FRAGMENTA PALAEONTOLOGICA HUNGARICA
Volume 33 Budapest, 2016 pp. 135–154

Sorex (Mammalia, Soricidae) remains from the late Early Pleistocene Somssich Hill 2 locality (Villány Hills, Southern Hungary)

Dániel Botka & Lukács Mészáros

Eötvös Loránd University, Department of Palaeontology,
H-1117 Budapest, Pázmány Péter sétány 1/C, Hungary.
E-mail: botkadani@gmail.com, lgy.meszaros@gmail.com

Abstract – Three *Sorex* species (*Sorex minutus* Linnaeus, 1766, *Sorex runtonensis* Hinton, 1911, and *Sorex* (*Drepanosorex*) *savini* Hinton, 1911) are reported from the Somssich Hill 2 locality. *Sorex* (*Drepanosorex*) *margaritodon* Kormos, 1930 is regarded here as a synonym of *S.* (*D.*) *savini* Hinton, 1911. The *Sorex* species occurring in the site support its late Early Pleistocene age. *S. runtonensis* indicates open vegetation in the surroundings of the locality in the whole sequence, while *S. minutus* marks the presence of forested or bushy areas in some of the layers. With 8 figures and 9 tables.

Key words – Early Pleistocene, Somssich Hill, *Sorex minutus*, *Sorex runtonensis*, *Sorex* (*Drepanosorex*) *savini*, Soricidae

INTRODUCTION

The present article is the third part of the series published in this journal on the late Early Pleistocene Soricidae fauna of the Somssich Hill 2 locality in Villány Hills, Southern Hungary. Detailed description of the locality and the history of the investigation of its fossil material are given in Hungarian by Botka & Mészáros (2015*a*). Brief English overviews are shown in Botka & Mészáros (2014*b*).

The first report of the soricids from the Somssich Hill 2 locality was given by Jánossy (1983), who determined only five shrew species. Today, the material is under elaboration by the cooperative research group of the Hungarian Academy of Sciences, the Hungarian Natural History Museum, and the Eötvös Loránd University (OTKA K104506, project leader: Piroska Pazonyi) in the Department of Palaeontology and Geology of the Hungarian Natural History Museum. Seven shrew species were mentioned by Botka & Mészáros (2014*a*) in a preliminary report on this material. By this time, the *Beremendia* (Botka & Mészáros 2014*b*, 2015*a*) and *Crocidura* (Botka & Mészáros 2015*b*) specimens were described in detail. In this paper, three *Sorex* species (*Sorex minutus* Linnaeus, 1766,

S. runtonensis Hinton, 1911, and *S.* (*Drepanosorex*) *savini* Hinton, 1911) of the Somssich Hill 2 fossils are present with their taxonomic, biostratigraphical, and palaeoecological relations. Furthermore, a palaeobiogeographical summary was prepared in case of *S.* (*D.*) *savini*.

MATERIAL AND METHODS

The 50 layers yielded 4649 *Sorex* remains, 380 specimens of which were identified as *S. minutus*, 4069 as *S. runtonensis*, and 200 as *S.* (*D.*) *savini*. The studied material is stored in the Department of Palaeontology and Geology of the Hungarian Natural History Museum, Budapest. Inventory numbers are listed in Tables 1, 3, and 5. Abbreviations used in the descriptions and in the tables: I = incisor, A = antemolar, P = premolar, M = molar, M^x = upper tooth, M_x = lower tooth, L = length, W = width, H = height, BL = buccal length, LL = lingual length, AW = anterior width, PW = posterior width, n = number, min. = minimum, max. = maximum, SD = standard deviation, inv. n. = inventory number, spec. n. = number of specimens, teeth n. = number of teeth, MNI = minimum number of individuals. Morphological terms are used after Reumer (1984). Measurements are given in mm.

SYSTEMATIC DESCRIPTION

Phylum Vertebrata Linnaeus, 1758
Classis Mammalia Linnaeus, 1758
Order Eulipotyphla Waddell *et al.*, 1999
Family Soricidae Fischer von Waldheim, 1817
Subfamily Soricinae Fischer von Waldheim, 1817
Tribe Soricini Fischer von Waldheim, 1817
Genus *Sorex* Linnaeus, 1758

Sorex minutus Linnaeus, 1766
(Fig. 1)

1911 *Sorex minutus* Linnaeus – Hinton, p. 534, text-fig. 14a, tabs 1–2, pl. XXV, fig. 14.
1949 *Sorex minutus* Linnaeus – Friant, pp. 235–236, fig. 5.
1958 *Sorex* sp. – Kowalski, p. 12, fig. 3.
1959 *Sorex* cf. *minutus* Linnaeus – Sulimski, pp. 142–143, pl. IV, figs 3a-b.
1962 *Sorex minutus* Linnaeus – Sulimski, pp. 460–461, text-pl. II, figs 2a-b, 3a-b, pl. II, figs 4–5.
1972 *Sorex* cf. *minutus* Linnaeus – Rabeder, pp. 411–414, tab. 12, pl. 7, fig. 21.
1984 *Sorex minutus* Linnaeus – Reumer, pp. 24–32, tabs 3–7, figs 7–8, pls 3–6.
1991 *Sorex minutus* Linnaeus – Rzebik-Kowalska, pp. 324–331, text-figs 1–2, tabs II–III.

1999 *Sorex minutus* Linnaeus – Mészáros, pp. 52–53, tab. 2, fig. 3.
1999 *Sorex minutus* Linnaeus – Reumer & Hordijk, p. 260, tabs 2–3, figs 7–8.
2000 *Sorex minutus* Linnaeus – Rzebik-Kowalska, pp. 2–4, tabs II–III, figs 1A, C, E.
2001 *Sorex minutus* Linnaeus – Koufos *et al.*, pp. 56–57, tabs 5–6, pl. 2, figs 1–22.
2003 *Sorex* cf. *minutus* Linnaeus – Popov, pp. 45–48, tab. I, fig. 1.
2006 *Sorex minutus* Linnaeus – Rzebik-Kowalska, pp. 92–94, tabs VI–VII, fig. 4A.
2010 *Sorex* cf. *minutus* Linnaeus – Maul & Parfitt, pp. 95–96, tabs 4–5, figs 2A, B-b.
2013 *Sorex minutus* Linnaeus – Rzebik-Kowalska, pp. 11–12, tab. 14, fig. 2: 3.
2013 *Sorex minutus* Linnaeus – Mészáros, pl. 1, figs 1–2.
2015 *Sorex minutus* Linnaeus – Mészáros, p. 150, fig. 4.

Material – Table 1.

Measurements – Table 2.

Morphology – Very small sized *Sorex* form with fissident A^1. Its buccal posterior edge is placed at a sharp angle to the dorsal margin. Five upper antemolars are present. P^4 is pentagonal, M^1-M^2 are subquadrate, all of them with specifically concave posterior emargination. Hypocone and protocone are separated by a wide valley. I_1 is tricuspulate. The buccal cingulum is well-developed but narrow and usually undulate on the lower molars. The M_3 talonid is well-developed and basined. The anterior edge of the coronoid process is concave, the apex bends slightly towards anterior direction. The external temporal fossa is developed as a longitudinal groove. The coronoid spicule is usually present. The internal temporal fossa is high and triangular, continuing to the tip of the coronoid process.

Fig. 1. *Sorex minutus* Linnaeus, 1766, right mandible with I_1 fragment and A_2-M_2, Somssich Hill 2, layer 38, scale bar = 1 mm (after Mészáros 2015)

Table 1. *Sorex minutus* occurrences in the layers of the Somssich Hill 2 locality (for the abbreviations see "Material and methods")

Layer	inv. n.	spec. n.	teeth n.	MNI	Layer	inv. n.	spec. n.	teeth n.	MNI
1	–	–	–	–	26	VER 2016.3469.	2	2	1
2	–	–	–	–	27	VER 2016.3470.	10	14	2
3	–	–	–	–	28	VER 2016.3471.	18	17	4
4	V.82.155.	8	9	3	29	VER 2016.3472.	5	7	3
5	V.82.54.	15	20	3	30	VER 2016.3473.	5	7	3
6	V.82.113.	2	3	1	31	VER 2016.3474.	6	6	1
7	VER 2016.3460.	1	1	1	32	VER 2016.3475.	7	7	2
8	–	–	–	–	33	VER 2016.3476.	7	8	1
9	V.83.55.	1	1	1	34	–	–	–	–
10	V.83.117.	1	3	1	35	VER 2016.3477.	8	10	2
11	–	–	–	–	36	VER 2016.3478.	12	11	3
12	–	–	–	–	37	VER 2016.3479.	5	9	1
13	V.84.51.	9	13	3	38	VER 2016.3480.	20	21	3
14	V.89.18.	5	10	13	39	VER 2016.3481.	14	15	3
15	V.89.51.	5	7	3	40	VER 2016.3482.	26	31	5
16	V.89.101.	3	10	2	41	VER 2016.3483.	15	26	3
17	–	–	–	–	42	VER 2016.3484.	17	19	3
18	VER 2016.3461.	1	2	1	43	VER 2016.3485.	20	34	4
19	VER 2016.3462.	3	3	1	44	VER 2016.3486.	10	7	4
20	–	–	–	–	45	VER 2016.3487.	37	44	4
21	VER 2016.3464.	5	7	1	46	VER 2016.3488.	3	3	1
22	VER 2016.3465.	14	17	3	47	VER 2016.3489.	6	11	2
23	VER 2016.3466.	10	10	2	48	VER 2016.3490.	1	2	1
24	VER 2016.3467.	20	28	5	49	VER 2016.3491.	3	5	1
25	VER 2016.3468.	16	16	4	50	VER 2016.3492.	4	7	2

