



Supporting Online Material for
**Early Reactivation of European Rivers
During the Last Deglaciation**

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This PDF file includes:

Methods
Table S1
References

Analytical methods

After freeze-drying and grinding, sediments were analyzed at CEREGE for their nitrogen and organic carbon contents with a Fisons NA-1500 Elemental Analyser (Carlo Erba NA-1500 Elemental Analyser ; see *S1* for details). For lipid analysis, 1 to 5 g of sediment was extracted for biomarkers by the accelerated solvent extraction method (ASE 200 system, Dionex, California, USA) at 120°C and 100 bars with dichloromethane/methanol (9:1 v/v). The total lipid extract was analyzed at CEREGE for alkenone concentrations by gas chromatography (GC8000 Series Fisons) with flame ionization detection (GC-FID) (using analytical conditions similar to *S2*). % C_{37:4} expresses the percentage of the tetra-unsaturated C₃₇ alkenone among the total of C₃₇ alkenones. Identification of alkenones is based on GC mass spectrometry (GC-MS ; GC8000 MD800 Fisons) and quantities are based on the chromatographic peak areas. The total lipid extract was subsequently separated into polar and apolar fractions using a column packed with Al₂O₃ using hexane/dichloromethane (9:1, v/v) and dichloromethane/methanol (1:1, v/v) as eluents, respectively. The polar fraction was then filtered through a 0.45- μ m, 4-mm diameter PTFE filter prior to injection. Glycerol dialkyl glycerol tetraethers were then identified and quantified at NIOZ by high-performance liquid chromatography/atmospheric pressure chemical ionization mass spectrometry using a HP LC 1100 Series-MS as described by *S3*.

The age/depth scale is based on tie points shown as triangles on Figure 2B, which rely on ¹⁴C ages (*S4*, *S5*) measured by accelerator mass spectrometry on monospecific samples of planktonic foraminifera *Neogloboquadrina pachyderma* (s.) or *Globigerina bulloides*. We calibrated these ¹⁴C ages by using the Calib 5.0 radiocarbon calibration program (*S6*) with the Marine04 curve (*S7*), and an extension (*S8*, *S9*) for the three oldest ¹⁴C ages. The age/depth model is then derived by a fifth order polynomial. The chronology is therefore fully independent of the GRIP and GISP2 records for the time span between 0 and 30 kyr BP.

References

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Table S1 Geochemical data for core MD 952002.

Depth (cm)	Age (kyr BP)	TOC (%)	C/N	C _{37:4} (% C _{37 tot})	BIT-index
0.5	1.8			0.0	
10.5	2.5	0.33	11.3	6.8	
20.5	3.2			2.6	
30.5	3.9	0.43	9.1	0.0	
40.5	4.6	0.49	14.1	0.0	0.04
50.5	5.2	0.40	10.5	0.0	
60.5	5.9	0.41	13.8	0.0	
70.5	6.4	0.49	16.2	0.0	
80.5	7.0	0.50	18.4	0.0	0.03
90.5	7.5	0.56	14.2	0.0	
100.5	8.1	0.61	14.5	0.0	
110.5	8.6	0.54	14.6	0.0	
120.5	9.0	0.67	18.1	0.0	0.03
130.5	9.5	0.63	12.6	0.0	
140.5	9.9	0.72	13.1	0.0	
150.5	10.3	0.65	12.5	0.4	
160.5	10.7	0.63	13.7	0.0	0.03
170.5	11.1	0.69	11.5	0.0	
180.5	11.4	0.84	17.5	0.0	
190.5	11.8	0.71	13.1	1.2	
200.5	12.1	0.64	12.7	0.7	0.03
210.5	12.4	0.59	12.8	1.0	
220.5	12.7	0.53	11.5		
230.5	13.0	0.55	13.9	1.9	
240.5	13.2	0.54	14.2	4.9	0.04
250.5	13.5	0.51	10.9	3.9	
260.5	13.7	0.54	15.9	3.1	
270.5	13.9	0.51	14.4	1.9	
280.5	14.2	0.58	12.2	2.5	0.05
290.5	14.4	0.59	15.9	1.8	
300.5	14.5	0.66	15.4	1.6	
310.5	14.7	0.71	13.7	2.9	
320.5	14.9	0.76	14.9	2.6	0.03
330.5	15.1	0.73	15.2	0.9	
340.5	15.2	0.73	12.8	4.2	
350.5	15.4	0.66	17.3	5.1	
360.5	15.5	0.58	11.8	5.9	0.03
370.5	15.6	0.64	12.1	8.5	
380.5	15.8	0.53	12.3	10.8	
390.5	15.9	0.44	11.5	10.7	
400.5	16.0	0.44	9.4	4.2	0.03

