Supplementary Table 1: Major-element composition of the dust, river and marine end-members.

Dust end-member: Sahara-Sahel dust and soils

Latitude	Longitude	Al(%)	Si (%)	K (%)	Ca (%)	Ti (%)	Fe (%)	Reference	Material
27º 50.00´ N	12º 53.00´ W	11.1	55.0	3.8	21.9	0.9	7.3	(Moreno et al., 2006)	Soil
27º 02.00´ N	13º 05.00´ W	8.9	52.0	3.3	30.4	0.6	4.7	(Moreno et al., 2006)	Soil
26º 37.00´ N	13º 03.00´ E	6.3	62.3	2.6	20.5	1.3	6.9	(Moreno et al., 2006)	Soil
25º 30.00´ N	05º 00.00´ E	16.2	63.5	3.9	4.6	1.7	10.1	(Guieu and Thomas, 1996)	Soil
25º 30.00´ N	05º 00.00´ E	15.2	67.3	5.0	3.7	1.1	7.8	(Guieu and Thomas, 1996)	Soil
22º 55.00´ N	5º 29.00´ E	17.1	63.5	4.5	3.8	1.8	9.3	(Moreno et al., 2006)	Soil
22º 47.00´ N	5º 32.00´ E	16.3	66.1	4.6	3.2	1.7	8.2	(Moreno et al., 2006)	Soil
17º 45.00´ N	17º 48.00´ E	16.6	66.5	2.7	2.2	1.4	10.6	(Moreno et al., 2006)	Soil
16º 37.00´ N	15º 02.00´ W	11.7	76.2	1.9	1.3	1.2	7.7	(Orange and Gac, 1990)	Aerosol Dust
16º 37.00´ N	15º 02.00´ W	12.1	75.7	2.0	1.0	1.2	7.9	(Orange et al., 1993)	Aerosol Dust
16º 37.00´ N	15º 02.00´ W	11.0	76.9	1.8	1.7	1.1	7.4	(Orange et al., 1993)	Aerosol Dust
15º 00.00´ N	10º 00.00´ E	13.6	72.5	2.8	2.2	1.5	7.3	(Moreno et al., 2006)	Aerosol Dust
14º 69.00´ N	17º 45.00´ W	13.7	71.1	3.7	3.0	1.2	7.3	(Orange et al., 1993)	Aerosol Dust
14º 69.00´ N	17º 45.00´ W	14.2	70.2	3.8	3.1	1.2	7.4	(Orange et al., 1993)	Aerosol Dust
14º 69.00´ N	17º 45.00´ W	12.5	72.3	2.7	3.1	1.1	8.3	(Orange et al., 1993)	Aerosol Dust
14º 69.00´ N	17º 45.00´ W	10.7	74.3	1.8	3.7	1.0	8.5	(Orange et al., 1993)	Aerosol Dust
14º 41.57´ N	17º 36.80´ W	12.2	73.8	4.2	3.4	0.9	5.6	(Orange and Gac, 1990)	Aerosol Dust
14º 25.00´ N	16º 58.00´ W	11.8	75.6	1.9	1.5	1.1	8.1	(Orange et al., 1993)	Aerosol Dust
14º 25.00´ N	16º 58.00´ W	10.9	77.1	1.8	1.7	1.1	7.5	(Orange et al., 1993)	Aerosol Dust
13º 23.00´ N	2º 28.00´ E	14.0	74.3	2.3	0.6	1.9	7.0	(Moreno et al., 2006)	Aerosol Dust
13º 23.00´ N	2º 28.00´ E	14.3	69.4	3.3	2.6	1.5	8.9	(Moreno et al., 2006)	Aerosol Dust
12º 00.00´ N	8º 31.00´ E	15.1	63.1	5.8	6.1	1.2	8.7	(Wilke et al., 1984)	Aerosol Dust
12º 00.00´ N	8º 31.00´ E	14.3	66.0	5.7	5.1	1.2	7.7	(Wilke et al., 1984)	Aerosol Dust
12º 00.00´ N	8º 31.00´ E	13.7	72.1	4.0	1.9	1.0	7.3	(Orange and Gac, 1990)	Aerosol Dust
11º 04.00´ N	7º 42.00´ E	13.8	65.9	6.6	5.0	1.2	7.4	(Wilke et al., 1984)	Aerosol Dust
11º 04.00´ N	7º 42.00´ E	12.4	71.2	5.7	3.2	1.3	6.2	(Wilke et al., 1984)	Aerosol Dust
10º 07.00´ N	14º 22.00´ E	11.7	71.8	2.5	6.7	0.7	6.5	(Nguetnkam et al., 2008)	Soil
10º 07.00´ N	14º 22.00´ E	14.5	69.0	2.3	5.0	1.0	8.2	(Nguetnkam et al., 2008)	Soil
	Mean	**13.1**	**69.1**	**3.5**	**5.4**	**1.2**	**7.7**		
	Std Dev.	**2.4**	**6.3**	**1.4**	**7.0**	**0.3**	**1.2**		

