULIMSKI, 1964, averages

*** after MEIN, 1970

Family Castoridae

cf. *Chalicomys jaegeri* KAUP 1832

No new material has become available since the original report. FRANZEN & STORCH (1975) regard *Palaeomys castoroides* as the correct name for *Chalicomys jaegeri*.

Family Eomyidae

Keramidomys sp.

Taf. 3, Fig. 10 u. Taf. 5, Fig. 20

Several years ago, the Institute for Paleontology and Historical Geology in Munich washed through a fine-mesh screen a small quantity of matrix from Kohfidisch. One result was the finding of an eomyid tooth representing the genus *Keramidomys*. This tooth, a right M₁ or M₂, was generously donated to the Natural History Museum of Vienna. The tooth measures 0.7 by 0.7 millimeters. Experience has shown, increasingly, that washing of matrix through extremely fine-mesh screens is necessary if the smallest mammal teeth present in the rock are to be recovered. The extension in time of eomyids, for example, has now been moved upward into the early Pleistocene. Probably eomyid abundance at Kohfidisch was considerably greater than this single tooth would indicate.

The tooth is about the size of comparable upper molars of *Keramidomys carpathicus* from Neudorf.

Family Gliridae

Muscardinus pliocaenicus austriacus BACHMAYER & WILSON 1970

Taf. 3, Fig. 11

Two additional specimens of *Muscardinus p. austriacus* are now to be recorded: (1) a left lower jaw with P₄—M₃ (somewhat smaller than the type specimen, and (2) a right lower jaw with M₁.

The fourth lower premolar in the new specimen differs somewhat from that in the type in having an anterior cingular ledge not evident in the type, but the posterior cingulum, if present, cannot be seen in this specimen. The remaining three ridges are more prominent and continuous. Even with these differences, the Kohfidisch specimens continue to differ from *M. p. pliocaenicus* in having three strong ridges.

The three-rooted first lower molars do not differ from that in the type specimen of *M. p. austriacus*.

The four-rooted second lower molar has six ridges with the same connections as in M₁, but a tendency exists to bend forward, most noticeable in the second, third, and fourth ridges. An extremely short ridge, almost an internal stylid, lies between the third and fourth ridges.

The third lower molar, seemingly three-rooted, exhibits ridges with a more pronounced tendency to bend forward than in M₂. In addition, the second ridge is very incomplete in the middle of the tooth, and the fourth and fifth ridges are slightly interrupted. In KOWALSKI's drawing (1963, p. 8, fig. 4c), this interruption is not evident.

Interruptions in the ridges of M₃, and the extra "ridge" of M₂ are perhaps to be viewed as "primitive" features.

Measurements (in millimeters)
Muscardinus pliocaenicus austriacus

	Type specimen	Others
P $\bar{4}$ —M $\bar{3}$, L (occlusal):	—	4.8
P $\bar{4}$, L:	0.6	0.6
W:	0.7	0.6
M $\bar{1}$, L:	1.5	1.4—1.5
W:	1.3	1.1—1.2
M $\bar{2}$, L:	—	1.1
W:	—	1.25
M $\bar{3}$, L:	—	1.0
W:	—	1.1

Myomimus cf. *M. dehmi* (DE BRUIJN 1966)

Peridyromys compositus BACHMAYER & WILSON 1970 (in part)

A number of glirid specimens have been obtained since the first account of the Kohfidisch fauna, and the naming and describing by us of *Peridyromys compositus*. What at that time was thought to be possible, but not probable, namely that the specimens assigned to *P. compositus* represented two different species, turns out to be correct. One species is close to *Peridyromys dehmi* DE BRUIJN 1966, the other to *Peridyromys multicristatus* DE BRUIJN 1966. Neither Kohfidisch species may be conspecific with the older Vallesian species, and two genera may in fact be represented, but material is insufficient in numbers to make this clear, and nothing seems gained by adding to the already complicated nomenclature and taxonomy of the Gliridae. The type specimen of *P. compositus*, and possibly all but the M $\bar{2}$ (?) of the original description, relates to *M.* cf. *M. dehmi*. New material consists of five fragments of upper jaw, and nine fragments of lower jaw.

Description: Small glirid with concave occlusal surfaces and three-rooted cheek-teeth. Neither endoloph nor endolophid continuous. No obvious decoration of lingual borders of upper cheek-teeth. Major enamel crests stronger than minor. P $\bar{4}$ with length of anteroloph variable; centroloph may be present or absent; if present may be either isolated or appear as anterior centroloph; well-developed metaloph and posteroloph. M $\bar{1}$ with variable centrolophs; anterior one may be shorter or longer; two anterior accessory ridges (one short, one long) present in one specimen; one or no posterior ridges. M $\bar{2}$ with anterior centroloph longer than posterior; one anterior accessory; no posterior accessory (or only minute ridges). P $\bar{4}$ circular in outline, anterolophid cuspsate. M $\bar{1}$ without anterior accessory crests except as internally detached parts of metalophid in some; one strong posterior accessory between mesolophid and posterolophid. M $\bar{2}$ usually without anterior accessories (one specimen with minute crest); usually with strong posterior accessory as in M $\bar{1}$.

