SUPPLEMENTAL INFORMATION

Table S1: Equations used as part of this study.

No.	Equation	Description	Citation
1	$U_{37}^{k\prime} = \frac{[C_{37:2}]}{[C_{37:2} + C_{37:3}]}$	Simplified alkenone unsaturation index	(Prahl et al., 1988)
2	$U_{37}^{k\prime} = 0.033(SST) + 0.044$	Linear, global core-top calibration of SST to $U^{k\prime}_{37}$	(Müller et al., 1998)
3	$U_{37}^{k} = \frac{[C_{37:2} - C_{37:4}]}{[C_{37:2} + C_{37:3} + C_{37:4}]}$	Alkenone unsaturation index	(Brassell et al., 1986)
4	$U_{37}^{k\prime} = 0.033(SST) + 0.043$	Linear, culture-based calibration of growth temperature to $U^{k\prime}_{37}$	(Prahl & Wakeham, 1987)
5	$inferred\ U_{37}^{k\prime} = \frac{U_{37}^{k} + (\%C_{37:4} \times 0.01)}{1 - (\%C_{37:4} \times 0.01)}$	Calculate inferred $U^{k\prime}_{37}$ from U^{k}_{37} and $\%C_{37:4}$	This study

Table S2: Composite Sections and Interval Shifts

Sample ID	Relevance to Composite Splice	Shipboard MCD	Shift: Hole E relative to D	New MCD
0—52.50 MCD Interval: Holes D and E				
177 1090D 1H 3A 27-29	Interval start	3.62		3.62
177 1090E 5H 5A 33-35	Interval end	51.83		51.83
52.51—56.63 MCD Interval: Hole D				
177 1090D 6H 2A 14-16	Interval start	52.51		52.51
177 1090D 6H 4A 126-128	Interval end	56.63		56.63
56.64—61.44 MCD Interval: Hole E				
177 1090E 6H 1A 142-144	MCD shift tie	56.56	-0.06	56.50
177 1090E 6H 2A 1-3	Interval start	56.64		56.66
177 1090E 6H 2A 88-90	MCD shift tie	57.51	+0.89	58.40
177 1090E 6H 3A 148	MCD shift tie	59.62	-0.01	59.61
177 1090E 6H 5A 31-33	Interval end	61.44		61.42
177 1090E 6H 5A 91-93	MCD shift tie	62.04	-0.02	62.02
61.45—67.40 Interval: Hole D				
177 1090D 7H 1A 46-48	Interval start	61.45		61.45
177 1090D 7H 5A 41-43	Interval end	67.40		67.40
67.41—71.14 Interval: Hole E				
177 1090E 7H 1A 105-107	Interval start, MCD shift	66.15	+1.28	67.43
177 1090E 7H 4A 26-28	Interval end	69.86		71.14

Table S3: Age model tie points (N=20)

MCD	Age (kya)	MCD	Age (kya)
55.925	2630	63.5	3560
56.96	2715	64.3	3630
57.26	2742	64.7	3670
58.08	2832	65.05	3725
58.93	2950	65.95	3795
59.78	3035	66.5	3840
60.43	3135	68.97	3995
61.95	3295	69.64	4095
62.25	3320	70.19	4155
63.05	3465	71.04	4255

Table S4: $\%C_{37:4}$ and SST (°C) of samples measured both on the GC-FID and HPLC

Sample ID	Depth (MCD)	$\%C_{37:4}$ (GC-FID)	$\%C_{37:4}$ (HPLC)	$U^{K'}_{37}$ SST (°C, GC-FID)	$U^{K'}_{37}$ SST (°C, HPLC)
ODP 177 1090 E 6W 2A 121-123	58.59	3.54	0	12.08	10.77
ODP 177 1090 E 6H 3A 11-13	58.82	4.69	0.24	16.92	13.43
ODP 177 1090 E 6H 3A 17-18	58.85	3.45	0.64	14.24	14.58
ODP 177 1090 E 6H 3A 31-33	58.93	2.55	0	14.81	13.91
ODP 177 1090 E 6H 3A 107-108.5	59.37	8.99	0	11.49	12.49
ODP 177 1090 E 6H 3A 111-113	59.39	6.87	0	12.28	13.92
ODP 177 1090 E 6 H 3A 131-133	59.51	7.56	0.55	13.94	13.36
ODP 177 1090 E 6 H 4A 1-3	59.63	4.99	0	14.81	14.50
ODP 177 1090 E 6 H 4A 16-18	59.78	6.39	0	15.52	15.10
ODP 177 1090 E 6 H 4A 106-108	60.68	3.39	0	16.05	15.08
ODP 177 1090 E 6 H 4A 111-113	60.73	6.51	0	10.93	10.52
ODP 177 1090 E 6 H 4A 121-123	60.83	3.57	0	14.39	14.29
ODP 177 1090 E 6 H 5A 6-8	61.17	2.04	0.12	12.84	12.81
ODP 177 1090 E 6 H 5A 96-98	62.08	4.20	3.78	14.40	13.96
ODP 177 1090 E 6 H 5A 101-103	62.13	6.57	0	12.93	11.86
ODP 177 1090 E 6 H 5A 146-148	62.63	3.04	1.21	14.85	14.34

