

### Complement to the subsection 1.3.2. “Hopane identification and analyses”

The quantity of hopanes in some samples was too low to allow a duplicate analysis of the sample. For  $C_{31}$   $\alpha\beta$ -R hopanes, one samples out of 42 (220 cm-depth – 4.5 ka cal BP) had a single injection. For  $C_{31}$   $\beta\beta$  hopanes, 8 samples out of 43 had single injections: 340 cm-depth – 6.7 ka cal BP, 220 cm-depth – 4.5 ka cal BP, 180 cm-depth – 3.2 ka cal BP, 150 cm-depth – 2.0 ka cal BP, 140 cm-depth – 1.9 ka cal BP, 130 cm-depth – 1.8 ka cal BP, 90 cm-depth – 1.2 ka cal BP and 60 cm-depth – 0.9 ka cal BP. For these samples, the uncertainty values are the mean uncertainty values of the samples analyzed in duplicates and are 0.34 for both  $C_{31}$   $\alpha\beta$ -R and  $\beta\beta$  hopanes.

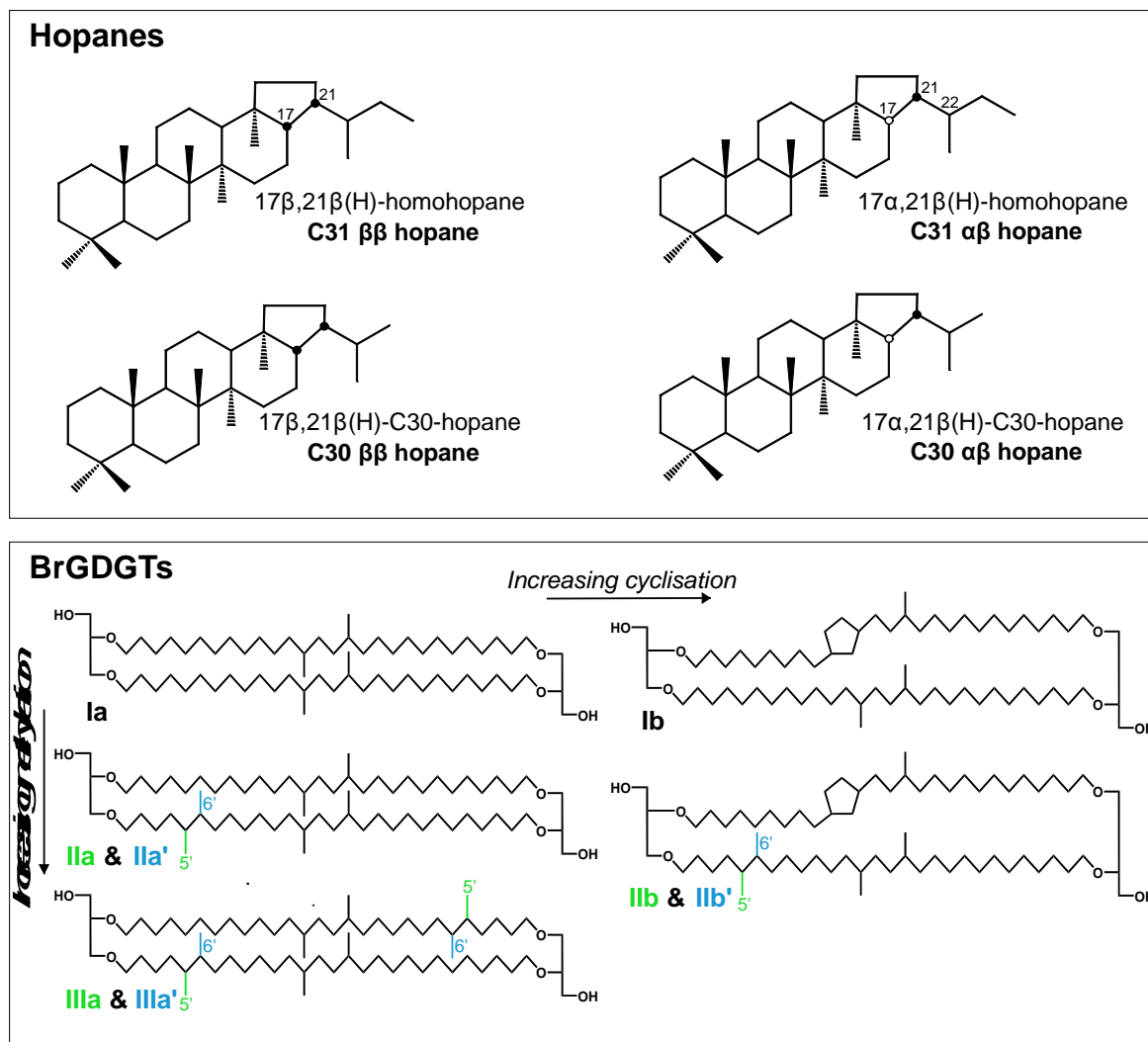


Figure S.1: Structures of hopanes and major brGDGTs analyzed in this study.  $C_{31}$  22S and 22R hopane isomers are not discriminated. Unrepresented brGDGTs-Ic, IIc and IIIc present two cycles, one on each alkyl chain.

