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Neogene habitats and freshwater Ostracoda on the territory of Slovakia

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Abstract: A paper summarise the knowledges about the freshwater ostracod fauna from Slovak Neogene deposits which actually comprise several tens of species from the various biotops. The environmental characteristics of the Upper Miocene and Pliocene sediments are given on the base of recents species and their ecological requirements. The particular endemic ostracods related to the Paratethys fauna are preserved in Turiec depression. This assemblage considered to be freshwater differs absolutely from the recent palearctic species and presents some specific features of stabil and cold habitats.

Key words: Slovakia, Neogene, freshwater Ostracods, endemic fauna, paleoenvironment

Introduction

A freshwater sedimentation took place in the Vienna, Danube and in the other basins since Middle – Upper Miocene and Pliocene after regresion of marin and brakish waters. In this time the freshwater ostracods became more nad more frequent in the sediments and reach on species. Their quantity results from the various environment conditions influenced by tectonic movements.

Regional distribution of fauna

Because only broken, thick and very rare ostracod fragments are known from the Midldle Miocene and oldest deposites containing mainly marin or brackish shells, the freshwater ostracods are regarded as a secondary element transported from inland environment resting unknown from the point of ostracods.

The valves of freshwater ostracods are dominant fossil group since zone E of the Pannonian (Fig. 1). The cyclic environment changes have been observed on the west margin of Danube basin by alteration of freshwater and brackish ostracods. The freshwater conditions are documented by *Candona candida* (O.F. MULLER), *Cyclocypris laevis* (O. F. MULLER), *Cyprinotus salinus* (BRADY), *Darwinula cylindrica* STRAUB, *D. stevensoni* (BRADY & ROBERTSON), *Ilyocyris gibba* RAMDOHR, *Paralimnocythere* sp., *Zonocypris* sp. (PIPÍK, 1998).

The assemblage from Vienna basin (locality Studienka) is a little bit younger and richer. It comprises the species *Cypria ophtalmica* (JURINE), *Darwinula stevensoni*, *D. cylindrica, Cyclocypris laevis*, *Eucypris* aff. *dulcifons* DIEBEL and PIETRZENIUK, *Candona balatonica* DADAY, *Paralimnocythere* aff. *relicta* (LILJEBORG), *Cyprinotus salinus*, *Candona fragilis* HARTWIG, *C. pratensis* HARTWIG, *C. fabaeformis* FISCHER, *Candona* ex gr. *neglecta* SARS, *Potamocypris* sp. 1 Janz, *Potamocypris* sp. An environment can not be presumed as absolutely freshwater because the brackish *Cyprideis* species prevail, they represent 95 % of all specimens. The age of a rock sequence is determined as the Pannonian, the zone F.

A northern and eastern part of the Danube basin (Čeľadince, Orešany) is filled by limeston sediments of the Pannonian age (zone H) where have been found the species as *Candona* cf. *balatonica affinis* ZALÁNYI, *Cavernocandona roaixensis* CARBONNEL, *Cypria tocorjescui* HANGANU, *Cyclocypris* sp., *Fabaeformiscandona* cf. *lineata* KRSTIČ and *Pseudocandona marchica* HARTWIG (Fordinál, 1994, Fordinál et al., 1996).

The Pliocen locality Hajnáčka rich on the mammalian rests is poor on the ostracods. Only the fragments of four species *Darwinula* sp., *Ilyocypris* sp., *Candona* sp. and *Pseudocandona* sp. are described from that area.

The numerous outcrops and boreholes from the Turiec depression which existed during the Upper Miocen (? Pliocene) offer a huge quantity of well preserved freshwater and oligohaline ostracod. The 87 species, from which 57 are new species, subspecies and varieties, belong to 20 genera. This enormous number of taxons results from isolation of the basin and intensive intralacustrin evolution. The fauna shows an inregular distribution in the basin and from the point of ecology and origine can be devided to 2 groups.

The species living up till now or having very close relationships with recent fauna are not numerous. This type is represented by *Candona devexa* KAUFFMAN, *C. eremita* (VEJDOVSKÝ), *C. kieferi* KLIE, *C. lozeki* ABSOLON, *C. weltneri obtusa* G. W. MULLER, *C. candida* n.

