

Main characteristics of development of gastropod fauna of the Carpathian Basin during the Late Quarternary

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ABSTRACT: The authog give a short synopsis from the development of Holocene gastropod fauna of the Carpathian Basin. According to the Hungarian and Slovakian data possible reconstruct paralell fauna and environment development. The new holocene xerotherm species (*Helicella obvia*, *Monacha cartusiana*, *Zebrina detrita*) appearances in central part of Carpathian Basin (Hungarian Great Plain) erlyer, than in the mountain ranges (Slovakian Karst region).

Developement, faunistical and zoogeographical summarization of gastropod fauna of the Carpathian Basin have been carried out by Lajos SOÓS in 1943, for the first time. Merit of the study is that beside the recent faunal examinations took the results of Tertiary and Quaternary investigations into consideration and it gave the opportunity for taking faunal historical statements from certain point of view. He pointed out that three representatives of the Miocen age fauna can be found among the recent species. Among these the *Gyraulus albus* and *Lymnaea palustris* are wide-spread in Europe, while the *Helicigona banatica* is a real endemic species of the Carpathian Basin.

The compilation which is considered as a basic study in many views the results of Quatermalacological investigations made significantly tinged. During the activity of Soós only faunae of some Quaternary age exposures were known. Some of them needed reconsideration since that time. Which is more independent Holocene age faunistical examinations have not been mentioned during that period.

As the results of Pleistocene malacological investigations of the last decades 206 species got known (KROLOPP, 1995). The climatological changes of the Quaternary period basically determined the composition of the above mentioned fauna. Significant proportion of the species of the Pleistocene molluscan fauna still live in the Carpathian Basin, it is why KROLOPP's (1983) statement is valid: the Pleistocene fauna is basically agree with the recent fauna. According to our knowledge - the examinations have not been closed, the numbers reflects the latest results - there are 22 species which presumably because of climatic causes belonged into the fauna certain period of the Pleisticene age only. Among these numerous species died out, and not known at the any other parts of Europe, e.g. : the species of the genus *Gastrocopta*.

Other species do not live in Hungary, and even during the Holocene age were lacking already, but can be found at other parts of Europe; e.g. : *Pupilla sterri* or *Vallonia tenuilabris*, which can be collected in Asia even nowadays. The number of the above mentioned species is 21. According to the further investigations we can state that the number of molluscan species (44) which are present in the Hungarian fauna and did not occur in the fossil record. Slugs are belong into this category.

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There were six faunal phases during the Quaternary according to KROLOPP, 1983. Five among them belong into the Pleistocene while the remaining is the part of the Holocene. The Holocene faunal phase can be characterised by the appearance of xerotherm species like *Monacha cartusiana*, *Helicella obvia*, *Zebrina detrita* which are also abundant in the recent fauna. KROLOPP (1983) dated the appearance of these species after the Bronze Age.

Results of the Holocene faunal examinations which began in the seventies and became an independent research field since that time, made valuable contribution about the formation of the recent molluscan fauna.

Evolutionary examinations of the species collected from medium high mountain ranges (mainly from cave sediments) and from subsided zones (mainly from lacustrine sediments) made it possible to outline main characteristic features of the development of the vegetation bound to change of the climate significantly determined the quantitative relation of the species of the fauna.

As it happened in connection with the Pleistocene age gastropods it was possible to determine the list of those species which are characteristic to certain Holocene phases (FÜKÖH, L. 1993a).

The knowledge of the Hungarian Holocene gastropod fauna made it possible to compare its characteristic features with the results of the faunal examinations outside of the Hungarian border. In this way it can be possible to show the main trends of faunal development within the Carpathian Basin.

With the analyses of faunae of the Holocene age exposures increasing in number we managed to make more exact the appearance of the above mentioned three, so called "mediterranean" species in Hungary. As the result of these examinations it is clear, that against the previous ideas, these species have been present in the Late-Holocene sediments of the Carpathian Basin. Data about the earliest appearance of *Zebrina detrita* were given by the excavations took place at Uppony (fig. 1.). The appearance of this species which occurred in the fauna of Horváti-hole on the basis of chronostratigraphical ranging of the whole fauna can be placed into the Boreal phase in age. It appears during the first warm period following the Pleistocene age (FÜKÖH, L. 1983).

The first occurrence of *Monacha cartusiana* in the Bükk Mountains is shown from the fauna of a rock-shelter at Szentléleki-valley. The fauna of the exposure lived during the Subatlantic phase (FÜKÖH, L. 1993b).

