Supporting materials

Relationship of seasonally riverine fresh water discharge and sea surface salinity at core site

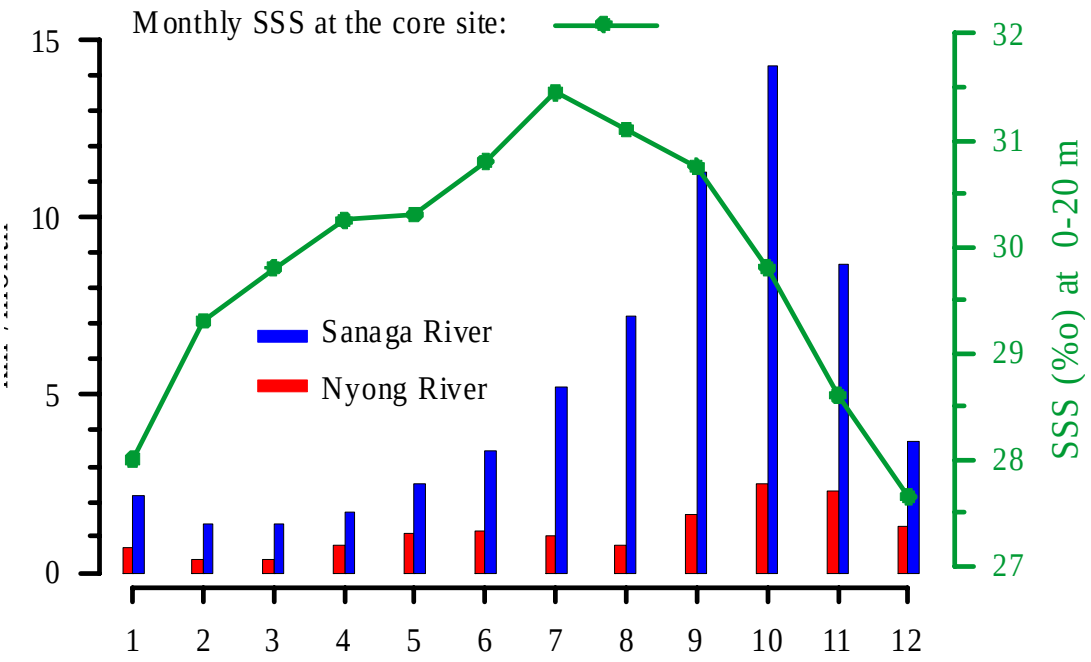

Figure DR1: Monthly riverine fresh water discharges of Sanaga and Nyong Rivers into the Gulf of Guinea (data from Global Runoff Data Center, Koblenz, Germany: http://grdc.bafg.de) and sea surface salinity (SSS) (average values from 0 to 0-20 m) at GeoB4905-4 site (Levitus and Boyer, 1994).

Relationship of $\delta^{18}O$ (sea water) and salinity in the eastern equatorial Atlantic

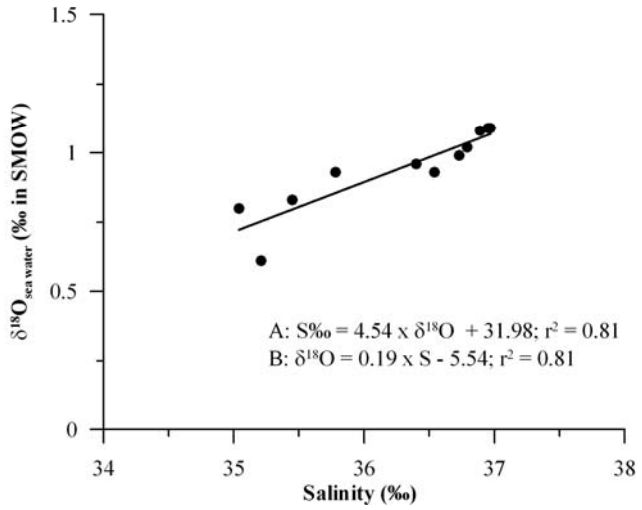

Figure DR2: Relationship of $\delta^{18}O$ and salinity of eastern Atlantic sea water taken from Figure 2 of the paper by Wang et al. (1995).

By plotting the eastern Atlantic data only (taken from Wang et al., 1995), we obtained following salinity- $\delta^{18}O_{sea\ water}$ relationship:

$$\mathbf{S\ [‰] = 4.54\ x\ \delta^{18}O_{sea\ water} + 31.98;\ r^2 = 0.81}$$

Local $\delta^{18}O_{sea\ water}$ has been calculated considering the temperature (T= Mg/Ca SST) and ice volume effect ($\delta^{18}O_{ice}$):

$$\delta^{18}O_{sea-water} = \left(\delta^{18}O_{G.ruber} - \delta^{18}O_{ice} - 21.9\right) + \sqrt{310.6 + 10\left(0.963xT + 3.147\right)}$$

Error estimate of salinity can be assessed by taking into account the uncertainties in the SST (±1°C equal to ± 0.5‰ salinity) estimate and $\delta^{18}O_{carbonate}$ analytical error (0.05‰) resulting in ±0.55‰ error in salinity estimation. Considering error in the $\delta^{18}O_{ice}$ estimation (related to continental ice volume) error in salinity estimation may account for ± 0.7 ‰.