River end-member: Senegal River suspension

Latitude	Longitude	Al(%)	Si (%)	K (%)	Ca (%)	Ti (%)	Fe (%)	Reference	Material
16°02´N	16°30´W	28.4	51.2	3.6	0.5	1.3	15.0	(Gac and Kane, 1986)	Senegal River suspension
16°02´N	16°30´W	28.1	51.5	3.2	0.5	1.2	15.4	(Gac and Kane, 1986)	Senegal River suspension
16°02´N	16°30´W	27.9	52.9	2.9	0.3	1.3	14.7	(Gac and Kane, 1986)	Senegal River suspension
16°02´N	16°30´W	28.9	51.3	3.0	0.3	1.2	15.3	(Gac and Kane, 1986)	Senegal River suspension
16°02´N	16°30´W	28.1	52.7	3.0	0.3	1.2	14.7	(Gac and Kane, 1986)	Senegal River suspension
16°02´N	16°30´W	27.5	52.7	3.1	0.3	1.2	15.2	(Gac and Kane, 1986)	Senegal River suspension
16°02´N	16°30´W	28.1	52.3	3.2	0.5	1.2	14.7	(Gac and Kane, 1986)	Senegal River suspension
16°02´N	16°30´W	27.1	52.4	3.2	0.8	1.2	15.2	(Gac and Kane, 1986)	Senegal River suspension
16°02´N	16°30´W	29.2	50.6	3.1	0.3	1.1	15.8	(Gac and Kane, 1986)	Senegal River suspension
	Mean	**28.3**	**51.8**	**3.1**	**0.4**	**1.2**	**15.1**		
	Std Dev.	**0.7**	**0.9**	**0.2**	**0.2**	**0.1**	**0.4**		

Marine end-member

	Al(%)	Si (%)	K (%)	Ca (%)	Ti (%)	Fe (%)	Reference
GeoB7920-2	0	4 ± 2	0	96 ± 2	0	0	(Mulitza et al., 2010; Collins et al., 2011)
GeoB9508-5	0	16 ± 6	0	84 ± 6	0	0	(Mulitza et al., 2010; Collins et al., 2011)
GeoB9526-5	0	29 ± 9	0	71 ± 9	0	0	(Mulitza et al., 2010; Collins et al., 2011)
GeoB9528-3	0	9 ± 2	0	91 ± 2	0	0	(Mulitza et al., 2010; Collins et al., 2011)

Collins, J.A., Schefuß, E., Heslop, D., Mulitza, S., Prange, M., Zabel, M., Tjallingii, R., Dokken, T.M., Huang, E., Mackensen, A., Schulz, M., Tian, J., Zarriess, M., and Wefer, G. 2011. Interhemispheric symmetry of the tropical African rainbelt over the past 23,000 years. *Nature Geoscience*. **4**: 42-45.

