

## Paleoecologic and paleoclimatic significance of the fossil mollusc assemblages from the Quaternary sediments near Hlohovec, (Slovakia).

PETER JONIAK

Department of Geology and Paleontology, Faculty of natural sciences, Comenius University, Mlynská dolina, 842 15 Bratislava, Slovak Republic

**Abstract.** The paper is dealing with paleoecologic and paleoclimatic evaluation of the malacofauna assemblages from loesses sediments near the Hlohovec town. Loesses of the studied section were predominantly deposited in open land environment. The uppermost part is characterized by the cool climate species dominance, the more thermophilous taxa prevail in the middle and lower part of the profile.

**Key words:** Quaternary, Pleistocene, loess, gastropoda, paleoecology, paleoclimatology

### Introduction

Mollusc assemblages in the Quaternary sediments are a very sensitive indicator of climatic and ecologic conditions. Detailed characterization of the studied biotops were possible through statistical study of the changes in occurrence of the individual species. This methodology was used by Ložek (1955, 1956) and Kernátsová (1991) in the southern part of the Považský Inovec Mts.. This paper analyzes the outcrop near the Hlohovec town. Loessial sediments with horizons of the fossil soil are exposed in the former quarry in a valley approximately 100 m south-east of the elevation point 266 (Fig. 1). The age of these sediments has not been determined yet by any method. Changes of biotops and influence of climatic factors in the investigated area were studied by bed-by-bed analysis of malacofauna communities.

### Results

Description of the lithological section (Fig. 2):

0.0 – 1.5 m (1.5 m) Soil horizon. Brown forest soil, gradually passing to underlying sediments.

1.5 – 3.4 m (1.9 m) Massive loessial sediment with prismatic jointing. The loess is slightly sandy, solid and porous, with small calcareous canals. The colour is buff to grey.

3.4 – 4.0 m (0.6 m) The loess is buff-coloured, with a dun to chocolate-brown tinge. Slightly porous, with numerous small calcareous canals; powdery, with sandy admixture. It can be probably an indistinct fossil soil complex.

4.0 – 6.0 m (2.0 m) Massive loess of yellow-brown to yellowish colour, with prismatic jointing. There are flushed sands with fine gravel in the upper part of horizon.

6.0 – 6.6 m (0.6 m) Loess and loessial loam, chocolate-brown to brownish, with a red-brown tinge, massive and solid, with small calcareous canals. It has a fossil soil character.

6.6 – 7.8 m (1.2 m) Layer has a sharp contact with the overlying bed. There is a horizon of loess-dolls in the upper part of this layer. It passes gradually to massive, yellow-brown powdery loess.

7.8 – 8.5 m (0.7 m) Loess to loessial loam of the same character as in the 4-th (6.0 – 6.6 m) layer. It is massive and solid, chocolate-brown, but generally of lighter colored.

8.5 - ? m Yellow-grey to yellowish, solid, moderately porous, powdery loess with loess-dolls in the upper part of the layer.

### Paleoecological evaluation of the preserved malacofauna

Seven samples of uniform weight (15 kg) were taken for qualitative and quantitative malacofauna evaluation. 967 specimens and shell fragments were identified. They belong to 14 families: *Bradybaenidae*, *Zonitidae*, *Clausiliidae*, *Helicidae*, *Edodontidae*, *Vitrinidae*, *Valloniidae*, *Vertiginidae*, *Pupillidae*, *Chondrinidae*, *Enidae*, *Cochlicopidae*, *Euconulidae*, and *Orculidae* (Tab. 1).

It is evident that the samples from the layer 1–7 (marked No.1 – No.7) show some changes in composition of malacofauna species, as well as changes in quantity (Fig. 2, Tab.1).

Sample No. 1 consists solely of treeless land species, some steppe and xerothermous rock species are also present. Forest species and species of mixed biotops (forest and treeless land) are totally absent. The identified fauna contains loessial species, predominantly of middle thermophilous to cold-loving assemblages.

