Supplementary Information for

Environmental controls of rapid terrestrial organic matter mobilization to the western Laptev Sea since the last deglaciation

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Supplementary Figs 1 to 5

Supplementary Tables 1 and 2

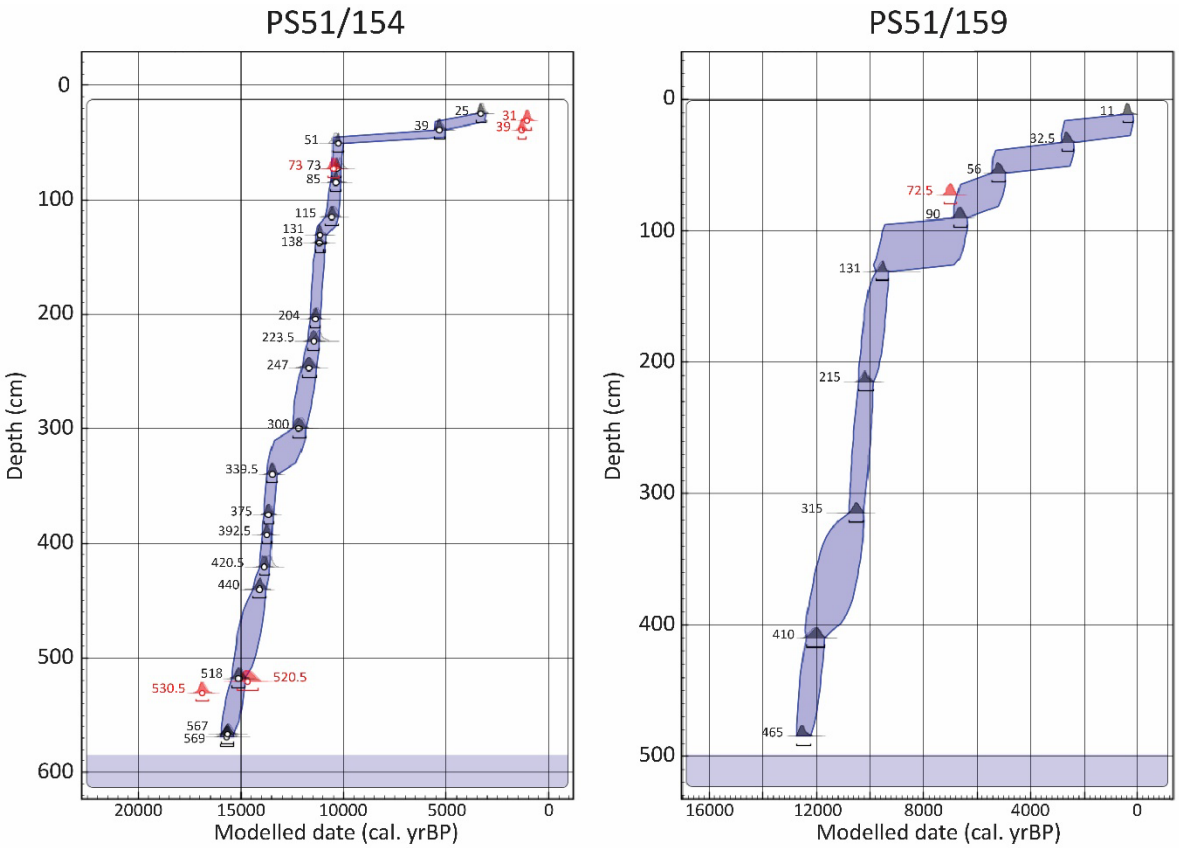

Fig S1. Age-depth models for cores PS51/154 and PS51/159. The two models are calculated by Oxcal 4.4 software (Bronk Ramsey, 2021), with Marine20 calibration curve (Heaton et al., 2020) and ΔR = −95±61 yr, according to the Laptev Sea reservoir age reconstruction from Bauch et al. (2001). The numbers next to the age probabilities denote the depth of the sample. Samples marked in red indicate the samples excluded from age model determination. The purple bands indicate the range of 95.4% age probability.