Gac, J.Y., and Kane, A. 1986. Le fleuve Sénégal: I. Bilan hydrologique et flux continentaux de matières particulaires à l'embouchure. *Sciences Géologiques Bulletin*. **39**.

Guieu, C., and Thomas, A.J. 1996. Saharan aerosols: from the soil to the ocean. In The impact of desert dust across the Mediterranean, Guerzoni, S., and Chester, R., (eds). Volume|: Series Title|: Publisher|: City|; p. Pages|.

Moreno, T., Querol, X., Castillo, S., Alastuey, A., Cuevas, E., Herrmann, L., Mounkaila, M., Elvira, J., and Gibbons, W. 2006. Geochemical variations in aeolian mineral particles from the Sahara-Sahel Dust Corridor. *Chemosphere*. **65**: 261-270.

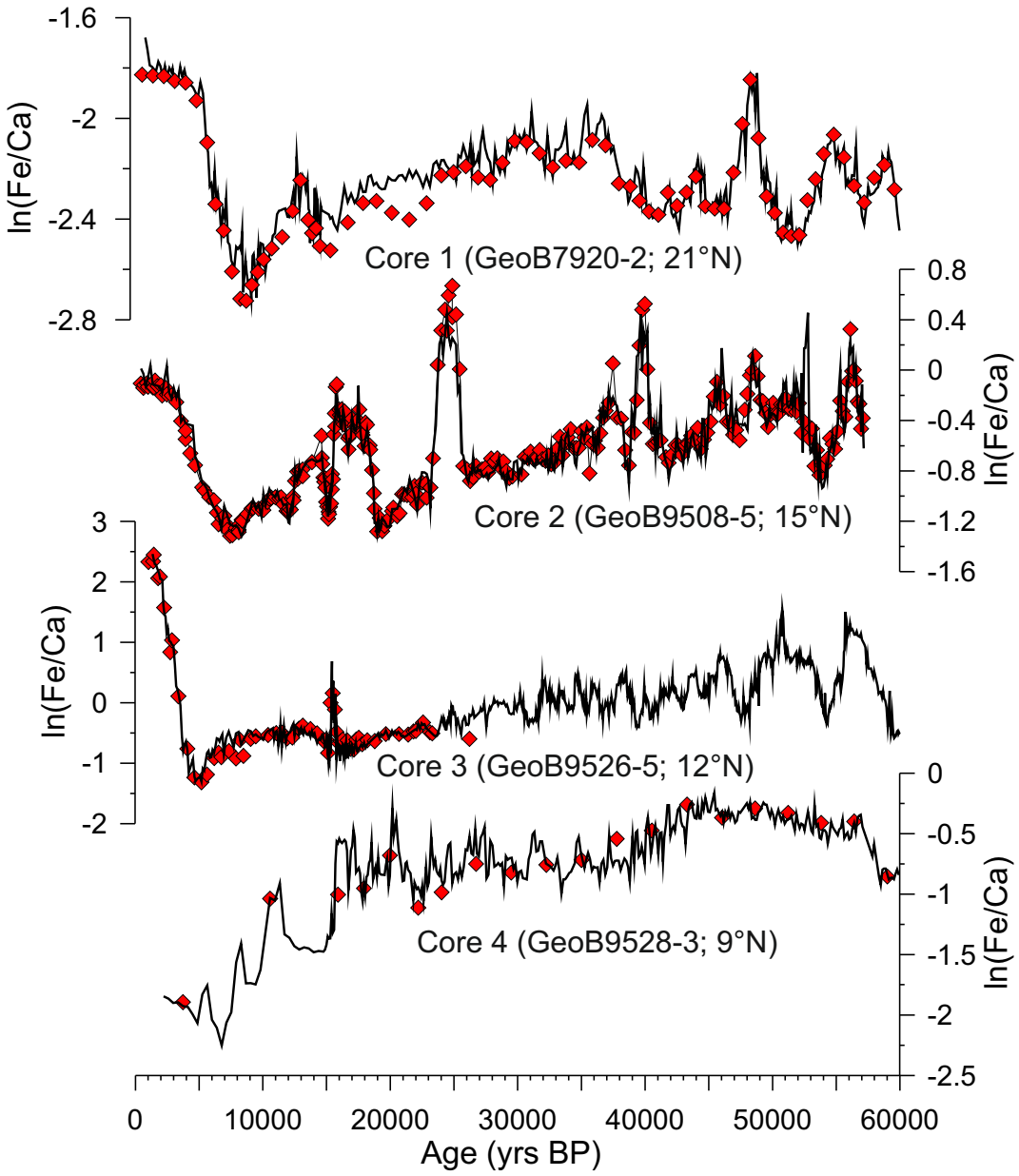
Mulitza, S., Heslop, D., Pittauerova, D., Fischer, H.W., Meyer, I., Stuut, J.-B., Zabel, M., Mollenhauer, G., Collins, J.A., Kuhnert, H., and Schulz, M. 2010. Increase in African dust flux at the onset of commercial agriculture in the Sahel region. *Nature*. **466**: 226-228.

