

Taxonomic study of the dormice (Gliridae, Mammalia) fauna from the late Early Pleistocene Somssich Hill 2 locality (Villány Hills, South Hungary) and its palaeoecological implications

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Abstract – The Somssich Hill 2 is one of the richest Early Pleistocene vertebrate localities of Hungary. Four dormice species were distinguished from this site: *Glis sackdillingensis*, *G. minor*, *Muscardinus dacicus*, and *Dryomimus eliomyoides*. The age of the fauna is considered approximately 900 ka, and so, this is the last known occurrence of *D. eliomyoides*. So far, this species was known only from Late Pliocene to middle Early Pleistocene sediments. Based on morphometrical analysis of *Glis* material from 7 Pliocene and Pleistocene localities, the smaller form (*G. minor*) occurred until the Holsteinian (MIS 11). According to the morphotype analysis of the fossil and recent *Muscardinus* M₁ presented in this study, morphologically *M. dacicus* is very similar to a morphotype of *M. avellanarius*. Although dormice are relatively rare fossils, these animals could have important role in the reconstruction of the past environments. On the basis of dormice fauna, three periods were recognized here, which have been characterized by shrubby or forested vegetation during the period represented by the sediments of Somssich Hill 2 locality. With 13 figures and 4 tables.

Key words – Late Early Pleistocene, Gliridae, South Hungary, Villány

INTRODUCTION

The Somssich Hill 2 locality (N 45° 52' 26.64", E 18° 26' 33.19") is located in the Villány Hills (South Hungary), at the top of Somssich Hill, near to the border of Villány town (Fig. 1). The locality is an artificial cavity, which was excavated by Dénes Jánosy and György Topál from 1975 to 1985 (JÁNOSY 1986). Unfortunately, Dénes Jánosy – due to his permanent illness – was not able to finish the scientific study of the very rich vertebrate material. However, his preliminary faunal list contained more than 70 taxa (from fish to mammals) (JÁNOSY 1990). In 2013, after nearly 30 years, a new project was started; this aimed the taxonomic, taphonomical, palaeoecological and stratigraphical investigation of the locality. In the framework of this project (OTKA K104506), the present study deals

with the taxonomic analysis of glirids from the site, and the reconstruction of the ancient palaeoenvironment based on the dormice fauna and other indicator taxa.

GEOLOGICAL SETTINGS

Although the contact of the infilling and the surrounding limestone (Upper Jurassic Szársomlyó Limestone Formation) was never found until now, the locality is considered here as a karstic fissure, since it is the most plausible explanation so far. Somssich Hill 2 is a typical Lower to Middle Pleistocene locality where the

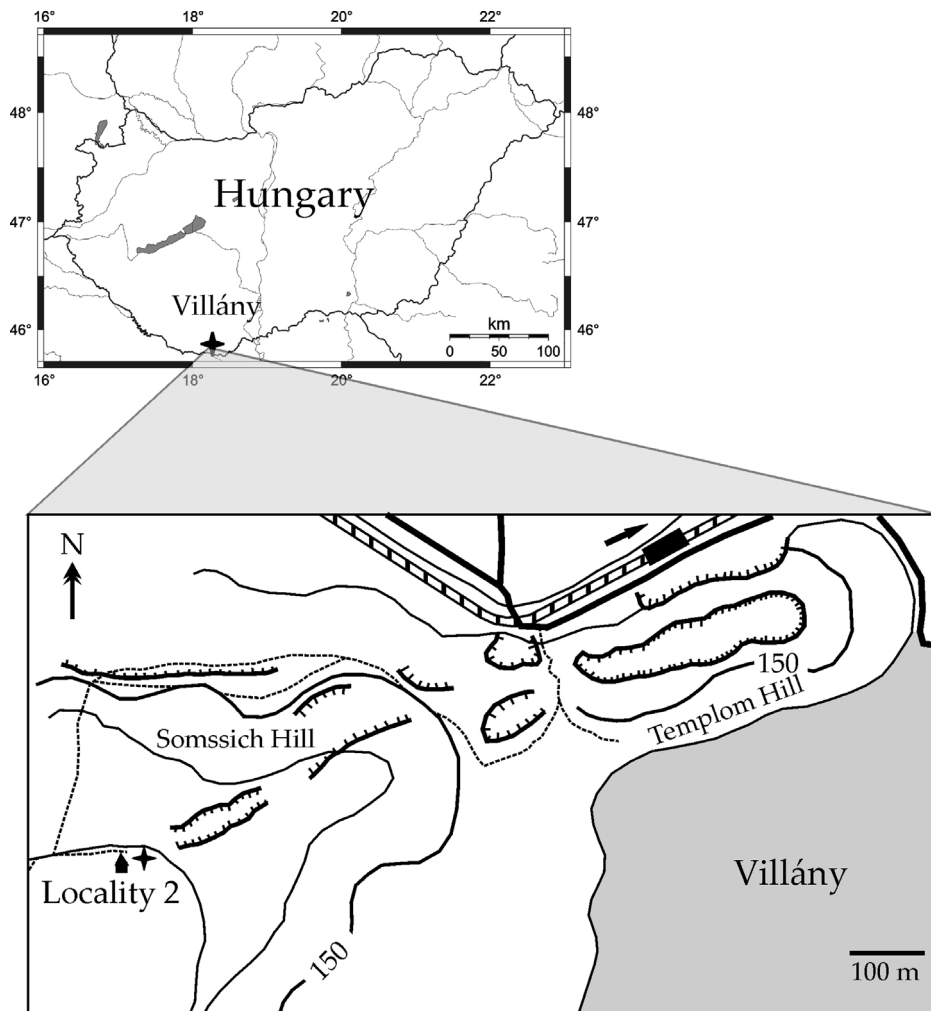


Fig. 1. Location of Somssich Hill 2 locality (Villány Hills, South Hungary)

fossil material was found in clay and loess (Fig. 2). The colour of the sediment is reddish brown at the bottom of the sequence to layer 28, whereas it got yellowish brown colour above layer 28. The latter sediment classified as typical loess, based



Fig. 2. Yellowish brown loess from the upper part of Somssich Hill 2 sequence

on petrographical criteria. Excavations were made to a depth of 9.5 m. Fifty “layers” were separated artificially during the original excavations. The thickness of each layers varied between 20 and 30 cm. The loess contained calcareous interbeddings of varying thickness (JÁNOSSY 1990).

MATERIAL

On the basis of preliminary studies by JÁNOSSY (1990), three glirids were found in the fauna: *Glis sackdillingensis*, *Muscardinus* sp. and *Dryomimus eliomyoides*. Since the vertebrate material, especially in the case of the lower layers, were washed and sieved but were only partially sorted, therefore we had to pick out the dormice remains first. Together with the previously processed material, 107 *Glis*, 13 *Muscardinus* and 12 *Dryomimus* teeth were found.

METHODS

Based on the number of individual teeth, the minimum number of specimens was counted for each species (Table 1). Teeth were compared to recent (*Muscardinus avellanarius* from the Mecsek and Villány Hills (Institute of Biology, University of Pécs; 10 specimens), and other specimens stored in the Mammalia Collection of the Hungarian Natural History Museum, Budapest; 41 specimens) and fossil material of the Hungarian Natural History Museum (Osztramos 7, Betfia 2, 10, 13, Kövesvárad; 8 specimens) as well.

Separation of the two *Glis* species was carried out by measurements of length and width of teeth (Fig. 3). Since these teeth are sufficiently small (1.4–2.0 mm), the measuring was made with an eyepiece micrometer in a Nikon SMZ445 stereomicroscope. We used the *P*-values of the Shapiro-Wilk and Anderson-Darling normality tests to demonstrate the separation of the species (SHAPIRO & WILK 1965; RAZALI & WAH 2011). We accepted normal distribution, which could indicate the presence only one species, if the *P*-value was above 0.05 (in case of a 95% confidence interval) (GOODMAN 2008). We also used Hartigan’s diptest of unimodality (HARTIGAN & HARTIGAN 1985) and Kruskal-Wallis rank sum test (KRUSKAL & WALLIS 1952) to compare the unmatched groups of the species. All of the calculations were performed by a statistical program, called R (R CORE TEAM 2013).

The palaeoecological conclusions were based on mainly the present ecological conditions of the recent dormice, but other taxa, such as frogs, insectivores, and other rodents, which occurred together with the glirids at the Somssich Hill 2 site, were also taken into consideration.

Table 1. Minimum number of specimens of Gliridae from the Somssich Hill 2 locality

layer	<i>Glis</i>	<i>Muscardinus</i>	<i>Dryomimus</i>
1	1		
2	1		
4	4	2	1
5	3		
11	1		
12	2		
13	8		
14	2		1
15		1	
19			1
23	1		
24	2		
25	1		
26	2		
27	1		
28	3	1	
29	2	1	
30	3	2	
31	2		
33	1		
34	1		
35	1		
36	1		
37	1		
38	1		
40	1		
41	2		
42	1		1
43	1		
44	1		1
45		1	
46	1		

PHYLOGENY OF FAMILY GLIRIDAE

The family Gliridae, belonging to the squirrel-like rodents (Rodentia Ordo, Sciuromorpha Subordo) includes 27 extant dormice species (HOLDEN 1993) distributed among three subfamilies. These are the Glirinae, comprising *Glis*, *Glirulus* and *Muscardinus*, the Leithiinae, which is subdivided into four genera, *Dryomys*, *Eliomys*, *Myomimus* and *Selevinia*, and the monotypic Graphiurinae, containing only *Graphiurus*. Members of the Glirinae and Leithiinae are found in the Palearctic and central and south-western Asia, as well as in Japan (*Glirulus japonicus*) and North Africa (*Eliomys melanurus*).