Table 2. Measurements of *Sorex minutus* teeth from the Somssich Hill 2 locality (for the abbreviations see "Material and methods")

		n.	min.	mean	max.	SD
M^1	LL	5	1.12	1.16	1.22	0.0498
	BL	5	1.12	1.16	1.22	0.0548
	AW	5	1.22	1.24	1.28	0.0261
	PW	5	1.20	1.26	1.32	0.0456
M^2	LL	5	0.94	1.00	1.12	0.0708
	BL	5	0.96	1.02	1.08	0.0510
	AW	5	1.20	1.23	1.26	0.0228
	PW	5	1.08	1.13	1.16	0.0335
M_1	L	5	1.12	1.14	1.18	0.0261
	W	5	0.60	0.65	0.72	0.0559
M_2	L	5	0.96	1.02	1.08	0.0477
	W	5	0.56	0.61	0.64	0.0390

Sorex runtonensis Hinton, 1911
(Fig. 2)

1911 *Sorex runtonensis* n. sp. – Hinton, p. 532, text-fig. 8a, tab. 2, pl. XXV, figs 8–9.
1911 *Sorex kennardi* n. sp. – Hinton, p. 533, text-fig. 11a, tabs 1–2, pl. XXV, fig. 11.
1930 *Sorex runtonensis* Hinton – Heller, p. 259, text-fig. 6, pl. XV, figs 5a-b.
1930 *Sorex araneoides* n. sp. – Heller, pp. 260–261, text-fig. 10, pl. XV, figs 4a-b.
1941 *Drepanosorex* (?) *runtonensis* (Hinton) – Kretzoi, p. 110, text-fig. 1B.
1958 *Sorex* cf. *runtonensis* Hinton – Kowalski, pp. 11–12, fig. 2.
1959 *Sorex helleri* n. sp. – Kretzoi, p. 247.
1959 *Sorex runtonensis* Hinton – Sulimski, pp. 140–142, pl. IV, figs 5a-c.
1962 *Sorex runtonensis* Hinton – Sulimski, pp. 458–459, text-pl. I, figs 3a-b.
1972 *Sorex* cf. *helleri* Kretzoi – Rabeder, pp. 409–411, tab. 11, pl. 6, figs 16–20.
1991 *Sorex runtonensis* Hinton – Rzebik-Kowalska, pp. 368–374, text-fig. 9, tab. XIX.
1996 *Sorex kennardi* Hinton – Harrison, pp. 205, 207–208, tabs I–III, figs 1B, 2–5, pl. 1.
1996 *Sorex runtonensis* Hinton – Harrison, pp. 209–210, figs 6–7.
2000 *Sorex runtonensis* Hinton – Rzebik-Kowalska, pp. 7–12, tabs VII–VIII, figs 3A-E, 4A-D.
2002 *Sorex* cf. *runtonensis* Hinton – Zaitsev & Baryshnikov, pp. 291–293, tab. 2, fig. 5.
2003 *Sorex runtonensis* Hinton – Popov, pp. 48–51, tab. II, fig. 3.
2006 *Sorex runtonensis* Hinton – Rzebik-Kowalska, pp. 95–99, tabs VIII–X, fig. 4B.
2006 *Sorex runtonensis* Hinton – Osipova *et al.*, pp. 133–135.
2010 *Sorex runtonensis* Hinton – Maul & Parfitt, p. 96, tab. 5, figs 2C-c, D-d.
2013 *Sorex runtonensis* Hinton – Rzebik-Kowalska, pp. 12–13, tabs 17–18, fig. 2: 4.
2013 *Sorex* sp.1 – Cuenca-Bescós *et al.*, fig. 4E.
2015 *Sorex runtonensis* Hinton – Mészáros, p. 150, fig. 5.
2016 *Sorex runtonensis* Hinton – Rofes *et al.*, pp. 6–10, tabs 1–2, figs 2–3.

Material – Table 3.

Measurements – Table 4.

Morphology – I^1 is slightly fissident, its dorsal and posterior margins form a sharp angle. The pentagonal P^4 has a well-developed parastyle and protocone.

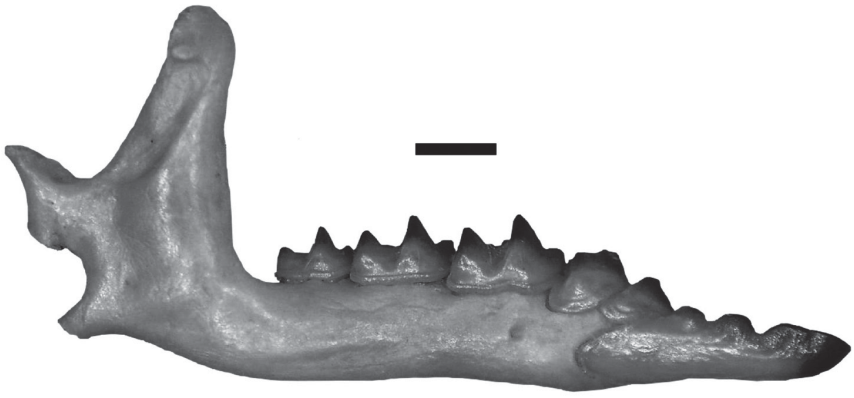

Fig. 2. *Sorex runtonensis* Hinton, 1911, right mandible with complete dentition, Somssich Hill 2, layer 45, scale bar = 1 mm (after Mészáros 2015)

Table 3. *Sorex runtonensis* occurrences in the layers of the Somssich Hill 2 locality (for the abbreviations see "Material and methods")

Layer	inv. n.	spec. n.	teeth n.	MNI	Layer	inv. n.	spec. n.	teeth n.	MNI
1	–	–	–	–	26	VER 2016.3501.	33	39	9
2	V.81.34.	2	4	1	27	VER 2016.3502.	69	96	14
3	V.81.85.	1	3	1	28	VER 2016.3503.	149	234	31
4	V.81.79., V.82.154., V. 82.66.	45	61	15	29	VER 2016.3504.	99	141	25
5	V.82.54.	95	144	20	30	VER 2016.3505.	56	73	15
6	V.82.113.	28	43	10	31	VER 2016.3506.	54	116	24
7	V.82.134.	19	27	8	32	VER 2016.3507.	141	205	24
8	V.83.32.	33	63	10	33	VER 2016.3508.	94	132	12
9	V.83.55.	13	15	4	34	VER 2016.3509.	53	67	9
10	V.83.117.	16	29	6	35	VER 2016.3510.	137	186	23
11	V.83.107.	9	27	4	36	VER 2016.3511.	152	171	19
12	V.84.24.	35	74	11	37	VER 2016.3512.	97	121	12
13	V.84.51.	41	94	15	38	VER 2016.3513.	67	94	10
14	V.89.18.	24	46	7	39	VER 2016.3514.	113	171	21
15	V.89.51., V.89.59.	34	59	8	40	VER 2016.3515.	128	183	19
16	V.89.101.	8	18	4	41	VER 2016.3516.	183	266	26
17	V.89.121.	5	9	2	42	VER 2016.3517.	237	349	33
18	VER 2016.3493.	12	20	3	43	VER 2016.3518.	253	343	31
19	VER 2016.3494.	14	26	4	44	VER 2016.3519.	324	515	37
20	VER 2016.3495.	9	12	2	45	VER 2016.3520.	327	431	25
21	VER 2016.3496.	5	7	1	46	VER 2016.3521.	194	305	40
22	VER 2016.3497.	69	92	16	47	VER 2016.3522.	205	317	21
23	VER 2016.3498.	53	60	14	48	VER 2016.3523.	67	111	20
24	VER 2016.3499.	39	56	7	49	VER 2016.3524.	79	103	11
25	VER 2016.3500.	103	151	11	50	VER 2016.3525.	46	56	5

