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► **To cite this version:**

Géraldine Lucchi, Rémy Reynaud, Karine Gourrat, Isabelle Andriot, Sylvie Cordelle, et al.. Characterization of the key aroma compounds in Burgundy truffle. Journées françaises de Spectrométrie de Masse et Analyse Protéomique (SMAP 2019), Sep 2019, Strasbourg, France. , 1 p., 2019. hal-02787577

HAL Id: hal-02787577

<https://hal.inrae.fr/hal-02787577v1>

Submitted on 5 Jun 2020

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Characterization of the key aroma compounds in Burgundy truffle

Géraldine Lucchi, Remy Reynaud, Karine Gourrat, Isabelle Andriot, Sylvie Cordelle, Olivier Berdeaux



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Introduction

Truffles are a fungus of the genus *Tuber*. Some of them have an important economic value due to their gastronomic qualities appreciated in "grande cuisine". Perigord truffle (*T. melanosporum* or Black truffle) and White Alba truffle (*T. magnatum pico*) are actually the noblest ones. While these two species are well-valued, Burgundy truffle (*T. uncinatum*) is less well-characterized in its production area and truffle producers encounter some difficulties to sell their harvest at its fair value.

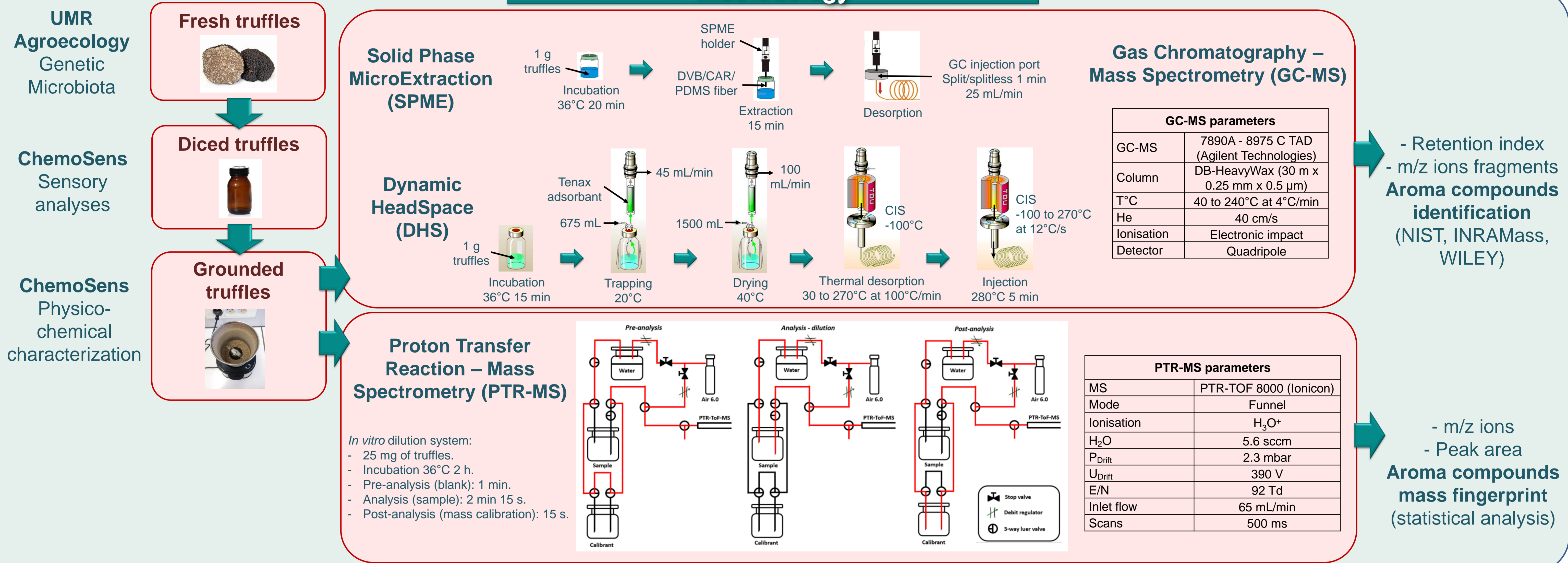


INRA of Dijon is strongly involved in the BIJOU project (truffe de Bourgogne, un produit de qualité à forte valeur ajoutée), in order to help the professionals to better characterize the Burgundy truffle through different research axes. Because maturation and geographical origin have been reported to influence the aromatic composition of truffles (1), the results should provide answers to, at least, 3 questions:

- Is it possible to highlight specific aromatic notes/compounds in Burgundy truffle compared to truffles from other regions? (2,3)
- Which gleba color is required for a quality harvest (related to ripening stage)?
- In which area is harvested the quality Burgundy truffle?

The first objective of this large project is to define an analytical strategy to characterize volatile aroma compounds (VOC) in Burgundy truffles.

