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New preliminary data for evolution of the Holocene Hungarian Mollusc fauna

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Abstract: The article introduce the examination of the malacological material of Late Quaternary sediments carried out from Red Marsh at Császártöltés during the past couple of years.
Key words: Red Marsh, Danube valley, Holocene, Hungary

The Vörös-mocsár (Red Marsh) is a southern unit of the mire system of the Danube-Tisza Interfluve running south in the former watercourse of the river Danube. This marsh developed in a filled up river channel and it is situated at the border of two significantly different regions (Solti Plain and Sand Dune Region) on the analysed area. The Solti Plain belonging to the Danube floodplain is covered with the network of abandoned watercourses of the river Danube. The Solti Plain and the adjoining Sand Dune Region of the Danube-Tisza Interfluve are separated by an approximately 10 meters high, steep loessy high-bluff.

The natural vegetation of the sand and loess covered high-bluff was *Junipero-Populetum* scrub and sandy grasslands, formed by *Bromus squarrosus, Secale sylvestre, Stipa borystenica* and *Festuca vaginata*. Well-drained areas were occupied by oak forests *(Iridi variegatae-Quercetum roboris, Polygonato latifolii-Quercetum roboris)*. Recently most of the area is cultural landscape with ploughlands and vineyards and some patches of natural vegetation. The Solti Plain was a widespread peatland with patches of *Fraxino pannonicae-Alnetum* forests. Water regulations started in 1873 destroyed the original vegetation of this peatland. The artificial Danube Basin Channel, finished in 1929, drained the mires. Only some patches of the natural vegetation survived. After the water regulations peat-cutting altered the landscape. Most areas of the Red Marsh were destroyed by peat-cutting. Nowadays the peatlands are covered with secondary vegetation: meadows, reed-swamps and sedge-swamps.

Some cores were retrieved using a five cm diameter Russian corer, but only one core contained mollusc shells, therefore malacological analysis was made only on this 280 cm deep undisturbed core sequence. This sediment sequence was used for plant macrofossil (Jakab, G. 2005), pollen and geochemical analyses. Detailed description of the peat core follows the system described by Troels-Smith (1955). Some radiocarbon dating of the sequence was obtained by both bulk and AMS analyses. The core was divided into 4 cm samples. The organic content of the core samples were estimated by loss-on-ignition at 550 °C for 5 hours and the carbonate content by the further loss-on-ignition at 900 °C for 5 hours. A sequential extraction method with a long established history in the analysis of geochemical composition of lacustrine and peat sediments was adopted in our work. Mollusc fauna inwashed from sediment using by sieves with 0.5 mm diameter. More than 2000 specimens belonging to 37 species have come to light from the core.

Lithological horizons

Three major lithostratigraphic units could have been identified on the undisturbed, continuous core of the 280 cm deep borehole. The first unit located between the depths of 280 and 200 cm is made up of alternating layers of fine laminated unweathering sandy sediment. These assumptions are justified by findings of radiocarbon measurements. According to radiocarbon data the development of these silty intercalations must have taken place between 13.000–9.000 BP at the end of the Pleistocene and at the transition zone of lateglacial/postglacial age.

The next sedimentary unit is located between the depths of 200 and 160 cm. This horizon is composed of dark brown muds with a low carbonate and high organic content. This sequence must have been deposited in a relatively shallow, lacustrine system with eutrophic conditions. This lacustrine phase characterized by the deposition of organic rich mud must have existed between 9000 and 7.000 BP in the area.

From the depth of 160 cm there is a sudden decrease in the carbonate content accompanied by a prominent increase in the organic content. The distribution of organic matter is not homogenous and by no means dispersed but resembles a downward flame like structure made up of the remnants of reed (*Phragmites*), and Mg, Na rich peat sediment accumulated between 160 and 100 cm. According to the radiocarbon dating the sedimentation of peat started from the beginning of the Atlantic phase.

From the depth of 100 cm there was a gradually change in the peat composition. The reed remains decline gradually and the dominance of the sedge remains started increasing. The radiocarbon data suggest that this change in the peat composition developed from 3000–3500 BP years ago.

Malacological results

According to the Mollusc fauna four malacological zones can be divided on this sequence from the Late Glacial until Late Holocene. The pollen, macrobotanical and geochemical data suggest that the malacological changes followed the paleohydrological and vegetation changes on this filling river bed.

The first malacological zone is located between the depths of 280–200 cm. According to radiocarbon data this horizon must have developed between 13.000 and 9300 BP. The ratio of species with a preference for moving water habitats is above 60 % in this horizon *(Valvata piscinalis, Lithoglyphus naticoides, Lymnaea stagnalis, Planorbis cf. carinatus, Unio* cf. *crassus, Pisidium amnicum)*.