Today, four monotypical genera of them live in Europe: *Glis*, *Muscardinus*, *Dryomys* and *Eliomys*. Although, these genera differ taxonomically, the species of

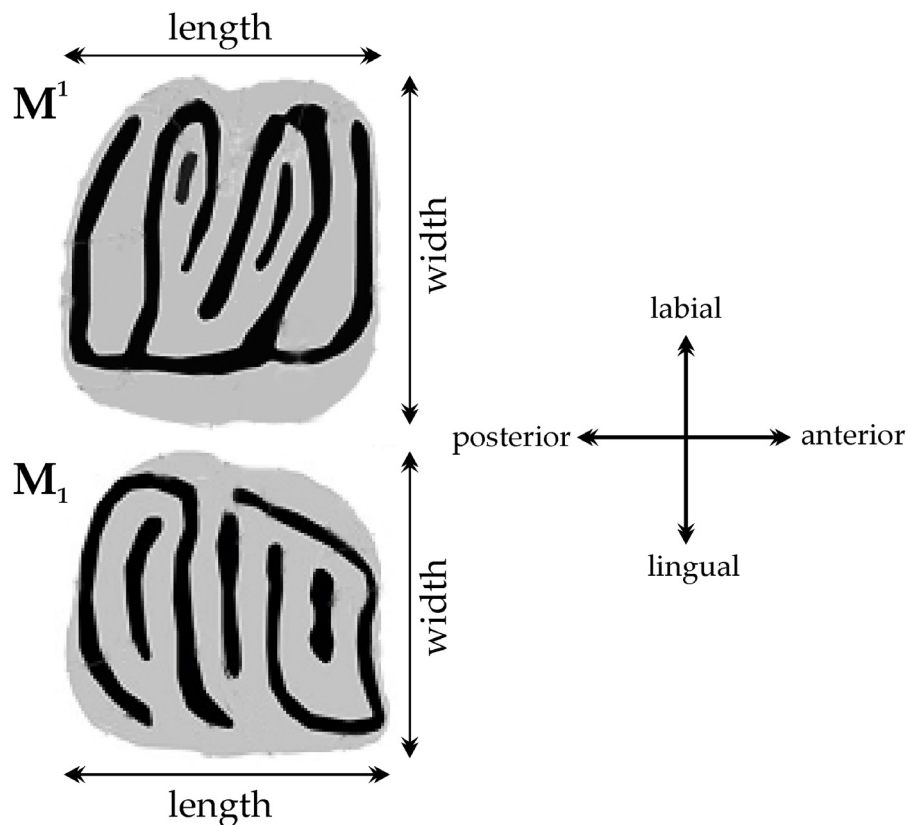


Fig. 3. Upper and lower first molars of glirids with indication of the measurements mentioned in the text (modified after KAYA & KAYMAKÇI 2013)

Glis and *Muscardinus* as well as *Dryomys* and *Eliomys* are morphologically similar to each other (JÁNOSSY 1966; DAAMS & DE BRUIJN 1995).

However, the recent glirid species diversity contrasts sharply with the fossil record, as more than 38 extinct genera have been described (DAAMS & DE BRUIJN 1995). This led to the view that extant dormice represent a relict rodent group, which is probably in decline (HARTENBERGER 1994; DAAMS & DE BRUIJN 1995). The earliest records date back to the Early Eocene (50 Ma ago) with the family representing a derived offshoot of the fossil ischyromyoids (HARTENBERGER 1998). The two fossil genera, *Eoglravus* and *Gliravus* (subfamily Gliravinae according to DAAMS & DE BRUIJN (1995)), are dated from the Early and Late Eocene, respectively, and are thought to represent the primitive glirids that gave rise to the modern forms. The first evidence of extant genera is from the Late Oligocene for *Glis* (ca. 28 million years ago) and the Early Miocene for *Glirulus* and *Myomimus* (ancestor of *Dryomimus*) (ca. 24 million years ago), whereas the first appearances of *Muscardinus*, *Eliomys* and *Dryomys* date from the Middle Miocene (ca. 18 million years ago; DAAMS & DE BRUIJN 1995; DAAMS 1999). Most fossils have been recorded in Europe, which suggests a European origin for the family.

According to the molecular systematic study of MONTGELARD *et al.* (2003), the Glirinae subfamily should be reduced to only *Glis* and *Glirulus*, while *Muscardinus* should be included in the Leithiinae.

GENERAL DENTITION OF GLIRIDS

Glirids have one incisor, one premolar and three molars on either side of both of their upper and lower tooth-row. Their cheek teeth (Fig. 4) are highly distinctive – brachyodont and table-like in most genera, with multiple ridges running laterolingually across the occlusal surface. This form is most strikingly developed in *Muscardinus*, followed by *Glis*, and *Glirulus* has a similar arrangement in miniature, but with a strongly bulging cingulum. In the other living genera the occlusal ridges curve up to higher palatal (in the upper teeth) or lingual (lower teeth) cusps, most prominently in *Eliomys*, followed by *Dryomys*. *Myomimus* occupies dentally an intermediate position (HILLSON 2005).

SYSTEMATIC PART

In contrast to the preliminary list by JÁNOSSY (1990) (*Glis sackdillingensis*, *Muscardinus* sp., *Dryomimus eliomyoides*), four species were identified here in the Somssich Hill 2 material: *Glis sackdillingensis*, *G. minor*, *Muscardinus dacicus* and *Dryomimus eliomyoides*.

Ordo Rodentia Bowdich, 1821
Subordo Sciuromorpha Brandt, 1855
Family Gliridae Muirhead, 1819
Genus *Glis* Birsson, 1762

Remarks – Two *Glis* species were identified from the locality, *Glis sackdillingensis* (Heller, 1930) and *G. minor* Kowalski, 1956. The molar teeth of the latter species are not distinguishable based on their morphological characters. Both of them are similar to the recent *G. glis*, but their teeth are smaller.

Glis sackdillingensis (Heller, 1930)

- 1930 *Myxodus sackdillingensis* n. sp. – HELLER, p. 281–282, pl. XVI. figs 5a-b, 6.
1962 *Glis sackdillingensis* (Heller, 1930) – DEHM, p. 46–47.
1963 *Glis sackdillingensis* (Heller, 1930) – KOWALSKI, p. 553–558, fig. 12.
1986 *Glis sackdillingensis* (Heller, 1930) – AGUILAR *et al.*, p. 141, fig. 3a-c.

Description – P^4 : Rounded tooth, with five ridges. The first ridge (anteroloph) is isolated, slightly arched anteriorly. The second ridge (protoloph) is long, and joined with the third one (anterior extra ridge) on the central part of the tooth. The fourth and the fifth ridges (metaloph and posteroloph) are isolated.

M^1 : The tooth has rounded square shape and seven ridges. The first and third main ridges (anteroloph and protoloph) are isolated; there is a small, isolated ridge (anterior extra ridge) between the latter two. The fourth ridge is isolated (anterior centraloph), whereas the fifth and seventh ridges (metaloph and posteroloph) are joined on the palatinal side. Between the latter two ridges, there is a small, isolated ridge (posterior extra ridge).

M^2 : Labiopalatinaly elongated tooth, with seven ridges. The first ridge (anteroloph) is joins with a small ridge (anterior extra ridge) on the central part of tooth. The third and fourth ridges (protoloph and anterior centraloph) are isolated. The fifth and seventh ridges (metaloph and posteroloph) are joined on the palatinal side. The sixth small ridge (posterior extra ridge) is joined with the seventh ridge on the labial side.

M^3 : Triangular tooth, with eight ridges. The first and third ridges (anteroloph and protoloph) are joined on the palatinal side. The anterior extra ridge (second ridge) is longer than the anterior centraloph (fourth ridge). These former ridges are joined on the palatinal side. The fifth ridge (posterior centraloph) is isolated. The extra ridges (second and sixth ridges) are joined on the labial side. The seventh ridge (metaloph) is small and isolated. The eighth ridge (posteroloph) is also joined the two extra ridges on the labial side.

P_4 : Triangular tooth, with five ridges. The first and the second ridges (anterolophid and metalophid) are joined on both sides. The third ridge (mesolophid)

is isolated, whereas the fourth and fifth ridges (posterior extra ridge and postero-lophid) are joined on the labial side.

M_1 : Anteriorly elongated, narrowed tooth, with seven ridges. The first, second and third ridges (anterolophid, anterior extra ridge and metalophid) are joined on the labial side. The fourth ridge (centralophid) is short and isolated.

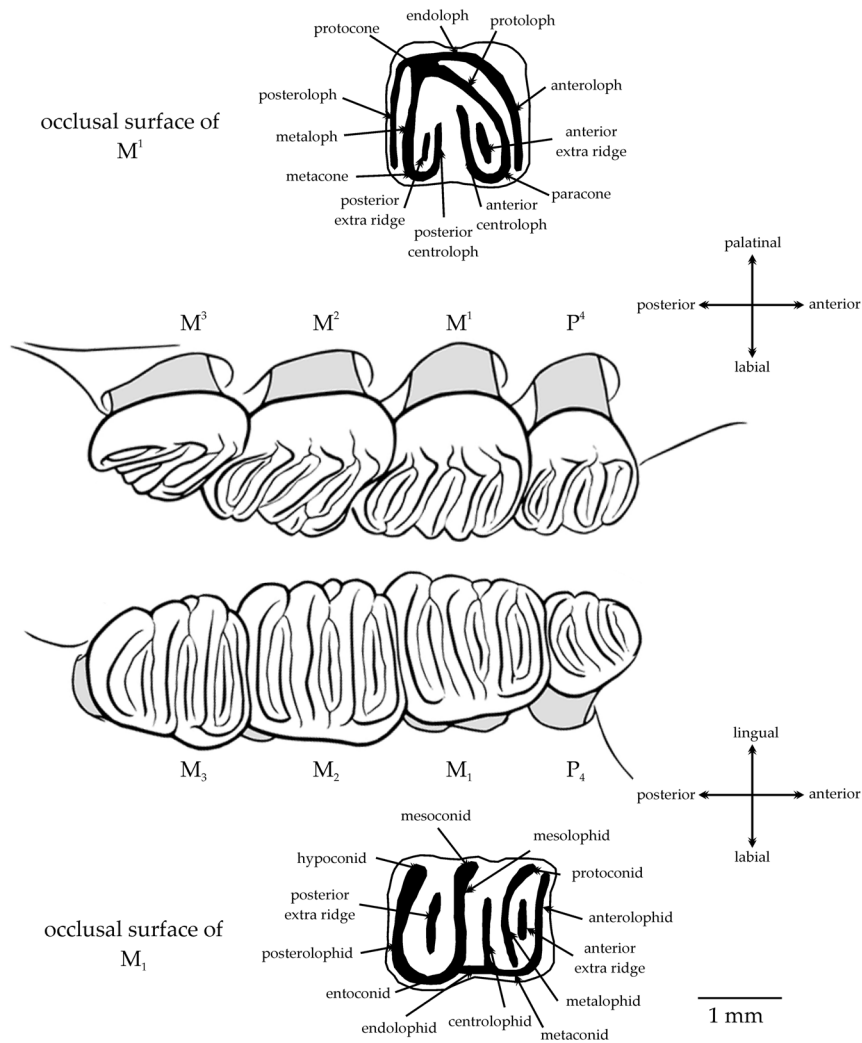


Fig. 4. Upper and lower molars of glirids with morphological terms used in the text (modified after DAAMS 1981 (occlusal surfaces of M_1 and M_1) and HILLSON 2005)

The fifth, sixth and seventh ridges (mesolophid, posterior extra ridge and postero-
rolophid) are joined on the labial side.

