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Terrestrial climate signal of the "8200-yr cold event" in the Labrador Sea region

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Methods and chronology

Core stratigraphy. A 9m-long peat core (NDN02/1) was collected from Nordans Pond Bog in 2002 using a large-bore Russian corer. Sub-samples were taken at 8-cm intervals to permit centennial-scale resolution throughout the Holocene. Additional sampling was conducted at intervals of 4cm from 8400 to 8000 yr BP, and 1cm across the primary isotopic event, to provide sub-centennial and decadal resolution, respectively. In contrast to $\delta^{18}O$ analyses of bulk peat by earlier workers, *Sphagnum* leaves were isolated from each sub-sample using a stacked sieve system and density-separation procedure (Daley, 2007). The grain-size fraction containing the highest abundance of *Sphagnum* remains was subjected to density separation by hand swirling in a petri dish to separate non-*Sphagnum* elements, which were removed by pipette. The effectiveness of this procedure was verified by microscopic examination. Alpha-cellulose was prepared from the *Sphagnum* concentrates for isotopic analysis (Loader et al., 1997). Absence of *Sphagnum* remains precluded measurement of $\delta^{18}O$ on some sampled levels but only led to short gaps in the $\delta^{18}O_{Sphagnum}$ time series (see Table DR1**).**

Isotopic analysis. Water samples (n = 8) were collected from the bog surface in July 2004 and analysed using a standard Zn-reduction method for δD and standard equilibration for $\delta^{18}O$. Stable-isotope ratios were measured on an automated VG Isogas Sira 12 triple-collecting mass spectrometer and the results expressed using conventional δ notation in per mille (‰) relative to VSMOW (Vienna Standard Mean Ocean Water). δD data were normalised to the SMOW-SLAP scale using IAEA standards OH-1, OH-3 and OH-4. Alpha-cellulose samples were pyrolysed over glassy carbon at 1090ºC using an ANCA-GSL elemental analyser interfaced with a PDZ Europa 20-20 isotope-ratio mass spectrometer and the results expressed in δ notation (‰) relative to VSMOW. The precision of replicate alpha-cellulose extractions from a single core level was ± 0.32‰ (1σ, n = 10).

Palaeoclimatic reconstruction. $\delta^{18}O_{precipitation}$ was estimated from $\delta^{18}O_{Sphagnum}$ using the measured cellulose-water enrichment factor $\alpha = 1.0274 \pm 0.0010$ (1σ) (Daley, 2007). The slope of the modern ΔT - $\Delta\delta^{18}O_{precipitation}$ relationship was derived by linear regression from the GNIP datasets for Goose Bay, Labrador ($R^2 = 0.60$, $p << 0.0001$, n = 57) and Truro, Nova Scotia ($R^2 = 0.62$, $p << 0.0001$, n = 75). Both GNIP datasets pass normality-assumption testing by the Kolmogorov-Smirnov technique. The 1σ error of the $\delta^{18}O_{precipitation}$ estimates is given by $\pm \sqrt{[(0.32)^2 + (1.0)^2]}$.

Radiocarbon chronology. 23 levels were selected from core NDN02/1 for AMS ^{14}C dating (Fig. DR1 and Table DR2). Dated material picked from peat sub-samples comprised aerial parts of *in situ* plant remains only. The calibrated age of each sample was taken to be the mid-point of the most probable age range given by CALIB 5.0.2 (Stuiver and Reimer, 1993). Dating uncertainty (Fig. 4) was given by the 2σ range from CALIB 5.0.2. Three dates exhibit temporal reversals at 450 cm, 652 cm and 616 cm. Whilst every effort to sample above ground in situ remains was made, it is possible that young root material, difficult to identify by microscopy, was present in these individual samples. Two options exist for modelling a sequence in which temporal reversals are present. Either a choice needs to be taken to omit one of the two dates that comprise a reversal or a global model needs to be fitted that treats each date as equally probable and avoids the inherent subjectivity of selecting one for omission. The second, more objective option has been used here. The age-depth model for the core was constructed by cubic regression (equation 1) ($R^2 = 0.9964$):

$$\text{Age (yr BP)} = -156.6 + 4.46\,(\text{depth}) + 0.0361\,(\text{depth})^2 - 0.000035\,(\text{depth})^3 \qquad (1),$$

where depth is measured in cm down-core.

Figure DR1. Calibrated ^{14}C dates for NDN02/1 (circles) with calibration ranges from 2σ errors on conventional radiocarbon ages (bars). Cubic regression age-depth model ($y = -156.6 + 4.46x + 0.03617x^2 - 0.000035x^3$) shown by bold black line.