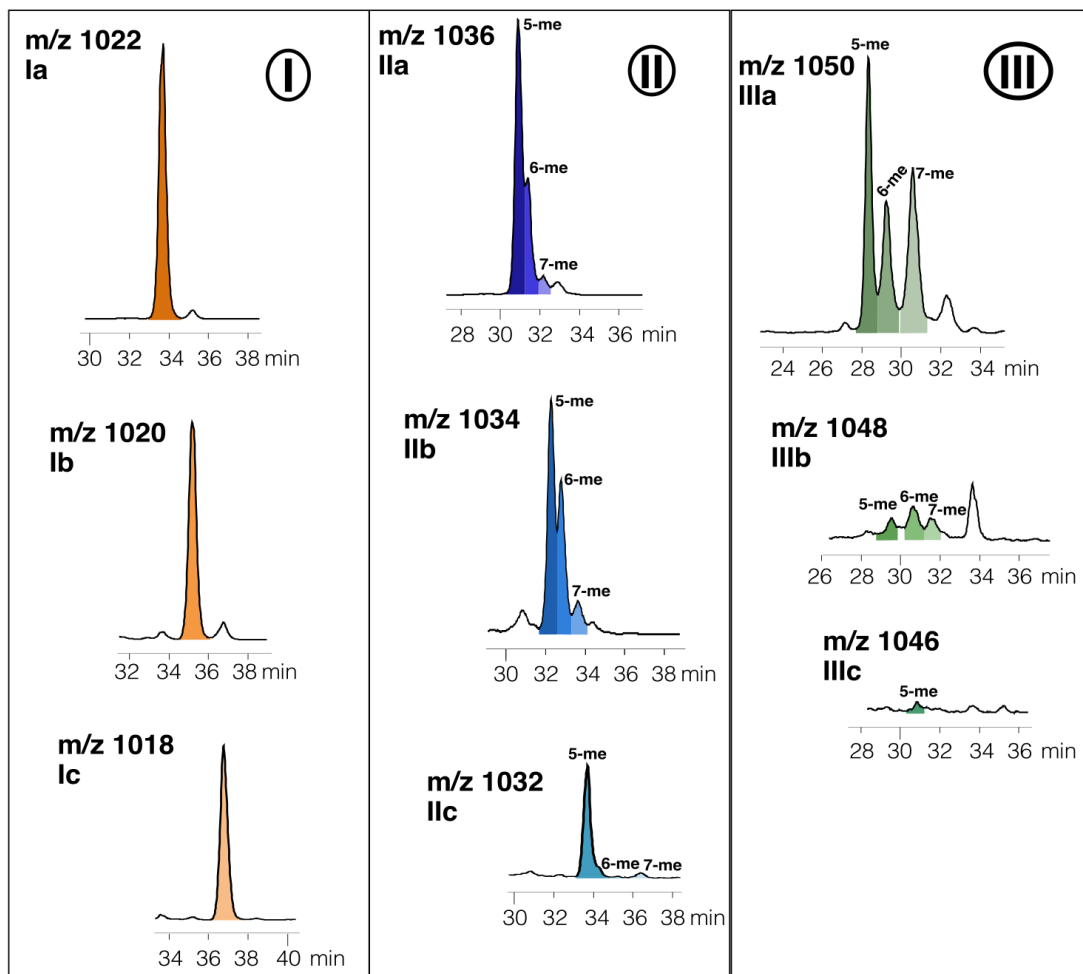
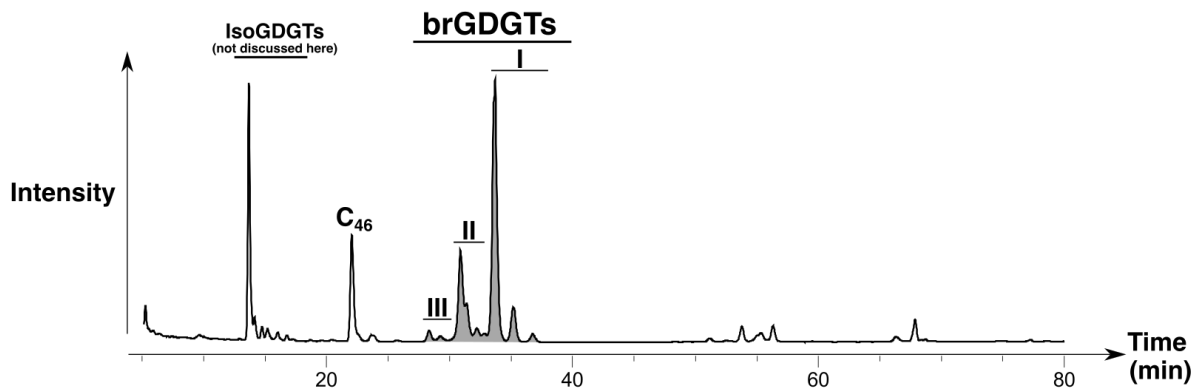
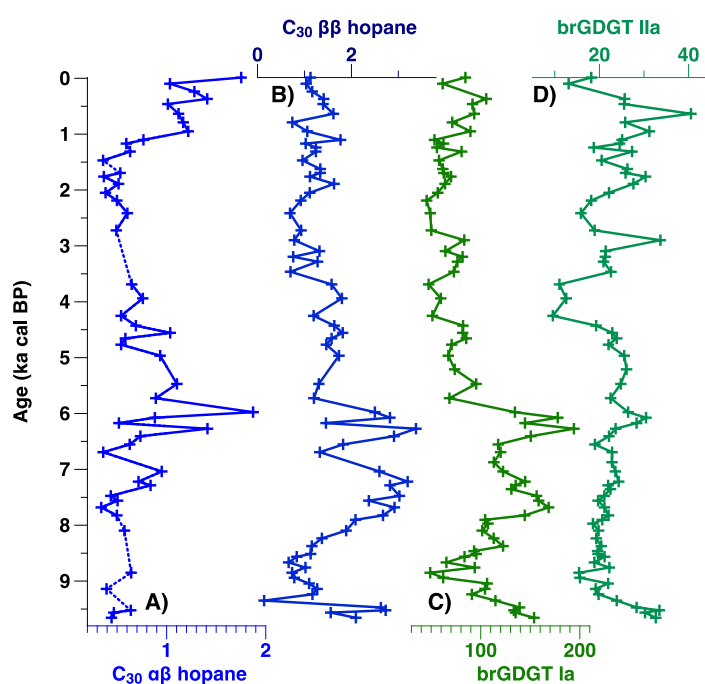


Figure S.2: HPLC-APCI-MS chromatogram of the GDGT fraction of the sample at 70 cm-depth (1.1 ka cal BP) and extracted ion chromatograms of brGDGTs. For corresponding compound structures, please refer to Figure S.1. The peak of  $C_{46}$  corresponds to the internal standard. IsoGDGTs are not discussed in this article.