Sample preparation and analysis of Mg/Ca

The sample preparation was conducted following cleaning procedures described by Martin and Lea (2002). However, alkaline chelation using buffered DTPA (Di-ethylene-tetra-penta-acid) was omitted and microscopic check conducted (see below). Briefly, approximately 60 individuals of *Globigerinoides ruber* white (250-300µm) were gently crushed and transferred into acid-leached

0.5-ml vials. Samples were rinsed with ultrapure water several times and ultrasonically treated. The samples were then rinsed with twice-distilled methanol and treated ultrasonically again, followed by a reduction step (anhydrous hydrazine- ammonium hydroxide-ammonium citrate solution) and treatments with hot oxidizing solutions (hydrogen peroxides buffered with sodium hydroxide). After every step the samples were rinsed with ultrapure water and ultrasonically treated. Afterwards the samples were checked under the microscope for silicate grains and strongly discolored test fragments, and these were removed using a fine-haired brush. Thereafter, the samples were transferred into new acid-leached vials and leached with weak nitric acid solution (0.001 N). The samples were dissolved using 0.075 N nitric acid. Immediately after the dissolution of carbonate test fragments, the sample solutions were transferred into acid-leached 2-ml vials.

The Mg/Ca measurements were conducted on ICP-OES (Perkin Elmar Optima 3300 R). For stabilization and minimizing the matrix effect, an internal standard (yttrium) was added and samples were diluted to equal Ca concentration depending on the Ca concentration from a preliminary ICP-OES measurement. Standards and replicate analyses of samples gave a mean reproducibility of ± 0.05 Mg/Ca mmol/mol. Parallel to Mg/Ca ratios, Sr/Ca, Fe/Ca, Mn/Ca, and Ba/Ca were also analyzed. Fe/Ca and Mn/Ca ratios were used for monitoring the cleaning efficiency. Those showing anomalously high Mg/Ca values and accompanying high Fe/Ca and/or Mn/Ca ratios were rejected. Rejected samples were less than 2% of the total samples

Table DR1: Age control points for the age model of GeoB4905-4

Lab code	Core depth (cm)	Material	^{14}C Age (yr, BP)	Calib. Age (yr, BP)	2 σ range of cal. age (yr, BP)	Reference
KIA20514	5,5	G. r. p.	900 ± 25	509	466 - 552	This study
KIA23465	38.75	G. r. p.	3080 ± 30	2849	2758 - 2939	This study
KIA20513	73	G. r. p.	4840 ± 35	5145	5016 - 5273	This study
KIA20512	143	G. r. p.	7185 ± 40	7654	7567 - 7741	This study
KIA23466	190.25	G. r. p.	8710 ± 40	9378	9281 - 9475	This study
KIA20510	213	G. r. p.	9885 ± 50	10824	10611 - 11037	This study
KIA19673	258	G. r. p.	10900 ± 60	12452	12200 - 12704	This study
KIA20509	303	G. r. p.	12470 ± 60	13919	13782 - 14056	This study
KIA13717	343	m.pl foram.	13660 ± 90	15730	15312 - 16147	Adegbie et al. (2003)
KIA13716	433	m.pl foram.	16170 ± 110	19016	18807 - 19224	Adegbie et al. (2003)
KIA13715	523	m.pl foram.	18440 ± 150	21469	20960 - 21978	Adegbie et al. (2003)

G. r. p. and m. pl. form denotes G. ruber pink and mixed planktonic foraminifers, respectively

For the conversion of the ^{14}C datings to calendar age, CALIB version 5.01 (Stuiver and Reimer, 1993) and Marine04 Data Set (Hughen et al, 2004) was used.

Cited references

Adegbie, A.T., Schneider, R., Röhl, U., and Wefer, G., 2003, Glacial millennial-scale fluctuation in central African precipitation recorded in terrigenous sediment supply and fresh water signals offshore Cameroon: Palaeogeography Palaeoclimatology Palaeoecology, v. 197, p. 323-333, doi: 10.1016/S0031-0182(03)00474-7.