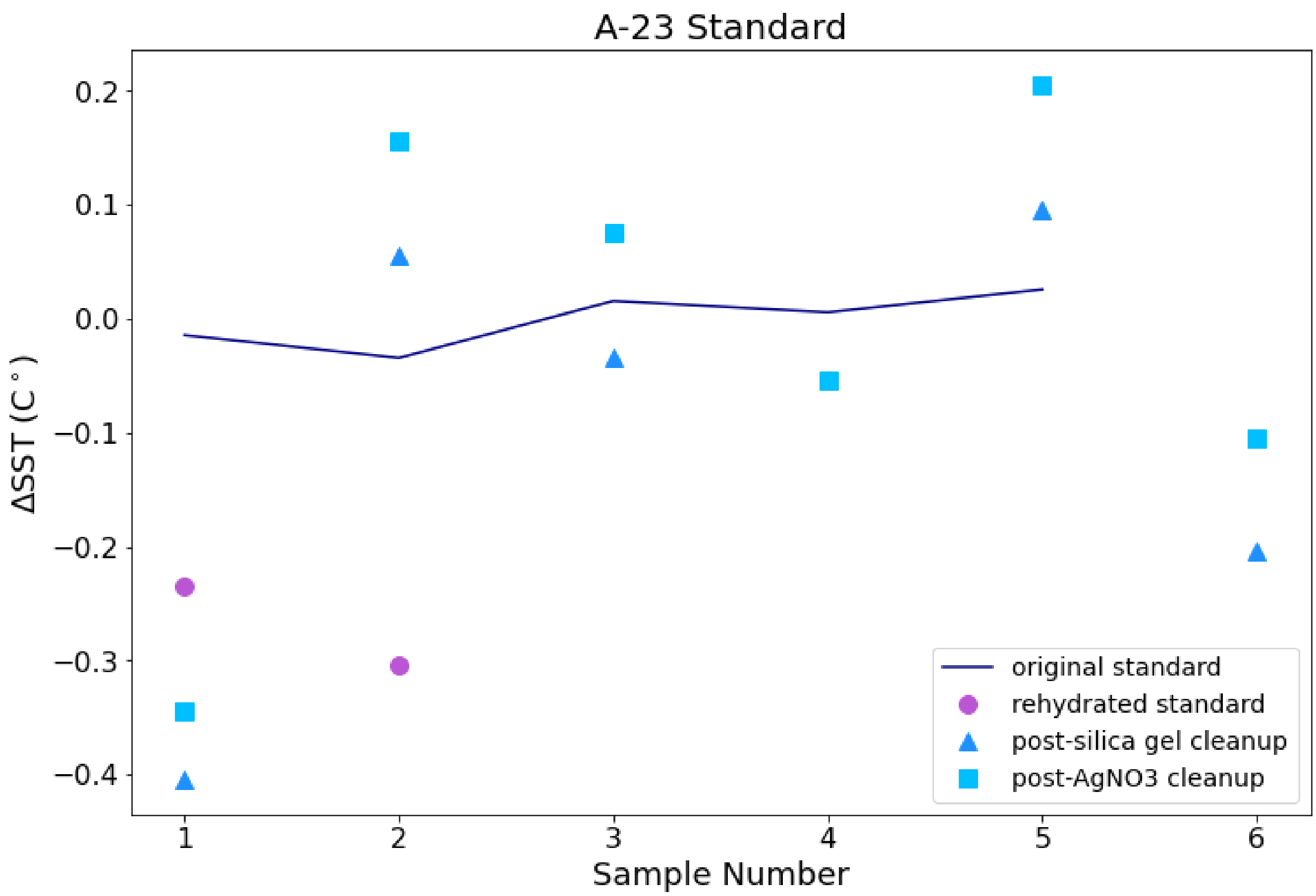

Fig. S1: The resulting difference in $U^{K'}_{37}$-based SST between the average SST derived from measurements of our unadulterated A23 standard (dark blue line) and that derived from the rehydrated A23 standard, A23 that was subjected to cleanup by just silica gel columns, and A23 that underwent cleanup with both silica gel and silver nitrate. All SSTs are within our window of error of 1.5°C.