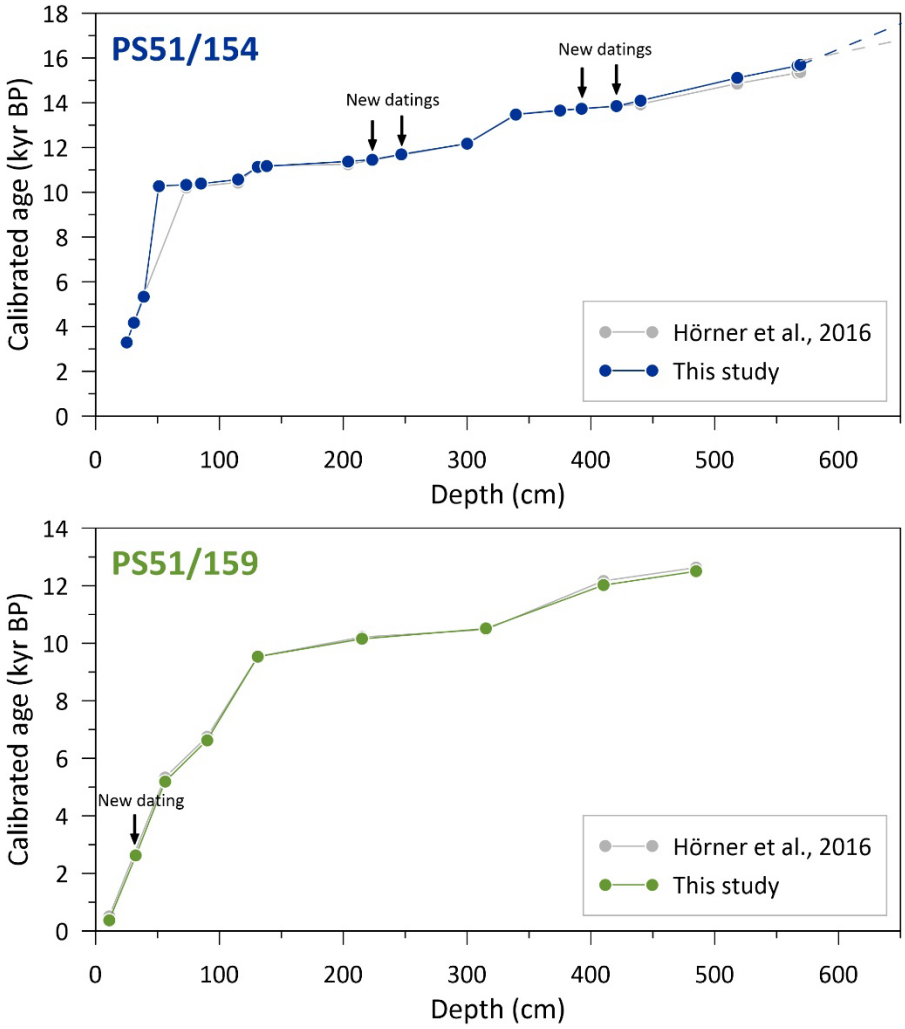

Fig S2. Age-depth models of core PS51/154 and PS51/159 published in Hörner et al. (2016) (grey lines) and in this study (colored lines). Black arrows indicate the new radiocarbon dating results added in this study (see Table 1). The dashed lines at the bottom of the core PS51/154 indicate the age model extrapolated from the radiocarbon dating points.

