

## THE HOLOCENE FOREST LIMIT IN THE NORTHERN PIRIN MTS (SOUTH-WESTERN BULGARIA) – PALAEOECOLOGICAL EVIDENCE FROM POLLEN ANALYSIS, MACROFOSSIL PLANT REMAINS AND <sup>14</sup>C DATING

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**ABSTRACT.** The results of plant-macrofossil and pollen analysis at the Praso peat-bog (1900 m) and in Lake Popovo Ezero (2185 m), both situated within the range of the potential forest limit are presented. The composition of the vegetation and changes in the forest limit since 7200 BP are discussed.

**KEY WORDS:** Holocene, forest limit, pollen, plant macrofossils

### INTRODUCTION

In the northern Pirin Mts the forest limit is formed by communities of the Balkan endemic species *Pinus peuce* Grieseb., *Picea abies* (L.) Karst. and the Balkan relict subendemic species *Pinus heldreichii* Christ, at 2000–2100 m a.s.l. The results of the present palaeoecological study conducted at two sites, both located within the range of the potential forest limit, shed light on the composition of Holocene vegetation and fluctuations in the forest limit.

### SITE INFORMATION

Lake Popovo Ezero-6 (2185 m a.s.l.) and the Praso peat-bog (1900 m a.s.l.) are located in the northern part of the Pirin Mts (south-western Bulgaria). Alpine meadow vegetation (Caricetum) occurs around the lake and communities of *Pinus mugo* Turra and *Juniperus sibirica* Burgsd. are typical on the surrounding slopes. A *Pinus peuce* forest with single trees of *Pinus sylvestris* L. and *Picea abies* surrounds the Praso peat-bog. The species which occur at the upper forest limit in the study area, today at about 2000–2100 m a.s.l., are *Pinus peuce* and *Picea abies*.

### VEGETATION CHANGES AROUND LAKE POPOVO EZERO-6 AND THE PRASO PEAT-BOG

The Praso peat-bog and the exposed part of the bed of Lake Popovo Ezero-6 were cored using a Dachnowsky

corer. Six <sup>14</sup>C datings revealed sedimentary records spanning 7200 BP. The detailed data on pollen and macrofossil material obtained from the cores were given by Stefanova & Oeggl (1993) for Praso and by Stefanova & Bozilova (1995) for Popovo Ezero. From their results Figs 1 and 2 were constructed, which show the macrofossil concentrations (per 50 cm<sup>3</sup>) and pollen percentages of selected tree taxa.

The following brief overview of the vegetation development and major vegetation changes is based on these results:

7000 (7200)–6700 (6500) BP (zone A): A *Betula pendula* forest with single trees of *Salix* and *Populus* grew around the Praso peat-bog. At the same time, herb vegetation dominated by Poaceae, Asteraceae and Caryophyllaceae covered the area around Lake Popovo Ezero-6. The low content of macrofossils from *Betula* within the Popovo Ezero-6 core suggests a reduced incidence of birch above 2000 m.

6700 (6500)–4800 BP (zone B): This period is characterized by a mass expansion of *Pinus* species and genus *Abies* Miller and a continuous decrease of *Betula*. According to pollen and macrofossil records at Popovo Ezero-6, *Pinus peuce* reached the lake area and formed monodominant communities. This conclusion is based on the pollen percentages of *Pinus peuce* (40–42%) which are higher than those reported from the analysis of recent surface samples (32–37%) (Stefanova 1996). *Abies* reached its maximum altitude (up to 1900 m) and, together with *Pinus peuce*, formed part of the vegetation around the Praso peat-bog. *Pinus sylvestris* constituted