This was the so called *Valvata piscinalis-Lithoglyphus naticoides* paleoassociation include cold resistant (widespread during the Pleistocene in the Carpathian Basin) *(eg.: Valvata pulchella, Bithynia leachi)* and thermophilous (widespread during the Holocene in the Carpathian Basin) *(e.g.: Lithoglyphus naticoides, Bithynia tentaculata)* elements as well. The composition of this fauna as well as the lithology of the embedding sediments is fully identical with the *Lithoglyphus naticoides – Valvata piscinalis* biozone of Fűköh (1991, 1992, 1997). Macrobotanical remains suggest that a living water environment with *Equisetetum fluitantis* and *Nymphaeetum albo-luteae* paleocommunities developed in the ancient Danube channel during this transition zone of lateglacial/postglacial periods. The paleochannel could have been a spill-stream of River Danube during this period.

The second malacological zone formed between the depths of 200–160 cm (9000–7000 BP years). The rheophilous elements decline and disappear in this zone. The first terrestrial elements *(Succinea putris, Vallonia puchella, Vertigo antivertigo)* emerged in this zone. The Mollusc fauna composition suggests that the *Valvata cristata-Bithynia leachi-Bithynia tentaculata* paleoassociation developed in this zone.

Elements with different ecological requirements (deep and shallow water, open and dense aquatic vegetation) dominated in the same quantity. This phenomenon is explicable with the periodic flood of River Danube. Macrofossil concentration was lower. *Typha, Phragmites* plants were the major macrobotanical remains. Pioneer mud vegetation and water-crowfoot communities formed in this zone. The water level of the initial phase of this horse-shoe lake was somewhat lower and fluctuating.

The third malacological zone formed between the depths of 160–100 cm (7000–3000/ 3500 BP years).The *Valvata cristata* shells were frequent (more than 50%). The frequency of aquatic *(Lymnaea palustris, Pisidium spp., Segmentina nitida)*, amphibious *(Succinea oblonga, Oxyloma elegans, Carychium minimum)* and strongly hygrophilous terrestrial elements *(Vertigo antivertigo, Vallonia enniensis)* is the highest in this zone.

On the basis of radiocarbon dating the first agricultural human populations occupy the territory at this time. Presumably the high quantity of sediment and terrestrial mollusca shell got into the channel derived from the shore, because of human impact. *Typha, Phragmites* remains were the major peat components, with in combination of *Carex elata* remains. Remains of water-lily communities detected in this zone. Water table was higher, but water surface was covered by closed plant mat.

From 100 cm the aquatic malacofauna changed. *Valvata cristata* declines, and the frequency of *Bithynia tentaculata* increased, indicating the eutrophication of water. The xerophilous and mesophilous elemets *(Pupilla muscorum, Vallonia costata, Helicopsis striata)* emerge among the terrestrial species. *Carex elata* and *Phragmites australis* remains were the major peat components and Fe, K rich peat formed on the top of the peat series. Water table is somewhat lower and *Caricetum elatae* plant community started covering the peatland surface during the last 3000 years.

Summary

The Red Marsh get well oxygenised, nutrient and carbonate rich surface water since the sediment accumulation have started. Then the paleochannel of the Red Marsh isolated from the flood waters of the Danube and got only underground water since the Early Holocene, when the increased erosion activity, caused by the Holocene neotectonic subsidence of the Solti Plain, got large amount of inorganic sediment to the cannel. *Phragmites* dominated plant associations emerged only in the Early Holocene. Tussock-hollow forming *Caricetum elatae* plant association emerged in the fragmented chanell, because of the increasing trophity and improving climate after 3500/30000 year BP.

Paleoassociations determined with the help of malacological data form a line of successions with the first fluvial phase appearing as early as 13.000 - 9.000 BP. This faunal assemblage must have been linked to a fluvial system. The appearance of several fluvial species (*Valvata piscinalis, Lithoglyphus naticoides, Planorbis* cf. *carinatus, Unio* cf. *crassus, Pisidium amnicum*) is also connected to this sandy layers.

This fluvial environment existing in a lateglacial paleochannel must have been surrounded by an open, gallery-like mixed taiga vegetation. Around 9.000 BP the channel started filling up with sediment resulting in the emergence of a eutrophic lacustrine environment characterized by an organic rich water depth of 2- 3 m in the deepest parts of the horse-shoes lake.

Parallel with these changes the surrounding vegetation also underwent a significant transformation resulting in the emergence of the deciduous woodland with the dominance of birch, then oak-lime and ash in the closest vicinity. This aquatic habitat underwent a total transformation first with the emergence of developing a reed peatland. The emergence of eutrophic conditions brought about a complete alteration of the Mollusk fauna as well. According to the radiocarbon data the accumulation of peat must have initiated as early as the beginning of the Atlantic phase in the paleochannel.

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