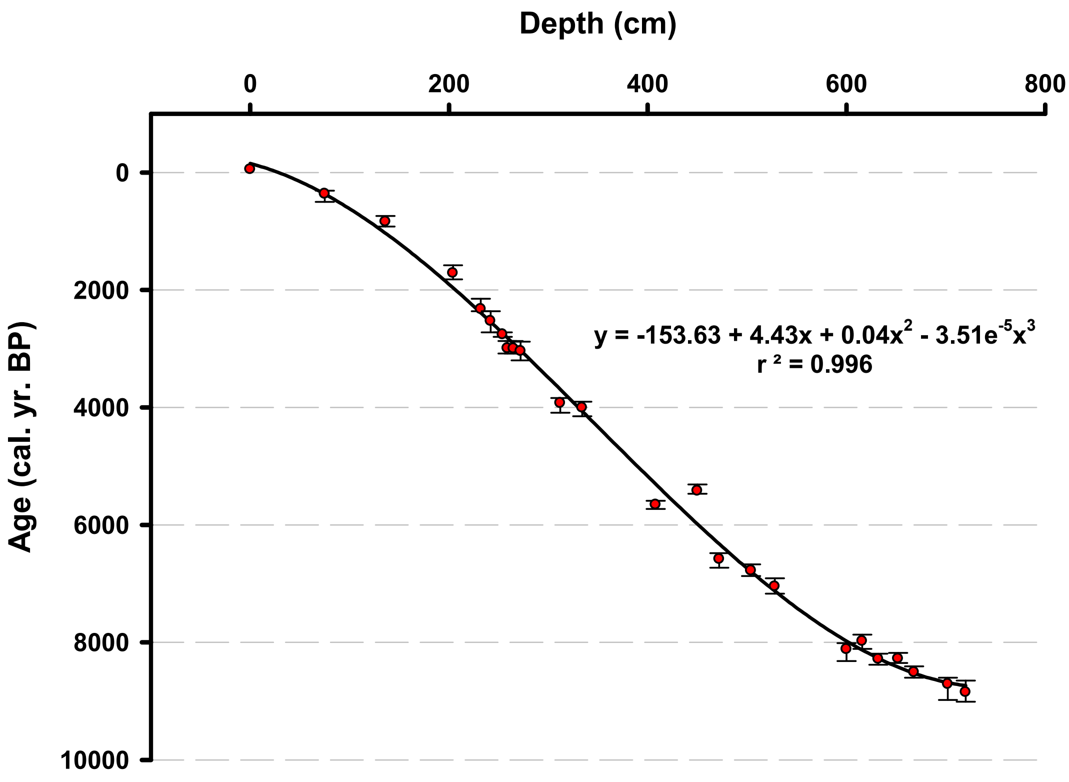

Table DR1. NDN02/1 Core stratigraphical data.

Measured $\delta^{18}O_{Sphagnum}$ data used to generate $\delta^{18}O_{precipitation}$ estimates with their corresponding depths and interpolated ages (Table DR2). $\delta^{18}O_{precipitation}$ values were derived using the measured $\alpha_{cellulose\text{-}precipitation}$ enrichment factor of 1.0274 ± 0.0010 (1σ) (Daley, 2007).

NDN02/1 core stratigraphic data

Depth below surface (cm)	Age (cal. yr. BP)	$\delta^{18}O_{Sphangum}$ (‰)	$\delta^{18}O_{Precipitation}$ (‰)
0	-157	19.70	-7.50
8	-119	20.19	-7.02
16	-76	20.42	-6.79
24	-29	19.97	-7.23
32	22	19.67	-7.53
40	77	20.40	-6.82
48	137	20.29	-6.92
56	200	19.91	-7.29
64	268	20.89	-6.34
72	339	21.02	-6.21
80	414	20.31	-6.90
88	492	20.19	-7.02
96	574	19.74	-7.46
104	659	19.67	-7.52
112	747	19.89	-7.31
120	839	20.06	-7.14
128	933	20.47	-6.75
136	1031	20.24	-6.97
144	1131	19.53	-7.66
152	1234	19.69	-7.51
160	1340	19.56	-7.64
168	1448	19.97	-7.24
176	1558	20.51	-6.71
184	1671	19.32	-7.87
192	1785	19.72	-7.48
200	1902	20.54	-6.68
208	2021	20.56	-6.66
216	2142	20.46	-6.76
220	2203	20.44	-6.77
224	2264	21.61	-5.64
232	2388	20.60	-6.62
240	2513	20.60	-6.62
248	2640	20.41	-6.81
256	2768	20.05	-7.16
264	2898	19.87	-7.33
272	3028	19.72	-7.48
276	3094	19.20	-7.99
280	3160	20.98	-6.25
284	3226	20.08	-7.13