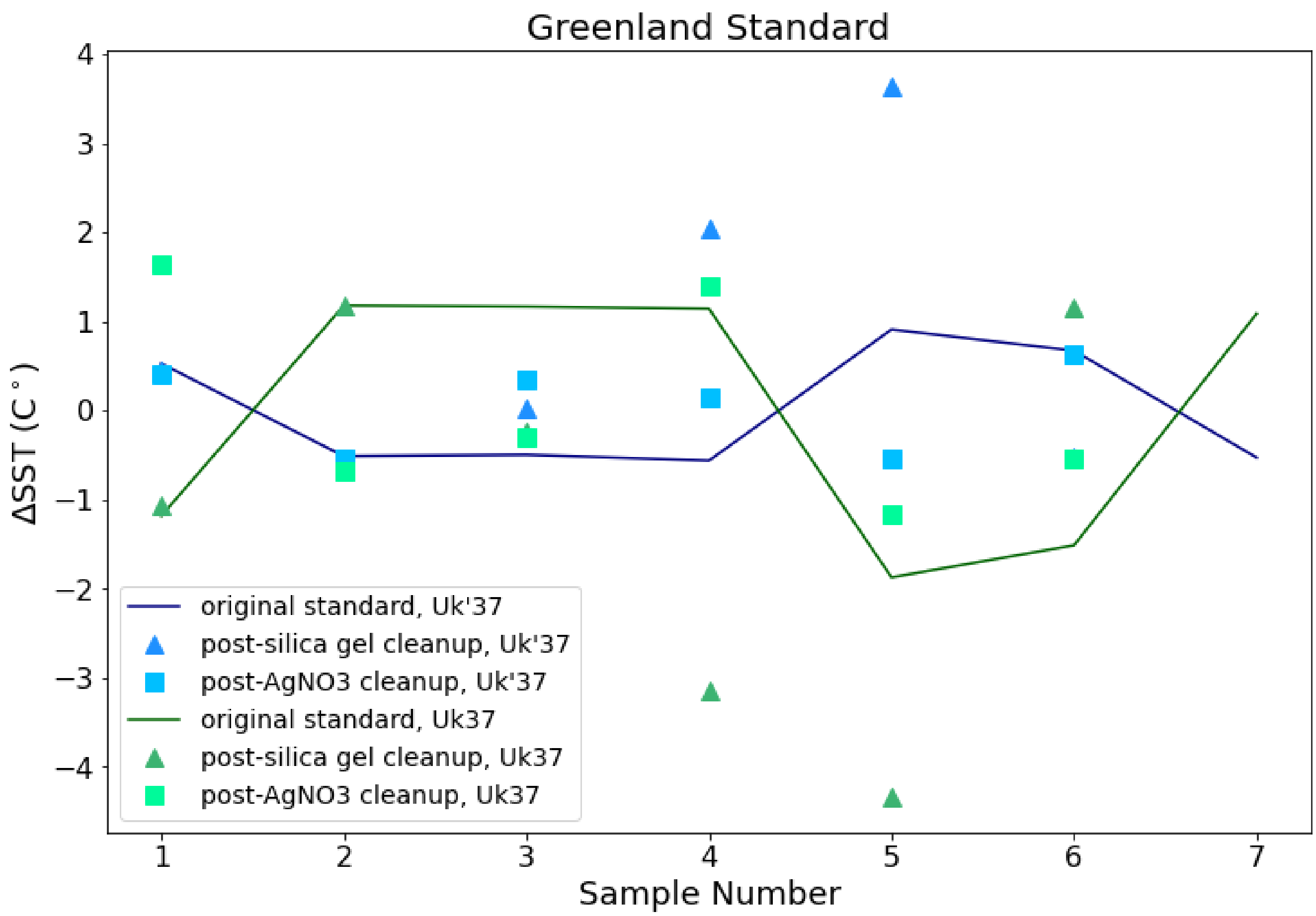

Fig S2: The resulting difference in $U^{K'}_{37}$-based (blue) and U^{K}_{37}-based (green) SST between the average SST derived from measurements of our unadulterated Greenland standard (dark blue/green lines) and those derived from the rehydrated Greenland standard, Greenland standard that was subjected to cleanup by just silica gel columns, and Greenland