Table 4. Measurements of *Sorex runtonensis* teeth from the Somssich Hill 2 locality, (for the abbreviations see "Material and methods")

		n.	min.	mean	max.	SD
M^1	LL	12	1.30	1.36	1.46	0.0497
	BL	12	1.28	1.35	1.44	0.0521
	AW	12	1.33	1.46	1.52	0.0531
	PW	12	1.48	1.55	1.60	0.0451
M^2	LL	12	1.12	1.16	1.28	0.0480
	BL	12	1.12	1.18	1.26	0.0473
	AW	12	1.48	1.51	1.58	0.0335
	PW	12	1.21	1.35	1.42	0.0533
M_1	L	12	1.44	1.51	1.60	0.0446
	W	12	0.80	0.86	0.92	0.0364
M_2	L	12	1.22	1.27	1.36	0.0395
	W	12	0.76	0.81	0.85	0.0283

The protocone is placed in the central part of the anterior side of the tooth. The subquadrate M^1 and M^2 have well developed hypocones and indistinct metalophs. M^1 is larger than M^2. The posterior emargination of P^4, M^1, and M^2 is moderately developed. The coronoid process is tall and leans forwards; its anterior margin is concave. The deep external temporal fossa runs along the posterior border of the process. The coronoid spicule is well-developed. The internal temporal fossa is high and triangular. I_1 is tricuspulate. M_1 is bigger than M_2 and its buccal cingulum is more undulate (it is straight on most of M_2 and M_3 teeth). The molars are characterized by high entoconid crests. M_3 is unreduced with basined talonid.

Sorex (*Drepanosorex*) *savini* Hinton, 1911
(Figs 3–4)

1911 *Sorex savini* n. sp. – Hinton, pp. 531–532, text-fig. 7a, tab. II, pl. XXV, figs 6–7.
1930 *Sorex margaritodon* n. sp. – Kormos, pp. 44, 57.
1935 *Sorex margaritodon* Kormos – Kormos, pp. 61–63, 67–72, figs 1–2.
1941 *Drepanosorex Tasnádii* n. g. n. sp. – Kretzoi, pp. 109–110, text-fig. 1A.
1965 *Drepanosorex* sp. (*savini*-Gruppe) – Kretzoi, pp. 118–119, figs 1–3.
1985 *Sorex* (*Drepanosorex*) *margaritodon* Kormos – Reumer, p. 55, figs 1–2.
1985 *Sorex* (*Drepanosorex*) *savini* Hinton – Reumer, pp. 55–56, fig. 3.
1991 *Sorex* (*Drepanosorex*) *savini* Hinton – Rzebik-Kowalska, pp. 389–395, text-figs 13–14, tabs XXVII–XXVIII.
2000 *Sorex* (*Drepanosorex*) *margaritodon* Kormos – Rzebik-Kowalska, pp. 17–21, tabs XVI–XVII, figs 6B-F.
2010 *Sorex* (*Drepanosorex*) *savini* Hinton – Maul & Parfitt, p. 96, tabs 4–5, figs 2e-F, G-g.
2011 *Sorex* (*Drepanosorex*) *savini* Hinton – Wagner *et al.*, fig. 6Q.
2013 *Sorex* (*Drepanosorex*) *margaritodon* Kormos – Rzebik-Kowalska, pp. 19–22, tab. 23, fig. 4: 1.
2013 *Sorex* sp. 2 – Cuenca-Bescós *et al.*, fig. 4F.
2013 *Sorex* (*Drepanosorex*) *margaritodon* Kormos – Rofes & Cuenca-Bescós, pp. 532–536, tabs 2–3, figs 2–3.
2015 *Sorex margaritodon* Kormos – Mészáros, p. 149, fig. 3.

Material – Table 5.

Measurements – Table 6.

Morphology – Large-sized shrew with exoedaenodont dental elements and light-orange pigmentation. I^1 is fissident, its dorsal and posterior margins form a sharp angle. A^1-A^2 are large and longer than broad. A^3-A^5 are smaller and broader than long. M^1 is always square, M^2 is varied in shape: oblong or square. The metalophs are present on most of M^1 and M^2. M^1 is somewhat larger than M^2. The tip of the coronoid process is usually wide with well-visible coronoid spicule. The internal temporal fossa is high. I_1 is tricuspulate. M_1 is bigger and more elongated than M_2. Buccal cingula are not undulate on the lower molars and their entoconid crests are high.

Taxonomic remarks – *Sorex savini* was described by Hinton (1911) from West Runton, England. In the Püspökfürdő (Betfia, Romania) material, Kormos

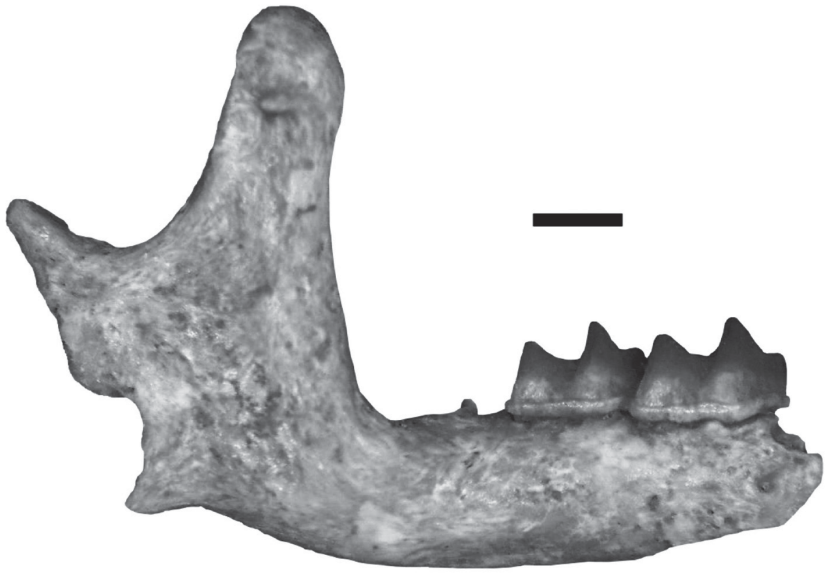

Fig. 3. *Sorex* (*Drepanosorex*) *savini* Hinton, 1911, right mandible fragment with M_1-M_2, Somssich Hill 2, layer 45, scale bar = 1 mm (after Mészáros 2015)

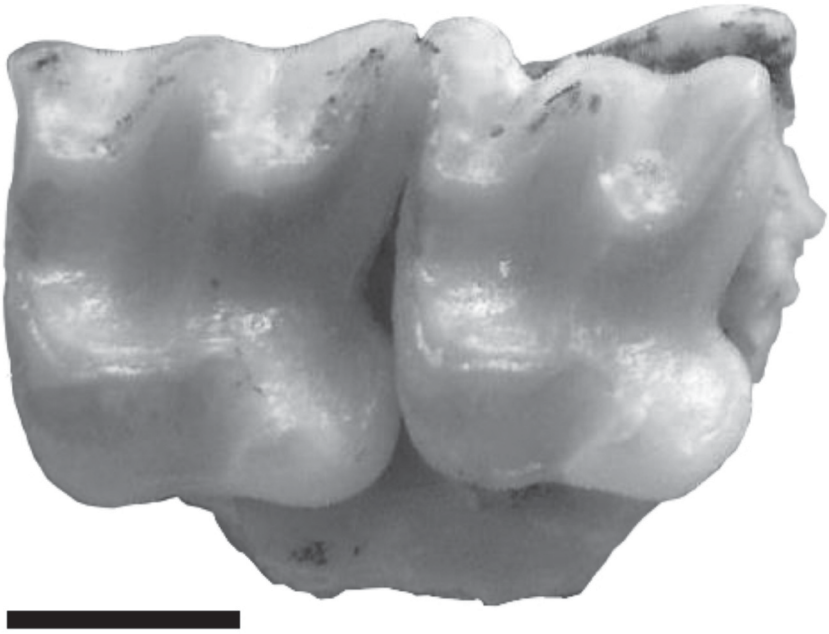

Fig. 4. *Sorex* (*Drepanosorex*) *savini* Hinton, 1911, left maxillary fragment with M^1-M^2, Somssich Hill 2, layer 40, scale bar = 1 mm

Table 5. *Sorex* (*Drepanosorex*) *savini* occurrences in the layers of the Somssich Hill 2 locality (for the abbreviations see "Material and methods")

