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CRICETUS CF. RUNTONENSIS (NEWTON, 1909) (CRICETIDAE, RODENTIA) FROM ZA HÁJOVNOU CAVE (THE CZECH REPUBLIC)

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Abstract. Isolated finds of a fossil hamster from Za Hájovnou Cave are attributed to the Middle Pleistocene taxon *Cricetus* cf. *runtonensis* NEWTON, 1909 on the basis of morphometric data. Their occurrence within the rusty deposits of the Kopaná chodba cave section probably indicates a rather humid and mild climate during the time of fossil accumulation.

■ *Cricetus*, Middle Pleistocene, Za Hájovnou Cave, Moravia

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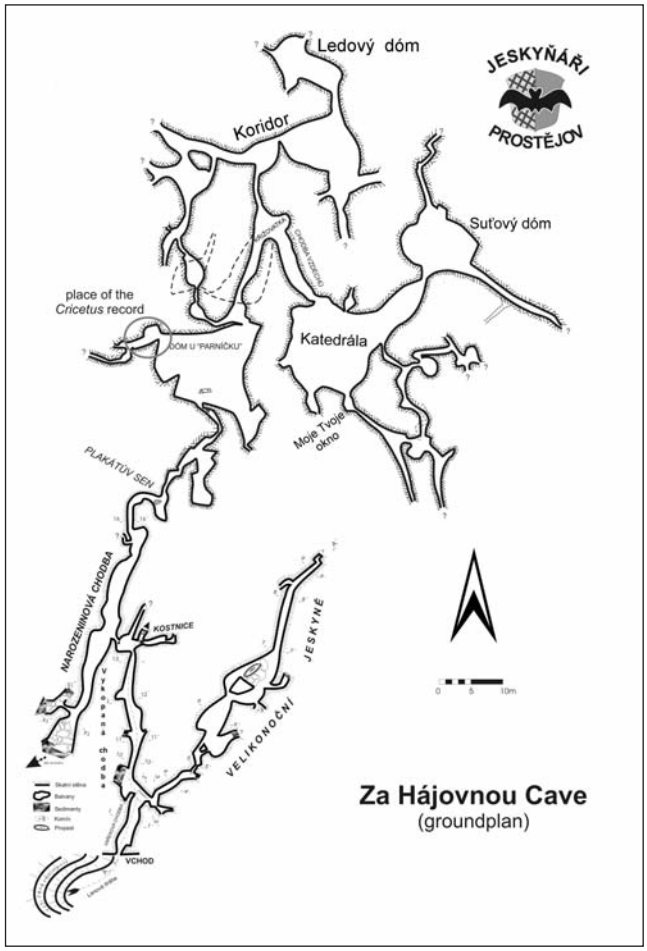
Introduction

In addition to fossil remains of voles (Arvicolinae) and murids (Muridae), those of hamsters (Cricetinae) are relatively frequently found in Quaternary sediments. The Pleistocene Cricetinae are represented in Central Europe by four to five genera – *Cricetus* LESKE, 1779; *Cricetulus* MILNE-EDWARDS, 1867; *Cricetinus* ZDANSKY, 1928; *Allocricetus* SCHAUB, 1930; *Rhinocricetus* KRETZOI, 1956; and *Phodopus* Miller, 1910. According to the classifications by McKenna and Bell (1997), however, *Cricetinus* and *Allocricetus* should be considered as synonymous with *Cricetulus*. *Rhinocricetus* is only known from the Early to Middle Pleistocene of Europe (McKenna and Bell 1997) and it was also considered to be synonymous with *Allocricetus* or *Cricetulus*. *Cricetinus* is a hamster genus of Asiatic origin, occurring in Eastern and Central Europe only during the late Early Pliocene to the earliest Pleistocene (MN 15 – MN 17) (Kälin 1999). *Allocricetus* first appeared in Europe in the Early Pliocene. The oldest record is known from Maramena (MN 14) in Greece (Kälin 1999) and Ivanovce (MN 15) in Slovakia (Fejfar 1970). The genus became extinct during the Late Pleistocene (Hír 1997b), probably before the beginning of the Last Glacial (Jánossy 1986). *Cricetulus migratorius* (PALLAS, 1773), today living only in the Middle East, was recorded in Central Europe during the Late Pleistocene and the early Holocene (Hír 1997b), although the genus could have already occured in Europe before the Late Pliocene (Topachevskiy and Skorik 1992, Kälin 1999). *Cricetus* still survives in Europe at the presen day with one species, *C. cricetus* (LINNAEUS, 1758). In the Quaternary of Europe, this genus was represented by four different species which may all represent indepedent lineages (Hír 1997b): 1) *C. nanus* SCHAUB, 1933 (Early Pleistocene), 2) *C. praeglacialis* SCHAUB, 1930 (Early to Middle Pleistocene) – *C. cricetus* (Late Pleistocene to Holocene), 3) *C. runtonensis* NEWTON, 1909 (Early to Middle/Late Pleistocene), and 4) *C. major* WOLDŘICH, 1880 (Middle to Late Pleistocene). Some palaeontologist (e.g. Kowalski 2001), however, doubt the phylogenetic and taxonomic relevance of these taxa and consider them mere ecomorphs or subspecies of *C. cricetus*. So far, only fossils of *C. major* (Woldřich 1880) and the slightly smaller *C. cricetus* (Horáček and Ložek 1988) have been found in the Quaternary deposits of Moravia. The isolated fossil remains of *C.* cf. *runtonensis* from Za Hájovnou Cave are the first record of this taxon in Moravia, although a fossil record of *Cricetus* sp. is also mentioned from Early to Middle Pleistocene from some other Moravian sites (Horáček and Ložek 1988, Kučera et al. 2009), this could also correspond with *C. runtonensis*.