M_2 : Squared tooth, with seven ridges. The first and second ridges (antero-
lophid and anterior extra ridge) are joined on the labial side. All other ridges are
isolated.

M_3 : Shield shaped tooth, which is rounded on the posterior side, with seven
ridges. The first, second, third and fourth ridges (anterolophid, anterior extra
ridge, metalophid and centralophid) are joined on the labial side. The fifth ridge

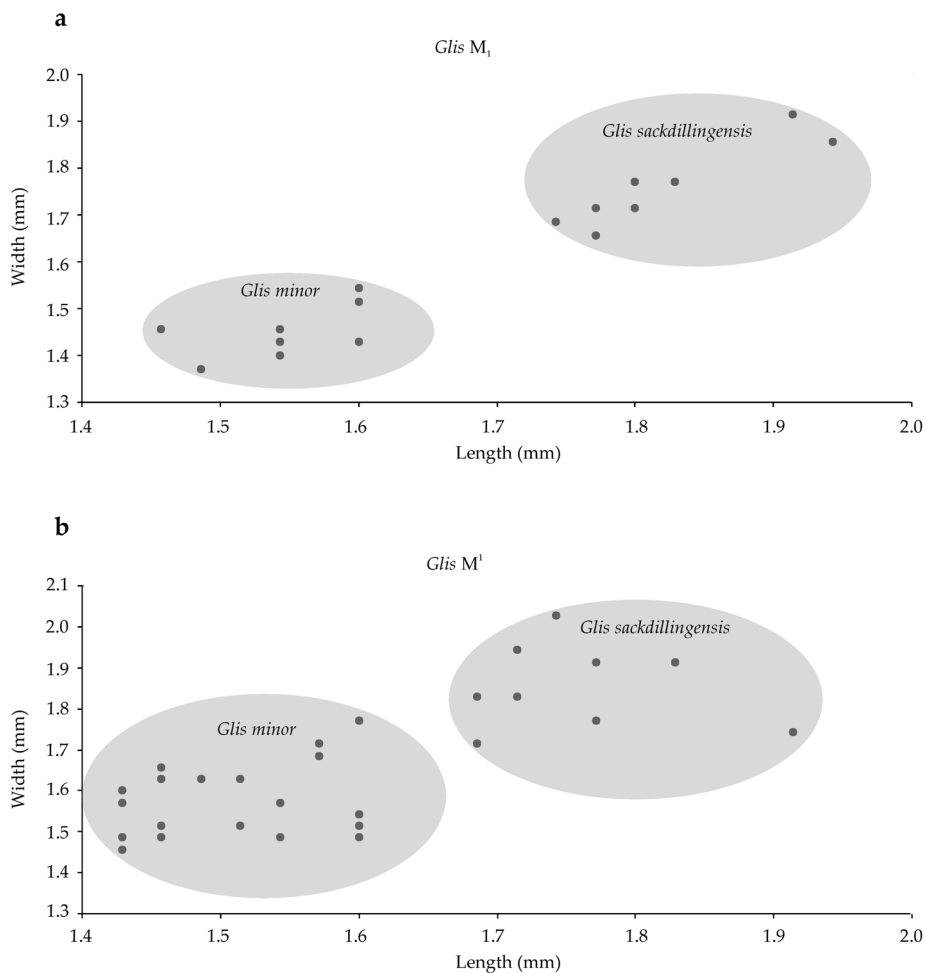


Fig. 5. Biplot of the length and width measurements made on *Glis* teeth from the Somssich Hill 2 locality. a = lower M₁; b = upper M₁

(mesolophid) is isolated, whereas the sixth and seventh ridges (posterior extra ridge and posterolophid) are joined on the labial side.

Remarks – Two species of the genus *Glis* have been described from the Pliocene: *G. minor* Kowalski, 1956 and *G. sackdillingensis* (Heller, 1930) (KOWALSKI 1956; AGUILAR *et al.* 1986), whereas several species of the genus have been observed in the Pleistocene: *G. sackdillingensis*, *G. mihevci* Aguilar et Michaux, 2011, *G. perko* Aguilar et Michaux, 2011 and the extant *G. glis* (Linnaeus, 1766) (KOWALSKI 1963; AGUILAR & MICHAUX 2011). A gradual size increase of the molars is observed in *Glis* from the Pliocene until recently. Morphology has evolved in this time span from primitive forms with transversal crests, synclines open on the lingual side in the upper molars and labial side in lower ones and accessory ridges reduced in P_4 and M_3 (KOWALSKI 1956; JÁNOSSY 1966; AGUILAR & MICHAUX 2011; MANSINO *et al.* 2013). According to a recently accepted view, the edible dormouse (*G. glis*) is descendant of *G. sackdillingensis*.

Altogether, 4 P_4 , 28 M^1 (9 *G. sackdillingensis*; 19 *G. minor*), 13 M^2 , 6 M^3 , 2 P_4 , 16 M_1 (8 *G. sackdillingensis*; 8 *G. minor*), 12 M_2 and 10 M_3 teeth of *Glis* were found in the Somssich Hill 2 samples. In case of *G. sackdillingensis* M_1 , the lengths of teeth vary between 1.7 and 1.95 mm, whereas the lengths of M^1 are 1.68–1.91 mm (Fig. 5). Within the sequence of locality, *G. sackdillingensis* was found with *G. minor* in most cases (layers 5, 13, 24, 28, 30–31, 40 and 45). The number of specimens of the latter taxon is usually lower than in the case of *G. minor*, but in cases of layers 4, 29–31, 36, and 40 *G. sackdillingensis* is the dominant dormouse in the fauna (Fig. 6; see also Fig. 12).

Glis minor Kowalski, 1956

1956 *Glis sackdillingensis minor* n. ssp. – KOWALSKI, p. 384–385, pl. IV, fig. 8, text-fig. 2f.

1959 *Glis minor* Kowalski, 1956 – KRETZOI, p. 240.

1963 *Glis minor* Kowalski, 1956 – KOWALSKI, p. 543–550, fig. 8–10.

1964 *Glis minor* Kowalski, 1956 – SULIMSKI, p. 228–229, pl. XIV.

Description – Since the molar teeth of the two *Glis* species are not distinguishable based on their morphological characters, description of teeth see above.

Remarks – In case of *G. minor* M_1 , the lengths of teeth are between 1.45 and 1.6 mm, while the lengths of M^1 are between 1.42 and 1.6 mm (Fig. 5). Within the sequence of locality, *G. minor* was the dominant dormouse in several layers (layers 2, 5, 12–14, 25–26, 28 and 45). The number of specimens increased particularly in the upper part of sequence.

Somssich Hill 2 locality was a later occurrence of *G. minor*, which earlier was only described from Pliocene (Csarnóta 2, Podlesice, Węże) and Early Pleistocene (Osztamos 7) localities (JÁNOSSY 1986; KOWALSKI 1956).

Genus *Muscardinus* Kaup, 1829

Remarks – One *Muscardinus* species was found in the material of Somssich Hill 2 locality. This species was not recognized by JÁNOSSY (1990), only *Muscardinus* sp. was mentioned in his preliminary list.

Muscardinus dacicus Kormos, 1930

1930 *Muscardinus dacicus* n. sp. – KORMOS, p. 243–244.

1963 *Muscardinus* aff. *dacicus* Kormos, 1930 – KOWALSKI, p. 543, fig. 6.

1993 *Muscardinus dacicus* Kormos, 1930 – DAOUD, p. 214–219, fig. 22.

2000 *Muscardinus* cf. *dacicus* Kormos, 1930 – MARCHETTI *et al.*, p. 101, fig. 6/41.

Description – *M¹*: The tooth is markedly brachyodont, with five ridges. The first mesial ridge (protoloph) is oblique, the second one (posterior centraloph) is longer, sinuous, oblique, and extending along the palatinal side. The first ridge is

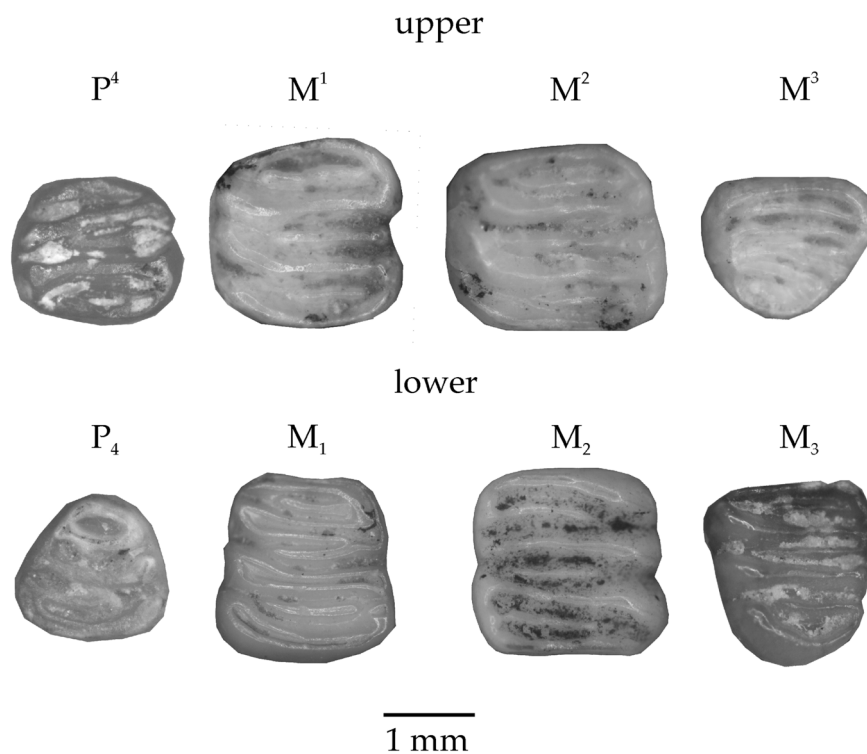
Glis sackdillingensis

Fig. 6. *Glis sackdillingensis* teeth from the Somssich Hill 2 locality

very wide apart from the second one. The second, fourth (metaloph), and fifth (posteroloph) ridges are joined on palatinal side with the endoloph. The third one (posterior extra ridge) is shorter, and isolated on both sides (morphotype 1), or sinuous, and joined on palatinal side to the endoloph (morphotype 2).