Depth (cm)	Age (kyr BP)	TOC (%)	C/N	C_{37:4} (% C_{37:tot})	BIT-index
410.5	16.1	0.44	11.4	23.3	
420.5	16.2	0.44	10.5	16.4	0.03
430.5	16.3	0.41	10.1	20.6	
440.5	16.4	0.41	10.3	27.7	0.03
450.5	16.4	0.35	9.1	24.6	
460.5	16.5	0.37	11.6	31.9	0.04
470.5	16.6	0.40	9.5	24.0	
480.5	16.7	0.43	9.3	26.4	0.03
490.5	16.7	0.42	9.2	27.1	
500.5	16.8	0.40	10.4	17.2	0.07
510.5	16.8	0.39	10.5	21.6	0.06
520.5	16.9	0.52	12.1		0.24
530.5	17.0	0.56	13.3	26.4	
540.5	17.0	0.45	14.5	35.2	0.23
550.5	17.1	0.59	13.7		0.38
560.5	17.1	0.63	15.4	21.2	0.56
570.5	17.2	0.64	15.1	17.0	0.58
580.5	17.2	0.60	17.1	14.5	0.43
590.5	17.2	0.62	16.7		
600.5	17.3	0.61	13.5	0.0	0.46
610.5	17.3	0.58	11.9	5.9	
620.5	17.4	0.57	12.3	10.0	0.47
630.5	17.4	0.61	17.1	5.3	
640.5	17.4	0.61	17.9		0.53
650.5	17.5	0.59	14.7		0.48
660.5	17.5	0.57	17.2	0.0	0.55
670.5	17.5	0.56	16.4		0.62
680.5	17.6	0.57	16.7		0.45
690.5	17.6	0.56	13.3	0.0	
700.5	17.7	0.54	17.9		0.40
710.5	17.7	0.57	20.5		
720.5	17.7	0.57	19.1		0.47
730.5	17.8	0.58	17.5		
740.5	17.8	0.58	18.2	5.5	0.52
750.5	17.8	0.71	20.9	4.6	0.57
760.5	17.9	0.62	17.6	0.0	0.67
770.5	17.9	0.62	18.7	0.0	0.54
780.5	18.0	0.64	17.3	0.0	0.49
790.5	18.0	0.70	17.9	0.0	0.62
800.5	18.0	0.61	25.5		0.56
810.5	18.1	0.70	18.4	0.0	
820.5	18.1	0.69	23.1	0.0	0.60
830.5	18.2	0.75	19.6	0.0	

