The Younger Dryas – its start, development and the transition to the Holocene as recorded in the laminated sediments of Lake Gosciaz, Central Poland

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A high-resolution record of proxy indicators of climate change (pollen, oxygen isotope ratios) for the Late Glacial/Early Holocene part of the annually laminated sediments of Lake Gosciaz (fig. 1) is presented. The chronology was formerly based on four well correlated cores from the central deep of the lake, and a single core (G1/90) from the western deep (Ralska-Jasiewiczowa et al., 1992). The laminated sequence in the Younger Dryas (YD) part of the central cores was interrupted by a sand layer, and the core G1/90 was the only one revealing continuous lamination over the whole period. However, the Late Glacial part of this core was collected in two segments labelled 13–14 m and 14–15 m. An attempt was made to correlate them with the laminated sequences from above and below the sand layer in the central cores. At that stage, the time span corresponding to the sand layer was estimated to ca. 520 years (Goslar et al., 1993), and the age of the whole YD sequence to ca 1640 years. When trying to correlate a new core G1/91 from the western deep, containing the YD sediment sequence in one segment, with other cores we found out that the two segments of core G1/90 overlap by ca 45 cm (fig. 2). The overlapping of segments was not taken into account during the previous attempts of core correlations, but is undoubted. It was probably caused by troubles during the coring from the boat (there was no ice cover on the lake over a period of several years). Finding the overlap revealed an erroneous correlation of the 14–15 m segment of G1/90 with the central cores, and enabled to find the correct one. It appeared then possible to correlate correctly the Late Glacial part of the core from the northern bay (T1/90, where a hiatus had been assumed) with all other cores.

The revised chronology of the Late Glacial part of the laminated sediments of Lake Gosciaz is now constructed using seven cores. The revision reduced the period corresponding to the sand layer to 4–10 years, and shortened the whole

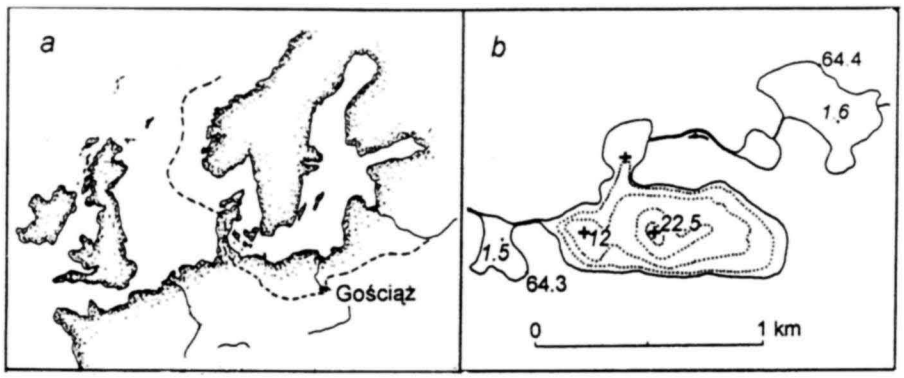

Fig. 1a. Schematic map showing the location of Lake Gosciaz and the extent of the Fennoscandian ice sheet (broken line) during the last glacial maximum (ca 18 000 BP).
Fig. 1b. Contour map of lake Gosciaz and its surroundings. The lake is the largest and deepest one in a complex of four lakes connected by the Ruda stream. The elevations above sea level and depths of the lakes are given in meters. Crosses indicate sampling points in the central deep, the western deep and the northern bay.

