Polycyclic Aromatic Hydrocarbons (PAHs) in speleothems.

J. Homann✉[1], S. F. M. Breitenbach[2], S. Carolin[3,4], D. Hodell[4], J. L. Oster[5], C. B. de Wet[5], T. Hoffmann[1]

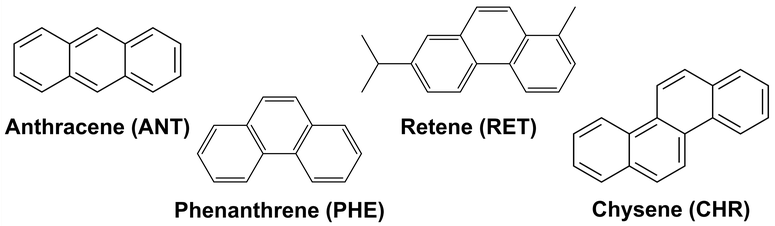
[1]Department of Chemistry, Johannes Gutenberg-Universität Mainz, Germany (✉ juhomann@uni-mainz.de) [2]Department of Geography and Environmental Sciences, Northumbria University, Newcastle upon Tyne, UK
[3]School of Archaeology, University of Oxford, Oxford, UK [4]Department of Earth Sciences, University of Cambridge, Cambridge, UK [5]Department of Earth and Environmental Sciences, Vanderbilt University, Nashville, TN, USA

1. Motivation

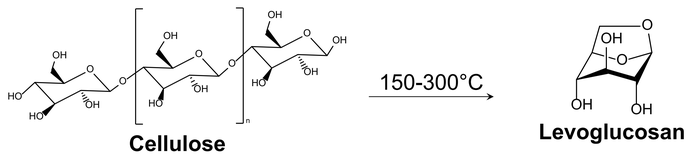
Speleothems are valuable high-resolution environmental archives that encompass various inorganic and organic substances that help reconstructing local and regional paleoenvironments.
One important aspect of past environments is the occurrence and dynamics of wildfire, whether natural or anthropogenic.
Fire-sensitive proxies in speleothems can help elucidate interactions among climate, regional hydrology, vegetation, and fire activity.
We use two independent fire proxies in tandem to not only reconstruct fire dynamics, but also to resolve fire regime changes (e.g., fire frequency, fire intensity, and fuel type) and to better understand proxy transport and incorporation mechanisms.

2. Analytes

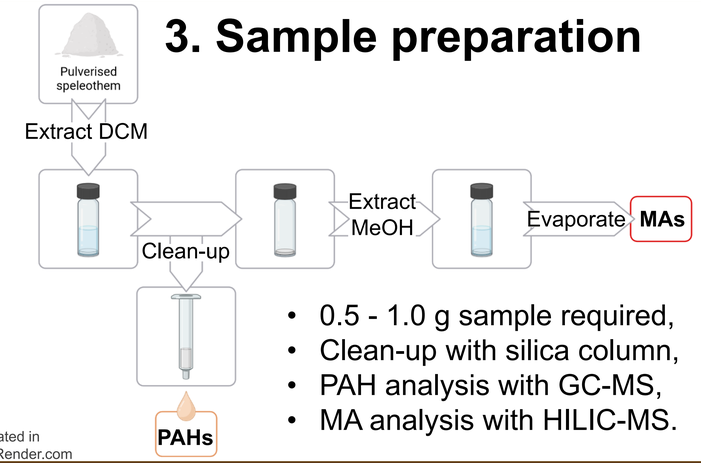
Polycyclic Aromatic Hydrocarbons (PAHs) are organic molecules composed of two or more fused aromatic rings.
They originate from incomplete combustion of organic matter at a wide temperature range (200-700°C).
PAH persistence in the environment makes them useful for the reconstruction of past fire activity recorded in paleoenvironmental archives.



Monosaccharide anhydrides (MAs) are formed during the combustion of biomass at lower temperatures (150-350°C). The predominant MA is levoglucosan, which is formed during the combustion of cellulose.

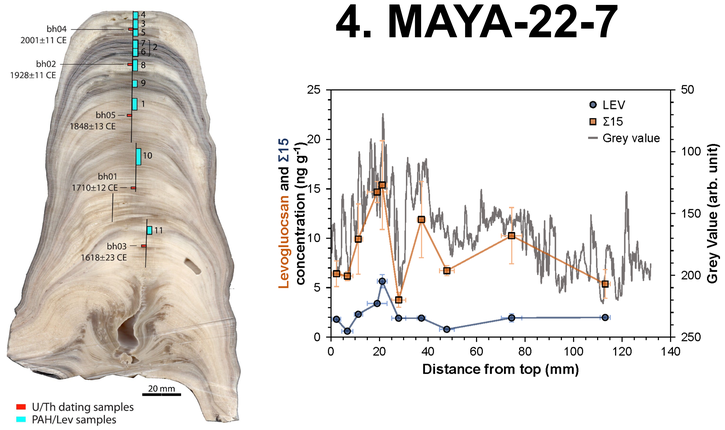


3. Sample preparation



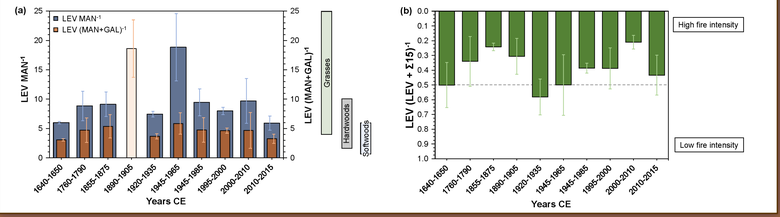
- 0.5 - 1.0 g sample required,
- Clean-up with silica column,
- PAH analysis with GC-MS,
- MA analysis with HILIC-MS.

4. MAYA-22-7



5. Diagnostic ratios

Ratio	Values	Interpretation
LMW/HMW	< 1	Pyrogenic
	> 1	Petrogenic
PHE/ANT	< 10	Pyrogenic
	> 15	Petrogenic
RET/(RET+CHR)	0.15-0.50	Petrol combustion
	0.30-0.45	Coal combustion
	0.83-0.96	Softwood combustion
RET/(RET+PHE+ANT)	> 0.1	Gymnosperm combustion
	< 0.1	Angiosperm combustion
LEV/(LEV+Σ15)	< 0.5	High intensity fires
	0.5	Boundary
	> 0.5	Low intensity fires
LEV/(MAN+GAL)	0.5-6	Softwoods
	1.5-10	Hardwoods
	4-55	Grasses



6. Outlook

- Combine with $\delta^{13}C$, $\delta^{18}O$, and trace elements,
- Monitor rainfall and dripwater,
- Apply methods to other speleothems from the same and other sites,
- Add other source-specific PAHs.

Preprint of this study
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Poster Abstract

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