**Table S.1: Relative abundance (%) and concentration ( $\mu\text{g}/\text{g}_{\text{TOC}}$ ) of brGDGTs discussed in this paper. The relative abundances are calculated taking into account the 5 methyl, 6 methyl and 7 methyl isomers of each brGDGT. Tr = Traces are for values under 0.05**

brGDGT	Abundance (%)				Concentration ( $\mu\text{g}/\text{g}_{\text{TOC}}$ )			
	Mean	Min	Max	Median	Mean	Min	Max	Median
Ia	72.4	57.7	84.6	74.0	96.0	45.4	194.0	90.3
Ib	4.0	1.9	8.1	3.5	5.0	1.8	12.1	4.8
IIa	13.2	6.9	19.4	12.7	16.4	8.3	26.7	16.1
IIa'	2.9	0.7	6.8	2.7	3.6	0.7	9.7	3.6
IIb	0.6	0.2	1.4	0.5	0.7	0.3	2.2	0.6
IIb'	0.2	Tr	0.8	0.2	0.3	Tr	0.8	0.2
IIIa	1.1	0.4	2.1	1.0	1.3	0.5	2.7	1.2
IIIa'	0.6	0.2	1.4	0.6	0.8	0.3	2.0	0.7



**Figure S.3: Concentrations ( $\mu\text{g}/\text{g}_{\text{TOC}}$ ) of the  $\text{C}_{30}$   $\alpha\beta$  and  $\beta\beta$  hopanes ((A) and (B) respectively) and of the two most abundant brGDGTs (Ia and IIa, (C) and (D) respectively)**

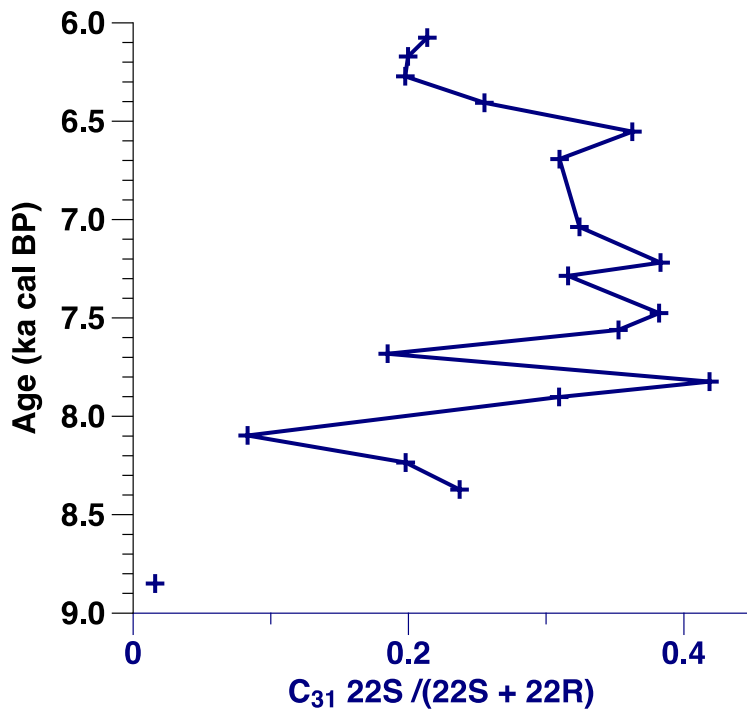


Figure S.4:  $C_{31} 22S / (22S + 22R)$  ratio developed by Mackenzie et al. (1980). The low or zero concentration of 22S isomer is responsible of the limited number of data points.