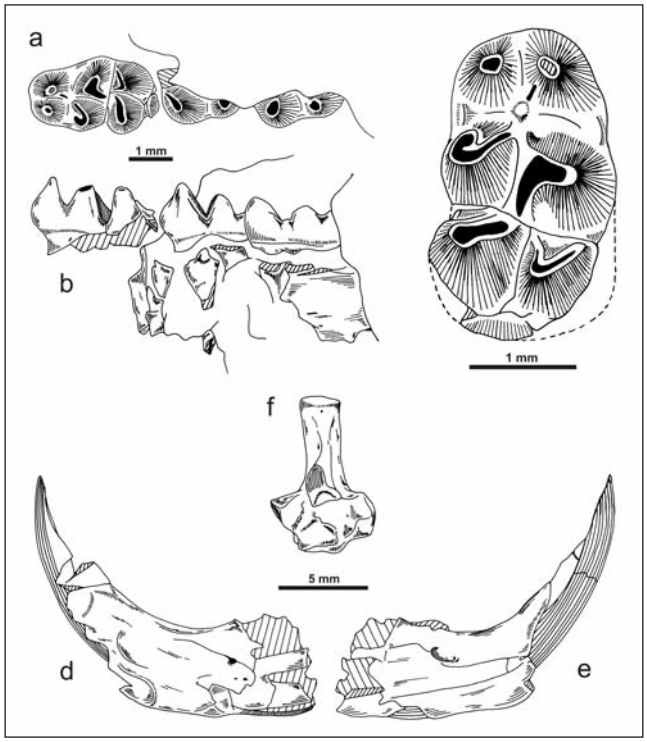
Material and methods

Fossil remains of *Cricetus* were found during a speleological exploration in 2013 in the so called Kopaná chodba (= Dug Corridor) within the Dóm u Parníčku (= Dome near the Steamer) cave part, which was discovered in 2012. The fossil material consists of a fragmented right mandible with dentition and left calcaneus. The fossils were deposited in yellow-brown to red-brown loam sediments cemented by a sinter, originally forming a chimney filling. The material is housed in the collections of the Moravian Museum – Museum Anthropos in Brno. Presumably, both the specimens represent one adult individual.

The dental remains were identified on the basis of their size and morphology. Measurements were taken according to Hír (1997c) with the ocular-micrometer of a stereomicroscope



Text-fig. 1. Ground plan of Za Hájovnou Cave (according to A. Tomica from 2012) with the cave part where cricetid fossils were found marked.



Text-fig. 2. Fossil remains of *Cricetus* cf. *runtonensis* Newton, 1909 from Za Hájovnou Cave (Moravia, Czech Republic), Middle Pleistocene. a–b) lower molar row (a – occlusal view, b – lingual view); c) m1 dext., occlusal view; d–e) left mandible fragment with incisor (d – lingual view, e – buccal view); f) calcaneus sin., anterior view.

(with an accuracy of 0.01 mm). The terminology of dental elements follows Mein and Freudenthal (1971a, b). Since the cricetid record from the site represents only an isolated find, no statistical methods could be used for more detailed evaluation.

Systematic palaeontology

Family: **Muridae Illiger, 1811**

Subfamily: **Cricetinae Fischer de Waldheim, 1817**

Genus: ***Cricetus* Leske, 1779**

***Cricetus* cf. *runtonensis* Newton, 1909**

Text-fig. 2

1909 *Newton, E. T.*, Hamster remains from the Norfolk Forest Bed. Geological Magazine, 6, London, 110-117.

Locus Typicus. West Runton, Norfolk, England (Cromerian Complex, early Middle Pleistocene).

Stratigraphic and geographic range. Early to late Middle Pleistocene (Nagyharsányhegyian to Solymárian substages), Europe.