M $\bar{3}$ without accessory crests (a minute trace of posterior accessory in one specimen).

Myomimus cf. *M. multicristatus* (DE BRUIJN 1966)

Taf. 3, Fig. 12, Fig. 13 u. Taf. 5, Fig. 19

?*Peridyromys compositus* BACHMAYER & WILSON 1970 (in part).

This glirid, larger than *M. cf. M. dehmi*, is known by five to six fragments of upper jaw, and six fragments of lower jaw.

The species is not only larger than cf. *M. dehmi*, but has a more complicated occlusal pattern with less of a discrepancy between major and minor crests, and perhaps flatter crowns as well.

Description: Lingual margins of upper molars slightly decorated; endolophs discontinuous, with notch separating anteroloph from remainder of inner border (although nearly continuous in one); crests somewhat *Gliridinus*-like in tendency to be oblique to tooth axes. Molars and P $\bar{4}$ three-rooted. P $\bar{4}$ with five main crests and strong posterior centroloph in all; short anterior centroloph in two of four specimens; tooth transversely oval in outline. M $\bar{1}$ with anterior centroloph which tends to break up internally into interrupted minute ridges; where integrated, it is longer than posterior centroloph; one to two anterior accessory ridges (if two usually because of branching internally); no posterior accessory ridges. M $\bar{2}$ with anterior centroloph longer, but not much longer, than posterior; anterior accessory ridges as in M $\bar{1}$; one small posterior accessory ridge. Crests of lower molars tending to be interrupted lingually; centrolophid when integrated by wear extending more than halfway across crown surface. M $\bar{1}$ with one to three anterior accessory crests; one or two posterior accessories (if only one, then two additional minute crests). M $\bar{2}$ with one anterior accessory crest (or one with two additional minute ridges); one or two posterior accessories (those with one may show minor ridges). M $\bar{3}$ with one anterior accessory and one posterior crest (with minor crest as well). Comparison of the two Kohfidisch species in tabular form follows.

	cf. <i>Myomimus dehmi</i>	cf. <i>Myomimus multicristatus</i>
P $\bar{4}$: anteroloph	variable, perhaps tending to be short	stronger
centroloph	present or absent; isolated; or as anterior centroloph	strong posterior centroloph in all; sometimes short anterior centroloph
metaloph	well-developed	well-developed
posteroloph	well-developed	well-developed

M1:	centroloph	variable; anterior may be shorter or longer	anterior centroloph tends to break up internally; where integrated, longer than posterior
	posterior accessories	1—0	0
	anterior accessories	2 anterior accessories in one specimen	1—2 anterior extra ridges
M2:	centroloph	anterior longer than posterior	anterior slightly longer than posterior
	posterior accessories	0	1 minor (in all?)
	anterior accessories	1	as in M1
M1̄:	anterior accessories	none (except detached part of metalophid in some)	1—3 (with three turned anteropost.)
	posterior accessories	1 and strong	1—2 (minor for more than one)
M2̄:	anterior accessories	usually 0, tiny in one	1 or 1 with two minute ridges
	posterior accessories	good posterior	1—2 (those with one frequently with minor crests)
M3̄:	anterior accessories	0	1
	posterior accessories	0 in one; possibly minute in other	1 (plus minor crest)

Discussion: The assignment of both cf. *M. dehmi* and cf. *M. multicristatus* to the genus *Myomimus* follows DE BRUIJN & al., who synonymize *Peridyromys* with the still extant genus (1970). DE BRUIJN himself is unsure of this assignment in respect to *M. multicristatus* (see 1974, p. 138), and we can find no direct reference to the fate of the related *dehmi*. There seems to be general agreement that a line: *Myomimus*—*Microdyromys*—*Glirulus* exists, and the small glirid may belong here as a relict of early *Myomimus* (along with the considerably evolved Recent *M. personatus*). BAUDELLOT (1972, p. 335) presents a chart where "*Peridyromys*" *multicristatus* is an end member of a line leading up through *Miodyromys*. On the other hand, DE BRUIJN does not think the distinction between *Miodyromys* and *Pseudodyromys* is clear. He writes (1974, p. 132), however, of a *Myomimus*-*Microdyromys* group (smaller), and a *Pseudodyromys*-*Miodyromys* group (larger), which might not be too far removed in thought from that expressed in the BAUDELLOT chart which has a base for her two lines in "*Peridyromys*". The larger Kohfidisch glirid could possibly be assigned to this second line also. In the Eichkogel fauna, DAXNER-

HÖCK (1970) lists three glirids, exclusive of *Muscardinus*: *Glirulus* sp., *Peridyromys* sp., and *Glirudinus* sp. *Glirudinus* sp. was listed as *Microdyromys* ? sp. in an earlier (1970) publication. The lack of *Glirulus* at Kohfidisch might find an explanation in the recovery methods used. This is a very small dormouse and, as in the instance of eomyids, needs underwater washing through fine screens. *Peridyromys* sp. is probably the size of our cf. *Myomimus dehmi*, and *Glirudinus* sp. of our cf. *M. multicristatus*. Some characters of *Glirudinus* which are present in our specimens, and the transfer of the Eichkogel form from *Microdyromys* to *Glirudinus*, makes us wonder if these glirids are not more closely related than is indicated by the generic assignment.

