

The cold event 8200 years ago recorded in annually laminated lake sediments in Eastern Europe

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DR1. The annual nature of the laminations at the top of the core was independently verified with ^{210}Pb datings and by detecting ^{137}Cs , ^{241}Am , and carbonaceous fly-ash marker layers. The ^{210}Pb chronology based on 15 samples fits well with the varve counts within its uncertainty range. The levels of the 1986 Chernobyl event and 1963 atmospheric nuclear bomb tests determined from the ^{137}Cs and ^{241}Am stratigraphy fall into the varve count within ± 1 year. A characteristic spherical fly-ash particle marker layer in the 1940s (Alliksaar et al., 1998) coincides with the varve chronology.

DR2. The results of the 4 out of 5 AMS dates on terrestrial macrophytes fit into the combined varve and paleomagnetic chronology of the Lake Rõuge sediment sequence. ^{14}C dates were calibrated with CALIB 4.2 program (Stuiver & Reimer, 1993), using the INTCAL98 calibration data (Stuiver et al., 1998). The bidecadal tree-ring data set A was used for calibration and a 10-sample smoothing was applied to the calibration curve.

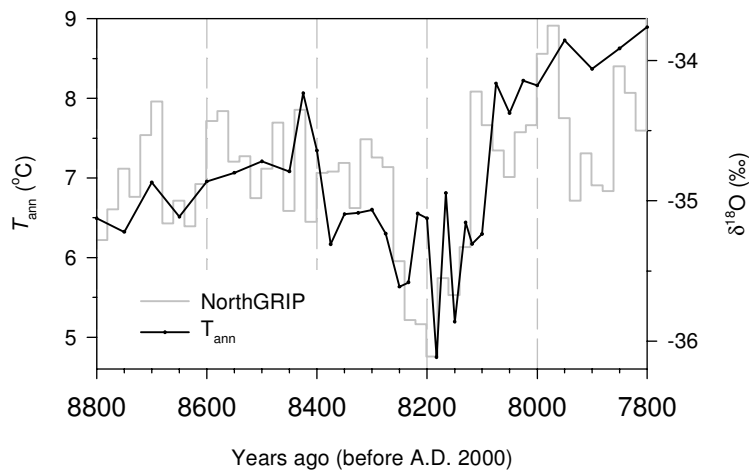
Depth (cm)	^{14}C age (yr BP)	Calibrated age (cal yr BP 1σ range)	Laboratory number	Dated material	Comparative varve age
197 – 200	1400 ± 50	1275 – 1350	Ua-19790	Mixed macrofossils	1365 – 1408
359 – 361	3230 ± 60	3370 – 3550	Ua-19532	Wood	3977 – 4010
453	4830 ± 45	5480 – 5610	Ua-21327	Wood	5470 – 5500
632 – 633	9145 ± 65	10220 – 10400	Ua-21328	Wood	Outlier
667 – 670	9160 ± 95	10220 – 10480	Ua-18439	Mixed macrofossils	10300 – 10400*

*Estimated by extrapolating from the lower varve contact at 9400 ± 85 years at a constant sedimentation rate

DR3. The pollen samples were prepared following standard methods (Berglund and Ralska-Jasiewiczowa, 1986) with *Lycopodium* spores added to calculate pollen influx (Stockmarr, 1971). At least 500 arboreal pollen grains were counted at each sample level. The percentages of terrestrial pollen and spore taxa were calculated on the basis of their total sum. Stable isotopic analyses were carried out with a Delta E (Finnigan MAT) mass spectrometer at the Isotope-Paleoclimatology Laboratory, Tallinn Technical University. Lake marl was decomposed on 100% phosphoric acid at 50 °C. The results are presented in the usual δ notation, as per mil (‰) deviation from the VPDB standard. Reproducibility of the replicate analyses (7 out of 37) was generally better than 0.1%.

DR4. The pollen-climate calibration set ranges from the Hemiboreal Zone in Southern Estonia to the oroarctic heaths of northernmost Fennoscandia. The gradient of the T_{ann} in the region is $10.2\text{ }^{\circ}\text{C}$ (5.5 to $-4.7\text{ }^{\circ}\text{C}$). The pollen surface samples (top $\sim 10\text{ mm}$) were collected from small- to medium-sized lakes in 1997 and 2002. The samples were prepared and analyzed in a standardized way by one analyst. The transfer functions and sample-specific reconstruction errors were generated with the CALIBRATE 0.81 and WAPLS programs (ter Braak and Juggins, 1993). For the reconstruction, a 2-component model of the WA-PLS method was chosen on the basis of the lowest RMSEP and highest r^2 . In the leave-one-out cross-validation (jack-knifing) the modern T_{ann} is reconstructed or ‘predicted’ n times using a training set of size $n-1$, omitting the sample from the site for which the modern climate is predicted (Birks, 1995). The transfer functions were developed using all terrestrial pollen and spore types, with their percentages transformed to square-roots to optimize the ‘signal-to-noise’ ratio and stabilize the variances (S5). The RMSEP as a percentage of the gradient length of T_{ann} is 8.8%.

DR5. A blowup of trends in the Lake Rõuge T_{ann} reconstruction (black line) and the NorthGRIP $\delta^{18}\text{O}$ record (grey bars) at 8800–7800 years ago. Both records have independent chronologies.



DR6. The measured varve thickness (total, organic, and minerogenic parts separately) proxy at Lake Rõuge was analyzed statistically to determine the correlation between varves and instrumentally measured runoff data at the stream running through the lake for the period 1983–1996. The results show that the correlation coefficient between varve thickness and annual runoff is 0.52 and winter/spring runoff 0.68. This supports the idea that lighter and more clastic varves show the intensity of the spring flood during snowmelt and indicate particularly severe and snow-rich winters.

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