Layer	inv. n.	spec. n.	teeth n.	MNI	Layer	inv. n.	spec. n.	teeth n.	MNI
1	–	–	–	–	26	VER 2016.3531.	–	–	–
2	–	–	–	–	27	–	–	–	–
3	–	–	–	–	28	VER 2016.3532.	2	4	1
4	V.82.85., V.82.151.	3	3	1	29	VER 2016.3533.	4	5	2
5	V.82.54.	12	16	2	30	VER 2016.3534.	1	2	1
6	V.82.113.	3	4	1	31	VER 2016.3535.	2	5	2
7	V.82.134.	2	4	2	32	VER 2016.3536.	1	2	1
8	V.83.32.	3	4	2	33	VER 2016.3537.	5	8	1
9	V.83.55.	1	1	1	34	VER 2016.3538.	2	6	1
10	–	–	–	–	35	VER 2016.3539.	13	16	2
11	V.83.107.	1	2	1	36	VER 2016.3540.	4	7	2
12	V.84.24.	1	3	1	37	VER 2016.3541.	5	5	1
13	V.84.51.	5	8	2	38	VER 2016.3542.	5	17	1
14	–	–	–	–	39	VER 2016.3543.	8	8	3
15	V.89.51.	3	5	1	40	VER 2016.3544.	11	19	2
16	V.89.101.	1	4	1	41	VER 2016.3545., VER 2016.3546.	9	15	2
17	–	–	–	–	42	VER 2016.3547.	13	24	3
18	–	–	–	–	43	VER 2016.3548.	3	10	2
19	–	–	–	–	44	VER 2016.3549.	3	3	1
20	–	–	–	–	45	VER 2016.3550.	11	15	2
21	VER 2016.3526.	1	1	1	46	VER 2016.3551.	15	36	5
22	VER 2016.3527.	11	19	2	47	VER 2016.3552.	3	3	1
23	VER 2016.3528.	8	12	2	48	VER 2016.3553.	3	8	2
24	VER 2016.3529.	14	28	5	49	–	–	–	–
25	VER 2016.3530.	8	14	2	50	–	–	–	–

Table 6. Measurements of *Sorex* (*Drepanosorex*) *savini* teeth from the Somssich Hill 2 locality (for the abbreviations see "Material and methods")

		n.	min.	mean	max.	SD
M^1	LL	13	1.53	1.62	1.71	0.0583
	BL	13	1.56	1.67	1.76	0.0558
	AW	13	1.68	1.83	1.94	0.0750
	PW	13	1.85	1.94	2.10	0.0830
M^2	LL	8	1.36	1.43	1.52	0.0519
	BL	8	1.36	1.44	1.48	0.0412
	AW	8	1.80	1.89	1.96	0.0490
	PW	8	1.66	1.78	1.90	0.0993
M_1	L	8	1.76	1.87	2.06	0.0907
	W	8	1.04	1.09	1.16	0.0397
M_2	L	10	1.56	1.65	1.75	0.0607
	W	10	0.96	1.01	1.04	0.0234

(1930) distinguished another species for a similar form as *S. margaritodon* on the basis of its smaller size than *S. savini*.

Rzebik-Kowalska (1991) demonstrated that the measurements of the two species considerably overlap and they are morphologically similar, therefore she synonymized them. Later, on the basis of her studies on the Betfia specimens, she observed that M^2 of *S.* (*D.*) *margaritodon* is oblong, opposite to the square one of *S.* (*D.*) *savini*. Based on this character and the difference in the presence of M^2 metaloph, she found that *S.* (*D.*) *margaritodon* is a separate species (Rzebik-Kowalska 2000).

Rofes & Cuenca-Bescós (2013) described *Drepanosorex* remains from Sima del Elefante, Spain, with square M^2 with metaloph. They classified those as *S.* (*D.*) *margaritodon* only by morphometrical analysis but the few data they worked on are not convincing to separate *S.* (*D.*) *savini* and *S.* (*D.*) *margaritodon*.

The form reported here is somewhat bigger than the Betfia specimens and it has square M^2 with metaloph. The remains discussed here have larger dimensions than the type material of Kormos (1930), thus they rather seem to belong to *S.* (*D.*) *savini*. However, the measurements of the Somssich Hill 2 specimens overlap those of the specimens described as *S.* (*D.*) *margaritodon* by Rzebik-Kowalska (2000) and by Rofes & Cuenca-Bescós (2013) (Fig. 5). Hence, the present authors

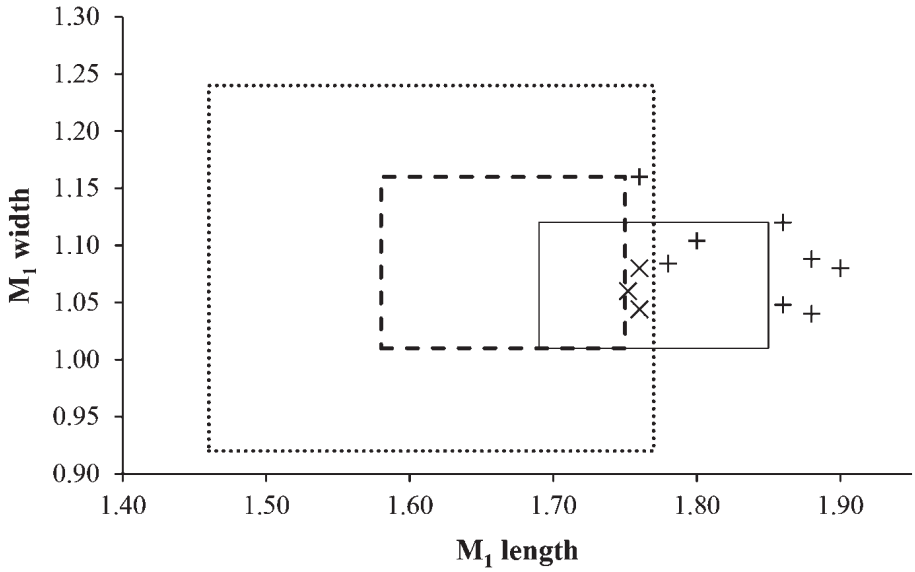

Fig. 5. M_1 length and width of *Sorex* (*Drepanosorex*) *savini* Hinton, 1911 discussed in the present paper (+ marker), in comparison with the material described by Kormos (1930) from Püspökfürdő (Betfia) as *Sorex margaritodon* n. sp. (X marker). These measurements overlap with the areas delineated on the basis of the min. and max. data given by Rzebik-Kowalska (1991) on *S.* (*D.*) *savini* (broken line), Rzebik-Kowalska (2000) on *S.* (*D.*) *margaritodon* (dotted line) and Rofes & Cuenca-Bescós (2013) on *S.* (*D.*) *margaritodon* (permanent line). The measurements are given in mm

think that *Sorex* (*Drepanosorex*) *margaritodon* Kormos, 1930 is a synonym of *Sorex* (*Drepanosorex*) *savini* Hinton, 1911, and determined the Somssich Hill 2 specimens as *S.* (*D.*) *savini*, which is the earlier, valid name. The proof of this hypothesis needs further morphometrical analyses but it is supported by the palaeobiogeographical data (Tables 7–8, Fig. 6). The tiny differences between the two species recognized by some authors may be the consequences of intraspecific variability like in case of *S. runtonensis* (Osipova *et al.* 2006) or subspecific characters.

There are only 4 localities where both of the aforementioned *Drepanosorex* species were described. Mészáros (2015) mentioned *Sorex margaritodon* from the Somssich Hill 2 locality, Hungary, but these remains are reconsidered as *S.* (*D.*) *savini* in the present article. Both of the species were described from Valerots, France and from Deutsch-Altenburg 2C, Austria. There were some transitional specimens found in Untermassfeld, Germany, and those are considered