Measurements (in millimeters)

	cf. <i>Myomimus dehmi</i>	cf. <i>Myomimus multicristatus</i>
P4—M3, L (alveolar):	—	4.6
P4, L:	0.7—0.8	0.8—0.9
W:	0.9—1.0	1.0—1.1
M1, L:	1.0	1.3
W:	1.2—1.25	1.4—1.5
M2, L:	1.0	1.3—1.4
W:	1.1—1.25	1.5
P4—M3, L (alveolar):	3.5—4.0	4.5—4.7
P4, L:	0.6?—0.8	—
W:	0.6?—0.75	—
M1, L:	0.9—1.1	1.2—1.5
W:	1.0	1.1—1.3
M2, L:	1.0—1.25	1.2—1.4
W:	1.0—1.2	1.25—1.3
M3, L:	1.0—1.1	1.1
W:	1.0	1.1

Gliridae, indeterminant

Taf. 3, Fig. 14

A right lower jaw fragment with M1, and a somewhat more complete left lower jaw with M2, show unusual patterns. In M1, the anterolophid is low and irregular in height, but continuous along the anterior tooth border, and also continuous with the protoconid. From the protoconid a well-defined crest extends inward before curving posteriorly to past the mid-point of the tooth. The hypoconid is separated distinctly from the protoconid by a well-defined notch. From the hypoconid, the posterolophid sweeps around the posterior edge of the tooth as a well-defined wall which turns anteriorly, and runs to the anterointernal corner of the tooth. A short crest extends from the anterior part of the wall into the basin between anterolophid and metalophid (?).

A short, cusped structure lies in the basin immediately internal to the hypoconid.

In $M\bar{2}$, a raised rim extends around the basin of the tooth, being interrupted only by the protoconid-hypoconid notch. This rim is highest at the metaconid. The only other definite structure is the metalophid, a slightly curving crest (concave anteriorly) dying away immediately external to the metaconid (without joining metaconid). A small cuspule lies in the large posterior basin immediately external to the position of the entoconid. $M\bar{1}$ is two-rooted; $M\bar{2}$ is three-rooted; and $M\bar{3}$ (alveolus) suggests a probable two-rooted condition. Such jaw structures as can be made out seem comparable to those of cf. *Myomimus dehmi*.

Measurements (in millimeters)

$M\bar{1}$, L:	1.1	$M\bar{2}$, L:	1.1
W:	1.0	W:	1.2

The obvious answer to these tooth patterns is heavy wear. A two-rooted $M\bar{1}$ is, however, absent or a rarity in other specimens. Moreover, worn specimens of other glirids in the collection seem to be producing patterns of a quite different kind. It is, in fact, difficult to see how normal wear in any rodent could produce the pattern evident in $M\bar{1}$. It must have done so, however, because these patterns are remote from those of any glirid known to date.

Family Zapodidae

Protozapus intermedius BACHMAYER & WILSON 1970

Taf. 4, Fig. 15

This zapodid is now represented by several additional jaw fragments with teeth. These add little to the original interpretation of the genus as intermediate between *Plesiosminthus* and *Sminthozapus*, and related to a group consisting of the latter together with *Pliozapus* and *Eozapus*. A new upper jaw with P_4 — $M\bar{2}$ is smaller than the type specimen of *P. intermedius*, but otherwise similar. Five additional jaw fragments have $M\bar{1}$ in place. In one an anteroconid is absent; in a second, it is represented only by a cingulum; in the third and fourth, it is small but quite distinct; and in the fifth, it is relatively small but double-cusped. $M\bar{2}$ in one additional specimen does not show the oblique valley separating anteroconid-metaconid from protoconid-mesoconid mentioned in the original description, but instead there is a connection. A second specimen, however, has an oblique valley agreeing with the original description. This latter specimen has $M\bar{3}$ in place. Its principal feature is that the mesolophid is short, failing to join a minute metastylid at the inner border. In proportions relative to $M\bar{2}$, it may be more like $M\bar{3}$ in the jaw figured by SULIMSKI (1964) as figure 6 of plate XVI than like the type specimen of *Sminthozapus janossyi*.