Hughen, K.A., Baillie, M.G.L., Bard, E., Bayliss, A., Beck, J.W., Bertrand, C., Blackwell, P.G., Buck, C.E., Burr, G., Cutler, K.B., Damon, P.E., Edwards, R.L., Fairbanks, R.G., Friedrich, M., Guilderson, T.P., Kromer, B., McCormac, F.G., Manning, S., Bronk Ramsey, C., Reimer, P.J., Reimer, R.W., Remmele, S., Southon, J.R., Stuiver, M., Talamo, S., Taylor, F.W., Van der Plicht, J., and Weyhenmeyer, C.E., 2004, Marine04 Marine Radiocarbon Age Calibration, 0–26 Cal Kyr BP: Radiocarbon, v. 46, p. 1059-1086

Stuiver, M., and Reimer, P.J., 1993, Extended 14C data-base and revised calib 3.0 C-14 age calibration program: Radiocarbon, v. 35, p. 215-230.

Table DR2**:** Results of Mg/Ca and $\delta^{18}O$ analyses (*G. ruber* pink), calculated Mg/Ca-SST, local $\delta^{18}O_{sw}$, and SSS of GeoB4905-4

Depth [cm]	Cal. Age [ka, BP]	Mg/Ca [mmol/mol]	Mg/Ca SST [°C]	$\delta^{18}O$ (G. r. p.) [‰ vs PDB]	$\delta^{18}O_{sw}$ [‰ vs SMOW]	SSS [‰]
3	0.06	3.96	26.05	-2.36	-0.10	31.45
8	0.69	4.09	26.40	-2.46	-0.13	31.32
13	1.04	3.90	25.86	-2.22	-0.01	31.88
18	1.39	3.95	26.02	-2.60	-0.35	30.31
23	1.74	3.93	25.96	-2.56	-0.32	30.43
25	1.88	4.11	26.44	-2.34	0.00	31.90
27	2.02	4.16	26.59	-2.59	-0.23	30.88
28	2.09	3.99	26.13	-3.09	-0.82	28.17
30	2.23			-2.68		
32	2.37	3.85	25.72			
33	2.44	3.63	25.09	-2.64	-0.57	29.29
35	2.59			-2.76		
38	2.80	3.69	25.26	-2.45	-0.34	30.34
40	2.93			-2.50		
42	3.07			-2.40		
43	3.13	3.58	24.92	-2.79	-0.78	28.34
48	3.47	3.84	25.71	-2.71	-0.54	29.46
53	3.80			-2.33		
58	4.14	3.84	25.70	-2.94	-0.78	28.37
63	4.47	4.11	26.47	-2.54	-0.22	30.91
68	4.91			-2.96		
73	5.15	4.14	26.53	-2.94	-0.61	29.12
78	5.32			-2.56		
83	5.50			-3.22		
85	5.58	4.22	26.74	-2.75	-0.39	30.13
87	5.65			-3.34		
88	5.68			-3.42		
90	5.75	4.44	27.32	-2.71	-0.23	30.86
93	5.86	3.88	25.81	-3.27	-1.11	26.87
97	6.01	4.04	26.26	-3.12	-0.87	27.96
98	6.04			-2.82		
100	6.11	4.26	26.85	-3.16	-0.78	28.35
102	6.18	4.33	27.03	-3.09	-0.68	28.83
103	6.22	3.84	25.70	-3.22	-1.09	26.95
108	6.40	3.89	25.84	-3.13	-0.97	27.49
110	6.47	3.99	26.14	-3.16	-0.94	27.62
112	6.54	4.16	26.58	-2.84	-0.54	
113	6.58	4.45	27.34	-3.35	-0.89	27.87
118	6.76	4.55	27.60	-3.31	-0.80	28.25
120	6.83	4.38	27.15			
123	6.94			-3.06		
128	7.12			-3.11		
133	7.30	4.29	26.94	-3.32	-0.97	27.52
138	7.47	4.10	26.43	-3.72	-1.48	25.18
140	7.55	3.99	26.12			
143	7.65	3.94	25.98			