The earliest occurrence of *Helicella obvia* can be traced in the lacustrine sediments containing terrestrial species as well of Lake-Péteri at the Danube - Tisza Interfluve (fig 2.). The sediments formed during the Atlantic phase (FÜKÖH, L. 1999). These three species are also members of the recent gastropod fauna of the Carpathian Basin. A terrestrial species, *Daudebardia helenae*, also have been found in the Holocene age sediments (FÜKÖH, L. 1985). But this species has no recent representative.

According to the examinations carried out at the territory of subsided zones several gastropod species have been shown which had no any recent equivalent found in Hungary, until now.

Gyraulus riparius also belongs into this group. Its stratigraphical importance is significant because this species were widely distributed during the Subboreal phase in Hungary (FÜKÖH, L. 1989). The species can be found in Late Pleistocene faunae (KROLOPP, E. 1983), but Early Holocene sediments do not contain this species.

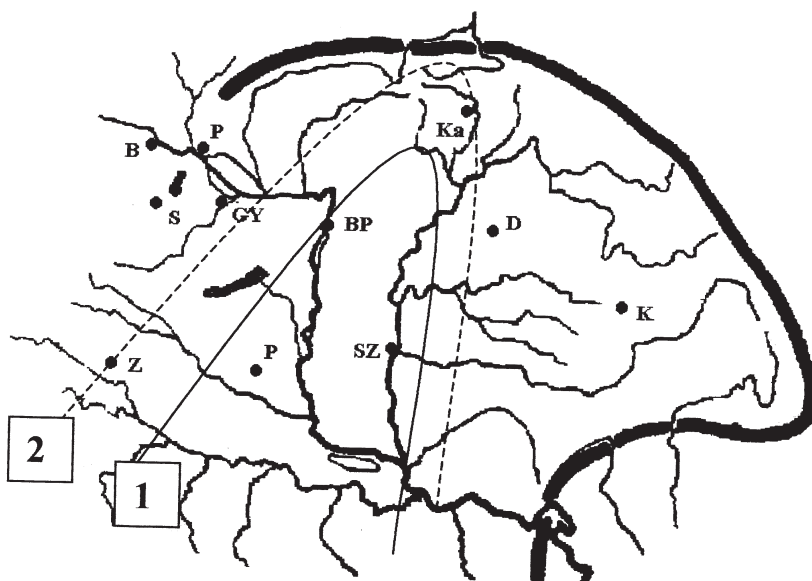


Fig. 1. Expansion of *Zebrina detrita* to Carpathian-basin
 1. Boreal
 2. Sub-atlantic

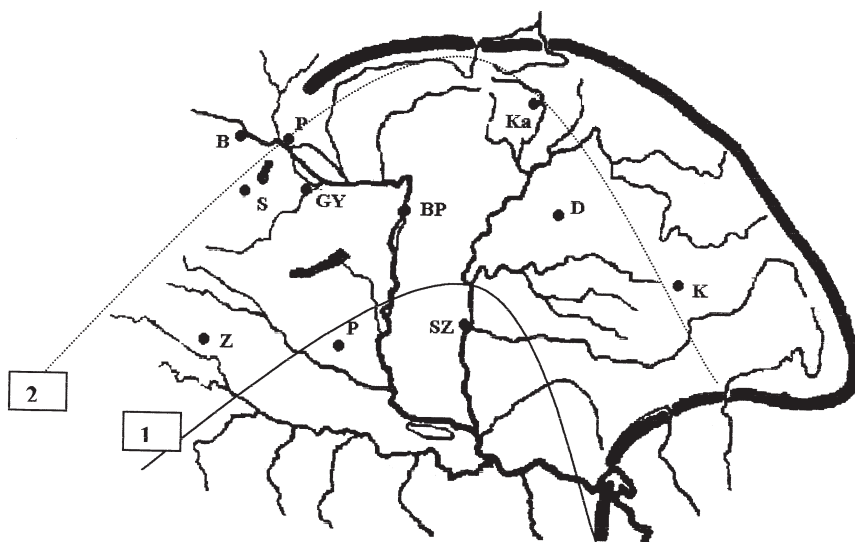
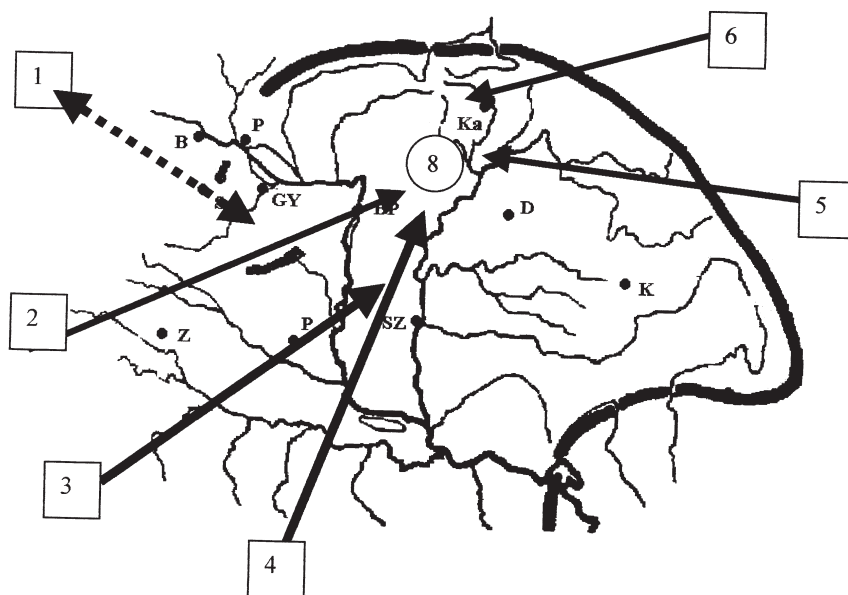