Another Kohfidisch jaw, with complete molar dentition, has an $M\bar{3}$ in which the pattern is much like that of figure 6, said by SULIMSKI to be unique among the Polish specimens. As in SULIMSKI's specimen, the mesolophid — if it be such — is free of the ectolophid, and has an anteroposterior orientation.

VAN DE WEERD (1976, p. 137) thinks *Protozapus* should be placed in synonymy with the Recent *Eozapus*. At the same time, however, he retains the genus, *Sminthozapus*. It seems to us, on the other hand, that the differences between the two extinct genera are too small to make this a practical solution. In addition, *Protozapus* appears to differ from the Recent genus in shortness of M_2 , and in features which may lack consistency, but seem absent in such specimens of *Eozapus* as we have examined, i. e., (1) weakness of the mesolophid in $M\bar{3}$, and (2) the oblique valley which frequently separates anteroconid-metaconid from protoconid-mesoconid. The differences in tooth proportion seem to be of real importance. That *Protozapus*, *Pliozapus*, *Sminthozapus*, and *Eozapus* are all closely related seems certain, and indicates eastern affinities for *P. intermedius*, whatever the taxonomy employed.

Family Cricetidae

Kowalskia fahlbuschi BACHMAYER & WILSON 1970

This species of *Kowalskia*, or something very like it, has been identified at various other localities such as Eichkogel (*K. cf. fahlbuschi*, which DE BRUIJN, MEIN, MONTENAT & VAN DE WEERD think is identical with *K. fahlbuschi* (1975a, p. 20); Crevillente 1, 2 and 3, Basin of Teruel at Vivero de la Rambla, and Los Aguanaces in Spain, and in deposits at Mollon and Lobrieu in France (ibid., p. 20).

Most of the additional specimens from Kohfidisch repeat what is already known. In any case, we feel it best to leave detailed study of the many specimens to later when adequate time is available for analysis of the species. One point of the original description, however, should be discussed. The M_1 was described as having a paracone spur. DAXNER-HÖCK has raised a question about the prevalence, or even existence, of this structure (1972b, p. 143). She states that the holotype is lacking in this respect. The paracone spur may be little more than an elevated cingulum which can be seen in lateral view rising above the general cingulum level. It may, as stated (BACHMAYER & WILSON, 1970, p. 570), be absent in some specimens, and "pronounced" in others. It is, contrary to DAXNER-HÖCK, present in the type specimen, which suggests that use of the term "pronounced" was ill-advised.

As more material accumulates, the size range in the sample grows, and suggests: (1) obliteration of some size distinctions, as for example between those at Eichkogel and Kohfidisch, or (2) that the material may be split into two biologically significant size groups.

Subfamily Gerbillinae ?

Epimeriones cf. *E. austriacus* DAXNER-HÖCK 1972

Taf. 4, Fig. 16

Rodentia, genus and species indet., BACHMAYER & WILSON 1970.

At the time of our original work, Recent comparative material was limited in scope, and it did not seem possible to make a reliable identification. Fossil gerbils have now been identified from horizons in Spain, Poland, Hungary, Germany and North Africa, as well as from the nearby Eichkogel fauna of the Vienna Basin. The Eichkogel material, as described by DAXNER-HÖCK (1972a), seems identical to the Kohfidisch species, so far as comparisons are possible. The single, original tooth agrees well with that figured by DAXNER-HÖCK (plate 1, fig. 5) in showing an extra fold in the enamel pattern, and the text mentions (p. 151) isolated islands of enamel within the dentine areas. It was these structures that were missing from the specimens of *Meriones* examined by us. In addition to the previously figured specimen from Kohfidisch, we now have a right M₁. As in the earlier record, this specimen also has accessory pit structures in each of the three lobes of the tooth. KOWALSKI has recently (1974) reported *Epimeriones* from Podlesice in Poland, as *E. progressus*, n. sp. He regarded this new species as more progressive than *E. austriacus* on the basis of higher crowns at the same stage of wear. Suggestive in this regard, perhaps, is the fact that both of our specimens show relict structures, a feature seemingly lacking in the known Polish material. Measurements for M₁ are: L = 2.1 (at base of crown); W = 1.2 (greatest width of posterior prism).

Although the relation of our specimens to *Epimeriones* is not in question, we have been informed by Dr. Hans DE BRUIJN that he and his colleagues at Utrecht do not think that *Epimeriones* is a gerbil. If this be true, then *Epimeriones* would be simply another case of parallel development of hypsodont dentitions in rodents with consequent pattern simplification.

Subfamily Arvicolinae

Promimomys (*Prosomys*) sp.