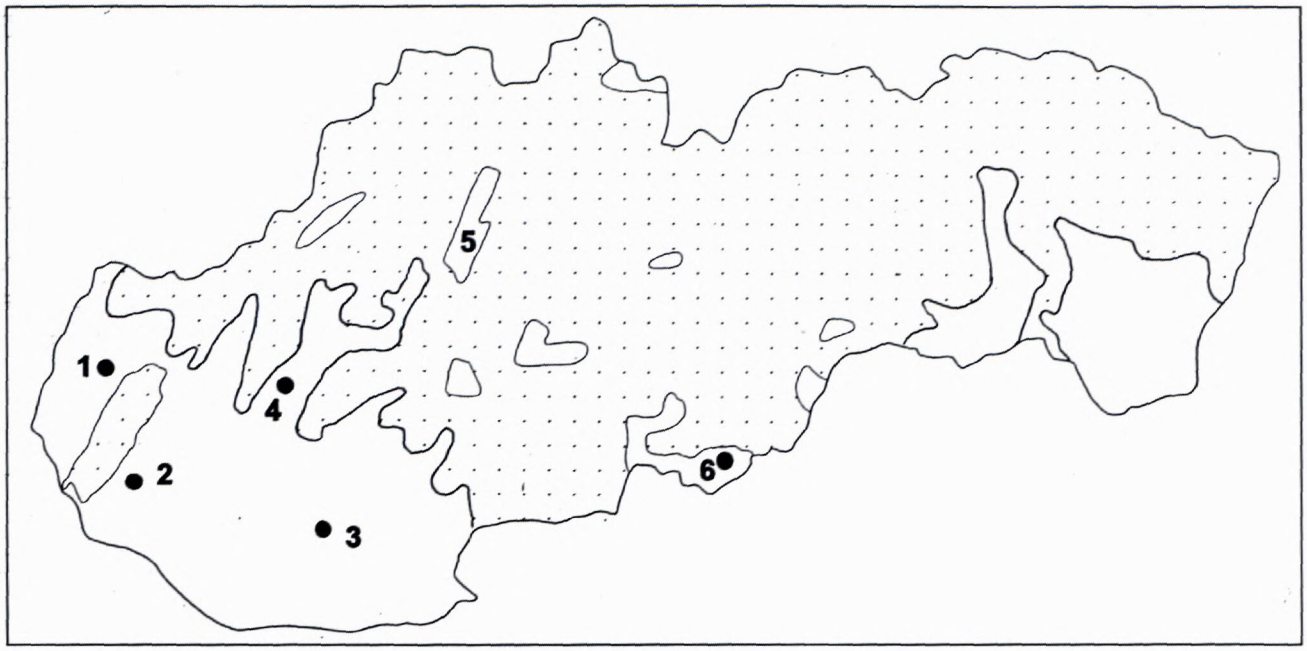

Fig. 1 Localities with fresh water ostracods in Slovak Neogene basins. Vienna basin: 1. Studienka; Danube basin: 2. Pezinok, 3. Čeľadince, 4. Orešany, 5. Turiec depression, 6. South slovak basin: 6. Hajnáčka. Neogene basins other geological units

var. *densa*, *C. carpathica* n. sp., *C. fatrica* n. sp., *C. tatrica* n. sp. *Candonopsis arida* (SIEBER), *C. regalis n. sp.*, *Cavernocypris subterranea* WOLF, *Cyclocypris laevis*, *Cypria ophtalmica*, *Cyprinotus salinus*, *Darwinula stevensoni*, *Ilyocypris gibba*, *I. papilioformensis* n. sp., *Ilyodromus pyramidatus* KRSTIČ n. var. *angustus*, *Pseudocandona albicans*, *P. compressa*, *Scottia browniana* (JONES).

The second group consists of more than 40 endemic species related to Paratethys fauna. A genus *Candona* is a dominant group – *Candona aculeata* n. sp., *C. eminens* n. sp., *C. expressa* n. sp., *C. fontana* n. sp., *Candona lacustris* n. sp., *C. laterisimilis* n. sp., *C. montana* n. sp., *C. palustris* n. sp., *C. prisca* n. sp., *C. stagnosa* n. sp., *C. vacuospinosa* n. sp, etc. They are accompanied by *Pseudocandona carbonnelii* n. sp., *Serbiella armata* n. sp., *S. pacifica* n. sp., *Typhlocypris* ex. gr. *centropunctata* SUZIN, *T. trigonella* n. subsp. *pharius*, etc. The specimens of *Cypria dorsoalta*, *Cypria servica* KRSTIČ, *Cypria bodergati n. sp.*, *Cypria isosceles n. sp.*, *Euxinocythere minuscula* n. sp. are more or less permanent element in this group.

Ecology and origin of fauna

A short review of freshwater ostracods shows that the Upper Miocene environments was occupied not only by the fossil species but the recent representants too. Believing that the ecological requirements of living ostracods didn't change throught the Pliocene and Quarternary time, we use Absolon's (1973), Sywula's (1974), Bronstein's (1988) and Rybecky's (1989) taxonomical and ecological data to reconstruct the Upper Miocene environment (Tab. 1).

A littoral environment is presumed in case of Pezinok (Danube basin). Because the freshwater species are not mixtured with a brackish fauna which is known from many layers, in time of freshwater sedimentation the environment can be characterised as a shallow lake.