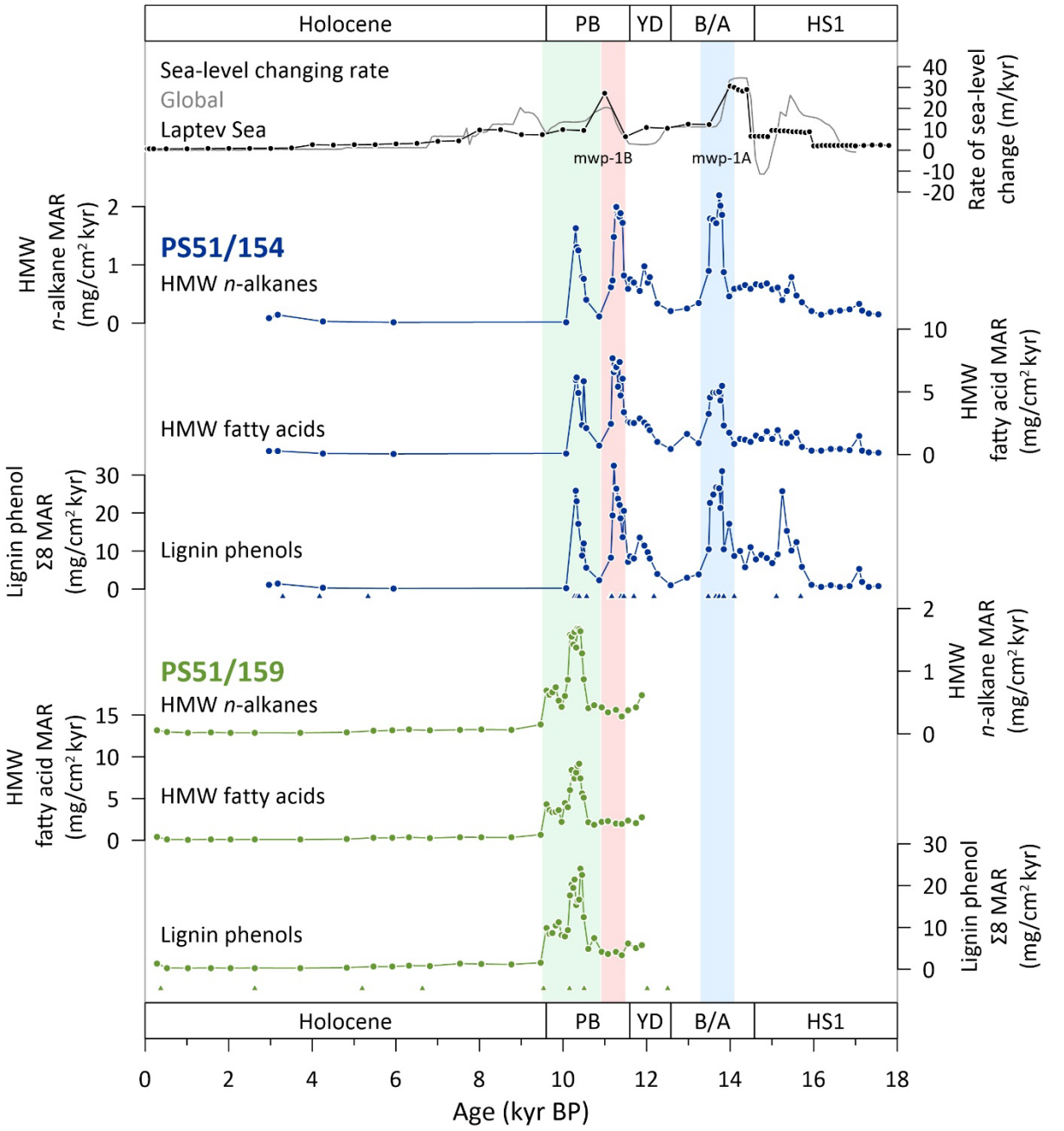

Fig S3. Terrestrial biomarker mass accumulation rates (MAR) from HMW *n*-alkanes, HMW fatty acids, and lignin phenols in cores PS51/154 (dark blue, this study) and PS51/159 (light green, this study). The compounds we used to calculate HMW *n*-alkane MAR include C_{27}, C_{29}, C_{31}, and C_{33}, and HMW fatty acid MAR includes $C_{24:0}$, $C_{26:0}$, $C_{28:0}$, and $C_{30:0}$. For lignin phenol MAR, we used the sum of Vl, Vn, Vd, Sl, Sn, Sd, *p*-Cd, and Fd (Σ8). The triangles denote the age points from radiocarbon dating measurements. The rate of global sea-level change is labeled in light grey (Lambeck et al., 2014), and the rate of sea-level change in the western Laptev Sea is labeled in black (Klemann et al., 2015). The color bars highlight the periods with HMW fatty acid MAR peaks from 14.1 to 13.2 kyr BP (blue, *MAR peak I*), from 11.6 to 10.9 kyr BP (red, *MAR peak II*), and from 10.9 to 9.5 kyr BP (green, *MAR peak III*). Meltwater pulses are denoted as mwp-1A and mwp-1B. The names of different paleoclimate periods are indicated by acronyms (HS1: Heinrich Stadial 1, B/A: Bølling-Allerød, YD: Younger Dryas, PB: Preboreal).