Taf. 4, Fig. 17, 17a, 17b

An incomplete left lower jaw with M₂ and alveoli for M₁ and part of M₃, is at present the only representative in the Kohfidisch fauna of a microtine. The specimen, from an undesignated part of the fissure system seems best to be assigned to the subgenus (or genus) *Prosomys* SHOTWELL, 1956. The mental foramen is high on the ramus in front of M₁. The anterior border of the ascending ramus is opposite the anterior edge of M₂. The only molar present, M₂, is prismatic, moderately hypsodont, but rooted and uncemented. The enamel is relatively thin, but undifferentiated. Two internal and two external reentrant folds in the enamel, of which the internal are the deeper, divide the occlusal pattern into a posterior loop and four triangles. The anterior two

triangles are broadly confluent, the posterior two somewhat alternating "triangles". The dentine areas are almost closed off by enamel except in the anterior "loop" of the first two triangles. Size (L: 2.2; W: 1.6) is larger than in *Prosomys mimus*, more as in *Propliophenacomys parkeri*.

Relationships: So far as tooth pattern and morphology are concerned, the Kohfidisch specimen seems closest to *Baranomys* (SULISMKI, 1964), *Promimomys* (as this genus is defined by REPENNING, 1968), and *Propliophenacomys* (MARTIN, 1975). It is clearly not of *Microscoptes* type. The form of the mandible and sharpness of the salients and reentrants suggest reference to something other than *Baranomys*. Both Miklos KRETZOI and Denis JÁNOSSY have seen the Kohfidisch specimen. KRETZOI thought it *Promimomys* (*Prosomys*), and JÁNOSSY suggested something close to *Promimomys* (*Polonomys*). The recently described *Propliophenacomys* is as close on available material. In the absence of an Eurasiatic record of *Propliophenacomys*, we assign our specimen to *Promimomys*. It should be mentioned, however, that the anterior part of M₂ seems more like an open loop (compare *Baranomys*) than the part does in either *Promimomys* or *Propliophenacomys*, and in dentition *Baranomys* and *Promimomys* are exceedingly close to each other (REPENNING, 1968, p. 49). FAHLBUSCH & MAYR (1975) and MEIN (1975) have both discussed recently the derivation of microtines from cricetid sources. It seems obvious that immediately preceding Kohfidisch time, some cricetid types (*Microtocricetus molassicus*, *Rotundomys bressanus*) were developing with dental attributes of primitive microtines. If the Kohfidisch specimen is the same age as the fauna as a whole, rapid change would have to take place to derive it from these cricetid types.

Stratigraphic significance: The spread of microtines, or even some microtine-like cricetines such as *Baranomys* and *Microtodon*, over Europe seems to have taken place later than the age seemingly represented by the Kohfidisch fauna. The specimen, unfortunately, has as locality data only the fact of its recovery from the Kohfidisch fissures. Thus the suggestion could be made that this is a later intrusion into the Kohfidisch fauna (as might be said also of the gerbil). Yet as has been pointed out by REPENNING (1967b, p. 291), *Promimomys* occurs in the Hemphillian of North America, and its presence in eastern Europe in association with more advanced genera of microtines suggests an earlier Pontian history. KRETZOI (1965) has described what he believes to be a genuine microtine, *Pannonicola brevidens*, out of the Hungarian Pannonian. Moreover, MARTIN's description (1975) of late Ogallala microtines from Nebraska suggests that temporally the Kohfidisch microtine could be genuinely associated with the typical fauna from there. In any case, it perhaps can be concluded that the presence of gerbils (?) and microtines does not necessarily elevate the fauna in time. On the other hand, the conservative woodland element may have led to an age estimate older than the Kohfidisch fauna really is.

Some points concerning the physical presence of the Kohfidisch microtine perhaps should be made. First, local geology and the fauna as a whole does not seem to suggest more than one age for the fauna, whatever that may be. Second, no fauna in the Museum collections seem to fit the interval marking the first appearance of microtines in central Europe generally, so that screen contamination seems out of the question. Finally, one of us (WILSON) actually found the specimen in a Kohfidisch concentrate so that it can hardly be one that accidentally was introduced into the Kohfidisch collection.

?Family Cricetidae

Prospalax petteri BACHMAYER & WILSON 1970

Additional material of this species does not add any information except that one M \bar{I} confirms the prediction in our original report (p. 573) that in early stages of wear of M \bar{I} , the dentine isthmus formed by opposing posteroexternal and internal folds meeting at the midpoint was probably cut through.

VIRET & SCHAUB (1946) and BACHMAYER & WILSON (1970) have stated that *Miospalax monacensis* STROMER and *Anomalomys gaudreyi* STROMER, 1928 from Grosslappen bei München are synonymous. DE BRUIJN, DAWSON & MEIN (1970), in a discussion of *Prospalax*, reopened the question of synonymy of the Grosslappen specimens. However, DE BRUIJN & VAN DER MEULEN (1975b) accepted *Miospalax* as a synonym of *Anomalomys* (p. 329). One of us (WILSON) has examined unpublished material from Marktl, a locality not much removed in time from Grosslappen. This new material includes an upper jaw nearly identical with *Miospalax* from Grosslappen, and lower jaws and teeth clearly referable to *Anomalomys*. This duplication at a second locality seems to us to indicate clearly that *Miospalax* is a junior synonym of *Anomalomys*. Otherwise, a curious distribution occurs in which upper dentitions belong to one genus and lowers to another.