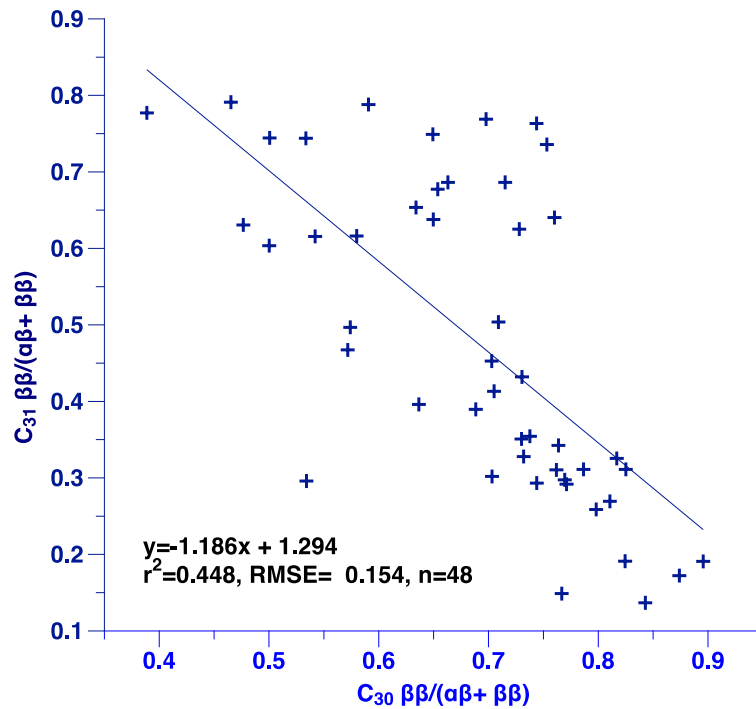


Figure S.5: Correlation between  $C_{30} \beta\beta / (\alpha\beta + \beta\beta)$  and  $C_{31} \beta\beta / (\alpha\beta + \beta\beta)$  hopane indices. The correlation is statistically significant (p-value is  $\ll 0.01$ ).

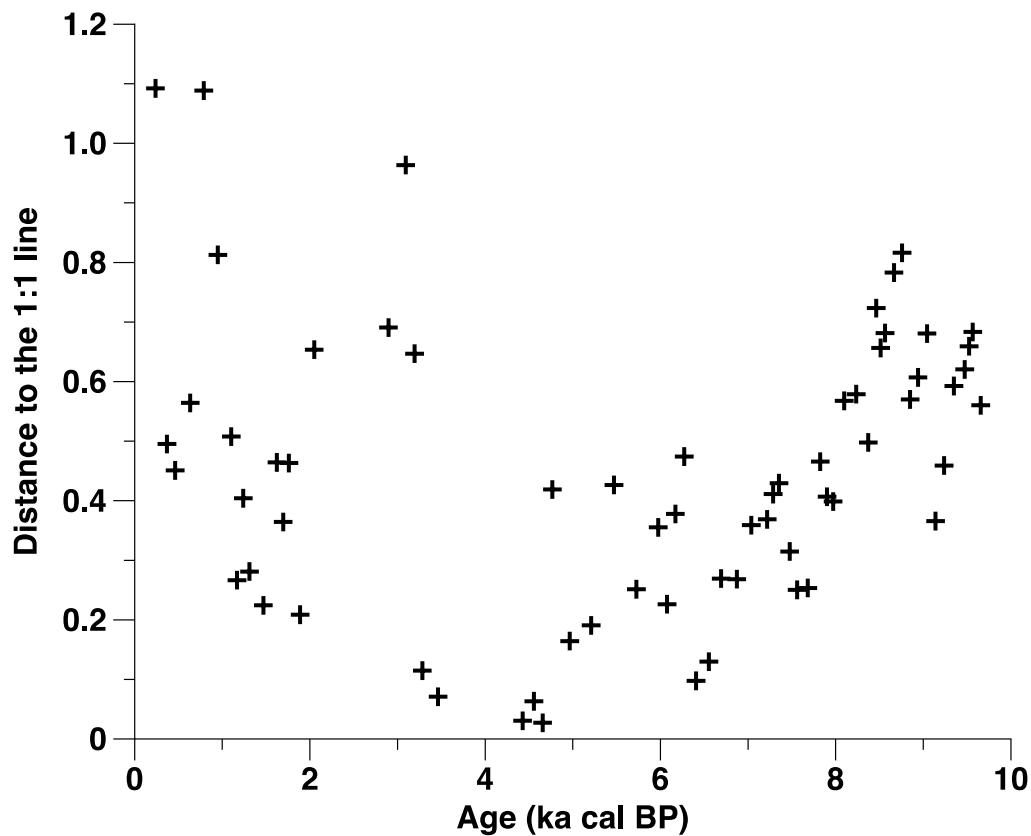


Figure S.6: Shortest distance between a data point in a  $\text{pH}_{\text{hopane}}$  vs  $\text{pH}_{\text{brGDGT}}$  frame and the 1:1 line plotted against the age of the sample. This graph is based on data point plotted in figure 6. There is an absence of correlation between the distance and the age.

