

A Wooden Brazier and Ritual Plant Burning in Early Iron Age Xinjiang, China

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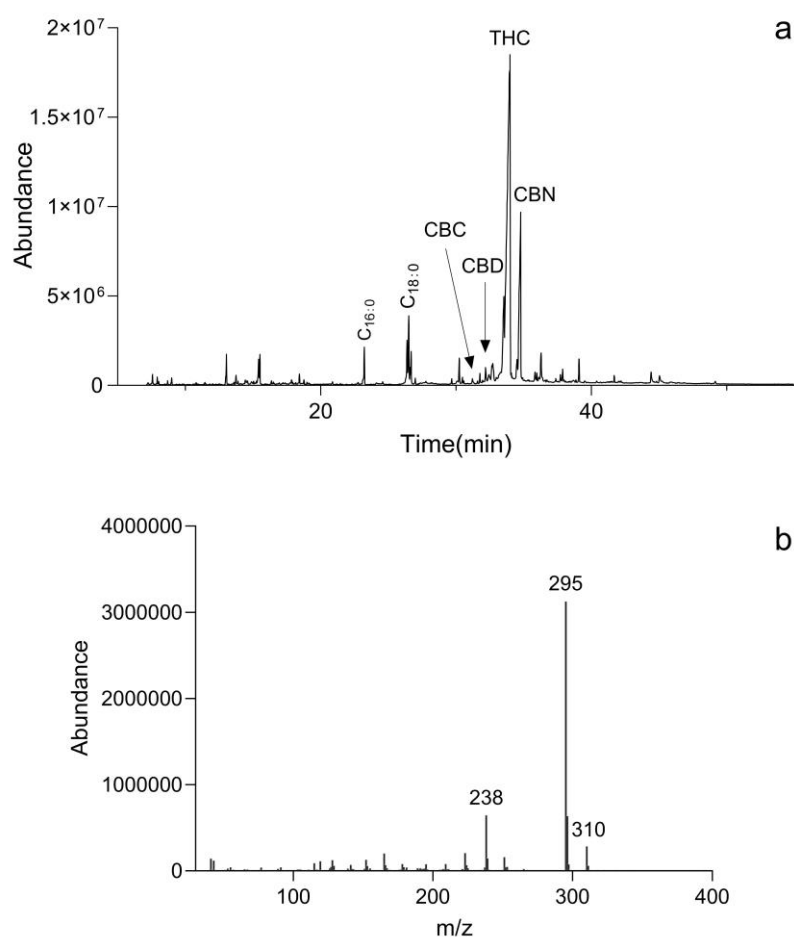
Supplementary information

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Supplementary Figure S1

To provide a reference for the identification of cannabis-related compounds in the archaeological samples, a modern cannabis plant sample (CS1) was analysed as a positive control under identical GC-MS conditions to those used for the archaeological materials. The chromatogram revealed several characteristic cannabinoids, including cannabichromene (CBC), cannabidiol (CBD), Δ^9 -tetrahydrocannabinol (THC), and cannabinol (CBN). The CBN peak exhibited a well-defined chromatographic response and a characteristic mass spectrum consistent with the NIST reference spectrum. These data served as a reference for comparison with the archaeological samples analysed in this study.



Supplementary Figure S1. GC-MS analysis of positive control sample cannabis

plant CS1. a TIC chromatogram of CS1, including Palmitic Acid ($C_{16:0}$, RT 23.231 min), Stearic Acid ($C_{18:0}$, RT 26.997 min), Cannabichromene (CBC, RT 30.590 min), Cannabidiol (CBD, RT 31.978 min), Δ^9 -Tetrahydrocannabinol (THC, RT 33.997 min), Cannabinol (CBN, RT 34.778 min). **b** Mass spectrum of the peak at RT 34.778 min in CS1, showing the characteristic mass spectrum of CBN.

Supplementary Table S1

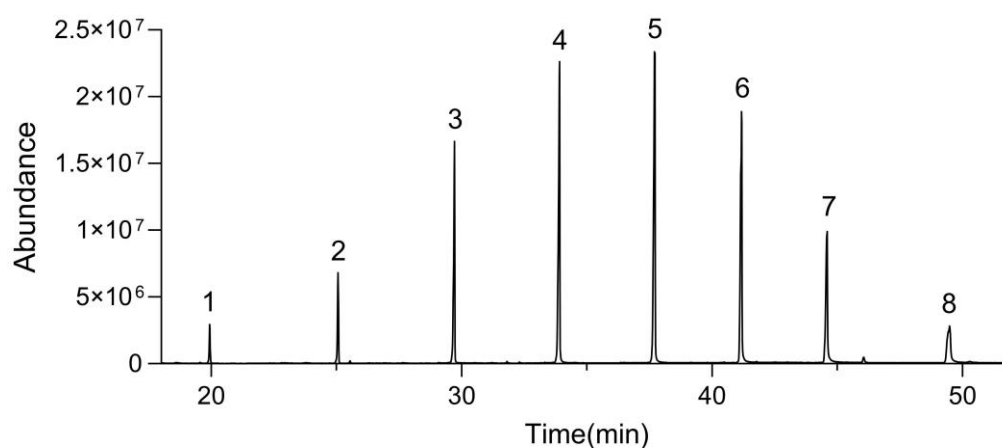
The positive controls included two cannabis plant samples (CS1 and CS2) and two cannabis seed samples (CS3 and CS4), all obtained from the Xi'an Public Security Judicial Authentication Center.

Supplementary Table S1. GC-MS results for cannabis positive control samples.