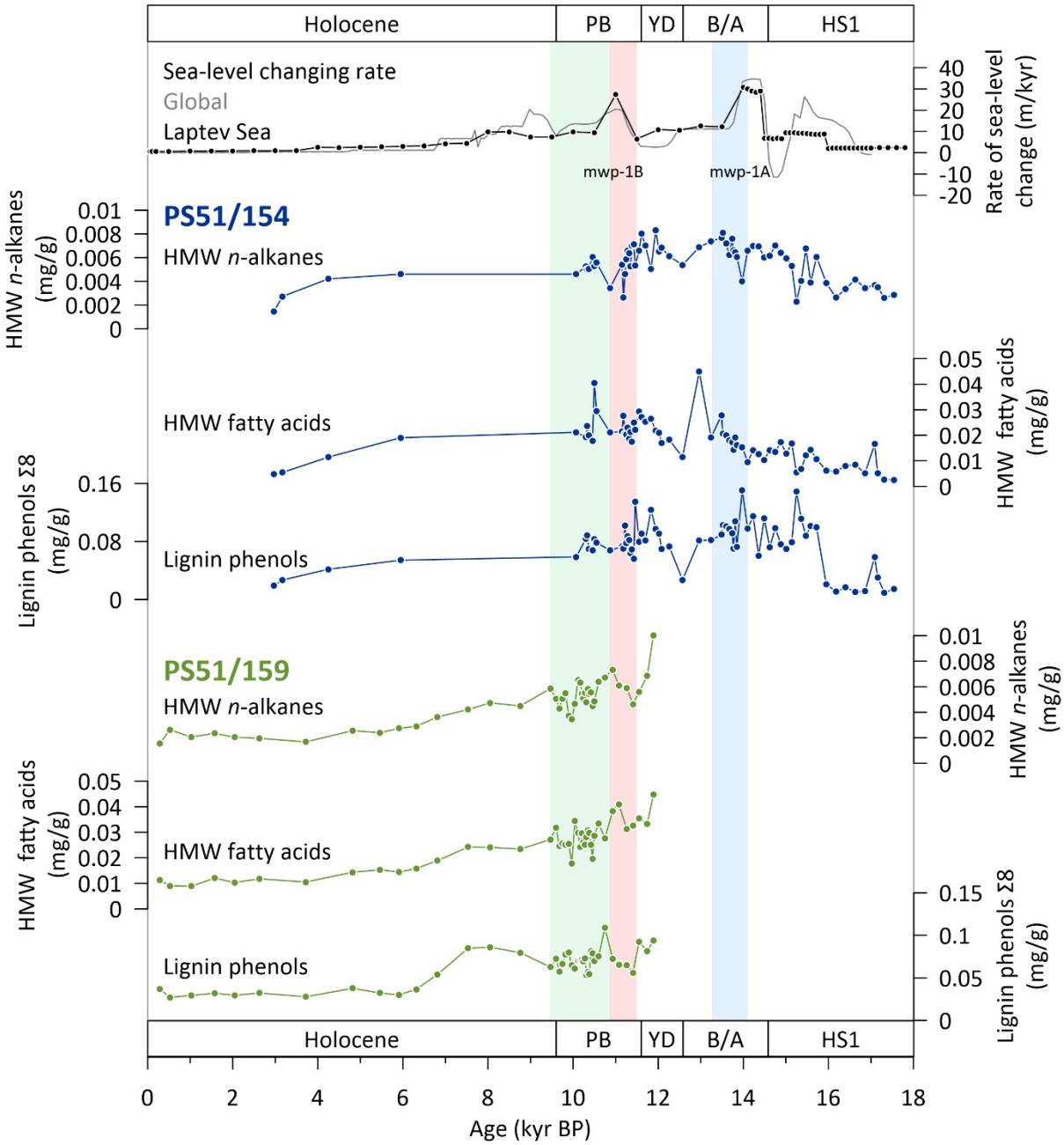

Fig S4. Terrestrial biomarker contents from HMW *n*-alkanes, HMW fatty acids, and lignin phenols in cores PS51/154 (dark blue, this study) and PS51/159 (light green, this study). The global sea-level changing rate is labeled in light gray (Lambeck et al., 2014), and the sea-level changing rate in the western Laptev Sea is labeled in black (Klemann et al., 2015). The color bars highlight the periods with HMW fatty acid MAR peaks from 14.1 to 13.2 kyr BP (blue, *MAR peak I*), from 11.6 to 10.9 kyr BP (red, *MAR peak II*), and from 10.9 to 9.5 kyr BP (green, *MAR peak III*). Meltwater pulses are denoted as mwp-1A and mwp-1B. The names of different paleoclimate periods are indicated by acronyms (HS1: Heinrich Stadial 1, B/A: Bølling-Allerød, YD: Younger Dryas, PB: Preboreal).