On the general subject of the relationships existing among *Spalax*, *Prospalax*, and *Anomalomys*, KRETZOI (1970—71) has given evidence which makes him come to the conclusion that *Prospalax* is related to *Anomalomys*, but that neither belongs with *Spalax*. Thus, according to KRETZOI, the Spalacidae include *Spalax*, *Nannospalax*, *Pliospalax*, and *Rhizospalax*. As Anomalomyidae, and derived from cricetodontids, are: *Prospalax*, *Pterospalax*, *Allospalax*, *Anomalomys*, and *Miospalax*. DE BRUIJN & VAN DER MEULEN (1975, p. 329—330) comment that *Pterospalax* and *Allospalax* are nomina nuda, and that *Rhizospalax* has been shown by various authors to be a theridomyid. Moreover, we are not convinced that *Spalax* is unrelated to *Prospalax*. Jaw distinctions could be those of a larger, more fossorial animal. Still another point of view is presented by FEJFAR (1972), in which *Prospalax* is regarded as not very closely related to *Anomalomys*.

Family Muridae

Progonomys woelferi BACHMAYER & WILSON 1970

There does not seem to be much that can be added to our original statement. The species, or something close to it, has now been identified in Crete and northern Tunisia. In fact, as regards to the Kastellios Hill occurrence (DE BRUIJN, SONDAAR & ZACHARIASSE, 1971), the species seem to be identical.

Perhaps of real stratigraphic significance is the fact that the Eichkogel fauna, relatively rich in murines, seems not to have the genus *Progonomys* represented, but only *Parapodemus lugdunensis* (DAXNER-HÖCK, 1970, p. 603).

The presence of both *Progonomys cathalai* and *P. woelferi* in the fauna from Crete seems to indicate separate species, and not geographic variants (one western, the other eastern). We had previously suggested such a possibility for *Parapodemus lugdunensis* and *P. schaubi* (= *P. gaudryi*), a position which also now seems untenable.

Parapodemus lugdunensis SCHAUB 1938*Parapodemus* cf. *P. lugdunensis*, BACHMAYER & WILSON 1970

As with *Progonomys woelferi*, there is little to add to the original statement, except to confirm the virtual certainty of species reference to *P. lugdunensis*. The separation of the two murines at Kohfidisch seems fully justifiable. Stephanomy, characteristic of *Parapodemus*, is best seen in M₁, but M₂, likewise, shows this condition in most cases. Four-rooted second upper molars, however, are rare in the new specimens. Several are clearly three-rooted, one has partly divided roots, and only one is clearly four-rooted, so that this feature does not seem of much importance taxonomically.

Family Hystricidae

Hystrix cf. *H. suevica* SCHLOSSER 1884

Seven additional teeth of this small "porcupine" are represented in the new material, thus doubling the known number, but without adding materially to our knowledge of the Kohfidisch hystricid. These new teeth are largely immature, and consequently with unworn crowns. The patterns are hence poorly developed, and difficult to interpret.

According to JÁNOSSY (1972b, p. 177) parallel development of small and large lines of European porcupines extends back to the "Unterplozän". Size, consequently, is of no stratigraphic significance, contrary to the suggestion previously made by us (BACHMAYER & WILSON, 1970, p. 541).

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Explanation of the plates

Tafel 1:

- Fig. 1 *Lanthanotherium* sp.
Rt. M $\bar{3}$?
Occlusal view, 10 \times .
- Fig. 2 cf. *Desmanella crusafonti* RÜMKE
Left lower jaw with P $\bar{4}$ —M $\bar{2}$.
Occlusal view, 6,5 \times .
- Fig. 2a cf. *Desmanella crusafonti* RÜMKE
Left lower jaw with P $\bar{4}$ —M $\bar{2}$.
Lateral view, 6,5 \times .
- Fig. 3 *Petényiella*? *repenningi* BACH-
MAYER & WILSON
upper jaw with penultimate ante-
molar.
Lateral view, 12 \times .
- Fig. 4 Neomyine? sp.
Rt. lower jaw with M $\bar{1}$ —M $\bar{3}$.
External view, 6 \times .
- Fig. 4a Neomyine? sp.
Rt. lower jaw with M $\bar{1}$ —M $\bar{3}$.
Internal view, 6 \times .
- Fig. 4b Neomyine? sp.
Rt. lower jaw with M $\bar{1}$ —M $\bar{3}$.
Occlusal view, 16,5 \times .