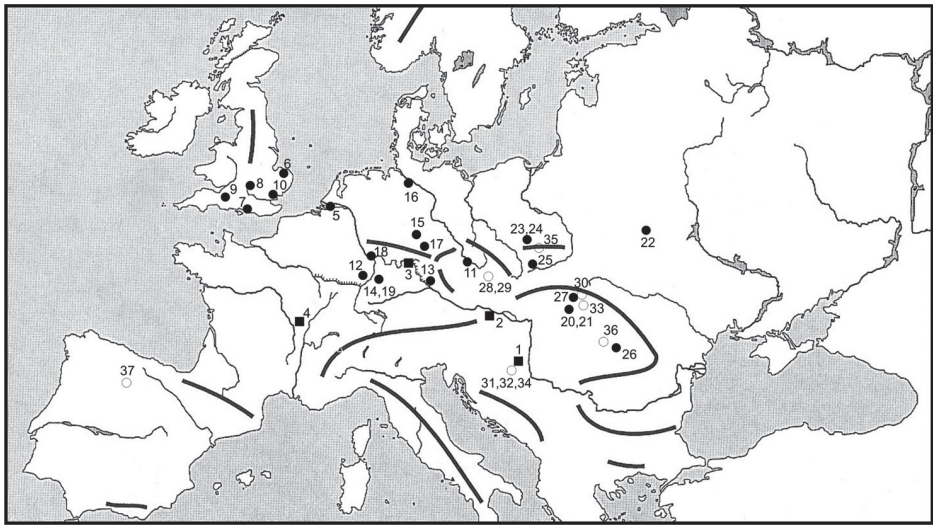

Fig. 6. The occurrences of the *S.* (*D.*) *savini* and *S.* (*D.*) *margaritodon* species in Europe. The solid squares mark the presence of both species, the solid circles indicate the localities with *S.* (*D.*) *savini*, while the empty circles sign the sites with *S.* (*D.*) *margaritodon*. 1 = Somssich Hill 2, Hungary; 2 = Deutsch-Altenburg, Austria; 3 = Untermassfeld, Germany; 4 = Valerots (Cote d'Or), France; 5 = Zuurland, The Netherlands; 6 = West Runton, England; 7 = Boxgrove, England; 8 = Sugworth, England; 9 = Westbury-sub-Mendip, England; 10 = Ostend, England; 11 = Přezletice, Czech Republic; 12 = Hohensülzen, Germany; 13 = Sackdillinger Höhle, Germany; 14 = Mosbach, Germany; 15 = Sudmer-Berg, Germany; 16 = Husarenhof, Germany; 17 = Voigtstedt, Germany; 18 = Miesenheim, Germany; 19 = Mauer, Germany; 20 = Uppony, Hungary; 21 = Tarkő, Hungary; 22 = Kuznetsovka, Ukraine; 23 = Zamkowa Dolna Cave, Poland; 24 = Zalesiaki, Poland; 25 = Kozi Grzbiet, Poland; 26 = Subpiatră, Romania; 27 = Gombasek, Slovakia; 28 = Holštejn, Czech Republic; 29 = Mladečská Cave, Czech Republic; 30 = Včeláre, Slovakia; 31 = Beremend, Hungary; 32 = Nagyharsányhegy, Hungary; 33 = Osztramos, Hungary; 34 = Villány, Hungary; 35 = Żabia Cave, Poland; 36 = Betfia, Romania; 37 = Sima del Elefante (Atapuerca), Spain (see the references in Tables 7–8)

Table 7. List of the European occurrences of *Sorex* (*Drepanosorex*) *savini*

Countries, localities	Pleistocene			References
	MN 17	Early	Middle	
The Netherlands				
Zuurland	cf.			Reumer & Hordijk (1999)
Austria				
Deutsch-Altenburg 2C		+		Rabeder (1972)
England				
West Runton			+	Hinton (1911); Maul & Parfitt (2010)
Boxgrove			+	Parfitt (1999)
Sugworth			cf.	Stuart (1980)
Westbury-sub-Mendip			+	Bishop (1982)
Ostend			+	Stuart (1982)
Czech Republic				
Přezletice			+	Maul (2001); Maul & Parfitt (2010)
Germany				
Untermassfeld		+		Kahlke (2000); Maul (2001)
Hohensülzen		+		Storch *et al.* (1973)
Sackdillinger Höhle		cf.		Brunner (1934)
Mosbach			+	Bahlo & Malec (1969)
Sudmer-Berg 2			+	Koenigswald (1972)
Husarenhof 4			+	Koenigswald (1973)
Voigtstedt			+	Maul (2001); Maul & Parfitt (2010)
Miesenheim I			+	van Kolfschoten & Turner (1996)
Mauer			+	Wagner *et al.* (2011)
Hungary				
Somssich Hill 2		+		present article
Uppony 1, layer 10			+	Jánossy (1986)
Tarkő 5–7, 9–13, 15			+	Jánossy (1986)
Ukraine				
Kuznetsovka			+	Agadjanian & Kondrashov (2007)
Poland				
Zamkowa Dolna Cave C		+	+	Rzebik-Kowalska (1991); Stefaniak *et al.* (2009)
Zalesiaki 1A		+		Rzebik-Kowalska (1991)
Kozi Grzbiet			+	Rzebik-Kowalska (1991)
Romania				
Subpiatră		+	+	Hír & Venczel (1992)
Slovakia				
Gombasek		+		Kretzoi (1941)
France				
Valerots (Cote d'Or)		+		Chaline *et al.* (1985); Erbajeva *et al.* (2001)

Table 8. List of the European occurrences of *Sorex* (*Drepanosorex*) *margaritodon*

Countries, localities	Pleistocene			References
	MN 17	Early	Middle	
Austria				
Deutsch-Altenburg 2C, 4A, 30A		+		Mais & Rabeder (1984)
Czech Republic				
Holštejn		+		Fejfar & Horáček (1983)
Mladečská Cave 1		+		Horáček & Ložek (1988)
Slovakia				
Včeláre 4A/7		+		Fejfar & Horáček (1983)
Hungary				
Beremend 16		aff.		Jánossy (1996)
Nagyharsányhegy 4		+		Jánossy (1986)
Osztramos 2		cf.		Jánossy & Kordos (1977); Jánossy (1986)
Osztramos 8		+		Jánossy & Kordos (1977); Jánossy (1986)
Somssich Hill 2		+		Mészáros (2015)
Villány 5, 6		+		Jánossy (1986)
Villány 8		+	+	Jánossy (1986)
France				
Valerots (Cote d'Or)		+		Erbajeva *et al.* (2001)
Germany				
Untermassfeld		+		Kahlke (2000); Maul (2001)
Poland				
Żabia Cave		+		Stefaniak *et al.* (2009); Rzebik-Kowalska (2013)
Romania				
Betfia VII/1, X, XI, XIII	+			Terzea (1994); Rzebik-Kowalska (2000, 2002)
Betfia II		+		Kormos (1930); Maul (2001)
Betfia V, VII/3		+		Terzea (1994); Rzebik-Kowalska (2000, 2002)
Betfia IX		+		Rzebik-Kowalska (2000, 2002)
Betfia VII/4			+	Rzebik-Kowalska (2000, 2002)
Spain				
Sima del Elefante TE7–14		+		Rofes & Cuenca-Bescós (2013); Cuenca-Bescós *et al.* (2013, 2015); Garcia *et al.* (2014); Huguet *et al.* (2017); Rofes *et al.* (2016)

as *S. margaritodon-savini*. In Figure 6 is visible that the areas of the two species do not separate from each other in time and space (Fig. 6).

CONCLUSIONS

Biostratigraphy

The first report of *S. minutus* is from the Pliocene (Late Ruscinian, MN 15 zone) and this is the only modern shrew species of the locality (Reumer 1984). *S. runtonensis* appeared at the beginning of the Early Pleistocene (MN 17 zone; Varshets, Bulgaria, Popov 2003) and became extinct by the Late Pleistocene (ca. 33 ka; Obłazowa 2 Cave, Poland, Osipova *et al.* 2006). *S.* (*D.*) *savini* is mentioned (either as *S.* (*D.*) *savini* or as *S.* (*D.*) *margaritodon*) from the Early Pleistocene (MN 17 zone; Zuurland, The Netherlands, Reumer & Hordijk 1999; and Betfia VII/1, X, XI, XIII, Terzea 1994; Rzebik-Kowalska 2000, 2002) up to the Toringian Stage of the Middle Pleistocene (ca. 320 ka; Tarkő 5–7 layers, Jánossy 1986).

Hence, the late Early Pleistocene age of the Somssich Hill 2 locality is supported by the stratigraphic ranges of the *Sorex* species occurring here (Fig. 7). The numeric age of the locality is around 950 ka based on ESR (electron spin resonance) dating, but an approximately 200 kyr age difference was suggested between the lowermost and uppermost part of the section (Pazonyi *et al.* 2016). This period is referred to the Biharian Stage in the Carpathian Basin (Fig. 7, Maul *et al.* 2014).

Palaeoecology

The ecological composition of the Somssich Hill 2 *Sorex* assemblage is varied (Table 9). *Sorex minutus* is the only recent species of the locality; it has a preference for wooded and bushy areas, where they spend part of their time burrowing or on the surface (Reumer 1984; Rzebik-Kowalska 1995). Contrarily, *S. runtonensis* is an indicator of arid and relatively open environments as the recent Alaskan and Siberian shrew, *S. tundrensis* Merriam, 1900 (Osipova *et al.* 2006). *S.* (*D.*) *savini* is probably an open water indicator (Kormos 1935; Reumer 1984; Maul & Parfitt 2010) or an opportunistic form.

The high relative abundance of *S. runtonensis* in the site (Fig. 8) indicates open vegetation in the surroundings of the locality in the whole sequence, while *S. minutus* points to the presence of forests or bushy areas in some of the layers. However, the detailed palaeoecological conclusions can be deducted only in the synopsis of the entire soricid fauna of the locality (mainly in comparison of *Crocidura* and *Sorex* occurrences). This review is going to be published by the authors in the next volume of the present journal.