Lab No.	Sample description	Main Compounds
CS1	Cannabis Plant	CBC, CBD, THC, CBN
CS2	Cannabis Plant	CBC, CBD, THC, CBN
CS3	Viable Cannabis Seed	THC, CBN
CS4	Non-viable Cannabis Seed	THC, CBN

Supplementary Figure S2

To evaluate whether the compounds identified in the archaeological samples could originate from polyethylene glycol (PEG) used during conservation, a control sample of PEG was analysed. Owing to the high concentration of PEG, BSTFA derivatisation was employed prior to GC-MS analysis to avoid adverse effects on the analytical system. The resulting chromatogram is dominated by a homologous series of PEG-derived TMS derivatives. No signals corresponding to the characteristic ions used for the identification of the target compounds were observed, indicating that these compounds were not produced by PEG under the analytical conditions employed in this study.



Supplementary Figure S2. TIC chromatogram of PEG control sample P2. 1 Tetraethylene Glycol-TMS, **2** Pentaethylene Glycol-TMS, **3** Hexaethylene Glycol-TMS, **4** Heptaethylene Glycol-TMS, **5** Octaethylene Glycol-TMS, **6** Nonaethylene Glycol-TMS, **7** Decaethylene Glycol-TMS, **8** Undecaethylene Glycol-TMS.

Supplementary Table S2

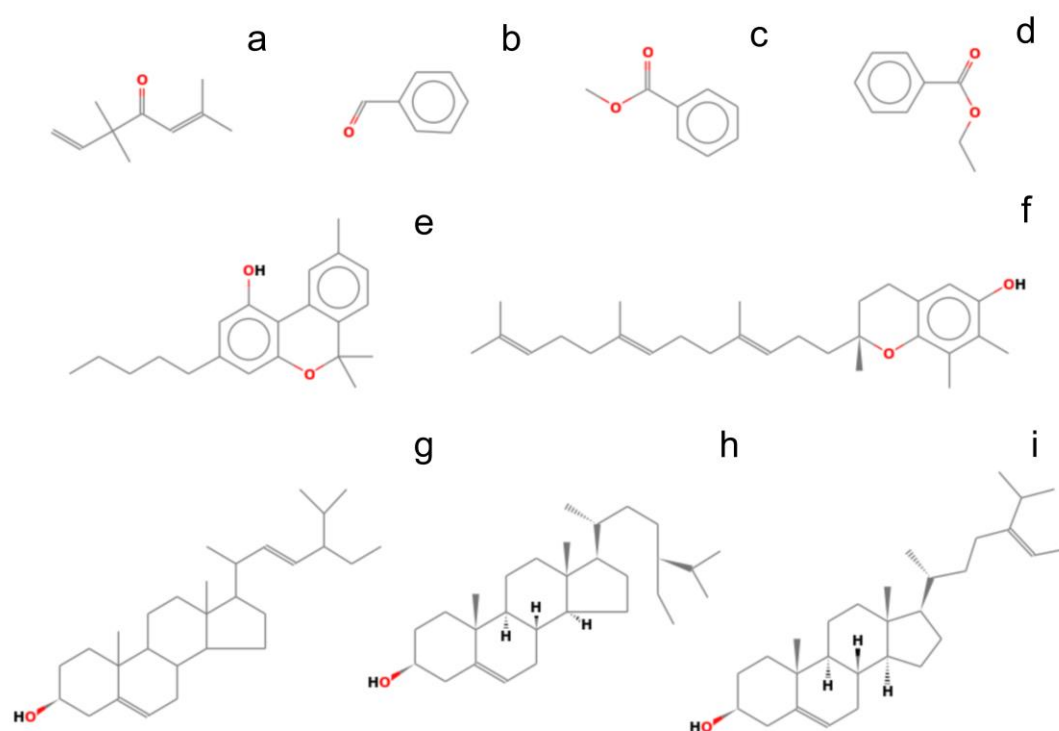
PEG reference materials (PEG 200, PEG 400, and a 1:1 mixture) were analysed under identical GC-MS conditions following BSTFA derivatisation. The compounds are reported as their corresponding TMS derivatives.

Supplementary Table S2. GC-MS results for PEG samples.

Lab No.	Sample description	Main Compounds
P0	PEG200 standard	Diethylene glycol-TMS through Heptaethylene glycol-TMS
P1	PEG200 standard	Diethylene glycol-TMS through Heptaethylene glycol-TMS
P2	PEG400 standard	Tetraethylene glycol-TMS through Undecaethylene glycol-TMS
P3	PEG400 standard	Tetraethylene glycol-TMS through Undecaethylene glycol-TMS
P4	PEG200 and 400 mixture (1:1, v/v)	Diethylene glycol-TMS through Undecaethylene glycol-TMS
P5	PEG200 and 400 mixture (1:1, v/v)	Diethylene glycol-TMS through Undecaethylene glycol-TMS

Supplementary Figure S3

To facilitate clear visual identification of the compounds detected in the archaeological samples, the structural formulae of the nine diagnostic compounds identified in the Hongshan wooden brazier residues are presented in Supplementary Figure S3.



Supplementary Figure S3. Diagnostic archaeological compounds identified in the wooden brazier residues from the Hongshan Cemetery. a Artemisia ketone, **b** Benzaldehyde, **c** Methyl benzoate, **d** Ethyl benzoate, **e** Cannabinol, **f** γ-Tocotrienol, **g** Stigmasterol, **h** γ-Sitosterol, **i** Isofucosterol. (Structural formulae are sourced from the NIST Chemistry WebBook.)