Tafel 2:

- Fig. 5 *Anourosorex kormosi* BACH-
MAYER & WILSON
Anterior part of skull with incisors.
Occlusal view, 6,5 \times .
- Fig. 5a *Anourosorex kormosi* BACH-
MAYER & WILSON
Anterior part of skull with incisors.
Lateral view, 6,5 \times .
- Fig. 6 *Rhinolophus grivensis* (DEPERET)
Rt. lower jaw with I $\bar{2}$ —M $\bar{3}$.
Occlusal view 7 \times .
- Fig. 6a *Rhinolophus grivensis* (DEPERET)
Rt. lower jaw I $\bar{2}$ —M $\bar{3}$.
Lateral view, 7 \times .

- Fig. 7 *Myotis* nr. *M. boyeri* MEIN
Rt. lower jaw with M $\bar{1}$ —M $\bar{2}$.
Occlusal view, 6,5 \times .

- Fig. 7a *Myotis* nr. *M. boyeri* MEIN
Rt. lower jaw with M $\bar{1}$ —M $\bar{2}$.
Lateral view, 6,5 \times .

- Fig. 8 cf. *Myotis* sp.
Left lower jaw with M $\bar{2}$ —M $\bar{3}$.
Occlusal view, 17,5 \times .

Tafel 3:

- Fig. 9 *Pliopetaurista* cf. *P. bressana* MEIN
Left upper jaw with P $\bar{4}$ —M $\bar{3}$.
Occlusal view, 6 \times .

- Fig. 10 *Keramidomys* sp.
Rt. M $\bar{1}$ or M $\bar{2}$.
Occlusal view, 15 \times .

- Fig. 11 *Muscardinus pliocaenicus austriacus* BACHMAYER & WILSON
Left lower jaw with P $\bar{4}$ —M $\bar{3}$.
Occlusal view, 15 \times .

- Fig. 12 *Myomimus* cf. *M. multicristatus* (DE BRUIJN)
Left upper jaw with P $\bar{4}$ —M $\bar{1}$.
Occlusal view, 6 \times .

- Fig. 13 *Myomimus* cf. *M. multicristatus* (DE BRUIJN)
Left lower jaw with M $\bar{1}$.
Occlusal view, 10 \times .

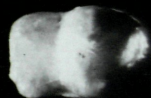
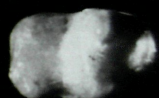
- Fig. 14 Gliridae, indeterminant
Rt. lower jaw with M $\bar{1}$.
Occlusal view, 16 \times .

Tafel 4:

- Fig. 15 *Protozapus intermedius* BACH-
MAYER & WILSON
Left lower jaw with M $\bar{1}$ —M $\bar{3}$.
Occlusal view, 15,5 \times .

- Fig. 16 *Epimeriones* cf. *E. austriacus* DAXNER-HÖCK
Rt. M $\bar{1}$.
Occlusal view, 16,5 \times .

- Fig. 17 *Promimomys (Prosomys)* sp.
Fragment of left lower jaw with
M₂.
Occlusal view, 7×.
- Fig. 17a *Promimomys (Prosomys)* sp.
Fragment of left lower jaw with
M₂.
Lateral view, 7×.
- Fig. 17b *Promimomys (Prosomys)* sp.
Fragment of left lower jaw with
M₂.
Lingual view, 7×.
- Tafel 5:
- Fig. 18 *Peténysia dubia* BACHMAYER &
WILSON
Left lower jaw.
External view, 20×.
- Fig. 19 *Myomimus* cf. *M. multicristatus*
(DE BRUIJN)
Left P₄—M₁.
Occlusal view, 55×
- Fig. 20 *Keramidomys* sp.
Right M₁ or M₂.
Occlusal view, 90×.



1



2



2a



3



4



4a



4b



5



5a



6



6a



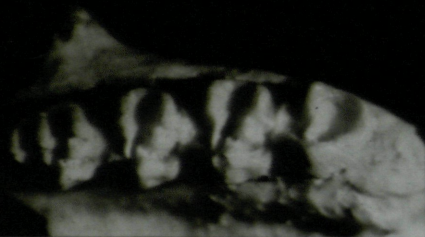
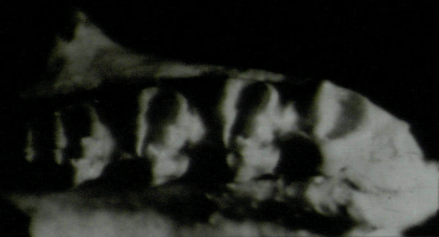
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7a



