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Age models for peat deposits on the basis of coupled lead-210 and radiocarbon data.

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The study presents three examples of age-model construction based on the results of ^{210}Pb and ^{14}C dating methods applied to peat deposits. The three sites are ombrotrophic peat bogs: the Misten (Belgium), Slowinskie Bloto (N Poland) and Puscizna Mala (S Poland). All sites have been subjected to multiproxy studies aimed at reconstructing paleoenvironment and human activity, covering the last 1500, 1300 and 1800 years, respectively (De Vleeschouwer et al. 2009A, 2009B, in prep., Fialkiewicz-Koziel, ongoing PhD). A detailed comparison between ^{210}Pb and post-bomb ^{14}C results in the Misten bog has also been carried out by Piotrowska et al. (2009).

In all cores, the ^{210}Pb activity was calculated using ^{210}Po and ^{208}Po activities after acid-extraction from bulk samples, subsequent deposition on silver discs and measurements by alpha spectrometry. Unsupported ^{210}Pb was detected until 35cm in Slowinskie Bloto, 15cm in the Misten and 19cm in Puscizna Mala. Constant Rate of Supply (CRS) model was then applied to compute ages of each 1-cm core interval.

For the Misten and Slowinskie Bloto, radiocarbon measurements were performed on selected aboveground plant macrofossils, mainly *Sphagnum spp.* or *Calluna vulgaris*, *Erica tetralix*, and *Andromeda polyfolia*. Radiocarbon ages were determined using accelerator mass spectrometry (AMS) after acid-alkali-acid wash, combustion, purification of carbon dioxide and graphitisation. For Puscizna Mala bulk samples were dated after chemical preparation of benzene for liquid scintillation counting (LSC) or CO_2 for gas proportional counting (GPC).

Radiocarbon calibration was undertaken using the Intcal04 calibration curve and OxCal 4 software. As *a priori* information the ^{210}Pb-derived ages were used in a *P_Sequence* model (Bronk Ramsey, 2008). A number of dates characterized by low agreement with stratigraphical order had to be considered as outliers and rejected from the final age model.

For building a continuous age models a non-linear approach called generalized additive model (GAM) was used, as described by Heegaard et al. (2005). The calculations were performed within each period on the middle-point of the 95.4 % range of calibrated age, while an uncertainty equal to half of this range was assumed. The results of ^{210}Pb dating are described by Gaussian distribution and in their case 1-sigma range was used. The resulting age-depth relationships provide a mean age and an age range for each 1-cm thick slice of peat, and allows for calculation of sedimentation rates.

This study highlights some important issues connected with radiocarbon dating of peat sequences. Commonly known problems are wide ranges of calibrated ages caused by wiggles in calibration curve for the period just beyond the range of precise ^{210}Pb dates, which can undoubtedly be solved by ^{14}C-dating more samples from thinner slices. It also emphasizes the great potential of Bayesian analysis applied in radiocarbon calibration. The high suitability of coupled ^{210}Pb-^{14}C dating applied to dating of peat deposits was also confirmed.

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