Nguetnkam, J.P., Kamga, R., Villiéras, F., Ekodeck, G.E., and Yvon, J. 2008. Altération différentielle du granite en zone tropicale. Exemple de deux séquences étudiées au Cameroun (Afrique centrale). *Comptes Rendus Geosciences*. **340**: 451-461.

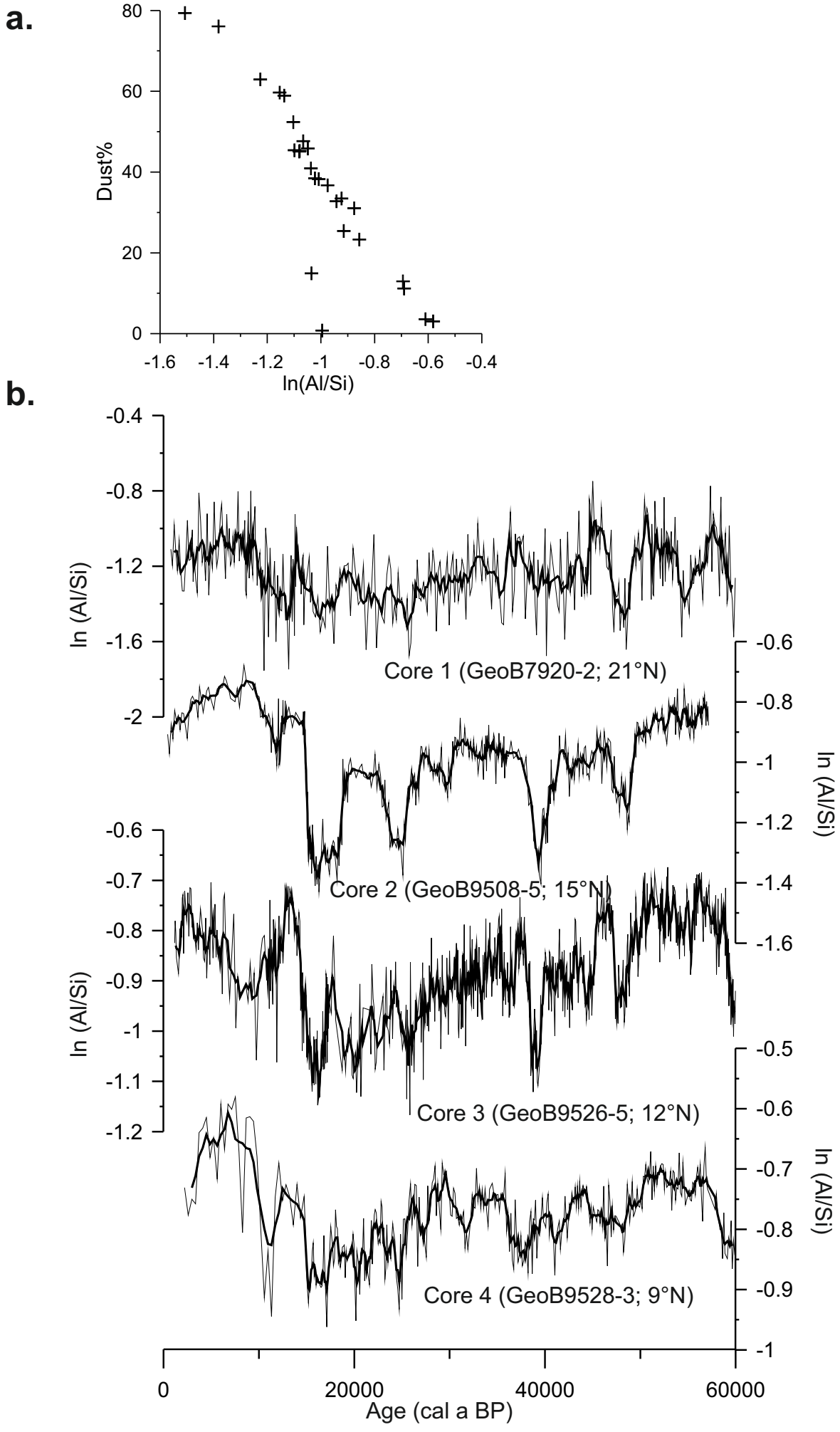
Orange, D., and Gac, J.Y. 1990. Bilan géochimique des apports atmosphériques en domaines sahélien et soudano-guinéen d'Afrique de l'Ouest (bassins supérieurs du Sénégal et de la Gambie). *Géodynamique*. **5**: 51-65.

