

Application note 41

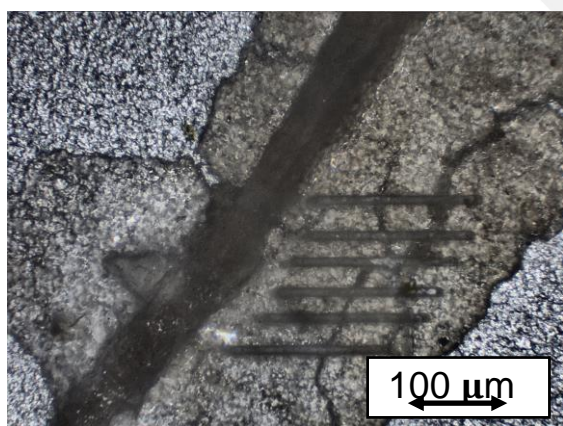
Pollen, Bee's Wax and Honey Measurements



$\delta^{13}\text{C}$ Analysis using Laser Ablation IRMS

Bees are highly important to humankind. They carry pollen across plants and pollinate crops. The honey they produce is highly nutritious. Pollen itself is a valuable marker of paleoclimate – when preserved in undisturbed sediment (e.g., peat bogs) it holds a wealth of information on past vegetation at that location.

Variations in the stable carbon isotope ratio ($\delta^{13}\text{C}$) of pollen associations are dictated by the type of plant (mainly C3 vs. C4) generating it. These variations are also found in the honey and wax produced by bees. Stable carbon isotope analyses are a key component of official standard procedures (ISCIRA, AOAC 991.41) for studies of honey adulteration.



Measurements were carried out on a Sercon HS2022 IRMS and Cryoflex interface coupled to a Teledyne Photon Machines LSX 213 G2+ laser ablation system fitted with a Terra Analytic isoScell $\Delta 100$ sample cell, at Terra Analytic.

All samples were sourced from Alba County, Romania. Pollen aggregates were homogenized and pelletized; wax and honey were ablated without any preparation. The ablation parameters are listed in Table 1.

Figure 1. Microscope photograph of the ablation tracks left on honey.

Scan Type	Spot Size (μm)	Repetition Rate (Hz)	Fluence (Jcm^{-2})	Scanning Speed ($\mu\text{m/s}$)	Ablation Time (s)
Line scan	50	20	1	10	20

Table 1. Ablation parameters used for the analyses.

Helium was used as carrier gas (35 mLPM flow rate), corresponding to 18.3 PSI operating pressure inside the ablation chamber. The furnace combustion temperature was set to 850° C, the GC column was heated at 30° C. International Atomic Energy Agency (IAEA) IAEA-C-3 cellulose ($\delta^{13}\text{C}_{\text{PDB}}$ of 24.91 ‰) was used as standard (ablated using the same parameters as in Table 1).

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Measurement	$\delta^{13}\text{C}$ Wax	$\delta^{13}\text{C}$ Honey	$\delta^{13}\text{C}$ Pollen
1	-26.64	-26.25	-27.16
2	-26.56	-26.29	-25.91
3	-26.46	-25.99	-27.21
4	-26.4	-26.04	-26.32
5	-26.55	-25.88	-26.49
STDEV	0.09	0.17	0.56

Table 2. $\delta^{13}\text{C}$ results for each ablated spot on the three analysed matrices.

Table 2 and Figure 2 summarize the results. Each sample was measured 5 times, with excellent precision. The analyzed pollen is sourced from a poly-floral association, which is reflected in the wider $\delta^{13}\text{C}$ range. The average value agrees with the natural range at the sampling site.

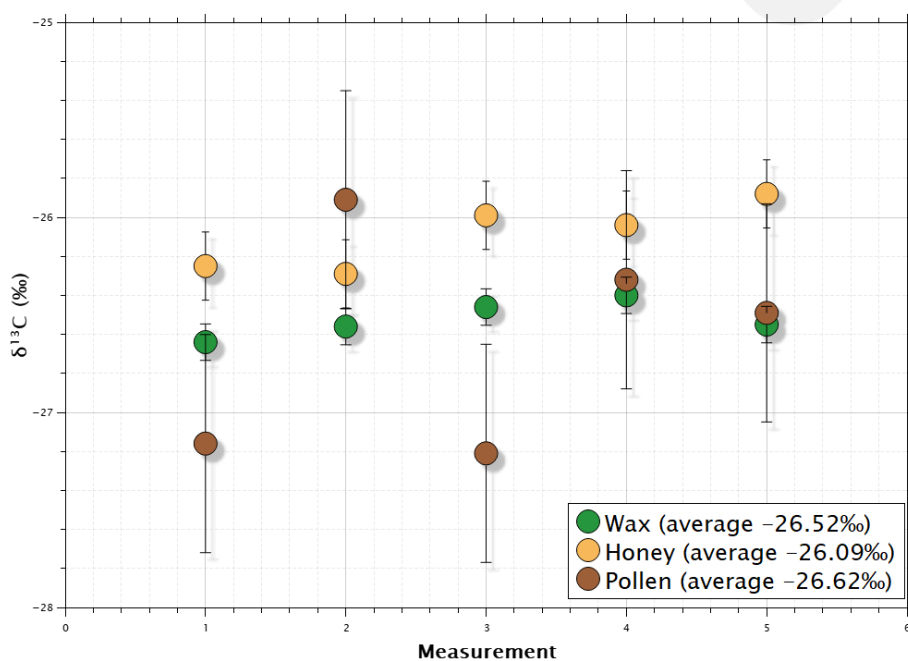


Figure 2. Graphic representation of the results.