standard that underwent cleanup with both silica gel and silver nitrate. All samples that underwent both forms of cleanup were well within our expected window of error of 1.5°C.

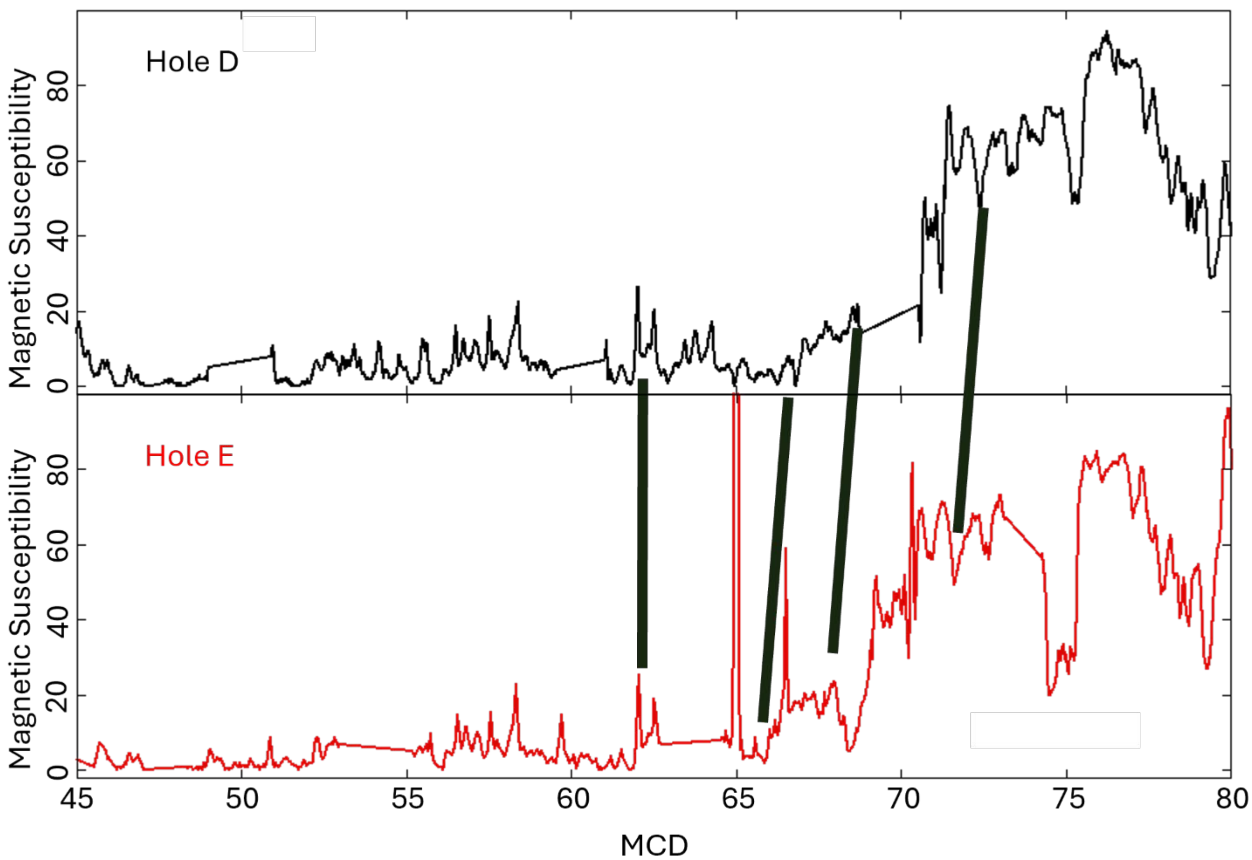

Fig S3: Magnetic susceptibility measurements from Holes D and E at ODP Site 1090 were utilized to construct our composite sediment record (Shipboard Scientific Party, 1999).