Fig. 2. Expansion of *Helicella obvia* to Carpathian-basin
 1. Boreal
 2. Sub-atlantic, Sub-recent

The *Mastoniopsis scholtzi* have been found at lot of localities of Transdanubia. It occurs in Early Holocene sediments (KROLOPP, E. - VÖRÖS, I. 1982). The *Bythiospeum* cf. *sandbergeri* led a quite special way of life. According to the investigations its only occurrence can be found only at Böhönye: Sárosberek, in Hungary (fig. 3.).

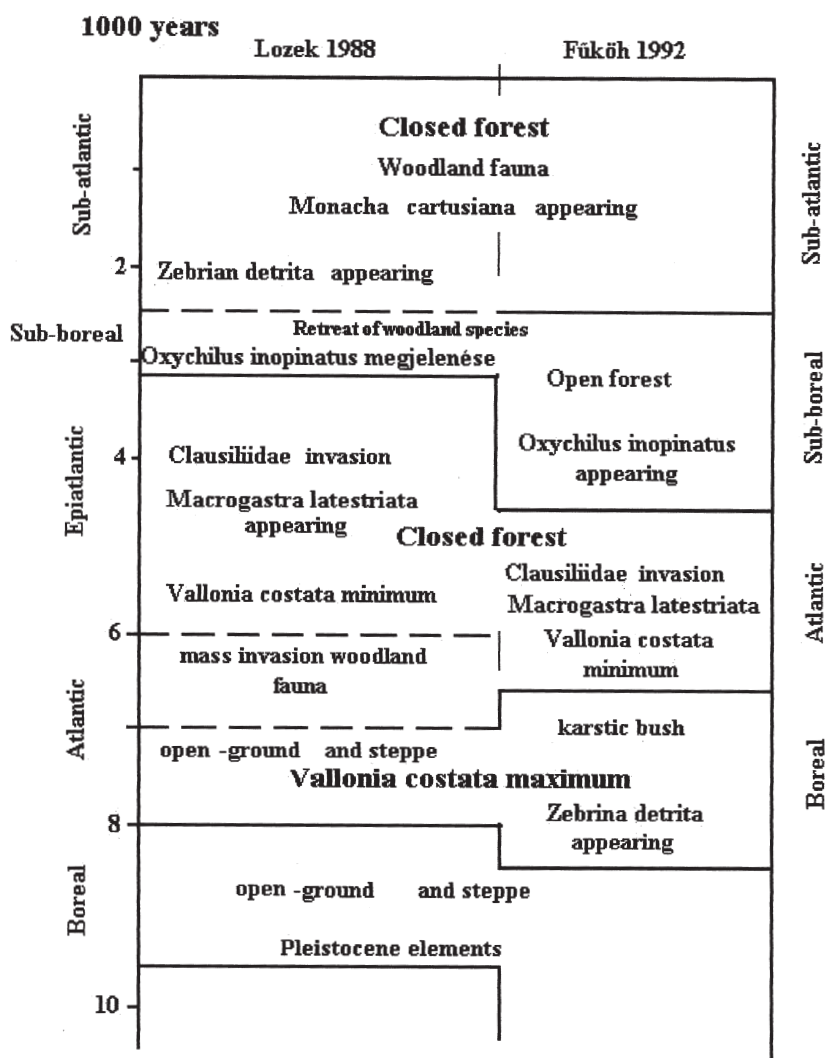


3. Invasion of the Holocene species to Carpathian-basin

1. *Gyraulus riparius*, *Marstoniopsis scholtzi*, *Bythiospeum sandbergeri*
2. *Monacha cartusiana*
3. *Helicella obvia*
4. *Zebrina detriti*
5. *Oxychilus inopinatus*
6. *Macrogastra latestriata*
7. *Daudebardia helenae*

Wide-ranging analyses (vertebrate paleontological, palynological, archaeological correlations) of the results of the Holocene faunal examinations made it possible to outline the main characteristic features of succession of the Hungarian gastropod fauna. As the result of the above mentioned investigations there were possible to establish four succession phases at the territory of the medium high mountain ranges and three ones in the case of the subsided zones. Because of these succession phases we manage to compare the Hungarian faunal development with the faunal formation of the neighbour territories.

As the result of the examinations of Ložek malacozones have been described in Slovakia. These zones can be very well correlated with vertebrate paleontological findings (LOŽEK, V. 1988). With the help of the simultaneous examination of the malacozones and the succession phases (FŰKÖH, L. 1991) it is possible to delineate the development of the gastropod fauna of the Carpathian Basin (fig. 4.).



4. Synoptic table of the development of the fauna and environment in Carpathian Basin

(The correlation of the Holocene stratigraphy carried out by the above mentioned two authors is not the aim of this compilation. In the lack of it the joint analyses of the faunal development also can be done.)

1. Because of the climatic changes at the end of the Pleistocene the opening up of the forests can be observed at the medium high mountain ranges. The territory of opened, scrubby forest is increasing. The frequency of the so called Pleistocene elements is significant. According to Ložek the occurrence of *Pupilla sterri* is still important in the fauna. This faunal phase can be studied mainly in Slovakia, but also can be observed at the Bükk Mountains (Csúnya valley, Muflon cave).