8



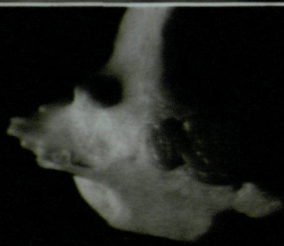
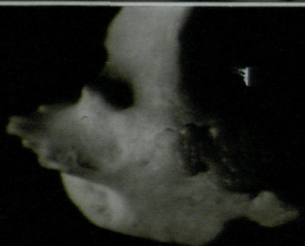
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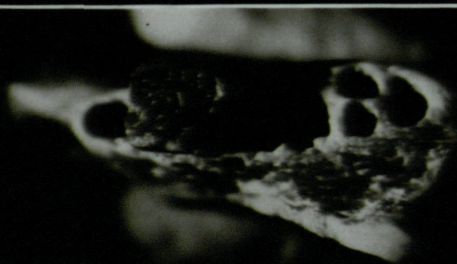
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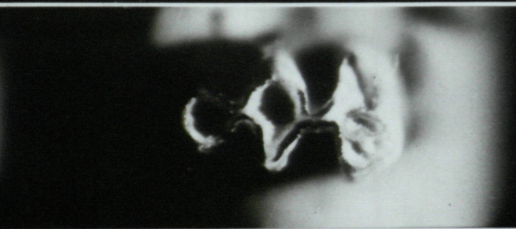
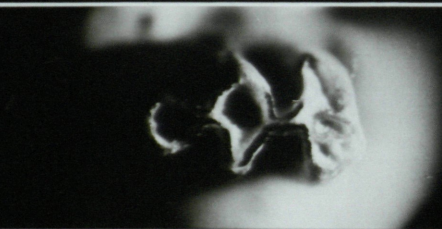
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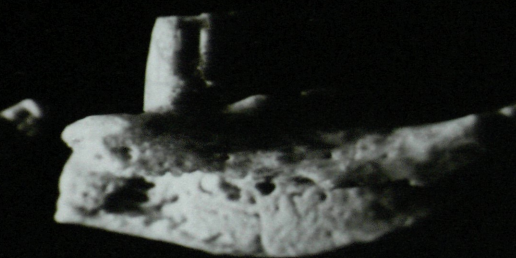
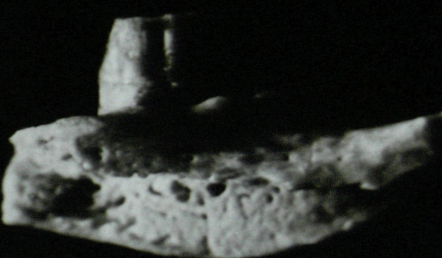
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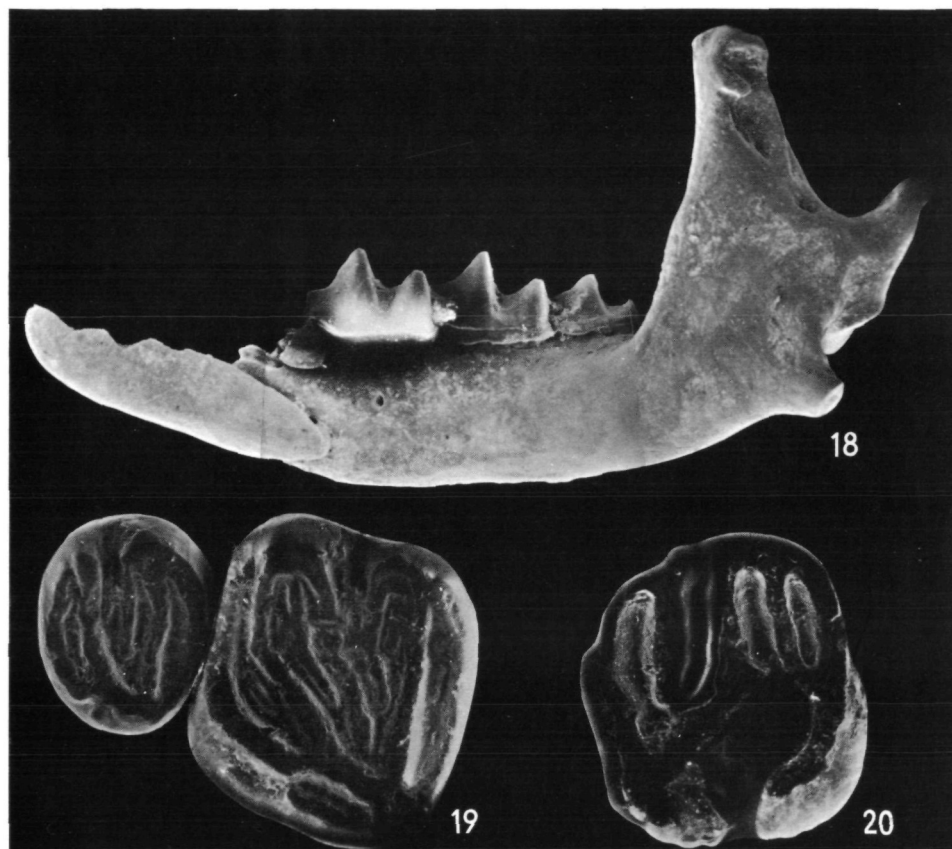
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17a



17b



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