LAKE POPOVO EZERO-6

Macrofossil concentrations

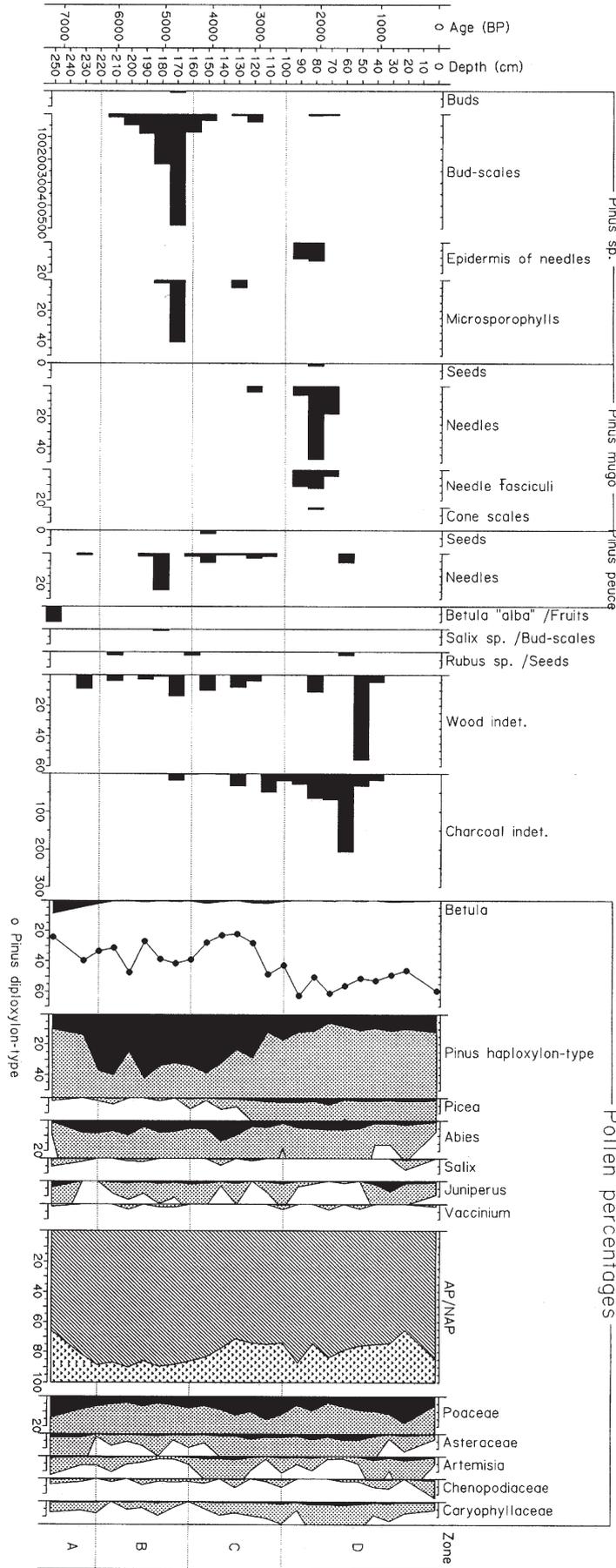


Fig. 1. Lake Popovo Ezero-6: Macrofossil concentrations and pollen percentages of major tree taxa