A similar mixtured faunal composition as in Studienka was studied by Barker (1983) in estuary of Ems, where the freshwater and euryhalinne species were observed. A habitat in this part of the Vienna basin can be determinated as a shallow littoral environment somewhere covered by water plants with strong freshwater influence. The estuary was bordered by the oxbows, the swapms and the pools, seasonal or permanent.

The sediments of the zone H of the Danube basin contain only freshwater fauna. For this reason a habitat is determined as a littoral freshwater lake covered by the water plants and bordered by a forest because a present of many terrestrial gastropods (Fordinál, 1994, Fordinál et al., 1996).

A northern part of the Turiec depression differs not much from the mentioned basins. The ostracods found in the sediments prefer the shallow lake conditions where the water plants grow. They can live also in the pools, the oxbows or in the swamps which could exist around the lake.

The cave and spring ostracods create a very distinguished group which is not surprising. The intensive tectonic movements and very vast carbonatic surface with caves existing in Slovakia up till now made a possibility for development of this biotop type. Besides of the freshwater springs, the haline sources could exist, inhabited by halobiont ostracod *Cyprinotus salinus* and the other halofils.

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Tab. 1 Ecological tolerance and habitats of recent ostracods according to Absolon, 1973, Bronstein, 1988, Rybecký, 1989, Sywula, 1974.

	caves	springs	pools	oxbows	rivers	swamps	lakes	deep of water	tolerance to salinity	bottom				widespread
										clay	mud	sand	plants	
Candona balatonica			+	+	+		+		halofil					paleartic
Candona candida	+		+	+		+	+	UTP	halofil					paleartic
Candona eremita	+	+												
Candona fragilis			+	+			+	littoral			+			paleartic
Candona kieferi	+													
Candona lozeki							+	littoral						
Candona pratensis			+	+		+					+		+	
Candona weltneri obtusa							+							paleartic
Cavernocypris subterranea	+	+												paleartic
Cyclocypric laevis		+	+	+		+	+	littoral	euryhaline					cosmopolitan
Cypria ophtalmica	+	+	+	+		+	+	UTP	halofil			+		cosmopolitan
Cyprinotus salinus		+	+						halobiont		+			paleartic
Darwinula stevensoni				+	+		+			+		+		cosmopolitan
Ilyocypris gibba			+	+	+	+	+	littoral	halofil	+		+		paleartic
Pseudocandona albicans			+	+			+						+	
Pseudocandona compressa			+	+		+	+	littoral	halofil					paleartic
Pseudocandona marchica		+	+	+			+	littoral			+		+	paleartic
Scottis browniana		+												paleartic

Besides the ecological data, the Table 1. shows also a biogeographic widespread of recent species in the Slovak Neogene basins. Recently they occupy a palearctic realm or they are the cosmopolitans. Generally, without of subterranean species, all live in the shallow water bodies. They have a high ability to migrate, they are resistant on the annual climatic changes when the cold and warm periods alternat and the pools or oxbows and lakes became frozen or dried up (Danielopol, 1980). The species of *Candonopsis arida, Candona devexa, Cavernocandona roiaxensis, Darwinula cylindrica,* which are known from the other european basins (Carbonnel, 1969; Janz, 1992, 1997) can be included to this group. This is a very interesting feature linking all mentioned ostracods.

On contrary, in some parties of Turiec depression rare fauna had been living and evoluting. Its ancestors or relatives lived doubtless on a vast Paratethys area. But that's all what can be said about it. To transmit the stratigraphic and ecologic data observed on Paratethys species it seems to be doubt. This endemic fauna presents some special features as a development of dorsum, very thick and hard shells, wide zone of the fussion with long, simple, numerous and dense marginal pore canals. A remarkable thing is an overlap of valves and pointed posterior. The species with triangular and trapezoidal shape with widely arched valves in posterior absolutely prevailed.

Such characteristic are typical for the species adapted to the stabil and cold environment typical for deeper lacustrin parts (sublittoral and profundal) and for ancient lakes like The Lake Baikal, The Lake Ohride, The Lake Malawi etc. (Stankovič, 1960; Kozhov, 1963; Danielopol, 1980).

Conclusion

The freshwater ostracod fauna became more frequent in the sediments after Middle Miocene. Several tens species is reported from different Neogene basins. Generally, the recent palearctic and cosmopolitan species together with fossil ones had been living in shallow lacustrin environment bordered by the pools, seasonal or permanent, the swapms and the rivers and their oxbows. The existing carstic surface and tectonic movements gave rise to springs and caves having their own fauna.

At the same time, an endemic ostracods had been occupied the Turiec depression which displey the morphological pecularities typical for the fauna of stabil and cold environment of deep lacustrin zone.

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