M^2 : The tooth is squared, with seven parallel, linear ridges. All ridges are joined on palatinal side with the endoloph. The third ridge (anterior extra ridge) is interrupted in the central part of the tooth. This ridge and the fourth one (anterior centraloph) are joined on labial side. The metacone is absent.

M_1 : The tooth is long with six almost parallel main ridges, which are narrow especially in the anterior part. All ridges are isolated from each other. These characters are corresponding with morphotype 8 of recent *M. avellanarius*.

M_2 : The tooth has six enamel ridges. The ridges are slightly arched anteriorly. The first, second, third and fourth ridges are isolated from each other. The fifth and sixth ridges (posterior extra ridge and posterolophid) are joined on lingual side (morphotype 1), or on both sides (morphotype 2).

Remarks – Altogether, 2 M^1 , 1 M^2 , 6 M_1 , and 4 M_2 teeth of *M. dacicus* were found in the Somssich Hill 2 samples. Our material was compared with an Early Pleistocene dormouse, *M. dacicus* (Kormos, 1930), and recent *M. avellanarius* (Linnaeus, 1758). These species are very similar, and László Kordos (March 2013, pers. comm.) suggested, that *M. dacicus* could plausibly correspond with the extant species. In order to verify this idea, recent *M. avellanarius* material was also analysed.

Eight morphotypes were determined by M_1 morphology of *M. avellanarius*, and these ones were compared with *M. dacicus* specimens from six Early and Middle Pleistocene localities: Betfia 2, 10, 13 (TERZEA & JURCSÁK 1967; TERZEA 1973), Osztramos 7, Kövesvárad (JÁNOSSY 1986) (Fig. 7a, b).

On the basis of the fossil material and 50 M_1 of recent *M. avellanarius*, the middle part of this tooth (between the second and fifth ridges) is steady, while its anterior and posterior parts are very various (Table 2, Fig. 7).

Morphotype 1: The first and second ridges are isolated, whereas the fifth and sixth ones join on the labial side.

Morphotype 2: All ridges are isolated.

Morphotype 3: The first and second ridges join on the labial side, whereas the fifth and sixth ones isolated.

Morphotype 4: The first and second ridges are isolated, whereas the fifth and sixth ones join on both sides.

Morphotype 5: The first and second ridges join on the lingual side, whereas the fifth and sixth ones join on the labial side.

Morphotype 6: The first and second ridges are isolated, whereas the fifth and sixth ones join on the lingual side.

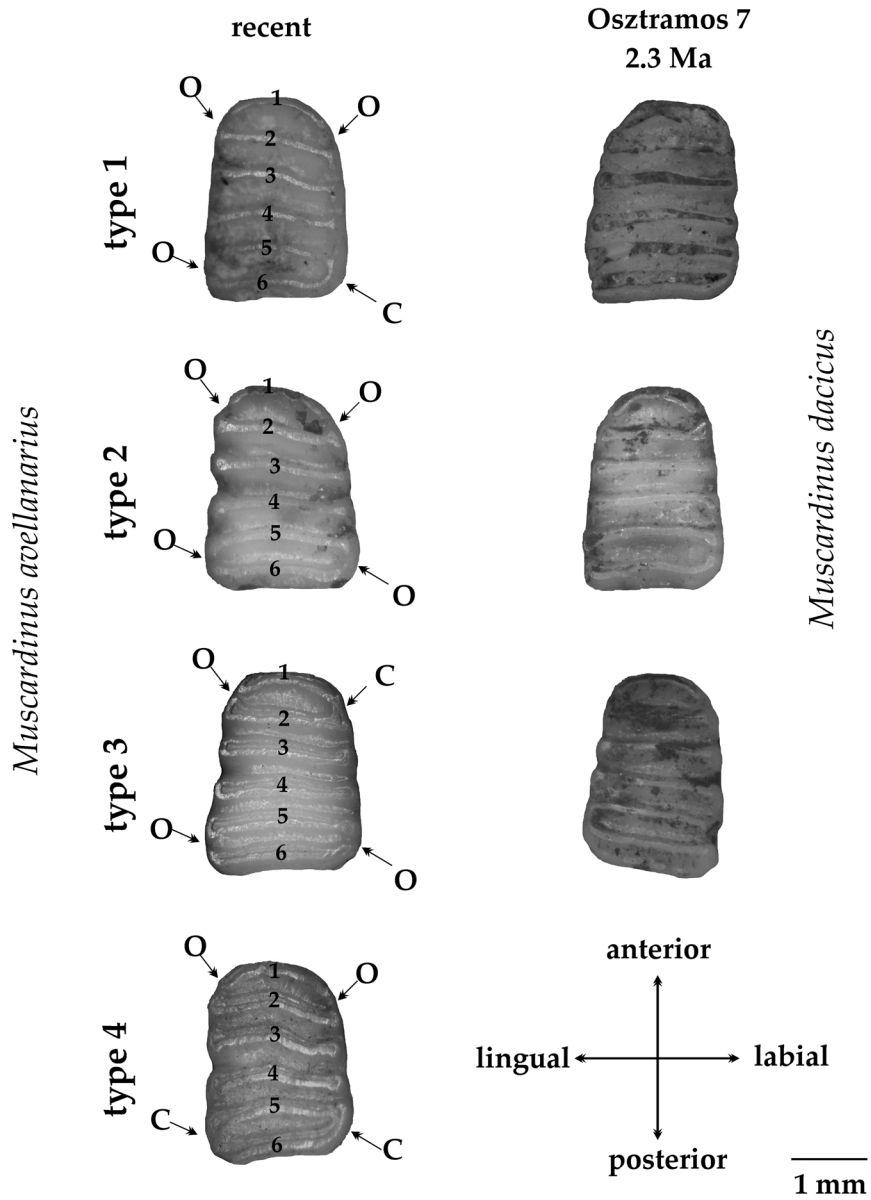


Fig. 7a. Morphotypes (types 1–4) of recent *Muscardinus avellanarius* M₁ (left side), and *M. dacicus* teeth (also M₁) from Osztramos 7 vertebrate locality (right side). O = opened, C = connected

Morphotype 7: The first and second ridges join on the labial side, and the fifth and sixth ones join on the labial side, too.

Morphotype 8: The first and second ridges join on the labial side, whereas the fifth and sixth ones join on both sides.

All *M. dacicus* specimens corresponded with some morphotype of *M. avellanarius*. *M. dacicus* specimens of Osztramos 7 corresponded with morphotypes 1, 2, 3 (Fig. 7a), all specimens from Betfia localities (2, 10, 13) paralleled with morphotype 6, specimen of Kövesváraad corresponded with morphotype 5, whereas all specimens of Somssich Hill 2 paralleled with morphotype 8. According to these results, morphologically *M. dacicus* M₁ is very similar to recent *M. avellanarius* (Fig. 7b). Therefore, it is conceivable that the Early Pleistocene *M. dacicus* was not a separate species, but a morphotype of the recent *M. avellanarius*.

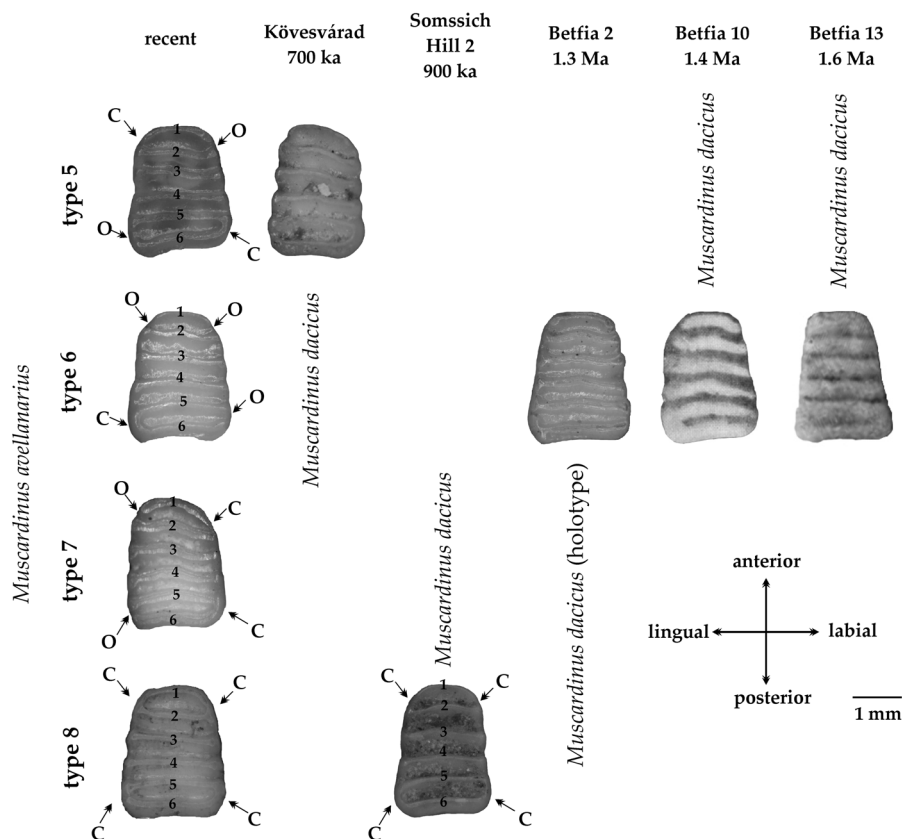


Fig. 7b. Morphotypes (types 5–8) of recent *Muscardinus avellanarius* M₁ (left side), and *M. dacicus* teeth (also M₁) from five fossil vertebrate localities (right side). O = opened, C = connected

Table 2. Characteristics of *Muscardinus avellanarius* morphotypes

morpho- type	anterior part (ridges 1–2)				posterior part (ridges 5–6)			
	labial side		lingual side		labial side		lingual side	
	close	open	close	open	close	open	close	open
1		•		•	•			•
2		•		•		•		•
3	•			•		•		•
4		•		•	•		•	
5		•	•		•			•
6		•		•		•	•	
7	•			•	•			•
8	•		•		•		•	

However, in order to prove this hypothesis, more morphological and metric analysis is required on all teeth of both species.

