

Palynological research in the Šumava Mountains

Palynologický výzkum Šumavy

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Abstract

Peat bogs are prominent and specific ecosystem in the Šumava Mts. They have an important and exceptional value; they keep recording information about their own recent and ancient past, about the vegetational history and factors of natural environment in the nearby and more distant landscape. This information is obtainable by means of paleobotanical methods, such as the pollen and macroscopic analyses. In the past, scientific studies of the Šumava Mts. were generally scarce, owing to their location in the frontier area. They are also little known palynologically. – Along with the geochemical investigation, pollen analysis of the upper part of Jezerní Míre section (thickness 0.26 m) was carried out, and dated by the newly applied ^{210}Pb method (VILE & al. 1995). Besides studying the peat bog sediments by means of pollen analysis, it was also suitable to apply this method to the lacustrine sediments of the Šumava lakes, i.e., to Černé Lake (BRÍZOVÁ 1991a, b, 1993, 1995; REISSINGER 1930, 1931; ŘEHÁKOVÁ 1991 – diatoms) and Čertovo Lake (BRÍZOVÁ 1991a, b, 1993, 1995; VESELÝ & al. 1993), the latter sediments being also used for geochemical study (VESELÝ 1994). Their thickness was 1.15 m and 0.8 m, respectively. The analysed deposits date back to the younger Subatlantic period (Period X – by FIRBAS 1949, 1952).

Key words: pollen analysis, Holocene, stratigraphy, Jezerní Míre, Černé Lake, Čertovo Lake

Introduction

The Šumava Mts. are one of the most significant peat bog areas in the Czech Republic. These vast peat bog complexes and Šumava glacial lakes are important sources of sediments suitable for pollen analysis which provides the opportunity to reconstruct vegetational evolution since the last glacial age until today. A study based on pollen analysis was hardly feasible in the past, since these sediments were located in the inaccessible frontier area during the Cold War.

Palynological data illustrating the whole development of vegetation come only from the Bavarian locality of Haidmühle (STALLING 1987) and from the Hůrecká mire in the Czech Republic (SVOBODOVÁ 1995). Additional information on pollen analysis, macro-remains and further scientific research in the Šumava peat bogs, is summarized in the works of SITENSKÝ (1886), SCHREIBER (1924), MÜLLER (1927), RUOFF (1932), KLEČKA (1928, 1933), SPIRHZANZL (1951), DOHNAL & al. (1965), SUCCOW & JESCHKE (1986); the pollen analyses performed in sediments in the Šumava foothills are described by RYBNÍČKOVÁ (1973) and by RYBNÍČEK & RYBNÍČKOVÁ (1974).

Palynological evaluation of the upper 0.26 m of the Jezerní Míre section was done along with the geochemical studies and ^{210}Pb dating (VILE & al. 1995).

Palynological research of the lacustrine sediments referred to Černé Lake (BRÍZOVÁ 1991a, b, 1993, 1995; REISSINGER 1930, 1931; ŘEHÁKOVÁ 1991 – diatoms) and Čertovo Lake (BRÍ-

ZOVÁ 1991a, b, 1993, 1995; VESELY & al. 1993) and was paralleled by geochemical studies (VESELY 1994).

Methodology

The samples for pollen analysis come from a collection obtained in the course of geochemical research. They were taken at intervals of 0.01 m, 0.02 m and 0.05 m, according to the need of simultaneous studies. The samples were processed in the laboratory by maceration in HF (FAEGRI & al. 1964, OVERBECK 1958) for one day, which caused decomposition of the mineral particles; for breaking up the cellulose and the other organic remains, the adapted acetolysis method of ERDTMAN (1943, 1954) was applied. Pollen grains and spores are kept in a mixture of glycerol, ethanol and distilled water in a favourable ratio. The data obtained by the microscopic analysis were evaluated and pollen diagrams were plotted. FIRBAS' (l.c.) subdivision was used in classifying the reconstructed vegetational development and chronological position of the sediments.