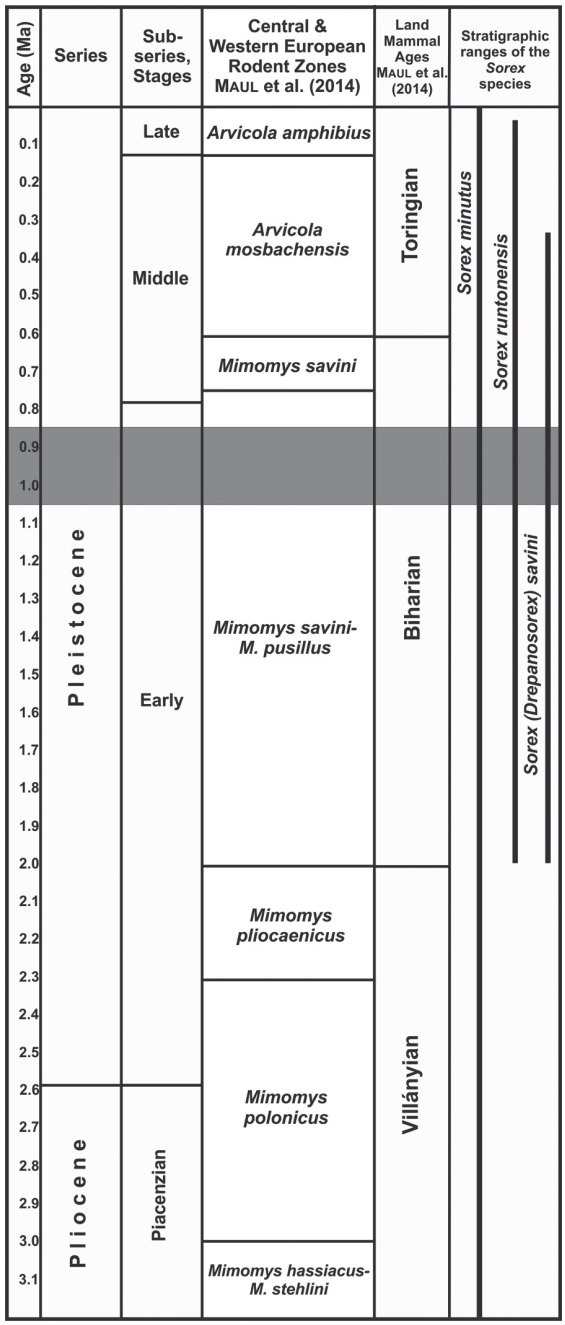

Fig. 7. Stratigraphical position of the Somssich Hill 2 locality (after MAUL *et al.* 2014 and PAZONYI *et al.* 2016) and the stratigraphical range of the studied *Sorex* species

Table 9. The specific content of the Somssich Hill 2 *Sorex* fauna (MNI and % of the entire *Sorex* assemblage, layer by layer)

Layer	*S. minutus*		*S. runtonensis*		*S. (D.) savini*		Layer	*S. minutus*		*S. runtonensis*		*S. (D.) savini*	
	MNI	%	MNI	%	MNI	%		MNI	%	MNI	%	MNI	%
1	0	0.00	0	0.00	0	0.00	26	1	10.00	9	90.00	0	0.00
2	0	0.00	1	100.00	0	0.00	27	2	12.50	14	87.50	0	0.00
3	0	0.00	1	100.00	0	0.00	28	4	11.11	31	86.11	1	2.78
4	3	15.79	15	78.95	1	5.26	29	3	10.00	25	83.33	2	6.67
5	3	12.00	20	80.00	2	8.00	30	3	15.79	15	78.95	1	5.26
6	1	8.33	10	83.33	1	8.33	31	1	3.70	24	88.89	2	7.41
7	1	9.09	8	72.73	2	18.18	32	2	7.41	24	88.89	1	3.70
8	0	0.00	10	83.33	2	16.67	33	1	7.14	12	85.71	1	7.14
9	1	16.67	4	66.67	1	16.67	34	0	0.00	9	90.00	1	10.00
10	1	14.29	6	85.71	0	0.00	35	2	7.41	23	85.19	2	7.41
11	0	0.00	4	80.00	1	20.00	36	3	12.50	19	79.17	2	8.33
12	0	0.00	11	91.67	1	8.33	37	1	7.14	12	85.71	1	7.14
13	3	15.00	15	75.00	2	10.00	38	3	21.43	10	71.43	1	7.14
14	13	65.00	7	35.00	0	0.00	39	3	11.11	21	77.78	3	11.11
15	3	25.00	8	66.67	1	8.33	40	5	19.23	19	73.08	2	7.69
16	2	28.57	4	57.14	1	14.29	41	3	9.68	26	83.87	2	6.45
17	0	0.00	2	100.00	0	0.00	42	3	7.69	33	84.62	3	7.69
18	1	25.00	3	75.00	0	0.00	43	4	10.81	31	83.78	2	5.41
19	1	20.00	4	80.00	0	0.00	44	4	9.52	37	88.10	1	2.38
20	0	0.00	2	100.00	0	0.00	45	4	12.90	25	80.65	2	6.45
21	1	33.33	1	33.33	1	33.33	46	1	2.17	40	86.96	5	10.87
22	3	14.29	16	76.19	2	9.52	47	2	8.33	21	87.50	1	4.17
23	2	11.11	14	77.78	2	11.11	48	1	4.35	20	86.96	2	8.70
24	5	29.41	7	41.18	5	29.41	49	1	8.33	11	91.67	0	0.00
25	4	23.53	11	64.71	2	11.76	50	2	28.57	5	71.43	0	0.00

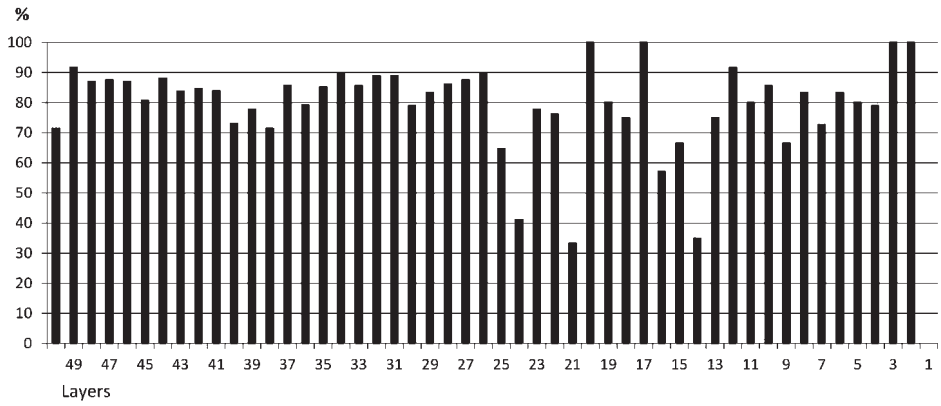

Fig. 8. Relative abundance of *S. runtonensis* within the *Sorex* assemblage of the Somssich Hill 2 locality, layer by layer (MNI)

Acknowledgements – The work was supported by the Hungarian Scientific Research Fund (OTKA K104506 project). The authors are indebted to the members of the OTKA Research Team, mainly to Piroska Pazonyi (project leader), Zoltán Szentesi, Mihály Gasparik and Attila Virág for their useful help and valuable suggestions. Special thanks to Piroska Pazonyi for the useful reviewer comments.

REFERENCES

Agadjanian A. K. & Kondrashov P. E. 2007: Mollusks and small mammals from the Kuznetsovka locality, Pleistocene of the Oka-Don Plain. – *Paleontological Journal* **41**(4): 395–406. http://dx.doi.org/10.1134/S0031030107040053

Bahlo E. & Malec F. 1969: Insectivoren (Mammalia) aus den Oberen Mosbacher Sanden (Mittelpleistozän) bei Wiesbaden-Biebrich/Hessen. – *Mainzer Naturwissenschaftliches Archiv* **8**: 56–76.

Bishop M. J. 1982: The Mammal Fauna of the early Middle Pleistocene Cavern Infill Site of Westbury-sub-Mendip, Somerset. – *Special Papers in Palaeontology* **28**: 1–108.