Within the sequence of the Somssich Hill 2 locality, *M. dacicus* (Fig. 8) was less abundant, than *Glis sackdillingensis* or *G. minor*. Generally, it appeared with *Glis* (layers 4, 28–30 and 45), but at layer 15 *M. dacicus* was the only dormouse.

Genus *Dryomimus* Kretzoi, 1959

Remarks – One *Dryomimus* species, *D. eliomyoides* Kretzoi, 1959, was identified from the locality. The name alludes to the transitional morphology of teeth of the aforementioned taxon between recent *Dryomys* and *Eliomys* species, although ridges appear on the occlusal surface too, similarly to *Glis* (DAAMS & DE BRUIJN 1995).

Dryomimus eliomyoides Kretzoi, 1959

1959 *Dryomimus eliomyoides* n. g. n. sp. – KRETZOI, p. 240.

Description – *P⁴*: Brachyodont, oval shaped tooth, which is prolated side-ward. The paracone and the metacone emerge markedly on the labial side. The occlusal surface of the tooth is concave, with six main ridges. All ridges are joined on palatal side with the endoloph, and are slightly arched anteriorly. The second and third ridges (protoloph and anterior centraloph) as well as the fourth and the fifth ridges (posterior centraloph and metaloph) are joined on the labial side. The anterior and posterior extra ridges are absent.

M¹: Rounded, oval shaped tooth, which is bigger than *P⁴*. The occlusal surface is similar to *P⁴*, but the ridges are more linear than in the case of the former one.

Altogether, 1 P⁴, 2 M¹, 2 M², 1 M₁, and 1 M₂ teeth of *D. eliomyoides* were found from the Somssich Hill 2 locality (Fig. 9). It is the latest occurrence of *Dryomimus eliomyoides*, which was earlier described only from Pliocene (Csarnóta 2: JÁNOSSY 1986; Calta (Ankara): SEN *et al.* 1998; Kastoria 1: KOUFOS 2001) and Early Pleistocene (Osztramos 7, Villány 3: JÁNOSSY 1986; Tourkovounia 1: KOUFOS 2001) localities. Although, *D. eliomyoides* was the most infrequent dormice at the locality, this species appeared also in such layers where other glirids were absent (layers 19, 42, 44). This result maybe indicates that *D. eliomyoides* preferred different environment than the other dormice.

RESULTS

Taxonomy

Glis sackdillingensis and *G. minor* are well distinguished by the size of the first upper and the first lower molars found in Somssich Hill 2 locality. The separation is supported by the morphometrical analysis made on the M₁ and M¹ length and width of the two species (Fig. 5). According to our measurements, the two different species seems to be valid groups, since there was no continuous transition between the two forms. *Glis* faunas of some Pliocene and Early, Middle Pleistocene localities (Podlesice, Osztramos 1, Kövesvárad, Uppony I. Shelter Cave, Sackdilling Cave, Tarkő Shelter Cave) were also investigated (Table 3).

On the basis of *P*-values of the Shapiro-Wilk and Anderson-Darling normality tests, as well as Hartigan's diptest, both width of M₁ and length of M¹

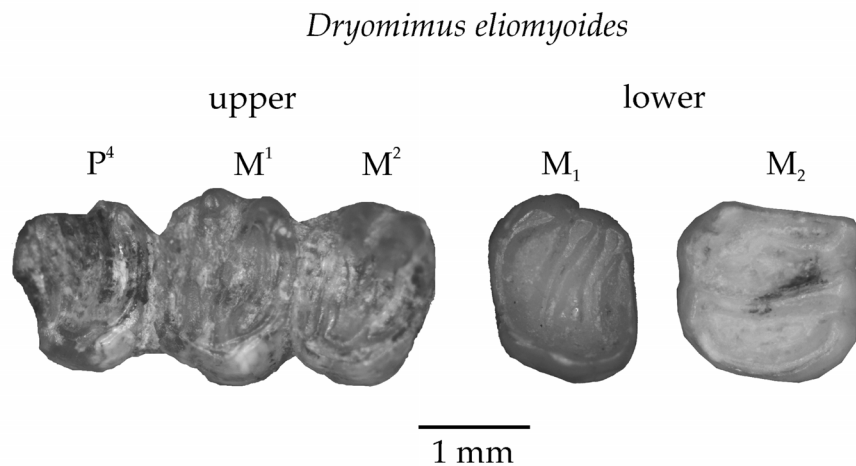


Fig. 9. *Dryomimus eliomyoides* teeth from Somssich Hill 2 locality

Table 3. Measurement data of *Glis* teeth (* = based on morphometrical analysis, the specimen is *Glis minor*; ** = based on morphometrical analysis, the specimen is *Glis sackdillingensis*)

Locality	Inventory number	M_1 of <i>Glis</i> species		Literature	
		Species name	Length (mm)		Width (mm)
Sackdillingen	type	<i>Glis sackdillingensis</i>	1.80	1.65	HELLER 1930
Sackdillingen	type	<i>Glis sackdillingensis</i>	1.83	1.80	HELLER 1930
Sackdillingen	type	<i>Glis sackdillingensis</i>	1.95	1.80	HELLER 1930
Sackdillingen	type	<i>Glis sackdillingensis</i>	1.80	1.65	HELLER 1930
Sackdillingen	type	<i>Glis sackdillingensis</i>	1.80	1.65	HELLER 1930
Sackdillingen	type	<i>Glis sackdillingensis</i>	1.80	1.65	HELLER 1930
Podlesice	type	<i>Glis minor</i>	1.50	1.50	KOWALSKI 1956
Kövesvárad	V 63.286.	<i>Glis sackdillingensis</i>	1.77	1.69	
Kövesvárad	V 63.286.	<i>Glis sackdillingensis</i>	1.74	1.66	
Kövesvárad	V 63.286.	<i>Glis sackdillingensis</i>	1.74	1.63	
Kövesvárad	V 63.286.	<i>Glis sackdillingensis</i>	1.80	1.66	
Kövesvárad	V 63.286.	<i>Glis sackdillingensis</i>	1.69	1.63	
Kövesvárad	V 63.286.	<i>Glis sackdillingensis</i>	1.80	1.74	
Kövesvárad	V 63.286.	<i>Glis sackdillingensis</i>	1.97	1.77	
Kövesvárad	V 63.286.	<i>Glis sackdillingensis</i>	1.71	1.57	
Kövesvárad	V 63.286.	<i>Glis sackdillingensis</i> *	1.57	1.54	
Kövesvárad	V 63.286.	<i>Glis sackdillingensis</i>	1.80	1.57	
Kövesvárad	V 63.286.	<i>Glis sackdillingensis</i>	1.69	1.57	
Tarkó	V 64.384.	<i>Glis sackdillingensis</i>	1.80	1.63	
Tarkó	V 64.399.	<i>Glis sackdillingensis</i>	1.86	1.71	
Tarkó	V 64.399.	<i>Glis sackdillingensis</i>	1.80	1.69	
Tarkó	V 64.399.	<i>Glis sackdillingensis</i>	1.77	1.63	
Tarkó	V 64.399.	<i>Glis sackdillingensis</i>	1.83	1.71	
Tarkó	V 64.399.	<i>Glis sackdillingensis</i>	1.80	1.60	
Tarkó	V 64.399.	<i>Glis sackdillingensis</i>	1.71	1.63	
Tarkó	V 64.399.	<i>Glis sackdillingensis</i>	1.71	1.49	
Tarkó	V 64.399.	<i>Glis sackdillingensis</i> *	1.51	1.31	
Tarkó	V 64.300.	<i>Glis sackdillingensis</i>	1.77	1.66	
Tarkó	V 64.300.	<i>Glis sackdillingensis</i>	1.91	1.80	
Tarkó	V 64.488.	<i>Glis sackdillingensis</i>	1.77	1.57	
Tarkó	V 64.488.	<i>Glis sackdillingensis</i>	1.88	1.69	

Table 3 (cont.)