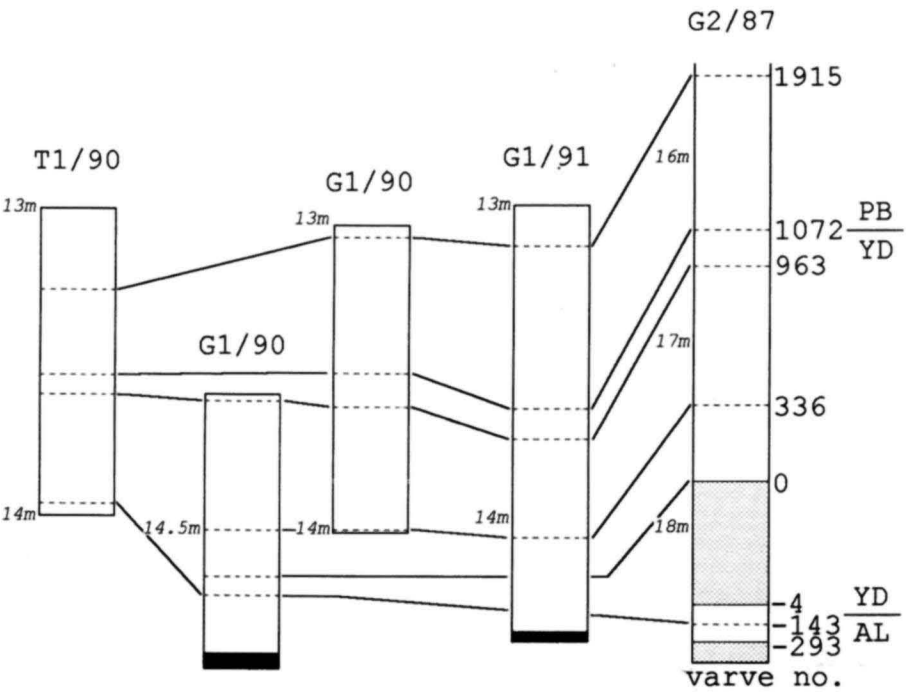

Fig. 2. Schematic correlation of cores from the northern bay (T1/90), western deep (G1/90) and G1/91) and the lake centre (represented by core G2/87) after the overlap of the two G1/90 segments has been found. The varve numbers are given to the right. Black layer: peat; small dots: sand.

Late Glacial section by ca 500 years. It was possible to put the samples collected from both segments of core G1/90 in a proper chronological order, so the pollen diagram is now consistent with that from the central deep (fig. 3).

At the present stage of studies the reconstruction of Late Glacial and Early Holocene environmental and climatic conditions is based on records coming from 5 profiles. A selection of data of two of them, representing the central (G1/87) and western (G1/90) deepest parts of the lake, are shown in fig. 3; three other profiles come from the northern bay and its margins (Demske 1993 and unpublished). They show altogether that the accumulation of biogenic matter in the sediment started first in the shallower marginal parts of the lake where the melting down of the dead-ice block proceeded faster. The pollen records from the marginal cores begin as early as the Older Dryas, or even the Oldest Dryas (Demske unpublished). However, the beginning of annually laminated sediment accumulation seems to be more or less synchronous in all known profiles and is dated at the late phase of the Allerød (AL).

The pollen records from particular cores show some differences that will be discussed elsewhere, but the general picture of the vegetational succession is consistent and may be summed up as follows:

During the later phase of the AL the dominant plant communities were open *Pinus-Betula* woods which during the AL/YD transition were replaced by open shrub-herb communities (reduction of *Betula* and *Populus* pollen frequencies followed by a rise of *Juniperus*, *Salix polaris* type, *Artemisia*, Chenopodiaceae and other indicative herb pollen types). A sharp drop of the alga *Tetraedron minimum* at the AL/YD transition reflects the decline of the summer temperatures in the lake. A certain variability of climate within the Younger Dryas cold period is apparent from both the microfossil and isotope curves. Generally two main phases can be distinguished: an older phase of relatively colder and drier climate followed by a period of milder climate (the last ca. 600 years before the Younger Dryas/Preboreal transition). The younger phase is characterized by a gradual increase of *Betula* pollen frequencies, coincidental with the decline of *Juniperus*, *Salix polaris*-type, Chenopodiaceae and later also *Artemisia*. All these changes point to a slow, gradual development of forest, reducing the open shrub-herb communities.

The YD/PB transition is characterized by a sharp drop of *Juniperus*, and a fast increase of thermophilous taxa like *Populus*, *Filipendula*, *Urtica* and *Tetraedron minimum*. The isotope and palynological data both indicate a sudden change of climate at the onset and at the termination of the YD, completed within approximate 150 and 70 years respectively, which is in close agreement with previous estimates derived from Greenland ice cores and marine sediments. The duration of the YD, concluded from laminae counts is now 1140 ± 40 years. The oxygen isotope data may indicate a short, relatively cool phase ca 100 years after the start of the Preboreal, but there is no contemporaneous palynological evidence for such a phenomenon.