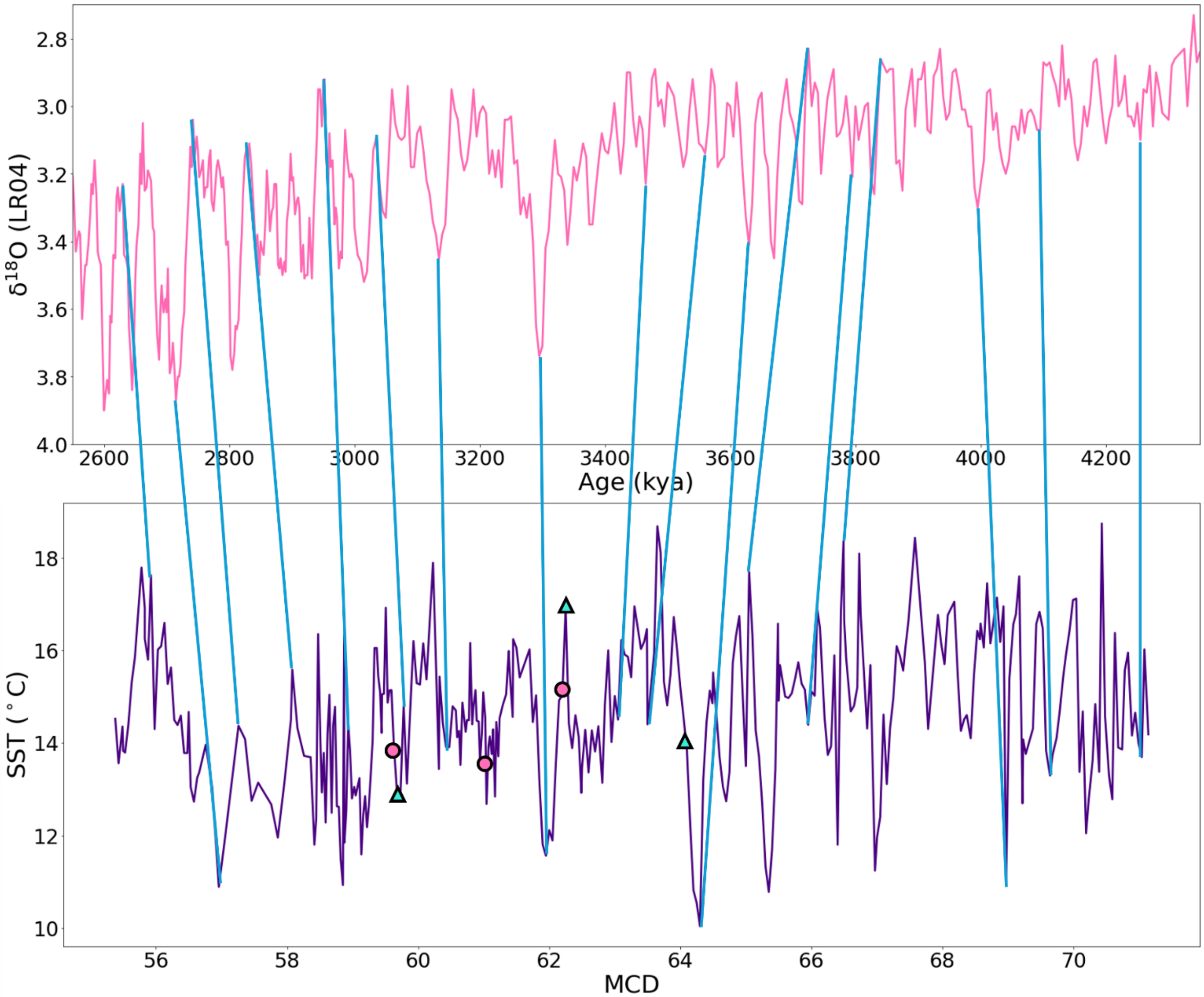

Fig. S4: Tie lines were established for our ODP Site 1090 age model by aligning our SST record with variations in the LR04 benthic oxygen isotope stack (Lisiecki & Raymo, 2005). In addition, magnetic reversal tie points, denoted at approximately 3.11, 3.22, and 3.33 Ma in Hole D (pink circles) and 3.22, 3.33, and 3.594 Ma in Hole E (teal triangles) were utilized to constrain our model.