Methodology



Results

DHS vs SPME

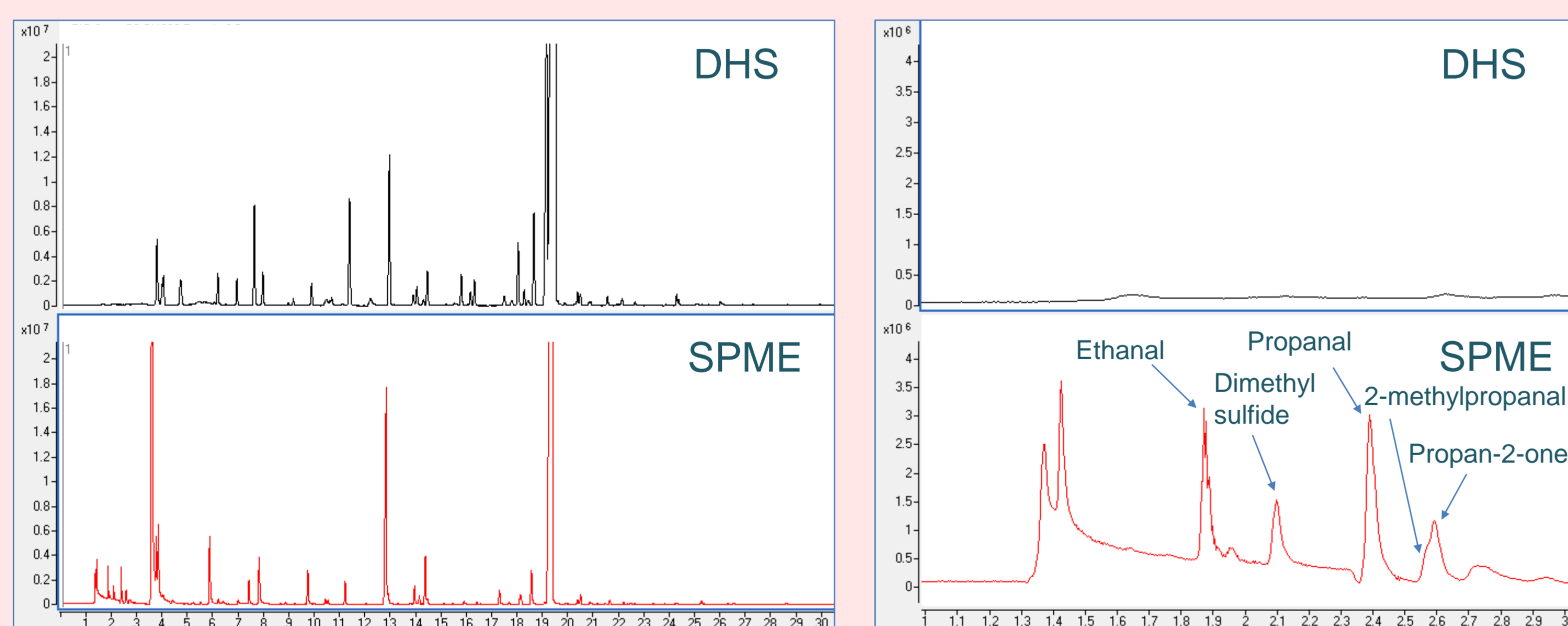


Figure 1 – TIC overlay for DHS and SPME analyses from 0 to 30 min.

Figure 2 – TIC overlay (zoom from 1 to 3 min) for DHS and SPME analyses.

Table 1 – VOC identification classified by chemical classes.

| Chemical classes | DHS | SPME |
|------------------|-----|------|
| Aldehydes | 22 | 19 |
| Alcohols | 17 | 12 |
| Ketones | 16 | 13 |
| Acids | 8 | 1 |
| Sulfur compounds | 2 | 3 |
| Lactones | 2 | 0 |
| Furans | 1 | 1 |
| Hydrocarbons | 1 | 1 |
| Phenols | 1 | 0 |
| Total | 70 | 50 |

- More VOC are identified by DHS analysis (Fig. 1) and intensities are often more important.
- An exception occurs for the elution range from 1 to 3 min (Fig. 2), where 5 chemical compounds are not found in the DHS analysis.
- The chemical classes expected in truffles (Table 1) are well represented in the DHS extraction, with on average 28 % more compounds identified compared to the SPME extraction.