Species characteristics. A relatively large extinct representative of the genus *Cricetus*, smaller than *C. major*, but larger than *C. praeglacialis* and *C. cricetus*, with a cusp-shaped entostyle on M1 and M2, and an ectostyle on m2 and m3 with more frequently doubled mesolophid in stratigraphically later forms (Hír 1997b, c, 1998; modified).

Material. A right fragmented mandible with dentition (incisor, isolated m1, and m2 – m3 in the rock) and a left calcaneus. The bones are a light colour (brown-white) and teeth crowns are white.

Description. The anterior part of the mandible fragment includes a slightly damaged incisor. The mental foramen is large, situated below the diastema, between the incisor and m1. The rest of the mandible ramus is located below the molars in the rock. The m1 is damaged in the posterior part on both lateral sides. This tooth is isolated but in anatomical order with m2 and m3, belonging to the posterior part of the mandible. The double-cuspid anteroconid of m1 is more or less isolated, slightly worn on the lingual conelet tip and damaged on the buccal conelet. The anterolophulid can be considered more likely to be reduced rather than connected to the buccal conelet of the anteroconid. Other cuspids (metaconid, protoconid, entoconid, hypoconid) are moderately worn. The mesolophid is missing. Since the posterior part of the crown is damaged, the morphology of the posterolophulid cannot be classified. The remaining part, however, suggests that it was probably simple rather than ramified. Based on that, this molar would more likely represent morphotype F1a than E1a as defined

by Hír (1997a, c, 1998). The two morphotypes differ in the level of anterolophulid reduction (reduced in the F1a morphotype and non-reduced, connected to the anteroconid buccal conelet in the E1a morphotype).

The lower molars (m2 and m3) are mostly covered by rock, and only the lingual cuspids (larger metaconid and lower entoconid) can be recognized. The antero-buccal part of m2 crown is absent.

The left calcaneus is completely preserved, probably belonging to the same individual as the fragmented mandible with teeth. The calcaneus is 9.0 mm long and 6.1 mm wide from the peroneal process to the medial tip of the sustentaculum. The calcaneal tubercle is long, transversely compressed with a slightly expanded proximal head. The calcaneoastragalar facet is convex and smoothly rounded. The sustentacular facet is flat and faces more or less dorsally. The narrow and relatively poorly defined sulcus calcaneus separates the sustentacular facet from the calcaneoastragalar facet. The sustentaculum talus is prominent, projecting medially. The distinct, shelf-shaped peroneal process is more expanded proximodistally, situated almost at the same level as the sustentaculum talus. The anterior plantar tubercle is faint, positioned more medially.

Discussion

The Pleistocene species of *Cricetus* are morphologically relatively uniform but differ in size. Larger samples, however, demonstrate also differences in their morphotype frequencies. For example, the majority of m1 morphotypes of *C. runtonensis* from Somssich-hegy 2 (Early Pleistocene) belong to the E1a morphotype (Hír 1998), whereas in *C. runtonensis* from Solymár (late Middle Pleistocene) (*C. runtonensis solymarensis*) the D1a morphotype predominates (Hír 1997c). Within the lineage *C. praeglacialis – C. cricetus*, a successive simplification of m1 morphology can be observed, in contrast to the tendency in *C. runtonensis* (Hír 1997a). Most m1s of *C. praeglacialis* from Villány 8 (Early Pleistocene) belong to the E1a morphotype, whereas recent samples of *C. cricetus* from Germany, Poland, and Hungary possess the more primitive morphotype F1a (Hír 1997a). The assumed morphotype of m1 from Za Hájovnou Cave is probably F1a, and indicates a relatively primitive stage, more similar to the situation in *C. cricetus* than in *C. runtonensis*, although the F1a morphotype is also frequently represented within samples of *C. runtonensis* (the second most frequent form in material from Somssich-hegy 2 and the third most frequent morphotype of m1s from Solymár).

Cricetus molars are bigger than those in the small-sized forms of *Allocricetus* and *Cricetulus*. Within *Cricetus*, the Early Pleistocene species *C. nanus* is the smallest and *C. major* from the Early/Middle to the Late Pleistocene is the largest species, whereas *C. runtonensis* (Early to Middle/Late Pleistocene) is larger than members of the *C. praeglacialis – C. cricetus* lineage (Early Pleistocene to Holocene). The calculated measurements of m1 from Za Hájovnou Cave (Tab. 1) are more similar to those of *C. runtonensis* from Hungarian (Solymár, Somssich-hegy 2) and Polish sites (Kozi Grzbiet, Zamkowa Dolna, Zalesiaki 1) than to those of modern *C. cricetus* or *C. praeglacialis* from Villány 8 (cf. Pradel 1988, Hír 1997c, 1998). However, overlaps in size do exist. For this reason, the fossil hamster remains from Za Hájovnou Cave in Moravia are referred as *Cricetus* cf. *runtonensis* Newton, 1909.

