

Supplemental Materials

Table S1 Conventional (age BP) and calibrated (calBC/calAD) radiocarbon data from the Loch Sween coralline algal bed.

Laboratory code (SUERC-)	Core id. (Tab.2)	Core depth (cm)	$\delta^{13}\text{C}_{\text{VPDB}}$ ‰	^{14}C age $\pm 1\sigma$ (yBP)	Calibrated age range (calAD/calBC) 95.4% probability σ	Calibrated age range (CalBP) 95.4% probability	Median probability
16011*	1	9	-6.7	Modern	Modern		
16013*	1	15	-6.9	Modern	Modern		
16005*	1	27	-4.1	320 \pm 40	1725 AD to present		
70365	2	28	0.5	336 \pm 40	1707 AD to 1950 AD		
16006*	1	31	12.0	335 \pm 40	1724 to 1950 calAD		
72181	2	40	-5.1	517 \pm 37	1643 to 1950 calAD	0 - 303	187
16012*	1	45	-3.9	630 \pm 40	1484 to 1804 calAD	146 - 466	331
72180	2	50	3.3	2975 \pm 35	999 to 740 calBC	2689 - 2947	2799
72179	2	59	0	3928 \pm 35	2215 to 1856 calBC	3805 - 4163	3977
70369	2	71	3.5	4378 \pm 37	2838 to 2475 calBC	4424 - 4786	4598

*From Kamenos (Kamenos, 2010) recalibrated as described here.

Table S2 Length and age profiles of each core. In situ depth = length of corer submerged prior to extraction from the sediment. Age model based on radiocarbon dating (see main text and Table 1 for details). Each single core horizon (2cm) represented a sediment age $\sim 20 - 180$ years.

	In situ depth (cm)	Length of record (yrs Cal BP)	Resolution (yrs)
Core 1	86	5071	20-40
Core 2	71	4245	20-180
Core 3	80	4492	20-180

Table S3 Species sampled as end members for stable isotope analyses

Terrestrial plants	Marine fauna	Macroalgae
<i>Salix caprea</i>	<i>Polymastia sp.</i>	<i>Gracilaria gracilis</i>
<i>Quercus petraea</i>	<i>Asciella apersa</i>	<i>Codium fragile</i>
<i>Alnus glutinosa</i>	<i>Asterias rubens</i>	<i>Fucus vesiculosus</i>
<i>Iris pseudacorus</i>	<i>Ophiocoma nigra</i>	<i>Fucus Serratus</i>
<i>Sorbus domestica</i>		<i>Corallina officinalis</i>
<i>Rhododendron ponticum</i>		<i>Ascophyllum nodosum</i>
		<i>Halidrys siliquosa</i>
		<i>Laminaria saccharina</i>
		<i>Corda filum</i>
		<i>Lithothamnion glaciale</i>