Tarkó	V 64.488.	<i>Glis sackdillingensis</i>	1.80	1.63
Tarkó	V 64.488.	<i>Glis sackdillingensis</i>	1.71	1.60
Tarkó Layer 8	V 64.651.	<i>Glis sackdillingensis</i>	1.86	1.71
Tarkó Layer 8	V 64.651.	<i>Glis sackdillingensis</i>	1.80	1.57
Tarkó Layer 9	V 64.725.	<i>Glis sackdillingensis</i>	1.83	1.69
Tarkó Layer 9	V 64.725.	<i>Glis sackdillingensis</i>	1.80	1.57
Tarkó Layer 9	V 64.725.	<i>Glis sackdillingensis</i>	1.80	1.74
Tarkó Layer 9	V 64.725.	<i>Glis sackdillingensis*</i>	1.63	1.49
Tarkó Layer 9	V 64.725.	<i>Glis sackdillingensis</i>	1.74	1.57
Tarkó Layer 9	V 64.725.	<i>Glis sackdillingensis</i>	1.86	1.71
Tarkó Layer 9	V 64.725.	<i>Glis sackdillingensis</i>	1.74	1.60
Tarkó Layer 9	V 64.725.	<i>Glis sackdillingensis*</i>	1.60	1.63
Tarkó Layer 9	V 64.725.	<i>Glis sackdillingensis</i>	1.86	1.74
Tarkó Layer 9	V 64.725.	<i>Glis sackdillingensis</i>	1.86	1.63
Tarkó Layer 9	V 64.725.	<i>Glis sackdillingensis</i>	1.80	1.60
Tarkó Layer 9	V 64.742.	<i>Glis sackdillingensis</i>	1.83	1.69
Tarkó Layer 9	V 64.742.	<i>Glis sackdillingensis</i>	1.77	1.67
Tarkó Layer 9	V 64.742.	<i>Glis sackdillingensis*</i>	1.63	1.49
Tarkó Layer 9	V 64.742.	<i>Glis sackdillingensis*</i>	1.63	1.46
Tarkó Layer 10	V 64.577.	<i>Glis sackdillingensis</i>	1.77	1.74
Tarkó Layer 10	V 64.577.	<i>Glis sackdillingensis</i>	1.80	1.71
Tarkó Layer 10	V 64.577.	<i>Glis sackdillingensis*</i>	1.63	1.46
Tarkó Layer 10	V 64.577.	<i>Glis sackdillingensis</i>	1.80	1.71
Tarkó Layer 12	V 64.707.	<i>Glis sackdillingensis</i>	1.71	1.51
Tarkó Layer 12	V 64.707.	<i>Glis sackdillingensis</i>	1.77	1.71
Tarkó Layer 12	V 64.707.	<i>Glis sackdillingensis</i>	1.71	1.63
Tarkó Layer 12	V 64.707.	<i>Glis sackdillingensis</i>	1.80	1.69
Uppony 1/7	V 65.227.	<i>Glis sackdillingensis</i>	1.80	1.54
Uppony 1/8	V 65.117.	<i>Glis sackdillingensis</i>	1.77	1.54
Uppony 1/8	V 65.117.	<i>Glis sackdillingensis</i>	1.80	1.60
Uppony 1/10	V 66.30.	<i>Glis sackdillingensis</i>	1.77	1.69
Uppony 1/10	V 66.30.	<i>Glis sackdillingensis*</i>	1.60	1.54
Osztramos 1/E	V 74.132.	<i>Glis minor**</i>	1.71	1.51
Osztramos 1/E	V 74.132.	<i>Glis minor</i>	1.60	1.46
Osztramos 1	V 73.27.	<i>Glis minor**</i>	1.77	1.63

Table 3 (cont.)

Osztramos 1	V 73.27.	<i>Glis minor</i>	1.60	1.49	
Osztramos 1	V 73.27.	<i>Glis minor</i> **	1.71	1.54	
Osztramos 1	V 73.27.	<i>Glis minor</i> **	1.74	1.51	
Osztramos 1	V 73.27.	<i>Glis minor</i>	1.63	1.43	
Osztramos 1	V 73.27.	<i>Glis minor</i> **	1.74	1.49	
Osztramos 1	V 73.27.	<i>Glis minor</i> **	1.66	1.57	
Osztramos 1	V 73.27.	<i>Glis minor</i> **	1.71	1.60	
Osztramos 1	V 73.27.	<i>Glis minor</i> **	1.86	1.66	
Osztramos 1	V 73.27.	<i>Glis minor</i> **	1.83	1.57	
Osztramos 1	V 73.27.	<i>Glis minor</i> **	1.77	1.49	
Osztramos 1	V 73.27.	<i>Glis minor</i> **	1.69	1.54	
Osztramos 1	V 73.27.	<i>Glis minor</i> **	1.77	1.63	
Osztramos 1	V 73.27.	<i>Glis minor</i> **	1.71	1.60	
Somssich Hill 2/4	VER 2014.71.	<i>Glis sackdillingensis</i>	1.77	1.66	
Somssich Hill 2/4	VER 2014.14.	<i>Glis sackdillingensis</i>	1.91	1.91	
Somssich Hill 2/5	VER 2014.72.	<i>Glis sackdillingensis</i>	1.94	1.86	
Somssich Hill 2/5	VER 2014.68.	<i>Glis minor</i>	1.60	1.54	
Somssich Hill 2/5	VER 2014.68.	<i>Glis minor</i>	1.49	1.37	
Somssich Hill 2/13	VER 2014.65.	<i>Glis minor</i>	1.54	1.46	
Somssich Hill 2/13	VER 2014.65.	<i>Glis minor</i>	1.54	1.40	
Somssich Hill 2/14	VER 2014.64.	<i>Glis minor</i>	1.60	1.43	
Somssich Hill 2/25	VER 2014.19.	<i>Glis minor</i>	1.54	1.43	
Somssich Hill 2/28	VER 2014.26.	<i>Glis sackdillingensis</i>	1.80	1.77	
Somssich Hill 2/28	VER 2014.25.	<i>Glis minor</i>	1.60	1.54	
Somssich Hill 2/28	VER 2014.25.	<i>Glis minor</i>	1.54	1.46	
Somssich Hill 2/29	VER 2014.30.	<i>Glis sackdillingensis</i>	1.83	1.77	
Somssich Hill 2/30	VER 2014.36.	<i>Glis sackdillingensis</i>	1.80	1.71	
Somssich Hill 2/30	VER 2014.33.	<i>Glis minor</i>	1.46	1.46	
Somssich Hill 2/30	VER 2014.36.	<i>Glis sackdillingensis</i>	1.77	1.71	
Somssich Hill 2/40	VER 2014.53.	<i>Glis sackdillingensis</i>	1.74	1.69	
Somssich Hill 2/40	VER 2014.52.	<i>Glis minor</i>	1.60	1.51	
M¹ of <i>Glis</i> species					
Podlesice	type	<i>Glis minor</i>	1.50	1.60	KOWALSKI 1956
Kövesvárad	V 63.293.	<i>Glis sackdillingensis</i>	1.66	1.97	
Kövesvárad	V 63.293.	<i>Glis sackdillingensis</i>	1.80	2.00	

Table 3 (cont.)

Kövesvárad	V 63.293.	<i>Glis sackdillingensis</i>	1.71	1.94
Kövesvárad	V 63.293.	<i>Glis sackdillingensis*</i>	1.57	1.63
Kövesvárad	V 63.293.	<i>Glis sackdillingensis</i>	1.71	1.77
Kövesvárad	V 63.293.	<i>Glis sackdillingensis</i>	1.69	1.89
Kövesvárad	V 63.293.	<i>Glis sackdillingensis*</i>	1.57	1.63
Tarkő	V 64.408.	<i>Glis sackdillingensis</i>	1.77	1.83
Tarkő	V 64.408.	<i>Glis sackdillingensis*</i>	1.63	1.63
Tarkő	V 64.408.	<i>Glis sackdillingensis</i>	1.74	1.89
Tarkő	V 64.408.	<i>Glis sackdillingensis*</i>	1.66	1.60
Tarkő	V 64.408.	<i>Glis sackdillingensis</i>	1.71	1.86
Tarkő	V 64.408.	<i>Glis sackdillingensis*</i>	1.57	1.54
Tarkő	V 64.408.	<i>Glis sackdillingensis*</i>	1.71	1.69
Tarkő	V 64.408.	<i>Glis sackdillingensis</i>	1.71	1.74
Tarkő	V 64.408.	<i>Glis sackdillingensis</i>	1.77	1.71
Tarkő	V 64.441.	<i>Glis sackdillingensis</i>	1.83	1.86
Tarkő	V 64.441.	<i>Glis sackdillingensis</i>	1.51	1.80
Tarkő	V 64.441.	<i>Glis sackdillingensis</i>	1.74	1.83
Tarkő	V 64.230.	<i>Glis sackdillingensis</i>	1.71	1.80
Tarkő	V 64.300.	<i>Glis sackdillingensis</i>	1.66	1.89
Tarkő	V 64.488.	<i>Glis sackdillingensis</i>	1.63	1.94
Tarkő	V 64.488.	<i>Glis sackdillingensis*</i>	1.71	1.57
Tarkő Layer 8	V 64.651.	<i>Glis sackdillingensis*</i>	1.71	1.60
Tarkő Layer 8	V 64.651.	<i>Glis sackdillingensis</i>	1.71	1.91
Tarkő Layer 8	V 64.651.	<i>Glis sackdillingensis</i>	1.74	1.71
Tarkő Layer 8	V 64.651.	<i>Glis sackdillingensis</i>	1.66	1.91
Tarkő Layer 8	V 64.651.	<i>Glis sackdillingensis</i>	1.77	1.80
Tarkő Layer 9	V 64.736.	<i>Glis sackdillingensis*</i>	1.66	1.57
Tarkő Layer 9	V 64.736.	<i>Glis sackdillingensis*</i>	1.57	1.51
Tarkő Layer 9	V 64.736.	<i>Glis sackdillingensis</i>	1.71	1.74
Tarkő Layer 9	V 64.736.	<i>Glis sackdillingensis</i>	1.74	1.83
Tarkő Layer 9	V 64.736.	<i>Glis sackdillingensis*</i>	1.51	1.63
Tarkő Layer 9	V 64.736.	<i>Glis sackdillingensis*</i>	1.71	1.60
Tarkő Layer 9	V 64.736.	<i>Glis sackdillingensis*</i>	1.60	1.51
Tarkő Layer 9	V 64.736.	<i>Glis sackdillingensis*</i>	1.51	1.60
Tarkő Layer 9	V 64.736.	<i>Glis sackdillingensis*</i>	1.57	1.66

Table 3 (cont.)