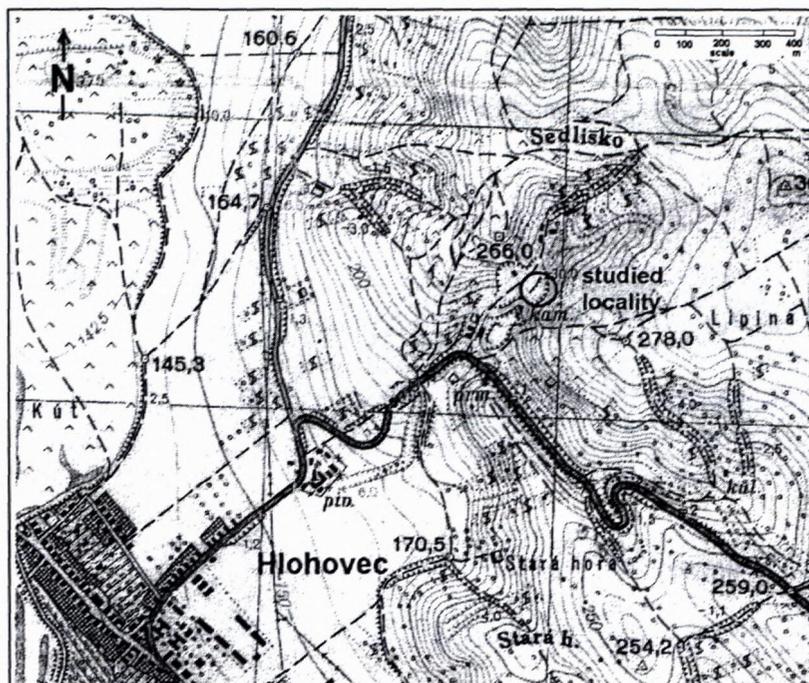


Fig. 1: Localisation of the loess outcrop near Hlohovec

Sample No. 2 contains the most diversified assemblages. The number of specimens is also very high. Loessial middle-thermophilous treeless land and steppe taxa prevail, but forest species and species of mixed biotops as well as typical cold-loving species are also abundant. The occurrence of typical banks-bog species *Perforatella bidentata* (GMEL.) is of peculiar interest.

Generally, cold-loving species *Columella columella* (MART.) dominates in samples No. 1 and 2. This taxon is characteristic for Würm3 in association with other cold-loving taxa: *Pupilla loessica* LŽK., *Pupilla musc. densegyrata* LŽK., *Clausilia dubia* DRAP., *Vallonia tenuilabris* (A. BR.) and *Vitrea crystalina* (MULL.). The occurrence of thermophilous taxa is probably due to some short warmer and wetter climatic event, which is documented by a very indistinct soil horizon (Würm 2/3). The above mentioned characteristics suggest open land (grassy plains, meadows) environment with local forests (typical forest species almost absent). The age of samples No. 1 and 2 is the Lowermost Pleistocene, Würm 3, partly Würm 2/3.

The fauna of sample No. 3 is very poor. Occasionally loessial and loessial treeless open land taxa prevail. Species of the mixed-biotops are also present, but both typically forest and cold-loving taxa are completely absent. Composition of sample No. 4 is quite similar to sample No. 3 in that occasionally loessial treeless open land taxa predominate. Present is also a forest and dry treeless land taxon, which indicates warmer climate. Occurrence of *Helicopsis striata* (MULL.) is of special importance because this taxon is representative of „striata fauna,, and it is not present in horizons younger than Würm 2 in the Vah river valley and the Danube lowland (LOŽEK, 1955, 1973).

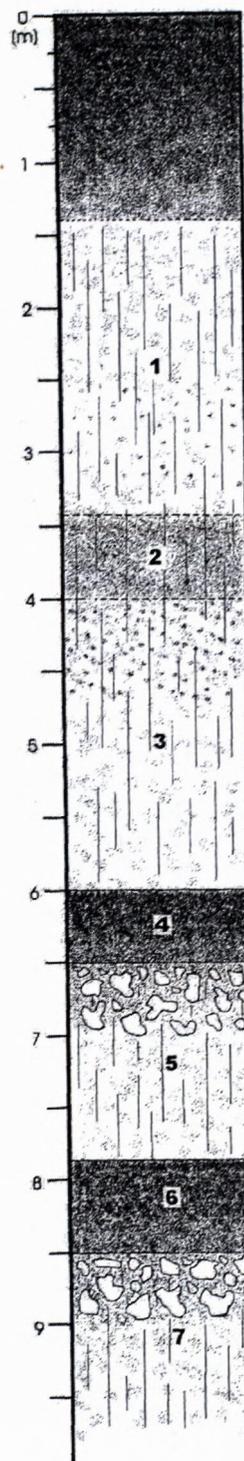


Fig. 2: Lithological profile; 1–7 different layers of the loess deposits, see text for explanation.