Depth (cm)	Age (kyr BP)	TOC (%)	C/N	C_{37:4} (% C_{37:tot})	BIT-index
840.5	18.2	0.62	24.7	0.0	0.49
850.5	18.3	0.61	21.8	0.0	
860.5	18.3	0.59	22.8	0.0	0.34
870.5	18.3	0.50	14.4	0.0	
880.5	18.4	0.56	17.9		0.18
890.5	18.4	0.59	16.8	0.0	
900.5	18.5	0.62	20.1	0.0	0.15
910.5	18.5	0.64	15.5	0.0	
920.5	18.6	0.68	16.2	0.0	0.19
930.5	18.7	0.62	20.5	0.0	
940.5	18.7	0.64	16.4	0.0	0.12
950.5	18.8	0.60	14.6	0.0	
960.5	18.8	0.62	14.1	0.0	0.08
970.5	18.9	0.68	28.3	0.0	0.27
980.5	19.0	0.76	33.0	0.0	0.25
990.5	19.0	0.81	21.4	0.0	
1000.5	19.1	0.87	22.2	0.0	0.33
1010.5	19.1	0.94	23.0		
1020.5	19.2	1.01	18.1	0.0	0.44
1030.5	19.3	1.06	22.5		0.46
1040.5	19.3	0.87	19.3	0.0	0.32
1050.5	19.4	0.75	12.5		
1060.5	19.5	0.79	13.1	0.0	0.27
1070.5	19.6	0.73	12.0		0.29
1080.5	19.6	0.61	10.9	0.0	0.10
1090.5	19.7	0.62	11.8		
1100.5	19.8	0.61	11.0	0.0	0.13
1110.5	19.9	0.56	11.1		0.16
1120.5	20.0	0.48	8.3	0.0	0.06
1130.5	20.0	0.55	9.6		0.23
1140.5	20.1	0.56	9.2	0.0	0.17
1150.5	20.2	0.60	9.0		
1160.5	20.3	0.54	9.2	0.0	0.09
1170.5	20.4	0.53	8.7		
1180.5	20.5	0.54	9.2	0.0	
1190.5	20.6	0.54	9.4		
1200.5	20.7	0.62	11.9	0.0	0.05
1210.5	20.8	0.62	11.5		
1220.5	20.9	0.47	8.8	0.0	0.05
1230.5	21.0	0.40	9.0		
1240.5	21.1	0.41	9.7	0.0	0.04
1250.5	21.2	0.41	6.6		
1260.5	21.3	0.54	13.5	0.0	0.07

Depth (cm)	Age (kyr BP)	TOC	TOC/N (%)	C _{37:4} (% C _{37 tot})	BIT-index
1270.5	21.4	0.54	10.8		
1280.5	21.6	0.49	10.0	0.0	
1290.5	21.7	0.46	10.0		
1300.5	21.8	0.46	8.8		0.05
1310.5	21.9	0.45	9.7		
1320.5	22.0	0.53	10.5	0.0	0.03
1330.5	22.2	0.41	8.7		
1340.5	22.3	0.42	7.8		0.03
1350.5	22.5	0.49	9.5		
1360.5	22.6	0.43	9.4	0.0	0.03
1370.5	22.7	0.47	10.6	0.0	
1380.5	22.9	0.51	10.1		0.04
1390.5	23.1	0.51	13.1	0.0	
1400.5	23.2	0.52	7.6	0.0	0.13
1410.5	23.4	0.69	9.6		
1420.5	23.5	0.38	9.7		0.09
1430.5	23.7	0.30	8.3		
1440.5	23.9	0.35	8.2	0.0	0.08
1450.5	24.1	0.34	7.5		
1460.5	24.3	0.33	10.3		0.09
1470.5	24.5	0.43	8.6		
1480.5	24.7	0.37	7.7	0.0	0.03
1490.5	24.9	0.42	7.8		
1500.5	25.1	0.30	7.9		0.08
1510.5	25.3	0.28	10.9	0.0	
1520.5	25.6	0.33	12.5	0.0	
1530.5	25.8	0.36	13.0		
1540.5	26.0	0.39	10.0	0.0	0.05
1550.5	26.3	0.37	15.2		
1560.5	26.6	0.40	10.3	0.0	
1570.5	26.8	0.42	14.6		
1580.5	27.1	0.39	10.9	0.0	0.06
1590.5	27.4	0.37	8.7		
1600.5	27.7	0.38	6.2	0.0	
1610.5	28.0	0.38	5.5	0.0	
1620.5	28.3	0.40	10.2	0.0	0.08
1630.5	28.7	0.50	8.9	4.0	
1640.5	29.0	0.42	9.1	0.0	0.04
1650.5	29.4	0.43	6.1	0.0	
1660.5	29.8	0.44	5.6	0.0	