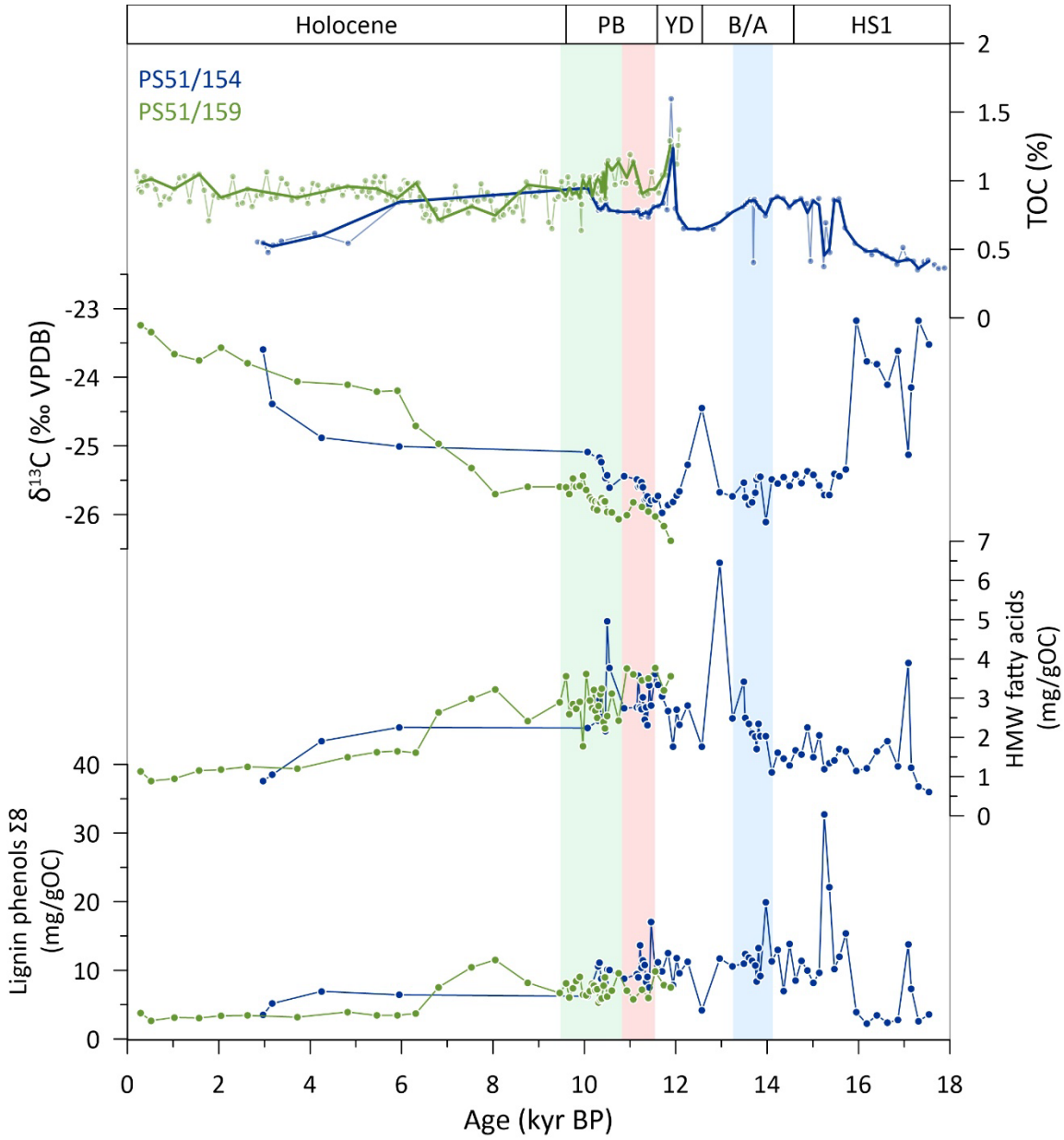

Fig S5. TOC (Hörner et al., 2016), $\delta^{13}C$ (this study), HMW fatty acid content (this study), and lignin phenol (Σ8) content (this study) in cores PS51/154 and PS51/159. The thick lines in TOC show the interpolated value at the same sampling resolution as the other measurements. The color bars highlight the periods with HMW fatty acid MAR peaks from 14.1 to 13.2 kyr BP (blue, *MAR peak I*), from 11.6 to 10.9 kyr BP (red, *MAR peak II*), and from 10.9 to 9.5 kyr BP (green, *MAR peak III*). The names of different paleoclimate periods are indicated by acronyms (HS1: Heinrich Stadial 1, B/A: Bølling-Allerød, YD: Younger Dryas, PB: Preboreal).

Table S1. Sedimentation rate, bulk density, and HMW fatty acid mass accumulation rate (MAR) of core PS51/154. The HMW fatty was calculated by the sum of $C_{24:0}$, $C_{26:0}$, $C_{28:0}$, and $C_{30:0}$ fatty acids.

Depth (cm)	Age (cal. kyr BP)	Sedimentation rate (cm/kyr)	Dry bulk density (g cm^{-3})	HMW fatty acid MAR (mg kyr^{-1} cm^{-2})
10.5	2.965	43.9	1.35	0.286

19.5	3.170	43.9	1.19	0.285
31.5	4.249	6.87	1.04	0.082