Tarkó Layer 9	V 64.736.	<i>Glis sackdillingensis</i> *	1.46	1.51
Tarkó Layer 9	V 64.736.	<i>Glis sackdillingensis</i> *	1.57	1.63
Tarkó Layer 9	V 64.736.	<i>Glis sackdillingensis</i>	1.66	1.71
Tarkó Layer 9	V 64.748.	<i>Glis sackdillingensis</i> *	1.51	1.57
Tarkó Layer 9	V 64.748.	<i>Glis sackdillingensis</i> *	1.71	1.69
Tarkó Layer 9	V 64.742.	<i>Glis sackdillingensis</i> *	1.66	1.66
Tarkó Layer 9	V 64.742.	<i>Glis sackdillingensis</i>	1.69	1.86
Tarkó Layer 9	V 64.742.	<i>Glis sackdillingensis</i> *	1.66	1.60
Tarkó Layer 9	V 64.742.	<i>Glis sackdillingensis</i> *	1.63	1.60
Tarkó Layer 9	V 64.742.	<i>Glis sackdillingensis</i>	1.66	1.77
Tarkó Layer 9	V 64.742.	<i>Glis sackdillingensis</i> *	1.49	1.40
Tarkó Layer 11	V 64.680.	<i>Glis sackdillingensis</i> *	1.43	1.49
Tarkó Layer 12/a	V 67.108.	<i>Glis sackdillingensis</i> *	1.49	1.54
Tarkó Layer 12	V 64.707.	<i>Glis sackdillingensis</i>	1.80	1.74
Tarkó Layer 12	V 64.707.	<i>Glis sackdillingensis</i>	1.71	1.74
Tarkó Layer 12	V 64.707.	<i>Glis sackdillingensis</i>	1.57	1.89
Tarkó Layer 12	V 64.707.	<i>Glis sackdillingensis</i> *	1.60	1.69
Tarkó Layer 12	V 64.707.	<i>Glis sackdillingensis</i>	1.66	1.71
Tarkó Layer 12	V 64.707.	<i>Glis sackdillingensis</i> *	1.54	1.63
Tarkó Layer 12	V 64.707.	<i>Glis sackdillingensis</i> *	1.66	1.60
Tarkó Layer 12	V 64.707.	<i>Glis sackdillingensis</i>	1.63	1.80
Uppony 1/8	V 65.117.	<i>Glis sackdillingensis</i> *	1.57	1.66
Uppony 1/10	V 66.30.	<i>Glis sackdillingensis</i>	1.74	1.71
Uppony 1/10	V 66.30.	<i>Glis sackdillingensis</i> *	1.57	1.57
Uppony 1/10	V 66.30.	<i>Glis sackdillingensis</i> *	1.57	1.51
Osztramos 9		<i>Glis minor</i>	1.34	1.37
Osztramos 1/E	V 74.132.	<i>Glis minor</i>	1.66	1.63
Osztramos 1/E	V 74.132.	<i>Glis minor</i> **	1.60	1.74
Osztramos 1/E	V 74.132.	<i>Glis minor</i> **	1.51	1.74
Osztramos 1/E	V 74.132.	<i>Glis minor</i>	1.49	1.60
Osztramos 1	V 73.27.	<i>Glis minor</i>	1.66	1.63
Osztramos 1	V 73.27.	<i>Glis minor</i>	1.51	1.57
Osztramos 1	V 73.27.	<i>Glis minor</i>	1.63	1.63
Osztramos 1	V 73.27.	<i>Glis minor</i>	1.60	1.60
Osztramos 1	V 73.27.	<i>Glis minor</i>	1.63	1.63

Table 3 (cont.)

Osztramos 1	V 73.27.	<i>Glis minor</i>	1.63	1.66
Osztramos 1	V 73.27.	<i>Glis minor</i> **	1.60	1.71
Osztramos 1	V 73.27.	<i>Glis minor</i> **	1.63	1.80
Osztramos 1	V 73.27.	<i>Glis minor</i>	1.63	1.57
Osztramos 1	V 73.27.	<i>Glis minor</i>	1.60	1.57
Osztramos 1	V 73.27.	<i>Glis minor</i>	1.57	1.63
Somssich Hill 2/2	V 81.48.	<i>Glis minor</i>	1.57	1.69
Somssich Hill 2/2	V 81.49.	<i>Glis minor</i>	1.54	1.51
Somssich Hill 2/4	VER 2014.70.	<i>Glis sackdillingensis</i>	1.77	1.77
Somssich Hill 2/5	VER 2014.63.	<i>Glis minor</i>	1.60	1.49
Somssich Hill 2/5	VER 2014.63.	<i>Glis minor</i>	1.43	1.60
Somssich Hill 2/5	VER 2014.63.	<i>Glis minor</i>	1.60	1.54
Somssich Hill 2/5	VER 2014.63.	<i>Glis minor</i>	1.46	1.66
Somssich Hill 2/5	VER 2014.63.	<i>Glis minor</i>	1.51	1.51
Somssich Hill 2/12	VER 2014.69.	<i>Glis minor</i>	1.46	1.49
Somssich Hill 2/13	VER 2014.66.	<i>Glis minor</i>	1.49	1.63
Somssich Hill 2/13	VER 2014.66.	<i>Glis minor</i>	1.46	1.51
Somssich Hill 2/13	VER 2014.67.	<i>Glis sackdillingensis</i>	1.57	1.71
Somssich Hill 2/13	VER 2014.66.	<i>Glis minor</i>	1.43	1.49
Somssich Hill 2/13	VER 2014.66.	<i>Glis minor</i>	1.54	1.49
Somssich Hill 2/13	VER 2014.66.	<i>Glis minor</i>	1.43	1.46
Somssich Hill 2/13	VER 2014.67.	<i>Glis sackdillingensis</i>	1.91	1.74
Somssich Hill 2/24	VER 2014.21.	<i>Glis minor</i>	1.51	1.63
Somssich Hill 2/24	VER 2014.20.	<i>Glis sackdillingensis</i>	1.77	1.91
Somssich Hill 2/26	VER 2014.15.	<i>Glis minor</i>	1.51	1.51
Somssich Hill 2/28	VER 2014.29.	<i>Glis minor</i>	1.54	1.57
Somssich Hill 2/28	VER 2014.29.	<i>Glis minor</i>	1.43	1.57
Somssich Hill 2/29	VER 2014.38.	<i>Glis sackdillingensis</i>	1.77	1.77
Somssich Hill 2/29	VER 2014.38.	<i>Glis sackdillingensis</i>	1.71	1.94
Somssich Hill 2/31	VER 2014.31.	<i>Glis sackdillingensis</i>	1.69	1.83
Somssich Hill 2/31	VER 2014.31.	<i>Glis sackdillingensis</i>	1.69	1.71
Somssich Hill 2/31	VER 2014.32.	<i>Glis minor</i>	1.46	1.63
Somssich Hill 2/36	VER 2014.44.	<i>Glis sackdillingensis</i>	1.71	1.83
Somssich Hill 2/40	VER 2014.54.	<i>Glis sackdillingensis</i>	1.74	2.03
Somssich Hill 2/45	VER 2014.60.	<i>Glis minor</i>	1.46	1.49

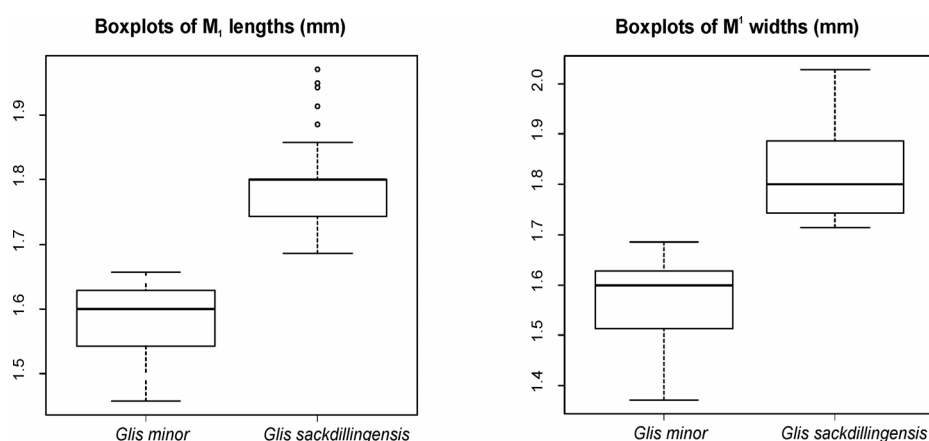
Table 3 (cont.)

Somssich Hill 2/45	VER 2014.60.	<i>Glis minor</i>	1.60	1.51
Somssich Hill 2/45	VER 2014.59.	<i>Glis sackdillingensis</i>	1.83	1.91
Somssich Hill 2/45	VER 2014.59.	<i>Glis sackdillingensis</i>	1.60	1.77
Somssich Hill 2/45	VER 2014.56.	<i>Glis minor</i>	1.46	1.63

show normal and unimodal distributions, while length of M_1 and width of M^1 both have non-normal and at least bimodal distributions (Table 4). As a consequence, in case of M_1 , *G. sackdillingensis* and *G. minor* were separated by the length of this tooth, while in case of M^1 the two species were separated by the width of M^1 (Fig. 10). On the basis of these results, length of *G. minor* M_1 was below 1.65 mm, while width of M^1 was below 1.7 mm. The bigger teeth were identified here as *G. sackdillingensis* (Fig. 11).

Table 4. Results of normality and modality tests, and Kruskal-Wallis rank sum test

Variable	P-values of normality tests		P-values of modality test
	Anderson-Darling test	Shapiro-Wilk test	Hartigan's diptest
Length of M_1	2.81×10^{-6}	5.35×10^{-4}	4.36×10^{-4}
Width of M_1	0.43	0.85	0.13
Length of M^1	0.06	0.19	5.6×10^{-4}
Width of M^1	7.12×10^{-12}	0.03	0.05
P-values of Kruskal-Wallis rank sum test			
M_1 of <i>Glis</i> species	1.89×10^{-12}		
M^1 of <i>Glis</i> species	2.58×10^{-12}		

Fig. 10. Boxplots of *Glis* M_1 length and M^1 width

The P -values of Kruskal-Wallis rank sum test were very low in the case of both the lower and the upper first molars, which means, that the two *Glis* species can be separated on the basis of these two teeth dimensions (Table 4).

Palaeoecology

Although dormice are relatively rare fossils, these animals have important role in the reconstruction of the palaeoenvironment. On the basis of recent ecological research made on glirids, these animals have extremely special environmental needs; therefore, dormice are excellent bioindicators (HECKER 2013). Recent dormice live almost exclusively in woods, which have shrubby undergrowth vegetation.