Results of palynological studies

Jezerní Mire

On the whole, 13 samples collected by M. Novák at 0.02 m were evaluated palynologically. The section can be dated to the youngest phase of the younger Subatlantic period (Xb). The ^{210}Pb method indicates the interval between 1550 and 1965. Vegetational development in that period, as recorded by the pollen diagram (VILE & al. 1995), shows already a considerable influence of humans on nature in the Šumava Mts., probably affected by the exploitation of the Jezerní Mire. Historical literature (e.g. NOŽICKÁ 1957) indicates that interference into the vegetational cover was brought about as early as in the 16th century, by the expansion of mining, ore dressing, glass production, pasture, wood felling and floating, by wind storms and by various pests. A comprehensive restoration of woodland was undertaken in the late 18th and early 19th century, however, mostly pine (*Pinus*), spruce (*Picea*) and less oak (*Quercus*) and beech (*Fagus*) were planted. The plantations of single-dominant coniferous stands culminated mainly in the sixties of the 18th century. Consequences showed as late as in the late 19th century. The change to the detriment of natural woodland composition is reflected in the pollen diagram between 0.14 and 0.16 m (1823–1845), which is also confirmed by the indicators of grazing, i.e. pollen grains of *Juniperus*, *Urtica* and *Plantago*, and indicators of cereals (*Cerealía*) accompanied by nitrophilous weeds. Human presence and activity is reflected in the pollen spectrum by a conspicuous rise of pollen values of pine (*Pinus*) and birch (*Betula*), and by a marked decline of pollen values of beech (*Fagus*) caused undoubtedly by increased felling of this tree used as important fuel and timber. The same applies to oak (*Quercus*).

The fall of pollen values of *Sphagnum*, the gradually increasing content of pollen grains of the family Ericaceae and of *Calluna vulgaris*, indicate a degradation and gradual desiccation of the peat bog mostly between 0.06 and 0.08 m (1898–1931). At the same time, the greatest fall in pollen values of trees at the depth of 0.08 m, throughout the whole section, might reflect a greater pressure of humans on the forest ecosystems of the Šumava Mts.

Černé Lake

It is the largest natural glacial lake in the Czech Republic. The lacustrine sediments were sampled in the course of J. VESELY's investigations in a 1.15 m thick section, at intervals of

0.01 m, 0.02 m and 0.05 m. Throughout the section, the pollen grains and spores were very well preserved as to their condition and number. They were dated merely by pollen analysis and compared with geochemical and literature data. Their age has been estimated to lie within 1000 A.D. and 1877 (Periods Xa and Xb – older and younger phases of the younger Subatlantic period by FIRBAS). Based on the vegetation evolution in the pollen spectrum, the boundary between these phases has been set at the depth of 0.95 m below the surface. Analysed section can be subdivided into three zones: 1. 0.00 – 0.14 (0.12) m, 2. (0.12) 0.14 – 0.95 m, 3. 0.95–1.15 m. The third zone represents the oldest part of the section, with the above mentioned boundary Xa/Xb, and is marked by the fall in the amount of pollen grains of the woody species *Corylus*, *Picea* and *Abies*, and by the appearance of synantropic plants such as *Rumex*, *Artemisia* and *Cerealia*. The second zone (middle part) is marked by constant drop in the curves of the above mentioned woody species and even of *Fagus*. The first zone – the youngest portion of the section, records the greatest impact on the ecosystems and direct interference of humans into nature, possibly even into the lake's environment.

Conditions in the lake are characterized by aquatic plants such as *Isoetes lacustris* (its occurrence on the territory of the Czech Republic being limited only to this locality) and the green alga *Botryococcus* whose mass occurrence indicates a probably high eutrophication of the lake at the depth of 0.75–1.00 m. This is confirmed by an increased Mg content (see VESELY 1994) which in turn reflects erosion caused by the retreat of forests; similar situation is at the uppermost 0.02 m.

Čertovo Lake

Its sediments were palynologically analysed merely on a test basis; only eight samples were investigated from a 0.80 m thick section, and no detailed evaluations, similar to those described in the previous sections, could be conducted. Stratigraphically, these sediments can be dated to the younger Subatlantic period (Period X by FIRBAS l.c.). The course of the curves in the pollen diagram resembles that in the previous pollen spectra. On the whole, the woodland species spectrum covering the analysed period is identical with that from Jezerní Mire and Černé Lake.

Summary

The Šumava peat bogs and glacial lakes are unique ecosystems which preserve in their deposits a valuable information on the recent and more distant past, on the vegetational history, and on environmental factors of the broader landscape. This information is obtained by means of palaeobotanical methods, e.g., the pollen analysis.

Palynological investigation of the Šumava area was conducted along with the geochemical studies of sediments of Jezerní Mire (0.26 m thick) and the lacustrine sediments of Černé Lake and Čertovo Lake (thickness 1.15 m and 0.8 m, respectively). The studied sections could be dated up to the younger Subatlantic period (Period X by Firbas 1949, 1952). Upon comparing the development of vegetation and available data from literature, it became clear that the changes in natural conditions were largely induced by the influence of humans on the given ecosystems, particularly in the course of the last centuries.

Accurate dating of the sediments is based on the ^{210}Pb method (see Jezerní Mire); the lacustrine sediments were dated with the aid of geochemical investigations and based on a survey of literature.

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