143	7.65			-3.44		
148	7.84	4.08	26.37	-2.99	-0.78	28.35
153	8.02	3.98	26.09	-3.21	-1.07	27.04
158	8.20	3.88	25.82	-3.40	-1.33	25.87
163	8.38	4.29		-2.98		
168	8.57			-3.52		
173	8.75	3.79	25.55	-2.89	-0.91	27.78
178	8.93	4.22	26.75	-3.02	-0.79	28.32
183	9.11			-2.97		
188	9.30	4.45	27.34	-3.30	-0.99	27.42
193	9.48	3.93	25.96	-2.98	-0.98	27.47
198	9.66	3.89	25.83	-3.09	-1.13	26.77
203	9.84			-3.32		
208	10.03	4.44	27.32	-3.16	-0.91	27.75
213	10.82	4.20	26.69	-3.31	-1.27	26.12
218	11.00	3.93	25.96	-3.17	-1.29	26.04
223	11.19	4.12	26.47	-3.28	-1.31	25.95
228	11.37			-2.80		
232	11.51	3.91	25.90			
233	11.55			-3.04		
238	11.73	3.76	25.46	-3.14	-1.42	25.45
243	11.91	3.70	25.28	-2.68	-1.01	27.30
248	12.09	3.61	25.02	-2.54	-0.96	27.53
253	12.27	3.97	26.07	-2.73	-0.97	27.51
258	12.45	4.03	26.25	-2.11	-0.36	30.27
260	12.52	3.81	25.62			
263	12.62	3.78	25.51	-1.54	0.04	32.07
265	12.68	3.67	25.18			
267	12.75	3.73	25.38			
268	12.78	3.94	25.99	-1.73	-0.09	31.47
273	12.94	4.02	26.22	-1.68	-0.01	31.86
278	13.10	3.62	25.05	-1.84	-0.44	29.92
283	13.27	3.75	25.44	-2.05	-0.58	29.28
288	13.43	3.77	25.49	-2.26	-0.79	28.30
293	13.59	3.71	25.31	-2.04	-0.63	29.05
298	13.76			-2.23		
303	13.92	3.91	25.90			
303	13.92			-2.11		
308	14.15	4.06	26.32	-2.36	-0.78	28.36
313	14.38	3.83	25.68	-2.21	-0.78	28.36
318	14.61	4.31	26.98	-1.57	0.05	32.12
323	14.84	4.11	26.45	-1.81	-0.40	30.07
328	15.07	3.88	25.82	-1.60	-0.37	30.22
333	15.29	3.52	24.74	-1.17	-0.20	30.98
338	15.52	3.66	25.16	-0.93	0.10	32.35
342.5	15.73	3.43	24.44	-0.90	-0.04	31.71
348	15.93	3.73	25.37	-0.81	0.24	32.97
353	16.11	3.35	24.18	-1.16	-0.38	30.19
358	16.29	3.72	25.34	-0.69	0.33	33.39
363	16.47	3.63	25.08	-0.78	0.18	32.71
368	16.66	3.31	24.05	-0.62	0.12	32.43
373	16.84	3.41	24.37	-0.84	-0.04	31.71

378	17.02	3.44	24.49	-0.60	0.22	32.90
383	17.20	3.32	24.08	-0.44	0.29	33.20
388	17.38	3.44	24.47	-0.68	0.13	32.47
393	17.56	3.30	24.02	-0.42	0.29	33.21
398	17.75			-0.95		
400	17.82	3.38	24.30	-0.45	0.31	33.30
402	17.89	3.22	23.73	-0.57	0.07	32.20
403	17.93	3.23	23.78	-1.11	-0.47	29.78
405	18.00	3.32	24.08	-0.51	0.20	32.81
407	18.07			-0.49		
408	18.11			-0.51		
410	18.18	3.34	24.15	-0.06	0.65	34.87
412	18.25			-0.89		
413	18.29	3.35	24.20	-0.68	0.04	32.10
415	18.36	3.46	24.54	-0.27	0.52	
417	18.44	3.51	24.71	-0.58	0.25	
418	18.47	3.78	25.51	-1.36	-0.36	30.25
420	18.54	3.60	24.99	-0.51	0.37	33.59
422	18.62			-0.59		
423	18.65	3.50	24.66	-0.83	-0.02	31.82
428	18.83	3.32	24.07	-0.96	-0.27	30.66
433	19.02	3.32	24.10	-1.11	-0.42	29.97
438	19.15	3.73	25.37	-1.01	-0.06	31.62
443	19.29	3.57	24.89	-0.90	-0.06	31.64
448	19.42	3.51	24.71	-0.63	0.17	32.66
453	19.56	3.17	23.56			
458	19.70	3.32	24.08	-0.64	-0.01	31.86
463	19.83	3.14	23.45	-0.94	-0.46	29.83
468	19.97	3.18	23.61	-0.56	-0.06	31.64
473	20.11	3.24	23.80	-0.68	-0.16	31.18
478	20.24	3.07	23.21	-0.92	-0.54	29.43
480	20.30	3.31	24.06	-0.28	0.26	
482	20.35	3.49	24.63	-0.21	0.46	
483	20.38	3.54	24.81	-1.20	-0.49	29.66
488	20.52	3.26	23.90	-0.37	0.14	32.53
493	20.65			-0.93		
498	20.79	3.70	25.28	-0.87	-0.06	31.61
508	21.06			-0.70		
513	21.20	3.82	25.65	-0.87	0.01	31.96
518	21.33			-1.00		
523	21.47	3.24	23.80	-0.86	-0.37	30.23
528	21.62	3.02	23.03	-0.74	-0.41	30.02
533	21.77	3.20	23.66	-0.80	-0.34	30.36