FOLIA HISTORICO-NATURALIA MUSEI MATRAENSIS
2016 40: 7–15

The malacostratigraphic study of the pleistocene sediments near Kislőd

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Abstract: The malacological material excavated near Kislőd (Veszprém County, Hungary) in 1969 by E. Horváth the late paleobotanist of the Savaria Museum, Szombathely. The identified material became part of the Quartermalacological collection of the Mátra Museum. The revision activities that are presently in process have made it possible for this material, which was only presented briefly earlier (Szabó 1982), to be introduced in detail. On the basis of the fauna analysis we may attempt to set up a malacostratigraphic classification of the sediments and their faunas. Regarding the species composing the fauna, the Pleistocene classification is obvious.

Introduction

The site can be found to the south of Kislőd, Veszprém County, on the area of a pasture, which is bordered by the Vashámor Woods from the west (Fig. 1). In the southern front of the Torna Stream, Old Hill, built up from Neogene sediments, emerges with its steep river-walls. Just

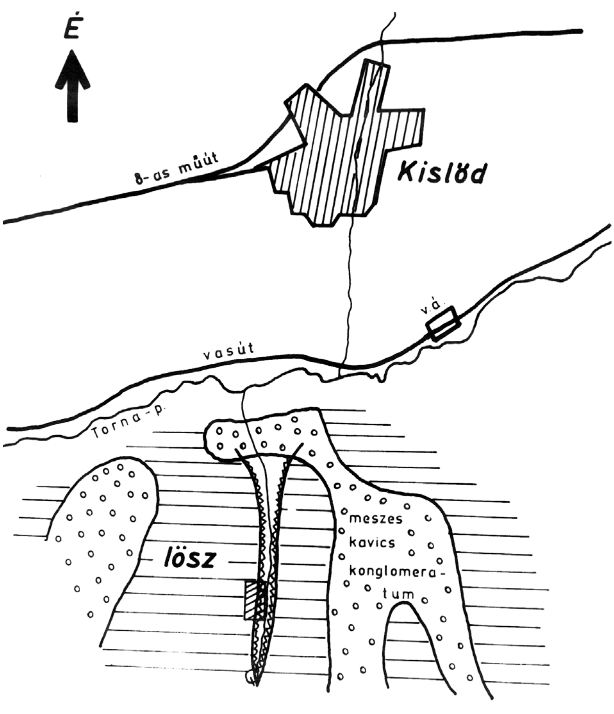

Fig. 1. The geographical position of the segment made in 1969

Fig. 2. Sediments revealed by a gully (site visit, 1964, photo by E. Horváth)

Fig. 3. The profile in the gully, excavated in 1969 (photo by E. Horváth)

like the area of the pasture, the hill itself is eroded by deep gullies of different sizes. The Pleistocene layers, which had been settled on Miocene gravel bed, were revealed by these gullies (Figs 1, 2).

The sediments of the site are approximately 60–70 metres above the Torna Stream level, which means they are about 350 metres above sea level. The segment revealed by the gully and the marking of the sample spots can be seen in (Figs 3, 5).

The site was discovered on a site visit in 1964 by Ernő Horváth, the late paleobotanist of the Savaria Museum, Szombathely: *"The glacial layers are revealed by a gully falling into the Toka Stream. Under the loess, sandy loess and loessial sand layers of the glacial layer, I found a grey sludge layer, which preserved the branch and stalk moulds of different plants. [...] Samples were taken from 16 levels of the excavations, since Molluscs can be collected almost in the whole area of the revealed 7–metre high wall."* (HORVÁTH 1973).