40.5	5.947	3.31	0.84	0.053
50.5	10.073	4.6	0.88	0.085
59.5	10.303	370	0.83	5.952
68.5	10.327	358	0.73	6.162
80.5	10.368	247	1.00	4.926
96.5	10.455	162	0.81	2.332
103.5	10.499	162	0.89	5.862
112	10.551	94.6	0.76	2.121
123.5	10.868	29.5	1.15	0.717
133.5	11.149	126	0.90	2.435
142.5	11.183	288	0.96	7.680
154	11.220	307	1.04	6.595
163.5	11.251	308	1.10	6.893
172.5	11.280	308	0.98	6.974
184.5	11.319	309	0.94	5.400
194.5	11.352	308	1.12	7.369
202	11.376	283	0.95	4.729
214.5	11.425	243	1.00	6.059
223.5	11.460	141	1.08	3.387
232.5	11.551	99.2	0.90	2.624
238	11.607	99.2	0.95	2.555
247	11.697	105	0.94	2.509
262	11.833	112	0.98	2.890
274	11.941	110	1.07	2.560
283	12.023	110	0.98	2.241
289	12.077	110	1.05	1.959
302.5	12.259	43.4	1.27	1.002
312	12.571	30.5	1.27	0.442
324	12.964	30.5	1.20	1.649
332.5	13.243	36.7	1.29	0.905
342	13.488	91.3	1.28	3.252
347.5	13.517	177	1.25	4.558
363	13.598	191	1.29	4.935
377	13.670	212	1.30	4.938
392.5	13.738	240	1.20	5.000
400.5	13.769	253	1.20	4.328
410.5	13.809	254	1.13	5.493
420.5	13.848	121	1.19	2.322
430.5	13.975	78.9	1.44	1.747
440.5	14.102	77.5	1.15	0.848
450.5	14.232	77	1.14	1.242