288	3292	18.86	-8.32
292	3358	19.17	-8.01
296	3425	18.77	-8.40
300	3492	20.23	-6.98
308	3626	18.96	-8.22
312	3693	20.17	-7.04
316	3760	21.61	-5.64
320	3828	22.43	-4.84
324	3895	20.72	-6.51
328	3963	21.06	-6.17
332	4030	20.51	-6.71
336	4098	22.25	-5.01
344	4233	22.25	-5.01
352	4368	22.33	-4.93
384	4908	21.99	-5.27
408	5307	21.41	-5.84
416	5439	21.32	-5.92
424	5569	21.93	-5.33
440	5827	21.27	-5.97
448	5954	21.50	-5.74
456	6080	21.41	-5.84
464	6204	22.50	-4.77
472	6326	22.46	-4.81
480	6447	22.05	-5.21
488	6566	22.75	-4.53
496	6683	23.17	-4.12
504	6798	21.79	-5.47
512	6911	21.77	-5.48
520	7022	21.55	-5.70
528	7130	21.30	-5.94
576	7724	20.14	-7.07
600	7981	19.57	-7.62
604	8020	19.34	-7.85
608	8059	20.23	-6.98
612	8097	19.66	-7.53
616	8135	18.76	-8.41
620	8171	18.57	-8.60
624	8206	19.42	-7.77
628	8241	20.46	-6.75
632	8274	19.58	-7.61
636	8306	20.06	-7.15
637	8314	19.85	-7.35
638	8322	18.97	-8.21
639	8330	18.36	-8.80
640	8338	17.92	-9.23
641	8346	17.67	-9.47
642	8353	17.78	-9.37
643	8361	17.46	-9.67
644	8368	17.47	-9.67
645	8376	17.59	-9.55
646	8383	17.87	-9.28
647	8391	17.72	-9.43
648	8398	18.61	-8.56
649	8405	18.09	-9.06

656	8454	21.99	-5.27
702	8691	21.62	-5.63
706	8704	22.02	-5.24
708	8710	22.14	-5.12
Measurement precision		±0.32	±1.05

Table DR2. Radiocarbon dates from core NDN02/1.
AMS ^{14}C age determinations and 1σ error ranges for all of the sampled levels. 2σ calibrated age ranges for these determinations were obtained from the calibration program CALIB 5.0.2. The calibrated date is taken as the midpoint of the most probable age range.

Table S2 Radiocarbon dates from Core NDN02/1

Lab. Code	Material	Depth below bog surface (cm)	^{14}C date (yr BP uncal.)	±1σ	Calibrated age (yr BP)	2σ calibrated range
SUERC - 508	*Sphagnum*	75	355	35	364	500 – 310
SUERC- 9924	*Sphagnum* and dicot remains	136	912	35	838	920 – 740
Beta -182370	*Sphagnum*	204	1790	40	1714	1820 – 1580
SUERC -9923	*Sphagnum* and dicot remains	232	2279	35	2326	2360 – 2150
GrA - 31483	*Sphagnum*	242	2470	30	2528	2720 – 2360
GrA - 31485	*Sphagnum*	254	2635	30	2758	2800 – 2720
GrA - 31487	*Sphagnum*	259	2855	30	2994	3080 – 2870
GrA - 31488	*Sphagnum*	265	2865	30	2998	3080 – 2870
Beta - 182371	*Sphagnum*	272	2890	40	3042	3200 – 2880
SUERC -9922	*Sphagnum* and dicot remains	312	3632	37	3926	4090 – 3840
SUERC - 538	*Sphagnum*	334	3691	40	4006	4150 – 3900
SUERC -9919	*Sphagnum*	408	4922	38	5660	5730 – 5590
SUERC - 539	*Sphagnum*	450	4640	31	5419	5470 – 5310
SUERC -9918	*Sphagnum*	472	5796	43	6584	6730 – 6480
Beta - 182373	*Sphagnum*	504	5950	40	6780	6870 – 6670
SUERC -9917	*Sphagnum*	528	6144	43	7048	7170 – 6910
SUERC -9915	*Sphagnum*	600	7330	62	8118	8320 – 8010
SUERC - 540	*Sphagnum*	616	7156	34	7980	8110 – 7870
SUERC -9914	*Sphagnum*	632	7475	50	8286	8380 – 8190
Beta - 182374	*Sphagnum*	652	7460	40	8279	8350 – 8180
SUERC -9913	*Sphagnum*	668	7740	52	8509	8600 – 8410
SUERC -9912	*Carex* eutricles and seeds	702	7921	52	8711	8980 – 8600
Beta - 182375	*Sphagnum*	720	7980	40	8850	9010 – 8650

References Cited

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