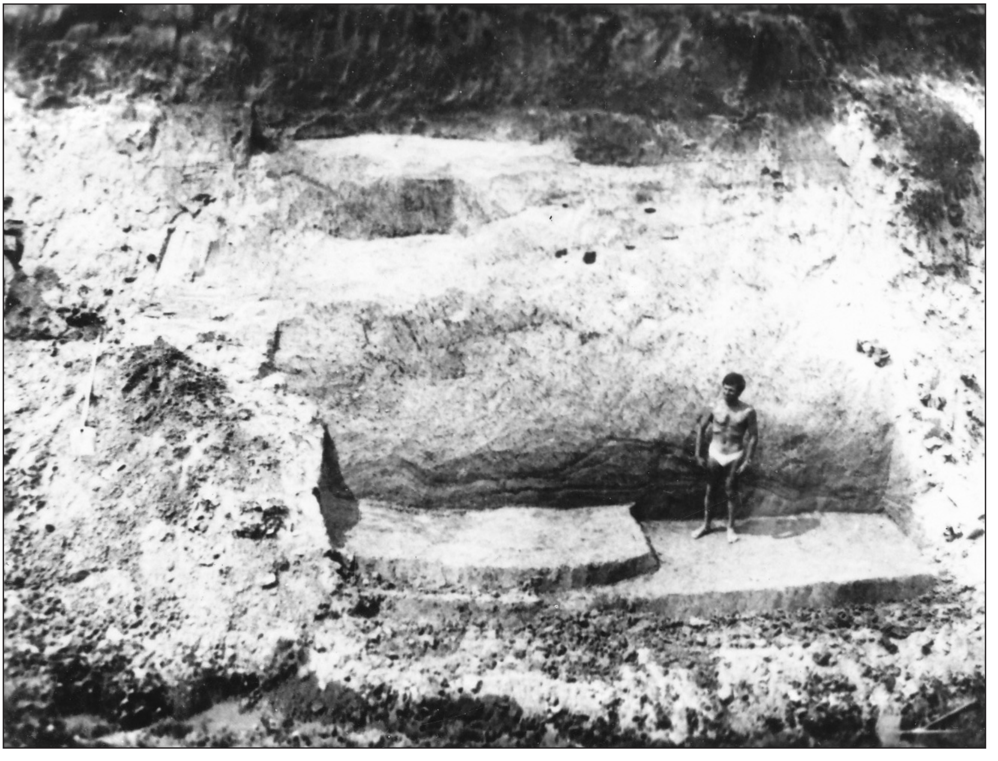

Fig. 4. The profile, excavated in 1969 (photo by E. Horváth)

The exploration of the segment and the collection of the material took place in July, 1969 (Fig. 4: the excavation). Ernő Horváth collected both the botanical and Mollusca fossils of the sediments; the malacological material was handed over to Endre Krolopp for study purposes, who in turn, forwarded it to his former student.

The identification and a quick assessment in a manuscript took place in 1976. The identified material became part of the Quartermalacological collection of the Mátra Museum, its collection