460.5	14.361	77.3	1.22	1.189
470.5	14.491	76.8	1.28	1.019
480.5	14.622	77	1.40	1.526
490.5	14.751	76.9	1.19	1.239
500.5	14.882	76.7	1.39	1.835
510.5	15.012	78	1.26	1.250
520.5	15.138	84.9	1.36	1.949
530.5	15.249	89.4	1.94	0.936
540.5	15.361	90.9	1.52	0.928
550.5	15.472	89.3	1.30	1.413
560.5	15.584	89.5	1.36	1.751
570.5	15.721	43.9	1.34	0.628
580.5	15.949	43.9	1.21	0.326
590.5	16.177	43.9	1.23	0.317
600.5	16.405	43.9	1.30	0.458
610.5	16.632	43.9	1.18	0.439
620.5	16.860	43.9	1.57	0.353
630.5	17.088	43.9	2.04	1.486
633.5	17.156	43.9	1.41	0.316
640.5	17.316	43.9	1.45	0.173
650.5	17.544	43.9	1.22	0.134

Table S2. Sedimentation rate, bulk density, and HMW fatty acid mass accumulation rate (MAR) of core PS51/159. The HMW fatty was calculated by the sum of $C_{24:0}$, $C_{26:0}$, $C_{28:0}$, and $C_{30:0}$ fatty acids.

Depth (cm)	Age (cal. kyr BP)	Sedimentation rate (cm/kyr)	Dry bulk density (g cm^{-3})	HMW fatty acid MAR (mg kyr^{-1} cm^{-2})
7.5	0.286	39.1	0.92	0.403
12.5	0.523	10	1.14	0.103
17.5	1.026	9.55	0.99	0.084
22.5	1.573	9.32	1.04	0.116
27	2.046	9.5	0.96	0.094
32.5	2.624	9.51	0.99	0.111
42.5	3.716	8.94	1.09	0.103
52.5	4.819	11	0.91	0.143
62.5	5.460	21.2	0.94	0.305
73	5.910	23.3	0.87	0.292
82.5	6.313	22.9	1.02	0.368
92.5	6.811	15.6	0.96	0.283
102.5	7.532	14.3	1.11	0.383
110	8.049	14.2	1.03	0.353
120	8.763	14.1	1.02	0.336
130	9.463	23.5	1.07	0.683

140	9.601	135	1.01	4.321
150	9.674	137	1.07	3.605
160	9.748	136	0.96	3.353
170	9.821	138	0.98	3.399
180.5	9.897	136	1.04	3.608
190	9.968	135	0.93	2.231
200	10.041	136	0.95	4.464
210	10.115	138	0.96	3.944
219.5	10.167	252	0.99	6.036
230	10.206	279	1.02	8.394
240	10.241	279	1.00	7.302
250	10.277	282	1.04	7.395
260	10.312	282	1.02	8.097
270	10.348	281	1.03	8.930
280	10.383	280	1.10	9.177
290	10.419	283	1.04	7.420
300	10.454	280	1.02	5.619
312	10.497	188	0.95	5.137
321	10.603	63	1.01	2.138
330	10.747	62.7	1.09	1.885
341.5	10.930	62.3	0.93	2.214
350.5	11.074	63.5	0.89	2.310
362.5	11.263	64	1.01	2.016
371.5	11.404	62.3	0.95	1.939
380.5	11.552	62.4	1.07	2.373
392.5	11.742	62	1.00	2.058
401.5	11.887	63.2	0.97	2.743

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