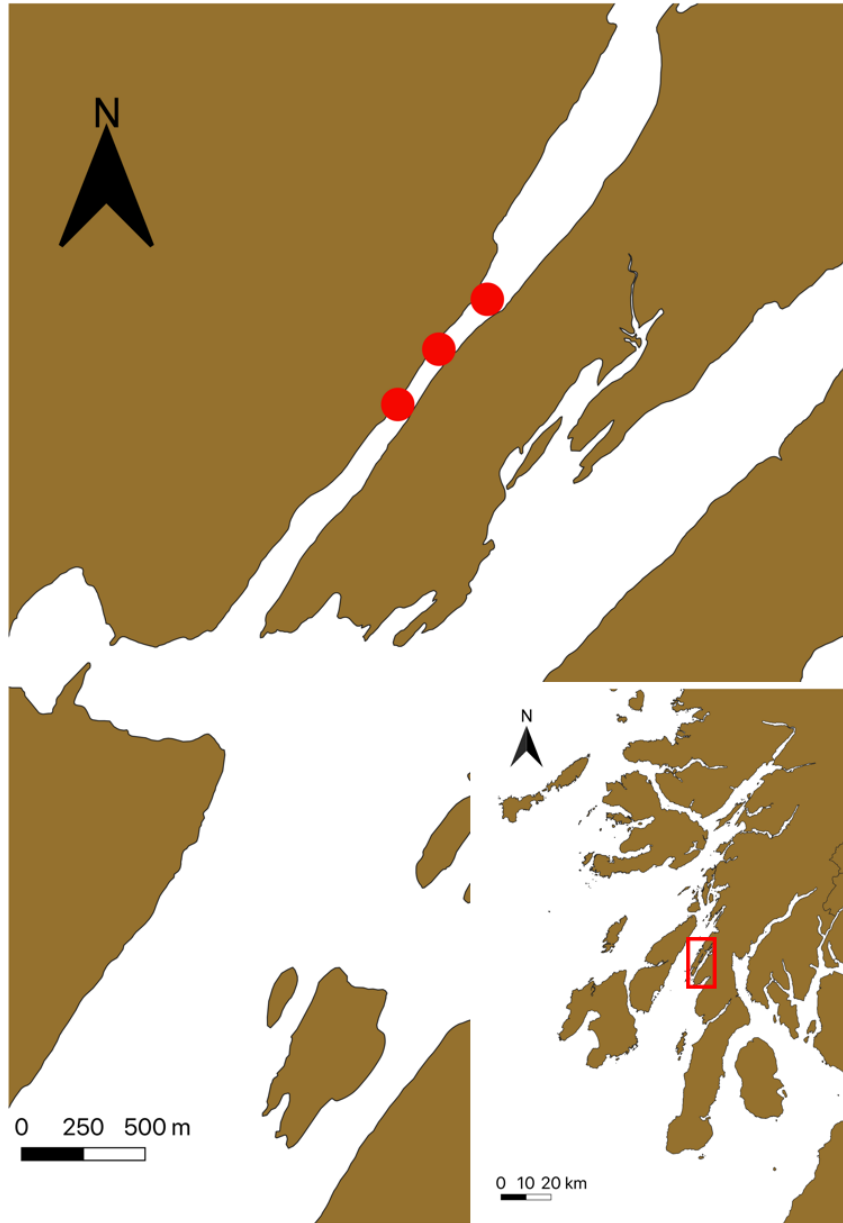


Figure S1: Caol Scottish (Loch Sween) indicating core locations (dots) with location within Scotland indicated (inset).

