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Ostracod preservation and response to Late Glacial and Early Holocene climate changes in a sub-alpine belt lake of the southern Romanian Carpathians

Sanda Iepure, Tadeusz Namiotko & Enikö K. Magyari

The role of ostracods in environmental and climate change reconstructions of Late Pleistocene and Holocene lacustrine environments of the Alpine region is well established (e.g., Löffler 1983; von Grafenstein 1999; Lauterbach et al. 2011). In contrast, ostracod studies in glacial lakes of the (sub-)alpine belt of the Carpathians in Romania thus far have been completely neglected, although the effects of the last glaciation have been more significant there than elsewhere in the southern Carpathians (Reuther et al. 2007). The Retezat Mountains in the Romanian Southern Carpathians are home of several peaks of over 2000 m asl that represented the major areas of ice accumulation during the Pleistocene (Reuther et al. 2007). Due to prevailing Mediterranean circulation of moist air masses this mountain unit is the wettest (1400 mm/yr at 1500–1600 m asl) in the Southern Carpathians (Mîndrescu et al. 2010). Recently, a series of Late Quaternary palaeoecological studies on the glacial lake sediments from the Carpathians has been initiated in order to provide regional palaeoclimatic and palaeoecological records inferred from multiple proxies (plant macrofossils, pollen, siliceous algae, cladocerans, chironomids as well as geochemical and ancient DNA analyses) (Magyari et al. 2009, 2011, Korponai et al. in press). The present study discusses the preservation of fossil ostracod assemblages and their response to Late Glacial and Early Holocene abrupt climate changes. The investigations were carried out on the lowermost 90 cm section of a 5 m-long core drilled in the sediments of Taul dintre Brazi Lake. This lake is located in the northern part of the Retezat Mountains at 1740 m asl in the sub-alpine belt. Due to its very small surface (about 30 m^2) and clearly defined catchment area, the lake is regarded as a very sensitively and rapidly responding ecosystem.

The studied core sediment sequence, corresponding to the period between 15.2 and 10.0 cal kyr BP, when an open mixed conifer forest formed around the lake (Magyari et al. 2011), yielded a total of 12,273 ostracod valves. However, the ostracod abundances of individual (2 cm-thick) sediment samples differed, varying between 0 (at the base of the sequence and around 14.8 cal kyr BP) and 975 (around 11.8 cal kyr BP), with an average of 342 valves per 10 cm^3 of fresh sediment. Although the overall ostracod abundances were high, the recovered valves were heavily decalcified,

lacking their calcitic part, while still retaining strong chitinous cuticle. Interestingly enough, remains of chitinous exoskeleton of the limbs as well as those of the Zenker organ and even spermatozoa were found well preserved almost throughout the entire studied sequence. The ostracod fossil assemblage of the lake proved to be monospecific, consisting of only *Cypria ophtalmica* (Jurine). The species is nearly cosmopolite generalist, inhabiting almost any type of inland waters, often doing well in stressed environments, as those highly organically polluted, hypoxic or acidic (Meisch 2000). It appears that *C. ophtalmica* colonized the lake around 14.3 cal kyr BP., i.e., after the period (15.7–14.5 cal. kyr BP) when low organic content and a shallow and oligotrophic environment prevailed (indicated by a poor assemblage of Cladocera: Korponai et al., in press).

Cypria ophtalmica showed markedly high fluctuations reflecting abrupt climate changes throughout the Late Pleistocene and the onset of the Holocene associated with the changes in the trophic level of the lake. Overall, the species abundance increased during significant episodes of warming (the first peak was observed in the GI-1c interstadial and the second one at the end of the Younger Dryas YD) and decreased when cooling conditions occurred (during YD) as indicated by the Greenland oxygen isotope record. At around 13.3 cal kyr BP, the abundance of *C. ophtalmica* and cladocerans *Chydorus sphaericus* (O.F. Müll.) and *Daphnia longispina* (O.F. Müll.) (Korponai et al. in press) shows a short rapid increase and reaches a maximum at 13.0 cal kyr BP. The decrease in *C. ophtalmica* abundance was associated with the organic content depletion in the sediment that could be further linked with the re-advance of the M3 glacier in the northern part of the Retezat Mountains and the associated cooling effect. During the YD, the abrupt increase in seasonality caused an evident decrease of *C. ophtalmica*, but the species abundance was maintained as moderate until the onset of the Holocene. However, throughout the entire YD reversal, the lake productivity did not drastically decrease, as evidenced by the sediment stratigraphy and loss of ignition measurements (Magyari et al. 2010). From the beginning of the Holocene population of *C. ophtalmica* decreased significantly until 10.1 cal kyr BP when reconstructed temperature was 13.2 °C, higher than at the present day in July at this elevation (Magyari et al. 2010). This work is the first contribution on Late Glacial–Holocene ostracods of the (sub-)alpine lacustrine habitats in the Romanian Carpathians.

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Authors addresses:
Sanda Iepure
Babes-Bolyai University, Department of Mineralogy, Kogalniceanu 1, 3400, Cluj, and Speleological Institute “Emil Racovitza”, Department of Cluj (Biospeleology), Clinicilor 5, 400006 Cluj Napoca, Romania
siepure@hasdeu.ubbcluj.ro

Tadeusz Namiotko
University of Gdansk, Department of Genetics, Laboratory of Limnozoology, Kladki 24, 80-822 Gdansk, Poland
namiotko@biotech.ug.gda.pl

Enikö K. Magyari
MTA-MTM Research Group for Paleontology, 1476 Budapest, P.O. Box 222, Hungary
magyari@bot.nhmus.hu