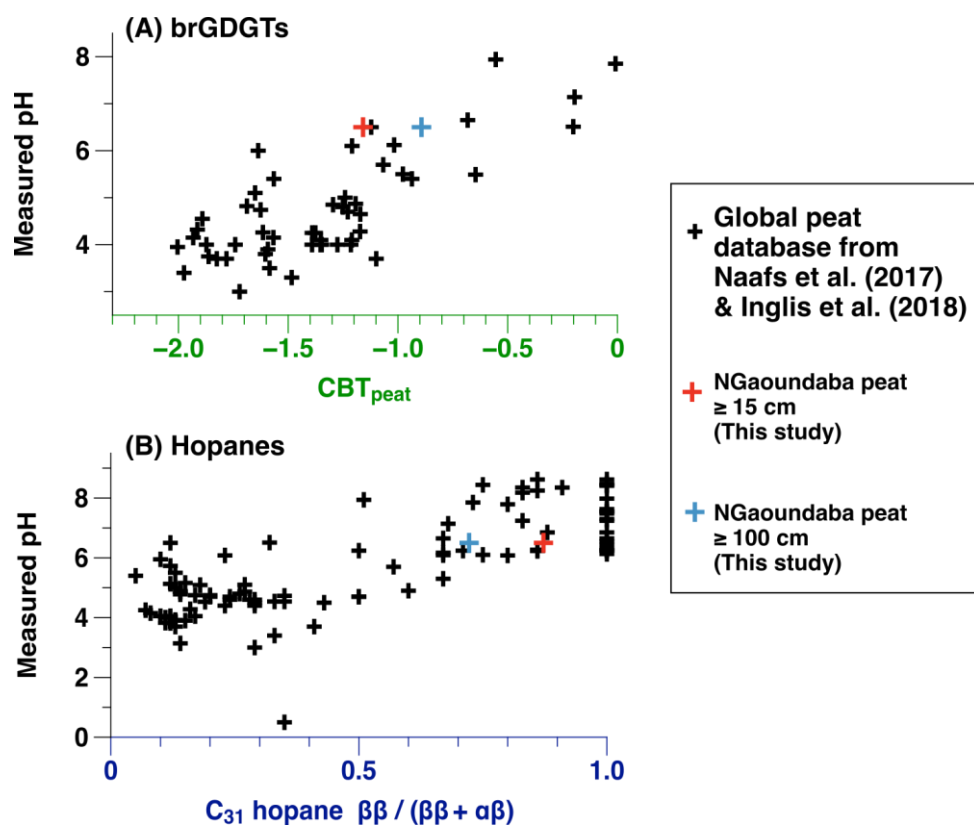


Figure S.7: Measured pH as a function of  $CBT_{peat}$  (A) and  $C_{31}$  hopane  $\beta\beta/(\alpha\beta+\beta\beta)$  ratio (B) from the NGaoundaba peat deposit compared with the Global peat database used in the calibration papers from Naafs et al. (2017) and Inglis et al. (2018). The values from the global peat database are mostly based on samples from above 100-cm depth but for some sites shorter core or surface samples have been analyzed (see Naafs et al., 2017; Inglis et al., 2018 for more details). Therefore, the x-values for the NGaoundaba peat deposit are obtained by averaging the samples from above 15-cm depth (red cross) and 100-cm depth (blue cross). The y-values for the NGaoundaba peat deposit correspond to a pH measurement at subsurface in April 2022.