PTR-MS methodological development

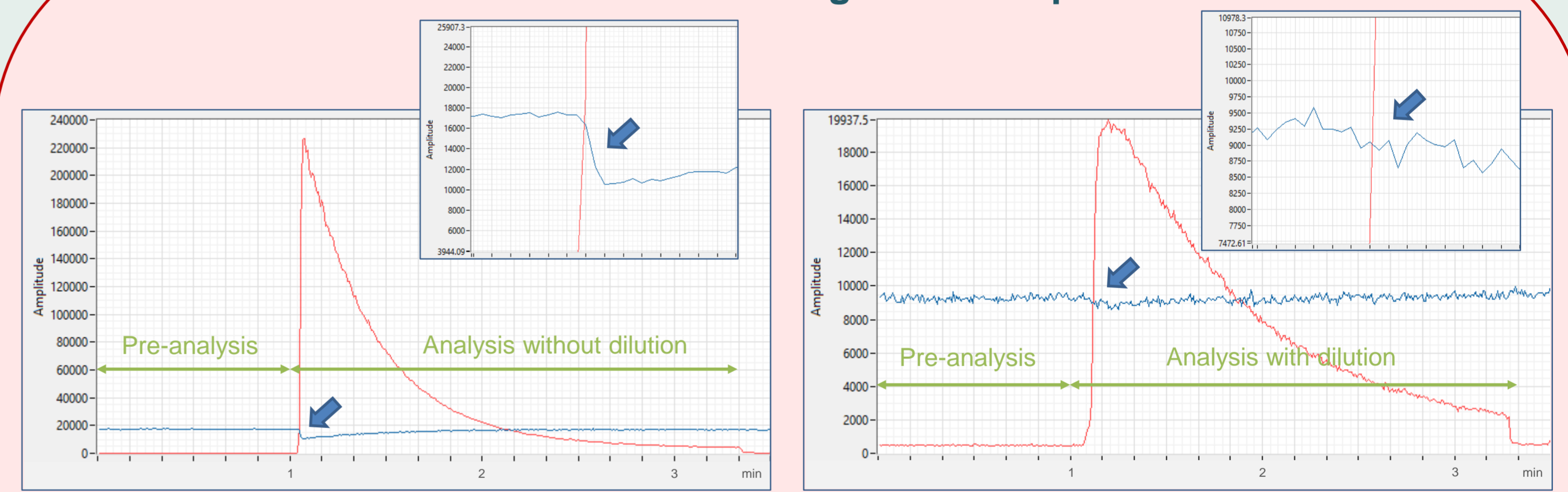


Figure 3 – TIC for H₃O⁺ ions (blue) and acetone ions (red) released by 25 mg of grounded truffles. Measurement without (left) and with optimised dilution system (right).

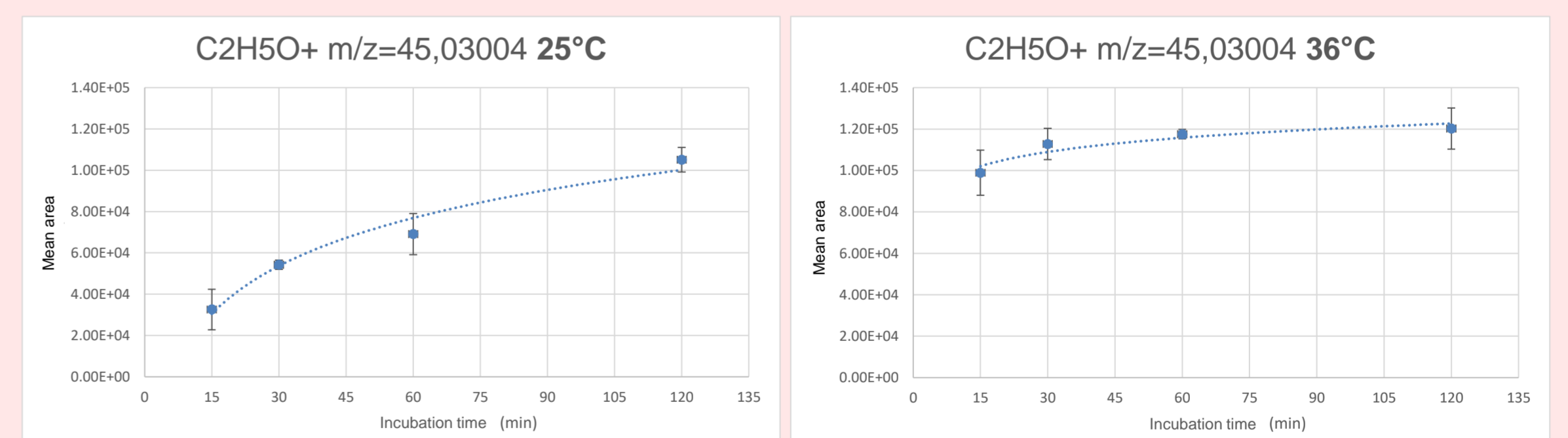


Figure 4 – Kinetic analysis of the incubation time (15, 30, 60 and 120 min) according to incubation temperature (25°C and 36°C). Example with the ion C₂H₅O⁺ (m/z = 45).

- The blue arrows (↙) in Fig. 3 shows the hydronium ions depletion when aroma compounds are released from the headspace of the vial. Optimisation of a dilution system with humidified air at 1500 mL/min avoids to decrease H₃O⁺ ions for a better ionisation of the VOC.
- Ion C₂H₅O⁺ was chosen as a representative aroma compound in truffle (Fig. 4). Peak integration enables peak area calculation. A temperature of 36°C during 2 h allows to reach equilibrium between grounded truffles and headspace in the vial. ANOVA analysis on 9 different ions confirmed this result (data not shown).

Conclusion & Perspectives

These preliminary results allowed to set up an extraction and an analysis method by DHS GC-MS and PTR-MS to better characterize the truffle aroma.

Between June and December 2019, truffles from different localizations (Burgundy and south of France) will be harvested and analyzed by this approach. Physico-chemical results will then be combined to microbiota, genetic and sensory analyses. This work will bring a scientific contribution to the creation of an IGP (Indication Géographique Protégée) request.

Contact

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