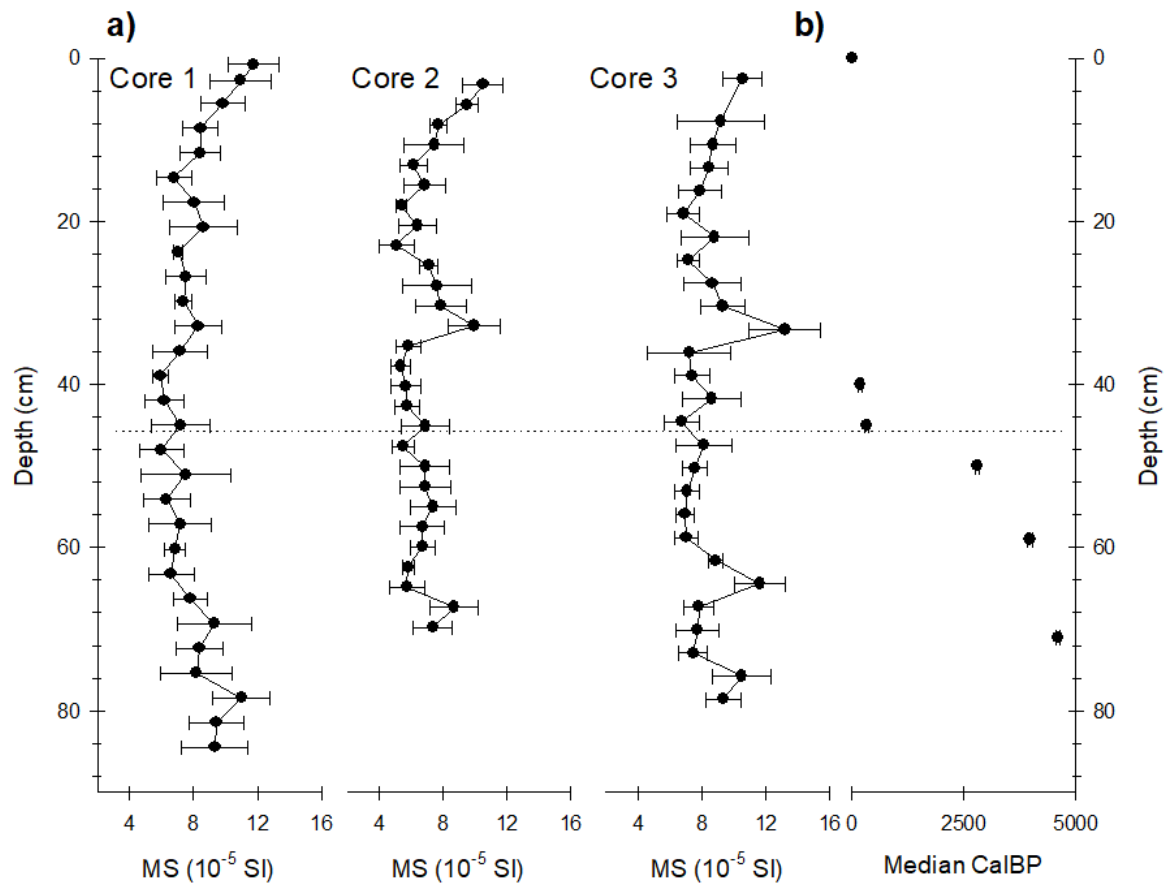


Figure S2: Magnetic susceptibility (MS unit in SI; Mean \pm SD) measured in all three cores (plate a). Missing data due to insufficient sample size for accurate MS. Median calibrated age BP (CalBP) \pm error as detailed in Table S1 derived from 95.4 probability age range. Dotted line denotes 370 CalBP.