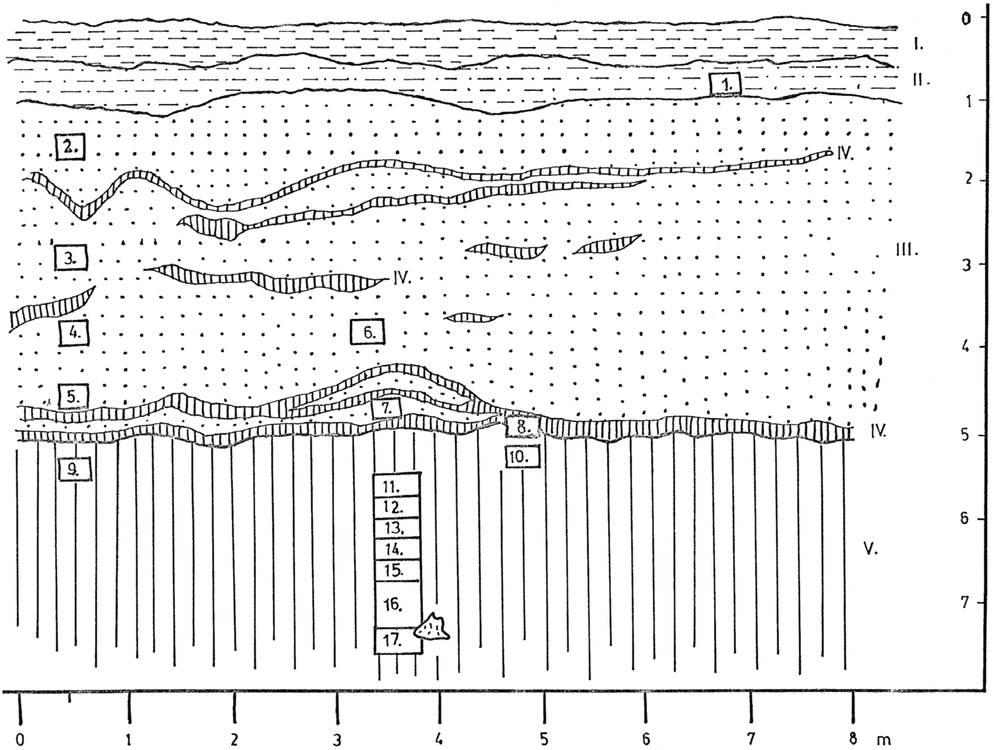

Fig. 5. Samplings of malacological matererial in the segment (drawing by E. Horváth)
1–17 = sample numbers, I–V = types of sediment
(I = humic loess, II = loess, III = sand with iron oxide streams, IV = limonite stripes, V = grey sludge)

classification was in 2014. The revision activities that are presently in process have made it possible for this material, which was only presented briefly earlier (Szabó 1982), to be introduced in detail.

Material and methods

According to the records, the collection of the fauna was carried out suitably to the fine stratigraphic methods in identical 1 kg samples. The sample collection from the upper layer of the segment was carried out to the extent of 70 cm, since it was fauna free. The lack of fauna of these layers is probably due to the solving effect of humic acids seeping from the soils that cover the loess layer on the shells.

A more frequent, 20 cm, sampling procedure had to be carried out in the case of the grey sludge layer, marked „V", because it was apparently rich in fossils.

On the basis of the dominance values (relative frequency) of the dominant species, the species can be categorised into groups, as it can be supposed that the frequency of the species is determined by the environment, because the species of the same ecological needs would react to the environmental changes the same way (Table 1). It is very useful for both the paleoecological reconstruction and the malacostratigraphic classification. The dominance values (relative frequency) reflect the chronology, the direction and the degree of the changes that took place during the formation of the layers so well that they provide useful information concerning even extinct taxa (Krolopp 2014).

Faunistic analysis

The species occurring in the samples and their relative frequency.

The samples 1, 2, 3, 4 and 6 that were taken from the upper sediments of the segment (Fig. 5) (humic and loamy loess, yellow-coloured sand) contain no malacological material, or only not so characteristic fragments. Only a little amount of malacological material was found in sample 5. The relative frequency data of this sample is presented for informative reasons because of the small number of specimens, but they cannot be compared to the relative frequency data of other samples.

Sample 5

Limacidae indet.:	2 specimens	18.18%
Nesovitrea hammonis:	1 specimen	9.09%
Semilimax kotulai:	1 specimen	9.09%
Succinea oblonga:	3 specimens	27.27%
Trichia striolata:	2 specimens	18.18%
Vertigo sp.:	2 specimens	18.18%

The malacostratigraphic evaluation was made possible by the faunas of the samples 7–17 (Table 1). In some samples, the two *Pupilla* species – *P. muscorum* and *P. sterri* – could be found only in fragments, which were difficult to identify, therefore it was practical to mark their presence on the family level in fauna lists as it is a common practice in other cases. This did not affect the later evaluation.

Among those samples that represent little fauna diversity, samples 14 and 17 show significant differences in the specimen numbers. The faunas of the sediments comprise almost exclusively of terrestrial species, amongst them the moisture-preferring (hygrophilic) elements are dominant. The most prominent and stable frequency is represented by *Succinea oblonga*. Besides this dominant species, the continuous presence of the cold tolerant *Pupilla sterri*, *Columella edentula*, *Vallonia tenuilabris*, *Semilimax kotulai*, *Vertigo parcedentata,* and *Pupilla muscorum* with a high ecological tolerance can be observed.

Semilimax kotulai that appears in the faunas is rare in the Pleistocene sediments; according to Krolopp's studies, it is known from Transdanubian loess layers (Korolopp 1973).

735–715 cm (sample 17)

The fauna composition of sample 17 shows a significant difference from the faunas of the younger sediments. Here such species appear – *Punctum pygmaeum*, *Vitrea crystallina*, Clausiliidae indet. – that also refer to ecological change in comparison with the younger faunas that are almost exclusively dominated by cold tolerant species. *Succinea schumacheri* also occurs in the fauna of sample 17; its relative frequency is 11.7% (Table 1).