2. This faunal phase can be characterized by the gradually increasing warming up and decreasing humidity. The frequency of *Granaria frumentum* is increasing. This phase is the maximum of *Vallonia costata*. Frequency of the occurring Pleistocene elements is not significant. The vegetation can be characterized by dissected karstic bush. Palynological investigations show the dominance of grass species (Graminae). While pine trees were abundant at the Bükk Mountains. *Zebrina detrita* which is wide-spread at the mediterranean territories appears at the warm karstic regions of Hungary. Faunal changes and changes of dominance within the fauna begins earlier at the territory of Hungary and takes longer than it happened to the north from us.

3. The fauna referring to dry and warm climate changes and the dominance of forest elements can be observed. Both territories can be characterized by the appearance of new species which have never been member of the fauna before. The most outstanding among them is the *Macrogaster latestriata* which typical species of the closed deciduous forest. According to Ložek it is a characteristic dendrophilous species.

Dominance of *Vallonia costata*, preferring open, scrubby vegetation is decreased. While similar tendencies can be observed in consideration of faunal development significant alteration is shown between the periods at the two territories. According to Hungarian data this phase lasts until approximately 2000-2500 years, but Ložek mentions about 4000-4500 years. (fig. 4.) The cause of the difference must be presumably that the influence of the wet, rainy period is faster at the hilly region comparing with the inner parts of the Carpathian Basin. By the end of this climatic phase because of the climate becoming more and more arid the proportion of steppe areas increase at the Great Hungarian Plain. It is proved by the appearance of *Helicella obvia* inside the basin.

4. As a consequence of the climate degradation decrease of forest vegetation and increase of open spaces can be observed. Regarding the gastropod fauna beside the dominance of forest elements the proportion of species preferring open rocky surfaces (*Granaria frumentum*) increase. The presence of *Oxychilus inopinatus* and *Trichia hispida* become general in the fauna.

This phase is more characteristic at the territory of Hungary, again. Swamp formation begins at the subsided zone of the Great Plain. The *Gyraulus riparius* becomes general in the sediments.

5. The faunal composition is the same in the case of both territories (at the territories without anthropogenic effects). The dominance of species preferring warm, wet, closed forest can be observed. Good example for the similarity is the presence of *Monacha cartusiana*. The difference is that this phase in which the *Zebrina detrita* appears for the first time followed by *Helicella obvia* later.