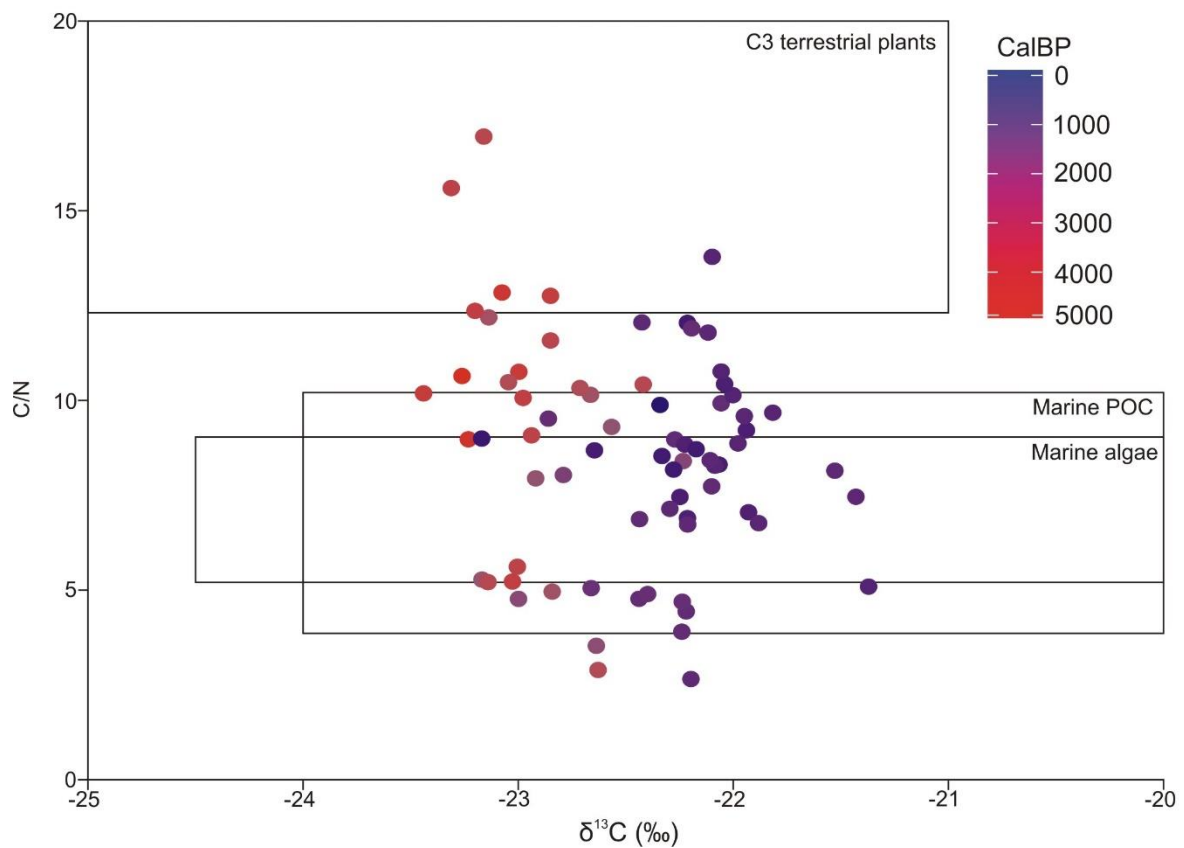


Figure S3 $\delta^{13}\text{C}$ (‰) against C/N elemental ratio of core organic material. Symbols colour coded according to sediment age. The $\delta^{13}\text{C}$ and C/N ranges of C3 terrestrial plants, marine particulate organic carbon (POC) and marine algae are taken from Lamb et al (Lamb, Wilson, & Leng, 2006) and Macreadie et al (Macreadie, Allen, Kelaher, Ralph, & Skilbeck, 2012).

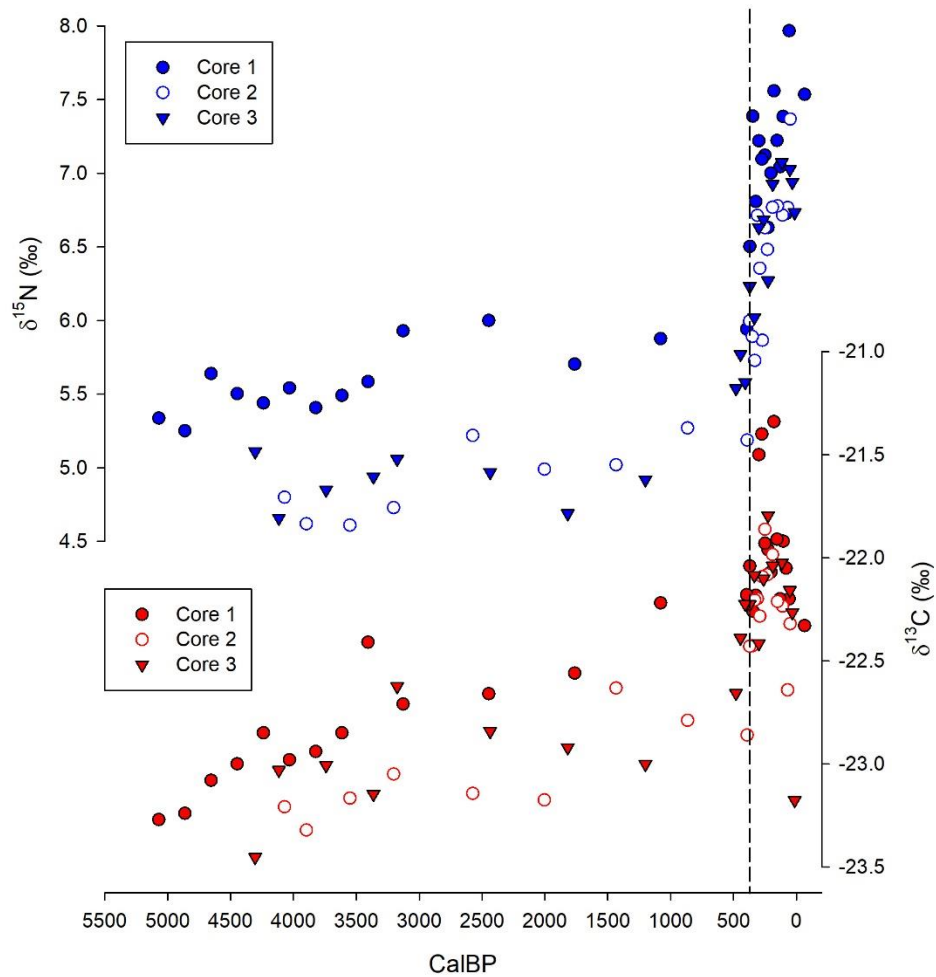


Figure S4: $\delta^{15}\text{N}$ (blue) and $\delta^{13}\text{C}$ (red) (‰) over time from all cores (core 1; closed circles, core 2; open circles, cores 3; closed triangles). Dashed vertical line is at 370 CalBP. $\delta^{13}\text{C}$ regression equation: $\delta^{13}\text{C} = -22.69 + 0.003x$, $R^2 = 0.60$. Post-370 CalBP $\delta^{15}\text{N}$ regression equation: $\delta^{15}\text{N} = 2.268 + 0.0025x$, $R^2 = 0.44$.