Botka D. & Mészáros L. 2014*a*: A Somssich-hegy 2-es lelőhely alsó-pleisztocén Soricidae faunája. [The Lower Pleistocene Soricidae fauna of the Somssich Hill 2 locality.] – In: Bosnakoff M. & Dulai A. (eds): *Program, Előadáskivonatok, Kirándulásvezető, 17. Magyar Őslénytani Vándorgyűlés,* Győr, pp. 10–11. (in Hungarian)

Botka D. & Mészáros L. 2014*b*: *Beremendia* (Mammalia, Soricidae) remains from the late Early Pleistocene Somssich Hill 2 locality (Southern Hungary) and their taxonomic, biostratigraphical, palaeoecological and palaeobiogeographical relations. – *Fragmenta Palaeontologica Hungarica* **31**: 83–115. http://dx.doi.org/10.17111/FragmPalHung.2014.31.83

Botka D. & Mészáros L. 2015*a*: A Somssich-hegy 2-es lelőhely (Villányi-hegység) alsó-pleisztocén *Beremendia fissidens* (Mammalia, Soricidae) maradványainak taxonómiai és paleoökológiai vizsgálata. (Taxonomic and palaeoecological studies on the Lower Pleistocene *Beremendia fissidens* (Mammalia, Soricidae) remains of the Somssich Hill 2 locality (Villány Hills).) – *Földtani Közlöny* **145**(1): 73–84. (in Hungarian, with English abstract)

Botka D. & Mészáros L. 2015*b*: *Crocidura* (Mammalia, Soricidae) remains from the late Early Pleistocene Somssich Hill 2 locality (Villány Hills, Southern Hungary). – *Fragmenta Palaeontologica Hungarica* **32**: 67–98. http://dx.doi.org/10.17111/FragmPalHung.2015.32.67

Brunner G. 1934: Eine präglaciale fauna aus dem Windloch bei Sackdilling (Oberpfalz). – *Neues Jahrbuch für Mineralogie, Geologie und Paläontologie* **B71**: 303–328.

Chaline J., Renault-Miskovsky J., Brochet G., Clement-Dels R., Jammot D., Mourer-Chauvire C., Bonvalot J., Lang J., Leneuf N. & Pascal A. 1985: L'aven des Valerots (Nuits-Saint-Georges, Côte-d'Or), site de référence du Pléistocène inférieur. – *Revue de Géographie Physique et de Géologie Dynamique* **2**(2): 109–118.

Cuenca-Bescós G., Blain H.-A., Rofes J., Lozano-Fernández I., López-García J. M., Duval M., Galán J. & Núñez-Lahuerta C. 2015: Comparing two different Early Pleistocene microfaunal sequences from the caves of Atapuerca, Sima del Elefante and Gran Dolina (Spain): biochronological implications and significance of the Jaramillo subchron. – *Quaternary International* **389**: 148–158. http://dx.doi.org/10.1016/j.quaint.2014.12.059

Cuenca-Bescós G., Rofes J., López-García J. M., Blain H.-A., Rabal-Garcés R., Sauqué V., Arsuaga J. L., Bermúdez de Castro J. M. & Carbonell E. 2013: The small mammals of Sima del Elefante (Atapuerca, Spain) and the first entrance of *Homo* in Western Europe. – *Quaternary International* **295**: 28–35. http://dx.doi.org/10.1016/j.quaint.2011.12.012

Erbajeva M. A., Montuire S. & Chaline J. 2001: New ochotonids (Lagomorpha) from the Pleistocene of France. – *Geodiversitas* **23**(3): 395–409.

Fejfar O. & Horáček I. 1983: Zur Entwicklung der Kleinsäugerfaunen im Villányium und Alt-Biharium auf dem Gebiet der ČSSR. – *Schriftenreihe für Geologische Wissenschaften* **19–20**: 111–207.

Friant M. 1949: Les Musaraignes (Soricidae) quaternaires et actuelles de l'Europe occidentale. – *Annales de la Societe Geologique du Nord* **67**: 222–269.

Garcia J., Martínez K., Cuenca-Bescós G. & Carbonell E. 2014: Human occupation of Iberia prior to the Jaramillo magnetochron (>1.07 Myr). – *Quaternary Science Reviews* **98**: 84–99. http://dx.doi.org/10.1016/j.quascirev.2014.05.031

Harrison D. L. 1996: Systematic status of Kennard's shrew (*Sorex kennardi* Hinton, 1911, Insectivora: Soricidae): a study based on British and Polish material. – *Acta Zoologica Cracoviensia* **39**: 201–212.

Heller F. 1930: Eine Forest-Bed-Fauna aus der Sackdillinger Höhle (Oberpfalz). – *Neues Jahrbuch für Mineralogie, Geologie und Paläontologie, Abteilung* **B63**: 247–298.

Hinton M. A. C. 1911: I. — The British Fossil Shrews. – *Geological Magazine (Decade V)* **8**(12): 529–539.

Hír J. & Venczel M. 1992: The arvicolids (Rodentia, Mammalia) of the Lower Pleistocene vertebrate fauna of Subpiatră. – *Nymphaea* **22**: 75–91.

Horáček I. & Ložek V. 1988: Palaeozoology and the Mid-European Quaternary past: scope of the approach and selected results. – *Rozpravy ČSAV, Řada matematických a přírodních věd* **98**: 1–102.

Huguet R., Vallverdú J., Rodríguez-Álvarez X. P., Terradillos-Bernal M., Bargalló A., Lombera-Hermida A., Menéndez L., Modesto-Mata M., Van der Made J., Soto M., Blain H.-A., García N., Cuenca-Bescós G., Gómez-Merino G., Pérez-Martínez R., Expósito I., Allué E., Rofes J., Burjachs F., Canals A., Bennásar M., Nuñez-Lahuerta C., Bermúdez de Castro J. M. & Carbonell, E. 2017: Level TE9c of Sima del Elefante (Sierra de Atapuerca, Spain): A comprehensive approach. – *Quaternary International* **433**: 278-295. http://dx.doi.org/10.1016/j.quaint.2015.11.030

Jánossy D. 1983: Lemming-remain from the Older Pleistocene of Southern Hungary (Villány, Somssich Hill 2). – *Fragmenta Mineralogica et Palaeontologica* **11**: 55–60.

Jánossy D. 1986: *Pleistocene Vertebrate Faunas of Hungary*. – Akadémiai Kiadó, Budapest, 208 pp.

Jánossy D. 1996: Lower Pleistocene vertebrate faunas from the localities 16 and 17 of Beremend (Southern Hungary). – *Fragmenta Mineralogica et Palaeontologica* **18**: 91–102.

Jánossy D. & Kordos L. 1977: Az Osztramos gerinces lelőhelyeinek faunisztikai és karsztmorfológiai áttekintése (1975-ig). [Faunistical and karstmorphological review of palaeontological localities for vertebrates at Osztramos (Northern Hungary)]. – *Fragmenta Mineralogica et Palaeontologica* **8**: 39–72. (in Hungarian)

Kahlke R. D. 2000: The Early Pleistocene (Epivillafranchian) faunal site of Untermassfeld (Thuringia, Central Germany): Synthesis of new results. – *Eraul* **92**: 123–138.

Koenigswald W. von 1972: Sudmer-Berg-2, eine Fauna des frühen Mittelpleistozäns aus dem Harz. – *Neues Jahrbuch für Geologie und Paläontologie, Abhandlungen* **141**(2): 194–221.

Koenigswald W. von 1973: Husarenhof 4, eine alt- bis mittelpleistozäne Kleinsäugerfauna aus Württemberg mit *Petauria*. – *Neues Jahrbuch für Geologie und Paläontologie, Abhandlungen* **143**(1): 23–38.

Kolfschoten T. van & Turner E. 1996: Early Middle Pleistocene mammalian faunas from Kärlich and Miesenheim I and their biostratigraphical implications. – In: Turner E. (ed.): *The early Middle Pleistocene in Europe*, Balkema, Rotterdam, pp. 227–253.

Kormos T. 1930: Új adatok a püspökfürdői Somlyóhegy preglaciális faunájához. [New data of the praeglacial fauna of Somlyó Hill, Betfia.] – *Állattani Közlemények* **27**: 40–62.

Kormos T. 1935: Die perlzähnige Spitzmaus (*Sorex margaritodon* Korm.) und das Anpassungsproblem. – *Állattani Közlemények* **32**(1–2): 61–79.

Koufos G. D., Vassiliadou K. V., Koliadimou K. K. & Syrides G. E. 2001: Early Pleistocene small mammals from Marathoussa, a new locality in the Mygdonia basin, Macedonia, Greece. – *Deinsea* **8**: 49–102.

Kowalski K. 1958: An early Pleistocene fauna of small mammals from Kadzielnia Hill in Kielce (Poland). – *Acta Palaeontologica Polonica* **3**(1): 1–47.

Kretzoi M. 1941: Weitere Beiträge zur Kenntnis der Fauna von Gombaszög. – *Annales historico-naturales Musei nationalis hungarici* **34**: 105–139.

Kretzoi M. 1959: Insectivores, rodents and lagomorphs of the early Pleistocene fauna of Csarnóta in the Villány area (South Hungary). – *Vertebrata Hungarica* **1**: 237–246.

Kretzoi M. 1965: *Drepanosorex* – neu definiert. – *Vertebrata Hungarica* **7**(1–2): 117–129.