The lowest layer of the grey sludge represents a particular climatic period (or part of it) in itself. The species number is the highest (14) in this type of sediment, while the number of sediments is also one of the most prominent (802). Compared to the upper layers, the so-called ubiquitous species are the most dominant beside the cold tolerant elements.

Table 1. Synoptic table – number of individuals and percentage distribution – of the gastropod fauna of the Kislőd profile

Position of samples (cm)	Number of samples	Arianta arbustorum	Chondrula tridens	Clausiliidae indet.	Columella edentula	Euconulus fulvus	Limacidae indet.	Physa fontinalis	Punctum pygmaeum	Pupilla muscorum	Pupilla muscorum densegyrata	Pupillidae indet	Pupilla sterri	Semilimax kotulai	Succinea oblonga	Succinea schumacheri	Trichia striolata	Vallonia tenuilabris	Vertigo parcedentata	Vitrea crystallina
520.475	7				7/2.66	1/0.38	24/9.13					7/2.66	6/2.28	40/15.21	173/65.78				5/1.9	
	8	1/0.62			1/0.62		4/2.48					4/2.48	1/0.62	18/11.18	127/78.88				5/3.11	
580-520	9				75/8.87	17/2.01	26/3.07	1/0.12		56/6.62		53/6.23	44/5.2	37/4.37	464/54.85		15/1.77	37/4.37	21/2.48	
	10		T		25/6.89	3/0.83	17/4.68			22/6.06		28/7.71	16/4.41	20/5.51	207/57.02		7/1.93	16/4.41	2/0.55	
	11				11/3.38	10/3.08	3/0.92			18/5.54		20/6.15	3/0.92	13/4.00	226/69.54			6/1.85	15/4.62	
620-580	12	1/0.22			9/1.95	4/0.87	11/2.38			4/0.87		17/3.68	1/0.22	25/5.41	367/79.44		5/1.08	7/1.52	11/2.38	
	13	1/0.14			46/6.24	20/2.71	34/4.61			58/7.87		10/1.36	7/0.95	48/6.51	466/63.23		7/0.95	25/3.39	15/2.04	
715-620	14	3/0.24			125/10.06	29/2.33	18/1.45			251/20.19		42/3.38	3/0.24	64/5.15	622/50.04		25/2.01	34/3.54	17/1.37	
	15				3/1.75	5/2.92	5/2.92			29/16.96		8/4.68		13/7.6	96/56.14		6/3.51	1/0.58	5/2.92	
	16				16/4.85	17/5.15	17/5.15			24/7.27		44/13.33	9/2.73	23/6.97	156/47.27		7/2.12	14/4.24	3/0.91	
735-715	17	2/0.25		1/0.12	138/17.21	3/0.37			22/2.74	53/6.61	5/0.62	14/1.75		17/2.12	335/41.77	94/11.72	27/3.37		82/10.22	9/1.12

715–475 cm (samples 16–7)

The species composing the fauna of the upper layers of the grey sludge refer to cold climate. So do the four dominant cold tolerant species (*Succinea oblonga, Vallonia tenuilabris*, *Columella edentula*, *Pupilla sterri*) and *Semilimax kotulai*, *Vertigo parcedentata*, and *Pupilla muscorum* with a high tolerance. The dominancy of *Succinea oblonga* implies a climate being cool and humid. On the basis of the fauna composition, it is possible to distinguish four ecological periods (Table 1):

a) 715–620 cm (samples 16–14)
The composition of the faunas of these samples differs significantly from the faunas of both the upper and the lower sediments. The relative frequency of the moisture-demanding *Succinea oblonga* is around 50%, which is lower than the frequency of 79% observed in the younger sediments, so it can be concluded that this sediment was formed in cooler and drier circumstances. The high dominancy rate of *Pupilla muscorum* (20%) supports this assumption, since it represents the highest specimen number in sample 14. The specimen numbers are determined by three, typically Pleistocene species – *Succinea oblonga*, *Pupilla muscorum and Columella edentula.* Their total frequency is 61%.

b) 620–580 cm (sample 13–12)
In this section, the relative frequency of the dominant *Succinea oblonga* reaches its climax of 79% (sample 12); the fauna is almost exclusively characterised by this species. The frequency of *Pupilla muscorum* is only around 1%, compared to the 20% in the previous samples, so it declined significantly. Supposedly, this fauna composition refers to more humid and rainy climatic conditions.