Samples No. 3 and 4 are characterized by total absence of cold-loving species. On the other hand, middle thermophilous open land species occupying dry meadows, steppes and xerothermous rocks are more frequent (*Vallonia costata* (MULL.), *Pupilla muscorum* (L), *Chondrula tridens* (MULL.)). Forest taxa are also practically

absent, except for the mixed-biotop species *Bradybaena fruticum* (MULL.). Sample No. 4 has a soil complex character. This fact is confirmed by composition of malacofauna and especially by the occurrence of *Helicopsis striata* (MULL.). Stratigraphically, sample No. 4 belongs

to soil complex No. 3, Ris/Würm to Würm 1. The climate was warmer and wetter during this period (according to Ložek, 1973).

The diversity and number of specimens increase in sample No. 5. Occasionally loessial species dominate

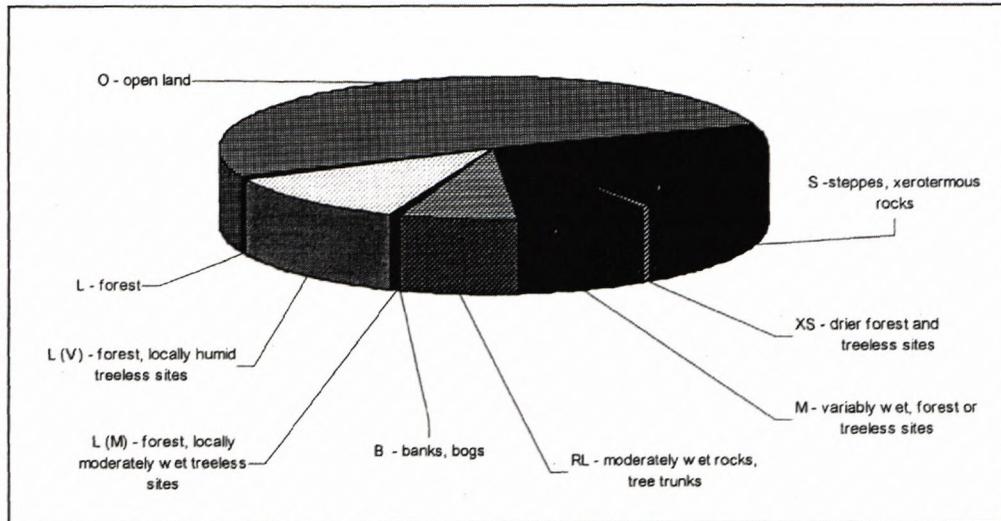


Fig. 3: Quantitative and qualitative evaluation of taxa and their ecological characteristics

Tab. 1: The frequency of individual taxa and their ecological characteristics.