Dormice are abundant in three intervals within the sequence of Somssich Hill 2 locality (Fig. 12). Three taxa appear between layers 31–24, the two *Glis* species and *Muscardinus dacicus*, respectively. *G. sackdillingensis* is dominant in the first part of this interval (layers 31–29), and then *G. minor* becomes the prevalent species (between layers 28–24). All four dormice taxa appear between layers 15–12, with the dominance of *G. minor*. The last abundance peak, between layers 5–2, is characterized with the presence of all dormice taxa and the dominance of *G. minor*. Beyond these peaks, *D. eliomyoides* appears also in layers 44, 42, and 19.

According to investigation of other animals from this locality, relative abundance of glirids generally increases together with the abundance of some frogs (*Bombina variegata*, *Hyla arborea*, *Rana temporaria*), and mammals (*Beremendia fissidens*, *Apodemus* sp., *Pitymys arvalidens* and *Myodes* sp.) (Fig. 13). On the basis of ecological needs of the analogous recent species, these forms prefer moist environments with shrubby or woody vegetation (HÍR 1998; PAZONYI *et al.* 2013;

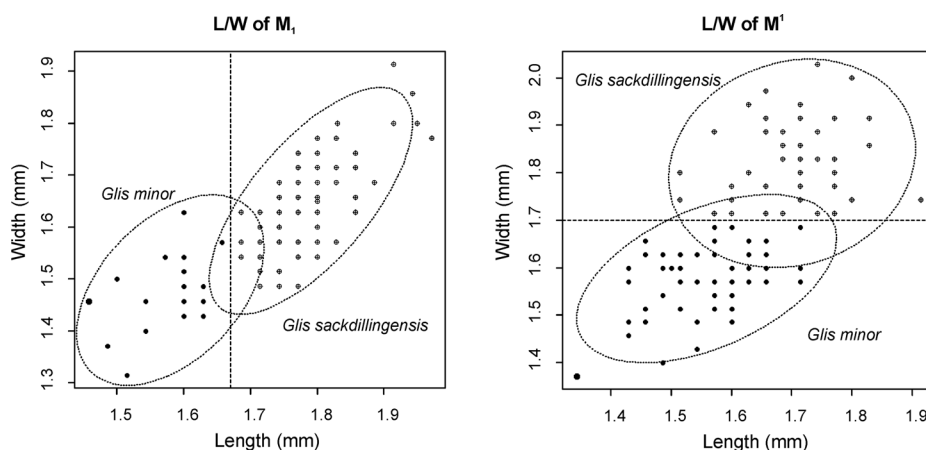


Fig. 11. Biplots of the length and width measurements made on *Glis* M_1 and M^1 from some Pliocene and Pleistocene localities (Podlesice, Osztamos 1, Somssich Hill 2, Kövesvárad, Uppony I. Shelter Cave, Sackdilling Cave, Tarkó Shelter Cave)

BOTKA & MÉSZÁROS in press; BOTKA & STRICZKY 2014; PAZONYI & VIRÁG 2014; SZENTESI 2014). Contrary to this observation, *Dryomimus eliomyoides* occurred in such intervals, when the typical steppe species (*Lagurus pannonicus*, *L. aranka*, *Cricetus runtonensis*, *Allocricetus bursae*) were dominant in the mammalian fauna (HÍR 1998; PAZONYI *et al.* 2013).

CONCLUSION

Although the dormice fauna of Somssich Hill 2 locality is not too rich compared to other mammalian taxa (e.g. the voles are represented by more than 15,000 specimens), four species (*Glis sackdillingensis*, *G. minor*, *Muscardinus dacicus*, *Dryomimus eliomyoides*) were determined. It is important to notice, that this site (late Early Pleistocene, 900 ka) represents the last known occurrence of *D. eliomyoides*. Based on the morphometrical analysis of *Glis* material from seven Pliocene and Pleistocene localities, *G. minor* occurred until the Holsteinian (MIS 11).

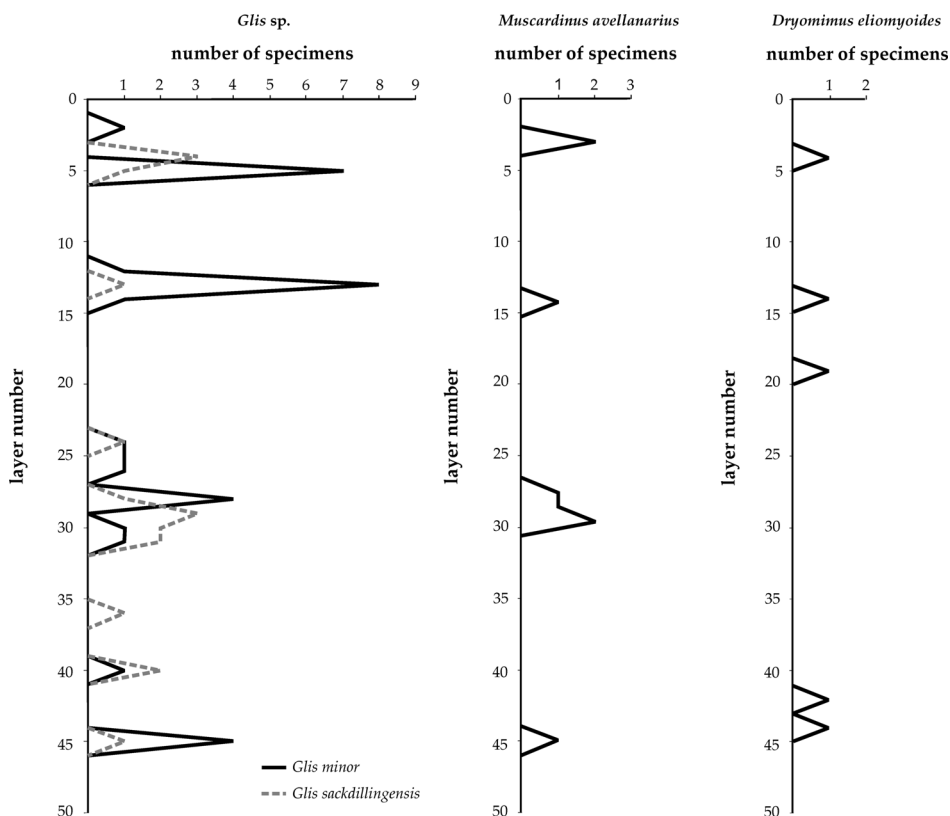


Fig. 12. Number of specimens of the two *Glis* species (*G. sackdillingensis* and *G. minor*), *Muscardinus avellanarius* and *Dryomimus eliomyoides* within the sequence of Somssich Hill 2 locality

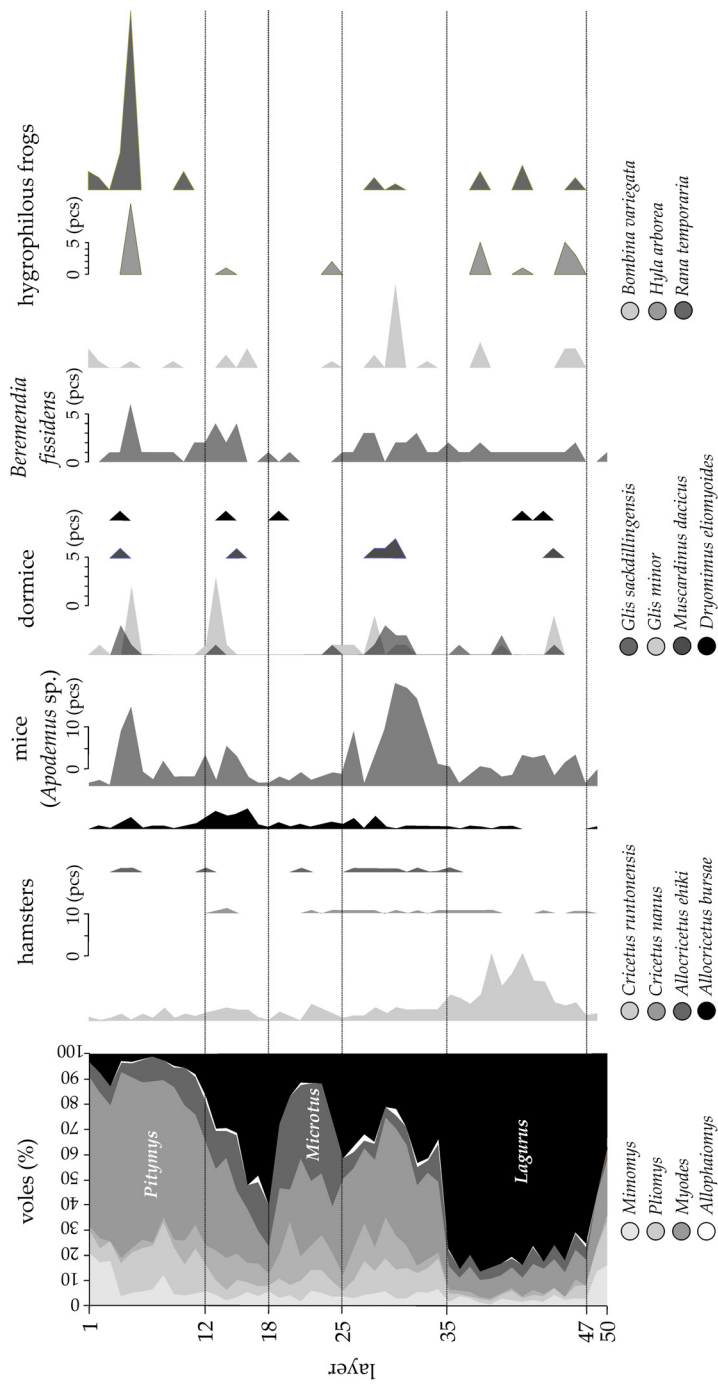


Fig. 13. Distribution of some vertebrate taxa (voles, hamsters, mice, dormice, *Beremendia fassidens* and hygrophilous frogs) within the sequence of Somssich Hill 2 locality

On the basis of our palaeoecological results, *Glis* and *Muscardinus* species lived in similar environments as today (woods, which had shrubby undergrowth vegetation), but *D. eliomyoides* preferred dryer steppe vegetation.

*

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