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Late Pleistocene and Holocene climatic variability in the Carpathian-Balkan region. Abstracts volume



**Late Pleistocene and Holocene Climatic Variability
in the Carpathian-Balkan Region**

ABSTRACTS VOLUME



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Drivers of Holocene treeline and timberline changes in the Retezat Mountains (South Carpathians, Romania)

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Four high-altitude lake sediment sequences (Lake Brazi, 1740 m a.s.l., Lake Gales 1990 m a.s.l., Lake Bucura, 2040 m a.s.l. and Lake Lia, 1910 m a.s.l.) were analyzed using multi-proxy methods (pollen, stomata, plant macrofossil and micro- and macrocharcoal) in order to study responses of treeline and alpine/subalpine vegetation to climate change and human impact during the last 15000 years. Observing and reconstructing the changes of the position and structure of the treeline can provide valuable information on biotic and other factors such as human activities. Sediment cores were taken from two lakes on the northern slope (Lake Brazi and Lake Gales) and two lakes from the southern slope (Lake Lia and Lake Bucura) in the Retezat Mountains, South Carpathians (Romania).

Our results suggest that the treeline on the northern slope reached the lower lake (1740 m), during the late glacial (~14,000 cal yr BP) while the treeline ecotone reached the upper lake (Lake Gales, 1990 m) at ~11,900 cal yr BP. During the Early Holocene the timberline reached and passed the elevation of Lake Brazi (1740 m) and has stayed above it. The zone of closed forest did not reach as high as Lake Gales (1990 m) during the last 15,000 years. The presence of two species was recorded by stomata and macrofossil analyses. European larch (*Larix decidua*) was the dominant tree species in the terminal part of the late glacial and in the Early Holocene (between 12,300 and 10,200 cal yr BP) around Lake Brazi, but was most likely outcompeted under a more oceanic climate by European spruce (*Picea abies*) and Swiss stone pine (*Pinus cembra*) and went extinct during the Mid Holocene. Silver fir (*Abies alba*) appeared as high as Lake Gales between 8100 and 6800 cal yr BP, which is ~650 m higher than its present upper distributional limit.

On the southern slopes Lake Lia was colonized by trees and shrubs around 12,200 cal yr BP, and the timberline also reached and probably exceeded its elevation around 9000 cal yr BP. Lake Lia

was surrounded by *Picea abies* and *Pinus cembra* between 6700 and 3800 cal yr BP with *Pinus mugo*. The results of the macrofossil analysis from Lake Bucura suggest that the timberline did not reach the altitude of the lake (2040 m). Dwarf pine (*Pinus mugo*) was the dominant woody species until 3000 cal yr BP, when its abundance decreased and later it disappeared from the macrofossil record (~ 2000 cal yr BP).

The disappearance of tree species from the lake-shores of Gales and Lia in the late Holocene (between *ca.* 3800 and 4200 cal yr BP) can be explained partly by regional climate change and partly by anthropogenic impact. In one hand, the chironomid-based July air temperature reconstructions suggesting strong temperature decline between 4000 and 4500 cal yr BP, which follows the change of the summer insolation in this period. The increasing concentration of *Pinus cembra* fossils in Lake Brazi at the same period suggesting a downslope shift in the lower limit of its distribution which also pointing to climatic change. On the other hand, results of the pollen analysis also showed increased human impact in this period, lowland cultural indicators such as *Plantago lanceolata* and *Plantago major-media* appeared in the record from 4200 cal yr BP.

Our results show that the treeline ecotone in the Retezat Mts consisted of dwarf pine (*Pinus mugo*), European spruce (*Picea abies*) and Swiss stone pine (*Pinus cembra*), while in the Alps the treeline ecotone was mostly composed of European larch (*Larix decidua*) and mountain pine (*Pinus uncinata*). Pioneer species, such as dwarf pine (*Pinus mugo*), Scots pine (*Pinus sylvestris*) and European larch (*Larix decidua*) spread widely in response to Early Holocene warming in the Alps. The latter species was dominant until around 9000-8000 cal yr BP in the Alps and still plays an important role in the continental part of the treeline ecotone, whereas it went totally extinct in the Retezat Mountains around 8500 cal yr BP.

In summary, the results show that significant climate change started earlier (*ca.* 4500 cal yr BP) then followed by the intensified human impact.