On the basis of the phases of the demonstrated faunal development the following conclusion can be drawn: at the territory of the Carpathian basin with the consideration of the mesoclimate determined by the geomorphological variety a uniform faunal development can be traced. By the end of glaciation begins the advance of xerotherm forest fauna which is proved by the zoogeographical composition. The appearance and spreading of xerotherm species take place earlier inside the basin than at the marginal, higher territories. In the case of these places the modifying effect of dominance relations within the fauna caused by climate oscillation is more significant.

Összefoglalás

A csiga fauna fejlődésének főbb jellegzetességei a Kárpát-medencében a fiatal negyedidőszak folyamán

A Kárpát medence csiga faunájának fejlődését, faunisztikai és zoogeográfiai alapvetését először Soós Lajos készítette el 1943-ban. A munka érdeme, hogy a recens faunavizsgálatok mellett a már ismert harmad- és negyedidőszaki vizsgálati eredményeket is figyelembe vette. A sok tekintetben ma is alapmunkának számító feldolgozást elsősorban Krolopp Endre kvartermalakológiai vizsgálatainak eredményei jelentősen árnyaltabbá tették.

Az 1970-es években megindult, s azóta már önálló kutatási területté vált holocén faunavizsgálatok igen sok új adattal gazdagították a mai fauna kialakulásáról alkotott képet. Szlovákia területén Ložek vizsgálatainak eredményeként gerincespaleontológiai leletekkel jól korrelált un. malakozónák kerültek leírásra. Ezeknek a malakozónáknak, ill. a magyarországi malakosztratigráfiai egységeknek az együttes vizsgálatából kirajzolódik a Kárpát-medencében élő csigafauna fejlődése.

A pleisztocén végeztével bekövetkező klímaváltozás a középhegységi területeken az erdők felnyílásával járt együtt, egyre nagyobb területeken figyelhető meg a nyílt cserjés bokros vegetációval borított sztyepprétek által tagolt erdő képe. Az egyre fokozódó felmelegedés és a humiditás csökkenése határozza meg a faunaképet, melyet a *Granaria frumentum* gyakorisága és a *Vallonia costata* maximuma jellemez. A pollenvizsgálatok a fűfélék dominanciáját mutatják, még a Bükk-hegység területén is jelentősebb a fenyőfélék gyakorisága, mint a lombhullató fáké. Magyarország területén a meleg karszton megjelenik a mediterrán elterjedésű *Zebrina detrita*.

A klímaoptimum idején a meleg száraz klímára utaló faunakép megváltozik, az erdei elemek igen markáns megjelenése figyelhető meg. Az erdei fauna egyik karakter faja a *Macrogaster latesriata*, mely tipikusan lombos zárt erdőkre jellemző, dendrofil elem. A medence belsejében, az Alföldön a klímaszakasz végén bekövetkező csapadékszegénység bizonyítéka a *Helicella obvia* megjelenése.

Az ismételt klímaromlás következtében megváltozó faunában ekkor válik általánossá az *Oxychilus inopinatus* megjelenése. A medence belsejében meginduló láposodás jellemző faja a *Gyraulus riparius*. Ma elterjedésének délkeleti határa Szlovákia.

Az antropogén hatástól nem érintett területeken ismét a meleg, nedves, zárt erdőkre jellemző fajok dominálnak, amit a *Monacha cartusiana* megjelenése is alátámaszt. A *Zebrina detrita*, s a *Helicella obvia* expanziója ekkor éri el Szlovákiát.

A bemutatott faunafejlődésből levonható az a következtetés, hogy a Kárpát-medence területén a geomorfológiai által meghatározott mezoklimatikus eltérések ellenére egységes faunafejlődés követhető nyomon. A jégkor elmúltával az antropogén tevékenység által nem zavart területeken megindul a melegkedvelő erdei fauna fokozatos előrenyomulása, amit a zoogeográfiai kép is alátámaszt. A medence belsejében a melegkedvelő, szárazságtűrő mediterrán fajok hamarabb jelennek meg és terjednek el, mint a peremterületek magasabban fekvő vidékein, s itt kifejezettebb a klímaingadozások hatására bekövetkező faunán belüli dominanciaviszonyok változása. A holocén végére eltűnik a Dunántúli vízi faunánkból az északi elterjedésű *Marstoniopsis scholtzi*.

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