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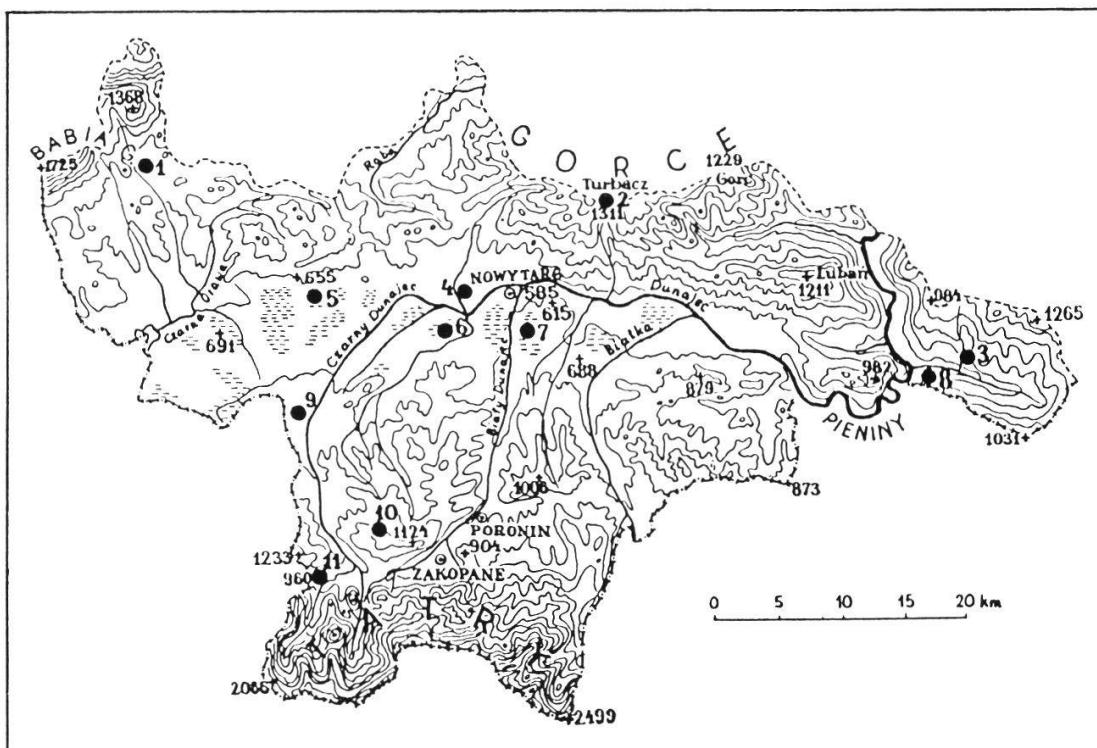
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## Major aspects of the history of vegetation in the Podhale area (Inner West Carpathians, S. Poland)

Andrzej OBIDOWICZ

Palynological investigations have been carried out in the Podhale Basin since the nineteen-twenties (Fig. 1). The first modern description of the Late-Glacial and Holocene vegetation changes is owed to KOPEROWA (1962). This



**Fig. 1.** The Podhale region and distribution of peat bogs palynologically examined.  
1 - Zubrzyca Gorna, 2 - Kiczora, 3 - Bryjarka, 4 - Grel, 5 - Puscizna Rekowianska, 6 - Przymiarki, 7 - Bor na Czerwonem, 8 - Staszowa, 9 - Rudne, 10 - Palenica, 11 - Molkowka (for references see OBIDOWICZ 1990).

paper presents results of the long-term palaeo-ecological investigations of the West Carpathian peat bogs (cf. OBIDOWICZ 1989, 1990).

