ENDEMIC EVOLUTION AND ICE AGE REFUGIA IN A THERMAL LAKE AT THE FRINGE OF A LOESSY LANDSCAPE DURING THE LATE GLACIAL AND THE HOLOCENE

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Support of the Ministry of Human Capacities, Hungary grants NFF 129265 and 20391-3/2018/FEKUSTRAT is acknowledged.

Microcolpia parreyssyi (Philippi, 1847) is a relic gastropod taxon restricted to a single thermal spring-fed lake in northwestern Romania. Based on morphological analyses, M. parreyssyi seems to be a descendant of M. duidobatarti acostei. The nature reserve includes three ponds and a river with thermal water at roughly constant 19°C temperature. The largest of the ponds Lake Petra is a small, thermal lake is home to many endemic taxa including the twilight, including Nymphaea lotus var. thermala. The research also incorporated paleoecological studies at Lake Petra on profile samples taken in 2009 by our research group encompassing 140 slates. The samples were divided into five groups of about 20, with similar shell conditions and other salts during the late Glacial. This pond with water temperatures ranging between 15-23°C based on the original fossils, including the prevalent SE European Lagena acostei and the subordinate Pannonian Tethysian prehistoric. This pool itself was of excellent hydrochemical conditions during the late Glacial. Recent human activities related to sewage reposition, thermal water exploration, and general personal use and paleontological studies have brought this unique taxon to the brink of extinction. The lake basin dried up in 2014. Despite the arid work to save some remaining specimens in this following the excavation, backlight and reintroduce it to other habitats, the taxon went extinct in 2014.

The hypothesised morphological lineage of Neubauer et al. (2014) adopted extensive outline analytical techniques to quantify morphological disparity of recent and subfossil specimens of M. parreyssyi. The pond itself was a refuge to these warmth-loving taxa during the ice age. Microcolpia parreyssyi must have emerged during the late Holocene. Recent human activities related to sewage reposition, thermal water exploration, and general personal use and paleontological studies have brought this unique taxon to the brink of extinction. The lake basin dried up in 2014. Despite the arid work to save some remaining specimens in this following the excavation, backlight and reintroduce it to other habitats, the taxon went extinct in 2014.

Several attempts have been made to elucidate the taxonomic identity of the forms. Most of these base on their visual observations and simple linear morphometric measurements. In their recent study on mixed museum specimens, Kormos et al. (2014) adopted an extensive allometric analysis of recent and subfossil specimens of M. parreyssyi. Nevertheless, their attempt to separate subgroups was unsuccessful. Only the taxonomic value of M. parreyssyi is certified based on morphometric data. Isotopic evidence presented were also inconclusive on the environmental conditions reflecting the Miocene climate. So the method reflected by the modern taxonomy was purely based on the information adopted from Kormos (2014). The second method of morphologic analysis of opercular subgroups and morphological adaptations has been carried out using Elliptic Fourier analysis of shell outlines (1999) techniques. As the study component in an isoploetic ordination it was also possible to highlight temporal morphological disparity. 25 harmonic components were used to capture the morphological information. A harmonic analysis, which as a result of the analysis the matrix has been subjected to PCA and deformations along PC axes highlighted. The recorded subgroups have revealed a great amount of variation that is linked with changes for the identified groups was also investigated using combined PCA of shape variables expressed on centered size.

The most important shape component (PCA 1) capturing 70% of total shape variation is shells being slender or more inflated. Other components represent smaller changes reflecting the emergence of shouldered, downward and sidesway displacement, rotation, elongation of the aperture, placement, and development of the individual shell for the development of typical shell appearance. Based on our findings two well-separated clusters are present corresponding to the turret-shaped forms (B) and the shouldered forms (A). Shell ornamentation (keels, ribs) appears in various forms and types in several original morphotypes reflecting individual variation. It is important to note that PCA1 corresponds to the common allometric component as well. This implies that when the two groups represent different morphotypes other than separate species. So within the two major groups shouldered is the key factor in creating subgroups and must be ontogenetically controlled. It is interesting to note that shouldered forms, though subordinately, appear together with turret shaped forms very early, at the base of our profile hammering the idea that these are direct descendants of turret shaped forms and emerged as a result of speciation. Based on their similarity to some phenotypes we recommend the use of names of M. duidobarti barbata (B) and M. parreyssyi (A). Morphological changes may multiple events of increasing disparity aborted by numerous reductions corresponding to multiple population bottlenecks after which new morphologies emerged. This periods of reduced morphologic disparity sometimes correspond to marked lithological changes implying environmental control on evolution. 

The hypothesis and model of evolution of Neubauer et al. (2014) is also depicted, with some forms collected from various localities (angomentum in type is biotoperical based on literatures descriptions).