Main ecological groups	Ecological characteristics	Species	Sample								Sum	
			1	2	3	4	5	6	7			
			1.4 - 3.4 m	3.4 - 4.0 m	4.0 - 6.0 m	6.0 - 6.6 m	6.6 - 7.8 m	7.8 - 8.5 m	8.5 - ? m			
forest (generally)	L (S)	<i>Bradybaena fruticum</i> (MULL.)				U	U	U				0
	L (V)	<i>Vitrea crystalina</i> (MULL.)		13							1	14
	L (M)	<i>Balea biplicata</i> (MTG.)		6								6
	L (V)	<i>Puctum pygmaeum</i> (DRAP.)		102								102
	L	<i>Semilimax semilimax</i> (FÉR.)	5	2				1				3
treeless land (generally)	O	<i>Vallonia tenuilabris</i> (A. BR.)		36								41
	O	<i>Vallonia costata</i> (MULL.)		3	4	4	5	4	21			41
	O	<i>Vertigo pygmaea</i> (DRAP.)					1					1
	O	<i>Columella columella</i> (MART.)		63								63
	O	<i>Pupilla loessica</i> LŽK.	7	20								27
	O	<i>Pupilla muscorum</i> (L.)	14	104	2	1	5	5	10			141
	O	<i>Pupilla musc. Densegyrata</i> LŽK.	11	172								183
	S	<i>Pupilla sterri</i> (VTH.)	12	148						14		174
	S	<i>Abida frumentum</i> (DRAP.)					3					3
	S	<i>Chondrula tridens</i> (MULL.)			3		10	2				15
S	<i>Helicopsis striata</i> (MULL.)				2	3					5	
forest & treeless land	XS	<i>Cochlicopa lubricella</i> (PORR.)		1			3	1				5
	M	<i>Trichia hispida</i> (L.)		58					3			61
	M	<i>Eucomulus fulvus</i> (MULL.)		14								14
	RL	<i>Clausilia dubia</i> DRAP.		53			3					56
water	RL	<i>Orcula dolium</i> (DRAP.)		4	1		6					11
	B	<i>Perforatella bidentata</i> (GMEL.)		1								1
Sum			10	7	40	12	49	967				

Ecological characteristics (biotop): L(S) – forest, locally also dry treeless sites, L(M) – forest, locally with moderately wet treeless sites, L(V) – forest, locally also with wet treeless sites, L – forest, O – open land, S – steppes, xerothermous rocks, XS – drier forest and treeless sites, M – moderately or variably wet sites, RL – moderately wet rocks, tree trunks in forest, B – banks, bogs

(mainly *Chondrula tridens* (MULL.). Thermophilous species and species of mixed-biotops (with various humidity demands) prevail, but a more cold-loving *Orcula dolium* (DRAP.) is also present.

Samples No. 6 and 7 contain mainly loessial and occasionally loessial taxa, occupying open land environments and less frequently steppes and inferior forest biotops. The majority of taxa belongs to middle thermophilous to thermophilous ecological groups, except for the specimen of *Vitrea crystalina* (MULL.). The presence of this specimen can be explained by redeposition from older eroded layers. Sample No. 6 represents a less distinct soil complex which can be ranged as soil complex No. 4, Ris 3, according to the occurrence of thermophilous taxa.

### Conclusion

From a paleoecological point of view, loesses of the studied section in the southern part of the Považský Inovec Mts. were deposited in open land environments (Fig. 3), such as foothill meadows, open grassy plains, less frequently steppes, with restricted forests and shrubbery. Sunny rocks and stony debris also occurred. On the other hand, river, lake or swamps environment was of minor importance, temporary swamps and puddles were created by

occasional streams and rain washes, existing probably only during more humid periods.

From a biostratigraphic perspective, the section near Hlohovec shows changes in malacofauna assemblages. The upper part is characterized by loesses with typical cold-loving "columella fauna". This part is ranged to Uppermost Pleistocene. However, a fossil soil complex No. 3 with mainly more thermophilous fauna (*Helicopsis striata* (MULL.), *Chondrula tridens* (MULL.) and others) occurring in the lower part of the section, is also present. It is dated to Ris/Würm.

**Acknowledgement.** The author would like to thank J. Kernátsová for help with the identification of malacofauna, and J. Schlögl, L. Haltmar for their field assistance.

### References

- Kernátsová, J., 1991: Quaternary molluscs from some outcrops of the western Slovakia. Manuscript, Fac. of Nat. Sc., Dept. of geol. and Paleont., Bratislava, 1 – 219.
- Ložek, V., 1955: Quaternary molluscs of Czechoslovakia. *Rozpravy Ústředního ústavu geologického (Praha)*, 17, 3, 510 p.
- Ložek, V., 1956: The key for quaternary molluscs, *Vyd. SAV, Bratislava*, 7 – 487.
- Ložek, V., 1973: The nature in Quaternary, *Akademia, Praha*, 372 p.