c) 580–520 cm (samples 11–9)
The decrease of the dominancy of *Succinea oblonga* (55%) and the increase of the frequency of *Pupilla sterri, Vallonia tenuilabris*, which prefer cool and dry climate, again imply a change in the ecological circumstances – a decline in humidity. It may be also confirmed by a fragment of *Chondrula tridens* in sample 10.

d) 520–475 cm (samples 8–7)
At the time of the sediment formation, humidity began to increase, and the frequency of *Succinea oblonga* is high again (sample 8: 79%, sample 7: 66%), while *Pupilla muscorum* disappears from the fauna, and the cold tolerant *Pupilla sterri* occurs instead. It refers to a fall in temperature, which is also confirmed by a rise in the frequency of *Semilimax kotulai* (sample 8: 11%, sample 7: 15%).

Malacostratigraphic classification

On the basis of the fauna analysis of the explored area, and in comparison with other faunas known from similar sediments in Hungary, we may attempt to set up a malacostratigraphic classification of the sediments and their faunas. Regarding the species composing the fauna, the Pleistocene classification is obvious. A more exact classification can be carried out on the basis of the Pleistocene biostratigraphic division of the already known faunas. The fauna of Pleistocene sediments in Kislőd is characterised by species extinct by the end of the Pleistocene, *Succinea schumacheri*, *Vertigo parcedentata*, and species no longer having a Hungarian habitat, *Columella columella*, *Pupilla sterri*, *Vallonia tenuilabris*, *Semilimax kotulai.* This fauna composition implies a so-called "loess fauna". Owing to this, it can be classified in the ***Bithinia leachi – Trichia hispida Oppel zone*** (KROLOPP 1983).

The further classification was made possible thanks to the above mentioned, more detailed analysis of the fauna (unfortunately, samples 6–1 (sand and loess) are fauna free). In the samples, besides a strong dominancy of *Succinea oblonga*, species that are either significant in cool and moderately humid climate, or cold tolerant, or of high ecological tolerance are prominent, such as *Pupilla muscorum*, *Vallonia tenuilabris*, *Arianta arbustorum*, *Columella edentula*, *Euconulus fulvus*, *Vertigo parcenetata*, *Pupilla sterri*, *Vallonia tennilabris*, and *Semilimax kotulai*; thus ***Semilimax kotulai subzone*** can be presumed, which took place at the same time as the last cold climax of the Pleistocene, the W_3.

It is confirmed by the Upper-Pleistocene zonule classification presented by SÜMEGI & KROLOPP (1995). According to their definitions, within the Semilimax kotulai subzone, further stratigraphic refinement was possible on the basis of paleoecological and paleoclimatological analyses. In compliance with these, sediments characterised by the mass appearance of specifically cold-preferring species, such as *Vallonia tenuilabris*, and cold tolerant, and mesophilic species (*Succinea oblonga*, *Columella edentula*, *Pupilla muscorum*) belong to ***Vallonia tenuilabris zonule***. The only exceptions are probably represented by samples 8 and 7.

Botanical results

The material collected in 1969 became part of the paleobotanical collection of the Savaria Museum (Szombathely), but its detailed study and evaluation has not taken place so far (reported by Lajos Balogh).

According to the data of the preliminary report (HORVÁTH 1973): *"Plant fossils can be only discovered in the lowest sludge layer. [...]it can be stated that on the basis of identified Picea-Larix, Betula, Alnus and other fossilsof similar needs, and typical Polygonum bistorta stem fosslis, our plants lived in a considerably humid and cool climate [...] in some interstadial or perhaps stadial period of the Würm. The cross-section views of thicker tree fossils also refer to cold climate and frozen soil for a significant time of the year..."*

Conclusion

The results of the paleobotanical and malacological analyses of the sediment layers excavated near Kislőd in 1969 represent accordance. Therefore, it can be supposed that the exposed grey sludge sediments were formed in the last cold period of the Pleistocene, in Würm 3, in cool and alternatingly humid climatic conditions.

The material collected in 1969 became part of the paleobotanical collection of the Savaria Museum (Szombathely, SAMU), but its detailed study and evaluation has not taken place so far (pers. comm. L. Balogh).

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