Orange, D., Gac, J.Y., and Diallo, M.I. 1993. Geochemical assessment of atmospheric deposition including Harmattan dust in continental west Africa *Tracers in Hydrology (Proceedings of the Yokohama Symposium, July 1993) IAMS Publ. no. 215*, 303-312.

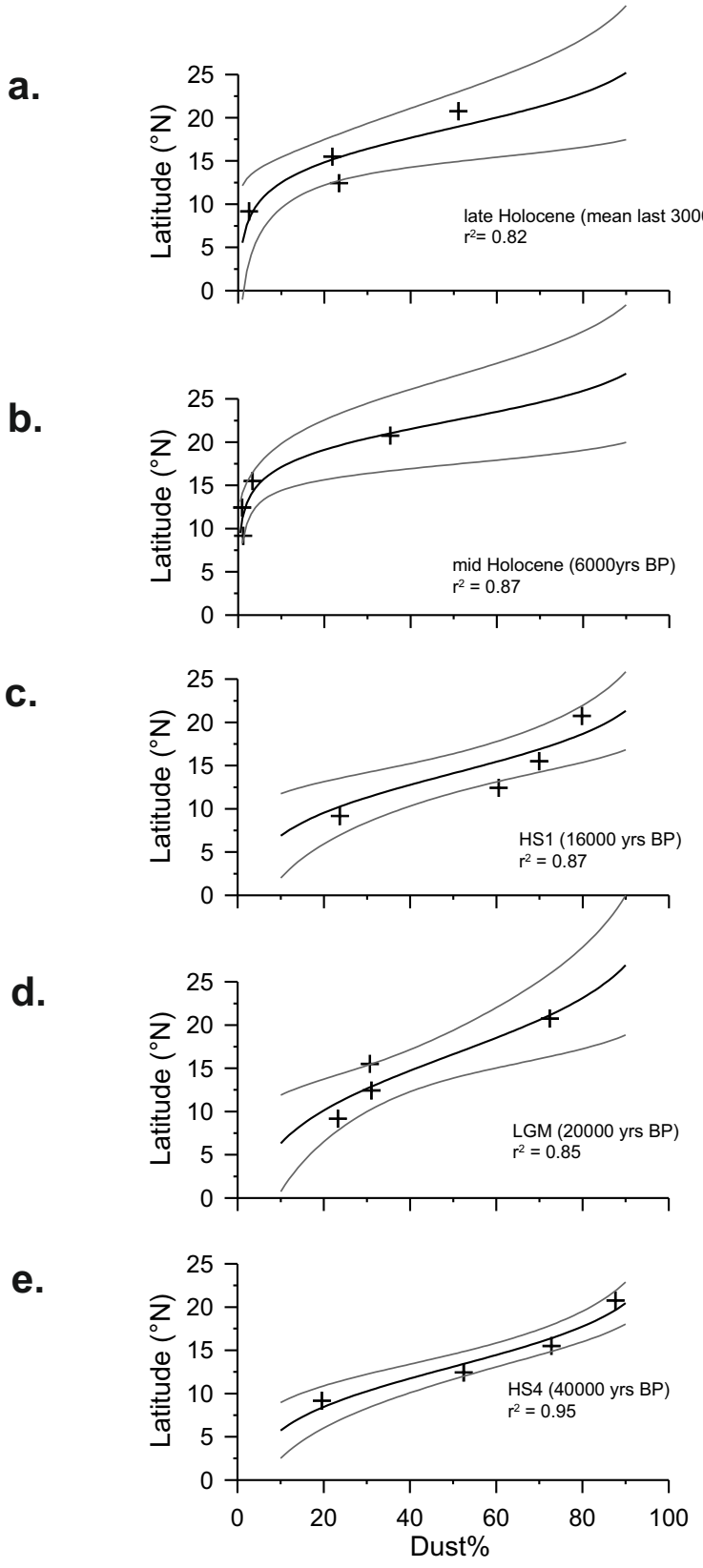
Wilke, B.M., Duke, B.J., and Jimoh, W.L.O. 1984. Mineralogy and chemistry of Harmattan dust in Northern Nigeria. *Catena*. **11**: 91-96.



Supplementary Figure 1. Fit of the calibrated scanner data with the discrete powder samples. Calibrated scanner data (black line) and EDP-XRF powder data (red diamonds) plotted against age. The calibration regresses the scanner data against the powder data for all element log-ratios (with Ca as the denominator). Mean r^2 values for all the log(element/Ca) regressions are: 0.74 (GeoB7920-2), 0.91 (GeoB9508-5), 0.95 (GeoB9526-5) and 0.93 (GeoB9528-3). Although the discreet powder samples do not cover the entire core for GeoB9526-5, they cover the most extreme sediment compositions as suggested by Weltje and Tjallingii (2008). As such, any additional powder samples would be unlikely to modify the calibrated scanner data. For core GeoB9528-3 the full core is calibrated using 50 samples covering the entire core (although only 20 cover this section of the core). Again, any additional samples would be unlikely to change the calibrated data.



Supplementary Figure 2. (a). ln(Al/Si) vs dust for the surface sediment samples (Govin et al, 2011). **(b).** ln(Al/Si) ratios for the last 60ka for each sediment core



Supplementary Figure 3. **Linear regression of dust% and latitude for past timeslices. (a)** Late Holocene (mean of last 3000 yrs). **(b)** mid Holocene (timestep at 6000 yrs BP). **(c)** HS1 (timestep at 16000 yrs BP). **(d)** LGM (timestep at 23000 yrs BP). **(e)** HS4 (timestep at 40000 yrs BP). Crosses mark sediment cores. Black lines represent robust linear regression. Data have been transformed as log ((100-dust%)/dust%) so that the regression lies in the interval (0, 100). Grey lines represent 68% confidence intervals. Regression is plotted between 0.5-90% dust for (a)-(b) and 10-90% dust for (c)-(e).