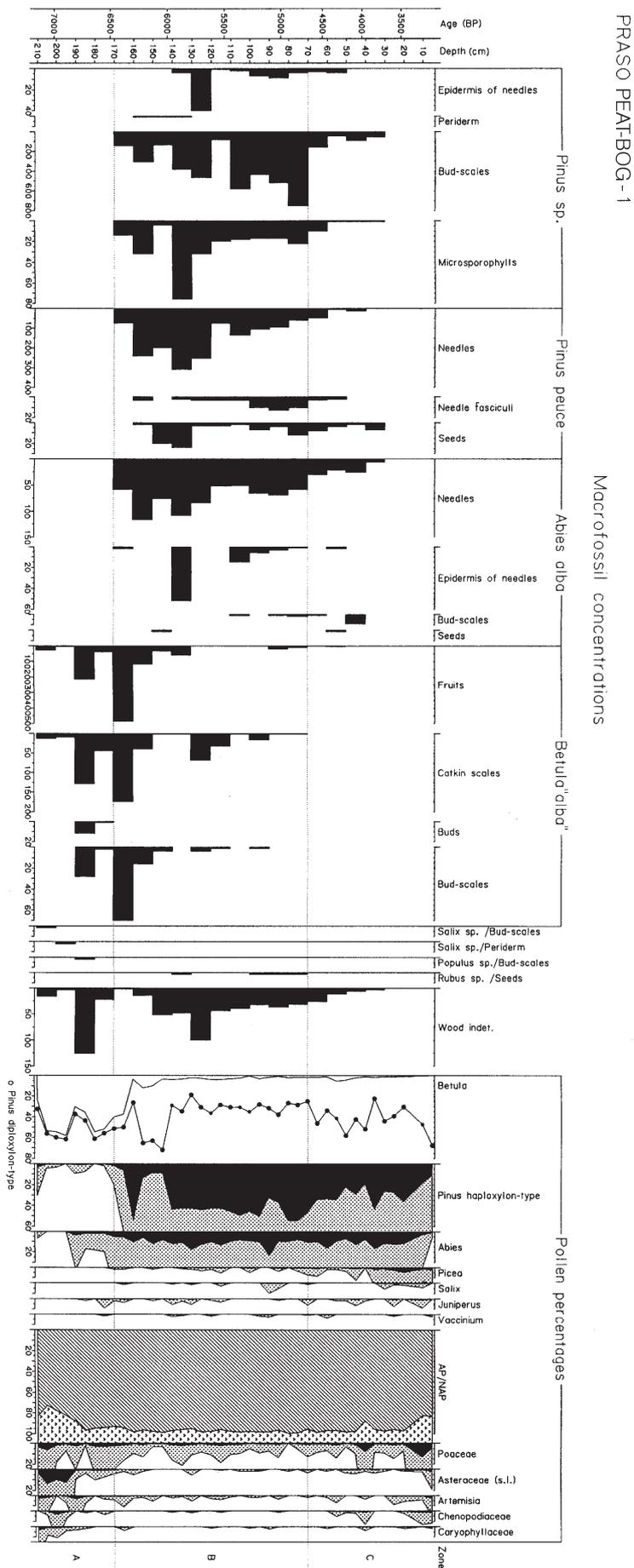


Fig. 2. Praso peat-bog: Macrofossil concentrations and pollen percentages of major tree taxa

pure communities at lower altitudes and probably occurred mixed with *Pinus peuce* in the contact zones.

4800–2500 BP (zone C): The incidence of *Pinus peuce* in the coniferous belt was reduced. The pollen percentages and macrofossil concentration showed a gradual decrease at both sites. In the sediments from Popovo Ezero-6 grains of charcoal particles were found. After 3900 BP *Abies* started to move down towards the lower part of the coniferous belt while around 3000 BP an expansion of *Picea* was observed.

2500–0 BP (zone D): *Pinus peuce* retreated and *Pinus mugo* established itself in the vacated areas around Popovo Ezero-6 between 2500–1300 BP. After 1300 BP the contemporary herb communities developed there. High concentrations of charcoal in the sediments lead to the assumption that the *Pinus mugo* communities were burnt down by man.

#### FLUCTUATIONS OF THE FOREST LIMIT

The results of both macrofossil- and pollen analysis from Lake Popovo Ezero and the Praso peat-bog show that between 7200–6700 (6500) BP *Betula pendula* formed the forest limit at 1900–2000 m a.s.l. After 6700 (6500) BP *Pinus peuce* became a dominant element in the upper part of the coniferous belt and formed the forest limit. The maximum pollen percentages and concentrations of macrofossils of *Pinus peuce* suggest that the species reached its optimum development under more favourable climatic and edaphic conditions. Between 6700 (6500)–4800 BP the upper forest limit reached its highest elevation, above 2200 m. After 4800 BP a decrease in the pollen percentages and macrofossils of *Pinus peuce* is observed, although the regular finds of needles during this period could mean that the upper forest limit did not

descend below 2200 m. After 2500 BP the macrofossil data indicate an overall fall in the forest limit.

The interpretation of the results from Praso and Lake Popovo Ezero-6 in terms of climate and human impact is not easy. Thus, for instance, pollen and macrofossils of *Pinus peuce* in the sediments from Popovo Ezero-6 show a decrease before the rise of grains of charcoal observed between 4800–2500 BP. This could imply that the decrease of *Pinus peuce* in this period resulted from climatic changes and the activities of man. However, it is more probable that human impact caused a lowering of the forest limit after 2500 BP. The grains of charcoal in the sediments of Popovo Ezero-6, as well as an increase in anthropophytes, support this assumption. The intensified human impact on the natural vegetation at the beginning of the Subatlantic is probably connected with the changes which occurred in the Thracian tribes' economy at the end of the Bronze Age (3000–2800 BP), i.e. the introduction of iron, the migration of the population to the metal-producing zones and the development of cattle-breeding in the mountain regions (Fol & Spiridonov 1983).

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