Mais K. & Rabeder G. 1984: Das größe Höhlensystem im Pfaffenberg bei Bad Deutsch-Altenburg (Niederösterreich) und seine fossilen Faunen. – *Die Höhle* **35**(3–4): 213–230.

Maul L. 2001: Die Kleinsäugerreste (Insectivora, Lagomorpha, Rodentia) aus dem Unterpleistozän von Untermassfeld. – In: Kahlke R. D. (ed.): Das Pleistozän von Untermassfeld bei Meiningen. *Römisch-Germanisches Zentralmuseums, Monographien* **40**(3): 783–887.

Maul L. C., Masini F., Parfitt S. A., Rekovets L. & Savorelli A. 2014: Evolutionary trends in arvicolids and the endemic murid *Mikrotia* – new data and a critical overview. – *Quaternary Science Reviews* **96**: 240–258. http://dx.doi.org/10.1016/j.quascirev.2013.09.017

Maul L. C. & Parfitt S. A. 2010: Micromammals from the 1995 Mammoth Excavation at West Runton, Norfolk, UK: Morphometric data, biostratigraphy and taxonomic reappraisal. – *Quaternary International* **228**(1): 91–115. http://dx.doi.org/10.1016/j.quaint.2009.01.005

Mészáros L. Gy. 1999: Uppermost Pleistocene shrews (Mammalia, Soricidae) from Vaskapu Cave (N-Hungary). – *Annales Universitatis Scientiarum Budapestinensis, Sectio Geologica* **32**: 49–56.

Mészáros L. 2013: Review of the Late Pleistocene Soricidae (Mammalia) fauna of the Vaskapu Cave (North Hungary). – *Hantkeniana* **8**: 163–169.

Mészáros L. 2015: Palaeoecology of the Early Pleistocene Somssich Hill 2 locality (Hungary) based on *Crocidura* and *Sorex* (Mammalia, Soricidae) occurrences. – *Hantkeniana* **10**: 147–152.

Osipova V. A., Rzebik-Kowalska B. & Zaitsev M. V. 2006: Intraspecific variability and phylogenetic relationships of the Pleistocene shrew *Sorex runtonensis* (Soricidae). – *Acta theriologica* **51**(2): 129–138. http://dx.doi.org/10.1007/BF03192664

Parfitt S. A. 1999: Mammalia. – In: Roberts M. B. & Parfitt S. A. (eds): *Boxgrove: Middle Pleistocene Hominid Site at Eartham Quarry, Boxgrove, West Sussex*, English Heritage, London, pp. 197–290.

Pazonyi P., Mészáros L., Szentesi Z., Gasparik M., Virág A., Gere K., Mészáros R., Botka D., Braun B. & Striczky L. 2016: Taxonomical, taphonomical and paleoecological aspects of a late Early Pleistocene vertebrate fauna from the Somssich Hill 2 site (South Hungary). – In: Holwerda F., Madern A., Voeten D., van Heteren A., Meijer H. & den Ouden N. (eds): *XIV Annual Meeting of the European Association of Vertebrate Palaeontologists, Programme and Abstract Book, Koninklijke Nederlandse Akademie van Wetenschappen*, Haarlem, The Netherlands, p. 36.

Popov V. V. 2003: Late Pliocene Soricidae (Insectivora, Mammalia) from Varshets (North Bulgaria). – *Acta Zoologica Cracoviensia* **46**: 43–72.

Rabeder G. 1972: Die Insectivoren und Chiropteren (Mammalia) aus dem Altpleistozän von Hundsheim (Niederösterreich). – *Annalen des naturhistorischen Museums in Wien* **76**: 375–474.

Reumer J. W. F. 1984: Ruscinian and early Pleistocene Soricidae (Insectivora, Mammalia) from Tegelen (The Netherlands) and Hungary. – *Scripta Geologica* **73**: 1–173.

Reumer J. W. F. 1985: The generic status and species of *Drepanosorex* reconsidered (Mammalia, Soricidae). – *Revue de Paléobiologie* **4**(1): 53–58.

Reumer J. W. F. & Hordijk L. W. 1999: Pleistocene Insectivora (Mammalia) from the Zuurland boreholes near Rotterdam, The Netherlands. – In: Reumer J. W. F. & De Vos J. (eds): Elephants have a snorkel! Papers in honour of Paul Yves Sondaar. – *Deinsea* **7**: 253–281.

Rofes J. & Cuenca-Bescós G. 2013: First record of *Sorex* (*Drepanosorex*) *margaritodon* (Mammalia, Soricidae) in Western Europe: biostratigraphy, biogeography and evolution of the species. – *Paläontologische Zeitschrift* **87**(4): 529–541. http://dx.doi.org/10.1007/s12542-013-0172-6

Rofes J., Moya-Costa R., Bennàsar M., Blain H. A. & Cuenca-Bescós G. 2016: Biostratigraphy, palaeogeography and palaeoenvironmental significance of *Sorex runtonensis* Hinton, 1911 (Mammalia, Soricidae): First record from the Iberian Peninsula. – *Palaeogeography, Palaeoclimatology, Palaeoecology* **459**: 508–517. http://dx.doi.org/10.1016/j.palaeo.2016.07.021

Rzebik-Kowalska B. 1991: Pliocene and Pleistocene Insectivora (Mammalia) of Poland. VIII. Soricidae: *Sorex* Linnaeus, 1758, *Neomys* Kaup, 1829, *Macroneomys* Fejfar, 1966, *Paenelimnoecus* Baudelot, 1972 and Soricidae indeterminata. – *Acta Zoologica Cracoviensia* **34**(2): 323–424.

Rzebik-Kowalska B. 1995: Climate and history of European shrews (family Soricidae). – *Acta Zoologica Cracoviensia* **38**(1): 95–107.

Rzebik-Kowalska B. 2000: Insectivora (Mammalia) from the Early and early Middle Pleistocene of Betfia in Romania. I. Soricidae Fischer von Waldheim, 1817. – *Acta Zoologica Cracoviensia* **43**(1–2): 1–53.

Rzebik-Kowalska B. 2002: The Pliocene and Early Pleistocene Lipotyphla (Insectivora, Mammalia) from Romania. – *Acta Zoologica Cracoviensia* **45**(2): 251–281.

Rzebik-Kowalska B. 2006: Erinaceomorpha and Soricomorpha (Mammalia) from the Late Pleistocene and Holocene of Krucza Skała Rock Shelter and Komarowa Cave (Poland). – *Acta Zoologica Cracoviensia* **49**(1–2): 83–118.

Rzebik-Kowalska B. 2013: *Sorex bifidus* n. sp. and the rich insectivore mammal fauna (Erinaceomorpha, Soricomorpha, Mammalia) from the Early Pleistocene of Żabia Cave in Poland. – *Palaeontologia Electronica* **16**(2/12A): 1–35.

Stefaniak K., Tyc A. & Socha P. (eds) 2009: *Karst of the Częstochowa Upland and of the Eastern Sudetes: palaeoenvironments and protection.* – Studies of the Faculty of Earth Sciences University of Silesia, Wroclaw, 535 pp.

Storch G., Franzen J.-L. & Malec F. 1973: Die altpleistozäne Säugerfauna (Mammalia) von Hohensülzen bei Worms. – *Senckenbergiana lethaea* **54** (2–4): 311–343.

Stuart A. J. 1980: The vertebrate fauna from the interglacial deposits at Sugworth, near Oxford. – *Philosophical Transactions of the Royal Society of London* **B289**: 87–97.

Stuart A. J. 1982: *Pleistocene Vertebrates in the British Isles.* – University of Cambridge, Longman Publishing House, London/New York, 208 pp.

Sulimski A. 1959: Pliocene insectivores from Weze. – *Acta Palaeontologica Polonica* **4**: 119–173.

Sulimski A. 1962: Supplementary studies on the insectivores from Weze 1 (Poland). – *Acta Palaeontologica Polonica* **7**: 441–502.

Terzea E. 1994: Fossiliferous sites and the chronology of mammal faunas at Betfia (Bihor, Romania). – *Travaux du Museum National d'Histoire Naturelle "Grigore Antipa"* **34**: 467–485.

Wagner G. A., Maul L. C., Löscher M. & Schreiber H. D. 2011: Mauer – the type site of *Homo heidelbergensis*: palaeoenvironment and age. – *Quaternary Science Reviews* **30**(11): 1464–1473. http://dx.doi.org/10.1016/j.quascirev.2010.01.013

Zaitsev M. V. & Baryshnikov G. F. 2002: Pleistocene Soricidae (Lipotyphla, Insectivora, Mammalia) from Treugolnaya Cave, Northern Caucasus, Russia. – *Acta Zoologica Cracoviensia* **45**(2): 283–305.