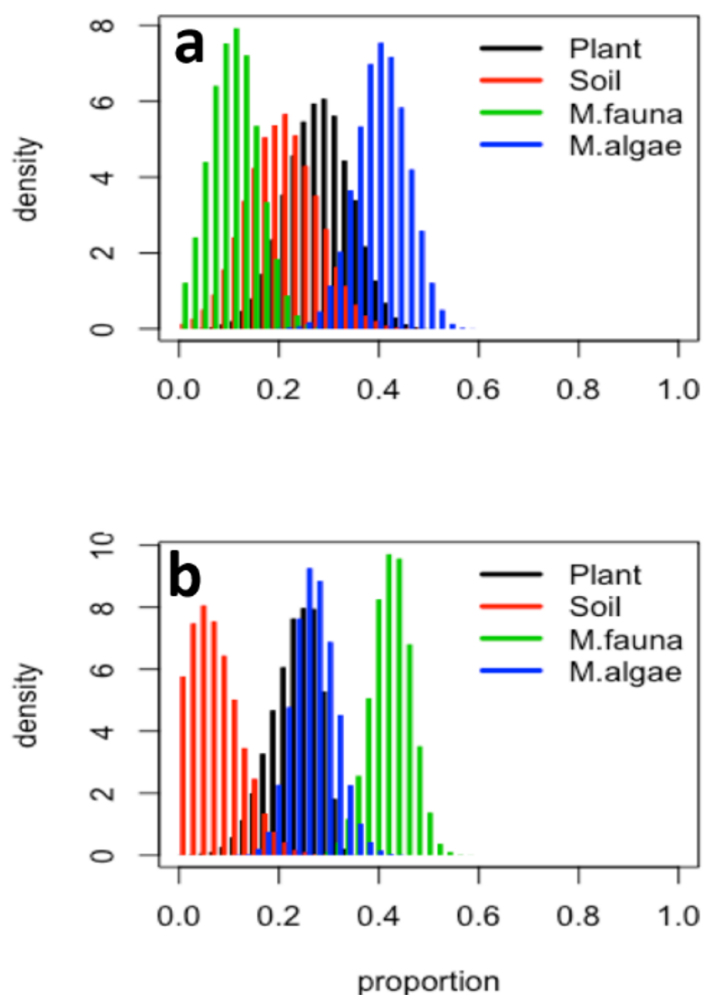


Figure S5: Proportional contribution of organic source material to observed isotopic patterns. Proportional contribution of terrestrial plants (Plant, black bars), soil (Soil, red bars), marine fauna (M.fauna, green bars) and marine macroalgae (M.algae, blue bars) to the observed isotopic composition (a) pre-370 CalBP and (b) post-370 CalBP.

References

- Kamenos, N. A. (2010). North Atlantic summers have warmed more than winters since 1353, and the response of marine zooplankton. *Proceedings of the National Academy of Sciences of the United States of America*, 107(52), 22442-22447. doi:<http://dx.doi.org/10.1073/pnas.1006141107>
- Lamb, A. L., Wilson, G. P., & Leng, M. J. (2006). A review of coastal palaeoclimate and relative sea-level reconstructions using $\delta^{13}\text{C}$ and C/N ratios in organic material. *Earth-Science Reviews*, 75(1-4), 29-57. doi:10.1016/j.earscirev.2005.10.003
- Macreadie, P. I., Allen, K., Kelaher, B. P., Ralph, P. J., & Skilbeck, C. G. (2012). Paleoreconstruction of estuarine sediments reveal human-induced weakening of coastal carbon sinks. *Global Change Biology*, 18(3), 891-901. doi:10.1111/j.1365-2486.2011.02582.x