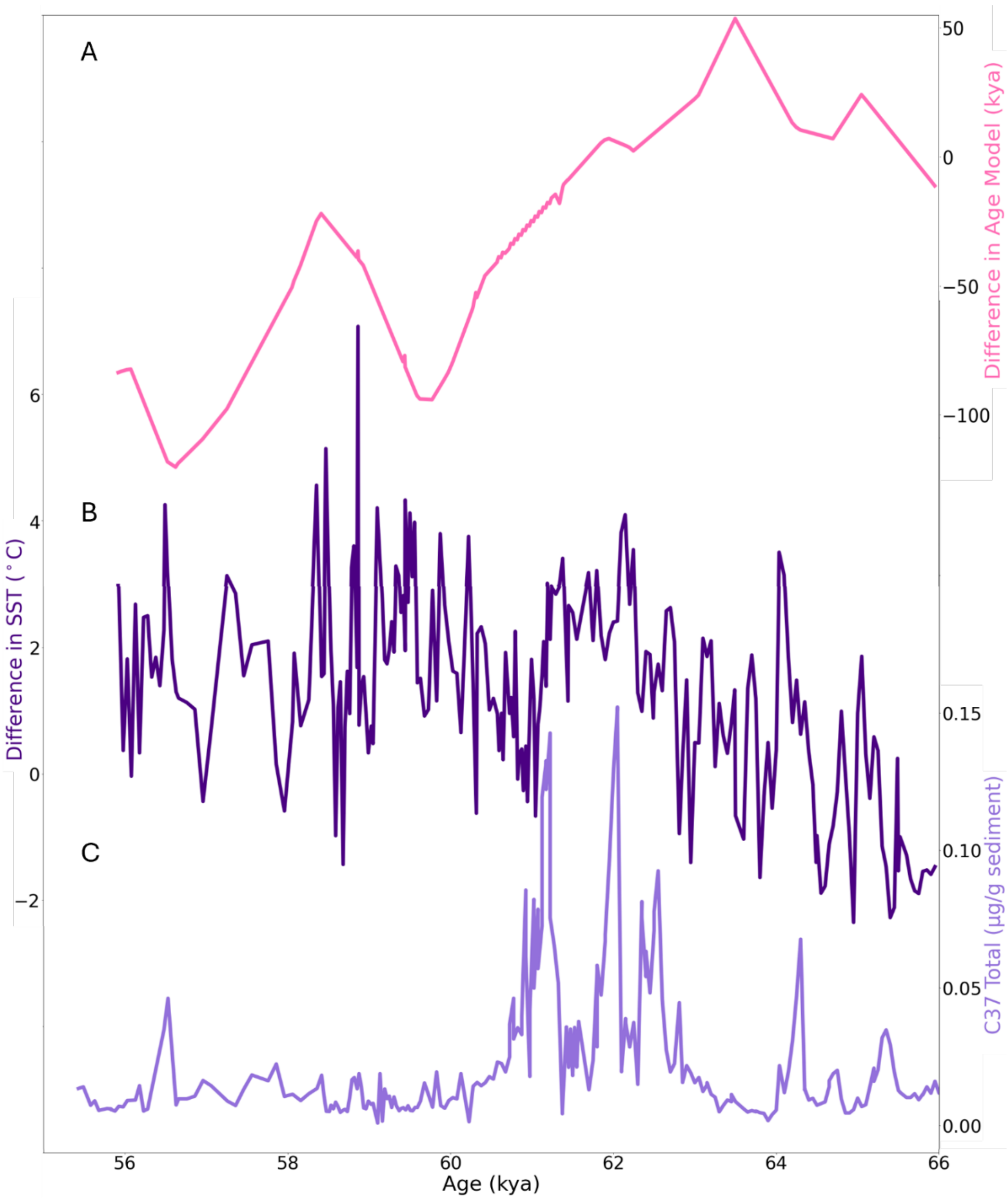

Fig S5: Panel [A] shows the difference in age assignments at a given depth between the age model constructed for this study and that of Martínez-García et al. (2011). Panel [B] shows the difference in SST estimation at a given depth between the two studies. Panel [C] illustrates the concentrations of the C_{37} alkenone ($C_{37total}$) we measured over the course of this study. All data was plotted according to the MCD composite established in this study.