Table 1. Size comparison of m1 from Za Hájovnou Cave with that of various Quaternary species of *Cricetus* (L = length, WA = anterior width, WP = posterior width). Measurements in mm. Data source: Fahlbusch 1986, Fejfar 1970, Hír 1997a, 1997c, 1998, Pradel 1988.

Cricetus species		m1			
		N	min.	max.	mean
C. nanus (Somssich-hegy 2)	L	12	2.54	2.85	2.70
	WA	12	0.91	1.20	1.08
	WP	12	1.45	1.70	1.58
C. runtonensis (Zalesiaki 1)	L	3	2.98	3.64	3.36
	WA	3	1.62	1.92	1.79
	WP	3	1.82	2.04	1.92
C. runtonensis (Zamkowa Dolna)	L	1	–	–	3.20
	WA	1	–	–	1.74
	WP	1	–	–	1.85
C. runtonensis (Kozi Grzbiet)	L	31	3.01	3.74	3.35
	WA	28	1.65	2.05	1.82
	WP	31	1.80	2.10	1.94
C. runtonensis (Somssich-hegy 2)	L	187	2.98	3.73	3.29
	WA	187	1.10	1.55	1.30
	WP	187	1.73	2.28	1.88
C. runtonensis (Solymár)	L	73	3.13	3.53	3.30
	WA	72	1.15	1.50	1.33
	WP	72	1.75	2.15	1.91
C. major (Petersbuch 1)	L	–	–	-	3.72
	WP	–	–	–	2.17
C. cf. *major* (Koněprusy – C 718)	L	9	3.55	4.00	–
	WP	9	2.00	2.35	–
C. praeglacialis (Betfia)	L	19	2.87	3.37	3.12
	WA	19	1.15	2.47	1.28
	WP	19	1.60	2.00	1.80
C. praeglacialis (Villány 8)	L	358	2.82	3.45	3.13
	WA	353	1.00	1.50	1.26
	WP	345	1.63	2.05	1.83
C. cricetus (Recent, Poland)	L	45	2.87	3.50	3.20
	WA	47	1.61	1.81	1.71
	WP	45	1.70	1.97	1.83
C. cricetus (Recent, Hungary)	L	168	2.73	3.25	2.99
	WA	167	0.85	1.38	1.16
	WP	169	1.65	1.98	1.79
C. cf. *runtonensis* (Za Hájovnou)	L	1	–	–	ca. 3.31
	WA	1	–	–	1.35
	WP	1	–	–	ca. 1.86

C. runtonensis is the first large-sized *Cricetus* species within the Early Pleistocene assemblages of Central Europe. The species is known from many Early and Middle Pleistocene sites of Central Europe (Heller 1958, Pradel 1988, Hír 1998). Most records are from Hungary, where it was present in the Early to early Middle Pleistocene Nagyharsányhegyian substage (Kretzoi 1956, Hír 1998), in the Middle Pleistocene Tarkő substage (Jánossy 1976), and also in the late Middle Pleistocene Solymárian substage (Hír 1989, 1995, 1997c). At the end of this period, the species gradually disappeared from Central Europe.

The palaeoecological preferences of *C. runtonensis* are not clear. As typical for most extant Cricetinae, the hamsters from Pongor Cave and Lök-völgyi Cave (Hír 1997c) as well as the assemblage from Somssich-hegy 2 indicate steppe conditions (Jánossy 1990). The modern common hamster (*C. cricetus*)

occurres in steppe and farmland, and along riverbanks (Clutton-Brock 2002). In contrast, the fauna from Solymár is supposed to reflect a forest ecosystem and mild climate (Hír 1997c), although the major bulk of the rodent assemblage, consisting mainly of *Microtus* species (Jánossy 1986), also indicates the presence of a more open environment. However *Cricetus* from Tarkő rockshelter in Hungary (early Middle Pleistocene; Hír 1997b) and from the Romanian Subpiatra (Early Pleistocene; Hír and Venczel 1991) indicate a forest habitat. A further argument is that the cemented (calcified) rusty fossiliferous sediment in Za Hájovnou Cave – Kopaná chodba indicates that this hamster lived in more humid conditions rather than an arid environmental.

Conclusions

Fossil hamster remains (a fragmented right mandible with dentition and left calcaneus) found in the Middle Pleistocene(?) rusty chimney sediments of the Kopaná chodba within Za Hájovnou Cave are attributed to the taxon *Cricetus* cf. *runtonensis* Newton, 1909 based on molar size and morphology, in particular that of m1. The tooth measurements are relatively similar to the records of this species from Poland and Hungary. The recorded hamster species as well as the sedimentary record indicate quite humid conditions with a mild climate that could be contemporaneous to the Middle Pleistocene ecosystem at Solymár.

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