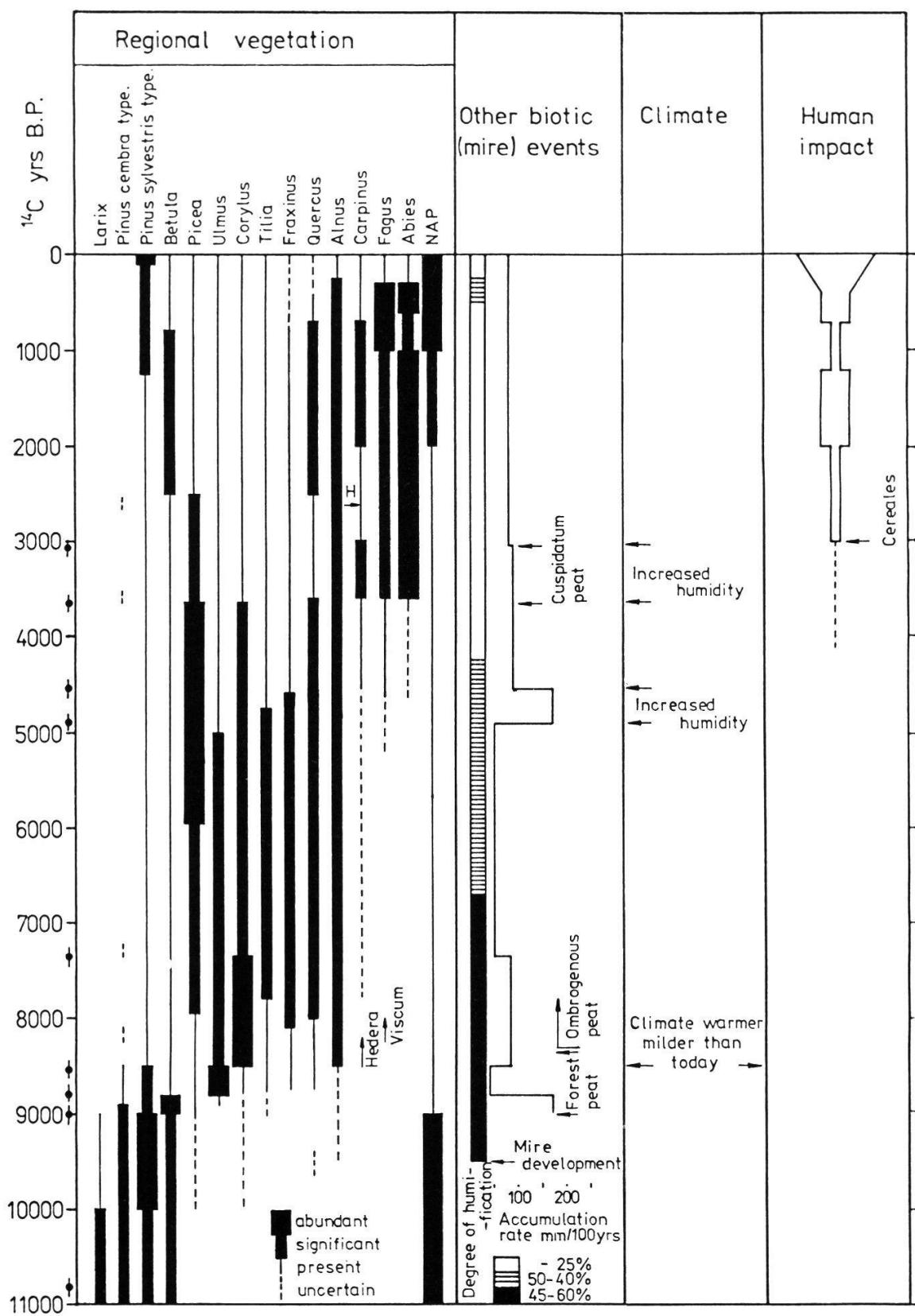
The history of the latest 10'000 years is recorded continuously in the peat deposits and the underlying layer of clay of the Puscizna Rekowianska bog (Fig. 2), and is representative of the Podhale area.

Puscizna Rekowianska is a high bog, about 280 ha in area. Deep ditches, draining its margins, have brought about the dominance of secondary communities of dwarf shrubs. The association, *Sphagnetum magellanici* and *Scheuchzerio-Sphagnetum cuspidati*, and a community with *Sphagnum papillosum* grow in the central part of the bog where the water table is high. The beginnings of the bog formation in Podhale date back to the Allerød when, according to KOPEROWA (1962), pine-spruce forests with birch, alder and fir were dominant. That first stage of biogenic deposit accumulation was interrupted owing to a progressive change in the watershed and a wide overflow of river waters. The Younger Dryas, at least its decline, represented at the bottom of Puscizna Rekowianska, was a period of forest-tundra vegetation which, at the beginning of the Holocene, gradually turned into pine and stone forests with an admixture of larch. Since 9'200-9'000 B.P., the forest area increased and the deposits of Puscizna Rekowianska began to accumulate. Peat layers containing 60-80% sedge remains with a contribution of *Equisetum fluviatile* and *Phragmites australis* were deposited, and peat comprising up to 90% remains of *Drepanocladus* sp. accumulated locally.

Starting from c. 9'000 B.P., the forests became denser, which is confirmed by the high concentration of AP. Birch and birch-pine swamp forests with abundant ferns, and a high proportion of *Filipendula* then dominated. The areas of peat accumulation are characterized by the mass occurrence of *Betula nana*, documented both in the pollen profile and by macrofossils.

