Title

Lake sediment fecal and biomass burning biomarkers provide direct evidence for prehistoric human-lit fires in New Zealand

Authors

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Supplementary information

Table S1 | List of considered polycyclic aromatic hydrocarbons with number of aromatic rings, weight class and mass-to-charge ratio used for the analysis.

Compound	**No. of aromatic rings**	**Weight class**[a]	***m/z***
Naphthalene	2	LMW	128
Acenaphthylene	2	LMW	152
Acenaphthene	2	LMW	154
Fluorene	2	LMW	166
Phenanthrene	3	MMW	178
Anthracene	3	MMW	178
Fluoranthene	3	MMW	202
Retene	3	MMW	234
Pyrene	4	MMW	202
Benzo(*a*)anthracene	4	MMW	228
Chrysene	4	MMW	234
Benzo(*b*)fluoranthene	4	HMW	252
Benzo(*k*)fluoranthene	4	HMW	252
Benzo(*a*)pyrene	5	HMW	252
Indeno(1,2,3-*cd*)pyrene	5	HMW	276
Benzo(*ghi*)perylene	6	HMW	276
Dibenzo(*ah*)antracene	5	HMW	278

[a] LMW: low molecular weight (128-166 g mol^{-1}), MMW: medium molecular weight (178-234 g mol^{-1}), HMW: high molecular weight (252-278 g mol^{-1}).

Table S2 | List of considered sterols with number of carbon atoms, origin and mass-to-charge ratio.

Compound	**No. of C atoms**	**Origin**	***m/z***
Coprostanol	C27	Human feces	215-370
Epi-Coprostanol	C27	Epimerization of Cop	215-370
Cholesterol	C27	Zoosterol	368-370
Cholestanol	C27	Zoosterol	355-460
Sitosterol	C29	Phytosterol	215-396
Sitostanol	C29	Phytosterol	215-473

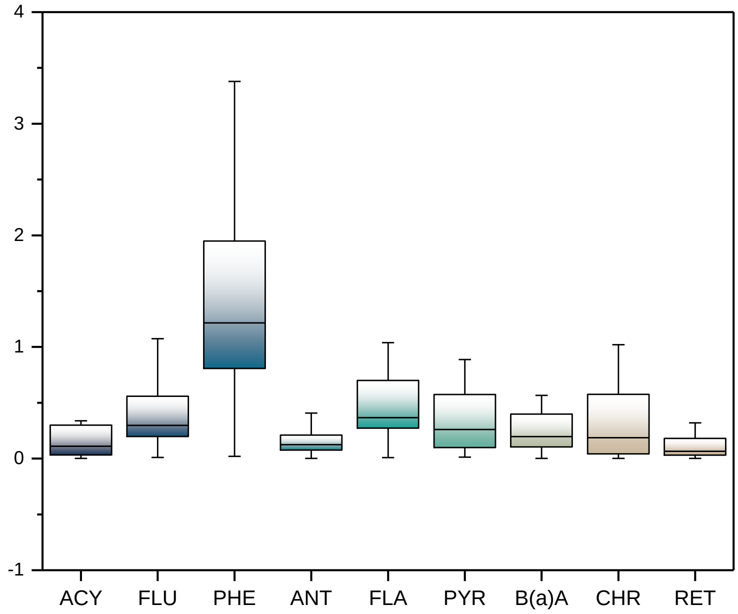

Figure S1 | PAH pattern. Distribution of PAH compounds detected in the sediment core from Lake Kirkpatrick.

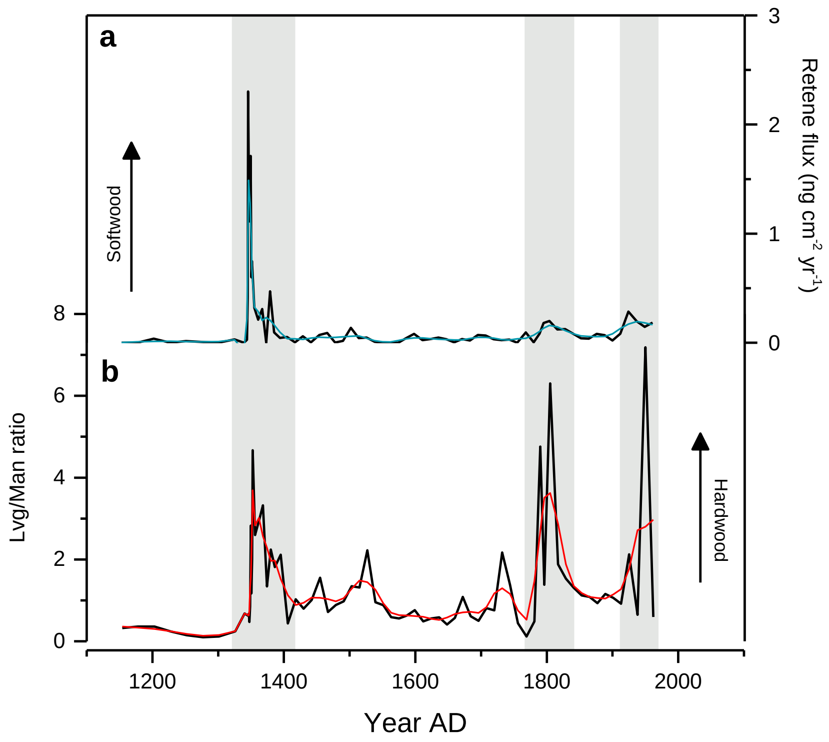

Figure S2 | Fuel characterization. a, Retene flux (ng cm^{-2} yr^{-1}) in Lake Kirkpatrick sediment core (black line) with 5 points adjacent averaging smoothing (blue line). **b**, Levoglucosan/mannosan ratio[1] in Lake Kirkpatrick sediment core (black line) with 5 points adjacent averaging smoothing (red line).

Sterols and stanols as terrigenous input and redox proxies

The use of Δ5-sterols and and 5α-stanols as markers of terrigenous input in sediments was first reviewed by Volkman (1986)[2]. The high content of sitosterol in plant tissue[3] makes this compound a good marker for the influx of organic material to the lake[4]. Moreover, the ratio between C29 and C27 sterols is frequently employed as indicator of terrestrial versus aquatic sources of lipids[2]. The degree of chemical conversion of Δ5-sterols (cholesterol and sitosterol) to 5α-stanols (cholestanol and sitostanol) was also suggested as a proxy of the redox conditions by several authors[5,6]. Conversion by anoxic bacteria is enhanced under highly reducing chemical conditions of the water column and the sediment, which may occur as a result of a high input of organic matter[6,7].

The high C29/C27 ratio in both the lake cores considered in this study (5÷10 for Lake Diamond and 2÷64 for Lake Kirkpatrick) indicates a clear predominance of allochthonous organic matter sources. The almost total absence of cholesterol in the Lake Kirkpatrick core and the abundance of cholestanol and sitostanol suggest the occurrence of anoxic processes[6] especially after the organic matter influx peak recorded at Lake Kirkpatrick during the Initial Burning Period.

References

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