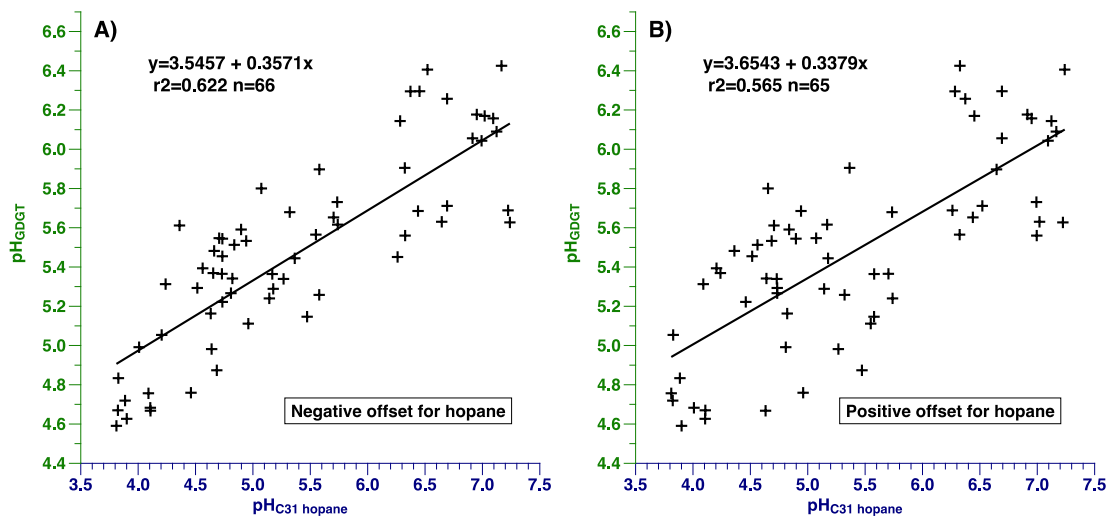


Figure S.8: Correlation between  $C_{31}$  hopane- and brGDGT-reconstructed pH in the NGaoundaba peat record. The pH value for  $C_{31}$  hopane-reconstruction of the uppermost sample is not taken into account. The negative offset for hopane (A) indicates that the  $pH_{C_{31} \text{ hopane}}$  at time  $t_n$  is compared to the  $pH_{brGDGT}$  at time  $t_{n-1}$ . The positive offset for hopane (B) indicates that the  $pH_{C_{31} \text{ hopane}}$  at time  $t_n$  is compared to the  $pH_{brGDGT}$  at time  $t_{n+1}$  with  $n$  the sample number increasing with increasing depth. Both correlations are statistically significant ( $p\text{-value} \ll 0.01$ )

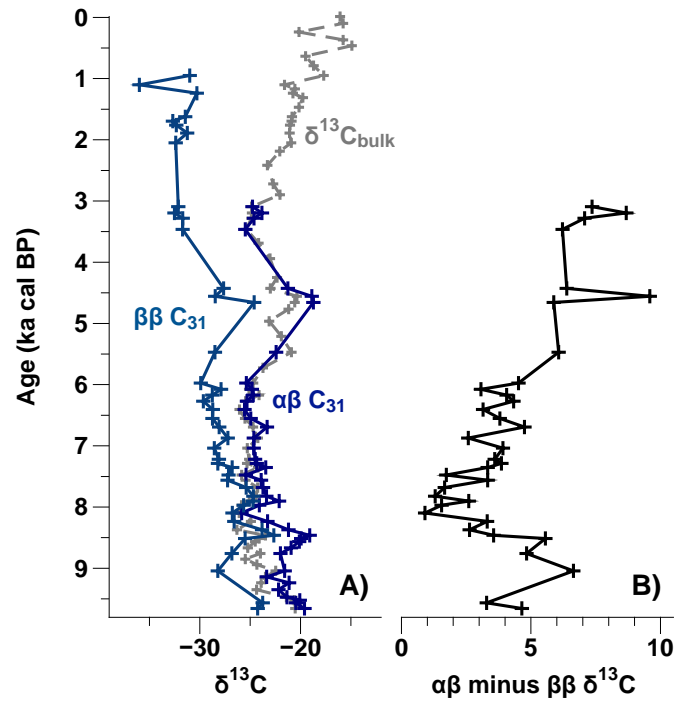


Figure S.9: Difference between the carbon isotopic composition of  $\alpha\beta$  and  $\beta\beta$  hopanes.