Immediately after the retreat of birch forests, *Ulmus* became a dominant element for a short time, *Acer* and *Corylus* appeared in Podhale, and *Picea* began to expand. A gradual warming of the climate without any significant changes in the total annual rainfall brought about a marked decrease in the rate of peat accumulation.

The phase of *Corylus* dominance started about 8'570±90 B.P. On south-facing slopes the hazel found suitable conditions to form communities related to the association, *Lonicero-Coryletum*, now associated with shallow and stony soils. It also contributed to the riparian forests of *Fraxino-Ulmetum* type. However, more common in the river valleys of Middle Podhale were forest communities of the *Alnetum incanae* type. During the hazel phase, *Quercus*



**Fig. 2.** Event stratigraphy table for the Western Carpathians.  
B.P. = before present.

and *Tilia* appeared in Podhale and sporadically, *Taxus*, which is its earliest Holocene appearance in the West Carpathians. The climate was warm and not very dry, with warm summers and mild winters (*Hedera*, *Viscum*). At about 8'300 B.P. the accumulation of minerogenic peat came to an end in a considerable part of Puscizna Rekowianska mire, ombrogenic peat started to grow. The *Eriophorum vaginatum* dominated community appeared at that time. The phase of dominant deciduous forests and the optimum development of carrs, surely comparable with the present-day *Fraxino-Ulmetum* or *Carici remotae-Fraxinetum* communities, began about 7'350±160 B.P. In the eastern part of Podhale alderwoods of the *Alnetum incanae* type were still fairly common. The south-facing slopes provided good conditions for *Asperulo-Tilietum* type forests. Spruce began to expand intensely about 6'000 years ago. Since c. 7'350±160 B.P., different peat types, dominated by the ombrrophic species of *Sphagnum*, began to accumulate. Their accumulation took place nearly all over the whole peat bog surface, but its rate is half lower than during the previous phase. The water table in the peat bog was relatively low during the growing season, resulting in the decrease in the accumulation rate and in an intense humification persisting till c. 6'700 B.P. Later on in this phase, the intensity of peat decomposition decreased.

About 5'000 B.P. the area occupied by carrs shrank and spruce forests expanded; from 4'540±150 B.P. they dominated absolutely. About 5'000 B.P. a rapid rise in the rate of peat accumulation occurred, without any noteworthy changes in the composition of peat-forming communities. This is undoubtedly an indication of increasing humidity connected with a cooling climate. A progressive transgression of ombrogenic peat beyond the initial area of the accumulation basis can be observed in this phase in the Podhale peat bogs. After 4'540±150 B.P. the accumulation rate decreased again. At the decline of *Picea* pollen assemblage zone, *Betula nana* disappeared from the Podhale. Swamp pine forests of the *Eriophoro vaginati-Pinetum* or *Pino rotundatae-Sphaggetum* type developed on some peat bogs as early as then.

During the period between 3'670±70 and 3'030±60 B.P., all the forest communities corresponding to recent communities of the West Carpathians were formed. The vertical zonal system resembling the present-day pattern developed as well. Later transformations were of mainly quantitative nature. The proportion of *Ericaceae* remains very distinctly decreased in the peat deposit, and the degree of peat decomposition has decreased. In the other peat bogs examined, the type of peat changed in conformity with a high water table. An essential change of climate connected with the increase of precipitation

during the growing season took place at that time. During the remaining 3'000 years hummock peat, and especially its variety with *Sphagnum magellanicum*, was deposited in all the peat bogs examined. This may indicate a stabilization of climate, particularly its humidity.

The first changes in the pollen diagram which may be connected with the episodic presence of Neolithic tribes are interpolated at c. 4'100 B.P. These changes might have occurred in the immediate neighbourhood of Puscizna Rekowianska. The early Bronze Age is represented in the form of a considerable number of archaeological materials in the West Carpathians. In the Podhale area, these are stone artefacts frequently devoid of pottery, which belonged to pastoral groups (VALDE-NOWAK 1986). Their apparition follows in the formation period of zonal tree communities (3'600-3'000 B.P.). The activities of these surely very few and sporadic groups had no influence on transformations of the Podhale forests. The increasing traces of settlement can be correlated with the period of Lusatian culture. At about 3'000 B.P. ( $^{14}\text{C}$  date) anthropogenic changes began to appear in the Podhale forests. The presence of man from this date has been confirmed by the continuous curve of cereals and the increasing proportion of apophytes and anthropophytes pollen. Since the beginning of the 13th century, the settlement in the Podhale has been documented by historical records. The beginning of peat harvesting put an end to its growth. The disturbed hydrological system favours the expansion of *Pinus* and development of the association, *Pino rotundatae-Sphagnetum* and in many peat bogs, also the development of a community with *Sphagnum capillifolium*.

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