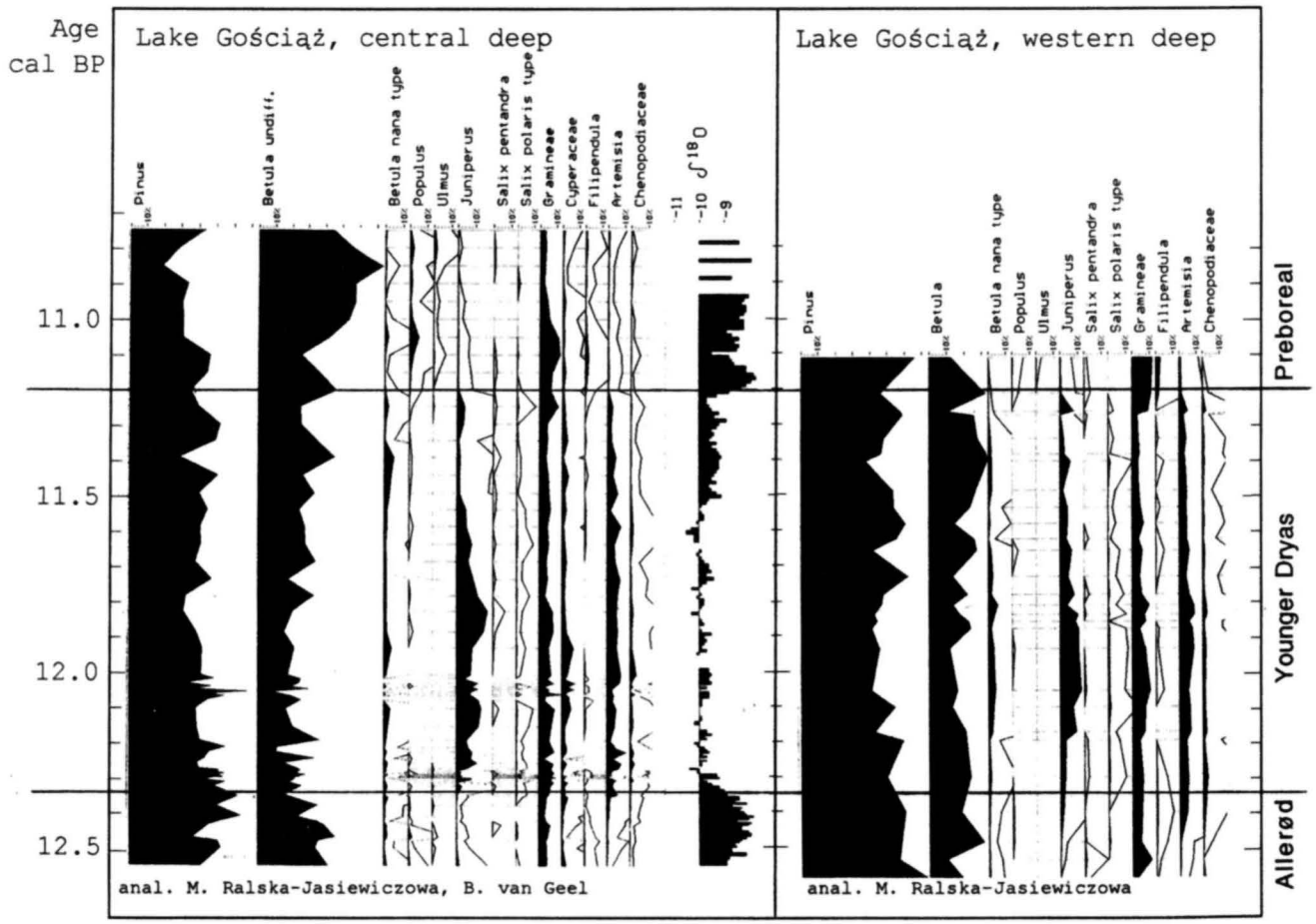

Fig. 3. Comparison of simplified pollen diagrams (selected pollen taxa) from the central (G1/87) and western deep (G1/90) of Lake Gosciaz, based on the varve to varve correlation of sediment cores. The high-resolution Oxygen isotope curve from G1/87 is shown in the middle column.

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